

Biophilic Design for Healthier Built Environments: A Connection Between Human Wellness and Biophilic Architecture

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Abstract

Humans' connection to the natural world has changed drastically due to rapid urbanization, environmental deterioration, and evolving lifestyles. Physical health problems, psychological stress, decreased productivity, and deteriorating overall well-being are all exacerbated by the fact that modern structures frequently place an emphasis on functionality and technological progress while restricting residents' contact with natural components. Biophilic architecture is a new way of thinking about building that incorporates elements of nature into man-made spaces in an effort to improve people's well-being, the environment, and the built environment as a whole. Biophilic design makes indoor and outdoor spaces healthier, more healing, more resilient by utilizing natural light, plants, water features, organic materials, natural ventilation, and spatial layouts inspired by nature. the function of biophilic design in creating buildings that are better for people's health and happiness. the principles of biophilic design and how it has been implemented in various types of buildings, including private residences, schools, hospitals, and public spaces. principles of design, such as those pertaining to landscape-sensitive planning, interior vegetation, green roofs, vertical gardens, visual and physical links with nature, natural material utilization, integration of biodiversity, optimization of daylight, and indoor vegetation. We also take a look at how new technology like sustainable building systems, smart environmental controls, and Building Information Modeling (BIM) might improve biophilic design results.

Keywords: Biophilic Architecture, Human Well-Being, Biophilic Design, Healthy Buildings, Sustainable Architecture

Introduction

Humans' interactions with nature have evolved considerably due to the fast speed of urbanization and development. Buildings including residences, workplaces, schools, hospitals, and commercial complexes house an ever-increasing percentage of urban inhabitants as cities grow. While contemporary structures are more practical and energy efficient thanks to technological developments, people spend less time outside as a result. A decline in general health, increased stress and anxiety, mental exhaustion, and respiratory diseases have all been linked to a lack of natural light, green spaces, fresh air, and scenic views. In response to these issues, the architectural, urban planning, and environmental research communities have been investigating new ways of making buildings that bring people back into harmony with nature and make them better places to live. One of the most significant ideas in modern sustainable design is biophilic architecture. Originating from the Greek word "biophilia," which means

"the inherent human affinity for nature," biophilic architecture incorporates biological processes, natural features, and patterns found in nature into the layout and construction of humans' built environments. Instead of viewing nature as an afterthought, biophilic design aims to integrate it into man-made spaces through the use of natural elements such as plants, sunlight, air circulation, water features, and materials derived from the environment. This method generates places that are good for people's physical and mental health as well as their ability to connect with others and the planet. Beyond mere aesthetics, biophilic design places an emphasis on how being in nature improves human health and performance. Stress, hypertension, cognitive function, creativity, healing, and productivity can all be improved by spending time in nature, according to a plethora of scientific studies. Studies have demonstrated that schools benefit from naturally lit classrooms and that healthcare facilities with access to gardens and natural views had shorter recovery times for patients. Employee happiness, absenteeism, and organizational productivity are all positively impacted by biophilic design aspects in the workplace. Biophilic design has become more important due to the growing concern for the environment. Large quantities of water, energy, and building materials are used up by modern structures, and they also release a lot of greenhouse gases. Biophilic architecture seeks to solve these problems by incorporating sustainable building materials, passive design principles, green roofs, vertical gardens, renewable energy systems, and the conservation of biodiversity into the design of buildings. In addition to making life healthier, these upgrades boost energy efficiency, improve indoor air quality, lessen the impact of urban heat islands, and lend a hand in the fight against climate change. Biophilic design has also been made more feasible by technological advancements. Building Information Modeling (BIM), environmental simulation software, smart sensors, AI, and IoT-based building management systems allow architects to maximize natural ventilation, daylight penetration, thermal comfort, vegetation placement, and overall building performance. Throughout a building's lifespan, these technologies allow for more sustainable practices and better occupant health and safety thanks to evidence-based design decisions. More and more, a wide range of building types—from private residences to public spaces, hotels, airports, schools, and hospitals—are incorporating biophilic design principles. Modern architecture is increasingly incorporating landscape elements such as green walls, interior plants, water features, courtyards, and rooftop gardens. Restoration of ecological balance, improvement of air quality, support for biodiversity, and creation of chances for human contact with nature in the face of constrained urban space are all outcomes of these interventions in fast-growing cities.

Biophilic Design Principles

The core principle of biophilic design is that people are naturally attuned to the natural world and that it is possible to improve people's physical and mental health as well as the environment by designing with natural aspects in mind. By way of spatial planning, materials, sensory experiences, and environmental interactions, biophilic design methodically incorporates nature into architecture, as opposed to merely including plants or ornamental natural elements. There are three main parts to the generally acknowledged biophilic design framework: Natural Analogues, Nature of the Space, and Nature in the Space. When used collectively, these principles result in constructed settings that are healthier, more engaging, and restorative.

Space and Nature

The term "Nature in the Space" describes the tangible incorporation of natural features into man-made settings. As a guiding principle, this idea stresses the importance of inhabitants' ongoing engagement with sensory-stimulating living or natural systems. The idea is to make it feel like you are in nature even when you are in a city or indoors.

Taking use of natural light is a crucial part of this idea. A building's visual comfort, circadian rhythm regulation, reliance on artificial lighting, and general wellness can all be improved with adequate sunshine penetration. Another crucial component that helps with IAQ, thermal comfort, and energy efficiency is natural ventilation, which lets air flow naturally through buildings.

