RE-THINKING BIOPHILIC DESIGN PATTERNS IN PRESCHOOL ENVIRONMENTS FOR CHILDREN

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ABSTRACT

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The unprecedented rate of urbanization globally is associated with a decrease in access to natural environments. Congested urban spaces are compelling adults and children to spend a considerable amount of time inside the buildings which by some reports is up to 90% of their life. Numerous studies have affirmed that Children at young ages are in a more critical demand of being connected to nature, in comparison to adults. Nature is an essential aspect of a child's requirements from living areas as it is inherent in the human makeup, in other words, 'Biophilia'. The biophilia hypothesis suggests that human beings have an innate biological connection with nature. Based on this hypothesis, biophilic design has been promoted to incorporate natural features and systems into built environments. The environment delivers physical and mental experiences that nothing else can, and separation from the natural environment is proven to have negative impacts on development, health, and well-being, in this case, detachment of children from their living environment. The majority of studies on reconnecting children with natural environments have focused on the outdoor-play of children. Whereas there is a vivid potential to catch the benefits of natural elements inside of the buildings as well. In this study, by addressing the missing link between nature and educational settings for children

between the age of 3 to 6, we are aiming to re-think biophilic design features in the preschool environment from an architectural aspect. This study is aiming to offer recommendations and suggestions for preschool designers to interconnect children with the benefits of nature and natural elements for their physical and mental health. To do so, the project is analyzing plans, features, and interior designs of preschool environments and probes them into Biophilic Design patterns.

Keywords: Biophilic Design, Biophilia, Preschool Environment, Natural Preschool Design

ÖZ

BIOFİLİK TASARIM KALIPLARININ KREŞ ÇEVRESİNDE YENİDEN DÜŞÜNME

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Dünya genelinde ölçüsüz kentleşme oranı, kentlerdeki insanların doğal çevrelere erişimini kısıtlamaya sebep olmuştur. Sıkışık kentsel alanlar, yetişkinlerin ve çocukların yaşamlarının % 90'ına kadar binaların içinde geçirmeye zorlamaktadır. Çeşitli çalışmalar genç yaştaki çocukların yetişkinlere kıyasla doğaya bağlanma talebinin daha kritik olduğunu doğrulamıştır. Doğa ile ilişkide olmak insanın doğasında var olduğu için (biyofiliya) bir çocuğun yaşam alanlarında olması gereken önemli bir yönüdür. Biyofiliya hipotezi, insanların doğa ile doğuştan gelen biyolojik bir bağları olduğunu düşündürmektedir. Bu hipoteze dayanarak, doğanın özellikleri ve sistemleri inşa edilmiş ortamlara dahil etmek üzere biyofilik tasarım ortaya çıkmıştır. Çocukların bulunduğu çevre, başka hiçbir şeyin yapamayacağı fiziksel ve zihinsel ve psikolojik deneyimler sunmakta olduğu ısbat edilmiştir. Bu yüzden onların bulunduğu çevrelerin doğadan kopuk olması en başta çocukların yaşam ortamlarından bağımsız hissetmek üzere, sağlıkları üzerinde de olumsuz etkileri yarattığı kanıtlanmıştır. Çocukları bulundukları ortama ve doğal ortamlara yeniden bağlamak üzerine yapılan çalışmaların çoğu çocukların açık havada oyun oynamalarına odaklanmıştır. Oysa binaların içinde de doğal unsurların faydalarını yakalamak için önemli bir potansiyel vardır. Bu çalışmada, 3 ila 6 yaş arasındaki

çocuklar için eğitim ortamları ile doğal ortamlar arasındaki eksik bağı göz önünde bulundurarak kreş çevrelerinde biyofilik tasarım potansiyellerini mimari açıdan yeniden düşünmeyi hedefliyoruz. Bu çalışmanın sonucunda, kreş tasarımcılarına çocukların fiziksel ve zihinsel sağlıklarına faydalı olması için tasarımsal öneriler sunmayı amaçlıyoruz. Bunu gerçekleştirmek için, seçili kreş projelerin çevrelerini planlarını, özelliklerini ve iç tasarımlarını analiz ediyor ve onları Biyofilik Tasarım modellerine ilişkilendirmeyi planliyoruz.

Anahtar Kelimeler: Biyofiliya, Biyofilik Tasarım, Anaokul Çevresı, Doğal Anaokul Tasarımı

To my beloved family

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TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

CHAPTER 1

INTRODUCTION

1.1 Motivation of the Study

When I was at the age of starting preschool, my parents were searching for the best preschool education-wise in town for me. After they found the one, they arranged a vacant place for me through lots of difficulties and networking because of competitiveness among parents to register their child in the best preschools. The most famous and well-known preschool in town was educationally so successful that the graduates from there had better chances to get accepted for more sophisticated elementary schools which were even pickier in choosing their students. Accordingly, succeeding to enroll a child into the right educational spaces from the beginning -preschool ages- was perceived as an achievement and investment for the child's whole educational life.

For this, the main focus of parents in choosing an outstanding preschool for their children, was predominantly the pedagogy systems of the school as in the educational program, qualification level of the teachers, and diversity in curriculum and syllabus. They also cared about the hygiene of the environment, and of course, the safety and security of the preschool building. With meeting an acceptable level of qualification on each of these features a preschool might sufficiently function to offer an advantageous education for preschoolers and to satisfy parents. However, the environment of school conceives different from a child's point of view.

Attending a preschool is the first stage of a human's life for experiencing rather long hours of separation from family members and familiar spaces. So, it is extremely essential for preschool buildings to provide a space that feeds children the

sense of belonging as well as physical and mental comfort. Honestly, I and a few of my preschool classmates that we are still in touch do not remember the quality and details of education in that preschool. However, we vividly remember how we were feeling about the space of our classroom and the environment of the preschool. We all agree that the spaces provided for preschoolers in that school were one of the most depressing and suppressing educational spaces we have ever experienced.

The school building was mainly a primary school, providing preschool education as an add-on. The building was pre-residential and located in the heart of the urban setting of the city, adjacent to a high school building which was also pre-residential.

This primary school was giving service to approximately 400-450 students between the ages of seven to eleven on the first floor and second floor in sub-construction of nearly 250m^2 with a courtyard on one side of the building. As the building was not designed to function as a school for this many students, it was already malfunctioning as a primary school for narrow stairways, not offering proper windows for some classrooms, a humble-sized yard, some infrastructure problems like ventilation in classes, etc. On top of that, the classes for preschoolers were placed on the basement floor, making students who came there seeking a higher standard education feel psychologically unwell and detached from their educational environment.

Basically, the yard stairs leading to the basement classroom, and the classroom were the only areas preschoolers had access to. The entrance of the classroom was through a narrow set of stairs to the depth of the ground level at the corner of the schoolyard. Accordingly, these narrow stairs were captured by wall-like heights on both sides; the building and the ground. It means an unwelcoming and unpleasant path was leading the visitors through the entrance of the kindergarten. The classroom was shaped of two fairly large-sized cubic forms attached to each other on one edge. The area of the total classroom was around 40m^2, and the height of nearly 2,5 m. The only natural light coming through inner space was from a slender horizon line

of windows at the top of a wall. The plan and the 3D model of the preschool are provided in appendix A and appendix B.

Of course at that age, I was not aware of the exact reason for being extremely reluctant to go to that place for long hours. Only a "feeling" of being captured among walls, not having a proper connection with the outdoors, lack of view to the outside world, not relating and belonging to that gloomy, depressing, and even intimidating indoor space was present in me and most of the other students. I continued my education in the same building for 5 more years only for accessing to top-notch teachers and better education.

The unsettling memories of my primitive years of education –merely because of poor building qualification- was my main motivation to explore features and characteristics of architecture that soothes and appeases the human mind and spirit and also nourishes the positive feelings within their presence in that space. Certainly, the problem of an ill-conditioned building for human essence is not exclusive to one building on a specific spot in the world. By stepping back and observing the bigger picture, the necessity of comprehension of how modern, urbanized humans ended up living in settings that are not putting him in ease is inevitable. The question that arises in mind is: does the urban environment compel modern humans to be situated in a built environment that is not pleasant for him?

1.2 General Problem Area

It seems that the features of urban and built settings have transformed more rapidly than human's deep-rooted habits and tendencies. the fast growth of the built environment has caused designers to focus mostly on the function of the building and more recently on the impact of the building on the natural environment. the missing point here seems to be the compatibility of features of the built environment on human essence. Humans have lived and evolved in close interaction with a natural and urban environment almost through the entire history. They have had a balanced

relationship with nature due to this close interaction. As time passed and people grew both in number and knowledge, they started to change their attitude to their surroundings gradually. Our ancestors began to dwell in permanent settlements around 1000 years ago, to expand their population more rapidly and many privileges and advantages of living in cities allured villagers to progress to relocate to more populated places (White, 2004; United Nations, 2014; Hartig et al., 2010).

Civilizations continued to expand at an expected and predictable rate for many centuries. However, during the last two centuries, the rapid and unplanned growth of cities and the enormous increase of population in urban areas profoundly affected the structure of urban spaces and accordingly lifestyle of city-dwellers in many aspects (United Nations, 2017). Particularly in the last several decades, city environments were enforced to provide more buildings for unprepared population explosion and humankind has reached a point where the pace of his transformations have been so high that he has imposed unreturnable changes on the natural environment around them in favor of his own interests (U.N., 2017; Newman & Jennings, 2008; Söderlund & Newman, 2015; Beatley, 2017; Downton et al., 2017; Ryan, Browning, Clancy, Andrews, & Kallianpurkar, 2014). As the first solution, green areas got reduced, and the built environments prevailed over natural environments. Since advances of civilization progress overtook the feeling of the necessity of nature for people, nature began to fade away from the visage of the cities, exposing people more to human-made built settings.

The radical change in the habitat of people has led to some unfavorable consequences which not only concern nature but also collide with one of the human main innate tendencies and needs, which is to be integrated with natural surroundings (Downton et al., 2017; Kellert, 2006; Joye & Van Den Berg, 2011). Even though most of the epidemics and infectious diseases have been eradicated during last century, today's human is vulnerable to various depressions, mental diseases, high level of stress and new health threats (Soderlund & Newman, 2015; Moore & Marcus, 2008).

Along with alterations in lifestyle and daily routine of millennium human, most of their daily activities, which used to happen outdoors, began to take place indoors (McCracken, Allen, & Gow, 2016; Louv, 2008; Yin, Zhu, MacNaughton, Allen, & Spengler, 2018; Tinney, 2014; Kelly, 2018). Though it is not simple to measure the concise amount of time people spend indoors, and it is relevant to many factors such as climate, occupation, different ages, geography, etc.; the records conducted so far in showing the amount of time urban people spend indoors were unexpectedly low. Records demonstrate that urban dwellers live averagely 90% of their lives inside the buildings (Klepeis et al., 2001). This percentage has been provided by many sources. U.S. Environmental Protection Agency (EPA), 1989; Roberts (2016), Westervelt (2012); Ribble Cycles (2017), and Lucas Foglia (2018) have reported residents of U.S. and Britannia are spending 89% -93% of their daily lives indoors. The amount of time spent indoor has been reported as two-third of daily life for Japanese people by Jinno (2016). A most recent article in 'The Washington Times' presented the result of a survey as 25% of Americans spend all day inside of the buildings (Kelly, 2018). However, the best reference for this statistic appears to be "The National Human Activity Pattern Survey" conducted by Klepeis et al. in 2011, which demonstrates the rate of approximately 92% of lifetime indoors for Americans. Unfortunately, no more related data was found for other countries other than the mentioned ones.

In spite of being surrounded by the human-made built environment, a feeling of yearning for nature and natural environments never closed down in modern human essence. Urban People go to parks, mountains, lakes, and forests, finding this ancestral home entirely beautiful and authentic, whereas they perceive their own urban surroundings mostly to be false and inhospitable (Louv, 2011; Kellert & Calabrese, 2015; Moore & Marcus, 2008; Beatley, 2017). Or, it is better to rise up the question: have we missed an issue in the design of our buildings and urban environments? Was disfavoring built environment an inevitable consequence that had to bear with congestion in cities?

A growing body of research has been conducted to examine whether people with healthier mentality move to greener neighborhoods or proximity to green spaces improve mental health. This research concluded that moving to greener urban areas aides people to achieve sustained mental health improvement. The ultimate suggestion of this research was for urban designers to improve urban greenery and exposure to more natural settings to benefit public mental health (Alcock, White, Wheeler, Fleming, & Depledge, 2014), and restorative responses to nature (Joye & Van Den Berg, 2011).

It is also believed that modern citizen's alienation from nature was not an inevitable consequence of civilization; this separation took place as a result of a design flaw and can be fixed to a great deal by improving the design of the cities and buildings (Kellert, 2008). Regarding the United Nations several estimations about the further expansion of the cities in upcoming decades (U.N., 2014 & 2017), it becomes more crucial than ever to lead the development of urban and built environments in cities consciously to minimize unreturnable negative effects of manmade environments.

1.3 Aim of the Study

To restore the main motivation of this study, parallel with adults, millennium young children have been mainly under the influence of this rapidly changed lifestyle and culture. With the increasing number of families with working parents, children, as well as their parents, are being dragged into indoor spaces. It is observed that the amount of connection of young children with nature and natural areas has been dramatically reduced especially after the '80s and 90's decades, children still had the chance to grow up with intimate contact with nature. (Louv, 2008; Chawla, 2015; Moore & Marcus, 2008). Until around 1970, nature was in access of children in many forms in their neighborhood. Whenever children had the chance to free play, their first try was often to run away from the dull human-built environment and rush into the nearest natural environment, which could be a tree-house, barns, family farms, a

water stream in the woods, or in the close-by wild nature. And still, small "left-overs" were available within urban spaces, like parks, green sidewalks, vacant fields which had countless benefits for their physical, mental, psychological, spiritual health, and sense of belonging and attachment to their environment (Kahn & Kellert, 2002; White & Stoecklin, 2008).

Increasing urbanization has profoundly reduced the chances for children to freely play outdoors and parents practically prefer to keep their children indoors to protect them from being harmed (Veitch, Salmon, & Ball, 2010). Children's physical limitations to be free in natural environments have shrunk due to several considerations. Fear of harm from strangers to children, high rates of kidnapping and crime, fear of car accidents, dermal harm of UV rays, carious contaminations, diseases can be caused by street animals or insects are only some of the factors that keep parents from letting children play outside. Mentioned issues are only a part of the reason that urban kids -unlike their previous generations- are deprived of wandering and playing in their neighborhoods to get integrated with nature and explore it. (Louv & Fuller, 2017; Chawla, 2015; Pretty et al., 2009 Moore & Marcus, 2008; Clements, 2004; R. A. Wilson, 1997).

It is also undeniable that the trend of children drawn away from nature is amplified by the ease of using technology to entertain children at home. Today, with children's lives the virtual is replacing the real. In other words, with their limited experience and minimal connection to nature, almost all their knowledge of their environment is controlled, filtered and dominated by Media (Chawla, 2015). For example, for a child who never had the chance to explore nature and connect to it in person, nature is being perceived through the digital screen like, TV and phone, and watch from a nature documentary or as a magnificent wallpaper, making him deem that nature is in far places and out of reach. Accordingly, they are feeling more attached to the virtual and technological sources rather than experiencing their surroundings in reality.

Moreover, lack of experience with the natural world during the early years of one's life even is discussed to build insensibility and apathy towards environmental issues (Zhang, Goodale, & Chen, 2014). Withdrawing the chance to engage with the natural world from the childhood experience, does not only affect their growth and development. It also prepares the ground for further loss and damage to the natural environment, even worse than the current generation has done to it. On the contrary, if the future generation has a high opinion of the natural world, it ensures the preservation of the natural environment over the upcoming decades. Many kinds of research strongly support that children's regular integration with nature produces love of nature and positive environmental ethics toward it (Kellert, 2016; Chawla, 2015; Moore & Wong, 1997; Moore & Cosco, 2000; Keller, 2002; Phenice & Griffore, 2003)

According to many prominent names such as Peter Kahn, Stephen Kellert, Judith Heerwagen, Richard Louv, Frances Kuo, Roger Ulrich, Louise Chawla, and so many others, lack of integration with nature seems to be one of the main grounds of many newly propagated unwellness for children like Attention Deficit Hyperactivity Disorder (ADHD). Similarly, Louv (2008) invented the term 'nature deficit disorder' as an alternative name for this type of disorder in his book, "Last Child in the Woods". Even though it is not a recognized illness, empirical evidence supports this notion. The Nature Deficit Disorder movement in Richard Louv's "Last Child in the Woods", suggested that children's interactions with nature are increasingly becoming more restricted. And, every day more and more children are suffering from health threats caused by nature deficiency in their postmodern culture (Louv, 2008; Chawla, 2015; Richardson et al., 2019).

Although nature inside the buildings cannot compete with the benefits of the necessity of connection to intact nature and natural environments for children, there is a clear opportunity for architecture to step in and mimic natural features for buildings by using the patterning, forms, materials, symbols, and spaces, which represent nature and evoke similar responses.

In this context, we are witness of a significant increase of work around the intersections of wellbeing and architecture, both in research and in practice, has been emerged over the last few decades. Both Researchers and architecture practitioners are perusing the role of nature and nature-focused designs in different spaces on the wellbeing of the residents of those spaces. Instantly, various design principles and design patterns have been introduced to respect nature and natural elements in planning and designing buildings. Several architectural design movements have been suggested to worship nature inside the buildings.

Some of the architectural design movements have been catching more attention rather than others in this field; sustainable design, restorative environment design, biomimicry design, "green" buildings and salutogenic design are only a few well-known of them. Though all these design movements might sound very close in meaning, there are key differences among them, which will be discussed in chapter three. This thesis will focus on a rather new one, 'Biophilic Design', which responses more accurately to the bond between human wellbeing and worshiping natural elements in the built environment.

Kellert and Calabrese (2015) explain that the architectures and constructors are still treating nature in their construction and design plan as a factor to overcome or eliminate. Even if there are any relatedness and the sense of praising natural elements available for them, it is so minimal. In response to such isolation from nature and its purported benefits on people's health and well-being, Kellert and Calabrese propose that biophilia and biophilic design "promise" the fostering of a positive relationship to nature. "*Biophilic design seeks to create a good habitat for people as a biological organism in the modern built environment that advances people's health and wellbeing"* (Kellert & Calabrese, 2015).

Despite an expanded body of studies conducted through psychological, philosophical, and educational perspectives, giving guidelines and principles to designers for designing biophilic hospitals (Abdelaal & Soebarto, 2019), nursing homes, train stations (Roös, Jones, Downton, & Zeunert, 2018), and even prisons

(Söderlund & Newman, 2017), one of the main fields that should attract attention in this manner is preschool environments which is still a gap in this manner. This study seeks to promote biophilic design features in children's educational environments to stimulate their sense of belonging to the place and stronger attachment to nature which has countless benefits for their wellbeing.

1.4 Methodology of the Study

Most successful childcare centers are emphasizing on the importance of the basis and features that building provides for children to grow (Bailie, 2012; Monsur, 2015). One the other hand, existing researches, and studies around reconnecting modern children to nature and natural environments, predominantly embrace the idea of taking children to nature and increasing their free playtime outdoors, which is undoubtedly a significant matter to invest time and effort into it. So, it seems crucial to connect these two issues and re-evaluate the quality and features of built environments they are spending most of their time. Preschools are places that are being designed with the needs of children under the spotlight. And, after their homes, preschools are the second places that children are present. So, in order to attain more children and responding to their needs, it is wise to focus on preschool buildings rather than residences. This study will search for ways to maximize the integration of the natural environment into the built environment in preschool buildings.

In this study, a literature review is gathered to gain comprehension of the influence of interaction with natural elements and natural environments on children between the age of three to six in preschool environments. The theories and practices around the wellbeing of preschoolers are assorted for a firm grasp to better understanding the needs of children. In addition to general rules and laws for building preschool, some educational models are helping this research to gain a more comprehensive understanding of the innate needs of children from an educational place that they are spending a considerable amount of time in them. Also, their perspective for integrating children with natural features will be regarded. The result

of the literature review will be prepared as a list of distilled guidelines for designers to consider when designing an educational place for children.

There are many approaches and attempts to evaluate nature in architecture or by architecture like restorative environment design, salutogenic design, biomimicry and biophilic design. By discussing their key differences and the reason to choose the biophilic design in chapter 3, we will continue with expanding attributes, features, and 14 patterns of biophilic design which are the firm footsteps for this study. By combining the resolution of the literature review about the innate desire of children from a place with patterns of biophilic design, these 14 patterns will be prioritized for preschools in favor of children.

Aided by the concept of biophilic design, qualitative and analytical research methods are being used to evaluate the features of selected sample preschool designs. Five preschools are selected randomly among preschools which their projects have been published since the rise of biophilic design (last 5 years), are from various parts of the world, and are from a variety of location within the urban plan. The architectural features of different parts of these preschools will be analyzed in detail and their compatibility with biophilic design patterns will be assessed. Some practical recommendations will be provided for each feature of each school to promote them to become more biophilic. After practicing to give suggestions for existing preschools, with the help of information derived from the literature review and conceptual framework 8 practice-based recommendations will be generated particularly in support of prospective preschool designs.

With procreation of applicable biophilic guidelines for preschool building design, the question of the thesis will be partly quenched which was to find architectural solutions to help to improve the relation of children and the natural environment within the built environment.

1.5 Boundary and Structure of the Study

The triangle relation among human, nature, and architecture have been a profound issue throughout decades, centuries and even millenniums. Human being has always been looking for the perfect and optimized balance among them. In modernism and postmodernism years it flourished as an appreciation of vernacular architecture and also building's place in the ecological system of the planet and taking the energy consumption of the building in control and emphasizing sustainability concerns that were more focused on the connection of architecture and nature. Whereas biophilic design is pushing human needs forward and evaluated the natural features of a building from the perspective of human wellbeing. This thesis will exclusively maneuver around the biophilic design approach and will not assess the relation of building with sustainable or ecological design.

