

Enhancing The Human-Nature Connection Through Biophilic design

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"I go to Nature to be soothed and healed, and to have my senses put together." – John Burroughs

Abstract - Physical wellness, comfort and mental wellbeing are important factor in designing a built-form. We often neglect nature in process of design. Nature has no substitute. So, it is very important to consider while designing a building. Humans have evolved their behavioural mechanism & problem-solving tactics responding to the stimulus from the surrounding spaces. Architecture, here, has an infinite power to dictate the character and stimuli generation of a space. This stimulus to be positively conceived and delivered physically, psychologically and intellectually to the surroundings, is the core of the Biophilic Hypothesis. This paper discusses the impact of biophilic design on human health and well-being and presents a unified framework for its application in the design of biophilic spaces.

Key words: Well-Being, Psychological Restoration, Biophilic Design, Environmental Psychology, Restorative Environments.

1. Introduction

Starting from the antiquated Greek (bios: life; philia: cherish), Biophilia depicts the cherish for life and communicates the ethos of keeping up and creating the life of mankind in all dimensions (physical, mental, social, aesthetic, ethical, etc.). Pointing to supply space for consciousness and enhancing the relationship between human society and the characteristic world, Designers have an opportunity to incorporate this theory into their plan. Biophilic plan has gotten expanding consideration as a plan logic in later a long time. This survey paper cantered on the three Biophilic plan categories as proposed by Stephen Kellert and Elizabeth Calabrese in "The Home of Biophilic Design". Mental, peer looked into writing supporting the benefits of Biophilic plan was looked for through the focal point of therapeutic situations. Comes about show that there exists much prove supporting certain properties of Biophilic plan (such as the nearness of characteristic components), whereas observational prove for other qualities (such as the utilize of normal materials or forms) is missing. The audit concludes with a call for more inquire about on helpful situations and Biophilic plan.

2. What Is Biophilic Design?

Biophilic design encourages the use of natural elements and processes as design inspiration in the built environment. The idea behind this is that exposure to natural environments and features has beneficial effects on human health and wellbeing, which has been supported by a wide range of research. According to the biophilia hypothesis, these positive effects of contact with nature are based on a biological connection between humans and nature. These ideas were developed in two theories that

have been developed in the environmental psychology literature: attention restoration theory and stress restoration theory. Both theories suggest that some environments are stressful, some aren't, and still others can actively help people recover from stress and mental exhaustion. The environments that cause positive mood have real estate that attract people's attention, without being stressful or challenging, people can help themselves recover faster and full of mental fatigue and restorative environments. Although the concept of biophilic design is relatively new, the body of research into nature and restorative environments strongly supports the health and wellness potential of integrating biophilic design attributes into the built environment. Significant evidence for beneficial effects of exposure to natural environments, evidence for other biophilic aspects, such as use of natural materials, is sparse. The development of biophilic design features has led to the recently published article "the practice of biophilic design" by Stephen Kellert and Elizabeth Calabrese. The three experiences and 24 attributes are listed in table 1.

Evidence from over 3 many years of studies at the effect of nature on human fitness and wellness Can justify the declare that Biophilic design is useful, despite the fact that instructional literature searching specially at Biophilic design continues to be enormously rare. One of the primary instructional papers on Biophilic design got here from Joey who checked out empirical studies from numerous fields of psychology and the way it carried out to Biophilic design. Joey concluded that current studies, primarily withinside the discipline of restorative environments, lends help to the thoughts of Biophilic design. The evaluation did now no longer search for particular literature on Biophilic design attributes, as this evaluation does. Likewise, in a bankruptcy on restorative environmental design via way of means of Hartig and

colleague’s restorative environments had been checked out as a foundation for Biophilic design, however the bankruptcy does now no longer does now no longer evaluation particular Biophilic design attributes; as a substitute help for Biophilic design changed into centred on standard help from restorative environmental design studies. Several years have handed considering those evaluations had been conducted, and the proof in help of Biophilic design has increased. The cutting-edge paper tries to assess the proof for every of the 3 studies prominent via way of means of Kellert and Calabrese to help the principle that Biophilic design is useful for mental wellness.

with 3 major classes and 14 styles became proposed primarily based totally on an evaluation of the perception of nature and biophilia in addition to some of design cases (Browning et al., 2014). While the 2 models have numerous merits, they may be in addition evolved thru deconstructing and resynthesizing their additives for looking at biophilic design functions. Pertinent to this study, those models now no longer most effective offer a well signposted map to manual biophilic design however additionally introduce a framework that considers social, cultural, medical and creative functions of biophilic design. However, those models contain overlapping among styles, cross-referencing of functions, and recurrences. Take the version through

Table 1. Experiences and attributes of Biophilic design by Kellert and Calabrese.

