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DOCTORATE IN ARCHITECTURE

EXPLORING BIOPHILIC ARCHITECTURAL DESIGN CONCEPTS AND THE IMPORTANCE OF BRINGING INDOOR SPACES TO LIFE FOR HUMAN COMFORT AND WELLBEING.

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1. INTRODUCTION

Due to our way of life or status in life, the majority of people spend 80–90% of their lives indoors. For example, Children spend most of their time in school, parents spend most of their time at home or in the office, surrounded by all kinds of elements, materials, and objects. Moreover, studies show that much of these built environments affect our lives and our personality. During the Second World War in the last centuries, the black box building that had artificial lighting and air conditioning only throughout the building was designed without windows. It was cheap and flexible to stack up spaces for multiple levels of office and factory spaces. But the building created the blandest environment, equivalent to a sensory deprivation room (Behling 2016). According to Stefan Behling(2016), in a military submarine, crew members who experienced predicament whenever they came to shore, were discovered to have suffered from poor eyesight, poor hearing, and hallucinations because of sensory deprivation as a result of the time spent in the submarines. Their eyesight was disappearing because they were not using long-distance vision (Behling 2016). In our cities today, a lot of buildings especially high-rise buildings designed and constructed now can be likened to submarines: completely sealed, with an artificial environment. A person can be so close to the glass window but cannot experience the fresh air and smell of the plants right behind that window and the feel of the natural light from the sun's rays, The sound of birds, pets, and human movements, etc. studies show that such environment causes all sorts of mental disorder, discomfort, and diseases to occupants. This has become a wake-up call to some designers who have considered having significant attention to interior spaces designed for human habitation. The purpose of this paper is to understand the essence of biophilic Architecture and the need to bring buildings and spaces to life for positive environmental impact and human wellbeing. This kind of architecture is called living architecture that addresses strategies and concepts of biophilia in architecture (Amany R, 2015)

2. DESCRIPTION:

2.1 THE ORIGIN OF BIOPHILIA

The term biophilia is from the word ‘bio’ meaning life and ‘Philia’ is one of the four ancient Greek words for love (storge, agape, Eros, and Philia) that means tendency, friendliness, love, and abnormal appetite towards something or someone. (webster, 1828). Therefore, in simple definition -**Biophilia** is an innate friendly feeling or love towards natural environments or living things. According to studies done by Bill Browning (2015), Humans have a biological need to connect with nature physically; mentally, and socially therefore, they have developed to respond to natural surroundings. Moreover, it has been found that this connection and engagement with nature has a significant influence on human productivity, relationship, and general well-being. (Browning, 2015)

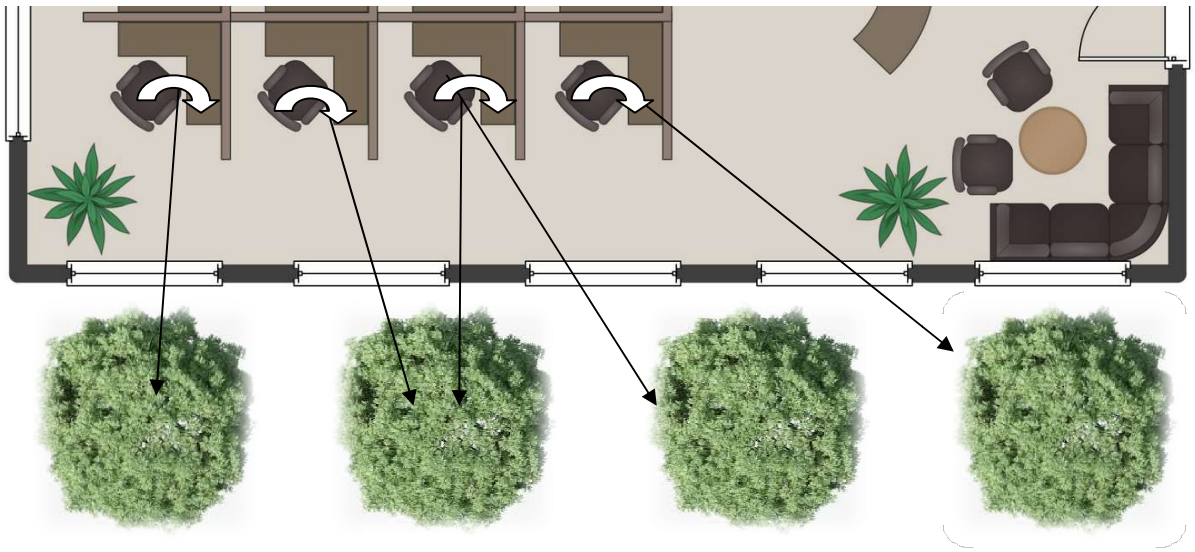
2.1.1 Biophilia in architecture employs various biophilic applications recognized as concepts and principles by a large population of scientific and design communities to help transform lifeless surroundings into extraordinary or stimulus environments. The biophilic concept is a design concept that allows nature or natural elements into the built environment. This results in indoor and outdoor interconnectivity.