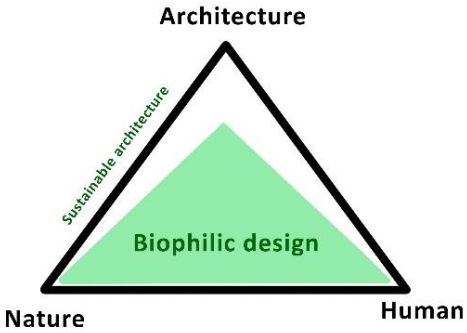


Figure 1.1 Place of biophilic design relation of architecture, human, nature
By Author

The main focus of this research will be on the characteristics and features of preschool buildings, where children perceive as their second homes. Preschool is a stage that educates and cares for children of age 3 to 6, for over 40 hours a week.

All humans under the age of 18 are considered as a child (Oatley and Jenkins, 2007; Seldin & Epstein, 2003). And, this age group has been divided differently by various resources, but most commonly are categorized in the groups below.

a) birth to two years of age are infants

b) three to six are preschool children

c) seven to twelve years of age are primary school children

d) thirteen to eighteen years of age are secondary school children

Though the motivation of this study was directly derived from personal psychological drama experienced in the childhood, regarding the field of study, this thesis will only emphasize on the dialogue between natural environments and built environments – especially preschool environment- by a conceptual framework that is influencing all the world for many years now.

The structure of the thesis is composed of five chapters. In the first chapter, there is an introduction to the study with the explanation of the aim and structure. A brief history has been conducted around the transformation of the modern human lifestyle in comparison to the pre-civilization era. In follow, the general area of the problem, the role of architects and designers in this matter is highlighted.

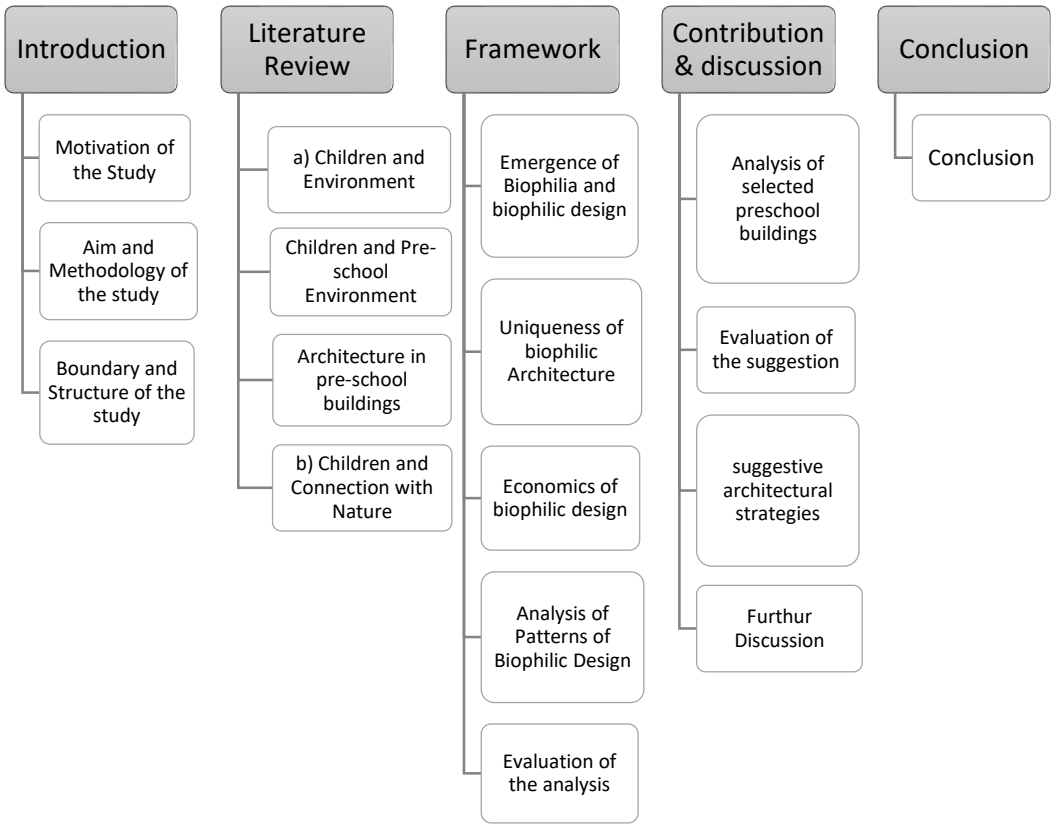
In the second chapter, the definitions of pre-school age, wellbeing, and interior environment of preschool buildings are explained. The characteristics of young children examined in order to get familiar with their needs to interfere with natural elements and natural environments.

In the third chapter, the main framework of the thesis is demonstrated, which is biophilic design and its features and elements and interpretation of them for a preschool building. Here, the relation among child, nature, and architecture of preschool will be re-observed with the vision of biophilic design and taxonomy classification of biophilic patterns priorities for preschool environments.

The fourth chapter includes my contributions and suggestions to this study. A delicate selection of existing preschools from all around the world are being analyzed and criticized architecturally and on the basis of information gathered on the second and third chapter, some suggestions are provided for each critic. Then by

evaluating these suggestions, eight applicable recommendations are given for designers of preschools. The last chapter builds up the conclusion of the whole thesis.

Table 1.1 The Outline of the Thesis



CHAPTER 2

LITERATURE REVIEW: CHILDREN, PRESCHOOL ENVIRONMENT, AND NATURE

Theories and researches around children's development and wellbeing is a body of knowledge that is growing extremely fast since the 1970s among scientists and psychologists to be used in interdisciplinary fields education planning, healthcare systems, and environment designers in practice. It has been proven that the quality of the built environment influences the physical and mental well-being of children and affects the way children use the environment. On the other hand, humans have an innate desire for nature, and children instinctively are driven by curiosity in the natural environment. Therefore, nature is an important contributor to the development process and the wellbeing of children.

This chapter consists of two main bodies of research on a) how children's physical activity and the psychological mood gets influenced by the characteristics of the preschool environment, and b) how nature plays a critical role in children's mental and psychological peace, cognitive and creativity enhancement, and the way children perceive the environment and use it.

2.1 Children and Preschool Environmnet

Many dimensions have an impact on the wellbeing of children. As architects, we are responsible for the quality and characteristics that built environment offers to them. Since there are not generous chances to integrate with the natural environment and the neighborhood landscapes, millennium children under the school age are predominately spending most of their lives in two places: their homes, and

kindergarten.[1] In this study, we prefer to study characteristics of kindergartens over the residential environment because of two reasons. The first reason is to fulfill the main objective of the thesis, which is to help designing preschools that are improving children's wellbeing by integrating them with nature and natural features. The second one is to reach a bigger community of children in their educational spaces.

Education can take place in various spaces, like home, museum, natural parks, etc. But, the only space that is designed exclusively to respond to children's needs to invest in studying and planning is school. One of the key agents of this fact is the physical condition and design of the school building which has a major impact on motivation, learning experience, and health and wellbeing of children. Barrett et al. (2015) and Hunter (2006) emphasized the importance of the heating system, operative ventilation and convenient lighting on pupil's learning motivation and overall morale. Olson and Kellum (2003) and Ricciardi & Buratti (2018) are putting forward that indoor air quality, proper acoustic, and natural ventilation system as remarkably advantageous characteristics to student achievements.

In design patterns of preschools, the main spaces include open-plan care rooms, washing rooms, and outdoor play areas (Midbjer, 2007). As the care room is the place that preschoolers spend the most of their time, researchers brought out that improving the classroom's physical environment with the help of items like brightness, view to outdoors, interior variety, and furniture sets according to the o the preference of the users will greatly help the performance of students (Barrett, Davies, Zhang, & Barrett, 2015; Ramli, Ahmad, & Masri, 2013). Vasquez et al. (2019) and Wei Wu & Edward Ng (2003) emphasize on the intuition of children in classrooms with large windows and natural lighting, or well-fit skylights perform better than their peers in classrooms without any windows.

[1] There are some alternative names in different regions of the world for the property that educates and takes care of children between age three to six during day time, such as kindergarten, preschool, day care, nursery, child care.

2.1.1 Architectural Context in Preschool Buildings

The list of researches and studies conducted on the impacts of the physical condition of pre-school buildings are endless. In each part of the world, these features and conditions are categorized as a variety of educational concepts and pre-school building guidelines for designers. For instance, ministry of education in Turkey has published a Education Buildings Minimum Design Standard Guide to lead architects and constructors for detailed minimum design standards for schools and pre-schools which gets renewals every few years according to the new findings around wellbeing of students and providing better learning environments (T.C. MİLLİ EĞİTİM BAKANLIĞI, 2015, 2019). Existing Architectural disciplines and principles generally are not designed for specific educational models.

However, in addition to every country's national educational system's general instructions and rules for school buildings, which are more limited to the legal policy and rules of construction, it is important to understand some of the philosophies and educational models suggested by philosophers and psychologist for the environment of children. They look deeper and more delicately in the fundamental psychological, cognitive, spiritual, and mental demands of children from their environment.

To maintain within the scope of this study, we avoid extending the explanations of various educational systems which are massive fields of discussion. We will pick out the characteristics of the environment they recommend those can be implemented in the architecture and design of a preschool. By perusing the attribute that they recommend about the quality and arrangement of spaces in a preschool environment, the first characteristic that catches attention is the personalization of the environment for children, to give them independence and a sense of possessing and dominating the place.

Emphasize on personalization is of the environment is highlighted in Montessori schools more than the others by making it a necessity to provide the small

version of all the facilities that adults use in a daily life. Basically, various spaces of the Montessori pre-school often resemble the physical world for children, offering a constructivist type model of learning to the children and allowing children to gain the highest level of belonging to the place and independence. Accordingly, the self-confidence of children will boost up as they have a self-image of a successful person (Al et al., 2012; Seldin & Epstein, 2003; Kirkham & Kidd, 2017).

It is observed that children in the early years focus on the senses, imaginations, and bodies, and direct stimulation of the intelligence isn't focused on until the teenage years (Bjørnholt, 2014). In preschool ages, the spiritual need of children is to become independent, identified, suited, fitted, and belonging to their space. Therefore, the learning areas are highly personalized within the provided curtains, covers, toy fences, or simply by furniture arrangement provided.

Some other philosophers like Waldorf have commented on the personalization of the space from an additional aspect. They encourage kindergarten spaces to provide small tent-like refuge spots for children to stimulate their spiritual quality and bring out the deepest essence of their minds and spiritual uniqueness by giving them privacy and isolated small areas (Bjørnholt, 2014; Goldshmidt, 2017; House, 2013). However, other educational systems did not underline extreme privacy for children, they also pointed out small places that children can feel fitted and suited in it is an innate demand at early ages.

Figure 2.1 Refuge spots created for children by architecture and decoration
Left: https://www.architonic.com/es/project/arka-design-montessori-kindergarten-beijing/20026647
Right:https://www.31daily.com/diy-kids-tents-and-teepees/

The second significant characteristic evident in the design guidelines of some educational models is dividing the area into smaller groups. And, keeping the circulation in between these small areas dynamic and welcoming. It means that the corridors between these articulated group spaces not only provide a connection between these spaces but also they are supposed to attract the curiosity of children to move from one place to another to be exposed to various activities available in the preschool.

Whereas some educational models emphasize the articulation mostly within the classroom –like the Montessori approach-, some others emphasize the smooth flow between areas within the indoor-outdoor frame- like the Reggio Emilia approach. the diagram below attempts to show the desired articulation of preschool among spaces. *"The other children are the first educator, the second the teacher, and the third the environment." Loris Malaguzzi (founder of Reggio Emilia approach).* This means that not only do children learn from collaboration and influence from teachers and other students, but also the environment plays a crucial role in their education.

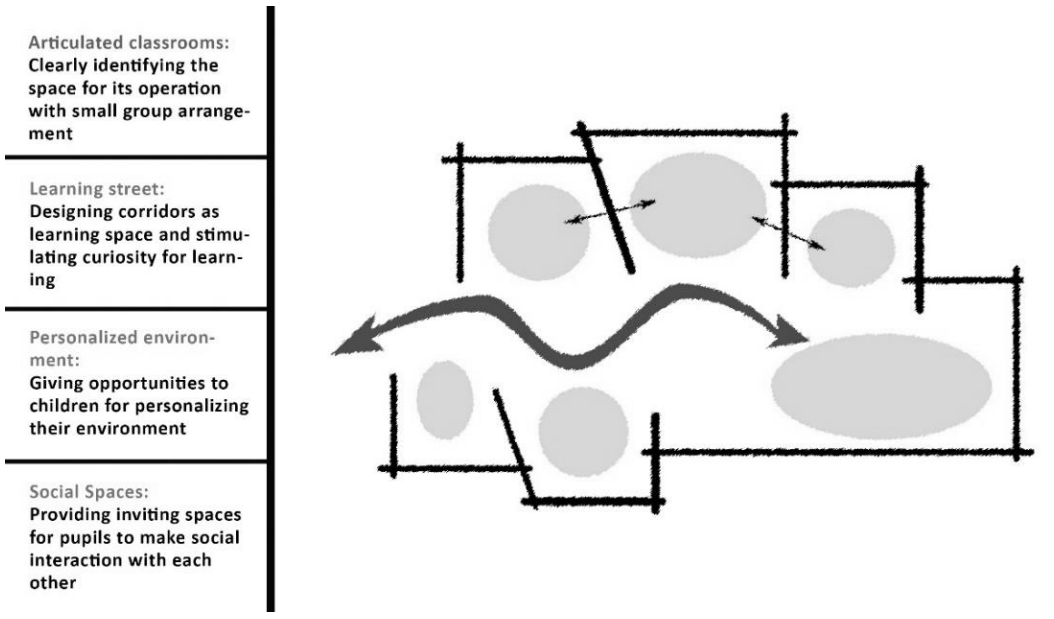


Figure 2.2 Articulated classrooms according to Montessori
Small group arrangements and connecting through 'learning streets' according to Montessori, sketched by the author

Each educational approach needs a school design that supports the theory and philosophy behind educational models. Hence, in Reggio Emilia's approach the general architectural form of the pre-school should provide spacious spaces for students to encourage exploration and creativity. Also, the spaces should be interconnected and especially connected to outdoor spaces of preschool. The architectural output will follow these general principles shown in the picture.

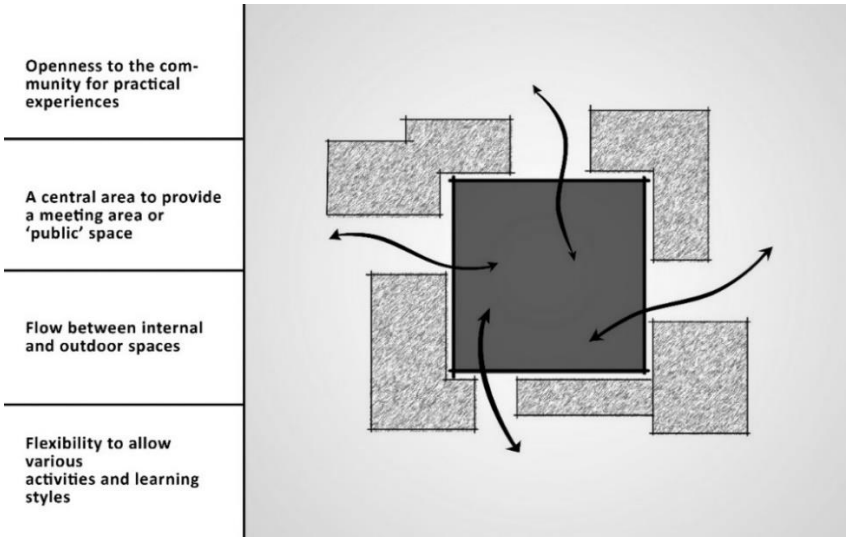


Figure 2.3 Reggio - focus, dynamic flexible space, in/outdoor flow, sketched byauthor

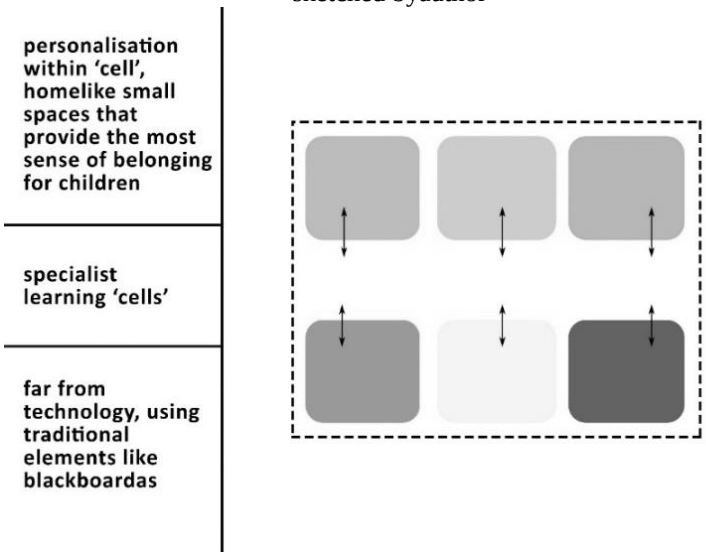


Figure 2.4 Articulation of classroom according to Waldorf (Steiner) sketched by author

Figure 2.5 Waldorf preschool classrooms
Left: https://www.windsongpreschool.com/a-little-tour.html,
Middle:https://www.manchestersteinerschoolproject.org/ Right:http://pikby.com/media/316589048789847896

According to psychologists like Montessori, another important principle is the connection to living things. Besides, practicing everyday skills like washing one's own dishes after a meal in a small designed kitchen, children should be responsible for feeding, raising, and taking care of small animals, like hamsters, fish, rabbits being kept in the classroom or outside the school building. Also, students are running a class garden and are watering and taking care of plants in indoor spaces of their school (Seldin & Epstein, 2003; Kirkham & Kidd, 2017). This benefits them largely to strengthen their bond with the natural world and benefit from the spiritual advantages of this matter. *"The child who has felt a strong love for his surroundings and for all living creatures, who has discovered joy and enthusiasm in work, gives us reason to hope that humanity can develop in a new direction." Maria Montessori*

According to the educational systems above, they are mostly focusing on educational aspects and what is beneficial for children's learning process and development.

- personalization of the space
- connection to the environment (natural and cultural)
- dividing the space into smaller zones
- experiential learning
- Sensory stimulation

Briefly, in addition to common constructional rules for a preschool building, features mentioned above are considered to be essential for the wellbeing of preschoolers. However, there appears to be a missing link in regards to how nature can facilitate development and the incorporation of it into the design of the preschool classroom. The following section will discuss nature, its place in the learning environment, and how it is critical to child development, health, and wellbeing. From here, nature becomes the dominant dynamic of this study.

2.2 Children and the Connection with Nature in Preschool Environments

Psychological unwellness among citizens through nature deficiency in urban built environments, absorbed scientific attention after eminent psychiatrist, Harold Searles published his book *'The nonhuman environment', (1960) "The non-human environment, far from being of little or no account to human personality development, constitutes one of the most basically important ingredients of human psychological existence." Harold Searles (1960).* Since then, research and practice unified to support the idea that human being psychologically, physically and biologically has the need to affiliate with nature and natural environments, especially during critical formative childhood years. As well as adults, this relationship is very important and beneficial to children's development, health, and wellbeing (Kellert and Wilson 1993, Kellert 2005, Louv 2008).

Some authorities stated that childhood is the only stage of life that human beings can establish a viewpoint of care, love, and respect for nature. If it does not happen during the early years of one's life there is a risk of never attaining such perspective (Sobel, 1996; Wilson, 1997). With modern urban children's extremely limited access to the natural world for free play, the places they are spending most of their daily lives seem like human being's only opportunity to inject a dose of nature in those places and expose children to as much natural environment as

possible. These places mainly include their two places: their homes and kindergartens. Most of the urban children between the age of 3 and 6 are spending 40 to 50 hours a week in the kindergarten and preschool (Malone & Tranter, 2003; Mohidin, Ismail, & Ramli, 2015). Respectively, kindergartens and pre-school buildings are outlined as the best opportunity to improve children's interconnectedness to the natural world.

"Health is much more than mere absence of illness. It is the responsibility of today's adults to identify hazards and conditions that impair children's ability to grow and mature safely and in good health." Anita Olds

The innate tendency of human beings towards nature has been introduced as 'Biophilia', the urge to affiliate with the natural world, by Edward O. Wilson in his book *Biophilia* published in 1986. He felt a necessity to promote this word when he observed high rates of migration to urban settings and the accelerating rate of urbanization and disconnectedness from nature coming in consequence of it. Later in 1995, Edward O. Wilson and Stephen Kellert co-edited The Biophilia Hypothesis. "No one has learned more about the intricate relations of the human to nature, as expressed in our architecture than Stephen Kellert," says Edward. O. Wilson.

One of the prominent names in the area of biophilic design and biophilic design for children is social ecologist Stephan Kellert who has written many books around this subject. The relationship between nature and society has been a long-time concern for Stephen Kellert, as seen by his early works such as *The Value of Life: Biological Diversity and Human Society (1996)* and *Kinship to Mastery: Biophilia in Human Evolution and Development (1997).* This interest has expanded to his consideration of nature and built environments, as in the collection *Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life* edited by Kellert, Heerwagen, and Mador in 2008.

