



THE CONSIDERATIONS OF BIOPHILIC DESIGN TOWARDS SUCCESSFUL APPLICATION IN OFFICE BUILDING

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Abstract

Biophilic design has become one of the most important factors for the health and the success of the office buildings occupants. By applying the elements of biophilic design and their impact on the health of human- beings, we have been able to propose a future design strategies that can be applied in office spaces through the use of descriptive approach who applied in the office buildings, therefore to study the positive within the negative impact of this design on the employees to build a biophilic considerations for architects which can be use while designing an office buildings and work spaces.

Keywords: biophilic design, architecture, biophilic applications, workspace

BİYOFİLİK TASARIMIN OFİS BİNALARINDA BAŞARILI BİR ŞEKİLDE UYGULANMASI KAPSAMINDA DİKKATE ALINMASI GEREKEN UNSURLAR

Özet

Biyofilik tasarım, ofis binalarında yaşayanların sağlığı ve başarısı için en önemli faktörlerden biri haline gelmiştir. Biyofilik tasarım unsurlarını ve bunların insan sağlığı üzerindeki etkilerini dikkate alıp, ofis binalarında uygulanan tanımlayıcı yaklaşımı kullanarak ofis mekanlarında uygulanabilecek bir gelecek tasarım stratejisi önerilmektedir. Bu tasarımın çalışanlar üzerindeki olumlu ve olumsuz etkilerini inceleyerek mimarlar için ofis binaları ve çalışma alanları tasarlarken kullanılacak biyofilik düşünceler oluşturmak mekan tasarımı konusunda önemli bir yere sahiptir.

Anahtar Kelimeler: biyofilik tasarım, mimarlık, biyofilik uygulamalar, çalışma alanı

1. Introduction

A lack of green spaces who surround the urban buildings, is one of the main reasons for the discomfort of building occupants, who are spending most of their work time confined in an environment that is almost completely separated from nature, which subsequently leads to health and mental problems, a lack of productivity and creativity, as a result of that it has become necessary to provide their workplace With a healthy and high-quality design, by studying the interior within exterior environment of office buildings, to modify problems using biophilic design strategies based on its patterns as a future way to raise the quality through a thoughtful application that enhances the well-being of architectural design and the health of the workers. On the other hand, the research sheds light on the stress and anxious disorder due to work long hours of working, which made labor health organizations point to the need to consider the health of

employees within the work spaces, by searching for tools and methods that reduce diseases resulting from psychological and physical stress (ILO2016).

Recent studies for Browning and Kellert, indicated that biophilic design reduces stress and stimulates creativity and clarity of thought, which helps well-being and recovery from diseases through exposure to green spaces that calm the mind and revitalize the body (Calabrese, & Dommert, 2018). User needs can be met by integrating design strategies and environmental psychology theories that are oriented towards human well-being when designing workplaces by creating a restorative environment that distracts employees and supports creativity (Browning, Ryan, & Clancy, 2014). A few scientists and architects have suggested several biophilic design negative impact of biophilic design strategies and its application while design the office buildings. This requires a lot of effort to search for strategies, tools and considerations that can be used to enhance future design. This article wants to create a new guideline for developing workspaces in office buildings (Tarek, 2021).

The term biophilia was coined for the first time to describe the love of life. through two descriptions, the first is to love life and the second is the preservation of death threats (Wilson,1994). Linked to the basis of learning from nature (Wilson,1993). Biophilia hypotheses describe the mechanism of human reactions when interacting with nature. They provide the basis for developing a bio-design framework through the following(Kellert & & Wilson. 1993), (Kaplan,1989), (Peavey, 2011).