This style of design is mostly perceived as luxurious for people who want extraordinary spaces for working or for people who just want to showcase how environmentally responsible they are, however, it is more impactful than how it is considered by the masses. therefore this should be seen as a necessary or needful style of living for all.

2.2 COST-EFFECTIVENESS OF BIOPHILIC CONCEPTS IN DESIGN

Biophilic design concepts employed in the working environment are cost-effective according to a study done by the Sacramento municipal utility district (SMUD) through an experiment carried out on an office-story building with a call center on one of the floors. The call center has large windows with trees outside the windows, great daylighting, and raised floors with vents that can be controlled by occupants. The space has good thermal performance and high indoor air quality that won a LEED gold certification. The workstations were perpendicular to the windows as shown in diagram 1. Since the workers had to focus on their computer monitors, however, to see the view outside required that they either turn their whole body or turn their necks. (Browning, 2015).

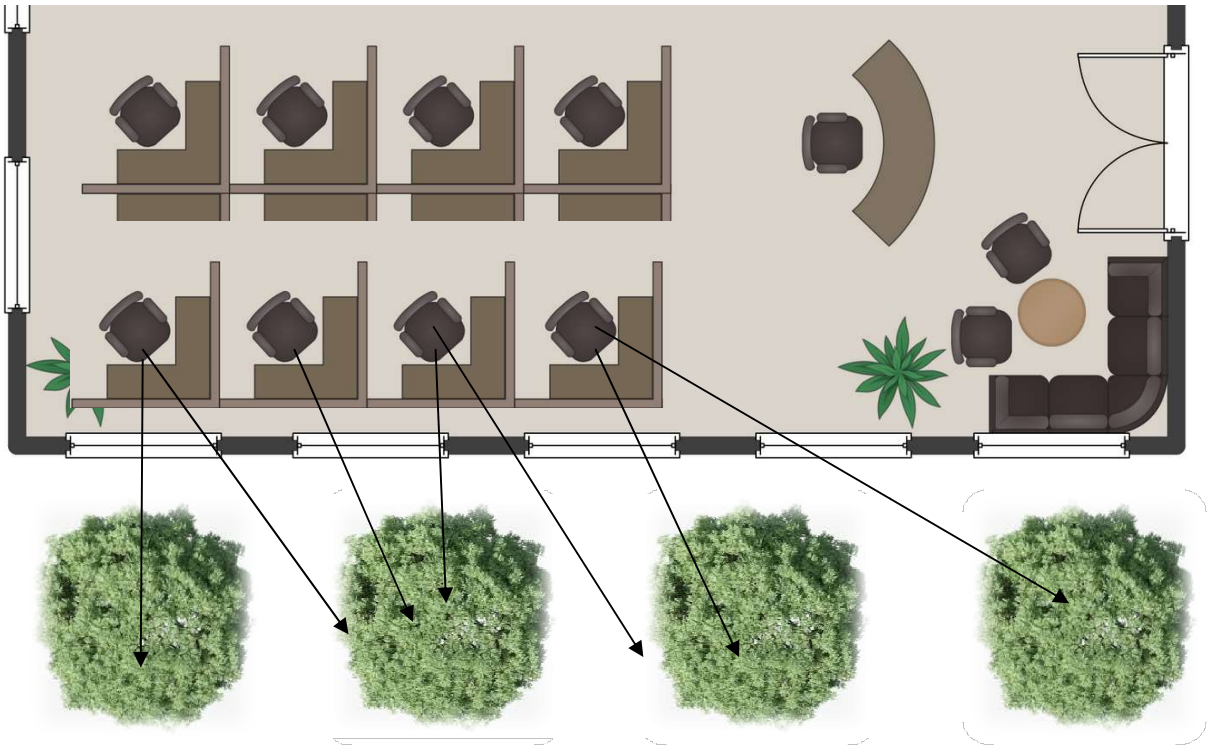
2.2.1 DIAGRAM 1(illustration by author)



