Biophilic Design: Enhancing the Human-Nature Relationship in the Built Environment

The desire to engage with nature is innate to the human experience and has profound impacts on health and well-being. When aspects of nature are brought into the built work environment, these impacts are extended to include improved productivity of employees and economical benefits to the companies that employ them.

Biophilia stems from the Greek words bio ("life") and philia ("affinity") (Browning, 2015). German psychoanalyst Erich Fromm coined the term and used it to describe the human attraction to all living things. Edward Wilson, an American biologist, expanded the meaning of the term, adding that the cause of such an affinity to nature is rooted in evolutionary and ontogenetic development (Clark & Chatto, 2012; Wilson, 2006). That is, those who had access to water and other natural resources were more fit for survival. Evidence of this is the universality of the inherent attraction humans feel to the natural world (Clark & Chatto, 2012) and the positive effects that nature has on humans' physical and mental health.

An Evolutionary Basis for Bringing the Outdoors In

Biophilia has inspired a movement in design that seeks to incorporate nature into the built environment (Browning 2015). For most of its history, the human species evolved through adaptations in response to the natural environment and not a built environment (Kellert, 2015). That is, "the evolutionary context for the development of the human mind and body was a mainly sensory world dominated by critical environmental features such as light, sound, odor, wind, weather, water, vegetation, animals, and landscapes" (Kellert, 2008, p. 3). Biophilic design endeavors to create spaces that contain similar elements or qualities of a supportive natural environment, one that would promote success of a species, such as lush vegetation and spaces both to find prey and to seek refuge, for example (Clark & Chatto, 2012).

When applied effectively, biophilic design should provide many physical, mental, and behavioral benefits (Browning, 2015; Kellert, 2015; Kellert & Calabrese, 2015). Some of these are particularly advantageous to the workplace context. Supporting the human-nature relationship results in several positive physical outcomes, including physical fitness, increased comfort and satisfaction (Biederman & Vessel, 2006), fewer illness symptoms, and improved overall health (Browning, 2015; Kellert & Calabrese, 2015). Mental outcomes include increased satisfaction and motivation, lower stress levels (Park, Tsunetsugu, Kasetani, Morikawa, Kagawa, & Miyazaki, 2009), improved problem solving and improved creativity (Kellert & Calabrese, 2015). For example, a study in Austria found that natural wood surfaces reduced blood pressure in students. Students who were taught in classrooms with natural wood on the ceilings, floors, and walls maintained lower heart rates than students taught in classrooms lacking these design installations (Kelz, Grote, & Moser, 2011). Finally, some behavioral change benefits include increased productivity (Browning 2015), enhanced attention and concentration (Heschong, 2003; Lee, Williams, Sargent, Williams, Johnson, 2015), improved social interaction, and less hostility and aggression (Kellert & Calabrese, 2015).

In addition to physical, mental, and behavioral benefits, biophilic design also has a positive economic effect for employers. When employees are healthy and happy, employers will see increases in retention and decreases in absenteeism and presenteeism. Presenteeism describes the trend of employees reporting to work but underperforming once there due to low well-being or lack of engagement. Both absenteeism and presenteeism are major costs for work organizations (Terrapin Bright Green, 2012) and ones that can be successfully addressed with a biophilic intervention. Although designing for biophilic intervention can be costly upfront, these costs are offset by boosted productivity and lower turnover (Knoll Workplace Research,

2015). In an experiment conducted in a call center in Sacremento, researchers found that small changes could have rather large impacts on a business's bottom line. By rotating workstations that were perpendicular to windows a few degrees toward the windows, employees were more likely to glance toward movement through the trees outside of them. These quick glances were enough to give quick mental breaks to restore focus. The cost of this intervention was reported to be $1000 per employee. However, due to a 6% increase in productivity, the company saw a savings of $3000 per employee (Heschong, 2003; Loftness, 2008).

