

# Biophilic Design

## A Review of Principle and Practice

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The word “green” elicits many definitions and responses. From nature itself to environmentally friendly consumer items and building methods, the word has been ubiquitously slapped onto a multitude of products and services currently on the market. The “green” movement in construction particularly has a multitude of implications. For some, green architecture is a black and white definition, set by LEED (Leadership in Energy and Environmental Design) standards. Others seek aesthetic integration with the environment as a determining factor. A new movement related to green architecture—biophilic design—has recently gained much momentum within the building community. The leading experts in the biophilic design field hold that “we should bring as much of nature as we can into our everyday environments so as to experience it first-hand; second, we need to shape our built environment to incorporate those same geometrical qualities found in nature” (1). While the green movement has often focused on the means, biophilic design tends toward emphasizing the end results, establishing natural-based habitats for humans to live and work. Rather than merely erecting buildings, architects who utilize the tenets of biophilic design create spaces in which humans can truly fulfill their potential. Biophilic design incorporates elements derived from nature in order to maximize human functioning and health.

### Historical Context

While humans evolved over the millennia, their relation to the environment likewise changed. People depend on their surroundings for both natural resources and for enabling the establishment of community. As creatures of the earth, humans respond to its natural features, which can also be incorporated into constructed design. The modern history of architecture is characterized by building movements and styles, often imposed by an elite few who deemed this “good” architecture. The rigid geometry of Modern Architecture, for example, holds few relationships to the outside world. Conversely, “great architects in the past were better able to discern those qualities, and to reproduce them in their buildings because they were more engaged with their immediate surroundings.” As a consequence, buildings provided protection with the benefits of natural elements. The premise of biophilic design “aims not only to reduce the harm that stems from the built environment, but also to make the built environment more pleasing and enjoyable. It seeks both to avoid and minimize harmful impacts on the natural environment, as well as to provide and restore beneficial contacts between people and nature in the built environment.” Architecture in and of itself is not harmful, and its benefits of shelter and community cannot be overlooked. However, built environments can certainly cause stress. Biophilic design provides the answer

to this predicament, preventing harm to both people and nature while facilitating a beneficial link between the two (1).

Too often, a distinction has been made between architecture and environment, cutting people off from a psychologically-developed need to commune with nature. When architects overstep their role, using “images and surface effects” to “supplant everyday human desires and sensibilities in the name of artistic endeavor, humans are left to live out their lives in a series of ill-fitting, overexaggerated and often idiosyncratic formal architectural schemes.” Biophilic design does not advocate tree houses or cave-dwelling, but it does provide the nature-based features that prompt complex thinking in humans. Though not technically biophilic design, the nature-communing architecture of Frank Lloyd Wright’s Fallingwater arguably speaks to the human soul much more than a box-like “machine for living” by Le Corbusier. Not an architectural style, biophilic design must avoid becoming such. Designers can often become caught up with the potential of new technology, pushing its limits but not in the service of its users. Because of these risks, the “green” aspect of biophilic design must not overwhelm its overarching goals of creating an ideal environment for people (1).

Biophilic design affords humans a host of benefits. Using particular landscapes can reduce stress and enhance well-being because we gravitate toward certain configurations and natural contents. These landscapes were the environments prehistoric people inhabited throughout their evolution, and the human brain adapted to respond to these types of spaces. In built environments, we have obstructed the connection developed over millennia. We are so accustomed to our built habitats that we do not notice their deleterious effects, and as a result, stress has become a chronic issue in modern society. Eliminating some of the distinction between built and natural allows biophilic design to impart the benefits of both types of environments (2).

One crucial element of the natural landscape to human health is sunlight. We are evolutionarily programmed to respond positively to well-lighted or sunny areas over dark or overcast settings (1). People can expect these spaces to foster restoration, improve emotional well-being, and promote health (1). Distractions of modern life induce stress, especially the artifacts (i.e. cell phones, laptops, etc.) to which we are so attached (1). The rates of technological progress have far exceeded rates of psychological evolution, leaving us ill-equipped to cope with our lifestyle. Biophilia expert Yannick Joye states, “by including elements of ancestral habitats in the built environment, one can counter potential deleterious effects, which stem from this dominance, [of uniform/modernist environments], resulting in more positive effects and more relaxed physiological and psychological states” (2). Because biophilia attempts to integrate ancestral and current habitats, it can alleviate the stress

caused by the brain's constant attempts to function in a modern environment it has not yet evolved to handle (2).

## Applications of Biophilic Design

Because of its tremendous impact on human psychology, biophilic design plays a vital role in healthcare and healthcare delivery. The current healthcare system contains many flaws, especially in its physical spaces. Hospitals, clinics, and offices are high-stress environments for patients, visitors and families, and healthcare professionals alike. Integrating nature into healthcare facilities has numerous benefits for many groups. One well-known study by Ulrich *et al.* looked at patients after surgery. One group of patients had windows with a tree view; the others' windows faced a brick wall (2). The patients with windows facing trees "had shorter hospital stays, received fewer negative comments from the nurses, required less moderate and strong analgesics, and had slightly fewer postoperative complications" (2). The underlying reasons for this discrepancy are biological. For our ancestors, "a capability for fast recovery from stress following demanding episodes was so critical for enhancing survival chances of early humans as to favor individuals with a partly genetic predisposition for restorative responding to many nature settings" (1).

