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A Dimension of Biophilia in Urban Design

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Abstract. Erich Fromm coined the terminology of Biophilia in his book *The Heart of Man*. Hence, the concept was interpreted and established by Edward O. Wilson. It was described as human passionate of life and promoting well-being through natural elements. Throughout the years, the researchers show shreds of evidence of the positive benefits of nature interaction into human's life towards sustainable built environments. Biophilic is the terminology concept of design by integrating nature and natural elements, materials, and form in the built environment. The underpinnings theoretical frameworks are human experiences and the need for nature (Biophilia) through design principles and approaches (biophilic design) in the city built environment (urban design). This review paper will focus on the concept of Biophilia and biophilic by these two scholars, including Stephen Kellert and Elizabeth Calabrese that search through upon creating sustainable cities and restorative environment. The results will indicate the empirical evidence and call for further research on Biophilia in urban design.

1. Introduction

The Population Division of UN Department of Economics and Social Affairs (UN DESA) posits the size of the world's urban population are expected to be increased (2018 Revision of World Urbanization Prospects). United Nation's dataset stated currently, 55% of the world's population lives in urban areas and are expected to increase by 68% by 2050. According to UN-Habitat's in 2013 demographic data, the world has become predominantly an urban for the past 40 years. This rapid growth has resulted in imbalance environment in the cities and compensating for high construction in term of development. A considerable amount of literature has been published on elements of structuring the cities. A seminal author Kevin Lynch's *The Image of the City* [1] and to the influential contribution such as Gordon Cullen [2] promoted his townscape visual representation *'Concise of Townscape'*; Bentley et al [3] on seven attributes of responsive environment; Camillo Sitte's [4] *'City Planning According to Artistic Principles'* posits urban design in three words : infrastructure, ecology and urbanism; Frederick Law Olmsted with his mission brought the landscape close to urban population when he designed New York's Central Park in 1857; Jane Jacobs's [5] *'The Death and Life of Great American Cities'* key element in viewing the city as eco-systems, mixed-used developments, bottom-up city planning and local economies; and Jen Gehl [6] creating *'Cities for People'* suggested principles in designing quality of urban spaces in the city. This literature evidence suggests that in urban design, the concept of Biophilia that innate relationship between and nature has been established a way forward before it's current establishment.



1.1. Biophilic Design

Edward O Wilson conceptualized Biophilia as the innate relationship between human and nature, and need to be connected to nature simultaneously. He defined it as '*affinity towards nature*' [7], the people's positive emotions and attraction for certain living spaces and natural environments, '*attraction to everything that is alive*' [8], '*innate tendency to focus on life and lifelike processes*' [9], '*innate emotional affiliation of human beings to another living organism*' [10] and '*inborn affinity human beings have for other forms of life, an affiliation evoked, according to circumstances, by pleasure, or a sense of security, or awe, or even fascination blended with revulsion*' [9]; and '*the inherent human inclination to affiliate with nature*' [11]. A considerable amount of research on the restorative environment has been published and confirmed on human preference for natural rather than built environment [12][13][14] concluded from their evaluative review of empirical studies that devoid of nature may result in discord, which affect the environment, health, and well-being. The undepinning definition and theory of biophilic is the science of creating man-made built environment inspired by nature. The aim is to continue the culture-nature linkages of individual's connection with nature in the environment [15][16][17][18][19][20][21][22][23][24]. Hence, [19] defined Restorative Environmental Design as regenerative design: healing, revitalizing and restorative by restoring the positive impacts of nature on human beings and minimizing the damage of environment. They characterized into two categories as low and high environmental impact design. They posit that people are increasingly isolated from natural systems and processes in the world's current situations [17]. There is a growing body of evidence associated green natural elements that contributed to the positive physical and mental health benefits [25][26]. Hitherto, biophilic design is a response to the human need in which by introducing the natural setting, it connects people with nature and re-establish the connection in the built environment. Kellert [21] categorized Biophilic Design into two: (1) vernacular or place-based design that create place attachment by connecting culture, history, ecology within geographic context, (2) Organic design, natural approach, directly, indirectly and symbolic approach.

To articulate human biological sciences and nature into the built environment, [27] suggested: "14 patterns of Biophilic Design" for biophilic design enhancement. Hitherto, both of Kellert et al [19] and Beatley [28] proposed strategies for sustainable design and to reconnect people with the nature [29].

Table 1. 14 Patterns of biophilic design [27]

CONTEXT	PATTERNS
Nature in Space	1. Visual Connection with Nature 2. Non-Visual Connection with Nature 3. Non-Rhythmic Sensory Stimuli 4. Thermal and Airflow Variability 5. Presence of Water 6. Dynaic and Diffuse Light
Natural Analouques	7. Connection with Diffuse Light 8. Biomorphic Forms and Patterns 9. Material Connection with Nature 10. Coplexity and Order
Nature of The Space	11. Prospect 12. Refuge 13. Mystery 14. Risk/Peril

In order to enhance the health and well-being of the people, the above patterns became the framework for designing the built environment by corroborating with human biological science and nature design. There is a misconception on a biophilic design by people that think it is solely about

introducing vegetation into the built environment [30]. In contrast, fundamental principles and conditions of biophilic design as stated by [11] comprising of five attributes (Figure 2).

