

## **Biophilic by Default: Egyptian Architecture between Biophilia and Biomimicry Concepts from Ancient Times Until Now**

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**Abstract:** Biophilia is a new trend. That appeared recently in the field of design, which means “nature-loving design “.In which promotes positive communication between humans and the environment in the internal spaces. While Biomimetic design seeks to imitate nature’s patterns and systems. So when we take a look at many ancient buildings, we have a question: did ancient Egyptians build their buildings according to those concepts? Moreover, what about Islamic architecture, why did Muslims care a lot about nature in their buildings? Moreover, what about nowadays, do Egyptians still care about nature or imitate it in their buildings? Therefore, this research deals with Biophilic and Biomimetic design concepts in Egyptian Architecture from ancient times until now. By discussing those concepts within some examples of Egyptian buildings through the ages.

**Keywords:** Biophilia, Biomimicry, Nature, Egypt, architecture

### **Introduction:**

Architecture is the Mirror of civilizations, which reflects people's culture and development. Furthermore, it is a witness to the succession of times, as An Important indicator of the technical, political, economic, environmental, intellectual, and cultural situation of each age. Moreover, Nature is always the first inspiration in the design process. Natural objects, shapes, and processes have often acted as a source of inspiration throughout the history of architecture. Therefore, there is no doubt that architects throughout history have been inspired by Nature in building forms and ideas of decoration. Perhaps the most obvious example of this inspiration is the ornament, which often contains representations that are closely similar to the animal and plant world.

Scientists said that: “Man and the environment are closely related to each other, and civilization is a direct result of the interaction of man's efforts with the environment and harnesses its potential”. The relationships between nature, human biology, and the design of the built environment are known as” Biophilic design”. (Joy, 2007: 305).

### **The research problem:**

In the last ten years, ‘nature’ and Biophilic design have received widespread attention in architecture, especially in response to growing environmental challenges. Actually due to the desire of people to return to their essence. Moreover, the desire to live in a natural, healthy, and peaceful environment. However, many studies mentioned Biophilic design, and others studied the imitation and inspiration of nature in architecture, but none of the studies discussed the ancient origin of the idea of Biophilia, and biomimicry concepts, or

the first examples of Egyptian architecture Consistent with the Biophilic design standards. **Therefore, this paper aims to:**

1 –shedding light on Biophilic design in Egyptian architecture, by referring to Biophilia and Biomimicry concepts. In addition, to clarify the difference between Green design and Biophilic design.

2- Discussing the Historical relationship between man and nature in ancient Egypt. by Pointing out some of the ancient thoughts and beliefs in which the concept of environment affects human health were mentioned.

3- Tracing the roots of “Biophilia, Biomimicry, and Biophilic design” concepts through Egyptian architecture from ancient times.

4-. Having a survey on Egyptian monuments to discuss some examples consistent with the 14 elements of biophilic design.

### **Research Methodology:**

In order to achieve the research goal, I will take the historical approach and analytical descriptive method.

#### **❖ Biophilia and Biomimicry definition:**

**Biophilia** is a Greek term consisting of two words “Bio” which means life and “Philia” which means love. It literally means love of life. (Ryeard, 2022.p.184)

**Biomimicry**, which means, “nature inspiration” is based on a set of Greek roots where the word “Bio” means life and “Mimicry” means Inspiration (Ryeard, 2022.p.184)

#### **❖ The meaning and beginning of Biophilia hypothesis:**

**The Biophilia** hypothesis highlights the innate, positive response of humans to nature. It expresses the love for nature and life; and refers to the tendency of people to connect and be together instinctively/emotionally with nature and other living things. (Gunnarsson, B., & Hedblom, M., 2023, p.1)

Therefore, Biophilic design reconnects humans with nature within the built environment, and it plays a fundamental role in ensuring a healthy place to live and work.

The Biophilia theory was put forward for the first time in the 20th century by the American social psychologist Eric Fromm. He introduced Biophilia in 1964, in his book, “The Heart of the Man “. Eric used the term Biophilia” to describe human inclination towards everything with life and living; he meant the human tendency toward nature and landscapes. His system of thought originated at the peak of the environmental movements of the 1970s. Fromm opined that human attraction to Nature must serve as the Foundation for building a positive and life-affirming relationship with the environment. (Browning, 2014, p.7).

Later, Biologist Edward Wilson popularized the idea. Which have evolved from within the fields of biology and psychology, and been adapted to the fields of neuroscience, endocrinology, and architecture, He defined Biophilia as “the innate attraction to life and lifelike processes”. (Browning, 2014, p.7).

