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Promoting Therapeutic Recovery Through Biophilic Design Integration in a Leprosy Centre, Dutse, Nigeria

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Abstract
Humans' reliance on nature has reinforced the idea that being in a variety of healthy natural environments is essential to one's physical, psychological, and even moral well-being. This connection has shaped the decisions that people make in order to survive as a species and has led to significant changes in the natural and physical framework of the human world. In Nigeria, for example, there were over 2,000 new cases of leprosy in 2014, with an estimated 1,000 deaths from the disease. Despite this, there are only a few leprosy clinics, which are housed in various tertiary teaching hospitals across the nation. These facilities lack the necessary natural elements integrated into their design, which helps patients feel more connected to their natural surroundings. As such, this research aims to integrate biophilic design in a Leprosy Center, thereby creating a connection between life, nature and the built environment which evolves architecture that can positively contribute to the healing and psychological recovery of leprosy patients. Based on existing literature correlating biophilic design patterns and biological responses, strategies for the integration of biophilic design patterns were developed based on three broad patterns of biophilic design namely; Nature in the space, Natural analogues, and Nature of the space. 'Nature in the space' has seven patterns with fifteen proposed biophilic architectural strategies while 'Natural analogues' and 'Nature in the space' have three patterns with six proposed biophilic architectural strategies each. These strategies provided a design guideline for incorporating nature into a healthcare setting.

Keywords: Therapeutic recovery, Biophilic design, Leprosy center, Design integration, Biophilic Patterns

Introduction

Advancements in medical technology have led to a shift in focus from healing to nature, with more attention given to medical epidemiology rather than an all-inclusive approach to medicine (Hembrom et al., 2024). Professional hospitals now focus on the whole person, focusing on the mind, body, and spirit connection. Hansen's disease, also known as leprosy, affects the nerves, skin, eyes, and nasal mucosa. Treatment for leprosy is not just about treating the patient, but also addressing emotional chaos that affects personal relationships and the patient's ability to live and work. Untreated psychosocial needs can have antagonistic effects on the body's cardiovascular, immune, and endocrine systems, contributing to the decline in health associated with leprosy and its treatment. Untreated psychosocial needs can result in anxiety and emotional distress in patients with leprosy. Biophilia, the theory that humans have a natural linkage with nature, plays a vital role in healthcare delivery by integrating nature into facilities. This approach can address the flaws in the current healthcare system, providing a more stress-free environment for patients, visitors, families, and healthcare professionals (Hembrom et al., 2024).

Aim

The aim of this research is to integrate Biophilic elements in the design of Leprosy Centres to enhance wellbeing.

Objectives:

i. To investigate Biophilic design elements in Leprosy Centre Design.
ii. To explore the application of Biophilic design in the existing Leprosy Centre.

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iii. To integrate Biophilic design patterns in Leprosy Centre of the study area.

Therapeutic recovery:
Mental health recovery is defined as "a deeply personal, unique process of changing one's attitudes, values, feelings, goals, skills and/or roles. It is a way of living a satisfying, hopeful, and contributing life even with limitations caused by the illness (White et al., 2010). Recovery from mental illness and/or substance use disorders is defined as, "a process of change through which individuals improve their health and wellness, live a self- directed life, and strive to reach their full potential (Witkiewitz et al., 2020).

Biophilic design:
Biophilic design enhances people's physical, emotional, cognitive well-being when incorporated into the built environment. The views of nature, plants, animals, and outdoor sceneries have the same psychological impact as being outside in a naturalistic setting. People recover quickly, stress levels are lowered, and creativity is boosted when biophilic design features are included (Lei, 2015). He also outlined 14 biophilic design patterns that explain how to combine each group into a building, as shown Bellow. Which patterns to use are determined by the structure's necessities and the inhabitants' personal preferences; while some individuals desire live environmental aspects, others tend to prefer natural forms and sound. The beauty of biophilic design lies in mixing and matching its various components to build one's unique environment. (Heerwagen, 2009).
Nature in the Space

i. Visual Connection with Nature
ii. Non-Visual Connection with Nature
iii. Non-Rhythmic Sensory Stimuli
iv. Thermal & Airflow Variability
v. Presence of Water
vi. Dynamic & Diffuse Light
vii. Connection with Natural Systems

Natural Analogues

i. Biomorphic Forms & Patterns
ii. Material Connection with Nature
iii. Complexity & Order Nature

Nature of Space

i. Prospect
ii. Refuge
iii. Mystery
iv. Risk/Peril

For this study, these 14 patterns were simplified into three categories: Daylighting, Living Architecture, and Ventilation.