Green walls, courtyards, rooftop gardens, indoor plants, and landscaped open areas can help improve air quality and lessen the impact of urban heat islands by creating visible and physical links to nature. The soothing sounds and motion of water in water features like ponds, waterfalls, reflecting pools, and fountains can have a calming effect on the senses. Additional factors that aid in the alleviation of stress and the restoration of mental health include views of nearby landscapes, gardens, trees, and open green areas. Places that incorporate these natural factors are more conducive to rest, inspiration, productivity, and mental and emotional health.

Relatives in Nature

The term "natural analogy" refers to a style of architecture that draws inspiration from the natural world in its patterns, colors, materials, textures, and forms. Design features that are inspired by nature can nonetheless provoke the same psychological and emotional responses as being in nature, even when one does not have much direct touch with it.

Tree branches, honeycombs, leaves, flowers, shells, waves, and mountain outlines are some of the natural forms that architecture frequently attempts to imitate. In contrast to the mechanical, inflexible shapes typical of traditional architecture, biomorphic designs incorporate organic curves and flowing geometry. While lowering the environmental effect of construction, natural materials like wood, bamboo, stone, clay, cork, and natural fibers offer warmth, authenticity, and tactile richness.

Natural landscapes, oceans, forests, and deserts provide as color inspiration for aesthetically pleasing and calming interior design. Naturalistic textures that mimic bark, stone, water, or plant structures evoke a sense of wonder and realism in the environment. Interior finishes, artwork, and decorative patterns inspired by natural ecosystems deepen the link between people and the outdoors. By utilizing these design methods, Natural Analogues craft spaces that encourage coziness, recognition, and emotional healing.

Spatial Characteristics

Making virtual spaces that feel and look more like real ones found in nature is the main goal of Nature of the Space. Encouraging a sense of exploration, safety, curiosity, and discovery through one's perception and interaction with architectural settings is the focus of this approach. By mimicking qualities seen in natural environments, architectural design affects how people feel, act, and think.

Providing inhabitants with open and unhindered views allows them to comfortably examine their surroundings. A feeling of openness is achieved through the use of large windows, open

courtyards, balconies, terraces, and elevated perspectives, which also improve visual connectedness and allow for natural surveillance.

A place of refuge is a safe haven where people can go to feel at ease and protected. Even in bustling public spaces, people can find a secluded spot to read, relax, or recharge their emotions in a nook, alcove, shaded seating area, indoor garden, or other designated quiet location.

Partially hiding areas or making winding roads, planted walkways, and gradually unfolding views that stimulate investigation are all ways mystery provides elements of wonder. Attractive and harmonious visual flow is achieved by thoughtfully planned space transitions.

The goal of Risk and Peril is to provide exciting, yet safe, experiences. Glass floors, high walkways, observation decks, suspension bridges, or stunning perspectives create a sense of adventure while assuring the safety of occupants, which generates positive emotional involvement.

Nature of the Space integrates various spatial aspects to create spaces that elevate people's emotional connection to their surroundings, promote social engagement, and boost psychological comfort.

A thorough foundation for designing structures that meaningfully and tangibly link humans with nature is provided by the principles of biophilic design. Natural Analogues incorporate natural materials and forms into architectural design, Nature of the Space generates spatial experiences that mirror the variety and complexity of natural landscapes, and Nature in the Space encourages direct engagement with living systems and environmental conditions. All of these things—occupant happiness, physical and mental health, environmental sustainability, and building performance—are enhanced when these principles are put into practice. The importance of creating physical environments that are healthier, more resilient, and sustainable through the use of biophilic design principles will only increase as urban populations keep on growing.

Conclusion

An innovative new paradigm in the field of built environment design, biophilic architecture places a premium on human health and ecological preservation. The importance of incorporating natural elements into architectural design for the creation of healthier, more resilient, and habitable spaces is growing as people's relationship with nature is being reduced by urbanization. A biophilic building is one that improves the quality of life for its inhabitants by mimicking the natural environment as closely as possible through the use of natural light, air, plants, water features, materials, and layouts. The study shows that there are many advantages to biophilic design in terms of health, happiness, society, and the environment. Indoor air quality, stress levels, cognitive performance, emotional well-being, and productivity can all be improved when buildings have access to nature. Faster patient recovery and better healthcare outcomes are two benefits of biophilic environments in healthcare settings. Biophilic environments also promote better focus, creativity, learning, and employee happiness in educational institutions and workplaces. The significance of creating structures that promote functional efficiency and human health is underscored by these advantages. Sustainable development is greatly enhanced by biophilic design, which goes beyond only boosting occupant well-being. We can lessen our influence on the environment, save energy, preserve

resources, boost biodiversity, and slow the pace of climate change by including green roofs, vertical gardens, passive ventilation systems, renewable energy, rainwater collection, and eco-friendly construction materials. Biophilic design is already highly effective, but it may be much more so with the help of smart technologies like environmental simulation tools, Building Information Modeling (BIM), Artificial Intelligence (AI), and the Internet of Things (IoT). In highly populated metropolitan regions, space limits, regulatory hurdles, lower awareness, higher initial investment costs, and maintenance requirements are some of the obstacles to implementing biophilic architecture, despite its many advantages. More education and understanding among architects, developers, planners, and building owners, as well as supporting policymaking from the government, are necessary to overcome these obstacles. To encourage the broad use of biophilic principles, it is crucial to invest in research, teaching, and sustainable design techniques. Designs that integrate the natural and built worlds will be more important in the years to come, as both urbanization and environmental crises gain momentum. To strike this balance, biophilic architecture offers a practical and futuristic framework for making eco-friendly, energy-efficient, people-first structures. The building and architecture sector may help build healthier communities, more resilient urban ecosystems, and more progress toward global sustainability objectives by adopting biophilic design concepts. In the end, biophilic architecture is more than just a theory; it is a method for creating spaces that are good for humans and the earth.

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