

جامعة الإسكندرية
ALEXANDRIA
UNIVERSITY



Faculty of Fine Arts
Décor Department

Integrating Bio-Architectural Approaches into Interior Architecture of Students' Accommodations

Submitted By:

Nada Hossam El Din Mohamed Kamel

Specialization: Interior Architecture
Faculty of Fine Arts - Alexandria University

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Supervisors

Prof.

Dr. Nagwan Abd El- kader Shehata

Professor of Interior architecture
Décor Department

Vice Dean for Education and Students Affairs
Faculty of Fine Arts, Alexandria University

Dr. Eman Ahmed Al-Sayed Al-Akaby

Lecturer of Interior architecture
Décor Department

Faculty of Fine Arts, Alexandria University

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Thesis Summary

Nature has strategies and patterns that have been tested for over 3.8 billion years, strategies that enable it to adapt and survive. Natural selection proved the wisdom of these strategies, which is what sets them critically apart from many man-made systems. The study of these strategies provides more sustainable ideas and solutions to human challenges. Accordingly, "Bio-Architecture" can be the key to translating natural strategies and systems and integrating nature into engineering fields and architectural designs.

It was not only the efficiency and success of nature's strategies that prompted the interest of today's architects and designers to study and draw inspiration from nature, but also that sustainability's focus on "automated" solutions for energy efficiency led to the separation of humans from buildings and altered the primary design goal - to provide and maintain a suitable indoor environment for the human. So came the need for ideas and designs that emphasize the complementary relationship and harmony between nature, mankind and the built environment. And Bioarchitecture and its approaches were the answers to achieve that harmony.

The research examined the possibility of designing the interior architecture of students' accommodation from the perspective of Bioarchitecture, as students' accommodations constitute vital periods of students' lives. It is not just a place for students to live for a few years near their places of study, but rather a place where they live, study and communicate.

The research consists of five chapters, according to the following sequence:

Chapter One: Evolution of the concept of sustainability and its impact on human well-being

Increasing concerns about energy affordability, unsteady global fuel sources, and greenhouse gas emissions have raised interest in unlocking the potential of energy-efficient buildings as an energy resource. To achieve that, green building strategies have been developed to transform traditional buildings into green buildings through performance targets, assessment methods, and "ultra-efficient" building technologies for HVAC and lighting. But it has resulted in the difficulty of balancing comfort and efficiency choices as 'robotic' buildings become more disconnected from the user.

Accordingly, sustainability approaches developed for new ones, which mainly include in their objectives the provision and maintenance of a suitable interior environment for users. Hence Regenerative architecture, whose goal is to design and operate renewable buildings to reflect damage and achieve a positive impact on the environment. They were inspired and simulated by nature and ecosystem strategies to achieve this balance.

Based on the fact that the human aspect is an integral part of today's architecture, this chapter deals with human well-being and health through the perspective of interior architecture, as they are an essential component of contemporary sustainability approaches. Human health and comfort do not depend merely on objective well-being, while it is an essential part of achieving absolute human well-being, but subjective well-being must be achieved with it to ensure that.

Parameters of interior environment quality, such as air quality, thermal, visual and acoustic comfort, are fundamental to achieving objective human well-being, and to contribute to the subjective well being of the occupant of the interior space, there are also a number of aspects that may affect his psychological behavior; Identity, privacy, design flexibility, design aesthetics ... This chapter deals with design considerations that contribute to taking into account these aspects.

The chapter also has referenced to "phenomenology", as it is strongly linked with the approaches of architecture that work to confirm this link between humans, the built environment and nature. It provides a conceptual framework that allows dealing with the interrelationships between technology, humans and the built environment in a possible comprehensive manner. It does not seek to exclude technology but rather to integrate it into the human world in a way that does not dominate other areas of human activity. Phenomenology also avoids the linear sequential view that a sustainable future can only be reached through the implementation of a series of alternative technologies and scientific innovations to achieve environmental sustainability. Instead, it attempts to uncover the deep spirit or underlying structures for environmental designers to take into account when making decisions about implementing biomimicry in the Built environment.

Finally, the chapter deals with the methods of "post-occupancy evaluation". If our goals are sustainable buildings that ensure harmony between the human being and the built environment in a way that achieves and ensures his comfort, well-being and productivity, then the continuous performance of those buildings must be monitored and the occupant's reaction and evaluation of the building must be analyzed in order to ensure the optimum performance for sustainable and renewable designs, in harmony with people.

Chapter Two: Bio Architecture, Between Concept and approaches"

Living species have evolved over millions of years and have adapted to continuous changes over time. Ecosystems are resilient, adaptive and have the ability to heal, and most importantly, they create favorable conditions for life. Consequently, humans have a wide range of examples and strategies that can be relied upon to solve the design challenges facing society, which organisms may have already addressed efficiently, regarding energy and material.

And if the living world were to give designers insights into architectural design, buildings could be thought of as parts of an ecosystem. In the same way as an ecosystem, these buildings can be designed to: produce energy and nutrients (materials); Fresh air and water; The use and transfer of waste in a complex, adaptive and cyclical system. Besides ensuring a positive impact on human health, comfort and well-being.

Bio-inspiration is the use of life and nature as a source of inspiration, especially in solving problems. The term " Bio-Inspired Design" is often used as a generic term that encompasses all of the different design approaches inspired by life, nature and living things. Inspiration from nature is nothing new, in science, art or design. From early studies of Leonardo da Vinci, to discussions of the Fibonacci series and the golden ratio in nature, arts and architecture have had a long history of inspiration in nature.