Biophilia Hypothesis	
Biophilia	Biophilia is defined as the evolutionary dependence on nature for survival and personal gratification
Dwelling and Occupants	According to evolutionary psychology, the emotional need for nature came from the emotion inherited from the experience of dwelling choice
Restorative environment	proposes that excessive consumption of human brain functions leads to mental stress, further the interaction with nature does not require much energy, it helps to restore exhausted attention.
Place	proposes that excessive consumption of human brain functions leads to mental stress, further the interaction with nature does not require much energy, it helps to restore exhausted attention

Table 1. Source The Reasercher by :(Kellert andWilson. 1993), (Kaplan,1989), (Peavey, 2011).

As for sustainable architecture, the biophilic design faced various challenges by reviewing the design elements to clarify the positive relationship between bio-design and sustainability (Almusaed, A., Almssad, Abdushaik, & Khalil, 2006)). Now these challenges can be addressed through biophilic design goals and

strategies such as climate problems (Peavey,2011), (Moore, & Guy,2005). Biophilic design goals can solve and better understand the problems of green architecture (Africa, Heerwagen, Loftness, & Balagtas, 2019). Where this article aims to review biophilic design strategies and sustainable architecture literature to reveal the negative effects on office building occupants or discover the most appropriate design elements (Sharifi, & Sabernejad, 2016).





Many studies have found the impact of anxiety and psychological problems that the environment can cause on human health over a long period, which made reconnecting with nature a priority for contemporary construction and modern lifestyle Occupant indoor environmental quality survey and building (benchmarking,2021).The research provides examples of the different effects of bio-design when applied to office buildings. Where the practical environment can provide a healthy atmosphere for employees that maintains their health and increases their productivity (Nicklas, & Bailey,1996).


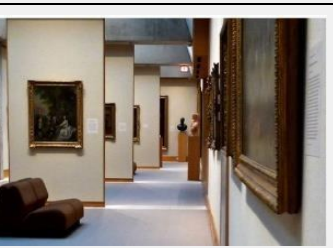

2. Methodology



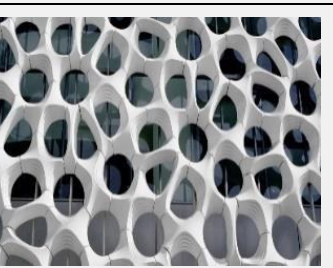
The biophilic design needs strategies and guidelines to be able to apply the elements and methods in architectural design, where experiences, strengths and weaknesses in the sustainable curriculum and some applications of bio-design can be adopted as a way to draw the framework of design considerations and its desired goals. Establishing a framework of considerations requires multiple knowledge of the sustainable approach and the structural framework of biophilic design .By making a comparison of the literature of biophilic design positive impact and sustainable design weakness pointers, we can form the achievement of the goal of integrating biophilic design with architectural design in methodological ways to reduce its severity of the design (Browning, Ryan, & Clancy, 2014), (Tarek, 2021), (Wilson,1994).

2.1. Biophilic Design Positive Impact In The Office Space

In nineties, the green building movement was linked to improving the environment and employee productivity. The results of this movement were positive on the economic level, and productivity was considered one of the elements of health and well-being .This section explained the importance of environmental theories on human recovery, meaning that all the elements of nature have a positive impact, whether directly or indirectly, when performing daily activities through a set of positive applications that we will present as follows(Browning, Ryan, & Clancy, 2014):

Biophilic Pattern Applications For The Nature In Space	Results On Office Workers	
Visual contact with nature	<p>Employees who enjoy the presence of nature in their offices have less anxiety and more satisfaction (Stigsdotter, & Stud, 2004).</p>	 <p>Figure 1. The New York Times buildings.</p>
Non-visual connection with nature	<p>Employees who do not have an access to nonvisual source of nature, such as watching a movie with the sounds of water or natural trees movements, have more energy than employees who sit in boring or noisy offices (Heerwagen, 2006).</p>	 <p>Figure 2. Alhambra courtyard.</p>
Water elements	<p>The sound of water can calm and reduce employee stress (Loftness , Hartkopf, Snyder, Hua, Gu, Choi, & Yang, 2006).</p>	 <p>Figure 3. The dockside green community, Canada.</p>
Daylight	<p>Productivity increases when daylight in workspaces</p>	 <p>Figure 4. The Terry Avenue Office space.</p>