Kellert's interest is reflected in many types of research regarding nature and the built environment and entails the study of both exterior environments and, more

recently, interior spaces. In the meanwhile, Kellert spread his work around the environment for children as seen in the *Children and Nature (2002)*, edited by Kellert and Kahn. A few years afterward, with *Building for Life: Designing and Understanding the Human-Nature Connection,* Kellert draws attention to injecting nature into our modern living spaces, particularly in the built environment. Following the footprints of this book, he put out *Design: The Theory, Science, and Practice of Bringing Buildings to Life (2008),* an innovative guide to the emerging practice of biophilic design.

2.3 Evaluation of Literature Review

In this chapter we attemped to peruse other scholar's works around the relation of children with their environment and their relation with nature. It was evident that children's physical environment has irreplaceable impacts on children's physical activity, in how they use the space and their sence of belonging to the space. On ther other hand, crucial benefits of nature on children's physical health, cognitive functioning , and psychological wellbeing have been proven. And, it is believed that parents, educators and designers should focus more delicately on improving children's connectedness to natural environmnets.

Regarding children's relationship with their educational environmnets, we derived out the critic points from guidelines provided for designers of preschool buildings by psychologists and founders of some educational models. We chose to do so in order to get a more comprehensive understanding of the children's inner needs and desires from an educational environment, as the architectural and structural rules and laws available for builders are not focusing on the matter from children's perspective. The resolution from this research came out as design guidelines like personalization of the space, connection to the environment (natural and cultural), dividing the space into smaller zones, experiential learning , Sensory

stimulation. The strategies for applying these factors in preschool environments will be provided in Chapter 4.

CHAPTER 3

CONCEPTUAL FRAMEWORK: BIOPHILIC DESIGN

3.1 Emergence of Biophilic Design

The notion of biophilia was first introduced by the philosopher and social psychologist Erich Fromm in his book *The Heart of Man* (1964). He mentioned this concept while describing the difference between human beings from the rest of nature. He suggested that humans being aware of their "beingness" and being aware of their "mortality" is separating them from the rest of the living things in the natural world, leaving him with confusion and anxiety to find his place in the cycle of life. Philosophically speaking, this confliction within humankind's spirit leads him to a choice in the relationship towards the world. To face this anxiety, human-being is spiritually and psychologically compelled to take one of the two paths to tranquilize the anxiety of being different from the rest of nature. The first path is "the syndrome of decay" that similar to archaic and animalistic era of humans, feeds human with the dimwitted senses of narcism or self-admiration, extreme violence to other living things, exaggerated dependence to mother or known as incestuous symbiosis, and even sometimes excessive fascination to dead known as necrophilia (Fromm, 1964). On the other hand, the second enterprising path leads to "the syndrome of growth" in which human-being is welcome to take the way of unselfishness and consideration to other living things wellbeing known as altruism, sense of freedom from self-centeredness and the struggle to adaption and blend into the natural environment

around them, and love of life and living processes introduced as biophilia.[2] (Fromm, 1964, p.114)

However, the biophilia hypothesis was coined by Eric Fromm, the word was later popularized by Nobel Prize–winner Harvard biologist Edward O. Wilson in his book *Biophilia* (1984). Based on Wilson's occupation, he spent a considerable amount of time exploring and contemplating the natural world. He describes that he was feeling a deep connectedness and a yearning to affiliate with other living forms during the period of his examinations in nature. Then he generalizes biophilia regarding "*the connections that human beings subconsciously seek with the rest of life*".

While Fromm brought biophilia into the world as a psychological and philosophical term, Wilson besides affirming Fromm's premise, added a biological dimension to this hypothesis and suggests that human's tendency towards nature comes as an inherent value. Fromm and Wilson both agreed that biophilic tendencies in today's humans are a factor that has been survived in the evolutionary natural selection throughout history and it needs to be nourished and amplified. Otherwise, there will not be sufficient opportunity to develop love towards life, nature, and living things. Thus, humankind will tent to take the regressive path of "decay" which means the anxiety will lead man into violence, self-centeredness, hatred of life, and

---

[2] To illustrate the word "Biophilia" more clearly, referring to a more common word might be helpful. The term "phobia" literally means an extreme or irrational fear of something. It is customarily used as a suffix in many words in our daily used words, like Claustrophobia (fear of closed spaces), Insectophobia (fear of insect), Thalassophobia (fear of ocean). Ancient Greek words phobia and philia are opposite in the meaning. Contrary to phobia, Philia means tendency and friendly feeling toward something

death. Wilson felt a necessity to promote the concept of biophilia when he observed high rates of migration to urban settings and the accelerating rate of urbanization and disconnectedness from nature coming in consequence of it, causing urban people anxiety, various mental unwellness, and even hate for life.

3.2 Biophilic Design

Wilson started to wonder in his book *biophilia* if the modern city life is suitable to foster biophilic propensity in modern human's essence. He observed that if people are given a choice to choose their own habitat, they would prefer to live on vegetated, savannah-like lands, and near water sources. Even when they are tangled in modern cities, there is an attempt to value the features of desired savannah-like habitat like growing grasslands, planting trees, making small gardens wherever they can, building fountains, accessing to natural light, etc. So, urban people unconsciously and instinctively tend to rely on their innate adoptions and affinity towards nature and so to prefer to be in natural environments in which they can feel better and their functions improve.

Edward O. Wilson dedicated his life to educating people about the necessity of putting people in mind of reconnection with their innate tendencies to embrace nature in their daily lives even in modern city lifestyles and preserving biodiversity. Rather than Fromm's premise explaining the intellectual, spiritual and philosophical aspects of the biophilia notion, Wilson's *biophilia* book caught wider attention since he narrated his personal experience and journeys he had in the natural environment.

After a decade, along with Wilson, numerous scholars like Kellert, Heerwagen, Ulrich, and others began to pass this mission hand in hand to attract the awareness of public to the positive impacts of natural aspects of their living environments by publishing *The Biophilia Hypothesis* in 1993 which became the second reliable source on the biophilia hypothesis. After this book, biophilia term promoted as a hypothesis. In this book eminent leaders of biophilic perspective commented,

deepened and detailed this conception from various points of view. The concept of biophilia began to attract a broader range of attention after the Rhode Island conference in 2006.

As shown in the chart below, demonstrating the trend of biophilic design in the last fifteen years, it is clear that the conference in 2006 had a huge impact on the popularity of the biophilic design.

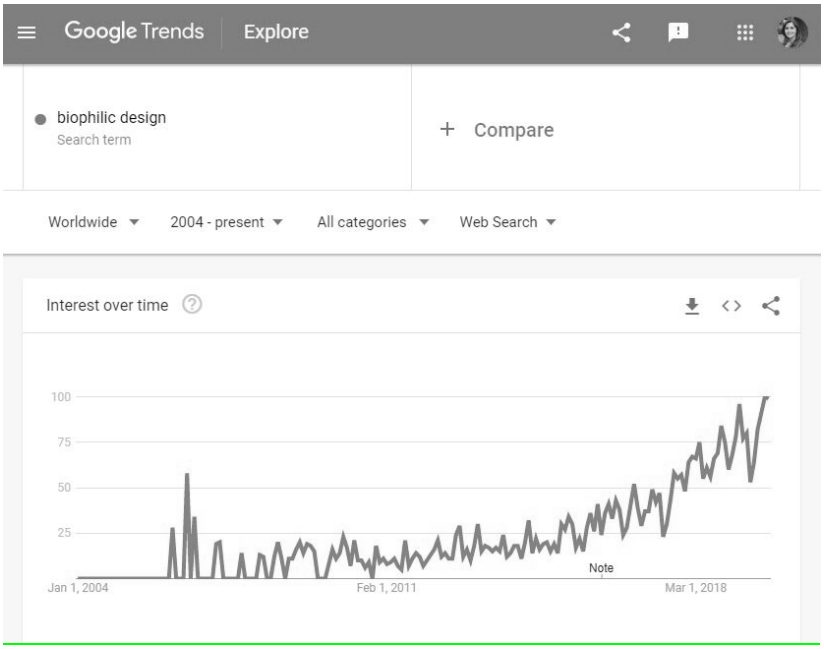


Figure 3.1 Accelerating trend of the biophilic design shown in Google Trends

In this conference, the world's expert representative of various fields from academic, financial, industrial and even governmental aspects gathered to discuss *The Hypothesis of Biophilia* and to evaluate the functional and feasible solutions to trigger the biophilic move. The discussed ideas and suggestive design principles from various perspectives in this conference were gathered in another book *"Biophilic Design: The theory, science, and practice of bringing buildings to life"* by Kellert et al. in 2008. According to the google trend report above and available research materials, the progression around the research on the subject of biophilic

design came in powerfully in 2006 and got attention again around 2008 by the launch of the latter book.

Though the chapters of this book are approaching to the subject from different angles like urban planning (Hartig et al., 2008), biophilic design elements and features (Kellert et al., 2008), the impact of connection to nature on healthcare (Roger S. Ulrich, 2008), designing biophilic spaces for children (Moore & Marcus, 2008) and other aspects, they are all united to acknowledge a disconnection from nature in current urban society. Accordingly, they are all in agreement for the necessity for a new approach to human-nature connection in urban settings and integrating as much nature and natural features as possible with urban life and therefore design.

The second major Global Conference of Biophilic Cities took place in 2013 at Virginia University. As demonstrated by the trend chart, after this conference the trend of biophilic design notion has generally been accelerated considerably into this date. All these conferences and gatherings were taking place in an interdisciplinary platform, because as Kellert mentioned in 1993 when he and Wilson invited the scholars for the first time to discuss newborn biophilia hypothesis which was being built on the foundation of previous studies from diverse fields. So, on behalf of "richness of the topic" they needed commentary from various perspectives.

While evaluating biophilia from their own points of view and from various disciplines, the authors and lecturers were generally agreed that current urban society is being disconnected from nature due to radically changed urban lifestyle. Although from the beginning of civilization there were attempts to value nature in built environments, during the last decades there is an undeniable gap between humans and nature. In order to regain and apprize the nature and preservation of nature, various approaches have been conducted after the late twentieth century. Approaches like sustainable design, green architecture, green roofs, green walls, vernacular architecture, and other strategies served the idea of reconnecting the natural environment and the built environment.

3.3 The Uniqueness of Biophilic Design

There are some similar terms to biophilic design in concept and literacy which are aimed to be explained in this part to draw a clear line around the area of concern in biophilic design. First of all, we are going to explore the place of biophilic design in Restorative Environment Design which also includes sustainable or green design within itself. Then, a comparison of Sualutogenic design –which might be comprehended as a close approach to biophilic design in concept- and biomimicry –which might sound comparable to biophilic design- will be explained.

3.3.1 Biophilic Design vs. Restorative Environment Design

To understand Biophilic architecture further, it is important to distinguish it from Restorative Environment Design (R.E.D). As defined by Burnard (2014), R.E.D is combining sustainable system principles with the building practices that promote occupant's health and wellbeing. While Gifford & Mccunn (2012) suggest that biophilic architecture design can be categorized as an item under a larger restorative design tab which is visualized in the diagram below.

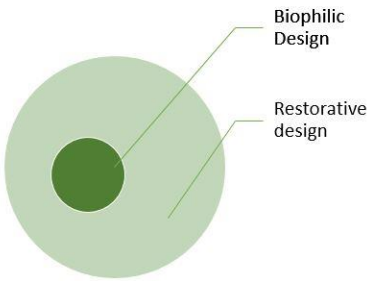


Figure 3.2 Relationship between biophilic design and R.E.D
By the Author

More extensively, in Derr’s and Kellert's opinion (2013) biophilic design is one of the two dimensions of R.E.D. Figure 11 illustrates the relationship between

R.E.D., sustainable/green design, and biophilic design in their explanations which is visualized in the diagram below according to Kellert and Derr.

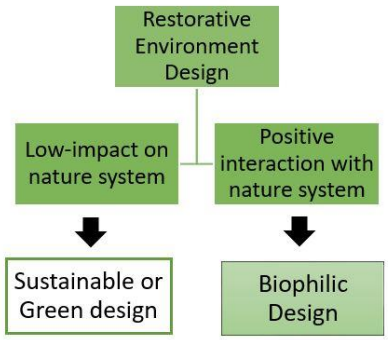


Figure 3.3 Relationship Between Biophilic Design and R.E.D,
By the Author

Not long ago, the general notion of good architecture was a building that was "*suitable*" to its environmental context and climate. The idea of sustainable architecture revised from a building that is '*sensitive*' to its environment to a building that will thoroughly preserve and protect the environment from the possible contaminations caused by human habitations It is 'the environment' that has been seen as needing protection (Kellert, 2012; Williamson, Radford, & Bennetts, 2003). However, Biophilic design turns on the pivot of humans and seeks to improve human functioning, health and wellbeing by integrating natural elements in the built environment (Kellert, 2012; Molthrop, 2011). So, a clear difference between biophilic design and sustainable design is the concern point of the two disciplines. In the table below some features of sustainable design and biophilic design are compared.

Table 3.1 Comparison of Sustainable Design and Biophilic Design Features

Type of source	Sustainable design feature	Biophilic design feature
Energy	Using renewable energy like solar energy Daylight as heat and luminance source	Preferring natural daylight to bulbs Natural Light rays as a pattern that varies within the day and night
Water	Water recycling Collecting rainwater	Direct nature (manmade water features like pools, constructed ponds, or fountains)
Material	Vernacular materials (cob structure, straw bale, or what is made by local labor) High thermal mass Using recycled materials (recycled wood flooring)	Natural material Natural forms and shapes
Environment	Minimizing land occupancy, working with natural landforms and processes Green roofs and vertical gardens	Ecological connection to place Direct exposure to plants and animals Evoking nature through natural shapes, forms, and features Green roofs and vertical gardens

As understood from the table above sustainable design features are developed in favor of minimizing energy consumption and omitting the pollution factors for the natural environment, like utilizing solar energy is to supply energy of the building to avoid the need to consume external power sources. It means solar energy can transform into electricity form and display in light bulbs as a source of lumination in the building. Whereas, biophilic factors are concentrating on optimizing the positive effects of natural features on human health and wellbeing. In the case of solar energy, biophilic design's point of concern is to prefer natural daylight as the source of lumination over electricity power. Or, one of the extremely successful applications

of biophilic design is to play with sunshine rays to perform patterns made of light in the interior spaces.

Figure 3.4 Designing Sunshine Rays in Biophilic Design
Left:https://deskgram.co/explore/tags/Amatelarchitettura Right:
https://www.archilovers.com/projects/218828/house-in-ishikiri.html

For another instance, the biophilic design suggests building pools, water fountains, artificial waterfalls, and even constructing ponds all of which are not recommended in a sustainable design framework due to unnecessary energy consumption. The biophilic design puts human health, wellbeing and inner need in the foreground. And the economic justifications of applying these feature is explained in section 3.4 Economic Benefits of Biophilic Design.

Measuring the sustainability of a building is possible via many green building rating systems like LEED (Leadership in Energy and Environmental Design), established for green design established in the U.S.A., or BREEM (Building Research Establishment Environmental Assessment Method) developed in the U.K. and some others are being applied internationally to rank sustainability of buildings. And while these frameworks are important steps for designing more sustainable buildings, they are not all-inclusive. Connectivity and integration to nature within buildings are one of the missing links in sustainability rating systems (Kellert, 2008). This is the reason R.E.D. combines these two approaches to address a more comprehensive prescription to a building that has a better balance between human

beings, built environment and natural environment. Since the purpose of this thesis is to promote the health and wellbeing of the human through architecture –in of design preschool buildings-, only biophilic design features will be assessed to maintain within the scope of the study.

Furthermore, there are some other similar architecture disciplinary other than green architecture and sustainable architecture that might sound related to biophilic design. For example, Salutogenic Architecture and Biomimicry may be perceived as comparable to Biophilic design. It is beneficial to clarify the line between the disciplines and definitions of them.

3.3.2 Biophilic Design vs. Salutogenic Design

The modern human is living longer ever than before. He is trying to establish a long and healthy lifestyle addressing the prevention of illness as well as the curative aspect of the healthcare system. During this period, the architectural profession has an opportunity to deliver optimal therapeutic environments that are supportive of wellbeing, treatments and recovery (Golembiewski, 2017; Rickard-Brideau, 2015; Sell, 2013). The two key design movements that are gaining attention in this field are salutogenic design and biophilic design.

Salutogenic is a theory developed originally by Aaron Antonovsky, a professor of medical sociology and the term is a mix of Greek and Latin which is closely translated to “health origins” and defines an approach focusing on factors that support human health and well-being, rather than on factors that cause disease. (Benz, Bull, Mittlemark, & Vaandrager, 2014). Salutogenic design is mostly used in healthcare architecture as well as other public places, like malls and workplaces. And it is concerned with the relationship between health, stress, and coping and aims to build structures that make people healthier and happier. (Sell, 2013) This approach is strongly focused on addressing people’s health by evaluating

many factors. Promoting natural elements in the spaces is only one part of these factors.

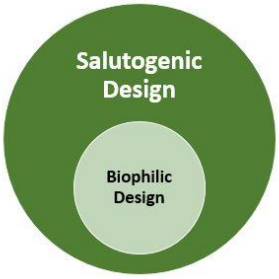


Figure 3.5 The Relation Between Salutogenic and Biophilic Design,
By Author

Architecture can be psychologically manipulative, for better or for worse. salutogenic architecture is believed to accomplish this manipulation by providing a narrative context that affects a person's behavior, neural and endocrine systems, and through its influence on the brain and the body (Golembiewski, 2017; Mazuch, 2017). The similarity of these two approaches is the ultimate objective of them which is to improve physical, mental and psychological conditions in urban society. Images below demonstrate a clearer difference and similarity of salutogenic and biophilic design.

Figure 3.6 Examples of Pathogenic Environments
Left: a mega floor workplace separated to cubical with partitions & Right: a gloomy hospital room
https://www.fastcompany.com/90159662/what-working-in-a-dark-office-does-to-your-brain
https://www.flickr.com/photos/tahitianlime/912907071/in/photostream/

Absence of natural light, any natural material, lack of plants and greenery, no trace of natural forms, shapes and patterns, lack of view to the outdoors, usage of

plain and dull colors, complete disconnection from natural systems, policy of preventing individuals from socializing to other peoples in the workplace all gather to perform a perfectly dull and pathogenic[3] space for the users. In the design of these places, no trace of salutogenic nor biophilic design can be found.

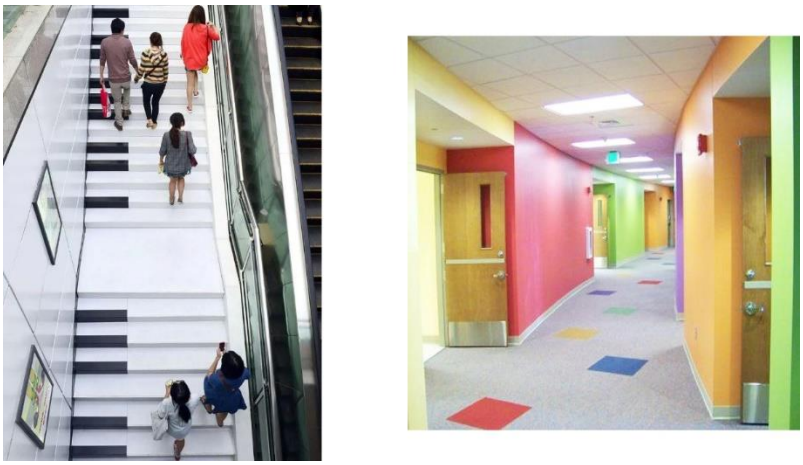


Figure 3.7 Examples of Merely Salutogenic Design

left: The Piano stairs playing music as passersby step on, Source: https://me.me/i/my-alamy-aly-a-alam-a-alamy-stock-photo-my-69968201a7fb46dd83c0242096a63d07 Right: a kindergarten corridor painted colorfully / source: https://www.segurbaby.com/es/180071/suelo-autoinstalable-losas-vinilo-para-interior.htm

The piano stairs that play music by being stepped on depicting a true example of merely salutogenic design and shows how design (without using the parameters of biophilic design) can manipulate people to become more physically active and use stairs instead of the escalator right next to it. The second salutogenic design example demonstrates specifying the design to address children's psychological and mental health, boosting their energy, and promoting a sense of belonging to space by regardless of biophilic design parameters.

[3] Pathogenic: opposite term for salutogenic, meaning causing disease

Figure 3.8 Biophilic and Salutogenic Office and Public Places
Left:https://tsunami-axis.com/trends/an-introduction-to-biophilic-design-for-offices
Right:https://www.ekoyapidergisi.org/6186-modern-yasamda-biyofilik-tasarimin-onemi.html

As illustrated in figure 13, all the biophilic design projects could be placed under the umbrella of salutogenic design as they both aim to favor the wellbeing of users of the building. The office and the public place are following the objectives of both Biophilic and Salutogenic Design.

3.3.3 Biophilia vs. Biomimicry

Nature has always been an inspiration source for contemporary architects, who keep trying to connect with it and learn from it; taking different pathways, bio-mimicry, bio-philia, and bio-morphology all might be perceived so close in meaning. However, they differ in their evolutionary focus, different priorities, weightings, and principles. Biomimicry (from bios, meaning life, and mimesis, meaning to imitate) seeks sustainable solutions to human challenges by studying nature's patterns, models, ideas, processes and strategies to mimic or take inspiration from nature to solve human problems (Biomimicry Institute 2018). Learning from termites how to create sustainable buildings is an example of this innovative approach. As shown in the diagram below, biophilic and biomimicry designs serve for totally different purposes, but they happen to have some features in common.

