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PARADIGM FOR LIVEABLE & SUSTAINABLE CITY: BIOPHILIC DESIGN AS A TOOL TO BRIDGE THE GAP IN BETWEEN THE NATURE AND HUMAN INTERACTION

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ABSTRACT

Human being had a very deep relationship with the nature to full fill his all the needs. Beyond this researcher also found that human biology responds to the built environment and in addition With the inception of industrial revolution modern infrastructure came in existence which don't have so much of scope for humans and nature interaction as a result of which lots of biological problems can be easily noticed. In this paper author are trying to identify the role of Biophilic Design for the development of sustainable and livable city.

1. Introduction

Biophilia at a workplace allows human- nature connection within a working environment [1]. Kellert and others formulated a set of principles using a biophilic solution at a workplace. The application introduces some natural elements into an architectural space in a more flexible manner. This paper discusses the impacts of biophilia on the performance, productivity, well-being and health of employees at an office environment. Thus, the aim is to identify the impacts of biophilia on human when connecting to nature. Literature on the implications of biophilia elements at workplace was reviewed, having focused on their influence at a working environment and economics.

2. Background. Evolution Of Biophilia

Back in 1973, knowledge on both biophilia and necrophilia was first brought into public's awareness by Formm. He expressed on the psychological state of human being and the innate tendency to appreciate life and living organisms. Thus, this is how the term biophilia was coined. On the other hand, the mental disturbances and internal conflicts that keeps man far from nature is described as necrophilia [2].

Then, Wilson popularizes the concept of "inborn tendency" having focused on life and lifelike processes" [3]. His definition on biophilia is based on distinctive inclinations of nature as part of preserving human survival and natural desire for nature. The concept further explains on the human attempt to refuge in nature [3]. Both ecologists, Wilson and Kellert's believe that the instinctive of nature can improve the well-being of urban residents [4]. Such concept shows that one desires for nature is more than just providing some basic needs like food [5].

Interestingly, the concept that developed by Wilson gained attention by a group of scholars during a conference held in 2006 at Rhode Island, US. Researchers from multiple specialties such as academia, industry, government, finance and civil areas had shown interest in the issues of biophilia. Their discussion had focused on the practical application of biophilia elements to the urban design in the built environment. As a result, a book on a biophilic design was published [6].

Though people spend long time at an indoor environment, surprisingly majority has lack connectivity to the nature elements. [7] Hence, it is becoming essential to understand the relation between an office environment and occupational health [8].

Psychologists have studied sociology, environment and how humans are affected by the presence or absence of nature in their surroundings that they live [9]. Biophilia within the built environment contributes to the enhancement of human well-being by fostering connections between people and nature [8]. Although there is empirical evidence of biophilia implications, people are found reluctant to connect themselves to nature. Perhaps, there are some employers who still assume that biophilia is something esoteric or whimsical. On the bright side, the strong effect of biophilia on health and productivity of employees has convinced some companies around the world to incorporate nature at ones' working spaces under the 'go green' concept [10].

3. The Principles And The Application Of Biophilia

The ancient architecture can be associated with nature since human settlements were found located near to natural settings. During the Egyptian civilization, nature was as an essential component to sustain a living [11]. In the past, some

built environments were distinguished amongst them using biophilic integration. The access to nature was smooth with the construction of built environment having ideas borrowed from the engineering style taught by nature [11]. Civilizations of the ancient have successfully brought nature into homes and public spaces. The primary example includes the garden courtyard of Alhambra, Spain, and the bonsai of the oriental. Amongst the nobles of Egypt, the papyrus ponds

were the common housing design [12]. Alexander, the King of Macedonian, once accepted the patterns of nature as the sign of language in human environment that supported the feeling of being alive and humanity [13].

Similarly, Wilson considers that humans are favour for aesthetic in nature because they are part and inborn to nature [14]. Participants in the biophilic design pointed the necessity to establish a mechanism to apply a link between the built environment and the components. The idea would bridge the gap between the elements of nature and built environment. Kellert has outlined several research papers on the issue of dimension of biophilia. It consists of two dimensions; e.g. organic (naturalistic) and place-based (vernacular) dimensions [15].

In his works, Wilson also describes the elements of biophilia. Generally, they can be categorised into six components. Each consists a set of features with a total of seventy elements [16]. Importantly, he describes biophilia into three types of experiences: i) Direct experience of nature, ii) Indirect experience of nature, and iii) experience of space and place [15]. Nature in the working space may refer to the combination of plants, water features, and animals. This may include an aquarium, potted plant, water feature and courtyard garden as one is viewing them from the inside of a building. Natural analogues are resources and patterns that are similar to nature; likewise, ornamentation, biomorphic forms, and the use of natural materials. Similarly, the concept of nature in a working space describes the manner in which employees are physically and mentally influenced [17].

