



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 9, September 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118



9940 572 462



6381 907 438



ijirset@gmail.com



www.ijirset.com

Biomimicry as a Catalyst to Improve the Behaviour of Building Performance

Eng. Enas Zien El-Abedin¹, Assoc. Prof. Shimaa Ali², Assoc. Prof. Ahmed Saleh³,
Prof. Mahmoud Fouad⁴

U.G. Student of Architecture Engineering and Urban Planning, Faculty of Engineering, Suez Canal University, Egypt¹

Associate Professor of Architecture and Urban Planning, Faculty of Engineering, Suez Canal University, Egypt²

Associate Professor of Architecture and Urban Planning, Faculty of Engineering, Suez Canal University, Egypt³

Professor of Regional and Urban Planning, Dean of Faculty of Engineering, Suez Canal University, Egypt⁴

ABSTRACT: Natural organisms with passive responsive capacities offer inspiration for the way sustainable bio-openings design can move away from the excessive reliance on complex and expensive mechanical control over internal building environments. The development of bio-openings integration of morphic systems can facilitate the creation of climatically adaptive architectures with materially embedded responsiveness enhancing occupant comfort, and well-being, and providing a spectacular visual expression and impact. Two approaches to biomimicry, need morphogenesis simulation. This paper will analyze the relationship between nature and openings design, and the effect of bio-opening skin using an indirect approach.

KEYWORDS: Biomimicry, Morphology, Openings, building skin, Environmental adaptation, Bio-design Creativity, Energy efficiency, building performance.

I. INTRODUCTION

In 1998, Banyus and Schmitt have founded biomimicry guides, which helped inspire nature then the researchers referred to the principles of treating nature and using it in design, which showed that form is an obvious feature of nature [2], just imitating it misses the objective. Biomimicry is an emerging field that argues for the need to imitate nature behaviors to ensure a more sustainable future. The solutions in bio-design are special because they have been tested in their behavior and response before by nature in the same environment. Biomimicry isn't reproducing systems only but also it is a simple and perfect solution for sustainable design [9]. In the field of constructed sustainable development, a new vocabulary and lexicon are developing that suggests a maturing approach to building, shifting from better waste management to advanced thought of biodiversity management in bio-design to build new forms of human life. This trend of biomimetics supports learning from nature as models for building design to save nature and preserve the human future.

Bio-morphogenesis is an advanced Simulation in openings for designing complex material systems and analyzing their behavior over extended periods. The requirements differ from one place to another in light, ventilation, and comfort. More sophisticated simulations like the flow of air, heat through spaces, and materials are standard modules in engineering software. As shown in the figure below Morph concerns itself with intense differentiation of bio-openings material, systems, and energetic interventions that are evolved from 1) Their specific behavioral tendencies in a given environment; 2) Their mutual feedback relationship between nature and openings through architects supports this relation; 3) Passive modulation strategies that are sustainable for bio-openings design and 4) Speculation on the resultant relationship between spatial and social arrangements, patterns, and potentials.

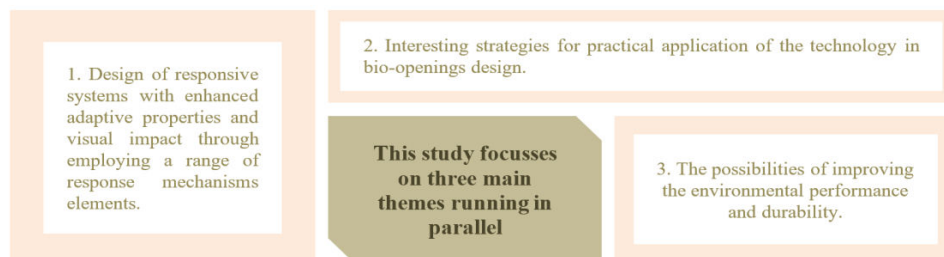


Fig. 1. Shows a focus on three main themes running in parallel throughout this study. Created by the author

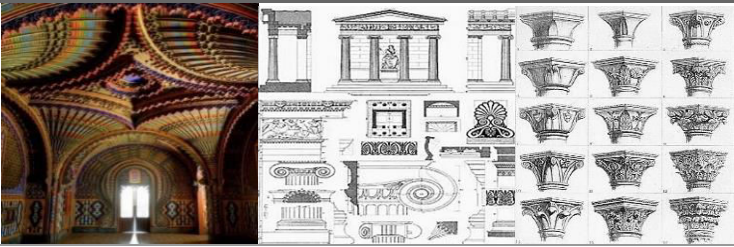
Natural organisms with passive responsive capacities offer inspiration for the way sustainable bio-openings design can move away from the excessive reliance on complex and expensive mechanical control over internal building environments. The development of bio-openings integration of morphic systems can facilitate the creation of climatically adaptive architectures with materially embedded responsiveness enhancing occupant comfort, and well-being, and providing a spectacular visual expression and impact. Two approaches to biomimicry, need morphogenesis simulation.

The study looks into achieving a balanced, stress-free workplace. The Bio-design in architecture trends is biomimicry concentrate on getting daylighting, thermal comfort, sustainable building materials, and natural environment incorporation that can mitigate these impacts according to what your senses receive. Analyzed case studies are a very important phase in explaining the work of bio-openings in buildings' skin to feel the effects of it in our life by using it and controlling openings in buildings' skin. The study assumed bio-indirect approach can support architecture openings design with many properties in form, function, and environmental behavior. The built environment becomes a vital component in the integration with and regeneration of natural behavior. This paper will analyze the relationship between nature and openings design, and the effect of bio-opening skin using an indirect approach.

