INTRODUCTION

People possess an inborn need for contact with nature essential to their physical and mental health, productivity and wellbeing. This is something we have called biophilia. Satisfying this need for contact with nature in the modern built environment is something we are calling biophilic design.

Peoples’ biological need for contact with nature originates in our long history as a species where we have evolved in a natural not artificial or human constructed world. Consequently, our senses, our emotions, and even our intellect developed in close association with nature.

This biological need for contact with nature continues to be important even in our highly built and increasingly urban society. Indeed, the natural habitat of modern people has in many ways become the built environment where on average we spend 90% of our time. Unfortunately, many if not most of our modern buildings and cities have become places of extensive environmental damage and increasing separation if not alienation from nature.

Recent progress in sustainable design has certainly improved this situation. But, most sustainable design focuses only on reducing environmental damage from waste and pollution, or excessive use of resources like energy and water. Largely missing has been the equally important need to reconnect people with nature in the modern built environment essential to their health and productivity. Biophilic design is, thus about creating good habitat for people in the modern built environment that satisfies their inherent need for beneficial contact with nature.

But, what specifically do we mean by biophilic design and how can it be accomplished? In addressing these important questions, we will confront such intriguing findings as:

- More productive and satisfied manufacturing workers when they move to facilities with natural light, restored landscapes, and other biophilic features.
- People recovering faster from major illnesses and medical surgery when they have contact with nature.
- Children having higher test scores, being less absent, and showing better attention when they are in schools with greater natural lighting, access to the outdoors, and fewer artificial materials.
- Many of the world’s most revered and celebrated buildings being filled with shapes and forms inspired by designs found in nature.

We are, therefore, convinced that environmental degradation and alienation from nature are not inevitable consequences of modern life, but rather failures in how we have deliberately chosen to design our buildings and our cities. We designed ourselves into this predicament and we can design ourselves out of it with the help of biophilic design.
ELEMENTS OF BIOPHILIC DESIGN

Given the benefits of connecting people in the built environment to nature, how do we accomplish biophilic design? There are many ways biophilic design can be achieved, some direct and obvious, others more subtle and indirect. Biophilic design strategies can occur singly or in combination – for example, a building of stone and wood, flooded with daylight, an interior atrium filled with plants, and decorations that mimic natural forms, all within an open yet secure space. We will explore these different elements of biophilic design in both historic and modern buildings and communities.

Biophilic Design is also about the use of materials obtained from nature – a tree converted to timber, then used as building material for walls, floors and furnishings; or, stone mined in a quarry used as a building façade, a lobby or a counter top. The use of natural materials can make buildings more functional and beautiful, creating feelings of connection to the natural world.

More subtly, biophilic design can be accomplished by bringing the forms and patterns of nature into a building. For example, we might encounter ornamentation reminiscent of vines rising on tree-like columns that support a rooftop. Or, we might experience building interiors that convey a feeling of spaciousness and the motion of natural light, as sometimes occurs in great cathedrals or even modern airports.

Biophilic design can also convey the feeling of connection to particular places through designs that link people to certain landscapes or cultural traditions.

**Comprehensive List of the Elements and Attributes of Biophilic Design (from Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life)**

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<thead>
<tr>
<th>ENVIRONMENTAL FEATURES</th>
<th>NATURAL SHAPES &amp; FORMS</th>
<th>NATURAL PATTERNS &amp; PROCESSES</th>
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<td>Color</td>
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<td>Air</td>
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<td>Plants</td>
<td>Habitats and ecosystems</td>
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<td>Animals</td>
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<td>Natural materials</td>
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<td>Bounded Spaces</td>
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<td>Transitional spaces</td>
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<td>Linked series/chains</td>
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<td>Botanical motifs</td>
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<td>Tree and columnar</td>
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<td>Animal motifs</td>
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<td>Shells and spirals</td>
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<td>Egg, oval, and tubular</td>
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<td></td>
<td>forms</td>
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<td></td>
<td>Arches, vaults, domes</td>
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**IMPACTS OF BIOPHILIC DESIGN**

We have seen how biophilic design can involve direct, indirect and more subtle ways of connecting people to nature. In a single location, like Grand Central Station in New York City, we can see many biophilic design elements layered upon one another. Even a scene this replete with biophilic design attributes cannot reflect the full range of strategies available to connect people with nature through architecture.

But, why is this important? How does it benefit people’s health and productivity? A growing body of evidence is beginning to reveal the positive affects of biophilic design, including enhanced learning, recovery from illness, improved work performance, and more livable and satisfying neighborhoods. We will now examine how buildings and communities can improve people’s lives by connecting them to nature.

Important healthcare research is starting to show how biophilic design can reduce stress, enhance healing, and improve hospital performance.

Studies are beginning to reveal how improving connections to nature in the workplace can enhance worker productivity and morale, and even help recruit and retain talent, all benefits that translate into any business’ bottom line.

