Chapter 10. LESSON THREE
BIOPHILIA AS A MECHANISM FOR HEALTH
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A. Our need for living structure

The Biophilia Hypothesis was put forward by one of our greatest biologists, Edward O. Wilson. It postulates a mechanism by which we require — and need to connect to — living structure in our environment. Importantly, this is neither a simple liking, nor an aesthetic preference, but a physical requirement equivalent to our need for air, water, and food. A quick survey of the sort of things we like to have in our living environment, when we can afford them, includes greenery in the immediate outdoors, indoor plants, domestic animals, and contact with other people. As social animals, we human beings prove the importance of the biophilic effect by shaping our environment in whatever way we can so that it nourishes us.

Many of the properties that make buildings attractive can be identified with healthy responses coming from biophilia. Although other factors also play a role, key elements of successful buildings (from the user’s point of view, not the architect’s) can certainly be ascribed to biophilia. I am using the criteria of enhanced human health exclusively for judgment. If we can ignore the fame or the architect and the media hype supporting certain fashions, then we can choose buildings by both named and anonymous architects that elicit the greatest sense of wellbeing from their users and other people in their vicinity. Those buildings’ structure triggers a healing process in our own bodies, so that we consequently wish to experience them as much and as often as possible.

There are two parallel strands explaining the biophilic effect. One source of the biophilic instinct is conjectured to come from inherited memory, from our evolution and development in the Savannah environment. Our ancestors became human in a particular natural setting, and therefore we genetically encode the geometrical qualities of that environment. Savannah consists of open grassland with clumps of bushes and scattered trees, lots of sunlight, streams of water, grazing animals, etc. Our development over many millennia has left its traces in our inherited memory and instinct, which all human beings possess.

The second source of biophilia comes from biological structure itself: the geometrical rules of biological forms with which we share a template and kinship. Most of the mechanisms of living structure are either the same, or they parallel the basic organization of biological systems. Biophilia, therefore, mixes geometrical
properties and elements of landscape with complex structures found in — and which are common to — all living forms.

Human sensory systems have evolved to respond to natural geometries, which are characterized by colors, fractals, scaling, and complex symmetries. Fine-tuned to perceive positive aspects (food, friends, mates) and negative aspects (threats) of the environment, our perceptual system connects positively — by generating positive emotions — with biophilic surroundings. Experiments in hospitals show much faster post-operative healing and reduced need for pain medicine in rooms looking out at trees. Hospitals and sanatoria since ancient Greece were set within natural surroundings, and part of the medical cure included spending time in gardens and under trees.

At the same time, our body signals any departure from natural geometries with anxiety and distress. Accumulating evidence and traditional wisdom document that social and mental health deteriorates in nature-less and minimalist surroundings. Since the advent of the industrial age, city dwellers that could afford to escaped the city in the summer, to take in the health benefits of the countryside.

B. Eight elements of the biophilic effect

Let me list the major factors that contribute to the biophilic effect experienced by human beings. Strictly speaking, our craving for natural light is properly termed “photophilia”, and that for natural environments “topophilia”. Nevertheless, it is most useful to include all of these physiological responses under a broader definition of biophilia.

1. LIGHT. Natural light, preferably from several different sides so that shadows do not diminish our stereoscopic vision (necessary for forming a 3-dimensional image). Natural light is not only essential for seeing and evaluating our surroundings and environment, but also our skin requires sunlight in order to manufacture vitamin D, which we need for our health and proper metabolism. We possess two different organs that require sunlight: our eyes and our skin. Furthermore, circadian rhythms are regulated by sunlight in the eye and on the skin, since these control our sleep cycle via Melatonin secretion. Whenever our circadian rhythms are disturbed (as in jet lag), the body cannot function properly.

