

Embodiment and Technical Application of Biophilia in Private Space

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Abstract. With the rapid development of urbanization and the current global epidemic of covid-19, our urban construction seems to be less connected to the natural world, ecological diversity is decreasing, and the relationship between human beings and nature is gradually weakening. At present, the proposal of a new design concept, biophilic design, has created a way that modern society can return to the essence of human beings. As Biophilia means "love for life and living systems", this design philosophy incorporates the essence of our lives and as a way of design brings nature into the environment in which we live and work. Design stimulates human cognition of nature from all senses, brings nature into the built environment, creates a space with a sense of comfort and well-being, and promotes sustainable development. Diversity of life can be preserved, and the relationship between human beings and nature can be harmonious. However, there are still a series of problems and challenges in the process of biophilic design practice. In this study, the concept and importance of biophilia are discussed, examines the issues and challenges of biophilic design for intimate spaces, expounds on how biophilic design builds the unification of indoor and outdoor spaces and discusses the process of biophilic design Whether privacy is preserved or rediscovered.

Keywords: Biophilia, Biophilic Design, Sustainability, Eco-Interior-Design, Interior And Exterior Space.

1. Introduction

As an individual, human beings often cannot exist in a self-independent form. Humans have acquired a strong inclination towards nature and the natural environment through their long evolutionary history, but unfortunately, modern humans, especially children, lack direct and frequent contact with nature, which can negatively affect their physical and mental health. Edward O. Wilson first introduced in his book *Biophilia* that humans have an innate tendency to seek connection with nature and other life forms, a hypothesis he defined as biophilia, "the urge to connect with other life forms" [1]. How to establish and promote biophilia in modern society is to connect people with nature in architectural design. Biophilic design is an effective way to design interior environments to inspire an individual's natural biophilia. This point of view has changed many people's perceptions of space, and it also raised the question, should the design of the interior imitate the outdoor environment to improve people's way of life and promote biological affinity? According to the 2001 National Survey of Human Activity Patterns, this view was affirmed and supported by data showing the need to bring outdoor activities indoors and create indoor environments that reference nature in various ways [2]. Biophilic design is both an ideology and a design method. How to use this awareness to enrich the places where we live and work, and create conditions that are beneficial to our lives, are the challenges that designers are facing now. "Life creates conditions conducive to life," writes Beynus, "and life, if we invite it into our buildings, can also create conditions conducive to our life" [3]. It is undeniable that biophilic design has been rapidly gaining popularity in recent years as an effective response to the problems of the built environment. However, some problems cannot be ignored in the development of the biophilic design. From the designer's point of view, some research on biophilic design is rarely conducted by people who have participated in the experience but is mainly studied

through images of biophilic spaces, which results in some designers not being able to come into contact with the needs of the people living in this space more intuitively [4]. Because biophilic design isn't just about visual quality, it's multisensory and context-specific. The mixed design of multiple disciplines and multiple concepts can easily lead to the neglect of the concept of biophilic design. In essence, biophilic design is not to use nature directly, but to analyze and extract certain patterns and states between humans and nature that are beneficial to human survival and development, and then transform them into an artificial environment. The biggest problem that people living in biophilic design environments is biophobia. The resistance to nature, the resistance to animals, plants, and organic materials, loses the connection between the living environment and nature [5]. Therefore, fully understanding people's biophilic design preferences, and then studying which factors affect or change people's perceptions or choices in the real environment, to protect and reduce biophobia, is the most needed action at present.

In recent years, with the acceleration of people's pace of life, the pressure on modern people's life is also increasing, both physically and psychologically. In the 21st century, people attach great importance to personal privacy. This can be reflected in the legal literature and people's preference for space design. In the late 1960s, American psychologist Sam put forward the concept of "personal space". He believes that there is a visible and inseparable space around everyone's body. If strangers enter this range, it will make people feel uncomfortable. With the development of society and economy. In a prosperous city, people are eager to get close to nature. The concept of symbiosis between human beings and nature has been put forward continuously, such as "green building" and "sustainable development". Thus, the concept of Biophilia is constantly being valued by people, and its benefits are also shown by people's research. interaction with nature can relieve stress, eliminate irritability, relieve mental fatigue and improve mood. The design of life affinity makes the surrounding environment play a predictive role in health, rather than the usual reactive pathological role. Therefore, more and more natural elements are added to modern architectural design. Combined with the local climate and terrain characteristics, appropriate design schemes are selected according to local conditions, so that the buildings can achieve perfect integration with the local natural landscape, which is conducive to the effective relief of people's pressure. Nowadays, the development of science and technology has brought great changes to people's way of life and work. People also apply a large number of advanced science and technology to modern architectural design to help realize the idea of Biophilia. The breakthrough of science and technology help the implementation of Biophilia design in practical situations.

