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The Impact of Biophilic Design Building on Human Health and Wellbeing of the Physical Environment in Kuala Lumpur

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Abstract: The relationship between human-nature environments deteriorates with building development that does not achieve the green building concept. Implementing patterns of biophilic design into the building, while reducing the overall environmental impact on the natural and built environment. This study aims to classify the patterns of biophilic design and to analyse the impact of psychological health and well-being on humans of the physical environment in the case study area. For this purpose, the mix-method that includes both observation and a questionnaire, the Perceived Restorativeness Scale (PRS), was designed and applied in KLPAC, a biophilic building. The findings revealed a positive correlation between the health and wellbeing of people. It supports the idea that the presence of biophilic patterns has a significant impact on the perceived restorative quality of the environment. The review concludes with a call for more research into the restorative quality of the environment and biophilic design.

Keywords: Biophilic Design, Relationship Human-Nature, Health and Well-being, Perceived Restorativeness Scale

1. Introduction

The interaction of humans and the environment is very important in building development in the city. It is difficult to see new buildings incorporating the concept of biophilic design. Implementing patterns of biophilic design into the building, while reducing the overall environmental impact on the natural and built environment. People's physical and health productivity is approaching the significant sustainability of buildings, which makes buildings more personalized, calm, and focused. In order to achieve a balanced human-nature relationship, the study is looking into understanding and classifying the patterns and impacts of biophilic design in buildings.

The aim of this research is to classify the patterns of biophilic design in the context of nature in space, natural analogues, and the nature of space. In addition, the impact of psychological health and well-being on humans in the case study area will be examined. Previous research has shown that the

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benefits of natural features and systems in people's-built environments satisfy human nature [8]. The Perceived Restorativeness Scale, which includes a psychological theory, was used to assess the effect and perspective of people's environments. The impact of psychological health and well-being on humans will be described based on previous studies and devised by descriptive analysis by distributing survey questions to people around the building. According to previous studies, descriptive analysis aimed at finding and elaborating on which patterns, as well as specific examples of qualities, people perceive as having the potential to be restorative or not, is critical to ensuring an optimal sampling of environments. To ensure compliance results with previous studies, comparison of reliability, correlation of the overall PRS score and correlations between subscales were established. These relations were widely used to conclude that the three major categorizations of patterns of biophilic design have a significant impact on the perceived restorative quality of the environment.

2. Application of Biophilic Design

Biophilia is the innate human instinct to connect with nature and other living beings. Biophilic design is defined as "the deliberate attempt to translate this understanding of the inherent human affinity to affiliate with natural systems and processes in the built environment" and is "an approach to designing the built environment in a way that emphasizes the necessity of maintaining, enhancing, and restoring beneficial experiences of nature." [10]. Basically, biophilic design is through the form of connection with nature (direct, indirect, or symbolic) or through Nature in the Space, Natural Analogues, or Nature of the Space that is then further divided into fourteen (14) patterns [2].

Naturally, this propensity was encoded because it proved to be helpful in increasing the physical and mental quality of human society during the long course of human development. The dependency of people on interaction with nature represents the truth of having evolved in an environment that is essentially natural but not constructed. Nature in Space experiences consist of 7 patterns that are created by direct connections with these natural elements, especially via variety, movement, and multi-sensory interactions. Natural Analogues refer to a design element that is inspired by natural elements that consist of 3 patterns, including ornamentation, natural materials, and biomorphic shapes. Nature of the Space (4 patterns) refers to natural spatial configurations in which we have an innate and learned need to be able to see our fascination with the slightly dangerous or unseen outside our immediate surroundings that provides a trusted element of protection.

3. Materials and Methods

3.1 Research Design

The research strategy made use of biophilic patterns in studies that looked at people's understanding of the environment's restorative qualities and perspectives on the environment. In this research, the method of observation was by observing the patterns of biophilic design of the case study building and the human-nature of the environment. The method by which the questionnaire was constructed involved comparing the data from the respondents to the restorative quality of the environment the respondents based on experience and perception of their surroundings. The purpose of using the method of the questionnaire is to encourage the researcher to find out what's on their mind, what they think, and how they feel about something.