Having responded to the issues of psychology and physiology, there is different in the spatial configurations. the biophilia patterns described the design application of biophilic elements in the build environment, Browning provides a practical methodology when adapting the biophilic philosophy [12]. The elements were described into fourteen patterns within three categories; e.g. i) Nature in space, it means the presence of nature's elements in the region where the human interaction is thru the senses; which results in visual connection with nature, non- visual connection with nature, non-rhythmic sensory stimuli, thermal & airflow variability, presence of water, dynamic & diffuse light, and connection with natural systems [12]. The nature elements include plants, animals, water, pot plants, aquariums, fountains, sounds of nature,

and natural scents. As an example, the Amazon headquarters in Seattle, United States. It is operational since 2018, where the structural glass design consists of

an internal natural environment inclusive of fifty thousand species of plants brought in from different continents. In front of the main building the three glass domes with pentagonal panels which allow light to enter and communicate with the outside environment, including the work environment [18]. ii) Natural analogue it means simulating the elements of nature as biomorphic forms & patterns, material connection with nature, and complexity & order, including landscape pictures, drawings, engravings, and the use of natural material in furniture's, for example, the design of SC Johnson wax administrative building designed by Frank Alloyed, where he took advantage of columns in the public space between offices and transformed the shape of columns into large trees [19]and iii) nature of space treatment means spatial formation in nature prospect as refuge, mystery, and risk/peril. It includes a sense of danger and ambiguity for example Museum of Art by Michael Heizer [20].

4. Method

The review presents the impact of the biophilia components on employees and focuses on the health aspects of employees, performance, well-being and production. This review supports the importance of biophilia design in the workplace, based on the application of the patterns of biophilia to Browning and el 2015. The literature included the effect of visual contact with nature by focusing the literature on studying the effect of pot plant, daylight, and the effect of landscapes on staff, On the other hand, there is a lack of literature on the rest of the elements, such as animals, water, etc., within the work environment

In addition, the lack of literature on non- visual communication, such as the sounds and smells of nature's elements. Most of the literature related to the first style of biophilic design is Nature in space. The review methodology was based on a set of keywords 1. Biophilia concept from articles and research by a group of authors like Kellert, Heerwagen, Martin, and Wilson. 2. Influence of the elements of nature from 1. databases: MDPI- Sciences Direct – Scopus. 2.Terrapin Bright Green 3. Research Gate 4. Human space report which from 2001 to 2018, data was then analysed using content analysis.

5. Evidence Of Biophilia Implications At The Workplace

Though there is great interest in nature, its application within the fabric of built environment in an urban setting is still low. For instance, there are buildings surrounded by nature, but others are far from nature. Biophilia aims to create places saturated with positivity, emotional experience, and enjoyment of nature [21]. The application faces challenges while addressing the shortcomings found in the contemporary architecture and landscape. Thus, consideration to create new framework to satisfy nature experience within built environment would be necessary [15]. Numerous studies have demonstrated the efficacy of using biophilia to improve space of a workplace [8]. Some may spend at least one-third of time working in an office; e.g. eight or more out of 24 hours that can be

stressful. Sometimes, employees may experience discomfort, which are due to the absence of nature elements [22]. In an urban area, some workplaces may provide a closed-design type of office system with zero opening [23].

What if one's workplace has no window? Thus, the employee may think twice whether to bring in a plant or others biophilia elements to the office. However, the situation would be different if one's office has a window. Regardless of age, gender, specialization and types of space, a window may influence one's thinking, attitude, manner and many more [24].

A study was conducted amongst the employees of various offices to determine the effect of nature on ones' stress level. It is found that by exposing to nature, a person can reduce stress. The study of biophilia also indicates that natural elements may provide high visual tranquility to an observer. In the past, it was believed that having linked to nature would assist to a better survival [25].

Nature at a workplace can improve employee well-being. Besides that, one's job satisfaction may linked to his job performance and production. This suggests a positive relationship is developed between well-being and performance [26]. Well-being is associated with general satisfaction, happiness and quality of life and hence it is a more comprehensive word than satisfaction and comfort [27]. Well-being in the work environment means that people feel happy, satisfied and at the best potential in terms of work productivity, when they do their jobs [28]. The work of Kaplan's (2001) shows that by viewing landscapes from a window can implicate workers state of mind; e.g. less frustrated and more patient and satisfaction and healthier than workers who are not able to access nature visually [29]. Another experiment was conducted in an office at a commercial land use. Result shows that after adding natural elements (e.g. plants and decorating elements as pictures of nature), there is an increase of creativity and well-being [30].

Review of literature indicates that health is one of the outcomes of biophilic within a workplace that can be comprehended through a set of indications. Here, certain biophilia elements are strategised to address issues at workplace [31] by improving the employees' health status [8]. This explains that biophilia at a workplace provides natural well-being through sunlight and plants. Several studies confirm that the elements of biophilia raise productivity, creativity and employee well-being (Bill & Cary, 2015, Browning et al., 2014, Gray, 2018) at a working environment.