II. LITERATURE SURVEY

Does natural behavior the best for architecture? The answer to the question (nature does it better?) includes stages through the historical development of using biomimicry in architecture design, Technology intervention, and the appearance of new biomimicry potentials that as shown in the next paragraph. Architects have always had the desire to bond unconsciously with nature, which is part of our heritage (see table 1) and plays a major role in human psychology. There was more than just a connection to our natural environment. Human solving problems has been influenced by natural solutions since the Stone Age, but it was only recently formalized as a method of inquiry [10].

Table 1: Explains a few examples from the past. Source: researcher based on references

period	describe
A. Scholars of Ancient Greece pointed to living phenomena as providing perfect, models of the harmonious symmetry between the components of a design, associated with the classical standard of beauty as shown in figure 2. Central principles of aesthetics were natural, had features of human organisms, and tended to be the best architectural works. [7]	 <p>Fig. 2. Greek Architects and designers have looked to biology just to imitate the forms of plants and animals. Source: http://www.sandie-go-zoo.org/biomimicry</p>

<p>B. Islamic architecture has a special element from nature such as minarets and domes (see Figure 3) which give the strength of architecture and continuation. [7]</p>	 <p>Fig. 3. elements of art from biomimicry and development to Islamic elements (Domes, Minarets). Source: http://www.sandie-gozoo.org/biomimicry</p>
<p>C. Classical Architecture. Since the advent of science in the early nineteenth century, architects including Joseph Paxton and Frank Lloyd Wright have turned to nature for motivation. They also attempted not only to mimic organisms or phenomena types (see figures 4, 5), but also to find design methods similar to the behavior and evolution in nature. [8]</p>	<div style="display: flex; justify-content: space-around;"> <div data-bbox="632 656 1023 992">  <p>Fig. 4. in England, Joseph Paxton designs the crystal palace; its construction was based on the study of water lily leaves. The key was that the radiating ribs connecting with flexible cross-ribs produced rigidity. Source: www.biomimicryinstitute.org</p> </div> <div data-bbox="1038 656 1412 992">  <p>Fig. 5. Frank Lloyd Wright integrated organic architecture into his projects, but in Falling Water, it has been a part of nature at the same time, it did not have nature elements or behavior from it as an overwhelming feature. Source: www.biomimicryinstitute.org</p> </div> </div>
<p>D. Modern Architecture. Biomimetic architecture does not reflect an impoverishment of human meaning: At least one critic of biomimicry has contended that biomimetic architecture which references animal or plant forms reflects (see figure 6) [6]. The biophilia hypothesis suggests all humans have an innate, positive emotional response to architectural form that mimics any naturally occurring geometries embodied by plants and animals. [12]</p> <p>- Gaudi's Sagrada Familia as shown in figure 7, mirrors branching trees and the scallop-shaped motifs enamor many people [1]. The frame technology, called STICK.S, emulates the hollow cylinder design to provide maximum strength with minimum material. STICK.S exhibits 35 percent less base shear under lateral loads and uses a remarkably 30 percent less material compared to conventional building frames. [4]</p>	<div style="display: flex; justify-content: space-around;"> <div data-bbox="632 1003 1023 1695">  <p>Fig. 6. architecture design of Casa Batlló from bones shape and skin of crowd's organism, Antoni Gaudi, Barcelona, Spain. Something about Gaudi's work makes me believe in magic. Source: Kaplinsky 2006</p> </div> <div data-bbox="1038 1003 1412 1695">  <p>Fig. 7. architectural design of Gaudi's Sagrada Familia from trees in nature. Source: Wilson 1984</p> </div> </div>

Nature has theories or principles we should respect them when architects design any part of a building that inspiration by nature. Bio-design is summarized in the choice to inspire nature as a model, measuring, or monitor. To think of nature adaptation there are two main approaches for applying Biomimicry in design as follows: 1) Direct approach (design to biology) requires designers to identify problems and biologists to match these to organisms that have solved similar issues; 2) Indirect approach (biology to design) requires having relevant biological or ecological knowledge and research rather than a design problem [3]. As scientists explain, the indirect one has the best results in architecture to solve problems because This type of process helps us to construct systems we couldn't even conceive of and lead to produce variable ways of sustainable bio-design that help to solve many problems in different cases both according to his condition so this study adopts this approach. [11]

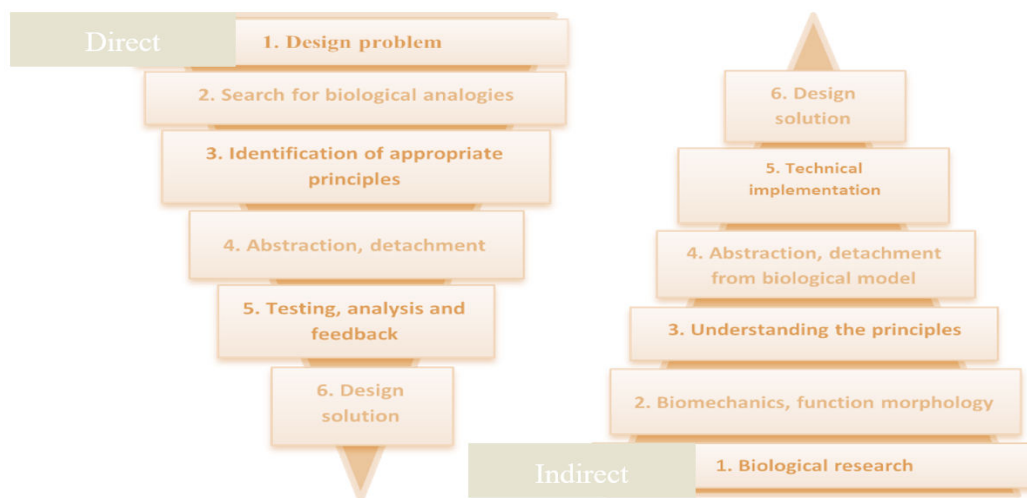


Fig. 8. Shows Bio-design Approach. Source: The researcher based on Helms, 2009

The levels of Biomimicry that using to solve problems of the building are organism, behavior, and ecosystem levels [5]. The behavior and ecosystem levels have a deeper understanding of how the organism treats with surrounding to still be alive [13]. So, this study adopts the behavior level.