3.2 Perceived Restorativeness Scale

The PRS is a measurement tool that can be used by designers to determine the effect of current and prospective environments on individuals [11]. According to the scale created by [3,4], it is the best-clarified and most readily available scale with its 26 items to characterize human-environment relations. Four subscales are: with calm (Fascination), far from ordinary life (Being away), any time or space restrictions (Extent), and a person's interests and preferences (Compatibility).

4. Results and Discussion

4.1 Results

Tables 1 shows the Biophilic Patterns existing at the specified area, as well as their correlations with other variables:

Table 1: Biophilic Patterns with their attributes

Patterns No.	Patterns	Interrelation	Images	Domain of Application	Attributes
P1	Visual Connection with Nature	P2		Landscape Building	Vegetation Terrain Soil Moderately designed landscape
P2	Non-Visual Connection with Nature	P3 P4		Landscape	Weather Natural Ventilation (operable window) Herbs & flowers Sun patches
P3	Non-Rhythmic Sensory Stimuli	P4		Landscape	Cloud movement Breezes
P4	Thermal & Airflow Variability	P1 P2		Building Landscape	Solar heat gain Shade & shadow Radiant surface material Vegetation with seasonal densification
P5	Presence of Water	P1 P2 P14		Landscape	Waterflow

Table 1: Biophilic Patterns with their attributes (continued)

P6	Dynamic & Diffuse Light	P3 P4		Building	Daylight form multiple angles Direct sunlight Diurnal & Seasonal light
P7	Connection with Natural Systems	P4		Landscape Building	Simulated daylighting systems Hedges & flowering vegetation
P8	Biomorphic Forms & Patterns	P1		Building Landscape	Column mimic of bamboo
P9	Material Connection with Nature	P8		Landscape Building	Bamboo Wall
P12	Refuge	P1 P11		Building Landscape	Space with weather & climate protection, speech & visual privacy
P14	Risk	P1		Building Landscape	Architectural bench concrete

Table 1, as are all tables, should be referenced in the text. Items on the table can be aligned to the cell-center, the right, or the left whenever appropriate. All tables must have a caption that is aligned to the left. Only horizontal lines should be used within a table, to distinguish the column headings from the body of the table, and immediately above and below the table. Tables must be embedded in the text and not supplied separately.

4.2 Perceived Restorativeness Environment Analysis

Descriptive analysis will be compared with a previous study titled "The perceived restorativeness of gardens - Assessing the restorativeness of a mixed built and natural scene type" by [11]. In order to assess the scale's performance, a reliability analysis of each a priori subscale's internal consistency was carried out, which revealed strong consistency in Table 2:

Table 2: Overall mean and standard deviation for each factor

Factor	Mean	Standard Deviation	Reliability Cronbach's, α	Correlation Overall PRS score
Being Away	4.39	1.311	0.91	0.78
Fascination	3.66	0.998	0.81	0.88
Extent	3.53	1.184	0.78	0.77
Compatibility	3.30	1.194	0.92	0.85

Table 2 demonstrates that dependability was generally high, whereas Extent had lower values. A low reliability of 0.78 for Extent, 0.78 and 0.79, was also found in the studies by [11] for both gardens, but it could still be used in this analysis. The reliability Cronbach's for all subscales are reliable in the range given. All subscales were strongly linked with the overall PRS score ($p < 0.05$), as shown in Table 2. Except for Extent, where correlations were 0.77 but still within the validity range, all subscales had correlations ranging from 0.77 to 0.88 (strong positive). Meanwhile, the low value in the [11] research, where the correlations were 0.66 and 0.61 for the gardens in Alnarp and Umeå. These were all significantly correlated ($p < 0.05$), with the exception of Extent, which had weaker relationships with the other subscales (see Table 3).