Although small changes toward biophilic environments in the workplace can have significant impacts, the most impactful designs are those that are well thought out, well planned, well executed, and cohesive. Thus, a thorough understanding of biophilic design and its applications is essential, though challenging. Descriptions and definitions of what constitutes good biophilic design are in constant flux, but Stephen Kellert has made it his mission to effectively communicate the elements of biophilic design and to continue to adapt these terms in an evolving and changing industry.

Defining and Applying Biophilic Design

Biophilic design transforms mundane spaces into stimulating ones that promote physical and mental health, fitness, and well-being. While the goal of biophilic design is clear, understanding it and its application is less so. Stephen Kellert (2008), in Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life, describes the dimensions, elements, and attributes of biophilic design. This explication provides guidance for how to effectively apply this design paradigm in the modern built environment, which has largely been stripped of natural systems and creates distance between humans and nature.

Dimensions of Biophilic Design

According to Kellert (2008), there are two dimensions of biophilic design. The first is an organic or naturalistic dimension. This dimension includes shapes and forms that directly, indirectly, or symbolically address the innate human need for connection to nature within the built space. Direct experience of nature in the built environment describes encounters with self-sustaining elements of nature such as daylight, air, plants, animals, and natural landscapes and ecosystems. Indirect experience with nature includes interactions with natural elements that require human intervention to survive, such as a potted plant or an aquarium. Symbolic experiences are characterized by representations of nature in the built environment through natural building materials; images of nature; simulations of light, air, and sound; and other modes of biomimicry. The second dimension, place-based or vernacular, is characterized by a spirit or feeling of a built environment that allows for a space to become meaningful and integral to individual and collective identities. Working within this dimension, biophilic design seeks to transform a built environment into a space to which individuals connect on an emotional or spiritual level. This connection motivates individuals to take responsibility for and become stewards of their spaces (Kellert, 2008, 2015).

Elements and Attributes of Biophilic Design

Related to the two dimensions are six elements of biophilic design: environmental features, natural shapes and forms, natural patterns and processes, light and space, place-based relationships, and evolved human-nature relationships.

Environmental features is the most recognizable of the biophilic design elements. This element employs easily identifiable components of nature in the design of the built environment. Some attributes of nature that invoke environmental features include but are not limited to color, water, air, plants, and natural materials. Color has had a particularly significant effect on humans' evolutionary development by marking resources essential for survival and danger that threatened it. The incorporation of colors found in nature into the built environment can easily be accomplished in the flooring application. Flooring can be black to emulate the color of soil or lavender or blue like a field of wildflowers or water. Water can be incorporated into a design directly (e.g. access to a pond or creek on the property), indirectly (e.g. a water feature in the office lobby), or symbolically (e.g. flooring). Flooring can be the color of water, but one might also experience nature through flooring that has a texture that mimics the rippling current of water.

Both of these attributes are effective means of utilizing environmental features to enhance human connection to nature in a built environment and engender the positive effects associated with biophilic design (Kellert, 2008).

The second element of biophilic design is natural shapes and forms. Natural shapes and forms include attributes that represent or simulate patterns and shapes found in nature. For example, botanical motifs, animal motifs, shells, and spirals: arches, vaults, and domes; simulation of natural features; and shapes that resist straight lines and right angles. These motifs and patterns can be incorporated into architectural elements, furniture, art and décor, or flooring.

Third, natural patterns and processes, is a complex element that incorporates attributes that represent properties found in nature. Sensory variability, information richness, and hierarchically organized ratios and scales are examples of ways natural patterns and properties are incorporated into built environments to satisfy the human desire for interactions with nature.

Light and space is the fourth biophilic design element. Natural light, filtered and diffused light, light and shadow, reflected light, light pools, warm light, and light as shape and form are attributes of nature that focus on qualities of light. Spaciousness, spatial variability, space as shape and form, spatial harmony, and inside-out spaces all focus on how space can be manipulated to improve connection to the natural environment.