Direct Experience of Nature	Indirect Experience of Nature	Experience of Space and Place
Light	Images of Nature	Prospect and refuge
Air	Natural materials	Organized complexity
Water	Natural colours	Integration of parts to wholes
Plants	Simulating natural light and air	Transitional spaces
Animals	Naturalistic shapes and forms	Mobility and wayfinding
Weather	Evoking nature	Cultural and ecological attachment to place
Natural landscapes and ecosystems	Information richness	-
Fire	Age, change and the patina of time	-
-	Natural geometries	-
-	Biomimicry	-

3. Methodology

Two models of biophilic design were proposed withinside the literature. First, primarily based totally on an evaluation of human’s wellness and its connections to nature, Stephen R. Kellert severely reviewed techniques to design, and mentioned a way to mitigate the rising demanding situations and gain a restorative environmental approach. In his study, a version of six factors became formed (Kellert, 2008). The first 3 factors: environmental functions, natural shapes and forms, natural styles and tactics are associated with nature. The fourth element, mild and space, includes each nature and place. The ultimate factors, place-primarily based totally relationships and advanced human-nature courting are connected to vicinity and those respectively. Kellert’s six biophilic factors may be classified below the 3 crucial pillars of the design idea: nature, vicinity and those, which can be meditated in Figure 1. The 2nd version

Browning, Ryan and Clancy as an example. Under the class of “nature of the distance styles”, the 5th sample “presence of water” is frequently used to provide an explanation for the opposite styles such as “visible reference to nature”, “non-visible reference to nature”, “non-rhythmic sensory stimuli”, “thermal and airflow variability”. In addition,

“Presence of water” is likewise referred withinside the styles below different classes, it additionally serves as a critical characteristic in a couple of styles, such as, “dynamic and diffuse mild”, and “reference to herbal systems”. Similar cross-referencing exists in lots of different scenarios. The presence of such cross-referencing and overlapping is because of the character of the idea of biophilic design. In this idea, there are a plethora of things to be considered. Thus, it’s miles instrumental to offer a clean roadmap to contain the elements of biophilic design and illustrate their complicated interrelations. The intertwined

relationships some of the 3 pillars of nature, vicinity and those may be visualised in Figure 1. Based on those 3 pillars, the 14 styles of biophilic design proposed through Browning et al. (2014) and biophilic design attributes offered through Kellert (2008) may be synthesised right into a matrix in Figure 2. Firstly, from the issue of “nature”, there are 3 domain names from sincere direct to indirect: herbal characteristic; herbal form and shape; herbal analogue, sample and process. Secondly, from the issue of “people”, there are domain names of focus: bodily and mental connections with nature. Physical reference to nature is split into 5 subdomains: visible connections; somatosensory connections (thermal and tactile sensations); auditory, olfactory and gustatory connections. Psychological reference to nature (smart interpretation of nature) has 4 subdomains: prospect; refuge; mystery; and risk/peril. Finally, from the issue of “vicinity”, the biophilic design functions in relation to “structure and settlement” may be classified into a couple of subdomains, such as region, settlement: grid and axis; street, road, lane and circulation; site: landscape; constructed shape: material; construction; spatial demarcation; meaning. The exact intertwined relationships some of the 3 pillars may be visualised withinside the shape of a matrix structure. Some biophilic design functions are conspicuous and they may be concretised withinside the bodily constructed environment, whilst a few functions may be much less tangible, together with functions that contain mental connections with nature. For the latter, a multidisciplinary angle might be useful to help a complete observation

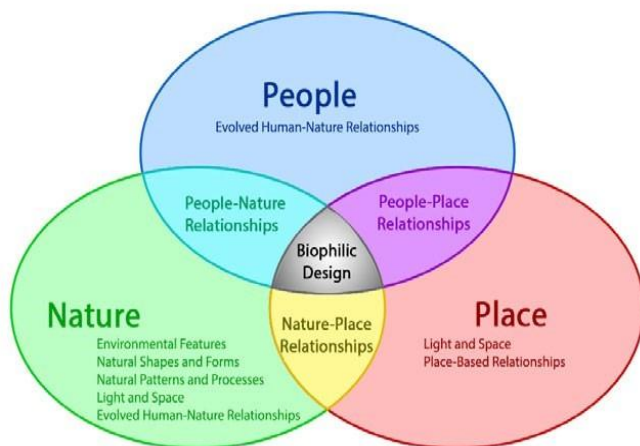


Figure 1. Three pillars and their intertwined relationships.