The Biophilia hypothesis explains why a view of a natural garden can enhance creativity, why shadows and heights give a sense of fascination, and why there are therapeutic benefits to accompanying animals and strolling in the garden. In addition, why do humans prefer urban parks and buildings to others? Diverse evidence has evolved from biology and psychology to neuroscience, endocrinology, and architecture; they all relate to the desire to connect with nature and natural systems (Browning, 2014, P.3; Gillis, 2015, p.985)

The translation of Biophilia as a design hypothesis of the built environment,” Biophilic design “, was the topic of a 2004 conference and subsequent book on Biophilic design in which Stephen Kellert identified more than 70 different mechanisms for engendering a biophilic experience. In addition, contributing authors William Browning and Jenifer Seal-Cramer outlined three classifications of user experience: Nature in the Space, Natural Analogue, and Nature of the Space. (Kellert, 2008; Browning, 2014, P.3)

#### ❖ **The meaning and beginning of Biomimicry:**

“**Biomimicry**” is the evolution of copying or drawing ideas from natural systems to address human challenges, it is concerned with emulating nature models and systems. (Benyus, 1997; Joy, 20073, p.313).

This term appeared a few times in scientific studies in 1962 and its use increased over time, especially among scientists working in materials science in the 1980s. Later, “Janine Benyus”, a famous American biologist, who was a pioneer in nature inspiration, documented her findings on inspiration from nature in the book, "Innovation Inspired by Nature”, and she referred to Biomimicry as a new science that studies nature models. Then simulates or draws inspiration from these designs and processes to solve human problems and achieve sustainability in design, she has written, "Life has been engineering for 3.8 billion years, and we have much to learn from its genius.” (Pawlyn, 2019.p.6)

Inspiration from nature has been classified into the third levels: Living Object "Organism "Behavior, and Ecosystem. The Design may be inspired by the individual organism's characteristics, or it may be inspired by the behavior of the living object, or the design may be inspired by the entire ecosystem of the living being and its surroundings, (Ryead, 2022.p.184)

Benyus contends that a complete imitation of nature involves at least three layers of mimicry (appearances, processes or functions, and ecosystems) to solve issues by:

1- Duplicating, including imaging: its aim is scanning anything with the brain, a detector, or an electromagnetic beam to create a visual depiction of it.

2- Abstraction: a pyramid shape is a concept simplifying the mountain.

3-, as in the production of buildings in the form of shells from seashells (Mohammed, 2023, p.243).

In addition, it is in a Visual inspiration “Organism”: In which the shape of the organisms is inspired by Nature and hence its use in innovating aesthetic aspects in Product design. In addition, Conceptual inspiration “behavior”: In which, behavior is inspired by Biological organisms through existing bases or processes. In nature, which helps translate and apply them to materials Construction, shapes, and design systems (Ryeed, 2022.p.184)

And according to Kellert;” Biologically we are predisposed to liking buildings and landscapes with prominent natural elements. But when we cannot place ourselves in an actual natural place, we make some effort to provide ourselves with substitutes in the form of natural archetype or simulations “(Kellert, 2012, p.127).

#### ❖ **Biophilic design:**

It is “Life-Friendly Design' “features reflect a human affinity for the natural world and create a satisfying and beneficial architecture (Kellert, 2012, p.127).

The biophilic design approach is based on respecting nature, being connected with nature, and integrating with nature. In which, open and closed areas are evaluated in a way that respects nature, and is in harmony with nature's Organic and vernacular design (Kellert, 2012, :127; Joy, 2007: 305).

#### ❖ **Biophilic design types:**

Kellert puts forth two dimensions to Biophilia, which are:

**1-Organic or naturalistic dimension;** “The first basic dimension of Biophilic design is an organic or naturalistic dimension, defined as shapes and forms in the built environment that directly, indirectly, or symbolically reflect the inherent human affinity for nature.” “Direct experience, Kellert describes as an informal experience of mechanisms which are self-sustaining and do not require human involvement to survive like daylight, plants, natural habitats, and ecosystems while indirect experience refers to something which requires human contact to survive like a potted plant, etc. (Kellert, 2012, p.127).

**2-Place-based or vernacular dimension;** the second-based dimension of biophilic design is place-based or vernacular, defined as buildings and landscapes that connect to the culture and ecology of a locality or geographic area. This dimension includes what has been called a sense or, better spirit of place, underscoring how buildings and landscapes of meanings of people become integral to their individual and collective identities, metaphorically transforming inanimate matter into something that feels lifelike and often sustains. (Kellert, 2012:127).