Table 3: Overall mean and standard deviation for each factor

Item	BA	FA	EX	COMP
BA	1.00	0.85	0.65	0.69
FA	0.85	1.00	0.69	0.81
EX	0.65	0.69	1.00	0.82
COMP	0.69	0.81	0.82	1.00

To summarize, the above analyses and findings indicate that three of the four subscales are highly interrelated, and the fourth, extents, may be a dimension in and of itself. The results of the comparison of reliability Cronbach's, α, Correlation Overall PRS score and Correlations between subscales lead to the conclusion that the three major categorizations of patterns of biophilic design have a significant impact on the perceived restorativeness of the environment. As stated in the introduction, it was vital in this study to conduct close comparisons with past studies concerned with the perception of the physical healing environment because these studies are uncommon.

4.3 Discussions

The research hypothesis is that a case study area respondent's perception of the environment influences the impact of the biophilic patterns present at KLPAC. The study discovered that the respondent's perception of the environment influences the patterns of biophilic present, which could be

useful in analyzing the impact of psychological health and well-being. Previous studies and papers have reviewed the potential impact on human psychological health and well-being.

Visual Connection with Nature (Pattern 1) has a significant impact on attitudes and personal wellbeing [1]. These can be linked to the PRS factor, which is a fascination with open areas as specific features of the surrounding area. Mood is an important aspect of daily life that has a significant impact on feelings of enjoyment, appreciating the present moment, dealing with difficult situations, and the overall quality of life [5].

Non-Visual Connection with Nature, Pattern 2 of biophilic patterns, has been shown to increase mental health and calm. Natural noises have been shown to minimize cognitive fatigue and boost motivation when compared to urban or workplace noise [6]. The songbirds in the case study area had a positive effect on reducing mental fatigue and increasing respondents' motivation.

Pattern 4 of Thermal & Airflow Variability can improve the perception of temporal and spatial pleasure (alliesthesia) of respondents [9]. Respondents like positive constants of sensory variety in their surroundings, such as light, music, and temperature variation, whereas boredom and passivity might result from an environment devoid of sensory stimulation and fluctuation. One of the things that can cause shifts in attention and increased concentration is biomorphic forms and patterns. [7] discovered that view preference can relieve stress. Respondents have a perceptual preference for organic and biomorphic forms based on observations of the attributes of column mimics of bamboo, though the exact reason for this is unknown.

Material Connection with Nature is an element of nature that represents the surrounding environment or geology to create a distinct sense of place. According to the observations, the exterior wall of the building is made of bamboo wood that has been processed with other materials to ensure long durability. This study emphasizes the increased comfort of people in a location.

Pattern 7 in biophilic design is Connection with Natural Systems where this pattern is access to natural systems has a health impact on humans. Increased positive health responses and a shift in environmental effect perception by [10] where the attributes based on Table 1 are simulated daylighting systems and hedges & flowering vegetation.

From the observations that have been made, the combination of the presence of water at KLPAC has promoted better focus and memory restoration. The Presence of Water promotes better results in both self-esteem and mood than activities performed in green surroundings without the presence of water.

Lastly, the impact of the Risk/Peril pattern can result in strong dopamine or pleasure responses. The observation obtained by the bench concrete along the walkway can cause risk, but due to a trusted aspect of safety, this threat is inert and unable to inflict harm. With this impact, it can help to encourage positive experiences that produce a lot of dopamine (brain chemical that influences your mood and feelings of reward and motivation) or pleasure.

5. Conclusion

This paper examined existing studies in biophilic design addressed through environmental design by identifying patterns of biophilic in the multidisciplinary literature relating to the influence of the built environment on respondents. The results of our multi-disciplinary literature review identified, categorized, and analyzed relevant studies that illustrated the impact on the psychological health of biophilic design specific to urban park settings. The findings of this paper might be used to conduct a relevant study in order to develop guidelines for buildings that may be implemented to have an impact on psychological health.

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