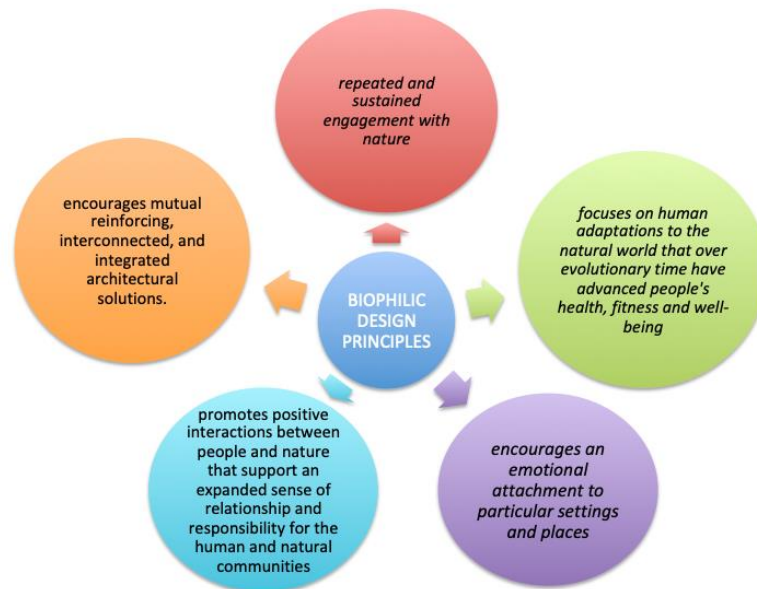


Figure 1. Biophilic design principles adopted from [11]

However,[29] suggested additional 15th patterns to the existing by [11]. In the context of nature in space (see Table 1), they posit that 'visual connection with nature'. This is only recognizes the tangible visual connectivity 'to elements of nature, living systems and natural processes' but not the surrogate visual connectivity. [29] recognize 'virtual connection with nature' as to 'a simulacrum of natural elements, living systems and natural process'. They are referring to key human physiological and psychological evidence [30] as one of the important elements that need to be considered in designing biophilic cities.

One of the most significant discussion by Beatley [31][26][28] and scholars, they suggest thinking on natural qualities holistically into a larger urban environment, besides the buildings. The vision of Biophilic Cities are put forward and Beatley [25][32] launched global Biophilic Cities Network in 2013 and fifteen cities are joining this network. The definition of Biophilic cities are "*cities of abundant nature in close proximity to large numbers of urbanites; biophilic cities are biodiverse cities, that value, protect and actively restore this biodiversity; that value, protect and actively restore this biodiversity; biophilic cities are green and growing cities, organic and natural*" [28]. Biophilic cities are the sustainable and resilient cities that provide contact with nature to foster an awareness of and caring for nature [26][28]. The vision is integrating nature, flora and fauna blended with the built environment into its own unique natural setting and qualities [19][25]. Many cities such as Chicago, Portland, Toronto, New York and Los Angeles have developed and implementing biophilic programs, initiatives and policies [33][26]. The important indicator for the biophilic cities is the people, the community engagement who actively involved in nature around them [Beatley, 2013]. Biophilic is a theory [Downton et al, 2017] and Beatley [33][26] listing the key qualities of physical design on how a biophilic city should be described and defined (Table 3).

KEY QUALITIES	ATTRIBUTES
Biophilic Conditions and Infrastructure	<ul style="list-style-type: none"> - Percentage of the population within a few hundred feet or meters of a park or greenspace; - Percentage of city land area covered by trees or other vegetation; - --Number of green design features (e.g., green rooftops, green walls, rain gardens); - Extent of natural images, shapes, forms employed in architecture and seen in the city; - Extent of flora and fauna (e.g., species) found within the city;
Biophilic Behaviors, Patterns, Practices, Lifestyles	<ul style="list-style-type: none"> - Average portion of the day spent outside; - Visitation rates for city parks; - Percent of trips made by walking; - Extent of membership and participation in local nature clubs and organizations;
Biophilic Attitudes and Knowledge	<ul style="list-style-type: none"> - Percent of residents who express care and concern for nature; - Percent of residents who can identify common species of flora and fauna;
Biophilic Institutions and Governance	<ul style="list-style-type: none"> - Priority given to nature conservation by local government; percent of municipal budget dedicated to biophilic programs; - Existence of design and planning regulations that promote biophilic conditions (e.g., mandatory green rooftop requirement, bird-friendly building design guidelines); - Presence and importance of institutions, from aquaria to natural history museums, that promote education and awareness of nature; - Number/extent of educational programs in local schools aimed at teaching about nature; - Number of nature organizations and clubs of various sorts in the city, from advocacy to social groups.