### ❖ **The importance of Biophilic design:**

Biophilic design can reduce stress; enhance creativity and clarity of thought, improve our well-being, and expedite healing, as the world population continues to urbanize, these qualities are ever more important. (Brwoning,2014, :3).

According to Environmental psychology, humans are aesthetically attracted to natural contents and particular landscape configurations. (Joye, 2007:305).

Scientific studies reveal that contact with nature has significant effects on people's physical and mental health, performance, and well-being; the 14-biophilic design patterns match with three main mind-body systems that are; stress reduction, cognitive performance, and emotional mood preference (Güngör, 2020:5)

It can affect: **1)-cognitive function:** Strong or routine connections with nature can provide opportunities for mental restoration, during which time our higher cognitive functions can sometimes take a break. As a result, our capacity for performing focused tasks is greater than that of someone with fatigued cognitive resources. (Browning, 2014:15)

**2)-Psychological Health and Well-being:** improving our adaptability, alertness, attention, concentration, and emotion and mood, stress management, empirical studies have reported that experiences in natural environments provide greater emotional restoration, with lower instances of tension, anxiety, anger, fatigue, confusion and total mood disturbance than urban environments with limited characteristics of nature (Browning, 2014:15)

**3)-Physiological Health and Well-being:** affect our aural, musculoskeletal, respiratory,

Circadian systems and overall physical comfort. Connections with nature include the relaxation of muscles, as well as the lowering of diastolic blood pressure and stress hormones Physiological responses to environmental stressors can be buffered through design, allowing for the restoration of bodily resources before system damage occurs (Browning, 2014: 15)

Moreover, the Application of the Biophilic design offers a sustainable design strategy, which seeks to reconnect people with the natural environment (Beatley, 2010.)

Furthermore, both biomimicry and biophilic design have gained popularity in recent years, as architects and designers have sought to create buildings that are more sustainable, energy-efficient, and in harmony with the natural world.

### ❖ **The difference between Biophilic design and Green building design:**

Green architecture is interested in “sustainable energy sources, the conservation of energy, the reuse and safety of building materials, and the siting of a building with consideration of its impact on the environment. “So green building design is leading the way of innovations in built form and its relationship to natural systems and processes,

But Biophilic design is often referred to as the “missing link” in green building design in order to achieve both environmental needs and human needs for contact with nature, despite, the green design incorporates aspects of biophilic design. (Omer, 2010, p.50; Kellert, 2008, p.235).

❖ **The 14 patterns of Biophilic design:** (Browning, 2014, P.5)

Biophilic design can be encountered in a building’s façade, interior environment, decorative features, and exterior landscape. Moreover, it can be directly, indirectly, or symbolically revealed. In addition, it can sometimes occur unconsciously without deliberate creation or even explicit recognition (Kellert, 2012:127).

The subjective elements of biophilic design underscore its ancient qualities, which often tap into inherent human affinities for nature that people frequently fail to recognize recognition (Kellert, 2012:127).

According to the principles of biophilic design, nature experiences in the built environment could be divided into three main categories. These are; the “Nature in Space” category, the “Natural Analogues” category, and the “Nature of Space”. Each level contains some dimensions defined at any level where design is included as inspiration from nature in the way it seems which are; form, material, construction, process, and function (Ryeard, 2022.p.184)

It is not only a building or a landscape that resembles nature but at some times also architectural scenes accord with an archetypal image of the nature world. Such as form, space, light, and darkness. (Kellert, 2012, p.127). Therefore, the 14 patterns are as follows:

**A-Nature in the Space Patterns:**

1. Visual Connection with Nature (A view of elements of nature, living systems, and natural processes.)
2. Non-Visual Connection with Nature (Auditory, haptic, olfactory, or gustatory stimuli that engender a deliberate and positive reference to nature, living systems, or natural processes.)
3. Non-Rhythmic Sensory Stimuli (Stochastic and ephemeral connections with nature that may be analyzed statistically but may not be predicted precisely)
4. Thermal and airflow Variability (Subtle changes in air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments.)
5. Presence of Water (A condition that enhances the experience of a place through seeing, hearing, or touching the water)
6. Dynamic & Diffuse Light (Leverages varying intensities of light and shadow that change over time to create conditions that occur in nature)

7. Connection with Natural Systems (Awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem.)

**Benefits:** the strongest Nature in the Space experiences are achieved through the creation of meaningful, direct connections with these natural elements, particularly through diversity, movement, and multi-sensory interactions.