The problem and challenge biophilic faced in his design process are that in today's society, the connection between people and nature are increasingly separated. People no longer fully support the connection between humans and nature, but more see nature as a raw material for technological transformation or as a nice but unnecessary recreational and aesthetic facility. This separation is reflected in many aspects, such as medical care, where people are more inclined to combine western medicine with chemistry rather than more natural Chinese medicine. In architectural design, the raw materials of urban buildings are more industrial products, unlike the local materials used to build houses [6]. Le Corbusier's Cite Radiant (unbuilt in 1924) may have led to disastrous urban design, but by setting the tower in a park surrounded by greenery, he tried to provide a connection with nature for the city dwellers. As the international style took root, glass buildings blossomed everywhere; Unfortunately, these buildings, especially the interiors of commercial buildings, increasingly disconnected people from nature. The modern assumption that humans no longer need to connect with nature is revealed in a wide range of practices that place people in sensory-deprived and artificial environments such as office buildings, hospitals, schools, and shopping malls -- with little exposure to natural forces and stimuli. The design of most of today's built environments lacks adequate natural light, natural ventilation, natural materials, vegetation, landscapes, environmental shapes and forms, and another evolutionary affinity with the natural world. The fundamental challenge of biophilic design is to address these deficiencies in the modern built environment by initiating a new framework

for the beneficial occurrence of nature. Our goal is to address the growing separation of human beings and nature in design and to fully support the connection between humans and nature [7].

2. Why Do We Need Good Design?

2.1 The relationship between Sustainability and design

Because of the current social development, sustainable development has become the main focus. Sustainability is the possibility for humans and other life to thrive forever on Earth [8]. However, there are obstacles to the development of this possibility. Overcoming these obstacles requires changing the mode of human existence through external behaviors and finding a way that is suitable for the co-existence of humans and nature. From the design point of view, sustainable development can cover many aspects, such as "environmentally friendly", "environmental design", "green design", and "new energy", which also puts forward high requirements for designers. A good design, on the premise of promoting sustainable development, can make the public realize the importance of sustainability. The goals of sustainable development and Ecologically Intentional Design are to create an environment where people can live a meaningful, peaceful, fulfilling life, in beautiful harmony with the natural world [9]. In the process of sustainable development, the role of the designer is not only to create and use sustainable products but more importantly, to promote and encourage sustainable development through intentional design.

2.2 Eco-interior-design

Ecological literacy is a concept derived from the goal that creating an environment where people live in harmony with nature. How to create a thinking framework that recognizes the relationship with the natural world and supports the development of new, forces to create sustainable lifestyles. To help the development of a sustainable society, designers should first make ecological literacy a basic skill in design. When ecologically literate, design becomes the most powerful tool for problem-solving. A good designer must be able to integrate into the local environment, by observing the surrounding environment, overcoming a series of obstacles, and identifying some ways to connect with nature. The designed products and services must be able to cultivate people's ecological literacy and encourage the interaction between people and nature. As a basic skill in design, ecological literacy can not only promote sustainable social progress but also promote harmony between humans and nature. Sustainability is achieved when everyone is ecologically literate.

2.3 Why is Biophilic design that important?

Similar to eco-literacy, biophilic design can also be a great way to promote sustainable development. In modern society, the aesthetic design of buildings is also very important for people's spiritual pleasure based on meeting people's physical pleasure. People indicate the concept of green building design and the concept of people-oriented sustainable development. In this case, the importance of Biophilia is highlighted. As the foundation of biophilic design, Biophilia uses natural materials, patterns, and phenomena to maintain a connection with nature in the built environment. Biophilic design can support cognitive function, physical health, and mental health. Obviously, under the pressure of modern society, people have gradually reduced their communication and connection with nature. Most of the time, people are enclosed in their work environment, and it is difficult to have direct contact with nature. In this context, biophilic design is becoming more and more popular. Google is one of the companies experimenting with "biophilic design inventions", the goal is to use biophilic design to create a healthy and productive work environment, allowing employees to feel nature indoors. Google has used skylights to provide more natural light, brought plants into the room in different forms, and used natural patterns for wallpapers and carpets to fully stimulate human awareness of nature from various senses. "We know anecdotally that Googlers feel deeper focus, more creative, and more productive when they have more access to natural light and biophilic elements in their workspace," says Less [10]. At present, it can be easily observed that many biophilic

design elements are used not only in the work environment but also in home design which can make people a very relaxing space. For example, abundant windows and lighting, can maximize natural light into the interior, and allow natural air and temperature flow. Various plants appear indoors in different forms, such as potted plants, plant green walls, some indoor garden landscapes, etc. As the population grows, and in the case of sustainable development, it becomes increasingly important to integrate nature into the built environment so that the connection between people and nature is not lost. To create a sensory atmosphere that allows humans to gain health and relaxation through their connection with nature, people need these design elements to feel psychologically and spiritually comfortable. Psychologists' research shows that connecting with nature is good for people's psychological recovery, which means that when we add a natural design to our daily life, texture, contour, especially the feeling they generated, can create a new sense of well-being and comfort for users. Such design can reduce stress, and enhance creativity. These qualities become increasingly important as the world's population continues to urbanize.