The fifth element of biophilic design is place-based relationships. As described above, place-based relationships involve attributes that connect culture and ecology in such a way that individuals develop emotional attachments and to and relationships with spaces. The connections people develop with places demonstrates another evolutionary adaptation: the need to establish control and ownership of spaces. Historically, establishing control over a space allowed humans to meet basic needs: to maintain control over resources, to have a safe space to retreat and seek refuge, and, in doing so, to achieve security. Feeling at home in a space remains important for well-being; thus, biophilic design employs methods to evoke familiarity (Kellert, 2010; Sodexo, 2015). Effective biophilic design helps an individual feel connected to the broader culture of the space and creates an emotional attachment to the space that results in a caring for and investment in that physical space (Clark & Chatto, 2012; Heerwagen, 2006).

Finally, evolved human-nature relationships is the sixth biophilic design element and includes fundamental features of the inherent human relationship with the natural world. Good biophilic design is more than simply addressing an affinity to nature. “Propsect and refuge, order and complexity, curiosity and enticement, change and metamorphisis, security and protection, mastery and control” are all elements of a more complex relationship between humans and nature that reveal the evolutionary influences. These attributes demonstrate a need for true engagement with nature and with design that seeks to bring the outdoors in (Kellert, 2008; 2010).

Reflecting Nature in Floor Design

Kellert’s design elements and attributions give industry professionals a roadmap for creating cohesive and effective biophilic environments. He stresses that good biophilic design is more than bringing potted plants and artwork into the space. Rather, good biophilic design is thoughtfully planned such that elements of nature are incorporated into every surface. Incorporating natural elements into multiple surfaces or dimensions in the workplace creates a more diverse and interesting built environment and increases the frequency of exposure to nature.

Flooring is a particularly important design surface in a workspace rife with opportunity for incorporating biophilic design principles. A space’s inhabitants are likely to be highly engaged with this surface throughout the day without consideration however, it is a surface that can serve important functions for individuals and an organization. When applied thoughtfully, biophilic design can be incorporated into flooring surfaces to provide the physical, mental, and behavioral benefits discussed above. It can create community by marking neighborhoods, teams, or formal and informal gathering areas with changes in colors, textures, or patterns (i.e. wayfinding). Flooring can also produce opportunities for organizational branding and espousing organizational values creating connection not only between individuals and nature but also between individuals and the

organization and its culture.

There are many ways to effectively execute biophilic design principles with flooring applications, the most straightforward of which is to replicate the colors, textures, and patterns found in the natural landscape. A biomorphic pattern on flooring can elicit feelings of affinity with nature, or tile installation can create a pattern that echoes nature (e.g. tile mosaics) (Browning et al., 2014). More, the mix of colors, textures, and patterns in the flooring installation can imitate graduated natural transitions found in the environment. For example, the transition of water to sand in nature can be replicated with a flooring transition from a blue hard surface or blue carpet to a beige or tan carpet. Finally, natural flooring materials are often used to apply biophilic design principles. Wood flooring brings nature into the built environment and creates a sustainable environment for workplace inhabitants. When natural materials or manufactured materials applied in a way to evoke thought and feelings of a natural environment are installed on the floor surface as part of a comprehensive biophilic design plan, employees and employers alike are able to engage with nature in the built environment in a way that satisfies humans, innate desires.

Building Nurturing Environments

When spaces are thoughtfully planned and designed to encourage and enhance people's relationships with the natural environment, they feel nurtured and cared for in a way that promotes good health, well-being, and an emotional connection to and caring for the place. These outcomes are economically beneficial to companies making biophilic design an attractive approach to planning a built environment. Importantly, though, biophilic design is a philosophy that requires a shift in focus from the space and dollars to the future occupants of the space. Pulling inspiration from the natural environment and the people who comprise the organizational culture, good biophilc design creates spaces that provide positive experiences, enjoyment, innovation, creativity, and emotional connection to other individuals, to the space, and to the organization.

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