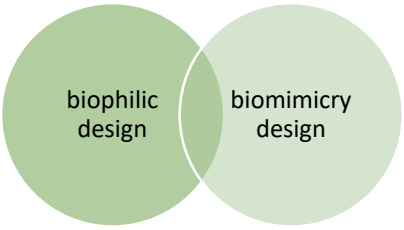


Figure 3.9 The relation Between Biophilic and Biomimicry Design
By Autor

One of the buildings that mimicked the structure of termite mount for natural ventilation is East Gate Center shopping mall, constructed in Zimbabwe, Africa. In this building, the purpose of mitigating a natural phenomenon was to replace a natural air conditioning system with regular fuel-based air conditioning. The aim of the project functioned successfully through many airways within the building letting natural winds and air motions find their ways throughout the building and provide a regulated airflow and air freshness for the users.

Figure 3.10 Structure Section of a Termite Colony and East Gate Centre
Left: https://video.nationalgeographic.com/video/magazine/decoder/00000163-4f96-de63-afe7-7fdf708d0000
Right: https://pikosy.com/media/270708627571606419

As presented in East Gate Center, the objective of biomimicry design focuses on fining compatible ideas in the natural environment, and apply them as adaptive responses to the function of the built environment. Whereas, in biophilic design, the building does not need to necessarily perform cohesively with a specific natural element. Yet, the features of natural elements are used to respond to human mental, spiritual, and psychological needs.

3.4 Economic Benefits of Biophilic Design

Though some of the biophilic contributions might collide with sustainable design principles, they offer an extremely rational economic justification. The first and most important economic benefits of biophilic design serve the main objective of this approach. Helping to promote urban human psychological, mental, spiritual, cognitive, and physical mood definitely has countless positive incomes that are not comparable to the calculation of the budget for providing a biophilic contribution to the building. Reduction of life stress, attention restoration, increased wellbeing, decreased crime rate, and faster healing are only some of the privileges of having benefits of natural elements in access. But, the question is how is it possible to calculate the positive financial outcome of these factors?

Most bodies of research have been conducted on the healing impact of biophilic design in the buildings. Reports show hastened healing in a biophilic recovery room in a hospital rather than a non-biophilic one (R. S. Ulrich, 1984; Park & Mattson, 2009). Therefore, the duration of expenses of nursery and medical care reduces to a considerable level. It has been shown that only by the existence of indoor plants and a nature view from the window of a hospital room, patients get recovered from surgery so much faster rather than being recovered in a simple plain room (R. S. Ulrich, 1984; Park & Mattson, 2009). Ryan et al. (2014) underlined the relevance of biophilic design with health and wellbeing of humans with pointing out various research in the neurosciences, endocrinology and other fields that scientifically validated the positive psychophysiological and cognitive benefits afforded by biophilic design (Browning, Ryan, & Clancy, 2014). Mentioned advantages of exposure to nature can be measured by the symptoms like measuring systolic blood pressure, accelerating the healing process, reducing pain level, improving patient's morale (ibid., 2014).

Another important financial aspect of using a biophilic approach in design is the higher level of productivity by workers in the workplace. Unproductivity, lack of concentration, absenteeism, and fatigue in the workplace can cost around

$100,000 annually for a company with 100 employees (Terrapin Bright Green, 2012). Similar to increasing the healing rate in hospitals, investing in providing a more biophilic atmosphere for workers will benefit an organization in the long run. Integration with direct nature like an indoor plant, natural view of windows and benefiting from natural daylight in the workplace, along with natural analogues like natural materials, natural forms, shapes, and patterns in the office will boost the mood and presentism of staff. More positive working motivation, increased productivity (Nieuwenhuis, et al, 2014; Heerwagen & Heerwagen, 2000), higher creativity (Berman, Jonides, & Kaplan, 2008), restorative effect from fatigue (Ikei, Komatsu, Song, Himoro, & Miyazaki, 2014; Tyrväinen et al., 2014), and reduced illness ad absenteeism in workplace by 10% only by providing more natural integrations (Terrapin Bright Green, 2012) are some of the reasons that biophilic design approach should also be considered from financial aspects for offices and workplaces.

Also, with obtaining satisfaction of employees the organization will retain its staff for longer years (ibid., 2012). An experiment put forward that by spending $1000 for each worker in the office to angle their desks in a direction to have a constant natural view and by providing operable windows, the organization gained back $2990 per employee within a period of four months (Terrapin Bright Green, 2012). All these reports have shown reasonable justification to invest in designing a biophilic workplace to simply boost up the job performance, hence financial outcome enhancement.

The most relevant economic aspect of biophilic design for this thesis is providing a better learning environment for students in educational buildings. Along with cognitive advances like improving concentration Kuo, Barnes, & Jordan, 2019, directed attention (Taylor, Kuo, & Sulivan, 2002), reducing absenteeism rate among students (Terrapin Bright Green, 2012), restoration from tiredness and fatigue are the results of being integrated with nature. Students get better results on concentration tests in classrooms with a natural view in comparison with same level students taking the test in “built” view from their windows (Li & Sullivan, 2016;

Kuo, Barnes, & Jordan, 2019). Having indoor plants, providing natural daylight and ventilation, having regular visits to a vegetated courtyard and green outdoor spaces, and so many other delicate design considerations help students on a large scale to gain the most out of education. In addition, the natural environment provides a calmer and safer setting for education. It is reported that undisciplined behaviors like pushing their peers or talking out of turn are less than when in the classroom (Chawla, Keena, Pevec, & Stanley, 2014). It is suggested that nature helps children to get more self-disciplined and have more self-control (ibid., 2014; Bakir-Demir, Berument, & Sahin-Acar, 2019; Kumari Sahoo & Senapati, 2014; Taylor, Kuo, & Sulivan, 2002).

The positive impacts of biophilic design even extend to retail and trade. It has been proven that people tend to shop from stores placed in streets with greenery and vegetation rather than streets with a plain built urban setting. more surprisingly, customers have the propensity to travel longer distances to spend their shopping time in greener districts of the city (Wolf, 2005). Surprisingly, shoppers consider businesses surrounded by greener and more natural environment worthy of 25% higher costs than shops selling the same product in areas with no vegetation (Terrapin Bright Green, 2012). Moreover, the parking lots in greener areas of the city are prone to charge higher costs from citizens for parking their cars (ibid., 2012). Also, there are some chain stores in the U.S. like Target and REI that started the strategy of skylight during daytime in their stores and achieved a considerable reduction in energy cost for the sensors to adjust artificial lighting within the stores. And, even though not reported, the sales were increased by 15-20% in stores which were lit only by daylight (ibid.,2012).

Since some feature of biophilic design like investigating large green areas around the buildings to provide savannah-like views from the windows -which has been emphasized significantly in biophilic design suggestive guidelines- might conflict with the congestive structure of the urban areas designers will need to work harder to find alternative strategies to compensate the economic justification of a construction. Or, designers can focus more on evaluating the synergic features which

are apprised both in green design and biophilic design, like green roofs, which along with preventing stormwater to overflow and reducing urban heat-island effect, it also presents natural environment visage to the urban dwellers.

3.5 The Practice of Biophilic Design and its Patterns

A core theme from the biophilic design literature is that humanity has lost something in its approach to building design in modern times. Human affiliation with nature is seen to be historically reflected in organic building designs and materials, in patterning and spaces that mimic those of nature, and in traditional living with close, but respectful proximity, to the natural environment. The greening of roofs and walls was commonplace in traditional architecture. Classic examples include the garden courtyards of the places in first civilizations like Pasargad garden in Persia, Alhambra in Spain, zen gardens and bonsai in Japanese homes, papyrus ponds in the homes of Egyptian nobles, the cottage garden in medieval Germany, or the elusive hanging gardens of Babylon.

So, from the beginning of human civilization, there were hints of the biophilic approach in the design of urban environments and buildings. In the last two decades, many studies have been conducted on "how" to regain and reinforce the missing link of connection to nature in current urban settings. Studies of connectedness to the natural environment have been conducted on fields of healthcare, workplace, education, childcare, nursery homes, prisons, and many other places to discuss fundamental benefits of this matter on physical health and mental health. However, there are only a few scholars and designers who suggested applicable and practical toolkit to design a building with the biophilic approach.

After biophilic design got promoted globally by Kellert et al. (2008) some core motivators attempted to apply this approach to the built environment. They suggested a series of design strategies with various classification that aim to reconnect people with the natural environment in urban and building designing. Beatley has evidenced

the validity of the biophilic approach in his book *Biophilic Cities* (2010) for pointing to numerous exemplars and models that can enable the successful application of this approach. He has advocated putting the biophilia hypothesis into practice at an urban scale, proposing the essential elements of a biophilic city.

In the construction sector, Soderlund and Newman (2015) have proposed a new set of design that can assist to make buildings and cities more effective human abodes. They also suggested some strategies to incorporate biophilic design features in prisons to improve prisoners' sense of well-being, mental health and behavior (Söderlund & Newman, 2017).

Roös et al. have sought to apply biophilic design patterns as design and performance parameters in the new underground railway system in Melbourne in 2017 in the figure below.

Figure 3.11 Melbourne's New Underground Railway Stations
Conceptual drawings for Melbourne's new underground railway stations designed by Dr. Phillip Roös (2017), Source of both images: http://openjournal.com.au/moving-melbourne/

"*This isn't just about low-impact features like green power or water recycling, it is also recognizing that humans are drawn to the patterns inherent in living things, so if we can create something that follows these rules of nature, humans will benefit as well as the planet*," (Roös, 2017). "*Valuing trees in terms of dollars is where we go wrong," he said. "There are other intrinsic values that are more important, such as the human and social aspects*," (Roös, 2017).

The Atocha train station in Madrid, Spain is another good example of a public biophilic space that provides a spacious environment with a lush vegetated area like a rain forest and natural lighting from the glass roof for users.

Figure 3.12 Atocha Train Station in Madrid
Source of images: https://www.travelo.hu/tavol/20190227-egyesult-allamok-new-york-india-mumbai-a-vilag-legszebb-palyaudvarai.html

3.5.1 Elements, Attributes, and Patterns of Biophilic Design

There are design practitioners who categorized applicable features of what Fromm explained in biophilia theory. These pioneer researchers and practitioners tried to sketch the bones of biophilic design to provide instrumentation for designers. In order of the date, the charts presented by these eminent pioneers will be discussed.

- Heerwagen and Gregory (2008) outlined seven attributes to this approach,
- Kellert (2008) suggests there are two dimensions, six elements, and 70 design attributes to biophilia,
- Ryan et al. (2014) outline 14 patterns of biophilic design based on previous works and categorizations,
- Downton et al. (2017) added the fifteenth pattern to already suggested 14 pattern.

This section will briefly attempt to elucidate the perspectives of each categorization. The first biophilic design feature available is provided by Kellert. He explains in his research in Building for life (2008) that there are two dimensions of biophilic design, including “Organic or naturalistic” and “place-based or vernacular’.

The organic or natural dimension is defined as shapes and forms in the built environment that reflect the inherent human affinity for nature ‘directly’ such as daylight, plants, animals, natural habitats, and ecosystems; ‘indirectly’ like elements that are placed there by users of the space like potted plant, water fountain, or aquarium; or symbolically which means no actual contact with real nature, but rather the representation of the natural world through image, picture, video, metaphor, etc. Whereas, the place-based or vernacular dimension is defined as buildings and landscapes that connect to the culture and ecology of a location or geographic area.

This dimension refers to an intuitive perception which is called sense of place, or spirit of space by Kellert (2008), emphasizing how a landscape or building can penetrate in individual’s collective identities and a built environment unifies with its surroundings so perfectly that feels alive to the spirit of environment (Kellert 2008). Mentioned identity might recall the old term for the spirit of place- genius loci. Kellert highlights this identity and explains that without intimate interplaying and feel of attachment to their built environment, users will not feel responsible to preserve their heritages. In attempt to put this categorization into a diagram, something like diagram below will be attained:

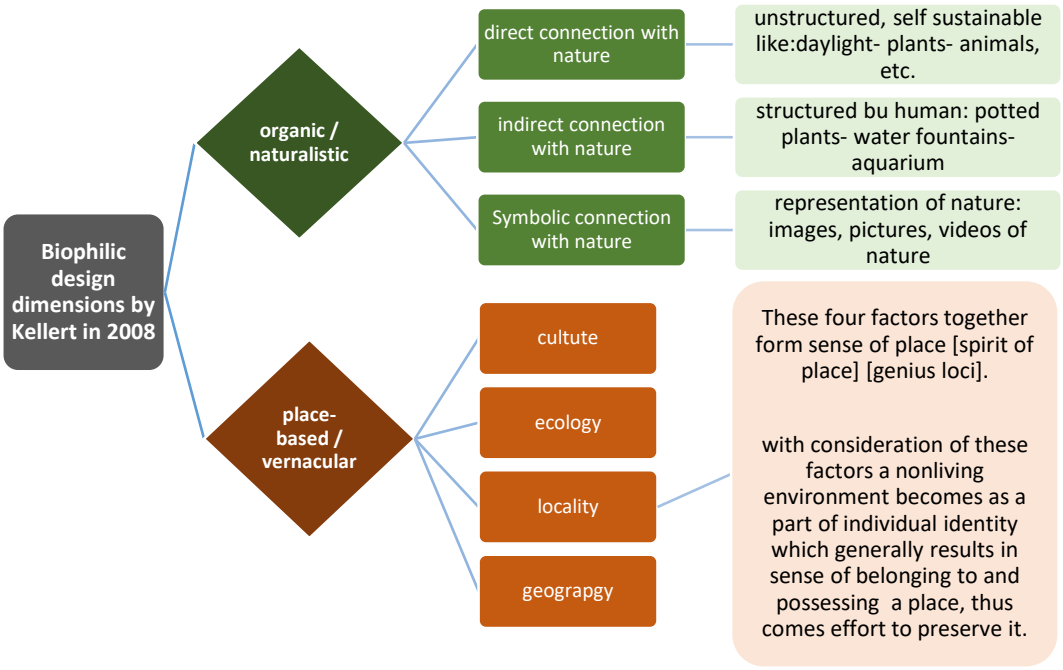


Figure 3.13 Two Dimensions of Biophilic Design
Provided by Kellert in 2008, Illustrated by the Author

Kellert Also categorizes the two basic dimensions of biophilic design into six biophilic design elements:

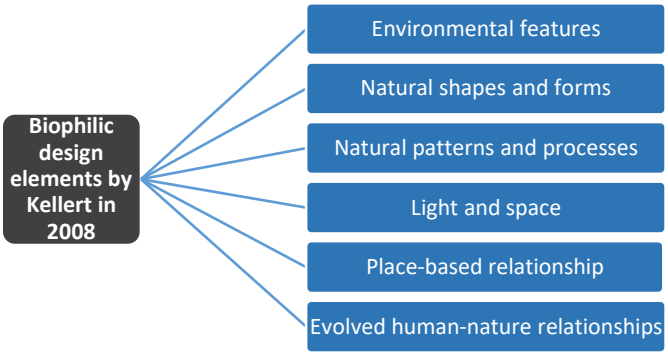


Figure 3.14 Six Elements of Biophilic Design
Provided by Kellert in 2008, Illustrated by the Author

Then these six elements are detailed in more than 70 design attributes:

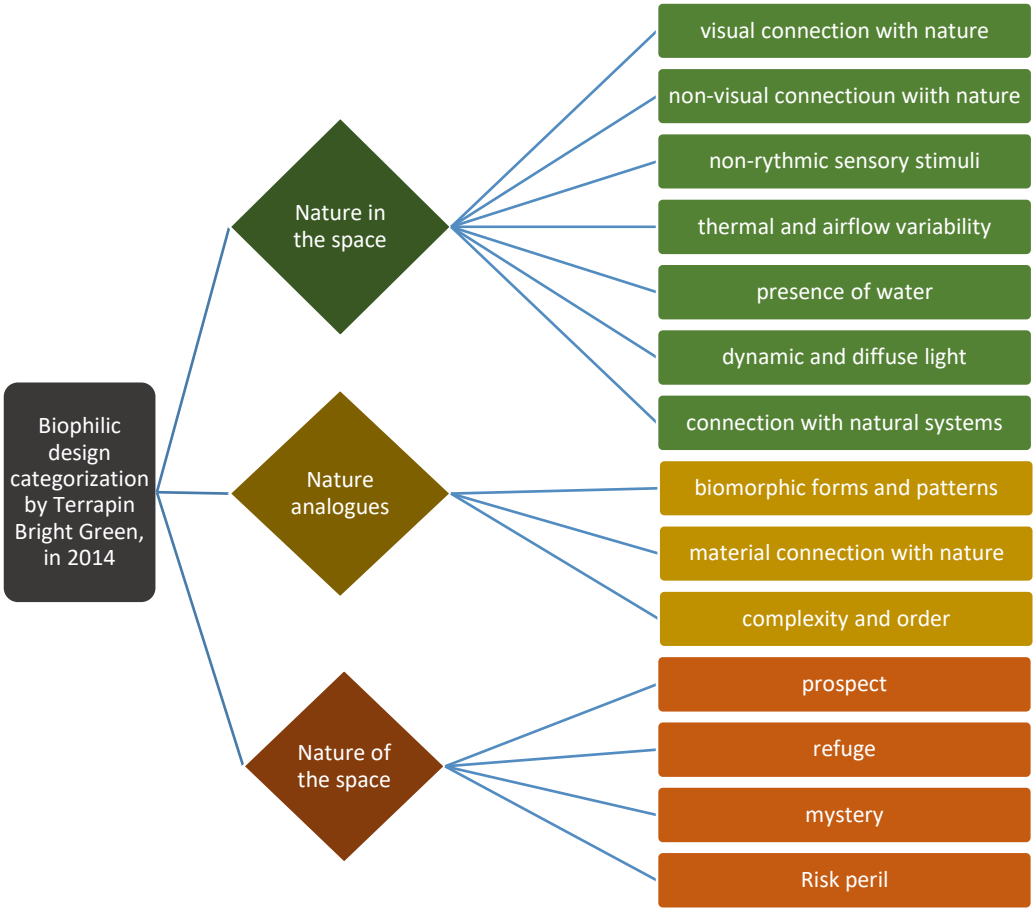
Table 3.2 The First Draft of Categorizing Biophilic Design Elements, Attributes by Kellert in 2008

Environmental features	**Natural shapes and forms**	**Natural patterns and processes**
Color **Water** **Air** **Sunlight** **Plants** **Animals** **Natural materials** **Views and vistas** **Facade greening** **Geology and landscape** **Habitats and ecosystems** **Fire**	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 Geomorphology Biomimicry	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
Light and Space	**Place-based relationships**	**Evolved human-nature relation**
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**	Geographic 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	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

As understood in this categorization, though the attributes of biophilic design perfectly fit in their tab of element, distinguishing the dimension of some tabs are not clear. Moreover, suggesting too many attributes could make it confusing for designers to use this first categorization as a guideline for designing. Overall this version of introducing biophilic design was giving much of general information about how to recognize features of biophilic design. Still, there was a gap to fill to bring biophilic design features into the play.

That is why Terrapin Bright Green LLC. supported a publication, which was written by Browning, Ryan, and Clancy on the firm footprints of Kellert, Heerwagen, Hartig, Kaplan, and others to inform, guide and assist in the design process. The result of their work published in 2014 in the booklet *14 Patterns of Biophilic Design: Improving Health and Wellbeing in the Built environment* in order to structure a unified biophilic design agreement among urban designers and architects. Those 14 patterns are listed as below:

Table 3.3 Final Categorization of Biophilic Design into 14 Patterns
by Terrapin Bright Green, in 2014



As conceived from the table in this categorization has merged some of the dimensions and element introduced by Kellert in the first place. For instance, direct and indirect nature have displayed under the tab of nature in the space. And, expanded some other elements as “Evolved human-nature relationship” is replaced by “Nature of the place”. The new categorization is displaying the essence of biophilic design more vividly.

In the table below the narrative explanations of patterns by the editors of “14 Biophilic Design Patterns” are listed. Plus, Downton et al. added up fifteenth pattern to existing table. They suggested that some biophilia effects can be achieved with no physically tangible link to nature at all. Even illusions of nature such as artificial sky

can generate biophilic psychophysiological responses (Downton, Jones, Zeunert, & Roös, 2017b). Accordingly, they proposed an additional pattern to specifically address the virtual connection with nature.