5.Result

The following section information the effects of the mental literature seek at the 3 Biophilic design experiences. Some overlap exists among the impartial

variables (the 24 attributes) explored in studies and this become cited withinside the overlapping attributes. For example, water could be visible as being fairly restorative withinside the constructed surroundings from each direct and oblique nature experience. Moreover, special herbal factors regularly characteristic collectively in environmental design, making it tough to differentiate sincerely among special components of Biophilic design.

5.1 Direct Experience of Nature

The direct experience of nature experience and its applicable attributes yielded the maximum peer-reviewed studies for this paper. The direct experience of nature manner having a right away touch with nature and natural processes. The 8 biophilic design attributes which are used on this experience are indexed in desk 1. The maximum researched attributes on this experience class in mental literature are the usage of flowers withinside the constructed surroundings and natural landscapes and ecosystems. Additionally, studies from a restorative surroundings’ attitude become additionally located on natural day, light, water and weather. Literature exists at the well-being advantages of the opposite attributes however inclusion of them become out of doors the restorative environments consciousness of this overview paper.

Natural Light

Natural light has been promoted through diverse disciplines as being useful for health of constructing occupants, inclusive of psychology. However, withinside the studies for this paper few effects have been discovered that studied restorative surroundings studies at the side of natural light. Most of the studies at the benefits of natural light is approached via a organic explanation, which includes circadian rhythms and nutrition D production.

From a Biophilic view, people developed under natural, diurnal light situations and consequently natural light and natural light tactics ought to be desired and maximum useful. Although the usage of home windows and natural light can be confounding, a observe on kids in a lecture room in Sweden, discovered that kids in rooms with daylight hours fluorescent lights without home windows had stepped forward attention whilst as compared with kids in school rooms without a home windows and traditional lights. This observe additionally lends assist to the simulating natural light and air characteristic withinside the oblique revel in of nature category. Daylight spectrum lights the ones modifications for the duration of the day to imitate natural light, which includes circadian lights, can be a manner to higher achieve the benefits of natural light.

Water

Water has also been found to be restorative, each through views of water and sounds of water. Kaplan and Kaplan observe how desired environments regularly have a view of water and this was also found in numerous different studies. In fact, pictures of the city surroundings that contained water have been discovered to be even extra desired than nature pictures containing no water. As with perspectives to nature, the nice of water affects the restrictiveness, that means that brown, grimy water might be much less restorative than smooth water. Incorporating clean water elements into the constructed surroundings has also been advised by researchers as a manner to tap into the Biophilic advantages of water. Articles which have focused at the mental advantages of water have referred to that there may be tons studies at the physiological advantages of water, but much less so at the mental wellbeing advantages.

Plants

Plants have the ability to directly bring green, living nature into the indoor environment. Psychological research has established the fitness and wellness blessings of placing plants inside. The effects indicate that small, green, gently scented flowers had been the maximum gold standard for fitness and wellness. Plants with red flowers were found to be fatiguing after a period of time. This will be defined through studies on coloration and creativity, where red has been found to be useful on tasks that require concentrated attention.

Natural Landscapes and Ecosystems

The view of greenery from a window, that is listed below the natural landscapes and ecosystems attribute, has been proven in numerous research as having useful effects at the wellbeing of constructing occupants. This is a great indication that in the built environment context, the kind of view does matter. In regions in which a city surroundings is the restricting issue toward viewing inexperienced nature, the supply of inexperienced roofs has been observed to be restorative. The quantity of restorative capability depends at the kind of flora, with a popularly used flora type, sedum, being considered as not being significantly more restorative than non-vegetated roofs.

5.2 Indirect Experience of Nature

The second experience proposed by Kellert and Calabrese is the indirect experience of nature. This enjoy is important, as direct touch with nature won't be feasible in each design situation, such as in positive medical environments, and appears at illustration of nature in the

built environment. This experience has ten attributes, which can be found in Table 1.