III. METHODOLOGY

The research studies the cases through three stages as illustrated in figure 9: 1) The design decisions that architects are taking to apply biomimicry in bio-opening skin; 2) Analysis of the indirect approach criteria in practical cases, and 3) illustrating the impact of Applying biomimicry in bio-opening skin as shown below.

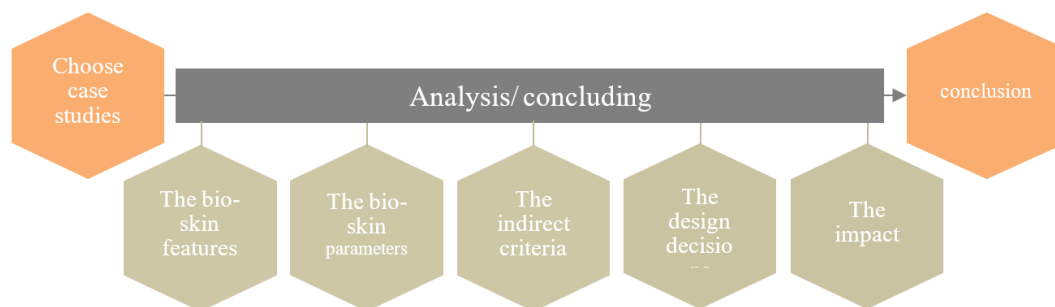


Fig. 9. Shows the stages of methodology in this study. Created by the author

IV. CHOOSING THE ANALYZED CASE STUDIES

To appear the importance of biomimicry to design openings and their effect on building performance, need to show the criteria of openings design that reach the best result for sustainable buildings. This part analysis important case studies that have bio-opening skins as shown in the next. This part explains the reasons to choose the cases as follows (see figure 10): 1) The variety between regional and international case studies; 2) The variety between built and unbuilt case studies; 3) The projects designed from 2005 to 2020 for illustrating the development of the ideas and experience; 4) The availability of scientific material; 5) The different climate zones, and 6) The different environmental solutions and organisms. The study isn't found any locality cases so architects need to support these types of ideas in Egypt for our environment and a better future especially, in this period of project development and the current country's trends of sustainability.

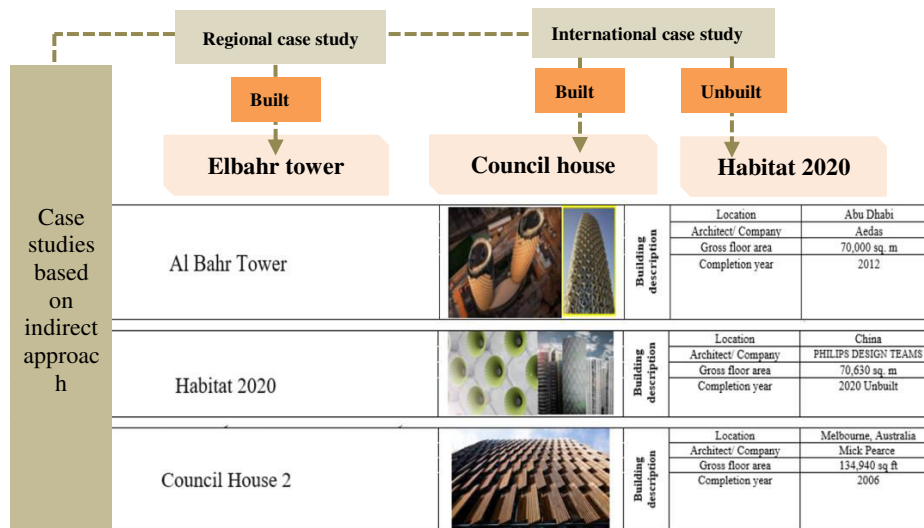


Fig. 10. Showing case studies that are chosen for analysis in the study. Created by the author

V. ANALYSIS RESULTS

In all of these proposals of architectural building, the buildings are Featured with different points of architectural elements like openings structure, function, and forms. It is considered a technological natural solution to solve building complex problems that are Divergent in more than one direction that serves the environment. The system behavior needed to be taken into account during the design process. This enables a computational evolution in which manipulation in the element setup, component assemblies, and the overall system is related to environmental modulations. These environmental modulation steps need to pass on a strategy that is shown in figure 11.

5.1. The Concluded Design Process of Bio-openingsSkin

The building's skin can be considered quite literally as a complex membrane capable of energy, material, and information exchanges. Emulating nature's strategies to innovate design for building skin could be successful. In this section, figure 11 shows the stages to make bio-skin systems for the buildings and the features of the building skins in the case studies, which were created.