As a consequence, nature and nature-based design have been integrated into the physical design of many hospitals. Dartmouth-Hitchcock Medical Center (DHMC), for example, boasts an atrium design, flooding daylight through the entire facility. Natural elements also permeate the building, including wood, stone, and numerous live plants. Though DHMC was built to originally incorporate these qualities, other hospitals have been retrofitted with elements of biophilia. This follows the trend of the application of biophilia's concepts to interior design in hospitals as administrators have witnessed patients' positive responses to nature. Changes to pre-existing hospitals allow immediate improvement for staff, patients, and visitors. In addition, scientific studies have shown that including gardens in healthcare design has a restorative effect for both faculty and patients. Whether in a concentrated garden setting or dispersed throughout the building, natural forms provide an oasis from the stress inherent within the healthcare system (1).

A few theories based on research have emerged to explain the effects of biophilic design on humans. One element likely contributing to biophilia's influence on human psychology is an underlying geometry of fractals within nature (2). Characteristics of fractals include "roughness [recurring] on different scales of magnitude," "self-similarity" on each level of magnification, and non-integer dimensionality (which is more easily witnessed than described) (2). Examples of fractal patterns include fern fronds, lightning bolts, and burning flames. The "nested scaling hierarchy" that are fractals can be found in many traditional architectural forms, confirming previous generations' greater connection (conscious or not) to the natural environment (1). The Gothic style in particular is obviously fractal (1). In addition, functional Magnetic Resonance Imaging (fMRI) studies have begun to reveal a link between aesthetic response and the brain's pleasure center (1). Logi-



Image courtesy of Figura.

Biophilic design can incorporate natural elements into workspaces.

cally, it follows that people would gravitate toward aesthetic forms that have been reinforced throughout their history.

Along with the concept of fractals, two overarching theories have attempted to explain humans' affinity for biophilia. The first is attention restoration theory, developed by the Kaplans, which "interprets restoration as the recovery of directed attention or the ability to focus. This capacity is deployed during tasks that require profound concentration, such as proofreading or studying. Natural settings have been found to be ideally suited to restore or rest directed attention." The second theory applies more broadly than just focusing on attention. Restoration is instead stress-reduction and "can occur even when directed attention is not fatigued". This theory—the psychoevolutionary theory, developed by Ulrich, is based on the experiences of early humans. The threats they encountered required immediate response and a rapid recovery, which "typically occurred in natural unthreatening (savanna-like) settings." The humans best-equipped to do this were the most likely to survive and reproduce, passing on these nature-induced restoration capabilities to their offspring. This continuing psychological evolution produced the current makeup of the human brain (2).

While the idea of biophilia is an attractive one, as with any theory, it has certain limitations. Some people do respond quite well to modern architecture even though they are biologically predisposed to respond to more natural forms. Biology is a key player in influencing human psychology, but culture must not be overlooked. In comparing cultures, however, people across the board respond similarly well to natural views, making it all the more likely that an affinity for biophilia has been solidified within the gene pool (1). Because people throughout the world associate biophilia with positive feelings, architects relying on biophilic design have the advantage of universal appeal. They also retain a high degree of flexibility and freedom, as biophilic design is not defined by one aesthetic.

Many existing buildings contain biophilic elements, but only a few have been built with the specific idea of biophilic design in mind. One such building is the Adam Joseph Lewis Center for Environmental Studies at Oberlin College. Direc-

tor of Oberlin's Environmental Studies Program, David Orr, explained the building's goals were "to create not just a place for classes but rather a building that would help to redefine the relationship between humankind and the environment—one that would expand our sense of ecological possibilities." Following the tenets of biophilic design led to mutual benefit for the environment and its human inhabitants. The Lewis Center is sustainable in a broader sense than the word can typically be applied. It minimizes energy use in harnessing solar power, utilizes both active and passive air systems, and monitors the weather to adapt to conditions. The Center's "Living Machine" treats wastewater by combining traditional wastewater technology with wetland ecosystems' purification processes, producing water that can be used in the toilets and for irrigation. In their design, Orr and his team engineered an outstanding space for students to thrive while insuring the surrounding environment could do the same.

Another example is the University of Guelph Humber Building in Ontario, Canada. It contains a centrally located biowall, vertically spanning the building. The wall is covered in dense foliage and can be seen from almost every level inside. The wall also functions as a new filtration system prototype. The wall purifies the air and has the potential to fulfill the building's fresh air intake requirements (3).

DHMC also incorporates an Arts program for the benefit of its patients and caregivers. A large portion of the paintings, photographs, and other works contain nature or natural elements. Elisabeth Gordon, head of the program, says the pieces she seeks are soothing and reflective, and they help reconnect the viewer to his or her humanity (4). Though she does not use the term "biophilic design," the works within DHMC certainly exhibit the same qualities.

## Conclusion

Biophilic design principles can be applied in a variety of contexts allowing growth of both people and environment. Human psychology clearly benefits from contact with nature, and inviting nature into our buildings is the ideal way to insure the both the continuation of our modern lifestyle and assuagement our more primitive needs. Positive effects can especially be seen in the realm of healthcare. Its typically stressful atmosphere holds tremendous room for improvement, and numerous studies evidence nature's role in healing. In sum, the built environment need not interfere with biological human needs to commune with nature nor with existing ecological systems. Ancient architects built for their cultures, which were almost always more in touch with the earth than western society of the present. They mimicked nature's forms, producing magnificent structures with which we are still awed—though biophilic design is a novel concept, they certainly employed some of its recommendations. Today, we can add another layer to this tradition and ensure maximal benefit for our planet and ourselves.

## References

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