Images of Nature

The use of images of nature in the built environment has been extensively investigated in environmental psychology. Images of nature were determined to be as strain lowering as real perspectives of nature in sure circumstances. Building occupants' want for human interaction with nature is so robust that workplace employees were determined to compensate for a loss of nature publicity by including photographs of nature to the workplace surroundings. By incorporating permanent Biophilic functions into the constructed surroundings, designers can make sure that everybody reaps the advantages with touch to nature, and now no longer simply occupants that sense comfortable with personalizing their space, or the ones who've the capacity to do so. In surroundings in which direct publicity might not be possible, including sterile scientific surroundings, photographs of nature can offer a connection to the natural world for each sufferer and scientific professionals. Images of nature may even be extra restorative than the view of actual nature, relying at the content material of the picture and the view of nature.

Therefore, photographs of nature can also additionally have a big role in environments in which exterior views with lush nature might not be possible, because of seasons, adjoining buildings, or outside environment.

Natural Materials

Natural materials are another Biophilic characteristic that falls into this revel in however this characteristic has obtained restricted interest in instructional studies from a psychological perspective. The restricted studies demonstrates that the quantity and form of fabric is crucial for perceived restorative best and preference. The results of this study again display that the quantity and form of Biophilic feature, in addition to the target audience, needs to be taken into consideration in design. In terms of different studies on natural substances, for this paper wooden became the handiest fabric located that became associated with Biophilic design research. This presents a possibility to analyse different substances, which include herbal stone, diverse clays, strawbale, hemp and different sorts of wooden. Materials which are indigenous to a constructing location can also be similarly investigated.

Natural Geometries

This characteristic mostly offers with fractals, despite the fact that additionally consists of different natural

geometries which include the Fibonacci series as well. The look at of fractals gives a proof as to why human beings are restored by nature. Fractals arise when a sample repeats itself because it receives smaller or larger, refers to as "self-similarity". Some tremendous ancient homes incorporate fractals, which incorporates Gothic architecture, considerably cathedrals. Fractals were observed in lots of herbal elements, for instance the Romanesco broccoli. This might be a proof as to why natural environments are regularly desired over built ones or why fractals were utilized in ancient architecture.

5.3 Experience of Space and Place

The third and final experience, the experience of space and place, relates to the spatial elements of the natural environment and how to replicate it into the built environment. There are six attributes in this experience, which are listed in Table 1. Based on the review of psychological literature on restorative environments, three attributes will be discussed.

Prospect and Refuge

There has been work done on prospect refuge theory, but not in terms of restorative environments. One study on prospect and refuge in terms of restorative environments became observed for this paper. The take a look at became carried out in the natural world and did now no longer use the constructed surroundings, similar to some of the formerly mentioned research associated with restorative environments. Nature this is non-threatening is notion to be restorative and this may be carried out to the constructed surroundings context as well. Results from this take a look at validated that nature with excessive degrees of views and low degrees of prospect have been deemed restorative; nature with low degree of perspectives and excessive degrees of prospect have been now no longer. Although being in nature may have the capacity of being extra threatening than managed surroundings in a building, the authors characteristic the effects in component to wayfinding, which has been studied withinside the built environment context. Wayfinding is the convenience at which someone can manage an environment. When a person has problems finding their way, their levels of stress rise.




Cultural and Ecological Attachment to Place

Another characteristic proposed by Kellert and Calabrese on this revel in is cultural and ecological attachment to area. Place attachment is a place of research in environmental psychology that "refers to the feel of rootedness human beings feel closer to certain places, a phenomenon every so often referred to as a feel of area". The paintings this is applicable right here is paintings on

preferred locations, that have been related to area attachment and recovery. Places which are appeared to be highly restorative were observed to have strong area attachments for human beings. In relation to this, in a 10month longitudinal study, natural environments, maximum probably because of their capacity to afford recovery, were observed have a more potent attachment as a favourite area. A utility of this on the subject of Biophilic design or built environments that include nature become now no longer observed for this paper. Although the literature on preferred locations shows that there may be a link between place attachment and recovery that is highly subjective and a revel in that develops over the years and possibly now no longer something that is easy to design.