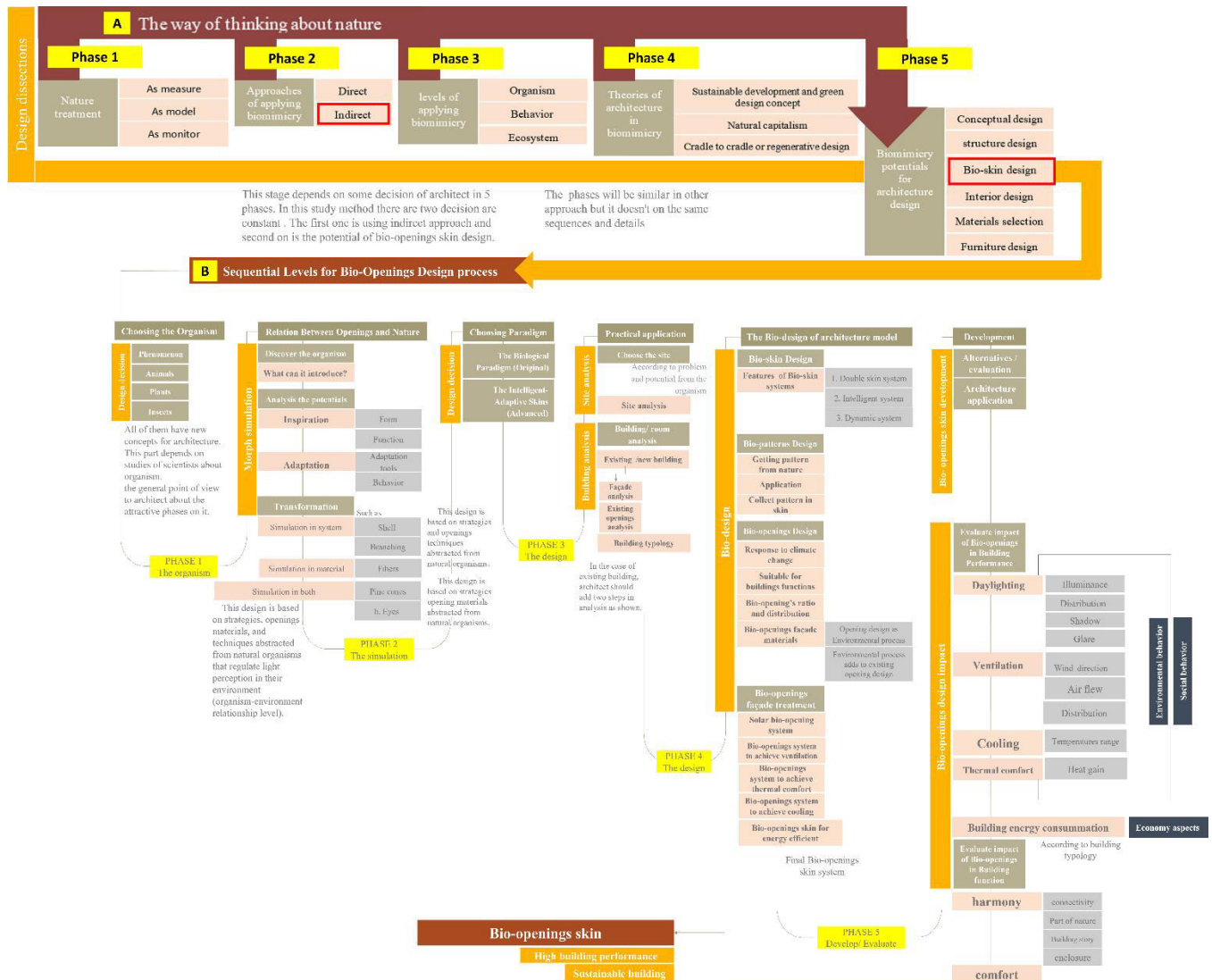


Fig.11. The Concluded biomimicry sustainable design process of Bio-openingsSkin based on indirect approach. Source: Created by the author

5.2. Bio-opening skin features:

The important task of bio-design is to provide bio-opening skin design opportunities that adapt to surrounding environment conditions like the case studies as illustrated in figure 12. The bio-openings in building skins are controlling environmental processes (ventilation- lighting- thermal comfort- energy). This approach concerns itself with intense differentiation of bio-openings study as systems. In addition, energetic interventions evolved from 1) Their specific behavioral tendencies in a given environment; 2) The mutual relationship between nature and openings that is supported by architects, and 3) The passive modulation strategies that are sustainable for bio- openings design. The harmony between architecture and nature was, is, and will continue to grow richer as we gain a deeper understanding of the world around us and how its systems might adopt in different scales and applications.

The Bio- openings skins features		
Controlling	Supporting	Having
Solar radiation	Inspired nature	Module and pattern
lighting	Adaptive	Multi layers
Breathing system	response	Dynamic system
Thermal comfort	smart	Intelligent treating
energy	Support energy efficiency	Using renewable energy
	Part of nature/ connectivity	Variety in design
	Quality of Internal environment	
	Variety in types	
	technology	

Fig. 12. Illustrates Bio-openings skin features when Applying biomimicry in bio-openings skin. Created by the author

The greatest way to create places is to imagine them as living things that are completely reliant on their natural environment for all of their water and energy needs. Especially when the profit is obvious, sustainable, and long-term, the architectural and interior design professions are sufficiently united to enable the quick dissemination of innovative ideas and new technology from the outside to the inside to achieve adaptation.

5.3. Bio-opening skin parameters:

The study noticed that the system behavior needed to be taken into account during the design process. This enables a computational evolution in which manipulation in the element setup, component assemblies, and the overall system is related to environmental modulations. From the study, as shown in table 2, the environmental modulation phases need to pass on a strategy that began with knowing the design considerations and performance parameters of bio-openings systems.

Table 2: Parameters and design considerations of Bio-openings systems. Created by author

Parameters	Independent Variables	Baseline
<ul style="list-style-type: none"> - Daylighting and Performance <ul style="list-style-type: none"> • Illuminance • Distribution • Glare • Shadow - Ventilation <ul style="list-style-type: none"> • Air flow • Distribution • Fresh air • emissions - Cooling <ul style="list-style-type: none"> • Temperatures range - Thermal comfort <ul style="list-style-type: none"> • Heat gain - Building energy consummation - Peak demands 	<ul style="list-style-type: none"> - Site analysis level <ul style="list-style-type: none"> • Daylight availability • Shading • Atmospheric conations • Wind direction • Airflow • Temperature - Room Level <ul style="list-style-type: none"> • Geometry • Surface reflectance • Typology and use - Window level <ul style="list-style-type: none"> • Size/ ratio • Position • Orientation • Systems needs • Distribution • Material - bio-skin system <ul style="list-style-type: none"> • Device Characteristics • Construction & Systems Integration • Control system • Colours 	<ul style="list-style-type: none"> - Environmental behavior - Social behavior - Economy
As standard in code	As simulation and design decisions	As sustainable approach