**B-Natural Analogues Patterns:**

8. Biomorphic Forms & Patterns (symbolic references to contoured, Patterned, textured, or numerical arrangements that persist in nature.)

9. Material Connection with Nature (Materials and elements from nature that, through minimal processing, reflect the local ecology or geology and create a distinct sense of place.)

10. Complexity & Order (Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature)

**C-Nature of the Space Patterns:**

Spatial configurations in nature. This includes our innate and learned desire to be able to see beyond our immediate surroundings, our fascination with the slightly dangerous or unknown; obscured views and revelatory moments; and sometimes even phobia-inducing properties when they include a trusted element of safety. It includes:

11. Prospect (An unimpeded view over a distance, for surveillance and planning.)

12. Refuge (A place for withdrawal from environmental conditions or the main flow of activity, in which the individual is protected from behind and overhead.)

13. Mystery (The promise of more information, achieved through partially Obscured views or other sensory devices that entice the individual to travel Deeper into the environment.)

14. Risk/Peril (An identifiable threat coupled with a reliable safeguard.)

**❖ Nature- Human Relationship through Egyptian History:**

The relationship with nature dates back to the Neolithic period. Particularly, after the invention of agriculture and animal husbandry. When people began to separate domestic nature from the wild. The biophilic trait develops a cycle of adaptation to develop new forms of adaptation and promote better use of nature according to the demands of the new Neolithic lifestyle. (Barbieri &Berto, 2021, p.4)

The ancient Egyptians were good observers of nature; they realized all the natural phenomena as well as the natural elements surrounding them. While they watched the universe's system, they were filled with wonder and love of natural phenomena. Nevertheless, sometimes they felt worried and fearful, and instead of naturally

interpreting these changes, they interpreted them as a natural religious interpretation, especially those phenomena that they could not explain and scared them Such as; lightning strikes and thunder, from these explanations came out a theory about the beginning of “myths” in ancient Egypt. They also imagined paradise as fields with rivers” yarrow” (نور الدين، 2009، ص24).

Symbols also played an important role in the life and thought of ancient Egyptians which they derived from their surrounding environment. Therefore, they can easily understand it by linking it to what it symbolizes. They also depicted their deities in various forms such as humans, animals, birds, Reptiles, and fish(نور الدين، 2009، ص178-179)

Moreover, according to ancient Egyptian beliefs, the king is a mediator between people and the forces of nature. Because of this sacred role, He is the only one who can enter the sanctuary in the temples of gods and perform the rituals with the high priest. (Shaw, 2000, p.131).

The famous Greek historian and traveler “Herodotus” famously described Egypt as “the gift of the Nile”; his description was true at the time of his visit to Egypt in the 5th century A.D. Nevertheless, the country's prosperity was not only because of the river's annual floods, but also because Egypt’s natural boundaries of deserts, seas, and boulder-strewn river rapids helped to protect the country from invaders and allowed its culture to flourish in relative security. (Ikram.2010, p.1)

Furthermore, the mutual influence and relationship between nature and humankind was clearly recognized by ancient Greek writers. For example, the Greek physician “Hippocrates” in the 4th century BC, observed the “effect of climate on human health, temperament, and intelligence and remarked that civilizations arose in lands of moderate or warm climate with light rainfall, where water supply was a major challenge. (Muller, 2023, p.2).

In addition, according to Christianity, biblical texts refer to the relationship of mutual responsibility between human beings and nature as the word “Tilling” refers to cultivating, ploughing, or working, while the word” keeping,” means caring, protecting, overseeing, and preserving. This implies the responsibility for God’s earth means that human beings, endowed with intelligence, must respect the laws of nature and the delicate existence between the creatures of this world.(عطية، 1950، ص10).

Furthermore, according to Islamic beliefs; the word of Allah reminds us a lot more to contemplate, gazing at thoughtfully Allah's Creation in nature. Through various verses of the Quran, He invites us to contemplate the many natural buildings and listen to their merits. In addition, Nature is the proof of the greatness and majesty of God Almighty, taking into account the nature of faith and it will increase our devotion to Him. Therefore, it is very important for us to show the greatness of nature as the direct creation of Allah when compared to the buildings or the creation of human’s (عطية، 1950، ص10)



### **❖ Man-Environment and Building relationship “roots of Biophilic Design”:**

According to Kellert “Biophilic design is an inherent human tendency to connect with nature, which remains critical to people's physical and mental health and well-being. (Kellert, 2015, p.3).