Daylighting:
A biophilic approach to daylighting, combined with artificial light, promotes the transition from reduced energy consumption to net-positive objectives and enhances the health and well-being of occupants and the planet (Heerwagen, 2009). Natural light-accessible settings improve human well-being, productivity, and engagement. Strategically positioning windows to admit daylight enhances the connection between humans and outdoor settings. Altering daylight patterns serves two purposes: providing eye- stimulating lighting options and keeping users' attention pleasant (Heerwagen, 2009). The objective should not be just to establish uniform lighting across a room, but to adapt to the unique needs of different environments as shown in Figure 1 and Figure 2.

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Figure 1: Providing natural lighting for built environment

Figure 2: Providing natural lighting for users in different Source: (Heerwagen, 2009).

Source: (Heerwagen, 2009).

Living architecture

The goal of linking living architectural patterns to natural features is targeted at increasing both awareness of biophilic designs and, ideally, the environmental sustainability in which these properties exist. Working with living architecture might be as easy as engaging in daily activities while looking at nature (Wilson, 2008).On the other hand, achieving it might also be a more complicated system integration, where architects have to demonstrate to the users of the spaces the link between the occupant behavior and the capacity of rainwater infrastructure, Figure 3, are examples of the standard features of living architecture (Tailor, 2021). The most powerful experiences are created through direct connections with these natural components, especially via variety, mobility, and multi-sensory interactions.

Figure 3: The immediate presence of nature within the built environment

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Source: (Heerwagen, 2009).

Ventilation

The comfort of building occupants and employee productivity both benefit from natural ventilation. Adjustments in the air flow, humidity, temperature, and barometric pressure are likely to improve the impression of natural ventilation in buildings (Grzegorzewska & Kirschke, 2021). These circumstances may be created via simple techniques like moveable windows or more complicated technical and engineering solutions. Everyone's senses are enhanced by being able to access windows and being guaranteed fresh air in the space (Nitu et al., 2022). In this regard, the occupants of a building will rush to open the windows as the first act during a bright sunny day and after being confined indoors for lengthy periods during winter. This explains the extent to which the location of windows and natural ventilation systems impacts the circulation of air to result in a cooler interior atmosphere and lower total energy expenditures.

Leprosy:

Hansen's disease (also known as leprosy) is an infection caused by bacteria called Mycobacterium leprae. These bacteria grow very slowly and it may take up to 20 years to develop signs of the infection (Gilmore et al., 2023). The disease can affect the nerves, skin, eyes, and lining of the nose (nasal mucosa). The bacteria attack the nerves, which can become swollen under the skin. This can cause the affected areas to lose the ability to sense touch and pain, which can lead to injuries, like cuts and burns. Usually, the affected skin changes color and either becomes:

i.lighter or darker, often dry or flaky, with loss of feeling, or
ii.reddish due to inflammation of the skin.

If left untreated, the nerve damage can result in paralysis of hands and feet. In very advanced cases, the person may have multiple injuries due to lack of sensation, and eventually the body may reabsorb the affected digits over time, resulting in the apparent loss of toes and fingers. Corneal ulcers and blindness can also occur if facial nerves are affected. Other signs of advanced Hansen's disease may include loss of eyebrows and saddle-nose deformity resulting from damage to the nasal septum (Florian et al., 2023).