Table 3.4 Narrative Explanations of Patterns
by the editors of "14 Biophilic Design Patterns"

14 + 1 Patterns of **Biophilic Design**	
1. Visual Connection with Nature. **A view to elements of nature, living systems, and natural processes.**	Ensure visual access to real presentations of nature throughout the station complexes in preference to simulated nature and non-nature representations
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.**	Enhance opportunities for sensory connections (audible, smell, texture, temperature) to nature throughout the station complexes, in preference to urban simulated or constructed representations
3. Non-Rhythmic Sensory Stimuli. **Stochastic and ephemeral connections with nature that may be analyzed statistically but may not be predicted precisely.**	Instill patterns of nature's movements and seasonality throughout the station complexes, using real or artistic representations where necessary
4. Thermal & Airflow Variability. **Subtle changes in air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments.**	Consider sequential changes in thermal and airflow variability to refresh spaces and to enable comfortability throughout the station complexes
5. Presence of Water. **A condition that enhances the experience of a place through seeing, hearing or touching the water.**	Use water as a static, dynamic and or variable design element to achieve multi-sensory experiences throughout the station complexes
6. Dynamic & Diffuse Light. **Leverages varying intensities of light and shadow that change over time to create conditions that occur in nature.**	Use mixtures of dynamic, diffuse and changeable lighting arrangements and patterns (including illuminance and color) to evoke movement, time, seasonality, while maximizing solar access throughout the station complexes
7. Connection with Natural Systems. **Awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem.**	Use natural systems (weather, hydrology, geology, terrestrial and aquatic wildlife, diurnal and seasonal patterns) as design inspirations throughout the station complexes

Table 3.4 (Cont'd)

8. Biomorphic Forms & Patterns. **Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature.**	Ensure biomorphic patterns legibility and interest in floor/ceiling/. roof/wall places and furniture detail throughout the station complexes
9. Material Connection with Nature. **Materials and elements from nature that, through minimal processing, reflect the local ecology or geology and create a distinct sense of place.**	Consider the richness of material color, warmth, authenticity, and tactility throughout the station complex
10. Complexity & Order. **Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature.**	Prioritize pattern compositional and order use enabling stimulation, interest, and legibility, including artwork throughout the station complexes
11. Prospect. **An unimpeded view over a distance, for surveillance and planning.**	Provide a sense of arrival, prospect, for each portal 'gate', concourse level and platform level for the station complexes
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.**	Provide opportunities for retreat, contemplation, waiting, meeting, refuge, for each portal 'gate', concourse level and platform level of the station complexes
13. Mystery. **The promise of more information, achieved through partially obscured views or other sensory devices that entice the individual to travel deeper into the environment.**	Provide a sense of journey in pedestrian environments that ensures sightlines, permeability, and variability in edges and planes
14. Risk/Peril. **An identifiable threat coupled with a reliable safeguard.**	Lessen personal risk in preference to safety but do not let safety considerations override Biophilic Design opportunities and principle execution
15. Virtual Connection with Nature. **A view to a simulacrum of natural elements, living systems, and natural processes**	Provide virtual connections with nature viewed through mediated means or evoked by simulacrums of nature, living systems, and natural processes. Examples include artificial skies, animatronics, and portrayal of nature via virtual reality

3.6 Interpretation of Biophilic Design Patterns Regarding Preschool Design

In the table above, a short narrative explanation of each pattern has been provided. However, there is a need for explaining them from a more practical perspective and providing some examples fro implementing each one of them in the design of the various places. By discussing the effects and objectives of each one of them, we are aiming to prioritize them for preschool environments.

3.6.1 Visual Connection with Nature

The characteristics of biophilic design are very broad. However, most of the findings on the benefits of biophilic design on health and well-being are based on the visual sense. According to a review article written by Gillis and Gatersleben (2015) which supports the benefits of biophilic design, much of the literature depends on the visual sense although nature is multisensory. In addition, most of its findings are about the attributes of natural lighting, vegetation, as well as representational and symbolic depictions of nature. Combining this information with the fact that visual connection is a significant stimulation for children to get integrated with the positive effects of nature, like reducing stress level, improving concentration, and more positive emotional functioning.

This pattern can be in relation -and combined- with:

Pattern #2: non-visual connection with nature

Pattern #3: non-rhythmic sensory stimuli

Pattern #5: presence of water

Pattern #6: dynamic and diffuse light

Pattern #7: connection with natural systems

Pattern #8: biomorphic forms and patterns

Pattern # 9: material connection with nature

Pattern #10: complexity and order

Pattern #11: prospect

Pattern #13: mystery

Pattern #14: risk/ peril

From an architectural perspective, window views, potted plants inside of the buildings, vertical gardens, designing a green courtyard, preferring materials with natural textures, providing the building with a prospect to water and many other solutions can be suggested in the response to this pattern.

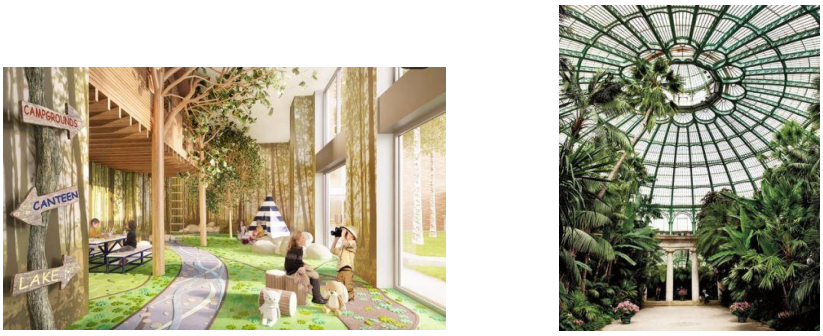


Figure 3.15 Examples for Visual Connection with Nature
Left:https://www.hauteresidence.com/out-of-the-box-kids-amenities-perfect-for-summer-in-nyc/
Right:https://www.bhanwarlaljidesigns.com/conservatorygreenhouse

This pattern can easily be implemented in the preschool environments by numerous architectural strategies suggested below:

Outside of the Preschool building	Inside of the Preschool Building	Indoor - Outdoor relation
• as much vegetation as possible- especially trees • working with the natural topography of the ground instead of manuplating and flattening it • preffering to design with smooth lines, edges, shapes, forms, and corners over straight and sharp ones • prefering natural materials like timber, stone, cob, bamboo, straw bale, etc.	• potted plants everywhere possible in the school • greenwalls or vertical gardens • providing and aquarium with live fish swiming inside of it • establishin a water fountain • taking care of some pets in the school (not architectural)	• maximizing size of windows • extending window sills down to the ground • extending windows tops up to the ceiling • providing sunroofs

Some implemented examples of suggestion are provided in images below:

Figure 3.16 Examples of Visual Connection with Nature in Preschools
Left: http://www.fairygardenhavens.com/kindergarten-landscape-plan/spectacular-kindergarten-landscape-plan-for-home-decoration-ideas-designing/ Middle:https://asacrew.asa.or.th/kurve7/
Right: https://lbpost.com/hi-lo/little-owl-preschool-raises-the-architectural-bar

3.6.2 Non-visual Connection with Nature

After the visual connection non-visual connection with nature is perceived to be the most significant one. All the other senses human being gets without using vision like auditory (hear), gustatory (taste), olfactory (smell), kinesthetic (sense of touch, temperature, and movement) fit in this category. Just imagine closing your eyes and trying to feel the level of freshness of a space. Hearing and feeling the

breeze, smell of the greenery like newly-mowed grass, flowers, or aromatic herbs and trees, petting animals, getting experimental with the texture of natural elements, listening to the tweets of birds and uncountable other attributes shape this pattern. As an architectural design, so many strategies can be utilized to stimulate the pleasure from non-visual connection to nature, such as providing a water fountain, artificial place-fitted waterfalls or any water that moves that make a sound. Natural ventilation, designing benches and resting areas right next to potted plants,

This pattern can be in relation with:

Pattern #1: visual connection with nature

Pattern #3: non-rhythmic sensory stimuli

Pattern #4: thermal and airflow variability

Pattern #5: presence of water

Pattern #6: dynamic and diffuse light

Pattern #7: connection with natural systems

Pattern # 9: material connection with nature

Pattern #13: mystery

Outside of the Preschool building	Inside of the Preschool Building	Indoor - Outdoor relation
• hearing the sound of the water fountain or waterfall • sound of the breezing wind and raining • sound of the birds singing • smelling the flowers and plants • touching the plants • tasting te fruit of the trees and bushes	• touching potted plants • touching natural materials • hearing the rain dripping on the window • hearing the sound of the interior water feature	• operable window that gives the oportunity to listen to the sounds of outdoors

Figure 3.17 Examples of Non-visual Connection with Nature in Preschools
Left: https://www.collinsandturner.com/openingbarangaroo-elc/
Right:https://www.thesurvivalpodcast.com/growing-children-in-the-garden

3.6.3 Non-rhythmic Sensory Stimuli

This pattern is dedicated to momentarily pleasing distractions happen in nature and distinguishes natural settings from dull, steady human-made built environments. Unpredicted movements that happen in nature help the human mind to stay fresh and concentrated (Browning et al., 2014). Leaves rustling in the wind, a drop of water and the waves breeding in the surface of water, an unexpected jump of a cat, movement of the clouds in the sky, even fragrance of flowers and aromatic plant, and every single feature that keeps a natural scene lively and different from an image of nature. Research shows that human psychology needs these welcome distractions to maintain focused and restore attention. Just like eye lens focal that get fatigued while staring at a book or computer screen for long durations and needs interval distractions to function its best, human mind and psychology need unpredictable movements, scents and visions to stimulate sharpness and vividness.

This pattern can be in relation -and combined- with:

Pattern #1: visual connection with nature

Pattern #2: non-visual connection with nature

Pattern #4: thermal and airflow variability

Pattern #5: presence of water

Pattern #7: connection with natural systems

Pattern #13: mystery

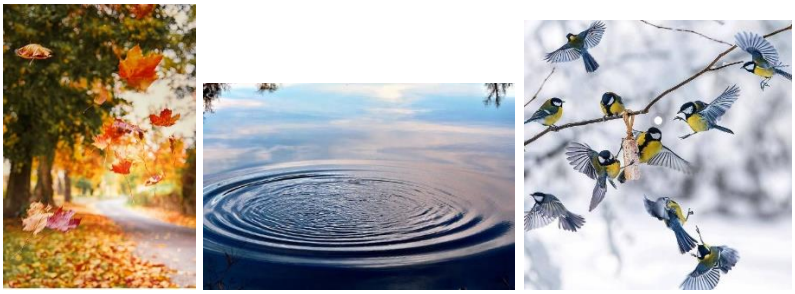


Figure 3.18 Examples of Non-rhythmic Stimuli
Left:https://tr.pinterest.com/pin/307863324520428933/
Middle:https://fineartamerica.com/featured/ripple-effect-caitlyn-stykowski.html
Right:https://virgobaskerville.tumblr.com/post/180887483244/dilililidi

This pattern can be implemented in the preschool environments by some architectural strategies suggested below:

Outside of the Preschool building	Inside of the Preschool Building	Indoor - Outdoor relation
• integrating with breezing wind, moving clouds, singing birds, flying birds, movement of othe animals • rustling ot the leaves of the trees and bushes • fragrance of plants • sound of a water drop falling into the steady water	• movement of fish inside of an aquarium • cloudes covering up sunshine suddenly and exposing interior environmnet to an unpredicted gloom momentarily	• wind enforcing its way into the indoors from seams of the winow and doors • birds sitting on the window frames and flying away • entrance of various flying insects into the interior space

3.6.4 Thermal and Airflow Variability

In most buildings, the ventilation system tries to sustain a narrow target of temperature which gives physical comfort to the human body. And, the human body tends to blend itself with the temperature of the environment. It is reported that staying in a place with stable temperature and airflow and steady artificial lighting throughout the day might cause boredom and passivity (Heerwagen, 2006). This

pattern suggests designing a building in a way that allows inhabitants to experience variability of temperature and airflow in order to tease their comfort temperature zone, thus to improve concentration and liveliness. It is also suggested that a variety of temperatures in the classroom can provoke better cognitive performance among students (Browning et al., 2014). The satisfaction of the users observed to be increased when users of a place have control over setting the temperature, lighting, and airflow. Thermal and airflow variability can occur naturally –like benefiting from solar heat variety, using shadow or shades, or vegetation with trees that have seasonal densification-, or constructed – by allowing occupants to have access to ventilation system controls, or window and curtain operation-.

This pattern can be in relation -and combined- with:

Pattern #2: non-visual connection with nature

Pattern #3: non-rhythmic sensory stimuli

Pattern #5: presence of water

Pattern #6: dynamic and diffuse light

Pattern #7: connection with natural systems

This pattern can be implemented in the preschool environments by some architectural strategies suggested below:

Outside of the Preschool building	Inside of the Preschool Building
• outdoors are the original source of thermal and airflow variability	• designing a natural ventilation system for the building • sunlight warming up the interior spaces during the day • sensing thermal and airflow variability in different seasons

3.6.5 Presence of Water

Humans have been observed to show emotional and psychological responses to the presence of water. Different forms of water can evoke various senses among the inhabitants. Designers can control the sense of place by adjusting fluidity, volume, sound, turbulence, and accessibility of the water feature they are providing for the place. For example, a high volume of waterfall can lead to discomfort of people in the building, or high turbulence of water might reduce acoustic quality indoors.

However, having a water feature within the built environments have reported to be generally comforting through lowering heart rate and blood pressure, reducing stress, and soothing the atmosphere. For gaining optimized positive outcome from a water feature it is suggested to prefer a multi-sensory experience which stimulates cognitive restoration and mood-boosting by vision, acoustic, and ability to touch. For working with this design pattern, along with giving view and access to natural water features like rivers, streams, ocean, and waterfall wherever possible, designers can construct artificial waterfalls, fountains, aquariums, and constructed streams and ponds to increase the feeling of tranquility among occupants.

This pattern can be in relation -and combined- with:

Pattern #1: visual connection with nature
Pattern #2: non-visual connection with nature
Pattern #3: non-rhythmic sensory stimuli
Pattern #7: connection with natural systems
Pattern #11: prospect
Pattern #14: risk/ peril

Figure 3.19 Examples for Presence of Water
Left:https://kontumquetoi.com/2014/04/25/tac-phong-du-lich/ Middle:https://33decor.com/33-cozy-backyard-kids-ideas-play-spaces-design/33-cozy-backyard-kids-ideas-play-spaces-design-7/ Right: https://kukolkam1.blogspot.com/2014/11/learning-for-life-bing.html

This pattern can be implemented in the preschool environments by some architectural strategies suggested below:

Outside of the Preschool building	Inside of the Preschool Building
• water fountain • waterfalls • swimming pool • artificial stream • artificial pond	• water fountain • waterfall • aquarium • aquarium flooring

3.6.6 Dynamic and Diffuse Light:

The design of the lighting extremely depends on the purpose of the function of the place and it can be easily managed to set a particular mood for a space. For example, whereas dramatic lighting might be perfect for religious places, it is not a good idea to prescribe it for workplaces and schools. On the other hand, in spaces where directed attention is needed, fierce penetration of sunlight is not recommended. In general, designers need to gain the ability to find the balance between distributing a unified and diffused lighting throughout the day –which might be boring- and extreme dynamicity and contrast –which can lead to glare discomfort-. Mostly during the day, in order to engage people with the circadian system, a reference to time, weather condition of the moment, and movement human

psychology and physiology are programmed to function better in natural daylight. As mentioned earlier, in daylit workplaces, stores, and classrooms, productivity enhances, sales are higher, and learning performance improves (Browning et al., 2014).

This pattern can be in relation -and combined- with:

Pattern #1: visual connection with nature

Pattern #2: non-visual connection with nature

Pattern #3: non-rhythmic sensory stimuli

Pattern #4: thermal and airflow variability

Pattern #5: presence of water

Pattern #7: connection with natural systems

Pattern #13: mystery

Figure 3.20 Examples for Dynamic and Diffuse Lighting
Left: https://store.hbr.org/product/the-1-office-perk-natural-light/H04IT7
Middle:https://www.stirworld.com/think-opinions-a-lighting-designer-s-introspection-on-the-abstraction-of-light-and-darkness Right:https://www.educationnews.org/k-12-schools/report-from-temperature-to-lights-classroom-design-matters/

This pattern can be implemented in the preschool environments by some architectural strategies suggested below:

Outside of the Preschool building	Inside of the Preschool Building
• control light and shadow with various shades • shade of the trees • different glare of lighting through out the day • variety in the glare of sunlight in seasonal changes	• usage of matte or transparent glass for windows to control directed or diffused light • size of the windows • positioning of the windows on the each side of the building • deepening window frames ro control drect sunlight

3.6.7 Connection with Natural Systems

The main objective of this design pattern is to integrate occupants of the building with seasonality, natural processes and cycles of life. Working with this pattern can be as simple as pointing out key content in a natural view from the window – for example observing the same tree changes color through seasons, from booming pink in spring, to growing green in the summer, falling orange in the fall and getting buried under the white snow during winter. Or, this pattern can be worked with a more complex approach like attempting to find the relation between the behavioral patterns of occupants –like frequency of showering-and amount of collected rainwater in raining seasons. Though this pattern can be evaluated with many approaches like using materials that change form under the solar heat, or constructing a stepwell for capturing the rainwater and so many other costly strategies, the most feasible and inexpensive way to work with this pattern is to allow integration with natural systems by giving a view to a natural vista. There are many factors like watching birds building a nest and breeding, observing rain, snow, fog, and quality of natural light during each time of the year brings forward the perfect way to integrate urban people with natural processes.

This pattern can be in relation -and combined- with:

Pattern #1: visual connection with nature

Pattern #2: non-visual connection with nature

Pattern #3: non-rhythmic sensory stimuli

Pattern #4: thermal and airflow variability

Pattern #5: presence of water

Pattern #6: dynamic and diffuse light

Figure 3.21 Examples for Connection with Natural Systems
Left:https://winnebagolife.com/2014/07/fallingwater-the-ultimate-home-tour
Middle:https://milvarusso.com/blog/our-trip-to-centara-grand-mirage-beach-resort-pattaya/
Right:http://www.leblog2charliemike.com/blog/2015/06/frank-lloyd-wright/

This pattern can be implemented in the preschool environments by some architectural strategies suggested below:

Outside of the Preschool building	Inside of the Preschool Building	Indoor - Outdoor relation
• climate conditions like rain, snow, storm, fog • seasonal changes • plants changing color and leaf density during different seasons	• the quality of natual lightin the interior through out different seasons of the year • the distance of penetration of sunlight into the indoors • the thermal power of the sunlight throughout the year	• the frequency of going outdoors during diferent seasons

3.6.8 Biomorphic Forms and Patterns

The reason of why human being visually prefers biomorphic and organic forms has not been formulated yet. But, the secret ratio between two elements has been formulated centuries ago known as “golden ratio” and “Fibonacci sequence”. Along with artists, architects tried to apply these ratios in their designs to achieve the optimum visual pleasure that comes originally from nature. We are witness of the golden ratio in many building such as Parthenon, Notre dame cathedral in Paris, CN tower in Toronto and many other buildings.

This patterns can flourish in two forms: a) decoration form as in wallpapers designed with biomorphic patterns, furniture and column ornaments, window details. b) structure form as in shape of the whole building, handrails, furniture form.

This pattern can be in relation -and combined- with:

Pattern #1: visual connection with nature

Pattern # 9: material connection with nature

Pattern #10: complexity and order

Figure 3.22 Examples of Biomorphic Forms and Patterns
Up left: https://www.pinterest.com.au/pin/405605510175765131/
Upright:http://www.keywordbasket.com/bWV0cm9wb2wgcGFyYXNvbCBtYXJrZXQ/ Down left:https://www.dominvrt.si/rubrika/trend/uzivanje-pod-velikanskimi-listi.html?page=1&order=ASC Down Middle: https://tr.pinterest.com/zakhrafah2020/ Down right:https://www.pinterest.co.uk/pin/293578469450292774/

This pattern can be implemented in the preschool environments by some architectural strategies suggested below:

Outside of the Preschool building	Inside of the Preschool Building	indoor-outdoor relation
• preferring biomorphic lines and shapes to design outdoor environmnet • ornament and decorate with biomorphic shapes • designing functional elements like fences and gate in biomorphic form	• designing interior architectural elements in biomorphic shapes • preffering biomorphic shaped furniture • using biomorphic artwork as decorative elements and ornaments	• designing windows and balconies in biomophic shapes and forms

3.6.9 Material Connection with Nature

While some patterns need more interpretation, some others like ‘material connection to nature’ have more obvious goals. The objective of applying this pattern is to study the characteristics of natural material and use them in the structure or as decorative items within the built environment. Since most of the natural materials used in the structure are processed – like wooden and stone flooring, bamboo walls, vernacular cob structure, and straw bale- the are only analogues of nature.

A space with natural material feels more comfortable and tranquilizing in comparison to brutal material. A perfect example of the positive impact of natural material is the scattered usage of wood among brutal concretes of the architecture department in METU. Only a rare presence of wood –natural material- among brutal concrete soothes and conditions the interior atmosphere to a great deal.

This pattern can be in relation -and combined- with:

Pattern #1: visual connection with nature

Pattern #2: non-visual connection with nature

Pattern #8: biomorphic forms and patterns

Pattern #10: complexity and order

Figure 3.23 Examples for Natural Material
Left:https://www.bamboebouwnederland.nl/bamboe-wandbekleding
Middle:https://deco.cookingtoday.me/ Right: https://techandmedia.club/2019/05/

This pattern can be implemented in the preschool environments by some architectural strategies suggested below:

Outside of the Preschool building	Inside of the Preschool Building
• natural material fencing like wooden sticks and bamboo • natural material tiling like stone or tree trunk • natural material facade like timber, bamboo, cob	• wooden flooring • stone tiling • wooden furniture and shelves • cotton, wool and leather usage in furniture

3.6.10 Complexity and Order:

It is so rare to find a plain surface in the natural world. Everything and every surface have a pattern or texture; even if looking simple, it usually reveals its breathtaking fractal patterns under an armed eye. Benefiting from fractal features in the built environment draws attention and enriches the environment visually. The best dose of implementing this pattern is when to find the balance between boring- by not using complexity- and overpowering – by overusing fractal patterns. Similar to biomorphic forms and natural materials, fractals can be displayed in both structure and decoration. Nowadays fractal forms can be easily produced by computer programs using mathematical algorithms. From an aesthetic perspective, it is recommended to artists and architectures to have at least three iterations in designing the fractal shapes and forms to reach the maximum visual pleasure. A place with good complexity and order positively impacts physiological stress (ibid., 2014).