<p>Thermal& airflow variability</p>	<p>Activity and vitality increase when the ability to control the air temperature (Alvarsson, Wiens , & Nilsson, 2010).</p>	 <p style="text-align: center;">Figure 5. Johnson headquarters racine.</p>
<p>Dynamic And diffuse light</p>	<p>Positive impact on biological performance on daily work Smith (Whitelegg ,& Williams, 2013)</p>	 <p style="text-align: center;">Figure 6. The Yale British Art Museum in New Haven.</p>
<p>Connection with Natural Systems</p>	<p>Improve the response to nature and environment positively (Lichtenfeld, Elliot, Maier, & Pekrun, 2012).</p>	 <p style="text-align: center;">Figure 7. The green roof c</p>

Biophilic Pattern Applications for Nature Analogous	Results On Office Workers	
Biomorphic Forms & Patterns	-Increases visual exploring which reduce stress due to the focus on human health (Lichtenfeld, Elliot, Maier, & Pekrun, 2012).	 <p data-bbox="883 590 1432 621">Figure 8. The New York Times Building facade.</p>
Natural Material	The spaces using wood reduce blood pressure and relax the occupant (Tsunetsugu , Miyazaki, & Sato ,2007)	 <p data-bbox="488 898 1101 930">Figure 9. The lobby of The Bank of America tower at One World Financial Center.</p>
Complexity & Order:	Distracting the employee and attracting his attention.	 <p data-bbox="776 1373 1432 1404">Figure 10. Manuel Gea Gonzalez Hospital – Mexico City.</p>



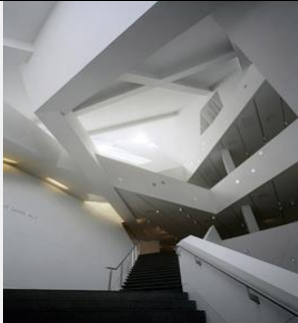

Biophilic Pattern Applications for Nature of Space	Results On Office Workers	
Prospect	Reduce stress and boredom , provide the feeling of safety.	 <p data-bbox="938 621 1432 653">Figure 11. Salk Institute – California, USA.</p>
Refuge	Increase the attention and focus of the employee	 <p data-bbox="1013 976 1432 1008">Figure 12. Cliff Palace, Mesa Verde.</p>
Mystery	Increase the pleasure sensations	 <p data-bbox="898 1398 1432 1430">Figure 13. Denver Art Museum - Denver,USA.</p>
Risk	Strong respond and good pleasure	 <p data-bbox="891 1753 1432 1785">Figure 14. Potsdamer Platz in Berlin, Germany.</p>

Table 2. Biophilic pattern applications for the nature in space and results on office workers (Browning and Kellert, 2014).

2.2. Biophilic Design Strategies Negative Impact Into Sustainable Architecture

The previous Section reviewed the positive impact on office workers , and how can the biophilic design be beneficial to the aim of environment developments of human health, but this approach doesn't cover the negative impact on the workers , to achieve a complementary frame work of consideration we must evaluate the negative affections results on the employees as the following literature of sustainable within biophilic design category (Aristizabal, Byun, Porter, Clements, Campanella, Mullan , Senerat, Nenadic, Browning, Loftness & Bauer, 2021):

Table 3. Biophilic pattern applications for the nature in space and results on office workers (Browning and Kellert, 2014).

Biophilic Pattern Applications For The nature in Space	Results On Office Workers
Visual contact with nature	If there is much interaction for long Period of time could cause distraction and a decrease the attention to the task.
Non-visual connection with nature	The use of multiple source of stimulation would over comfort The sensation which can increase the feeling to rest and sleep.
water elements	-Excessive presence of water can affect the sound and humidity -It can cause a negative emotional feeling of fear of life
Daylight	Distracted Glare which can increase the distraction , and affect the visual performance.
Thermal& airflow variability	High humidity and pollution,The circulation of air and mould risk.
Dynamic And diffuse light	Glare Discomfort
Connection with	Can Increase the feeling of distractions

Biophilic Pattern Applications for Nature of Space	Results On Office Workers

Prospect & Refuge	Wide open space can develop the sense of insecure.
Mystery	Discomfort due to the insecure feeling.
Risk	Creating a risk view can cost a physical Injury.