5.4. The design decisionsto start bio-openings skin design:

The study illustrates the theories of nature that architects respected in cases when they designed bio-opening skins for building as illustrated in the figure below. The Bio-design is summarized in the choice to inspire nature as a monitor (as a natural system and behavior). The bio-design is based on an indirect approach. The bio-design depended on the level of behavior in an organism as a very important and creative level in adaptation to the surrounding environment as shown in figure 13. According to this study on the biomimetic design, Architecture, technology, and nature are artists in architecture design and have directly related to environmental design and sustainability. In addition, numerous supplemental options are available to make a building more energy-efficient with beautiful features.

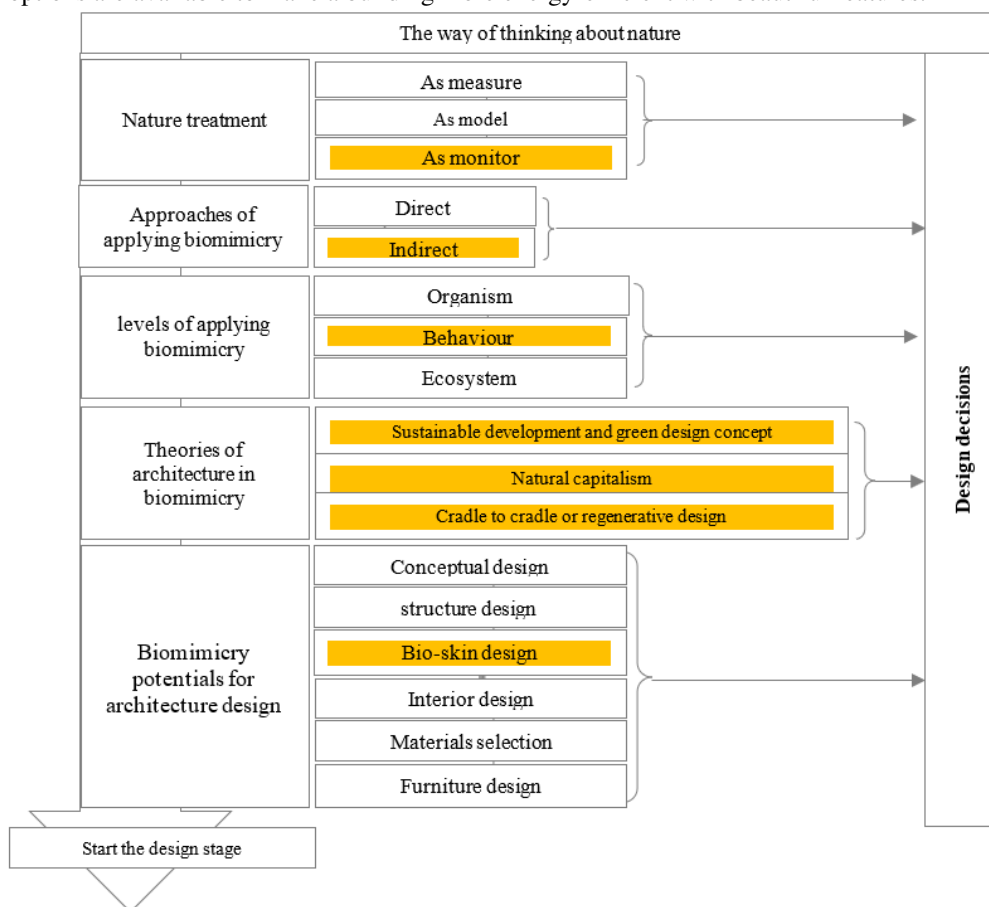


Fig. 13. Shows the design decisions to apply biomimicry in bio-openings skin in case studies. Created by the author

There are many potentials introduced by nature to design categories like form, structure, and texture. Figure 11 illustrates the architectural decisions that are taken before Applying biomimicry in bio-opening skin. The architecture and design can be inspired by creative organisms such as birds that fly through the skies or flowers that grow in the landscape that surrounds them, rather than by 21st-century machines. The study case studies found variety in choosing the organism and in choosing the type of simulation as shown in table 3. Although the case of habitat and council house had chosen the same organism to inspire, the bio-opening skin designs were different and creative and this is due to the variety of natural solutions and the variety in types of simulation.

Table 3: shows the choice of simulation for bio-openings skin design adaptation. Created by the author

Choosing organism	plant	Animal	phenomenon	insect	What is?
Relation between bio-openings design and nature	Discover the organism				
	Analysis potentials	Inspired nature			
		Adaptive tools			
	transformation	Simulation in system	Simulation in material	Simulation in both	
paradigm	Biological paradigm		Intelligent paradigm		

The study illustrated through the previous analysis of the second and third examples, they are the product of the analysis of the same organism but achieved a different simulation and design. It came from the variety in site analysis, design conditions, and type of simulation as shown in table 4. Therefore, the same organism can be simulated using more than one method with different results as a basis for an indirect approach.

Table 4: shows the choice of organisms for bio-opening skin design adaptation in case studies. Created by the author

ORGANISM	NATURAL BEHAVIOR	CASE STUDY	SKIN BEHAVIOR
Morning glory flower	Response to the sun's path Foldable flowers	Al-Bahr Towers	Deployable components Intelligent skin
Living skin Stoma of tree	The connection between the exterior and interior Elasticity and expansion	The Habitat 2020	Active, breathing, living skin, Interactive skin, Flexible, dynamic skin
Bark of tree	Passive ventilation Chimneys and air passages	CH2 Building	Passive ventilating skin, Climate adaptive skin, Recycling materials and systems

5.5. Evaluate the Impact of Bio-openings Skin in Case studies:

To evaluate how biomimicry in architectural design influences as illustrated in figure 14, evaluate how this kind of architecture affects the users of the building as a social axis, evaluate how this kind of architecture affects the building performance as an environmental axis, then evaluate how this kind of architecture affects in cost and saving energy as the economical axis. this type of evaluation is dependent on the previous analysis.