5.4 Individual Differences

Individuals may reply in a different way to Biophilic elements, which want to be taken into consideration in Biophilic design. Van den Berg and Ter Heijne observed that male individuals and those that are better sensation seeker reply greater definitely to threatening encounters in nature than females and those which can be decrease sensation seeker. Also observed through Van den Berg and Ter Heijne turned into that any form of nature may want to yield fear. This may be translated into the built environment, significantly with environments which have excessive prospect however reason a few individuals who are afraid of heights to come to be stressed. Another character distinction is that now no longer everybody sincerely likes nature and that this must be taken into consideration in design. Biophilic design may also growth the likeability of nature through greater exposure to natural processes and elements in a managed environment. This can growth a person's connection to nature and might inspire them to have interaction greater in wilderness nature. Individual variations in the built environment context have additionally yielded substantial results. In a examine, pics of summary and nature artwork produced substantial lower in anger and pressure in male workplace workers, however now no longer female. The summary artwork used withinside the examiner turned into Biophilic in nature, which turned into stated through the authors as explaining the results, since preceding studies had indicated that summary artwork turned into distracting. Differences among genders in restorative environments have been also observed, in which females proven improved performance when plants have been integrated into the room when as compared with males. In both studies, context is important, in which the form of assignment and environment may also play a massive function withinside the unique effects through gender. This may be utilized by designers when considering Biophilic design through understanding the form of task and stressors that people will enjoy of their environment.

P.NO	PATTERNS	INTER-RELATION	PICTORIAL REPRESENTATION	ATTRIBUTES PRESENT	DOMAIN OF APPLICABILITY	DESIGN CONSIDERATIONS
P1	VISUAL CONTACT	P2		Vegetation; Animals; terrain; soil; moderately designed landscape	LANDSCAPE BUILDING	<ul style="list-style-type: none"> Design to support visual connection that can be experienced for at least 5-20 minutes a day Prioritizing real nature over simulated
P2	NON VISUAL CONTACT	P3 P4		Weather ; Natural Ventilation (operable windows) ; herbs & flowers	LANDSCAPE	Connections easily accessed from one or multiple locations Through building openings facing open spaces
P3	NON- RHYTHMIC SENSORY STIMULI	-----		Cloud movement; Breezes	LANDSCAPE	-----
P4	THERMAL & AIRFLOW VARIABILITY	P1 P2		Solar heat gain ; Shade & shadow ; Radiant surface material ; vegetation with seasonal densification	BUILDING LANDSCAPE	Orientation of built form to suitably shade the interiors as well as promote self-shading due to adjacent structures
P6	DYNAMIC & DIFFUSE LIGHT	P1		Daylight from multiple angles; Direct sunlight ; Diurnal & Seasonal light	BUILDING	Strategic usage of skylights and translucent materials like fibre- glass sheets, producing diffused lighting to interactive spaces
P7	CONNECTIONS WITH NATURAL SYSTEMS	P1 P2 P6		Simulated daylighting systems; Hedges & flowering vegetation	BUILDING LANDSCAPE	-----
P10	COMPLEXITY & ORDER	P1 P16		Exposed structure ; Façade material; Floor plan ; Building skyline	BUILDING LANDSCAPE	Structure revealing fractal geometry
P11	PROSPECT	P1 P12 P21		Elevated planes Views including shade trees; Shade shadow	BUILDING LANDSCAPE	<ul style="list-style-type: none"> Orienting building; openings, fenestrations optimizing visual access to indoor & outdoor vistas, open interactive spaces. Where high ceilings present, building to be elevated 12'