2.3 The Applications Technique for Biophilic Design Applyment

The tables in the previous section were adopted to cover the impact of Biophilic Design on the occupant of office buildings. In the next section, the researcher will present a set of applications for biophilic design patterns used in sustainable and green buildings literature in order to generate a strategies and considerations when implementing any project related to office buildings (Aristizabal, et al 2021).The following groups include the necessary work mechanisms when applying the biophilic design at the building and how to link the relationship between them through (The exterior of the building- connectivity-Interior workspace):

2.3.1 The nature in space applications techniques

In order to achieve a successful design when applying biophilic design in the workplace, the natural elements must be linked in a meaningful way by making diversity and interaction with the senses through the following points (Aristizabal, et al 2021):

Exterior of The building:

1. Mimic nature and biodiversity are the design priorities
2. The harmony of the design with the surrounding environment of different land and terrain.
3. Providing access to the water element through (fountains, waterfalls, Artificial water).
4. Apply the landscape in a way that can serve the ecosystem instead of visual aesthetic.

Connectivity between Outdoor & Indoor:

1. Design a building facade with an experience that enhances the senses and the relationship with indoor & Outdoor.
2. Create a Self-shading by processing the glass.
3. Wide windows application for good visual interaction.
4. Apply kinetic shades that create the effect of daylight and it is possible to allow contact with the fresh air.
5. Using smart windows that can track daylight by sensing.
6. Create a sensory experience with a creative interface design

Interior Workspace:

1. Well design plan of work spaces for a better view of the nature.
2. Providing a side space on the edges of the window to apply plants that enhance visual communication.
3. Various elements such as water and air can be used and introduced into the workplace to support the sensory experience.
4. Provide an opportunity for the employee to control the internal environment.

5. Add vegetables or a water body to enhance communication with nature.

2.3.2 The natural analogous applications techniques:

Natural Analogous provide an indirect contact with nature , It can be applied by treating workplaces using elements, tools, materials, shapes and patterns derived from nature through the following (Aristizabal, et al 2021) :

Exterior of The Building:

1. Some of the living and organic forms that mimic nature can be used when designing the gates of the building.
2. Stone and wood are preferred when designing the external environment.
3. Use of geometric fractal shapes.

Connectivity of Outdoor And Indoor:

1. Focus while design on windows and architectural openings using natural models.
2. Make the external appearance of the building more natural with the least amount of industrial processing.
3. Use fractal shapes when designing an interfaces.

Interior Workspace:

1. The use of natural elements when designing interior spaces.
2. Using raw and natural materials in a variety of colors and shapes when designing office furniture.
3. The use of geometric shapes in a decorative way.

2.3.3 The nature of space application techniques:

Space patterns depend on the biological and sensory nature of humans and their consequences when present in private spaces in general. A sense of safety, danger and ambiguity can be generated according to the nature of the design as follows (Aristizabal, et al 2021).

Exterior of The Building:

1. Design who meets the needs of the ecosystem and the awareness of the culture of the place.
2. Supporting spaces with seating areas using furniture that emphasizes the relationship of the place with the surrounding environment by design a different shapes of seats and shades, whereby the user can feel safe, isolated or contained, and certainly prepared for climate changes.
3. A design provides the feeling of safety when drawing the movement of paths between plants and rocks or water, which creates enjoyable experiences.

Connectivity of Outdoor And Indoor:

1. Direct the building with a suitable orientation towards natural terrain for better visual visibility.
2. The use of transparent staircases which can provide multiple visualizations.
3. Orienting windows to a places of a movements nature, it can gives a sense of curiosity and exploration in the workplace.
4. Add a short seats next to the windows to enjoy a distinctive and healthy view.