This furniture arrangement in itself is not a bad idea, however, rotating the workstation a few degrees towards the windows made a positive difference as shown in diagram 2. Any movement

in the trees outside became easily noticed, felt, and glanced at. This caused the occupants to occasionally glance out of the window. Causing muscles in the eyes to relax by the changing visual focus from the computer screen to looking at distant pleasing views of the movements of the trees behind the windows. The occupants gained brief mental pauses that restored cognition focus. The installation of the workstation originally cost about $1000 per occupant but the experiment showed that moving the workstation, influenced the call handling capabilities of the staff to increase by more than 6 percent, leading to savings of approximately $3000 per occupant (3 times the installation cost) (Browning, 2015)

2.2.2 DIAGRAM 2 (**illustration by author)**



3. DISCUSSIONS

3.1 BIOPHILIC ARCHITECTURAL DESIGN:

Bill browning (2015) explains the emerged science that indicates the possibility of designed spaces improving cognitive functions, reducing stress, and enhancing creativity. It has been confirmed that spaces where we work and live deeply affect our health. Moreover, with this information, designers must carefully design spaces that are psychologically and physiologically efficient and sustain well-being such as lowering blood pressure, and heart rate, reducing muscular tension, increasing mental focus; lowered levels of hormones enhance creativity and problem-solving abilities in both children and adults.

Further studies and examinations done by neuroscientist, endocrinologists, environmental psychologist, and other related fields led to the identification of 14 design elements or patterns that promotes physical and psychological health benefits. They are biophilic design strategies huddled into 3 major categories namely:

3.1.1 **Nature in space:** This addresses natural elements present in the space: Visual Connection to Nature, Non-Visual Connection to Nature, Non-Rhythmic Sensory Stimuli, Access to Thermal and Air Flow Variability, Presence of Water, Dynamic and Diffuse Light, Connection to Natural Systems (to be reminded of the cycles and systems in nature). These may be living things(such as potted plants, flowerbeds, green walls or roofs), animals(such as domestic pets, bird feeders, butterfly gardens, aquariums), ephemeral elements like sound, breeze, scents, water, and other natural elements from water features, fountains and courtyard gardens. (Tavis, 2016)

3.1.2 **Natural analogue:** Addresses, Biomorphic Forms, and Patterns, Material Connection to Nature, Complexity, and Order. These may be organic objects, materials colors, shapes, sequences, and natural patterns with an indirect evocation of nature. These can be manifested as furniture with organic shapes, materials, and surfaces with natural textures like wood planks and granite tabletop. Interventions that manifest as artwork, ornamentation, décor, textile, mimicry of shell and leaves, animals, etc (Tavis, 2016)

3.1.3 **Nature of the space:** this category addresses Prospect, Refuge, Mystery, and Risk/Peril. These may be experienced through natural spacial experiences by taking into consideration refuge conditions for solitary work and places of prospect for surveying the space. an enhanced visual connection to nature in the design: Such as dynamic lighting designs, living green walls with patterns from nature, Views of a specific natural environment outside, and use of natural materials(stones on the walls, bamboo ceilings, wooden or stone textures on objects, countertops, door handle, floors, etc), daring to bring nature into indoor spaces, that are windowless and sterile, by establishing water features, stone walls, and views to the surrounding landscape or indoor man-made scapes. (Tavis, 2016)

3.2 A thorough analysis of the physiological and psychological benefits of a biophilic design environment under the 14 practical-based design patterns

Studies conducted by several neuroscientists, optical scientist, psychologist, endocrinologist, and prominent research universities indicates that biophilic designed environments are impactful and easy to create an intervention. (Browning, 2015)