2. COLOR. Color that is in parts intense, but which harmonizes overall, generates a healthy effect. Color is one of our senses (specific receptors in the eye and processing pathway in the brain) that links directly with our emotions. Humans evolved in natural light that ranges in coloration from red, to orange, to blue, depending upon the time of day. The color of plants, animals, rocks, etc. formed our preferences for colors in the environment. We experience color both in the transmitted quality of light, and as reflected from pigmented surfaces. The psychological effects of color run very deep, and they are used (and abused) extensively by the advertising industry. Interior designers employ colors and color harmonies to affect people’s psychological mood.
3. **GRAVITY.** We experience and relate to balance due to gravity. Plants and animals grow in gravity, thus their form shows an exquisite vertical balance. In natural structures, the heavier parts are on the bottom, while the obviously lighter parts are on the top. Our brain automatically computes the gravitational balance of forms that surround us. All objects in nature exist in gravitational equilibrium, and formed our mental reference for stable structures. Forced perspective — where the scale is deliberately shrunk in size as you go up — is used in traditional architecture and stage sets. Otherwise, perceiving gravitational imbalance affects us with anxiety and even with nausea. Our balance mechanism is linked with the inner ear and, curiously, nausea is triggered exactly the same way in case of imbalance (perceived loss of equilibrium) and with poisoning of the body through the ingestion of toxins.

4. **FRACTALS.** Our preference for fractal qualities comes from the geometry of living organisms. A fractal encodes geometrical structure at many different linked scales: it has no preferred scale, hence scale-free. All scales are present in a fractal, with complex structure showing at any magnification. A fractal contains well-defined subdivisions of structure in an ordered hierarchy of scales, from the large size down to the size of its details. Fern leaves and cauliflowers are examples. Much of living organic tissue is fractal, as for example the nervous system, the circulatory system, and the lung’s branching system of air passages. We recognize and respond positively to fractal structures because we have these in common with other animals and plants. This similarity links our own body cognitively to any structure that follows the same geometrical principles, such as landscape, trees, bushes, and animals. On the other hand, we react negatively to structures that are not fractal: something smooth or shiny creates alarm. This occurs because those contradict the fractal structures we are used to in natural environments.

5. **CURVES.** Curved forms are found everywhere in nature, where it is indeed difficult to come across a straight line. Again, curves come from the biological structure of animals and plants, and also from natural inanimate environments where matter is shaped by tectonic forces. Smooth curves are mathematically opposite from broken types of fractals such as appear in trees and on the weathering on natural materials. The point, however, is that the natural environment exhibits either fractal forms, or curved forms, or usually a combination of both. But we don’t expect either straight lines or right angles. Since our neurological response mechanisms are hard-wired, we obtain emotional pleasure from curves that possess a natural balance through symmetry. Unbalanced curves in the environment can become alarming, though.

6. **DETAIL.** On the most intimate scale — at arm’s length and closer — highly organized complex detail is both visible and touchable. Our sense of touch requires that we be near a surface or structure so as to recover information from the most detailed levels of scale. We focus on essential detail as the smallest sharply-defined natural structures and textures such as veins in stones (fossilized animals and plants), wood grain, branches and leaves in trees, etc. We expect the same complex structural detail in an artificial environment, since our perceptual mechanism is finely tuned to process such signals. Natural materials work as fractals, providing
interesting organic information at increasingly closer distance, combined with our ability to touch them. To communicate with animals (including humans), we focus on their eyes, pupils, lips, and nostrils (and the ears of cats and dogs). Meaningful response occurs through tiny details, predisposing us to focus on those. What is referred to as “subliminal communication” when communicating face-to-face with another person depends upon subtle anatomical cues we receive from such details.

7. LIFE. Actual and intimate contact with living forms nourishes us. This is the most obvious meaning of biophilia. We crave contact with plants, animals, and other human beings. This desire cannot be identified as a property of a building per se, but becomes a function of how well the building encourages the user to interact with a natural environment. For example, enclosing a courtyard garden, or interweaving the building with natural growth in an intimate way provides immediate access to nature, and is not merely decorative. Bringing potted plants into a building is motivated by the biophilic effect, yet this has nothing to do with the building itself, except for those buildings where the fresh air and interior light conditions are so poor that plants will not grow. (And what about the human inhabitants in those cases?)

8. WATER. Presence of water: human beings love to see it, or even better, hear it and feel it. Perhaps the need to be close to water is a reassurance that we have enough water supplies to drink, because without water we cannot survive. It could be a vestige of our ancestral environment. This conjecture does not, however, explain the innate joy of our interactions with the salty sea. A vast worldwide tourist industry is driven by vacations on the coastline, and voyages in boats of various sizes, from sailboats to cruise ships. (While not biophilia in the strict sense of attraction to living forms, this effect is included in this group for convenience).