This pattern can be in relation -and combined- with:
Pattern #1: visual connection with nature
Pattern #8: biomorphic forms and patterns
Pattern # 9: material connection with nature
Pattern #13: mystery

Figure 3.24 Examples of Complexity and Order
Up,left:https://imgur.com/gallery/5ZGFn/comment/48107180
Up,middle:https://www.pinterest.nz/pin/530087818611396553/
Up,right:https://depositphotos.com/14341773/stock-photo-tree-cut.html
Down,Left:https://tr.pinterest.com/pin/364017582362025668/?lp=true
Down,right:https://tr.pinterest.com/pin/332633122478112587/?lp=true

This pattern can be implemented in the preschool environments by some architectural strategies suggested below:

Outside of the Preschool building	Inside of the Preschool Building	Indoor - Outdoor relation
• all the natural elements present the best complexity and order • in design of the building and facade fractal geometries and hierarchical geometries should be preffered. • desihn of a amulti level waterfall that obeys fractal geometry • fractal geometry in fencing and tiling	• fractal geometry could be used in the design of the shelves and furniture and other functional and decorative items • stairs	• fencing and saftey rails on the windows, balconeies and doors are the best places to play with fractal geometry

The simplest way to implement this pattern is to repeat the same constructional or decorative element at least three times in order. For instance, three or more stairs in an environment add up some complexity and order to the

atmosphere. To improve and enhance the level up the implementations some divert in the shape and size of the elements can be recommended.

3.6.11 Prospect

Having an outlook on a far-distance view feels liberating and enhances the perception of safety in the engaged person. Especially an outlook from high grounds over savannah-like fields has always been propriety to feel safe and reassure the sense of control and dominance on the surrounding areas. The high altitude location of ancient castles, or preferring to inhabit in upper floors of the building to gain access to a broader vista in the modern urban areas gives a nod to this state. Human being prefers to look at far-distance prospects over shorter focal lengths as engaging with this characteristic of a place has proven to reduce stress level and boredom and stimulates a better sense of awareness and comfort (Browning et al., 2014). All the natural environments that give humans a perspective over than 30 meters are feeding the pattern of prospect.

This pattern can be in relation -and combined- with:
Pattern #1: visual connection with nature
Pattern #5: presence of water
Pattern #13: mystery
Pattern #14: risk/ peril
Best works with: Pattern #12: refuge

This pattern can work sustainably with P#12: refuge, as it is the optimized state of a place that human desires. The sense of surveillance and control over a place from the pattern of prospect, combined with the feeling of security and protection from the pattern of refuge collaborate to create a sustainable feeling of safety and awareness towards an environment. Especially in preschool environments, it is very wise to combine prospect with refuge, as demand for the prospect of children is not as broader as adults. Instead, they look for refuge and

fitting into a place. refuging in a place and out looking to a distance is feeding many demands in the child's essence, like being covered and protected, and awareness of the surrounding spaces.

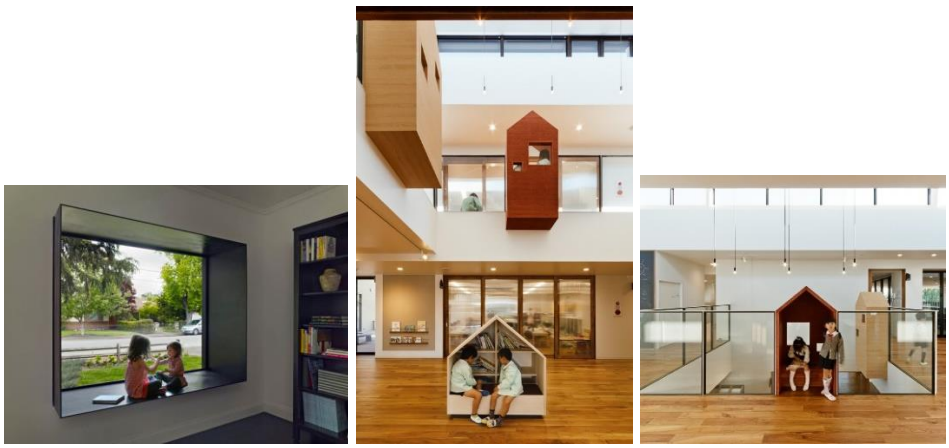


Figure 3.25 Examples for Prospect
Left:http://www.arquinauta.com/bal-house-terry-terry-architecture/2012/03/ Middle and right:https://www.dezeen.com/tag/kanagawa/

3.6.12 Refuge

The pattern Refuge is a sense of safety that breeds from being sheltered and covered by a space. Ancient humans sheltered in caves, or among walls, they built for themselves in the time of need. Although a mature human, living in a modern city is rarely exposed to various dangers, people still feel the demand for a refuge in a more private space for resting, reading, meditating, or other activities. The design of a space is able to easily respond to this inner need of human being. A specific piece of the space can feel separate and extra safe by a few design considerations. The simplest one is coverage of the space from the back where the occupant is. Human being tends to lean back to a secure element like the bulky trunk of a tree, wall, high backed seats and whatever that generates a sense of safety from behind where human has the least surveillance. Then, the sense of coverage from above might be the second priority to capture this sense of protection.

Covering the space from one side or both sides might be a plus point according to the function of the area. However, enclosing one specific area from all the directions might not be the best idea for obtaining a sustainable sense of peace in a place, as we completely cut off the connection from the outside world.

Figure 3.26 Examples of Refuge
Source: http://cpykami.ru/krovat-v-alkove/

This pattern can be in relation -and combined- with:
Pattern #13: mystery
Best works with: Pattern #11: prospect

The desire for refuge is stronger with children. Most of us might remember how we liked to fit in small spaces as a child and attempted to create tiny spaces as a small shelter to play in. Being covered from a few directions by elements like a wall, lowered ceiling, defining a smaller space by a curtain, partition, or decorative elements makes the child feel safe and protected, thus, more comfortable in that place.

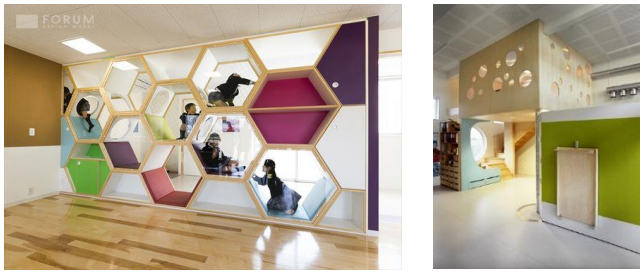


Figure 3.27 Examples of Refuge in Preschools
Left: https://tr.pinterest.com/pin/762586149374330398/
Right:https://www.pinterest.cl/pin/91057223690442749/

This pattern can be implemented in the preschool environments by some architectural strategies suggested below:

Outside of the Preschool building	Inside of the Preschool Building	Indoor - Outdoor relation
• leaning back on the trunk of a tree • tree house • gazebo • console • hiding behind the bushes	• leaning back on a wall • playing in the corner of the room • providing shortheight spaces within the room • excavating mini-cave like holes out of the wall • designing a small space under the stairs for children	• providing a second small main gate for enterance of children • some low hight windows that give view only to children and provide them with a deep window sill to sit on

3.6.13 Mystery

The encouragement that space creates in the human mind to proceed ahead to discover what is around the corner is fitting into mystery pattern. while other patterns of "nature of the space" can be experienced in a stationary position, mystery requires movement from one place to another to explore and understand it. So, it is most evident in pathways, corridors, and places that encourage moving forward like parks, museums, and shopping malls. This pattern can be implemented by design elements like curving pathways that give the passers-by medium length prospect and stimulating them to move forward to explore more of the place, leading floor patterns, ordered lights into a direction, etc. Integrating with spaces with good mystery supplies humans with pleasure and liveliness (Browning et al., 2014).

This pattern can be in relation -and combined- with:

Pattern #1: visual connection with nature

Pattern #2: non-visual connection with nature

Pattern #3: non-rhythmic sensory stimuli

Pattern #6: dynamic and diffuse light

Pattern #10: complexity and order

However, routine exposure to a familiar space might diminish this encouragement. So, in environments like preschool where children are visiting on a daily basis, the mystery of the environment will be faded away over time. Yet, there some minor design strategies that can feed this pattern to an extent, like providing small windows in between classrooms in eye level of children. A tiny transparent hatch that always reassures something is differing, and something new is happening on the other side at each moment might encourage children to go and sneak a peek from time to time.

3.6.14 Risk/Peril

Design attributes like glass fencing in a high terrace, transparent flooring, standing next to an extremely high wall, walking into a passage that leads to a darker space intrigues humans to experience the feeling of being in that position. However, it increases the level of dopamine (Browning et al., 2014), and excites the occupants.

This pattern can be in relation -and combined- with:

Pattern #1: visual connection with nature

Pattern #5: presence of water

Pattern #11: prospect

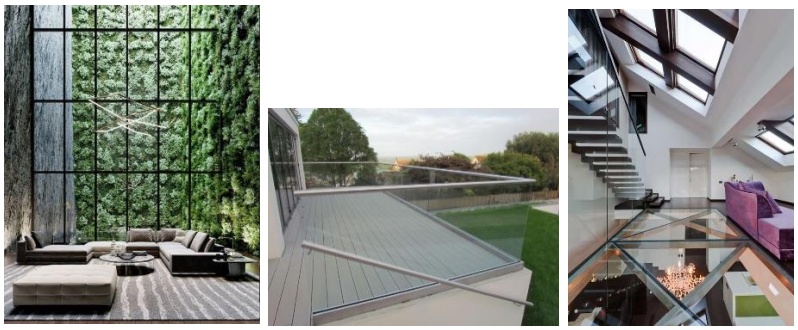


Figure 3.28 Examples for Risk/Peril
Left: https://tr.pinterest.com/pin/416020084329762794/?lp=true
Middle:https://www.pinterest.de/pin/744923594588542048/
Right:https://architizer.com/projects/cetatuia-loft/

In designing a preschool encouraging the pattern of Risk/Peril is not on top of the priority list as the preschool aims to provide a safe and comforting environment. However, a small dose of it can be implemented by using transparent material for protection and safety elements like fences.

Figure 3.29 Examples of Risk/Peril in kindergarten
Left:https://tr.pinterest.com/pin/455074737340885613/?lp=true
Right:https://tr.pinterest.com/pin/449445237805793857/

3.7 Evaluation of Interpretation of Biophilic Design Patterns

As comprehended from the interpretations and explanations of the patterns a single element in architecture can represent a few patterns collaborating together. For instance, a window with a natural view provides view of nature [P1 visual connection with nature], delivers the unexpected natural motions like rustling leaves or motion of birds in the sky [P3 non-rhythmic sensory stimuli], sunlight shining through window or an open window can address [P4 thermal and airflow variability]. The glass material or the direction of the window can have an impact on dynamic and diffuse light [P6]. Merely by a natural view of the window awareness arises towards seasonal and temporal changes [P7 connection with the natural systems], etc. Accordingly, patterns can work collaboratively and interconnectedly. In the diagram below there is an attempt to visualize the collaboration of patterns in general.

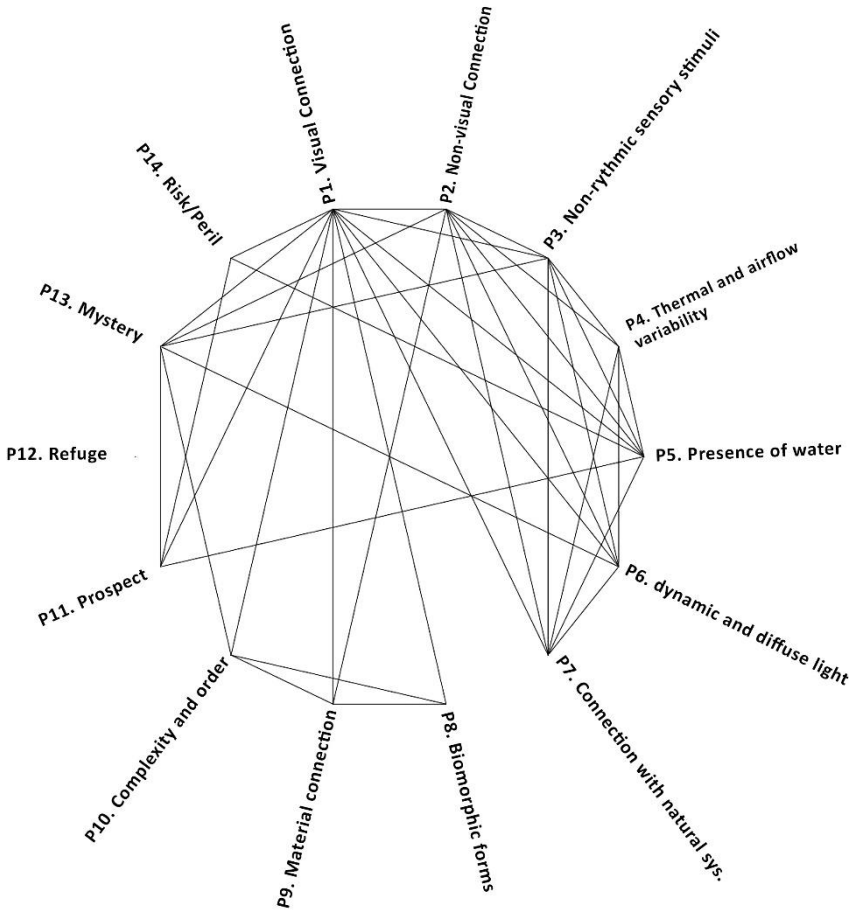


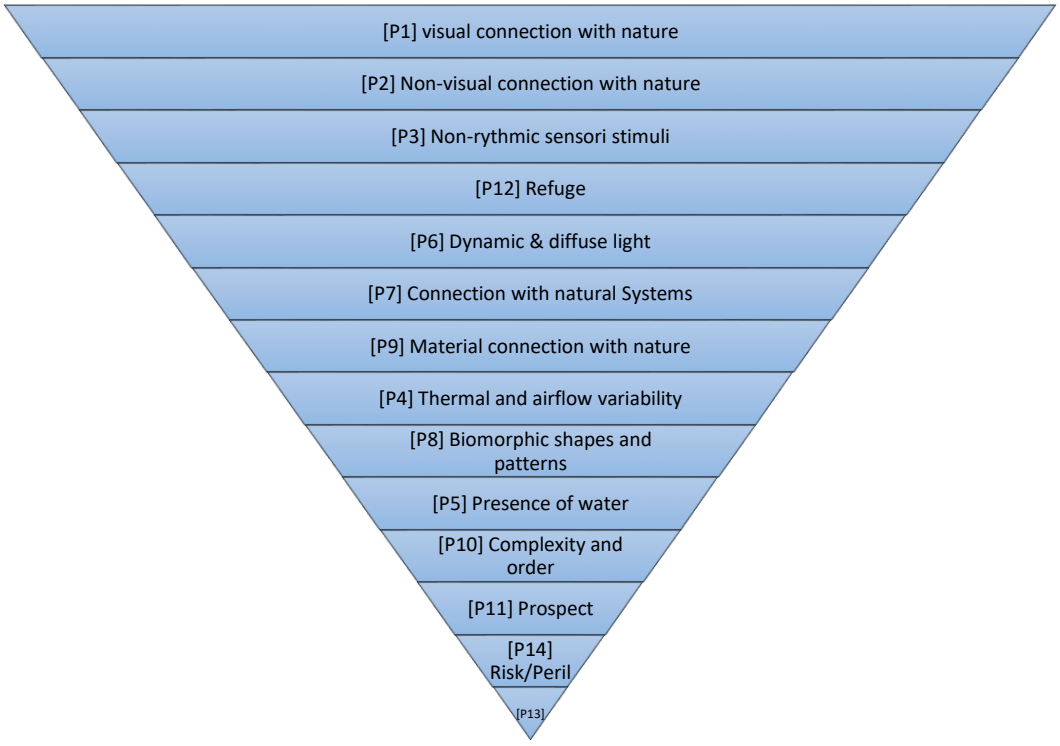
Figure 3.30 The Diagram of Interconnectedness Among Patterns
by Author

The second result that got more clear with interpretations was that not all of the patterns could be effectively implemented in every type of function. For example, [P13 mystery] is not necessary for places that are being used on a daily basis as people will not wonder what might be around the same corner they are exposed to every day. On the other hand, that pattern is perfect for places that people use in their leisure times like parks and museums where the space tents to be encouraging to move forward and discover new views.

In the case of preschool buildings, with the help of collective information gathered in the literature review about children's fundamental needs in the preschool environment combined with the interpretation of the patterns, it is possible to rank the necessity and priority of biophilic design patterns for planning and designing a

preschool. For example, one of the features that most of the pedi-psychologists and philosophers emphasized was to provide small spaces or divide the space into smaller zones for children that only humans in their size can fit in. These kinds of small places make children feel safe and belonging to the place where students can personalize as they desire (Goldshmidt, 2017), and the feeling of attachment to the place will stimulate their creativity and cognitive growth (Bjørnholt, 2014). Hence, regarding the architectural guidance derived from the literature review and interpretation of biophilic design patterns, the author has re-arranged the patterns according to their necessity and priority for children in preschools as shown below.

Table 3.5 Priority of Biophilic Design Patterns for Preschool Buildings



Biophilic design patterns provide us with a firm grasp to analyze and criticize existing preschool from the perspective of each pattern. According to the gained data, some practice-oriented suggestions for planning and designing of kindergartens are provided in the next chapter.

CHAPTER 4

PRACTICAL RECOMMENDATIONS FOR APPLYING BIOPHILIC DESIGN IN PRESCHOOLS

After collecting preschool building design programs in the second chapter and interpretation of biophilic design patterns in the third one, we are aiming to evaluate these patterns on existing preschool buildings in different parts of the world. By assessing and commenting on the compatibility of selected preschools with biophilic design values, some design suggestions and guidelines for future biophilic preschools will be provided.

4.1 Architectural Analysis of Selected Preschools

The selection of preschool is randomly among projects with a specific condition. They are selected from the projects which were built and published in the last 5 years due to the date of publication of biophilic design patterns. Also, they are chosen with a regard to variety of geography, variety of design approaches, buildings that serve only as kindergarten and are benefiting children in the age range of three to six -not preschools emerged with primary schools-, variety in the amount of area under construction, variety in their location in the urban setting. The number of selected projects has been limited to five, in order to give sufficient vision about different design approaches, and avoid confusion by repeating the already comprehended information. The table of selected preschools are as below:

Table 4.1 General Information About Selected Preschools

Name of the Project	Year of establishment	Country	Construction area	Location in the urban setting
HN Preschool	2017	Japan	~590 m²	Among residential area of the town
Maple Street Preschool	2016	U.S. Brooklyn	~300 m²	Among the congested context of the city
Eston Socon Preschool	2018	The U.K.	~350 m²	Among residential area of the town
TTC Elite Saigon Kindergarten	2018	Vietnam	~1900 m² (in 3 floors)	Among congested residential area of the city
Vashavskoye Preschool	2017	Russia	~3500 m² (in 3 floors)	Among residential towers at the limit of the city

A general understanding of some architectural feature about that building will be discussed right above each image supporting the explanation. At the end of each explanation critical review and architectural suggestive guidelines to increase the score of each biophilic design pattern will be provided.

4.1.1 HN Kindergarten in Japan

HN kindergarten designed and built by HIBINOSEKKEI + YOUJI NO SHIRO group, in 2017, in Kanagawa/ Japan, presents many admirable biophilic features in their construction, even though they have not referred to these characters as a biophilic approach. In fact, most of the Japanese kindergartens –and other buildings- respect nature in the essence of architecture due to the Japanese culture of worshiping the natural world. There were many other –in biophilic perspective- admirable preschool projects found in Japan, but in order to keep a variety of geography in selected preschools, we content with only one example.

The architecture group claims that HN preschool has been designed in demand of parents who desire their children to spend their time at nursery in a nature-enriched environment. They state that being in relation to nature in every corner was a priority in the design of this building. The natural material in use maximized indoor-outdoor relation through large windows -which extend to the floor to take role as a door to yard, and to the roof to act as sunroofs-, existence of a large and live tree, on the dirt floor inside of the building, naturally sloped and vegetated hill in the yard of the kindergarten that allows children to crawl, climb, slip, and touch the ground posit their acclaim.

This preschool is categorized as the most biophilic one among other selected kindergartens through many high and medium scores from evaluating biophilic design patterns. To digest the design of this building, we will progress step by step from outside to inside features of the building. The explanations and suggestions will address the biophilic design patterns by their numbers as [P1, P2, …] in the text.

Table 4.2 Analysis of HN kindergarten, in Japan

Outdoor area Ref. for photos: https://www.archdaily.com/899791/hn-nursery-hibinosekkei-plus-youji-no-shiro?ad_source=search&ad_medium=search_result_all	• Even though the kindergarten is not located in a very green area of the city, it has been attempted to vegetate inside of the yard [P1, P2, P7]. • The whole flooring of the yard is grass-covered [P1, P2, P7]. • existing trees in the site are worshiped and offered to children to climb.so they not only help [P1]: visual connection with nature, they also are a great source for [P2]: nonvisual connection with nature and they give an understanding of altering seasons by changes in the appearance of the tree and other vegetation.  