Interior Workspace:

1. Expand the visibility by opening spaces or using transparent partitions that allow visibility when designing workstations.
2. Diversity in heights, such as low heights, satisfy the feeling of safety, while high ones enhance the feeling of openness. It is also possible to diversify by using a different way to distribute the lighting with the ability to control it.
3. Shadow patterns stimulate a sense of continuous movement and enhance a sense of mystery by adding kinetic techniques to the environment.
4. External spaces of multiple heights, floating with internal balconies that provides visibility.

3. Discussion

After viewing the strategies of biophilic design implementation the researchers extract a group of consideration while Design an office place projects ,which aim to support the health and well-being of building occupants and workplaces, and therefore the most important considerations and main recommendations for design mechanisms are achieved as follows:

The Nature in Space Category Consideration:

A successful design of using the nature in space patterns style can be achieved by focusing on the purpose of connections with nature by use it in a various ways. By considering the following points:

1. Visual contact with nature by relying on plants, natural lighting and water, as well as representational symbolic images of nature.
2. Feeling the freshness of the workplace through other senses (hearing, tasting, smelling, touching) Integrating invisible connections with other aspects of design patterns.
3. The unexpected movements that occur in nature help maintain focus, restore attention, and stimulate clarity and vitality for workers.
4. Design the workplace in such a way that users can experience changing temperatures and air flow in order to control temperature, lighting and airflow settings to realize their thermal comfort and thus improve focus and vitality.

Designers can control the feel of water in space by adjusting fluidity, volume, sound, turbulence, and user accessibility.

6. The intense penetration of sunlight is not preferred, and a balance must be found between uniform and dynamic lighting distribution, and this is achieved through shading the facades and the use of internal courtyards that allow light with variable levels of diffusion.
7. Integration with natural systems by giving a view of a landscape or incorporating a design that is responsive to external environmental changes in the building cover.

The Natural Analogous Category Consideration:

1. Simulating nature in ways that create a desire for the user to interact with the environment to enhance performance and reduce stress.
2. A thoughtful application of materials and their impact on the user so that they reflect a comfortable design that promotes calmness instead of manufactured materials. The metaphor of the golden ratio when applying decorations for the visual pleasures they create.

3. Balance when executing complex fractal geometric shapes with extreme precision.

The Nature of Space Category Consideration:

1. Applying the theory of the prospect to reduce stress and boredom, feeling of liberation and relaxation for the employee is one of the priorities of the pattern.
2. Covering separate workspaces from the back to provide a feeling of safety and protection, and can be used later for meditation.
3. The ambiguity in the design requires the provision of moving from one place to another to stimulate the desire for exploration, which relieves stress and facilitates recovery.
4. Arousing a sense of danger with the addition of safe spaces that raise attention and enhance memory and problem-solving skills, and this can be achieved by adding the element of fear of falling, the possibility of getting wet or losing control.

4. Discussion

The main conclusions of the study may be presented in this section. If there is more than one appendix, they should be identified as A, B, etc. Formulae and equations in appendices should be given separate numbering: Eq. (A.1), Eq. (A.2), etc.; in a subsequent appendix, Eq. (B.1) and so on. Similarly for tables and figures: Table A.1; Fig. A.1, etc. Aurum Journal of Engineering Systems and Architecture publishes novel articles in English only. The preferred spelling is US English, except in citations of works published in UK English. All non-English words found in an unabridged US English dictionary should be treated as English words. In line with Chicago manual advice, Aurum follows the Merriam Webster's Collegiate Dictionary as a source for standard US spellings, including hyphenated and capitalized forms.

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CONFLICT OF INTEREST

The authors must declare that they have any conflict of interest.

AUTHOR STATEMENT

The authors have to declare that if there is any ethical approval, consent to participate, consent for publication, availability of data and material, and code availability etc.

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