The chapter focused on Bioarchitecture, as it combines architectural design and biology, it expresses a strong alliance between the architect and nature, as well, and the awareness that we all share a much greater dimension. "It integrates environment-inspired strategies into every part of the design, at all scales from the start. It is not just a copy of natural forms; it is not just a translation of natural principles on a larger scale. Rather, Bioarchitecture is a multi-scale approach to integrate nature's solutions and opportunities into solving global human challenges. It is a clear approach to the theory underlying overall design, the careful selection of materials for construction, the conditioning of principles, and the coherence of parts into a whole.

The chapter addressed the different approaches of Bioarchitecture in detail- whose concepts may often overlap, including Bionics, Biomimicry, Biotechnology, Biophilia and finally Biourbanism.

And with the tremendous development of design techniques, programs and digital fabrication, they have become an important means that help the designers to come up with their ideas, to produce interior architecture with new concepts, inspired by nature and free from traditional design restrictions. It helped elevate the simulation of nature to a new level, allowing designers to imitate more complex models of nature. Recent developments in the field of evolutionary computation offer a radically different approach. Hence, Biodigital architecture came, as it is considered a response to the requirements of the era, as the guarantee of re-generativity depends on the biological aspect of Biodigital architecture, which emphasizes the preservation of environment and its use as a source of architectural inspiration and other classic concepts of a conservative character, but in the guise of responding to the requirements of the age represented in the use of both digital technologies and biological technologies.

Chapter Three: Contributions of Bio-Architecture to the Architecture and Interior Architecture"

Bio-architecture ensures the provision of solutions learned from nature for more favorable, healthy, less energy-consuming environments, and other strategies that nature has succeeded in achieving over millions of years. The solutions produced by bio-architecture varied between:

(1) Bio- inspired materials:

Which provides a wide range of applications in architecture and building design, most of which contribute to reducing the negative environmental impacts of buildings in addition to saving energy resources and other positive benefits for human health, comfort and well-being. These materials varied between:

- Bio-Inspired Materials for Natural Recycling
- Bio-Inspired Materials Imitating Organisms' Micro/Macrostructure or Patterns
- Bio-Inspired Materials Imitating Organisms' Function
- Bio-Inspired Materials Imitating Biological Processes

This chapter mentioned the use of natural materials such as mycelium and melanin as potential biomaterials, as well.

(2) Bio-techniques that mimic the behavior of natural systems and ecosystems:

With the study of nature, and its strategies, techniques inspired by nature's approaches were developed, regarding:

- Adaptive behavior
- Energy production
- Reducing energy consumption
- Reducing pollution
- Improving health and well-being.
- Thermoregulation.

Finally, the chapter addressed the application of bio -inspiration to the creation of interior design accessories, in the way that combine sustainability with a distinctive aesthetic form.

Chapter Four: "Design guidelines for Students' accommodations "

Given the important and distinct role that universities have in the comprehensive development of social, economic, cultural aspects, they are one of the most important basic sources for the development of society in various areas of life. It aims to raise the educational and cultural level in the country through the quality of education and the provision of services in those universities. One of the most important of these services is students' accommodation, as it is an important part of the university that provides students with a place to stay during their studies there, because starting higher education indicates a new stage in the student's life.

Globally, students' accommodation is being built with the aim of facilitating and supporting this transitional phase in students' lives. Otherwise, students far from their homes will find it extremely difficult to attend classes and continue their studies. Therefore, this study aimed to contribute to deepening scientific knowledge about students' accommodation 's interior architecture, which would allow improving the service provided from higher education institutions and also the conditions of residence provided to the students, allowing greater satisfaction on the part of students, which could be translated into higher academic performance.

Hence, the role of architecture appears in order to provide a built environment that achieves safety, health, and psychological and physiological comfort for the student and helps to create social relations among them, in addition to integrating the latest technological developments into students' accommodation.

Accordingly, the chapter started with an overview of the development of students' accommodation through years, then the basic concepts and vocabulary of students'

accommodation, in addition to the different types of them. And the chapter dealt with the planning principles and design guidelines for students' accommodation's interior architecture.

Whereas new sustainability approaches have led to a number of concepts and approaches in the design of buildings, as a process to ensure adequate conditions for human comfort- by looking at the disciplines of human physiology, climatology and building physics- and because students' accommodation's environment has an impact on the health and well-being of students, the chapter addresses the importance of integrating ecological design and Bioarchitecture into the interior architecture of university environments, including biophilic design patterns as a solution to students' physical and psychological comfort.

Finally, how to achieve communication between the students' accommodation environments and the surrounding nature – whether in the renovation process or design process.

Chapter Five: “Integrating bio-architectural approaches into the interior architecture of students' accommodation of Alexandria University in “Ezbet Saad” (Male students).

The chapter started with an introduction to the case study, which is integrating bio-architectural approaches into the interior architecture of students' accommodation of Alexandria University in “Ezbet Saad”, the purpose of the design, and an overview of the students' accommodation (Smouha) of Alexandria University.

Then the chapter dealt with the application following the next sequence:

1. Redesigning the floorplan of the Ground and first floors of the building.
2. Creating 3D design for selected spaces of the building.
3. Design of an outdoor Pavilion.

Finally, analyzing the design submitted by the researcher, through the perspective of objective and subjective well-being, to ensure the health, comfort and well-being of students living in this accommodation.