3. How Does Biophilic Design Create A Unity Of Interior And Exterior Spaces?

3.1 Six principles that define the human connection to nature in our built environment

The drive to interact with nature through people encoded in their DNA is an innate desire to connect with other life forms and the outdoor environment. People now spend most of their time indoors, more than ever before, but there is still an instinct to connect with nature. This instinct is the premise for building the unity of inner and outer space [10]. The biophilic design translates the innate need of humans to connect with the natural world into our built environment. Specifically, it aims to infuse natural elements into our homes, offices, and communities, creating a sense of harmony and flow between our interior Spaces and the surrounding landscape.

Biophilic design aims to support human health through six defining principles that define the human connection to nature in our built environment. Any sensuous connection with nature helps to promote the unity of inner and outer space. Incorporating living plants into indoor and outdoor living Spaces, breezes through Windows and fires in fireplaces all help to stimulate the look and feel. This is the principle of Environment Characteristics. Apart from this principle, the natural shapes and forms principle pays attention to the vitality shown by nature, natural form, and form in all things designed. In the design, sensory connection with the perception of the surrounding environment is called natural patterns and processes. Time in nature is a restorative multi-sensory experience, such as hearing, vision, touch, and smell, which will be awakened by getting along with nature. The last three principles are light and space, location-based relationships, together with the evolutionary relationship between man and nature. In the building, natural light needs to be fully connected with the indoor and outdoor space. This is why clients often value light when choosing a house. The design principles are in harmony with the natural environment. The design needs to connect with the local ecology and prominent landscape (ocean, grassland, desert, forest, river, mountain). All the elements of the biophilic design come together to transform the basic built environment into a sanctuary that connects with nature and can promote a deeper sense of security, centrality, relaxation, and restoration.

3.2 Three contact experiences with nature

In terms of the current design, three contact experiences with nature represent the basic categories of most biophilic design frameworks. They can be summarized as the direct experience of nature, the indirect experience of nature, and the experience of space and place [11]. The direct experience of nature includes natural elements such as light, air, temperature, and water. People feel these elements through various senses of the body, such as touch, vision, hearing, and smell, to make the brain realize that they are in the natural environment, and to make contact with nature. In this way of experience, people are usually in an open natural environment rather than indoors.

Indirect experience of nature can be expressed by adding other designs with natural elements, such as colors, materials, and images. People who want to contact with nature often choose green wallpaper,

prefer furniture made of natural wood, and hang photos of natural scenery in the indoor space. In addition, advanced science and technology can also increase the indirect experience between man and nature which is used to simulate various natural scenery, light, and air at any time in a specific space, to help the biophilic design present better.

About the experience of space and place, Stephen R. Kellert and Elizabeth F. Calabrese explained in the article that it is spatial features characteristic of the natural environment that have advanced human health and well-being [11]. This experience is reflected in that when people are in an environment with natural elements, they will generally feel more comfortable and relaxed. Many houses through increasing the area of windows to increase the natural light entering the room, let people in the house can see a larger area of natural scenery, or increase indoor green plants. Studies have found that offices with natural light, materials, and vegetation can increase workplace productivity, improve employee morale and reduce absenteeism [12].

4. Is Privacy Preserved Or Rediscovered In The Process?

The existence of buildings is to satisfy people's various needs, providing private space for people. From the design, we can find how to connect human beings with nature through the combination of vegetation affinity and private space. When we adopt the biophilic design, are we destroying the original private space, or do we redefine the private space in the modern sense? Privacy is a kind of fundamental right, it had a long history and it can be traced back to before the birth of society. Different societies may have different views on privacy. Some primitive societies were indifferent to privacy. In modern society, the deliberation around privacy is a debate about modern freedoms [13]. From the perspective of historical development, privacy has been paid more and more attention. In biological design, to make a specific space have more natural elements or have more contact with nature, it will be more open and complex, which will destroy partial privacy. For example, Chinese classical windows use hollowed-out patterns to connect people in the room with the outside.

Nonetheless, no matter how many changes are made to the surrounding environment, it is based on a specific space. The size and orientation of the space have been determined, and only natural elements need to be added to the space's surface and interior. From this perspective, biophilic design maintains most of the privacy. The biological design framework using natural indirect experience can also effectively restore the destroyed original privacy, by using natural materials for sheltering, rearranging the space, and so on. Thus the privacy in the space is redefined to achieve the ideal effect for users.