P12	REFUGE	P1 P11 P18		Spaces with weather & climate protection, speech & visual privacy	BUILDING LANDSCAPE	<ul style="list-style-type: none"> • Providing level difference of spaces • Well shaded spaces • High height to depth ratio of built space
P13	MYSTERY	P1 P16 P21		Light & shadow : Meandering pathways; Visual disconnect; curving edges	BUILDING LANDSCAPE	<ul style="list-style-type: none"> • Curving edges those slowly reveal • Dramatic shade & shadow • Overgrowing, less maintained landscapes obscuring view of the passer by.
P14	RISK/ PERIL	P1		Architectural cantilevers; Experiences perceived to defy gravity	BUILDING LANDSCAPE	<ul style="list-style-type: none"> • Building heights at least 5 times human height, cantilevered or supported by minor supports
P16	CURIOSITY & EXCITEMENT	P1		Vibrant colours; Views & vistas; Transitional spaces; Complementary contrasts ; Elevated planes; Hierarchally organized ratios & scales	BUILDING LANDSCAPE	<ul style="list-style-type: none"> • Landscape with a quality of prospect • Visual composition of open built such that open spaces revealed later than built • Curving progressing paths towards a space
P17	CHANGE & METAMORPHOSIS	P1		Seasonal varying landscapes ; Diurnal variability of solar patterns	BUILDING LANDSCAPE	<ul style="list-style-type: none"> • Mix plantations of deciduous & evergreen trees
P18	SECURITY & PROTECTION	P1 P12		Spaces with weather & climate protection; Drop or lowered ceiling.	BUILDING LANDSCAPE	<ul style="list-style-type: none"> • Visual connectivity in a space through various levels • Shaded interactive spaces
P19	ATTACHMENT	-----		Views & vistas ; information richness ; Central focal point	BUILDING LANDSCAPE	-----
P20	ATTRACTION & BEAUTY	P1 P11 P4 P6		Landscapes; Complementary contrasts ; Spatial harmony	BUILDING LANDSCAPE	<ul style="list-style-type: none"> • Complementary colours of landscape and the surrounding built form • Camouflaging of building into the landscape
P21	EXPLORATION & DISCOVERY	P1		Transitional spaces; Heightened planes ; Shade & shadow ; visual disconnect & perspective	LANDSCAPE	<ul style="list-style-type: none"> • Creating visual perspectives with dark or low lit space at other end

6. Conclusions

This quote via way of means of Winston Churchill has regularly been used, which includes in affiliation with the Tartu Nature Building via way of means of Karisma Architects in Estonia. Given the fact at the back of this quote it's far unexpected that architects do now no longer get greater education on human nature. If because the biophilia speculation states, a connection to nature is vital, then it turns into an increasing number of vital for designers, planners, coverage makers and all of us worried in growing our constructed surroundings to have running understandings of the subject and the way to include it into their selections and practices, biophilic design addresses this. Since previous teething states, the biophilic disposition is a method of conception and no longer a "biophilic producer". This is a vital difference to make in a world crowded with labels, cortication's and titles. Biophilic Design isn't always something new- designers and designers were training it and exploring the theories at the back of it because the primitive living and What is new, except a greater reined dentition of patterns, is the developing frame of empirical proof helping the ideas of biophilic design and emphasizing its significance in our fitness and wellbeing. This is something architects want to take note of and design having a knowledge of, being tasked with ensuring "fitness, protection and welfare" of constructing occupants. Although many designers exercise biophilic design intuitively, the power at the back of knowledge the go disciplinary studies outcomes in higher utility via know-how and knowledge of the subject. Although principles can be old, growing a proper language across the subject matter creates a platform for speak among disciplines, withinside the instructional and expert geographical regions and additionally with clients- the significance of this must now no longer be underestimated.

We have moved from a "much less is more" method to a "do more with much less" method of architecture. When awaiting to do greater with much less, you can't have a take a observe factors in isolation, however in how they relate to every different and the way symbiotic relationships may be more suitable and supported- a middle precept to structures thinking. This must exist each withinside the challenge factors and design process, requiring go disciplinary paintings and proper collaboration. This is something that studies of biophilic design has achieved and encourages. Through studies into the subjects of biophilia and biophilic design and gaining base knowledge of ways they were applied; a second contradiction of types has become evident. It is observed that a design method to biophilic design desires to have a knowledge of the human- how we characteristic, how we reply to our surroundings and the

way we've evolved. So, a design this is human cantered. Yet the identical time we want to method this from a non-anthropocentric world view, spotting that we aren't on the centre, however connected. However, that an aggregate of a human focused design method, coming from a non-anthropocentric world view has constantly been at the basis of desirable design and may also offer design answers that make a contribution to each constructing and human performance, fitness and well-being, whilst growing symbiotic relationships with the structures to which they're connected. This approach acknowledging and knowledge that we as human beings are organic organisms, which includes herbal structures and strategies, that characteristic and rely upon the herbal structures and strategies round us. What commenced as easy huts for refuge and safety have now evolved into the complex-constructed environments, we stay in end up an vital a part of this equation. The design of those constructed environments now no longer handiest at once influences each our human structures and the herbal structures wherein they're set, however start to additionally effect the connection among the two.

7. References

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