NASA claims that a plant can absorb volatile gases resulting from finishing materials of furniture and electrical equipment. These gases can implicate one's health through headache, cough, sore throat and skin irritation [32]. A study by the Washington State University shows that a plant can reduce dust up to 20% based on an experiment that involved 305 workers from six offices [33]. Another result shows that an indoor plant helps reducing the percentage of absence, due to sick leave. This is because plants balance up the air humidity of a room. A low level humidity may lead workers into more susceptible to

viruses, whereas a high level of humidity may cause an eye inflammation and fungi [34]. Moreover, plants can absorb sound waves, which reduce the unnecessary acoustic [9].

The Human Space report (2015) shows that there was 15% increase of well-being index with 6% higher of productivity amongst the employees who were exposed to natural elements. The study had involved 7,600 employees from 16 countries around the world [1]. Another study indicates that humans need to spend 30 minutes or more in a week in a green space to reduce depression [35]. Daylight plays a vital role in providing lighting to the residence of a building. An opening with an appropriate size and techniques can reduce energy and increase one's comfort level. Both nature and sunlight affect an employee's mental health. Sunlight improves mental health in terms

of job satisfaction and reduces anxiety [36]. Sunshine in a work area increases worker satisfaction and productivity [37]. The sunlight affects the human biological clock [38] and getting in sync with the sunlight improves sleep quality for workers and students [39]. The water element helps to relax and reduce tension [40]. Pets in the built environment can implicate a person's physical health, such as lowering blood pressure [41]. The presence of a fish tank may increase one's well-being. Besides that, having an aquarium is less risky than having a dog [42]. People respond to nature as food, water, and shelter provider [29]. On the other hand, the negative attitude towards animals may pose a threat. The biophilia theory explain this phenomenon through biologically development. Biophilia supports human's emotion by being calm and friendly to animal. Uniquely, animals can enhance the social well-being and reduce physiological revenge [43]. The positive effect of nature is not only in the natural elements but also in the sound of nature like water, wind, and animals; humans prefer the sound of nature against anthropogenic sounds such as traffic, recreational noise, and industrial noise [44]. Human beings prefer the sound of nature as a treatment to relieve stress [45] through the design of Virtual jungle and simulating the sounds of nature upshots the human nervous system and increases the feeling of refreshment [46]. The sound of water from the fountain and birds decrease the movement and noise sound [47]. In addition, the aroma of nature like flowers, grass, and soil moisture evokes human feelings [48] and the flower plant increase the sense of calmness and attentiveness [49] and reduce the blood pressure [50].

As for the economic benefits, the study discusses the integration of biophilia at a workplace. Rather, it is an economic investment as the production costs are greater than 112 energy costs at a workplace. Importantly, biophilia namely plants, sunlight and landscapes are not as expensive as the healthy yields [17].

Merging the elements of nature at a workspace can save more than 2555USD per employee per year. More than 90% of the workplace has experiencing loss, due to employee sick leave [17]. The World Health Organization (2008) assumes that by 2020, a cardiovascular disease and mental health disorders would be the main disease world widely. Stress at workplace is a cause of both

mental health disorders and heart disease, but the direct access to nature can reduce it [51].

The impacts of biophilia	
For employees health	<ol style="list-style-type: none"> 1. Improve mental health (J. H.Heerwagen & Hase, 2001,Snell,2015,Craig, A., Torpy, F., Brennan, J. Burchett, 2010, Huynh & Torquati, 2019) 2. improve physical health (Zhang & Wynne, 2012, Stutte, Life, & Kennedy, 2019, Virginia I. Lohr, 2010, Al Horr et al., 2016)
For employees work	1.Increased productivity ,and well-being (Bill & Cary, 2015, Browning et al., 2014, Gray, 2018
For the economic	1.Reducing health care costs (Browning et al., 2015, Stephen R Kellert & Calabrese, 2015).

Table 5.2 Please provide the caption for this table

6. Conclusion

This study has focused on the impacts of biophilia at a workplace, since people spend most of their time in the space. There are many complaints about the effect of workplace on employee’s health. The negative effects were related to the psychological and physical health, which affects production, well-being, and creativity. This review does not provide a comprehensive finding. Yet, the results of the study that focused on the practices and evidences on the impacts of biophilia at workplace are presented for future design consideration. Evidences that are based on several experiments have supported the argument. Furthermore, lack of literature concerning biophilia elements does not diminish the importance of the elements at a workplace. The association of nature has a decisive role to man and well-being. Working is one of the essential factors to improve human mental health.

However, the working environment can improve one’s mental and physical health, if there is an element of nature introduced to the working environment [52]. Employees of all ages and specialties are desired for nature contact, whether direct or indirect [24]. Staff satisfaction is linked to well-being within the working environment, which influence quality of production, performance, and creativity outcomes [53]. The biophilia design patterns help people becoming more flexibly when there is contact between them. Using gradations for a direct biophilia contact with an attempt to simulate workers can be acquired from the repetition of nature’s experiences. This is evidenced in the literature review.

Suggestion for Future Research

There is a definite need to study the effects of other natural elements, which will determine the most appropriate elements for the workplace, so it becomes an integral part of the interior design in a way that fits the culture of the place.

Along with the assessment of its application, which is the part of design in the biophilia patterns.

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