A Lecture by Sami Miera and Philipe Boni of UGREEN (2021) on healthy spaces and best strategies for biophilic design, captures details of how biophilic design interventions can easily be used in our design and built environment to improve the comfort and wellbeing of people within a space. They stated that we shouldn't take so much care of our health by just exercising and eating good food, meditating, and having a good schedule for our daily activities when our environment and surroundings at home and our workplace do not support or encourage healthy and comfortable life we are working so hard for. (Miera, 2021)

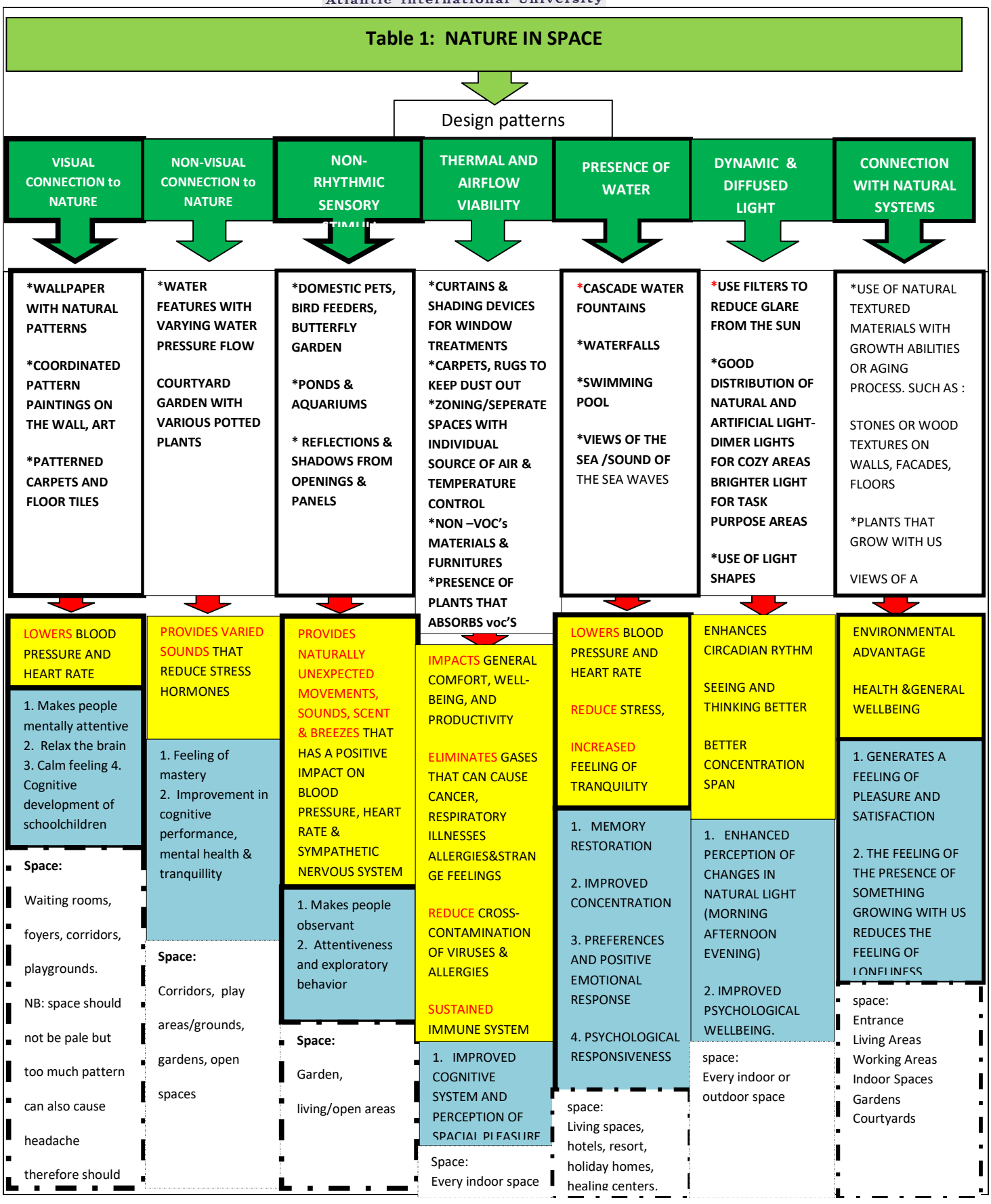
Your surroundings must reflect the health that you want, your surroundings must become a part of you, a space you enjoy and want to stay in for long without getting bored or sick of it. Sami (2021) mentioned that sick buildings are real and cause a detrimental effect on human health. A person can develop allergies chronic diseases, difficulty in breathing, irritation in the throat or eyes like a burning sensation in the eyes, itching skin, or cancer in worst-case scenarios.