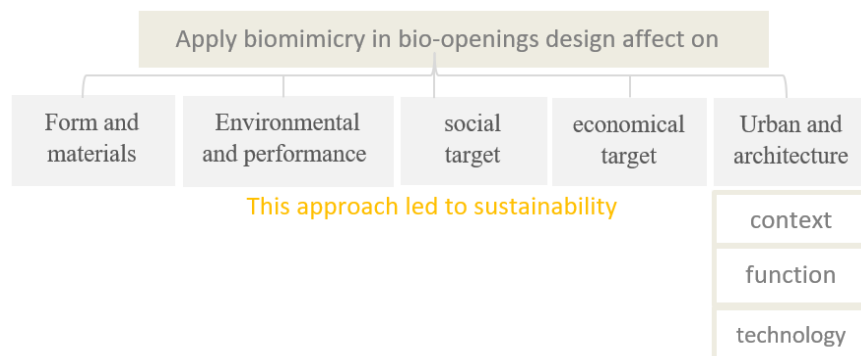


Fig. 14. explains the evaluation axis in bio-openings design that led to sustainability. Created by the author

There are objectives to applying biomimicry in openings skin design as shown in the analysis of case studies like benefiting from the forces of nature, Using the principles of biomimicry aspects ineffective design and biomimicry ideology. Part one of the tables below illustrate the achievements of applying biomimicry in the cases. According to the analysis of case studies, biomimicry affects openings form (ratio, distribution, material, and design as a basic). So, the form of openings skin design has taken many options as shown in part 2 of table 5 like case studies. The analysis of the case studies in form of bio-opening skin showed a variety of achievements in each case.

The study showed the materials that are used in bio-openings affect these designs and operations. The bio-materials improved the concluded system from biomimicry as shown in cases (see part 3 of table 5). The adaptation principle that is common between cases ensures that the building skin is flexible, transformable, and responsive. This makes the building skin multifunctional and necessitates each system (function-form-structure-material) of the building skin to integrate. The quality of the internal environment depended on the previous phase of building adaptation as shown in table 5. At the same time, it was considered the social axis in design because it provides comfort and welfare to the users as a sustainable building. Building skin, which can adapt to all kinds of conditions with different techniques, can

also integrate with its environment and therefore becomes sustainable as well. Principles, properties, and solutions of natural skins in the Tables below revealed the different concepts for function in building such as Harmony in nature, Connectivity, and Suitable to the building typology. The developments in technology and materials of skin gained the feature of intelligence, as it reacts to its environment, and can be programmed, arranged, and controlled with digital technologies. The above-mentioned features make the building skin very dynamic and free as shown in the table below.

Table 5: The evaluation axis of Bio-opening skin design in case studies Created by the author

The key of the table: not achieved (0-1), partially achieved (up to 1- 4), semi achieved (up to 4-7), achieved (up to 7).

Applying biomimicry					
Goals		Cases achievement			
		Al Bahr tower	Habitat 2020	Council House 2	
Exploiting and benefiting from the forces of nature		semi achieved	achieved	achieved	Points (30= 100%) 10
Using the principles of biomimicry aspects ineffective design		achieved	achieved	achieved	10
Results from biomimicry ideology		Semi-achieved	achieved	achieved	10
Bio-opening skin design affects the form					Points (30= 100%)
Integration with local form (identity)		achieved	semi achieved	achieved	Social axis context Tech. 10
Form flexibility		achieved	achieved	achieved	
Using not only shape or form		achieved	Achieved	achieved	
Bio-opening skin design affects the building materials					Points (20= 100%)
Reduction in materials and overall weight due to the highly fluid, rational, and optimized design.		achieved	semi achieved	achieved	10
Using Smart material (bio-material)		Not achieved	Not achieved	achieved	Tech. 10
Bio-opening skin design effects on environmental system					Points (150= 100%)
Response to surrounding change		semi achieved	achieved	achieved	10
Using surrounding nature forces		semi achieved	achieved	achieved	10
Protection system		achieved	achieved	achieved	10
Integration with local context		achieved	Not achieved	achieved	context 10
Bio-opening skin design effects on building adaptation and performance					
Limit the use of external additional cooling devices to the façade.		achieved	achieved	Achieved	10
Visibility & lighting		achieved	achieved	Achieved	10
Ventilation		achieved	achieved	Achieved	10
Air quality: Reduction in carbon emission for office space uses alone.		partially achieved	Semi achieved	Achieved	10
Water efficiency		Not achieved	achieved	achieved	10
Thermal comfort		achieved	achieved	achieved	10
Energy savings for office spaces alone and the building overall.		semi achieved	achieved	Achieved	10
Bio-opening skin design effects on social axis and quality of the internal environment					Points (60= 100%)
humanity		Semi achived	Semi achieved	achieved	10
High quality of internal environment		semi achieved	achieved	achieved	10
comfort	Maintain inside suitable temperature throughout the day.	semi achieved	achieved	achieved	ENV. axis 20
	Suitable Visibility	achieved	achieved	achieved	
motivation		achieved	Semi achieved	achieved	10
The economy of Bio-opening skin design					Points (80= 100%)
Resources management		Semi achieved	Achieved	Achieved	10
energy efficiency	The building saves energy	Semi achieved	achieved	achieved	20
	The building produces energy	Not achieved	achieved	achieved	
High Construction costs		Achieved	Not achieved	achieved	10
Low maintenance costs		Achieved	Not achieved	achieved	10
The building consumed low energy and costs (low operation cost)		achieved	Achieved	achieved	10
Never using the mechanical system for cooling		Semi achieved	achieved	achieved	10
High system quality		Semi achieved	achieved	achieved	10
Bio-opening skin design effects on building function					Points (50= 100%)
Harmony in nature		achieved	achieved	achieved	context 10
Connectivity in vision between inside and outside		semi achieved	not achieved	partially achieved	10
Suitable to the context		achieved	achieved	achieved	context 10
Expressed a building typology		achieved	achieved	achieved	10
Multi-functionality of the idea; whether it has simultaneous benefits such as structural, environmental, or aesthetic advantages		achieved	achieved	achieved	10
Using technology in Bio-opening skin design					Points (40= 100%)
Responding to environmental changes previously programmed.		achieved	achieved	achieved	10
Pass through many steps between simulation programs and architecture design.		achieved	achieved	achieved	10