Table 4.2 (cont'd)

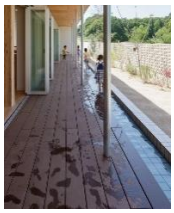
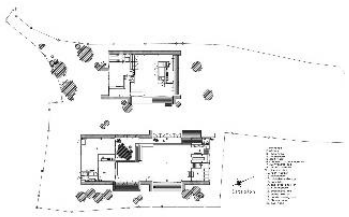
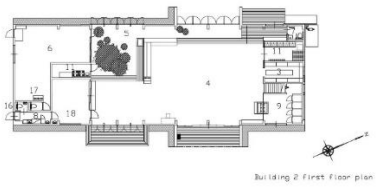
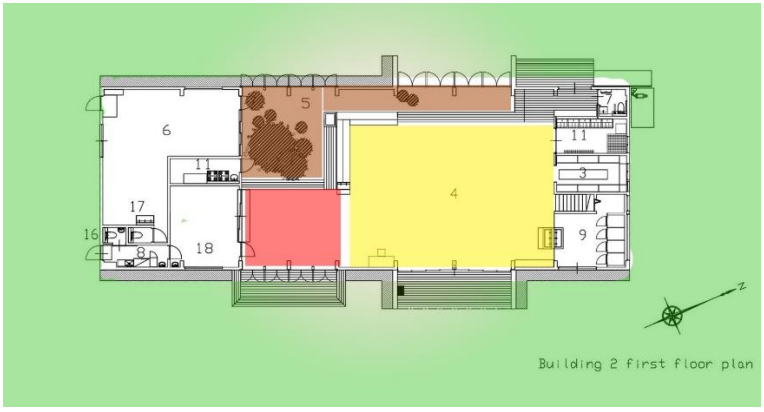
Suggestion Ref. for photos: https://www.archdaily.com/789519/tn-nursery-hibinosekkei-plus-youji-no-shiro/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-	• absence of a water feature is evident in the preschool environment [P5]. Since the climate is suitable for providing artificial streams, shallow pools, fountains and waterfalls it is recommended to add this pattern to the characteristics of the kindergarten, as they do in some peer establishments in Japan.  
The positioning of the building in the site plan & floor plan Ref. for photos: https://www.archdaily.com/899791/hn-nursery-hibinosekkei-plus-youji-no-shiro?ad_source=search&ad_medium=search_result_all	• The establishment includes two pieces of construction. The small building is dedicated to office and infant care. The bigger building is the main preschool which includes a caring room, dining room, dirt play floor, and facilities like kitchen, WC, and nursery room. In the last image, these areas are distinguished respectively in yellow, red, brown, and white colors. • Although the plan of kindergarten looks extravert, by looking at the bigger frame of the positioning of the yard in between two constructions, there is some privacy and introversion planned for the kindergarten environment [P12].   

Table 4.2 (cont'd)

Courtyard Ref. for photos: https://www.archdaily.com/899791/hn-nursery-hibinosekkei-plus-youji-no-shiro?ad_source=search&ad_medium=search_result_all	• Instead of manipulating bumps and holes of the ground to achieve a flattened and even base, the natural topography of the area has been praised [P2],[P7]. • Some footsteps have been developed around the trunk of the trees to help children to climb them [P2]. • Some horizontal planks have been dug into the ground along the slope of the hill, to motivate and welcome children to climb up the hill instead of only perceiving it as a view [P2]. • footsteps on the grass floor are made of sliced tree trunks [P9]. 
Façade & Entrance https://www.archdaily.com/899791/hn-nursery	• The elevation is not made from natural materials. Some wooden [P9]. • The entrance to the buildings are from grass floor of the yard with tree stumps dug into the ground as footsteps [P2],[P9]. • The entrance is from the window/wall/door features. 

Table 4.2 (cont'd)

Caring rooms	Ref. for photos: https://www.archdaily.com/899791/hn-nursery-hibinosekkei-plus-youji-no-shiro?ad_source=search&ad_medium=search_result_all	• The caring room is sheltered by a sloped ceiling and highlighted by orderly constructive wooden columns and beams, which give the perception of a traditional house [P10]. • The wooden flooring of the caring room is made of natural material [P9]. • Half of the caring salon has been dedicated to the dining area right next to a banyan tree planted on the dirt floor inside of the building which welcomes children to climb it [P1],[P2],[P3]. • The ceiling of the dining area and the planted tree is the extension of the window wall which welcomes sunlight inside of the building throw-out the day and awareness of weather conditions [P4],[P6],[P7]. • All of the interior space is surrounded either by dirt floor, or window walls that give a sense of connectedness to the outside.   

Table 4.2 (cont'd)

Architectural features in the care rooms Ref. for photos: https://www.archdaily.com/899791/hn-nursery-hibinosekkei-plus-youji-no-shiro?ad_source=search&ad_medium=search_result_all	• Extending and relating indoors to natural outdoor environment by creating full-height windows that open to a platform through the central courtyard [P1],[P4],[P7]. • Establishing a dirt floor and an intact tree inside of the building [P2],[P7]. • Designing a washing up faucet right next to the dirt floor and entrance to indoors to keep indoor floors clear from dirt [P5].    
Windows Ref. for photos: https://www.archdaily.com/899791/hn-nursery	• Window sills extend to the floor and act as doors to communicate with the courtyard [P1],[P7]. • Windows extend through the slope of the roof and welcome sunlight into the building, both for the vegetation's need and lighting of the room during the day [P4],[P6],[P7]. • The size of the windows has been set to the maximum to offer transparency, relation with natural systems, view, and prospect [P4],[P6],[P7],[11]. •  

4.1.2 Maple street Kindergarten in Brooklyn, U.S.

Maple Street preschool is located in the heart of the urban setting of Brooklyn, on the second floor of an existing building, at the side of the main road. Although located in the congested urban area, this preschool has a high potential of evaluating biophilic features in it. Unfortunately, only a few of them can be observed in the planning of the building.

The preschool includes 3 interconnected rooms divided by pocket walls that can divide the space whenever needed. Since this preschool does not have the privilege of having its own courtyard, the roof terrace is playing the outdoor environment role. The architecture group claim that the design of this kindergarten aimed to be an “extension of a home”. Maple flooring and furniture, along with light pastel colors that provide a warm and cozy atmosphere posit this acclaim.

Table 4.3 Analysis of Maple Street Preschool, In Brooklyn

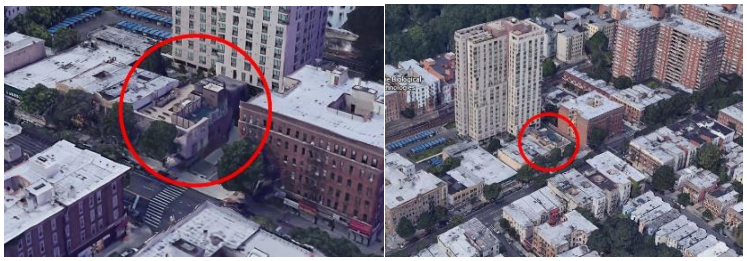
Outdoor area https://www.archdaily.com/909429/maple-street-school-preschool-bfdo-architects-plus-4mativ-design-studio?ad_source=search&ad_medium=search_result_all & www.google.earth.com	• The building is located in the heart of the urban area. • The terrace roof is acting as the preschool courtyard for children. 

Table 4.3 (cont'd)

The positioning of the building in the site plan & floor plan Ref. for photos: https://www.archdaily.com/909429/maple-street-school-preschool-bfdo-architects-plus-4mativ-design-studio?ad_source=search&ad_medium=search_result_all & www.google.earth.com	• The main preschool is defined on a single floor. The other two smaller plans belong to the plans of the stairs to the preschool floor, and up to the terrace roof. • Three interconnected classrooms are located on the east wing of the plan, marked as yellow. • The classrooms are overlooking the main road [P11]. • The official rooms and staff rooms are located in the inner part of the plan which does not have natural lighting or view from the windows and is shown by blue color in the plan. 

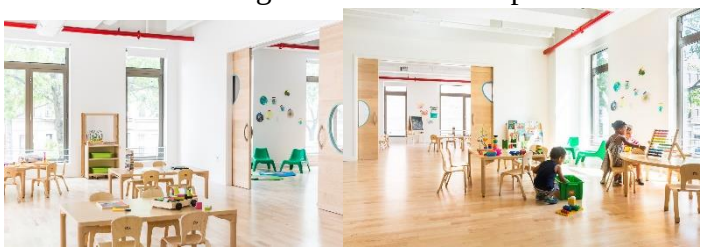
Table 4.3 (cont'd)

Courtyard Ref. for photos: https://www.archdaily.com/909429/maple-street-school-preschool-bfdo-architects-plus-4mativ-design-studio?ad_source=search&ad_medium=search_result_all	• The terrace roof yard is located on the upper floor of the preschool [P1],[P2],[P7]. • The cedar timbers have blocked the view of the main road and the tree branches existing in the main road[P9]. • Perforated aluminum fences are placed on the other side of the terrace for safety. • The floor of the terrace is covered with colorful rubber tiles 
Façade & Entrance https://www.archdaily.com/909429/maple-street-school-preschool-bfdo-architects-plus-4mativ-design-studio?ad_source=search&ad_medium=search_result_all & www.google.earth.com	• The entrance of the preschool is through the sub road. • The elevation of the building is plain brick material, not very welcoming for a preschool. 

Table 4.3 (cont'd)

Caring rooms Ref. for photos: https://www.archdaily.com/909429/maple-street-school-preschool-bfdo-architects-plus-4mativ-design-studio?ad_source=search&ad_medium=search_result_all	• Three interconnected care rooms have a view of the main road and its vegetation through full-height windows [P1],[P3],[P11]. • The rooms can be divided by full-height pocket doors that have some randomly shaped cutouts to give transparency and view to the other spaces for caretakers [P8],[P11]. • The dominant material is maple wood on the floor, furniture, and ceiling which compromises with the name of the preschool [P9]. 
Architectural features in the care rooms https://www.archdaily.com/909429/maple-street-school-preschool-bfdo-architects-plus-4mativ-design-studio?ad_source=search&ad_medium=search_result_all	• The most admirable architectural feature of the preschool might be dragging pocket doors which give flexibility to the size of the space according to the daily activity of students. 

Table 4.3 (cont'd)

Windows	https://www.archdaily.com/909429/maple-street-school-preschool-bfdo-architects-plus-4mativ-design-studio?ad_source=search&ad_medium=search_result_all	• Windows are large-sized and full height, ushering daylight into the care rooms [P4],[P6]. • On the other hand, the office and staff room have no natural light as shown in the plan. 

4.1.3 Eston Socon Preschool, in the United Kingdom

Easton Socon preschool was aimed to designed and built very budget-friendly in a residential area of Cambridge shire. The structural material of the building is prefabricated timber panels and glulam beams. The designing plan was to provide three spacious caring rooms with movement freedom for children. That is why the structure has been shaped in a crescent-like form with central access to the courtyard.

The green neighborhood of the preschool and the large courtyard offers a great potential to apprise biophilic design patterns. The suggestive strategies for this building will try to maintain the limited budget framework.

Table 4.4 Analysis of Eston Socon, in the U.K.

Outdoor area Ref. for photos: https://www.archdaily.com/923437/eaton-socon-preschool-devlin-architects/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user	• Although the construction area is limited to approximately 350 m², the field area is much more spacious. • While the building embraces southern wing of the field, the courtyard is offered in two parts: the central yard, and vast and open part in the northern wing • Luckily, Green trees out of the project field are visible from the inside of the school walls [P1].  

Table 4.4 (Cont'd)

The positioning of the building in the site plan & floor plan Ref. for photos: https://www.archdaily.com/923437/eaton-socon-preschool-devlin-architects/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user www.google.earth.com	• The construction has perfectly fitted into the site plan, providing a private little central yard in the middle [P12]. • The most spacious areas of the construction are dedicated to the caring room which was the main goal of this limited-budget project. • The caring rooms are benefitting from natural daylight from almost three directions, allowing children to spend time in the perfect light for their activities at the moment [P4],[P6],[P7]. • The classrooms are shown in yellow, the kitchen is shown in red, and the office and staffroom are marked as blue in the plan.   

Table 4.4 (cont'd)

Courtyard Ref. for photos: https://www.archdaily.com/923437/eaton-socon-preschool-devlin-architects/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user	• The central yard floor is covered with a non-natural resin material that even runs through interior spaces. • Although the yard flooring could be more natural and biophilic, it gives perfect accessibility to students with all levels of mobility. • The outer part of the central yard is covered with grass and stone tile pavement [P1],[P9]. • A plastic shelter is covering along the inner edge of the whole building, stabilized with metal beams.      
Suggestion	• Investing in planting saplings in the large grass covering for years ahead [P1],[P7]. • Planting ivy near the façade of buildings [P1].

Table 4.4 (cont'd)

Façade & Entrance Ref. for photos: https://www.archdaily.com/923437/eaton-socon-preschool-devlin-architects/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user	• The building offers several entrances for maximum movement freedom. Almost all the inner spaces are directly connected to the outside by a door. • In an attempt to keep the expenses to the minimum, the whole construction has been made of prefabricated containers. • Though the building is functioning it might not give the best welcoming sense to a kindergarten to children. • The surfaces of the building that are overlooking the central yard are covered with timbers probably to sooth and warm up the atmosphere [P1],[P9].  
Suggestion	• Although the building is extremely suitable for implementing green roofs [P1], it is not suggested to maintain within the limited budget of the project • Ivy plants seem to be a great solution to cover the outer surface of the building [P1].  [4]

[4] image Source: https://www.flickr.com/photos/evelynfitzgerald/3914649270

Table 4.4 (cont'd)

Caring rooms Ref. for photos: https://www.archdaily.com/923437/eaton-socon-preschool-devlin-architects/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user	• The color palette of the interior is quite simple. White walls, grey resin floor, wooden glulam beams. The colorful furniture is so scattered that they do not have much of impact on warming up the atmosphere for children. • The openings to the outside are not large enough to undertake the lighting of the interior. • The natural material of the furniture and the glulam beams are appreciated [P9].   

Table 4.4 (cont'd)

Suggestion	• There is almost no trace of vegetation in the interior space. The most efficient method to integrate with nature is to provide as much greenery, potted plants and flowerbeds as possible for inner spaces [P1],[P2]. • Since trying to remain within the budget, the material of the flooring is not much open to criticize. The color of the material could be closer to the natural earth color [P9]. • Some flower pots hung on the walls could influence the mood of the space positively [P1],[P2].  [5] • Since the care room spaces are too spacious and tall providing a safe and secure space for children in an adult's eye. However, children like to create small spaces for themselves for a warm feeling of safety. In order to give the refuge spot for children designing with constructional materials is not the only method [P12]. By providing a bar and a big piece of cloth we can offer children to make their own refuge spot, thus a sense of belonging to space.  [6]

[5] Image Source: https://www.designandmore.it/portavasi-da-balcone-interno/
[6] https://tr.pinterest.com/pin/Ae2or3HQSkpv-wumU38j65QjApR8ZV3EUWruXrPhQntwoDsX1-tOjIM/?lp=true

Table 4.4 (cont'd)

Architectural features in the care rooms	https://www.archdaily.com/923437/eaton-socon-preschool-devlin-architects/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user	• One of the interesting architectural features is allowing skylight to the indoors through a window-like opening from the slope of the roof [P1],[P6],[P7]. • Glass doors that extend to the floor offer extra absorbance of light into the inner spaces [P1],[P6],[P7].   

Table 4.4 (cont'd)

Windows Ref. for photos: https://www.archdaily.com/923437/eaton-socon-preschool-devlin-architects/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user	• Windows are various sized, scattered through the surface of the building. • Most of the windows are not in the vision height of children.  
Suggestion	• The window sills could have been lower than the eye level of children [P1]. • also, they could provide a seat for preschoolers or placing a plant vase.

4.1.4 TTC Elite Saigon Kindergarten

Elite Saigon preschool is located in the urban setting, among residential buildings taller than the preschool, designed by Keintruk o. Architecture group. This building was constructed in five stores, three of which are dedicated to the classrooms, care rooms, and inner playgrounds. The upper two floors consist of seminar rooms, staff training, and areas for organizing events. The architects claim that the use of smooth lines, geometric shapes, randomly shaped windows, and cheerful colors were their priority in design in order to attract the attention of children

who are living in the greyscale urban environment in the neighborhood. In the table below we are going to study the characteristics of each part of the kindergarten as we did in previous preschools.

Table 4.5 Analysis of Elite Saigon kindergarten, in Vietnam

Outdoor Area Ref. for photos: https://www.archdaily.com/921138/ttc-elite-saigon-kindergarten-kientruc-o?ad_source=search&ad_medium=search_result_all	• The white-colored building with smooth lines [P8] and decorated with colorful shapes are extremely standing out from the monotone texture of the neighborhood buildings. • Though there is some vegetation in the neighborhood, there is potential to amplify greenery in the surrounding area [P1]. • Luckily the building is open to windows from all the directions. 

Table 4.5 (Cont'd)

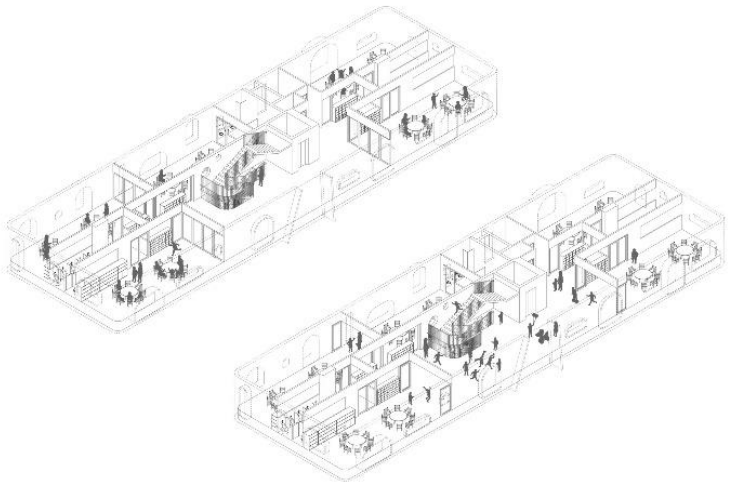
The positioning of the building in the site plan & floor plan Ref. for photos: https://www.archdaily.com/921138/ttc-elite-saigon-kindergarten-kientruc-o?ad_source=search&ad_medium=search_result_all	• The long facades of the building have elongated facing west and east direction. • Care rooms and classrooms are located in the corners of each floor. • The middle part of each floor consists of a large-sized staircase [P10], a void [P14], elevator, and washing rooms.   

Table 4.5 (Cont'd)

Courtyard	Ref. for photos: https://www.archdaily.com/921138/ttc-elite-saigon-kindergarten-kientruc-o?ad_source=search&ad_medium=search_result_all	• The courtyard encircled the building from all directions. • There is a high attempt to vegetated the courtyard with grass, bushes, flower beds, and trees [P1]. • A swimming pool provided for children on the northern side of the courtyard [P5]. • The green fencing around the courtyard offers a complementary color to the colors on the façade and the blue sky. It also blends perfectly with the vegetation inside the courtyard [P1].    

Table 4.5 (Cont'd)

Façade & Entrance Ref. for photos: https://www.archdaily.com/921138/ttc-elite-saigon-kindergarten-kientruc-o?ad_source=search&ad_medium=search_result_all	• The whole building is a collection of smooth lines in the edges, randomly sized and shaped windows in the façade of the building. Random geometrical shapes decorated the facades of the property [P8]. • The entrance of the preschool is from the eastern side of the building and formed of the largest geometric shape existing on the façade of the building [P8]. This large shape offers both entrance gate to the building, and transparency to the corridors of three floors. • Outstanding dominant white color, colorful shapes, geometric form of the main gate and windows, and smooth edges collaborate to offer a warm and welcoming façade and entrance to the children and visitors. 
suggestion	• The extension of geometric shapes at the top limit of the building where the skyline is formed could improve visual unity in the façade [P8]. • Pulled out window frames could transform into a small extravert balcony [P1],[P7],[P14].

Table 4.5 (Cont'd)

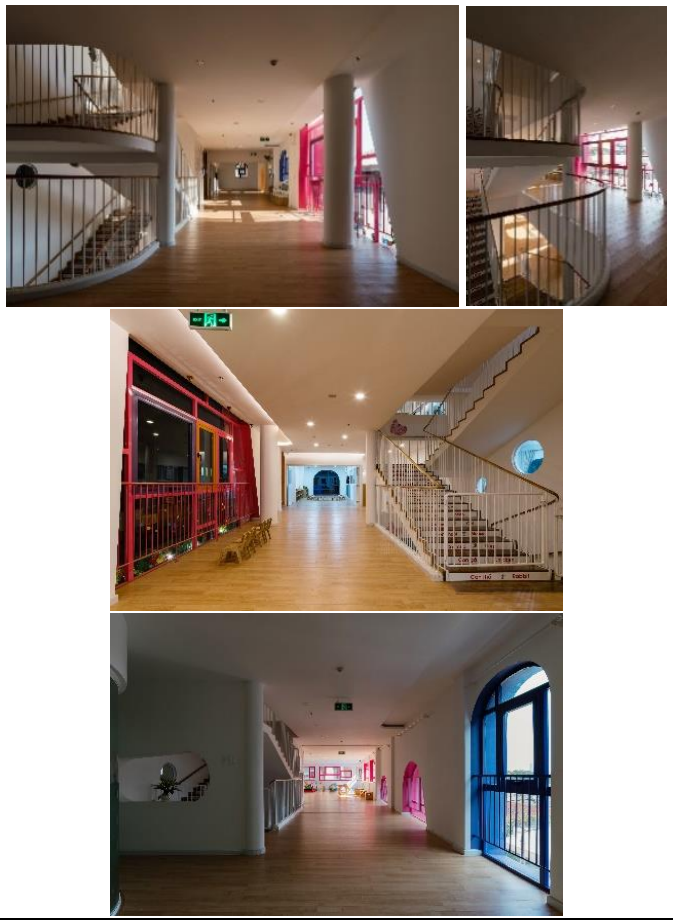
Corridors	Ref. for photos: https://www.archdaily.com/921138/ttc-elite-saigon-kindergarten-kientruc-o?ad_source=search&ad_medium=search_result_all	• Corridors on all three floors are considerably vast and spacious. • They are getting natural eastern light from the windows and offer an alternative playground for students [P6]. • The void of the large staircase is secured and protected by metal fences and wooden handrails [P10],[P14]. • All the walls and ceilings are monotone white-colored. 
Suggestion		• The corridors are quite vast and getting natural light. Plenty of potted plants and green walls are recommended for this space where is functioning as an alternative playground for children. • Wide corridors and receptions are the perfect areas to place a water feature like an aquarium or interior waterfall [P5].