Any building at all can be a sick building from hotels to beachfront houses, mansions, healthcare facilities; residential apartments, etc. a person can get sick in a building and die studies show. it does not matter the size, the value, and the beautiful aesthetically pleasing view the building may have. ‘Beauty is no more in enough’. (BONNIE, 2021)

Hence the need for specific interventions to reduce or prevent the negative impact buildings have on our physiological and psychological health to make worse buildings better and good buildings even extraordinarily better by taking the opportunity to design spaces that will contribute to and encourage health. Studies show that the way we think, judge things, memorize things, perception of things can be affected by the environment we are inserted in (Miera, 2021)

Architects and designers can improve physical and mental performance with the spaces they design for human habitation. They have the power to improve the quality of sleep and stimulate people to think clearly and act fast.

3.3 The tables below show a summary of the relationship between humans and nature through spacial elements and experiences leading to the impact of biophilic strategies on the physiological and psychological wellbeing of humans, described under the 14 design patterns and elements in 3 major biophilic design categories.



(Browning, 2015) (Filipe Bonnie ,Samie Meira, 2022) (Tavis, 2016) (chrsitopher trott , lance Hosey , 2016)

Table 2: NATURAL ANALOGUE

(Browning, 2015)

Design patterns

Biomorphic Forms and Patterns

*PATTERNS AND PROPORTIONS THAT FLOW WITH THE RHYTHM OF NATURE LIKE MUSIC. Eg A SLOPING AREA WITH CONTOURED STAIRS

*WINDOW FRAMES/WALL PANELS WITH TREE FORMS TO EVOCK THE NATURAL FORM

* ELEMENTS WITH NATURAL RESEMBLANCE TO TREE BRUNCHES, CRYSTALS, WEBS, HONEYCOMB, ETC

*SPACES WITH PLANTS AND ELEMENTS TO EVOKE THE FEELING OF WALKING THROUGH A FOREST OR THE WOODS

REDUCES BLOOD PRESSURE

ENHANCES COMFORT

Space:

RESORT ENVIRONMENT

HOTEL RECEPTION AREAS AND RESTAURANTS

LIVING ARES IN HOMES

SCHHOL PRAY GROUNDS, CORIDOORS, CLASS ROOMS

Material Connection to Nature

USE OF WALL PAINT, FURNITURE, AND OBJECTS WITH NATURAL COLOURS TO EVOKE WHAT WE SEE IN NATURE (AOK GREEN, DARK YELLOW, NATURAL COKE COLOUR ETC)

LARGE GLASS WINDOWS OR WINDOWLESS VIEWS OF OCEAN, RIVER, A FOREST, MOUNTAIN, OR GARDEN. PANORAMIC WINDOWS, OPENINGS, OR TERRACES) FOR GREAT OR UNIQUE EXTERNAL VIEWS

MATERIALS AND SURFACES WITH NATURAL TEXTURES.STONE WALLS, GREEN WALLS, WOOD GRAINS, AND MARBLE COUNTER TOPS AND FLOORS

REINFORCEMENT OF CIRCADIAN RYTHM

CAUSES MUSCLES IN THE EYES TO RELAX

DECREASES ILLNESSES

REDUCTION & PREVENTION OF MENTAL FATIGUE AND STRESS.

ENHANCES CREATIVE PERFORMANCE IN PEOPLE

STIMULATES A HAPPY FEELING

IMPROVES MONITORING CORTISOL LEVELS

INCREASES RETENTION AND IMPROVES JOB PERFORMANCE

space:
EVERY INDOOR SPACE

Complexity and Order

DRAW INSPIRATION FROM NATURE TO CREATE STRUCTURAL BIOMIMETIC FORMS AND ORDER SUCH A SERIES OF TREES, BRUNCHES, A SHELL, ROCKS IN GROUPS, MOUNTAINS, AND RIVERS, SHIPS ON THE SEA