According to the results obtained concerning the environment and the impact of biomimicry architectural design on the environment, the previous graph displays the percentage of results. it is noticed that the majority of the architectural professionals used the positive options, from which we can conclude that implementation of biomimicry design has a great impact on the environment and is one of the ways to improve sustainability in the design and construction industry.

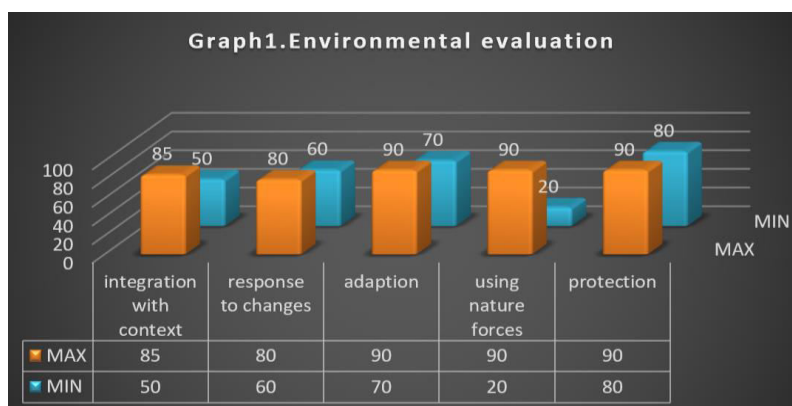


Fig. 15. Graph illustrates environmental impact evaluation. Created by author

According to the results obtained concerning the social aspect of the implementation of biomimicry design, the following graph displays the percentage of results. The study found humans and society are influenced by biomimicry-built design in different ratios. In addition to that, biomimicry design is a positive motivator for human activity in work.

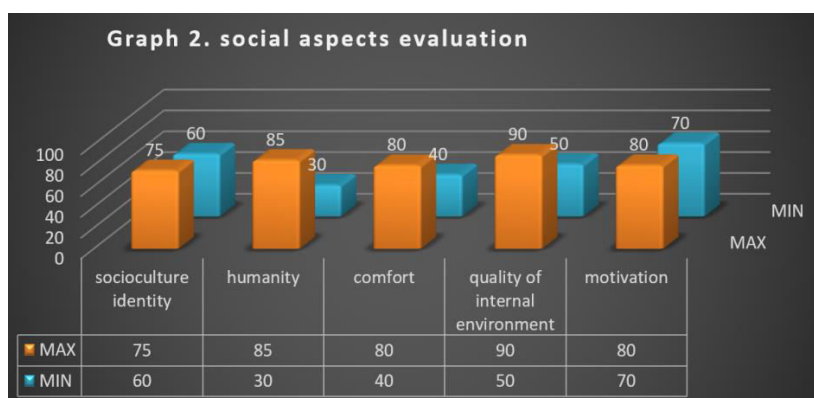


Fig. 16. Graph illustrates social impact evaluation. Created by author

According to economic indicators of biomimicry architectural design, the following graph displays the percentage results. The study showed the economic axis of the case studies differently because the buildings weren't saved cost inbuilt but they saved a lot of money in maintenance and operation. This process is achieved when saving energy and dispensing air conditions.

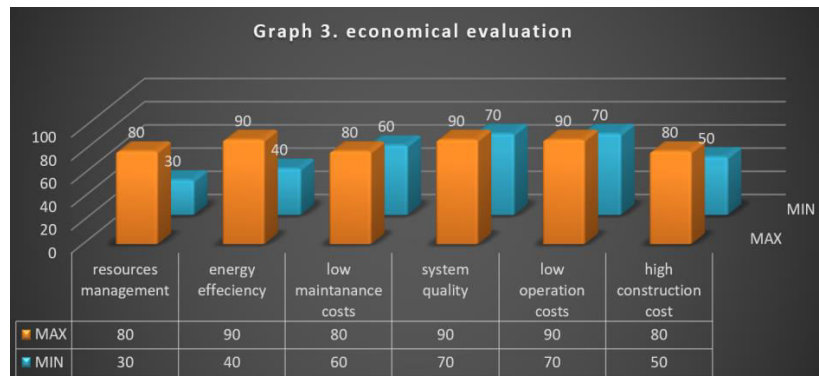


Fig. 17. Graph illustrates Economic impact evaluation. Created by author

As a result, the natural world acts as a great idea bank for architects to create ideas and transform them into designs. In this context, biological solutions should be well identified and understood taking into account the problems in building skin designs as shown in table 6. The architect should have the ability to interpret nature laws (from micro to macro levels) while creating the architectural object/building skin. The knowledge transformation process necessitates architects to cooperate with various disciplines such as civil engineering, biology, physics, chemistry, climatology, physiology, psychology, ecology, computer engineering, cybernetics, and artificial intelligence.