Biophilic design can extend beyond individual buildings to entire neighborhoods and even cities, where connections to nature can contribute to a higher quality of life. Biophilic design often occurs in the neighborhoods of old cities and well-designed modern communities where the widespread use of natural materials and the ordered complexity of the natural world are revealed.
Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life

**LIGHT AND SPACE**
- Natural light
- Filtered and diffused light
- Reflected light
- Light pools
- Warm light
- Spaciousness
- Light as shape and form
- Spatial variability
- Space as shape and form
- Spatial harmony
- Inside-outside spaces

**PLACE-BASED RELATIONSHIPS**
- Geographic connection to place
- Historic connection to place
- Ecological connection to place
- Cultural connection to place
- Spirit of place
- Indigenous materials
- Landscape orientation
- Landscape ecology
- Integration of culture and ecology
- Avoiding Placelessness
- Building form defined by landscape

**EVOLVED HUMAN-NATURE**
- Prospect and refuge
- Order and complexity
- Curiosity and enticement
- Change and metamorphosis
- Security and protection
- Affection/attachment
- Attraction and beauty
- Exploration and discovery
- Information and cognition
- Fear and awe
- Reverence and spirituality
- Mastery and control

**Direct Nature**
- Cal Academy, San Francisco, CA
  - Renzo Piano, 2008
- Cook+Fox Office, New York, NY
  - Cook+Fox, 2006
- Embassy of Finland, Washington, DC
  - Heikkinen and Komonen, 1994

**Natural Materials**
- Yale Kroon Hall, New Haven, CT
  - Hopkins, 2000
- Islandwood, Seattle, WA
  - Mithun, 2002
- Aldo Leopold Center, Baraboo, WI
  - Kubala Washatko, 2007

**Evoking Nature**
- Residence, Warren, VT
  - David Sellers
- Grand Central, New York, NY
  - Reed-Stern Warren-Wetmore, 1913

**Spirit of Place**
- Yale Kroon Hall, New Haven, CT
  - Hopkins, 2000
- Islandwood, Seattle, WA
  - Mithun, 2002
- Aldo Leopold Center, Baraboo, WI
  - Kubala Washatko, 2007

**Learning**
- King Middle School, Berkeley, CA
  - Edible Schoyard
- Sidwell Friends, Washington, DC
  - Kieran-Timberlake, 2006
- Oberlin College, Oberlin, OH
  - McDonough, 1998

**Healing**
- Sahlgrenska, Gothenburg, Sweden
  - White Arkitekter, 2007
- Doernbecher, Portland, OR
  - Zimmer, Gunsul, Frasca, 1998

**Work**
- Hinesburg, VT
  - From Macay, 2004
- David Mellor, Sheffield, UK
  - Hopkins, 1989
- Herman Miller, MI
  - McDonough, 1995
- YouTube, San Bruno, CA
  - McDonough, 1997
- Genzyme, Cambridge, MA
  - Behnisch, 2003

**Community**
- Village Homes, Davis, CA
  - Corbett, 1975
- EVA Lanxmeer, Holland
  - Kaptein, 1994
- High Point, Seattle, WA
  - Mithun, 2006
CONCLUSION

Ultimately, biophilic design is more about restoring our connection to nature than it is about adopting a new methodology for designing the built environment. Its accomplishment will therefore, require a fundamental shift in human consciousness that leads to a new ethic of responsibility for caring for the earth and our relationship to it.

The heart of this challenge is a modern world that has forgotten in so many ways how much our physical, mental and even spiritual health and wellbeing continue to rely on the quality of our relationship to nature. The promise of biophilic design will, therefore, require a new realization – whether at home or at work, at school or at play, indoors or outdoors – of how much we still depend on beneficial contact with nature to be healthy, productive and whole.

This change will require an ethic of responsibility for the natural world motivated not by the desire to save nature, but by a profound realization of our own self-interest. In the long-run, we will sustain only those things, whether buildings or species, that we are convinced contribute to a better and more fulfilling existence. This is the moral imperative of biophilic design. This is the understanding at the core of the great ecologist Aldo Leopold’s land ethic when he remarked more than one-half century ago:

There must be some force behind conservation more universal than profit, less awkward than government, less ephemeral than sport, something that reaches into all times and all places, something that brackets everything from rivers to raindrops, from whales to hummingbirds, from land-estates to window-boxes. I can see only one such force: a respect for the land as an organism, out of love for and obligation to that great biota.

ADDITIONAL READING

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<tr>
<th>Title</th>
<th>Author(s)</th>
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<th>Publisher</th>
<th>ISBN</th>
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<tr>
<td>Building for Life</td>
<td>Stephen Kellert</td>
<td>9/13/2005</td>
<td>Island Press</td>
<td>9781559637213</td>
<td>264</td>
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<tr>
<td>Biophilic Design</td>
<td>Stephen Kellert, Judith Heerwagen,</td>
<td>2/5/2008</td>
<td>Wiley</td>
<td>9780470163344</td>
<td>432</td>
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<td>Johnson Wax Building, Racine, WI Frank Lloyd Wright, 1936</td>
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