IMPACT ON PERCEPTION

POSITIVE IMPACT ON PSYCHOLOGICAL STRESS RESPONSE

Space:
MALLS
RESORTS
LIBRARIES
OBSERVATORIES
PARKS
LABS
ETC

(Browning, 2015) (Filipe Bonnie ,Samie Meira, 2022) (Tavis, 2016) (chrsitopher trott , lance Hosey , 2016)

Table 3: NATURE OF THE SPACE

(Browning, 2015)

Design patterns

Prospect	Refuge	Mystery	Risk/Peril
SPACES THAT OFFER GREAT VIEWS LIKE CONFERENCE ROOM WITH A FLOOR-TO-CEILING HEIGHT PANORAMIC WINDOW OR GLASS WALL THAT ALLOWS USERS TO HAVE A 90 DEGREES VIEW OF AN ENTIRE CITY OR AREA.	**SPACES THAT ALLOW A PERSON TO BE PROTECTED WHILE VIEWING AN OPEN SPACE LIKE SMALL SPACES WITH VIEWS OF THE EXTERNAL SURROUNDINGS** **A SPACE THAT GIVES THE SAME FEELING AS BEING ON A HIKE, STOPPING AT A PROTECTED CLIFF OR HILL, AND OVERLOOKING A CITY**	Create spaces to subtly entice or draw a person into space. Spaces that create drama and suspense are out of the ordinary. Use lights to create a sense of space Walking through corridors that draws you into a particular space without being too obvious Make the interior space more engaging and interesting by the Use of manmade elements that mimic nature, like artificial plants, artwork, patterns, etc	Recreate the layout of the natural landscape indoors. Create a wow factor within a space to make an interior engaging
Controls mental fatigue and Stress Heightens our awareness Encourages interest and entertainment	REDUCES BLOOD PRESSURE and heart rate Enhances concentration attention and the feeling of safety	Controls mental fatigue, Stress, and loneliness High response to pleasure Enhance Intrigue and creativity. Makes people observant Attentiveness and exploratory behaviour	Controls mental fatigue, Stress, and loneliness Release of strong dopamine higher response to pleasure Sense of excitement Positive feeling Attentiveness to details and exploratory behaviour enhance Intrigue and creativity
Space: RESORT ENVIRONMENT HOTEL, RECEPTION AREAS, AND RESTAURANTS LIVING ARES IN HOMES CONFERENCE ROOMS CORRIDORS, CLASSROOMS, LIBRARY	Space: Every indoor space	Space: Entrance Living Areas Working Areas Indoor Spaces	Space: Entrance Living Areas Working Areas Indoor Spaces Gardens Courtyards

(Browning, 2015) (Tavis, 2016) (FOX, 2020) (dfor, 2019)

4. CONCLUSION AND RECOMMENDATIONS

Finally, Sami Miera(2021) revealed in her webinar on 'how to design healthy spaces' that there are various biophilic strategies that can be used by designers who have dedicated themselves to creating spaces for health and wellbeing. However, out of these numerous strategies, this essay discussed just 14 evidence-based strategies that can easily be used in any small or big project. This research has helped me with understanding the need to take my design strategies to another level by specializing in creating spaces for psychological and physiological wellbeing. Out of these 14 strategies, I have settled on and summarised six biophilic concepts shared by Sami Meira (2022) I will name 6 biophilic 'pocket' strategies that can be used in creating public/client awareness and also use them in any project will handle henceforth. These six biophilic strategies are.

Environmental elements: it involves the use of natural colors, natural textured materials on walls, furniture, objects, and accessories, creating unique external views, generous natural ventilation with curtains & shading devices for window treatments, carpets, rugs to keep dust out, thermal controlled spaces with an individual source of air & temperature, use non –toxic (VOC's) materials & furniture, presence of plants that purifies and absorbs VOC's. According to the study I have done, this strategy positively impacts the users psychologically by enhancing creative performance in people, stimulating a happy feeling, increasing retention and improving job performance, reinforcement of circadian rhythm, causing muscles in the eyes to relax, decreasing illnesses, reduction & prevention of mental fatigue and stress.