Table 6: The advantages of using biomimicry in case studies. Created by the author

qualitative benefits from the bio-openings system	Advantages achieved		
	Al Bahr tower	Habitat 2020	Council House 2
	<ul style="list-style-type: none"> • Improvement of user-comfort and improved physical and psychological well-being of occupants. • The overall iconic identity of the building. • Better naturally lit spaces through better admission of natural diffused light. • Better visibility of external natural views, less use of obstructive and psychologically trapping blinds. • Improved comfort by reducing heavy air conditioning loads and air draft. • Provide the building with a unique identity, rooted in local heritage and environment. • Provide a unique and entertaining feature both to occupants and passing-by the public. 	<ul style="list-style-type: none"> • Design using bio-openings principles in advanced ways. • Gives the structure a living skin. • Building open, close, breathe and adapt to local conditions. It looked at the leaf system for inspiration funnel nets idea • Design urban landscape in China using eco-system at biomimicry level. • Overpopulation and resource allocation and keeping energy. • Conceptual can get extreme benefits from light. • Most logical emphasis on light. • Harness light through an intelligent façade. • Does not address the filtration system • Long-term or short-term storage. • Maintenance concerns are important conditions. • Maintain storage capacity for windless days. 	<ul style="list-style-type: none"> • Design using bio-openings principles using behavior level. • Gives the structure of living skin. • Building open, close, breathe and adapt to local conditions. • Getting extreme benefits from the surrounding environment to Indoor Environment Quality • Using materials and systems to keep energy • Reduced electricity use • Reduced gas use • Harness light through an intelligent façade. • Reduced emissions to a third • Using water mains supply and recycling it. • Maintenance concerns are important conditions. • Innovation in design.

VI. CONCLUSION

Wide streets and high-rise structures with enormous glass facades characterize modern towns; both of these features allow excessive light to enter the city. Utilizing electricity for air conditioning for nearly the entire year in these regions ultimately resolves the issues outlined above. The goal is to maintain a building's performance as much as feasible, thus interior spaces may experience more strong sunshine than they do now, and glare-reducing systems may be used, as in the case of the Al Bahr tower, to lessen glare. Because the habitat absorbs demands while isolating the skin from the outside to the inside, the situation was different there.

Openings are designed specifically to let in enough light. Instead of utilizing a typical window, the louvers could be employed in several locations, using the same amount of light to create balanced illumination inside. This technique might be used to simply direct light to dark places, like council houses.

Following concerns were noted during the analysis and evaluation of these projects: 1) All influencing elements should interact with a simulated environment to produce the form: This configuration allows for iterative analyses and evaluation cycles, allowing form, material, and structure to interact and affect one another in a simulated environment

to produce the particular form of the system; 2) Adaptation In this iterative computational process, each element modifies its morphology to handle natural forces by balancing its functional requirements with its specific sub-location within the larger system; 3) This morphogenetic process allows for the balancing and calibration of multiple, or even competing, design criteria as well as the unfolding of the material system's inherent performative capacity; 4) The system reached higher efficiency with multi-functional components, especially in council house and habitat, and 5) Integration rather than aiming for rationalisation or single-objective optimization.

REFERENCES

- [1] Aries, M. B., Aarts, M. P., & van Hoof, J. (2015). Daylight and health: A review of the evidence and consequences for the built environment. *Lighting Research & Technology*, 47(1), 6-27. A. Criminisi, P. Perez, and K. Toyama, "Region filling and object removal by exemplar-based image inpainting.", *IEEE Transactions on Image Processing*, vol. 13, no.9, pp. 1200–1212, 2004.
- [2] Bar-Cohen, Y. (2005 A). Biomimetics: Mimicking and being Inspired by Biology. In *Proceedings of SPIE Smart Structures Conference*. 5759, (2), 7-10.
- [3] Bosso, C. J. (Ed.). (2010). *Governing uncertainty: environmental regulation in the age of nanotechnology*. Routledge.
Eftychios A. Pnevmatikakis, Petros Maragos "An Inpainting System for Automatic Image Structure-Texture Restoration with Text Removal", *IEEE Trans.* 978-1-4244-1764, 2008
- [4] Gosztonyi, S., Gruber, P., Judex, F., Brychta, M., & Richter, S. (2013). BioSkin-Research potentials for biologically inspired energy efficient façade components and systems. *Vienna: nachhaltig wirtschaften BMVIT*.
- [5] Gruber, P. (2011). Biomimetics in architecture: the architecture of life and buildings (pp. 418-426). New York: Springer.
- [6] Korolija, I., Marjanovic-Halburd, L., Zhang, Y., & Hanby, V. I. (2011). Influence of building parameters and HVAC systems coupling on building energy performance. *Energy and Buildings*, 43(6), 1247-1253.
- [7] Markus, T. A., & Morris, E. N. (1978). *Buildings, climate, and energy*. London: Pitman Publishing, Ltd.
- [8] McDonough, W., & Braungart, M. (2002). Design for the triple top line: new tools for sustainable commerce. *Corporate Environmental Strategy*, 9(3), 251-258.
- [9] Michael, W., & Jude, H. (2002). *Intelligent skins*. UK: Oxford.
- [10] Rankouhi, A. (2012). Naturally Inspired Design investigation into the application of biomimicry in architectural design.
- [11] Vincent, J. F., Bogatyreva, O. A., Bogatyrev, N. R., Bowyer, A., & Pahl, A. K. (2006). Biomimetics: its practice and theory. *Journal of the Royal Society Interface*, 3(9), 471-482.
- [12] Weston, R. (2012). Biomimicry in architecture. *Architectural Review*, 231 (1380), 95-96
- [13] Zari, M. (2012). Ecosystem services analysis for the design of regenerative built environments. *Building Research & Information*, 40(1), 54-64.



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details