Methodology

For the purpose of this research I will adopt a strategy and empirical techniques and apply it in order to appraise and explore ways in which biophilic design patterns will be integrated in the design & construction of the Leprosy Center through a case study approach. In this research, case studies will be conducted using a qualitative approach.
The case studies selected for this study would be sampled purposely to at least possess two among the following criteria.

i. As a leprosy center with adequate coverage in scope and facilities required tooperate as a standard comprehensive Leprosy center.
ii. As a facility that possesses some biophilic design patterns.
iii. As a facility that represents a certain region, so as to look at factorsinvolving regional and technological diversities.

Results

The major of findings made from the cases studied are summarized in Table 4. below.

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Results

The major of findings made from the cases studied are summarized in Table 4. below.

PATTERNS OF BIOPHILIC DESIGN		MAJOR FINDINDS
Nature In The Space Patterns		
1.	Visual connection with nature.	All the cases studied were spatially planned to have visual connection with the existing varied landscaping and vegetation. Only the international cases studied have provision of healing gardens designed for the patients.
2.	Non-visual connection with nature.	Local cases studied strategically placed their parking facilities away from the facilities to reduce urban sound,
3.	Non-rhythmic sensory stimuli.	The local cases studied generally have poor incorporation of natural colours in their design. The international cases studied have their interior spaces painted with warm shades of colours and wooden finishes which further enhances the connection of those facilities with their exterior environment
4.	Thermal airflow & variability.	All the cases studied used passive means of lighting and ventilation by providing cross ventilation through the useof large operable windows and some cases studied employed the use of courtyard system.
5.	Presence of water	The use of water as a landscape element was adopted in the international case studies.
6.	Dynamic & diffuse light.	The local cases studied use verandas and covered walkways to direct solar radiations within the interiors, while the international cases studied employed large
7.	Connection with natural system	The local cases studied has little if not absence of any connection with natural system around their sites, as against the international cases which were designed to blend with their immediate environs?
Nature Of The Space Patterns		
8.	Biomorphic forms & patterns	All the cases studied do not incorporate botanical motifs within their interior. Moreover, the local cases studied have zero use of organic shapes, while their international counterparts have little reflection of the shapes.

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9.	Material connection withnature	
The materials used in construction of the local case studies from fabric to finishes were mostly refined materials (mostly concrete, glass and aluminium) which requires great energy in their production, as against most of the international case studies that employed the use of sustainable building materials (like wood and locally quarried limestone) which are low impact on theenvironment and are organic in nature.		
10.	Complexity & Order	Only Frauenshuh cancer center and Helen F Graham cancer employs curve forms in their design, while the building forms of the rest were generally rectilinear with perfect straight lines and sharp edges.
	Natural Analogues Patterns	
11.	Prospect	The fenestration and the interior corridors of tall the cases studied were arranged in such a way that they have a direct visual access to the surrounding landscape elements
12.	Refuge	The Architectural styles of the cases studied are all modern style as against vernacular style which is one of
13.	Mystery	All the cases studied have low maintenance gardens. Most of international cases use curve design toavoid sharp corner edges within their interior spaces

Source: (Researcher, 2024).

Conclusion

Biophilic design is the connection between nature and humans, benefiting people by promoting feelings of ease, aesthetic appreciation, and interpersonal relationships. Applying biophilic design to healthcare settings can facilitate patients' recovery from various illnesses. However, it's more than just adding plants, trees, or green walls; it's a comprehensive strategy requiring fresh perspectives and creative solutions to incorporate nature into medical settings, involving a holistic approach to integrate natural elements, light, and materials to create a calming and restorative environment, potentially reducing stress and anxiety, improving mood and cognitive function, and enhancing patient satisfaction and staff well-being.

Recommendations

1. Hot and dry countries like Nigeria can greatly benefit from biophilic design, particularly in healthcare settings such as leprosy centers, where courtyards can be effectively utilized to incorporate natural elements.
2. To achieve efficient biophilic design, it's essential to compile a list of suitable plants considering the local environment and budget constraints.
3. Furthermore, conducting in-depth research is crucial to determine the most effective environmental solutions for hospital settings. Additionally, organizing republican competitions can foster innovative concepts and

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solutions that integrate biophilic design principles, tailored to Nigeria's unique societal and environmental context, ultimately driving creative and sustainable solutions for healthcare architecture.

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