Table 4.5 (Cont'd)

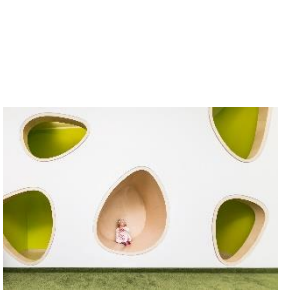
Caring rooms Ref. for photos: https://www.archdaily.com/921138/ttc-elite-saigon-kindergarten-kientruc-o?ad_source=search&ad_medium=search_result_all	• The flooring of all interior spaces is natural colored laminate parquet [P9]. • The walls of care rooms are plain white and for warming up the atmosphere is only leaning back on the colorful window frames. • 
Suggestion	• The same shapes of windows can be mimicked to create holes in the wall to offer a refuge spot for children [P12].   • Some small mini-architectural constructions can be built within spacious classrooms to dived the space in smaller ones and stimulate a sense of exploring and belonging in children.

Table 4.5 (Cont'd)

Windows	Ref. for photos: https://www.archdaily.com/921138/ttc-elite-saigon-kindergarten-kientruc-o?ad_source=search&ad_medium=search_result_all	• Even though some of the windows are not proper height for children, there are many other small windows that been provided exclusively for children, offering a warm and welcome feeling to the young occupants of the building. • The window sills have been extended to the outside as well, probably to prevent too much direct sunlight inside of the care rooms [P6]. • Window sills could offer a very perfect refuge area for children with a prospect to the outside [P12]. 

4.1.5 Vashavskoye Kindergarten

This preschool is a two-floor building located on the outskirts of Moscow, among residential buildings. The analysis of the architectural characteristics of the property has provided below.

Table 4.6 Analysis of Vashavskoye kindergarten, in Russia

Outdoor Area Ref. for photos: https://www.archdaily.com/892110/kindergarten-vashavskoye-hwy-141-buromoscow/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user	• There is a high potential for tree planting in the surrounding area [P1],[P7]. • Advantaging from the circle shape of the building, the windows are overlooking all around the site plan. •  
Suggestion	• Although there are plenty of trees in the neighborhood, a better plant preferring in severe weather conditions -like evergreen trees- could help better visualization of nature even throughout cold seasons [P1],[P7].

Table 4.6 (Cont'd)

The positioning of the building in the site plan & floor plan

Ref. for photos: https://www.archdaily.com/892110/kindergarten-vashavskoye-hwy-141-buromoscow/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user

- Among different potential building shapes for the site plan, architectures decided a circle shape for the building on two floors with an inner square-shaped yard [P8].
- According to available images, the ground floor seems to be auditory rooms where all the seats should be directed one direction, as in preschools the arrangement of the classrooms usually is divided into small groups [P12].
- The classrooms (shown in yellow) are located around the plan, probably to have a better view of the outdoors [P1],[P11] and better natural southern daylight [P6],[P7].
- The inner yard (shown in green) is providing light for corridors and southern light for one of the classrooms [P6].
- Overall the building is quite introverted, which is understandable for severely cold climates [P12].

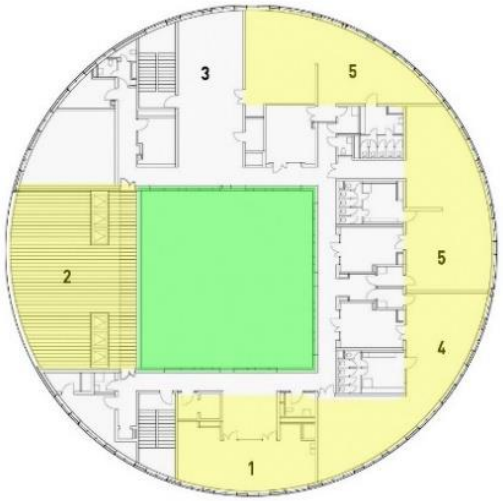


Table 4.6 (Cont'd)

Courtyard Ref. for photos: same source	• There is not enough architectural feature in the outer courtyard around the building. And, it looks mostly unused. 
Suggestion	• Unfortunately, there is not enough image available from the courtyard and inner yard, but here are some suggestions for making the most use of outside spaces in these kinds of cold regions: Providing some gazebos [P12] with a fireplace [P1],[P2],[P3],[P4] to integrate children with both severe weather conditions and natural warmth of fire responding to the human needs[P2]. Being in connection with cold weather for short periods might help children to feel more lively and concentrated when they go back indoors [P7].
Façade & Entrance Ref. for photos: https://www.archdaily.com/892110/kindergarten-vashavskoye-hwy-141-buromoscow/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user	• Similar to Elite Saigon preschool in Vietnam, architects again preferred white dominating color with scattered random shaped [P8], colorful windows for the façade of the building. • Although the main entrance is not as inviting as Elite Saigon. The main gate is blended with a row of lower rectangular windows. • Smooth shape lines of the building and butterfly-inspired shapes of the windows are admirable architectural efforts to attract the attention of children [P1],[P8].  

Table 4.6 (Cont'd)

Suggestion	• It might have been so much more interesting if some of the butterfly-like shapes were dragged inside and provided a sheltered balcony for the children in the classrooms. Balconies could be used for taking care of evergreen potted vegetation. And the temperature of these balconies would be better for vegetation [P10, P1, P4, P7].
Corridors Ref. for photos: https://www.archdaily.com/892110/kindergarten-vashavskoye-hwy-141-buromoscow/?ad_source=myarchdaily&ad_med	• The corridors are overlooking the inner yard through rectangular shaped windows. • The scattered colorful glass of some windows is appraisable to condition the white monotone atmosphere of the preschool.  
Suggestion	• The walls overlooking to windows could be ornamented by horizontal gardens, as the corridors are too narrow to place flowerbeds along with them [P1, P2]. • The flooring material of the corridors and whole interior could be chosen in a way to convey natural materials look [P1, P9].  [7]  [8]

[7] Image Source: https://www.novediciotto.com/tag/arredamento-uffici/
[8] Image Source: http://archiq.ru/the-drawers-house-proekt-studii-mia-design-studio-vetnam/

Table 4.6 (Cont'd)

Caring rooms Ref. for photos: https://www.archdaily.com/892110/kindergarten-vashavskoye-hwy-141-buromoscow/?ad_source=myarchdaily&ad_medium=bookmark-show&ad_content=current-user	• All of the classrooms have a curved wall which gives an interesting flavor according to the function of the rooms [P8]. • Colorful window frames and outstanding window shapes [P8] stand as a good idea for keeping children interested. • Although the height of some windows is not designed properly for the height of children, in every classroom there is at least one window that allows young occupants to have a view of outdoors [P11]. • White walls and ceiling, white curtains, pale daylight of that geography, white light bulbs, white shelves, and light-colored furniture cooperate to result in a monotone and cold feeling atmosphere.    

Table 4.6 (Cont'd)

Suggestion	• The flooring could be in a material that conveys natural colors and textures, like laminated parquet [P9, P1]. • The curtains could have the print of the same shapes as windows with remind the user of butterflies [P8]. • The shelves could be made of natural materials that feel warmer and more welcoming to touch [P9, P2]. • Since children do not have that much chance to be integrated with greenery and vegetation in cold weather conditions through most of the year, spacious classrooms provide the best opportunity to have lots of flowerbeds and potted plants [P1, P2, P3]. • The same shapes of windows can be mimicked to create holes in the wall to offer a refuge spot for children [P12].  9  10 • Unique window shapes offer the best chance to extend the depth of the window sills and give a refuge spot for children [P12, P11, P1, P7, P3]. In this case, children will spend more time by the window and be integrated with the outdoors • The white light bulbs are better to be replaced with light bulbs that give the closer spectrum of rays to the sunlight [P6].

[9] Image Source: https://www.pinterest.ch/pin/400398223112624337/
[10] Image Source: https://www.pinterest.ch/pin/316166836313381183/

4.2 Evaluation of the Analysis of Selected Preschools

To be able to compare and evaluate the architectural analysis of the various spaces of selected preschool, we formed a table

Table 4.7 Scoring Selected Preschools
by alignment to each biophilic design pattern (***: high, **: Medium, *: Low)

Preschool names	[P1] Visual connection with nature	[P2] Non visual connection with nature	[P3] Non rhythmic sensory stimuli	[P4] Thermal and airflow variability	[P5] Presence of water	[P6] Dynamic & diffuse light	[P7] Connection with natural systems	[P8] Biomorphic forms and patterns	[P9] Material connection with nature	[P10] Complexity and order	[P11] Prospect	[P12] Refuge	[P13] Mystery	[P14] Risk / peril
HN	***	***	**	***	*	***	***	*	**	**	***	*	**	**
Maple Street	**	**	**	*	*	**	**	*	***	**	**	*	*	*
Easton Socon	**	*	**	***	*	**	**	*	*	*	**	*	*	*
Elite Saigon	**	**	**	*	**	**	*	**	**	*	**	*	*	**
vashavskoye	*	*	*	*	*	**	*	**	*	*	**	*	*	*

As perceived from the scoring table, HN preschool in Japan seems to be the most biophilic preschool due to many high and medium scores in biophilic design patterns. On the other hand, Vashavskoye kindergarten in Russia is at the bottom of the table, marked as the least biophilic preschool. In total, 'nature in the space' [P1] to [P7] – highlighted in green- seems to have stronger position in the design in comparison to 'Natural Analogues' –[P7] to [P10] highlighted in yellow- and 'Nature of the space' [P10] to [P14]. However, we had resulted that [P12] Refuge was playing an eminent role in the creation of a sense of belonging and attachment to the educational space for preschoolers, and we witness the absence of this pattern in any preschool. Or, [P5] Presence of water is rather neglected in most of the preschool designs. With having these types of evaluations in mind, we are suggesting a set of practical recommendations for applying biophilic design in Preschool.

4.3 Practical Recommendations for Applying Biophilic Design in Preschools

By combining re-arranged biophilic design patterns for preschool environments with guiding factors derived from the literature review, and the result of architectural analysis of selected preschool, the author has generated a set of applicable recommendations for designers who are looking for strategies to implement the biophilic design in preschools. Those 8 applicable recommendations are as below:

1. Abundant usage of plants, green walls, and green roofs
2. Improving children's connection to the outside through windows
3. Providing refuge spots for children
4. Optimum use of sunlight for lighting interiors
5. Blending indoors and outdoors together
6. Use of natural material
7. Preferring to design with smooth lines over straight ones
8. Creative use of water

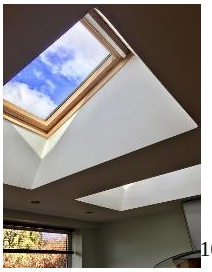
Narrative explanations of examples for each recommendation are provided in the table.

Table 4.8 Practical Recommendations for Applying Biophilic Design

	Principle	Aligned Pattern	Architectural Attributes	Example
1	**Abundant usage of plants, green walls, and green roofs**	[P1, P2, P7]	Potted plants indoors Flowerbeds in the entrance Green walls along corridors Planting ivy near the unpleasant façade to cover it Preferring local plants to raise awareness to the local nature	 [11]  [12]
2	**Improving children's connection to the outside through windows**	[P1, P3, P6, P7, P11, P12]	Adjusting window sills below eye level of children Deepening window sills to offer a seat by the window for children Framing the window in a way to offer a refuge spot for children or potted plants Maximizing size of the windows	 [13]  [14]

[11] Image Source: https://tr.pinterest.com/anaistheret/jardin/
[12] Image Source: https://www.homestolove.co.nz/real-homes/real-homes-gardens/courtyard-garden-lush-oasis-wellington
[13] Image Source: https://architizer.com/idea/649953/
[14] Image Source: https://mod-home.info/2014/03/05/succulent-window-box/

Table 4.8 (Cont'd)

3	**Providing refuge spots for children**	[P12, P11]	Treehouses and all gazebos in the courtyard Deep window sills below torso height of children Mini cave-like holes in the wall in a size that children could fit in individually or with a small group of peers Constructing the second floor in one part of the same classroom to provide an upper floor in a height of children Designing a small lounging area for children in the vacant spot under the stairs	 [15]  
4	**Optimum use of sunlight for lighting interiors**	[P1, P2, P3, P4, P6, P7]	Maximizing size of the windows Designing a roof window wherever possible	 [16]

[15] Image Source: https://tr.pinterest.com/pin/294704369356465405/?lp=true
[16] Image Source: http://newmusicseminars.com/3d2u5u/zzj5uv5no638rbvn/

Table 4.8 (Cont'd)

5	**Blending indoors and outdoors together**	[P4, P7, P13, P14]	Extending the indoor floor to the courtyard through a patio or a porch Designing an extravert or introvert balcony Planting full-size tree inside of the building, with a roof window	 17  18
6	**Use of natural material**	[P1, P2, P7, P9]	Preferring wooden floors, shelves, partitions, and furniture, or flooring, walls, and furniture that have a wooden display Stone tiling in the courtyard Usage of vernacular natural materials to raise awareness of surrounding nature	 19  20

[17] Image Source: https://architizer.com/idea/1854955/
[18] Image Source: https://www.archdaily.com/901054/san-jose-preschool-taller-de-arquitectura-de-bogota
[19] Image Source: https://buscarfoto.com/gallery-of-hn-nursery-hibinosekkei-youji-no-shiro-6/580178038756809627 1
[20] Image Source: https://ponostonehawaii.com/basalt-natural-stone/

Table 4.8 (Cont'd)

7	**Preferring to design with smooth lines over straight ones**	[P8, P13]	Designing the building with biomorphic forms When restricted to design with a sharp general form, attempt to condition the atmosphere with smoothing edges and lines Design interiors with ergonomic decorations and furniture	 21 
8	**Creative features of water**	[P1, P2, P5]	Water fountains in the courtyard Small fountains or waterfalls in the interior space to stimulate auditory connection to the sound of moving water Designing an aquarium in the common spaces of preschool	 22  23

[21] Image Source: https://www.archilovers.com/projects/39805/gallery?246970
[22]Image Source: http://kapemvun.info/construct-a-backyard-cinema/
[23] Image Source: https://www.pinterest.co.uk/amp/pin/732257220646185346/

4.4 Further Discussion

Further discussion of these guidelines can be specified to biophilic design guidelines for each geography and climate conditions since the practical strategies may differ for each climate condition. Another direction that further studies are predicted to follow is the optimizing a biophilic preschool by highlighting specific patterns in design for children with special needs of special conditions like children with autism, down syndrome, or ADHD (attention deficit hyperactivity disorder) as their needs from the environment is different from the children who do not have those conditions. As of the last word, this study is a humble attempt to take a step in recommending practical strategies for providing a built environment that is supportive of children's wellbeing.

CHAPTER 5

CONCLUSION

This study stepped into the path in hope of finding some suggestive architectural strategies and recommendations for designing preschool buildings, in order to prevent children from suffering psychologically and mentally in school because of poor designing and in consideration of child demands. In the Introduction chapter after explaining the ill-conditioned preschool building and the author's personal feelings as a child during the hours spent in that building which was the main motivation for this study, we discussed that this problem is not specific only for one building in one part of the world. The introduction leads that it is very common in urban settings to come across buildings that are neglecting the innate needs and expectations of occupants from the built environment and how congested urban environment which is compelled to grow as fast as possible is vanishing or harming nature from the visage of the cities; thus, stealing privileges of being interacted with nature and natural elements from urban people's daily experiences. Then by flashing back to the main focus of the study, we discussed how being interacted with nature plays a more necessary role in children's cognitive, physical, psychological health rather than matures.

Then, we explained the impact of the preschool environment on children's health and wellbeing. In order to gain a more comprehensive understanding of children's desire and expectations from the preschool environment researching about rules and laws of designing preschool was not enough. Taking a look at the guidelines of some of the well-known educational models gave us the ability to categorize the opinions of eminent Pedi psychologists and philosophers on what characteristics are expected from a place to optimize children's wellbeing. And, what features in a place make

preschoolers feel connected to their educational environment and give them a sense of belonging, accordingly put them in a sustainable stage during the time they spend in preschool. The distilled information derived from education models that also concern architectures are as below:

- Personalization of the space
- Connection to the environment (natural and cultural)
- Dividing the space into smaller zones
- Experiential learning
- Sensory stimulation

The second part of the literature review emphasizes the necessity of interaction with nature for children. And, why the widening gap between buildings and nature is becoming more and more concerning. The majority of the sources are underlining increasing outdoor playtime or taking children to nature camps which is a pedagogical matter as well as being important. However, as architects, we are looking for design approaches to improve children's nature relations within built environments.

Among various architectural approaches supporting the significance of appraising nature in the built environment, the biophilic design was the leader approach due to the ultimate objective of this thesis, which is to respond to the inner demands of humans by the language of the built environment. 14 Patterns of biophilic design gathered by a large group of scholars, architects, researchers, and urban designers provided a firm base for the conceptual framework of this study. Altogether, the patterns deliver a holistic experience that fosters physical and mental peace and well-being of users of the built environment. All of the patterns are being explained and interpreted by the author and visualized with potential design suggestions.

The guidelines for children’s needs from the literature review along with an interpretation of biophilic design patterns we re-prioritized the patterns in respect of their importance for preschool buildings in favor of children and it enabled the critics

to shape towards existing preschool buildings. In re-prioritization, the 12th pattern – refuge- climbed its path all the way up in the taxonomy classification of biophilic design patterns for preschools since it seems superior to other patterns for children according to the importance of "Dividing the space into smaller zones".

By random selection of five existing preschool projects, built in the last five years, from all over the world and diverse weather conditions, and various locations of the building on the city map, a detailed analysis of architectural characteristics got conducted. Then, by filtering the critics through biophilic design patterns some practical recommendations presented for each preschool in order to help promote biophilic features.

After maneuvering over how biophilic design patterns can be implemented on preschool buildings, and combining it with the children's needs from nature and environment, eight general applicable recommendation for designing a preschool that respects biophilic pattern is provided with implementation explanation and some visual examples.

9. Abundant usage of plants, green walls, and green roofs
10. Improving children's connection to the outside through windows
11. Providing refuge spots for children
12. Optimum use of sunlight for lighting interiors
13. Blending indoors and outdoors together
14. Use of natural material
15. Preferring to design with smooth lines over straight ones
16. Creative use of water

14 patterns of biophilic design deliver a general categorization to recognize biophilic design features in a place. The implementation of them in various places obey different sets of guidelines. Biophilic design patterns had priorly been examined in places like nursery houses, prisons, train stations, restaurants, and other places. This study was aiming to fill the gap for the implementation strategies and priorities of biophilic design patterns in preschool environments. By generating applicable

suggestions with narrative explanations and visual examples for designers who seek building preschools that have a better connection with nature, we answered the main question of the thesis to a certain extent which was to find some architectural solutions and recommendations to cherish the inner desire of children to feel connected with their first educational environment.

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APPENDICES

A. Plan of Author's Preschool

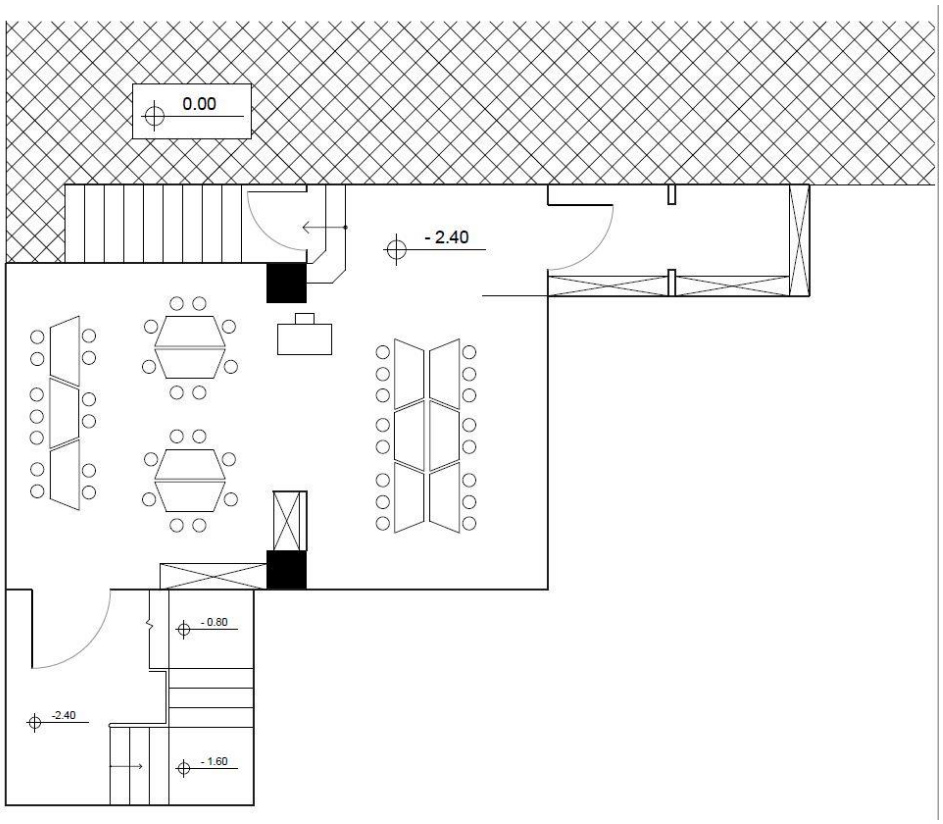

Figure 5.1 Plan of the Preschool which was the Motivation of the Study

The stairways down to the entrance start at the ground level of the schoolyard. After opening the rather small main gate of the classroom small desk and small chairs of students were visible in two cubic shape spaces. The two cubes were distinguished from each other by the teacher's desk in the middle and the outgrowth of columns into the class and the lowered ceiling where two columns were lined.

B. 3D Model of the Preschool which was the Motivation of the Study