Figure 2. Dimension of biophilic cities by Beatley [33][26][28]

2. Materials and Methods

The academic literature of biophilic and Biophilia was reviewed to identify the most significant studies. By identifying the theoretical origins and development of the related theories, the paper will develop and refine the definition that is grounded in the literature and addresses conceptual and principles of the study. This paper provides the overview of the field of urban studies in the dimension of Biophilia and biophilic in terms of its underpinning concepts, principles and assumptions, state-of-the-art research and development and future development of the sustainable urban design. As the design strategy, the paper reviews existing biophilic dimension, their strength and weakness are discussed on the extent to which the existing contribution to the goal of sustainable cities and restorative environment.

The Thomson Reuters Web of Science (WoS) and Elsevier's Scopus citation databases were used to identify the literature on Biophilia and biophilic over 55-year period beginning 1970 (after Fromm coined the terminology of Biophilia in 1964) and ending in 2019. Although relatively comprehensive, the database includes article, conference paper, book chapter, book, editorial and other open access publications or otherwise. The search terms 'biophilia' and 'biophilia' yielded 335 results in Scopus and 256 in WoS. Biophilia and/or biophilic is a general subject study area inclusive of social sciences, environmental science, engineering, psychology, agricultural and biological, energy, art and humanities, medicine and others. The most significant publications that related to design and urban design is limited to seminal authors on the subject which are Beatley [34][25][32][33][35][36][33][26][28] and Kellert [11][15][16][17][18][19][20][21][22][23][23]. The data refined 96 documents in Scopus referencing to 'Kellert' and 'Beatley'. Although the concept of Biophilia has a long history in health and psychology studies, coined and established by biologist Edward O Wilson [7] and psychoanalysis Erich Fromm [8]. They are often cited as the origin of Biophilia and Biophilic concept and theory.

3. Results and Discussions

There is an important consociation between biophilic cities and Biophilia in urban development for its sustainability and resilience. Biophilic design will enhance the city's ecology, economy and socio-cultural through the protection of its natural systems and elements in the city. These natural-adaptation design will strengthen the climatic and micro-climatic conditions in the cities like exemplars and precedents by Beatley [33][26][28], an old city of Freiburg, Germany which promoted green infrastructure, energy, waste management and green economy as an initiative of the development. Hence, through green economy, they built community solidary and appreciation towards green development. "Singapore, a city in The Garden" with Landscape Replacement Policy, San Francisco with Sidewalk Garden Permit, Portland on its green streets are some of few cities that adopted the greenery 'biophilic' approach in their new development agenda. The phenomenon gives an impact through a new mechanism aimed for sustainable and restorative environment. The community as an important role in enhancing the biophilic cities must be envisioned as part of initiatives in adopting the biophilic design principles. Dimension of Biophilia in urban design represents a conglomeration of ecological, technical and social components. The concept of sustainable cities should envision Berry's [37] as the kinds of places we want to live, grow old in. The visions for future cities to be compelling and appealing as a place for living.

Debate continues about the best strategies for the management of Sustainable Development Goal 11: Sustainable Cities and Communities. There are a number of scientific studies and the issue has grown in importance in light recent adverse effects created due to detachment from the natural systems in urban development. Biophilic is an approach by motivating cities development to improve the attachment and genius loci of the place in term of sustainability goal. As the current title of biophilic implies in urban design, this paper suggested to look into seminal studies by Tuan [38][39], Topophilia as "*affective bond between people and place or setting*" [38] and "*the human being's affective ties with the material environment*"[38]. He has sought to view into two environmental element 'space' and 'place' through collective human experience, experiential perspective. Hitherto, Tuan's Topophilia has been widely referenced in urban studies and other environmental disciplines in which offered and interpretation of people towards environmental experiences. Urban design draws a connection of people and places, urban form and movement, history and morphology, nature and urban fabric. The three concepts as fundamental in planning and design the city: sense of place, experience of place and place making as a design. Urban design deploying place-making in building and creating the character and identity of these urban development. Sense of place as "*the particular experience of a person in a particular setting*" [40] and spirit of place as "*the combination of characteristics that gives some locations a special feel or personality*" [40], "*Sense is the interaction between person and place...[and]...depends on spatial form and quality, culture, temperament, status, experience and current purpose of the observer*" [1]. Norberg-Shulz [41] defined "*spaces where life occurs are places*" and are the result of relationships between actions, conceptions, and physical attributes.

4. Conclusion

In order to promote a convergent approach between biophilic and urban design, three dimensions have been identified as a framework: ecological feature (natural resources of the places in determining the identity and character), current built environment (infrastructures) and functions of the place. Hence, to achieve these, we selected a case study of Langkawi Island UNESCO Global GeoPark in which was affected in the long history by dramatic changes of territory. With its rapid transition in term of urban revolution, the landscape changed by urban sprawl and affected its coastal territories particularly.

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