



Theory of Biophilic Design

By: Rami Vagal, WELL AP, LEED AP BD+C, Senior Manager, Sustainability

Course Summary

This course discusses Biophilia, “humankind’s innate biological connection with nature” and the theory that as humans we have an inherent need to affiliate with the world around us. The course examines the theory of biophilic design, along with its benefits and the types of effects it creates. It also addresses the 14 Patterns of Biophilic Design and how those patterns are incorporated into products and architectural.

Learning Objectives

1. Understand the theory of Biophilia and the definition of Biophilic Design as it relates to the built environment
2. Focus in depth on the core elements of Biophilic Design, the 14 patterns and how they fit in the different elements
3. Learn about the business case for Biophilic Design

Theory and Definition

Biophilia can be defined as a love of life or living systems. It is theorized that we as humans have an inherent need to affiliate with the world around us—and that we are naturally inclined to do so. This inclination is inborn and, as much as we gravitate toward it, we can also be adverse to it. For instance, we might naturally want to be outside in the sunlight and warmth of a summer day, but we also do not want to find ourselves near a poisonous snake.

Biophilic design helps us discover how the built environment could—and should—be radically re-conceptualized around the fundamental workings of the human mind.

“We need, and are ever more in a position to create, a richer built environment, grounded in the way people actually experience the world around them. This concept could be seen as the “the missing link in sustainable design,” as if no one wants to BE in a building, then it will go to waste—and that truly is unsustainable and diverges from the intent of “green” design.” — Bill Browning, “Economics of Biophilic Design”

According to the EPA, 87% of our time is spent indoors, mostly sedentary and additional 6% on an average, in vehicles.

14 Patterns of Biophilic Design

Biophilic design has 14 patterns that can be broken into three categories:

- Nature in the space
- Design natural analogues
- Nature of the space

Nature in the Space

Nature in the Space addresses the direct, physical and ephemeral presence of nature in a space or place. This includes plant life, water and animals, as well as breezes, sounds, scents and other natural elements. Common examples include potted plants, flowerbeds, bird feeders, butterfly gardens, water features, fountains, aquariums, courtyard gardens and green walls or vegetated roofs. The strongest Nature in the Space experiences are achieved through the creation of meaningful, direct connections with these natural elements, particularly through diversity, movement and multi-sensory interactions. Nature in the Space encompasses seven biophilic design patterns:

1. **Visual Connection with Nature**
A view to elements of nature, living systems and natural processes.
2. **Non-Visual Connection with Nature**
Auditory, haptic, olfactory, or gustatory stimuli that engender a deliberate and positive reference to nature, living systems or natural processes.
3. **Non-Rhythmic Sensory Stimuli**
Stochastic and ephemeral connections with nature that may be analyzed statistically but may not be predicted precisely.



4. **Thermal & Airflow Variability**

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

5. **Presence of Water**

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

6. **Dynamic & Diffuse Light**

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

7. **Connection with Natural Systems**

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

Design Natural Analogues

Natural Analogues addresses organic, non-living and indirect evocations of nature. Objects, materials, colors, shapes, sequences and patterns found in nature manifest as artwork, ornamentation, furniture, décor, and textiles in the built environment. Mimicry of shells and leaves, furniture with organic shapes, and natural materials that have been processed or extensively altered (e.g., wood planks, granite tabletops) each provide an indirect connection with nature: while they are real, they are only analogous of the items in their 'natural' state. The strongest Natural Analogue experiences are achieved by providing information richness in an organized and sometimes evolving manner. Natural Analogues encompasses three patterns of biophilic design:

1. **Biomorphic Forms & Patterns**

Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature. Biomorphic patterns are those inspired from organized geometric patterns in nature, such as fractal patterns.

2. **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.

3. **Complexity & Order**

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

Nature of the Space

Nature of the Space addresses spatial configurations in nature. This includes our innate and learned desire to be able to see beyond our immediate surroundings, our fascination with the slightly dangerous or unknown; obscured views and revelatory moments; and sometimes even phobia-inducing properties when they include a trusted element of safety. The strongest Nature of the Space experiences are achieved through the creation of deliberate and engaging spatial configurations commingled with patterns of Nature in the Space and Natural Analogues. Nature of the Space encompasses four biophilic design patterns:

1. **Prospect**

An unimpeded view over a distance, for surveillance and planning.

2. **Refuge**

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

3. **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.

4. **Risk/Peril**

An identifiable threat coupled with a reliable safeguard

Impacts of Biophilic Design by Business Case

Workspace

By creating a space where employees want to be fully engaged, companies experience the positive results of presenteeism.

- A typical company with 100 employees stands to lose \$100,000 a year because employees have a lack of attention to work.
- Companies might achieve greater presenteeism by offering daylighting and outdoor views, along with natural ventilation to reduce eye strain and mental fatigue. These changes can help return employees' attention to the work at hand.



Retail

The happiness and comfort that natural daylighting and plant life can bring can be translated into retail spaces optimized for increased customer time spent in store as well as increased sales. Studies show that:

- Greener retail settings in comparison to those with no plant life the products were perceived to be 20% above market value.
- Largely skylighted stores not only save energy from the reduced need for artificial lights, but the sales increased significantly from \$4.56 to \$12.54 per square foot. These findings spurred a dramatic reconfiguration of multiple shopping districts.

Education

Studies in educational environments have found that biophilic design can increase collaborative and creative behavior, encourages social interactions, reduces negative behavior and promotes cross-cultural understanding.

Additional studies found the following:

- Children learn 20-26% faster in natural daylight
- Attendance at daylit schools increased by 3.2-3.8 days per year compared to attendance at non-daylit schools
- Mobile, windowless classrooms saw test scores drop 17% compared to other classrooms in the same study period
- Students in classrooms with the most daylighting tested 7-18% higher than those with the least.

Healing Environments

Patients with a view to nature, instead of a nondescript wall, are more likely to experience hospital stays that are 8.5% shorter, with fewer negative observational comments from nurses, and significantly fewer strong, post-surgical analgesics. A study of 174 patients with bipolar disorder and depression found:

- Those staying in naturally daylit units were released an average length of 2.6 days sooner than patients

lacking access to natural light.

- Patients exposed to greater dosages of sunlight took 22% less analgesic medications per hour.
- Patients exposed to more daylight accumulated 21% less in pain medication costs for the length of their stay.

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