British geographer Jay Appleton hypothesized that we inherited our experience of landscapes strategically and geographically from our hunter/gatherer ancestors. His analysis of landscape paintings found that people preferred paintings that showed two main elements: "foreground," a broad, bright, distant landscape where potential food sources or predators could be observed; and "sanctuary," a smaller, Darker, and more enclosed areas for protection and privacy [13].

"Designers have struggled for years to create spaces that ensure openness and privacy at the same time," Hase said. "That's what nature has always given us." She points out that in recent years, work environments have become increasingly Be more open to improving visual connections and encouraging collaboration. These intimate spaces offer "a lot of perspectives", with floor plans with multiple views from most locations and multiple paths through the space. However, Hase also points out that this must be balanced by a shelter-like space that provides privacy and avoids distractions [14].

For providing privacy in a room, we can do this with movable partitions, specially placed artwork, or some hanging coverings. If combined with biophilic design elements, using some plants to enclose the space is a good option. The spaces enclosed by vegetation are diverse. The opening space makes people feel free and has a wide view, but lacks privacy. The closed space makes people's sight blocked and feels oppressive, but the privacy is better. If the biophilic design in private spaces can meet the

physiological needs of people, it can create a harmonious and unified space while maintaining the privacy of the room.

5. Conclusion

In general, the emerging field of biophilic design is developing rapidly. For biophilic design in private spaces, even though there are many problems and challenges, researchers and designers are still actively seeking solutions. "Biophilia" refers to the emotional bond between humans and other organisms, and it is the nature of human beings to be close to nature. In the modern world, people need these design elements to feel psychological and spiritual comfort. Like every design element, biophilic design elements integrate human's affinity for nature into the design of the built environment through the senses, seeking harmony between human beings and nature. The prevailing view is that biophilic design principles should be embraced and the connection between human beings and nature should be gradually restored through architecture. During the period of the covid-19 epidemic, the global blockade has led to a surge in people's interest in contact with nature, and long-term living in private spaces is more likely to stimulate human nature to be close to nature. The goal of humanity should be a shift in design thinking, with biophilic design as a philosophy to enrich our society and create a healthier future. By caring for and practicing nature, the harmony between architecture and nature can be promoted. Times are changing, and tomorrow's architecture will become more harmonious and positive.

References

- [1] E.O. Wilson, *Biophilia*, Harvard University Press, 1984.
- [2] G. Barbiero, R. Berto, *Biophilia as Evolutionary Adaptation: An Onto- and Phylogenetic Framework for Biophilic Design*, *Frontiers in psychology*, vol. 12, 2021, DOI: 10.3389/fpsyg.2021.700709
- [3] J. Kane, N.A. Sachs, Book Review: *Biophilic design: The theory, science and practice of bringing buildings to life*, *Health Environments Research & Design*, vol. 9, 2016, pp. 176 - 178.
- [4] W.D. Browning, C. O. Ryan, *Nature inside: a biophilic design guide*, Routledge, 2020.
- [5] L.C. Markie, *Incorporating an eco-informed orientation into family therapy education*, *Eco-Informed Practice*, Springer, Cham, 2019, pp. 109-121.
- [6] J. Clancy, W.D. Browning, C. O. Ryan, *14 PATTERNS OF BIOPHILIC DESIGN Improving Health & Well-Being in the Built Environment*, Terrapin, 2014.
- [7] S.R. Kellert, *What Is and Is Not Biophilic Design*, Buildings, 2015.
- [8] J.R. Ehrenfeld, *Sustainability by design*, *Sustainability by Design*. Yale University Press, 2008.
- [9] N. Stegall, *Designing for Sustainability: A Philosophy for Ecologically Intentional Design*, *Design Issues*, 22(2) (2006) 56–63, DOI: <http://www.jstor.org/stable/25224047>
- [10] K. Obrzud, *Biophilic Design: Staying Connected with Nature Inside Your Home*, Buildings, 2022
- [11] S.R. Kellert, E.F. Calabrese, *The practice of biophilic design*, Buildings, 2015
- [12] K. Cifolelli, *What is Biophilic Design and How Can it Improve Workplace Productivity*, *Intelligent Buildings International*, 2020
- [13] J. Appleton, *Landscape evaluation: the theoretical vacuum*, *Transactions of the Institute of British Geographers*, 1975, pp. 120-123.
- [14] J. Heerwagen, B. Hase, *Building biophilia: Connecting people to nature in building design*, *Environmental Design and Construction*, no. 3, 2001, pp. 30-36.