Having outlined eight distinct contributions to the biophilic effect, it is not difficult to see how different designs either possess them or do not. Obviously, biophilia is not the same thing as a superficial interpretation of biomimicry: to obtain the sought-after healthy effect, an architect must apply basic guidelines for generating specific design elements, and not just copy some organic form. Taking the above eight points as a rough design checklist for biophilic properties, we can use them as defining criteria for evaluating health-inducing aspects of buildings.

C. Biophilia explains a building’s success

Many buildings are attractive because of their biophilic qualities, which may be perceived very differently with distance. A building could be biophilic on one scale (at one dimension of approach or distance from the user), but it could be anti-biophilic on the other scales. Or, it could be entirely anti-biophilic yet still work because of its setting, by using the natural surroundings for the biophilic affect. Two famous examples of the latter are the Glass House by Philip Johnson, and the Farnsworth House by Ludwig Mies van der Rohe.

Biophilia is illustrated in the extensive use of natural polished stone in both the Stoclet House, by Josef Hoffmann, and in the German Pavilion for the International
Exhibition in Barcelona, by Ludwig Mies van der Rohe. The large-scale geometry of those buildings, however, is not biophilic, but modernist (that is, severely geometric in an unnatural way). Notice how both buildings use pools of water as an enhancing attractive element. Their architects understood biophilia, even as they were determined to break their designs away from it. For this reason, there exist incompatible forces at play in these buildings (and in the work of many other architects during this transitional period).

Let’s look at some buildings throughout history and evaluate their biophilic content. For sheer exuberance, the buildings of Louis Sullivan are unparalleled in their combined use of fractals and curves. One of my favorite examples is the Carson, Pirie, Scott Building (originally the Schlesinger & Mayer Building). Equally fractal but even more curved are the Art Nouveau buildings from the same period, the start of the 20th Century, which include masterpieces by Victor Horta in Belgium (Musée Horta, Brussels) and Hector Guimard in France (entrances to the Paris Metro). These three architects are chosen for a purpose: they applied the new building techniques employing industrial materials at the end of the 19th Century that ushered in the beginning of the modernist era. As such, we are not talking about hand-made Medieval or Renaissance construction work (which might easily be dismissed today as too far removed from practicality), but early 20th Century industrial manufacturing using terracotta panels, cast iron, and glass panels.

Going back in history, the grand and opulent 17th, 18th, and 19th Century formal architectures all rely upon their curves and ornamentation to trigger the biophilic effect. A good example is the Paris Opera House by Charles Garnier. The best examples are those where the entire structure is harmonious despite the richness of the different contributing structures, colors, and details. Many buildings from this period, however, overdo it, presenting a visual and structural complexity that is incoherent, and has no parallel in the perfectly organized complexity found in nature. We react to those with a feeling of being overstuffed.

Plain, ordinary buildings throughout history before the industrial age have always used natural materials, and so the biophilic effect comes in part from those. In addition, whenever possible, owner-built houses are ornamented both on the inside and on the outside. Ornament as found in both traditional and vernacular architectures is driven by the need for biophilic surfaces in spaces for living. This phenomenon is seen as a key characteristic of cultures all over the world. Ornamentation has only come to a stop because of the modernist ban on ornament, imposed for a long time by the educational system and supported by the media.

Which buildings throughout history and in different regions of the world employ the biophilic effect for their success? I can save a lot of time here and just classify all buildings in history, as selected for example in Sir Bannister Fletcher’s “A History of Architecture”. Every building up to the 20th Century relies upon the biophilic effect (though not exclusively so). The architecture of the 20th Century either abandons it, or uses biophilia very selectively, and even in those cases, not always successfully. If we count all buildings throughout history according to their proper temporal
presence, then the anti-biophilic buildings from the 20th Century and later are only a blip in a millennia-long practice of applying biophilia to architecture.

In conclusion, to create a healing environment in a new building, it is necessary to design it using biophilic design guidelines. Those are necessary but not sufficient conditions, since other factors outside biophilia can enhance (or detract from) the healing effect experienced from a building. Furthermore, it is important to realize that some architects are not interested in designing for the healing effect, so their buildings apply entirely different criteria. Yet that should not be misinterpreted to mean that a healing environment is not important. I consider it imperative that students learn how to design with these qualities, so they can apply them if they so wish.