Natural forms: this involves borrowing inspiration from nature to create natural elements and simulations within a space. Such as patterns and proportions that flow with the rhythm of nature like music. E.g., a sloping area can be designed with curvy contoured stairs; window frames/wall panels with tree forms to evoke the natural form of a tree, Elements with natural resemblance to tree brunches, crystals, webs, honeycomb, spaces with plants and elements to evoke the feeling of walking through a forest or the woods. Drawing inspiration from nature to create structural biomimetic forms and order such a series of trees, branches, a shell, and rocks in groups, mountains, rivers, ships on the sea, etc. studies show that this strategy has a positive impact on psychological stress response and enhances comfort. Physiologically it has an impact on perception and reduces blood pressure

Natural Patterns: includes natural artistic wall designs with patterns and processes, paint, wallpaper with patterns to keep the brain engaged and curious especially in a waiting room, a foyer or an exhibition wall, and any object with natural patterns and sequences that can be seen on the wall, floor or window can do a lot of magic to the brain. These make people mentally attentive, relax the brain, and generate Calm feelings, cognitive development of schoolchildren. Physiologically this strategy lowers blood pressure and heart rate

Light and space: it involves the use of natural and artificial light shapes to create lighting designs, reflections & shadows from openings & panels, and appropriate distribution and filtration of light within spaces. E.g. some spaces shouldn't have too much bright light others need a lot of light but just enough to prevent glare (glare can cause headache and other eye discomforts). Therefore, curtains & shading devices can be used for window treatments. This strategy enhances the perception of change in natural light (i.e. your body can perceive when it is

morning, afternoon, and evening without haven to look at the clock by just relying on the different shades of light the sun gives throughout the day. This is a psychological benefit and enhances the quality of sleep.

Space relationship: this involves creating spaces that connect people to nature in a meaningful way, Such as connecting the past and present to the future. To encourage the belief that, the present and future are linked to a historical path. This will create a sense of space when people tend to reminisce when they step into the space. This can be done by welcoming natural elements like plants that grow with you, domestic pets, bird feeders, butterfly gardens, ponds & aquariums, and Natural textured materials with growth abilities or aging processes like stones or natural wood textured walls, facades, floors. The use of traditional or vernacular forms and patterns in design. This has been proven to stimulate and enhance positive feelings, reactions, and behavior like stirring up the sense of belonging and feeling at home. Using just a generous amount of plants is a poor way of applying the biophilic concept even though the presence of plants is one of the important elements to reduce or absorb concentrated CO2 within an indoor space. Creating a sense of space for a client will connect them to themselves, the past, present, and future which will eventually make the space part of them, they will take care of the space, enjoy the space, and feel safe and at home. The feeling of the presence of something growing with us reduces the feeling of loneliness.

Evolved human-nature relationship: it involves daring to bring nature indoors such as indoor gardens, indoor water features, natural forms, and elements to create a calm serene, and forest-like presence. Though we may feel calm and relaxed when get has magnificent views of a waterfall or forest from a distance, however, being too close to a massive waterfall or lost in a forest can trigger fear in a person. Because we know, that water can dominate us due to the reality that we are small compared to the waterfall and the tall large trees in the forest. However,

the fact that we can bring a miniature version into our spaces gives us a sense of domination, control, and challenge over nature. This creates a progressive relationship between humans and nature by stirring up reverence and love for nature in us. We become calmer from the breeze, varying water pressure sounds, and movements of water and plants or domestic pets. This strategy has physiological benefits like lowering blood pressure and heart rate, reducing stress, increasing the feeling of tranquility and various psychological benefits like memory restoration, improved concentration, preferences and positive emotional response, psychological responsiveness, enhances observatory abilities, Attentiveness, and exploratory behavior. Positive cognitive development, quality of sleep, concentration, and focus, increase the quality of learning and generates a feeling of pleasure and satisfaction.

In conclusion, I would say that biophilic strategic interventions are like medication for the polluted environment, sick buildings, and a "vaccine" for negative psychological and physiological impacts on manmade spaces. Maybe it's time to redefine the professional name “Architect” we can do more than just connect and construct spaces into one component and call it a building for human habitations. We should create to make a positive impact on humans. Just like God the chief architect who thought of everything we need or may need and placed them in what we see as nature on earth. Can you imagine how the world would have been if there were no trees to absorb Co2 and shade us, Water to soften a part of our hard earth, and crops for food and medication? I will leave that to your imagination. Therefore, we need to design with the physiological and psychological needs of our clients in focus so that we will give them spaces they will forever cherish, enjoy and live long in.

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