Furthermore, Nature themes could be found in the earliest human structures Stylized animals characteristic of the Neolithic such as the Egyptian sphinx, or the acanthus leaves adorning Greek temples; from the primitive hut to the delicate, leafy filigrees of Rococo design. Representations of animals and plants have long been used for decorative and symbolic ornamentation. Beyond representation, cultures around the world have long brought nature into homes and public spaces. Classic examples include the garden courtyards of the Alhambra in Spain, porcelain fish bowls in ancient China, bonsai in Japanese homes, papyrus ponds in the homes of Egyptian nobles, the cottage garden in medieval Germany, or the elusive hanging gardens of Babylon. (Browning, 2014, p.6)

The consistency of natural themes in historic structures and places suggests that biophilic design is not a new phenomenon; rather, as a field of applied science, it is the codification of history, human intuition, and neural sciences showing that connections with nature are vital to maintaining a healthful and vibrant existence as an urban species. (Browning, 2014, p.6). From this concept and back to Egyptian history, we will find that the condition of the environment and physical and mental health were mentioned in different genres of literature throughout history. in addition, monuments reveal to us the attempts of nature adaption to achieve this concept of biophilic design and we can trace the Biophilic design patterns throughout Egyptian architectural history. As following:

#### **A)-In ancient Egypt:**

One of the reasons for building huge temples is that the temple serves as a home for the manifestation of the deity, where he receives worshippers, receives offerings, and celebrates with them his feasts. Therefore, ancient Egyptians built temples for their gods, as an imitation of palaces, such as the Karnak Temple, which they considered as an official palace for Amun. (قاسم، 2020، ص8، 7).

#### **1-Visual Connection with Nature:**

**-Materials Connection with Nature:** Since the predynastic period, Ancient Egyptians made their houses from mud and brick. Egyptians used to use surrounding environmental materials to construct their buildings such as; mud, clay, and, bricks, which consist of a mixture of brown or blackish-grey Nile mud, sand, plant fibers, or small stones and fragments of brick. Occasionally yellowish bricks are found with a strong admixture of clay. in addition to using granite, and basalt for columns and obelisks (Arnold, 2003, p.34; (قاسم، 2020، ص7، 7).

**-Gardens and landscape:** Ancient Egyptians had three types of gardens; house gardens, temple gardens, and tomb gardens. the function of temple gardens was to produce the floral, vegetable, and fruit offerings needed for the rituals of the gods, as well as for the perfumes used for anointing the statues, also to provision the staff of priests and workpeople in the temple. The space provided by gardens was used for processions within the temple enclosure, and to accommodate large gatherings of priests and attendants. (Wilkinson, 1994, p. 4).

Furthermore, in the building complexes of large temples, such as at Karnak, several gardens were usually laid out, always including a pool. Karnak temple garden, is so-called botanical Garden, was set up by Thutmose III; animals and plants were depicted there in relief, including a few exotic plants previously unknown in Egypt such as the dragonroot, the arum, and a type of iris. Because those plants were drawn realistically, they must have been growing in the temple garden at that time; (Wilkinson, 1994, p.5-6; Germer, p.5)

In temple gardens, important flowers were planted, such as; waterlilies (lotus), which, floating on the lakes were reminders that the sun god had originally sprung from the waterlily. papyrus was the home of Hathor (Wilkinson, 1994, p. 2) and was also the place where Isis had hidden her son Horus, after the murder of her husband Osiris. Palms were sacred to the gods of the sun, moon, and fertility (Wilkinson, 1994, p. 2). Date palms were connected with the sun god, doum palms with the scribe of the gods, Thoth, and with Min, the fertility god. Another of Min's plants was the humble lettuce (Wilkinson, 1994, p. 2).

**-Live Animals:** Animals were bred at various temples. Some were the sacred animals to the deity of the temples; such as rams at Mendes and Elephantine), bulls at Memphis (Wilkinson, 1994, p. 5-6).), etc.

Kings arranged for the construction of fowl yards in the temple of Amun at Karnak (Wilkinson, 1994, p. 5-6). The function of temple gardens was to provide floral, vegetable, and animal offerings and provisions. However, in the house's pool, people bred fish and birds for food.in addition to (Wilkinson, 1994, p. 5-6).

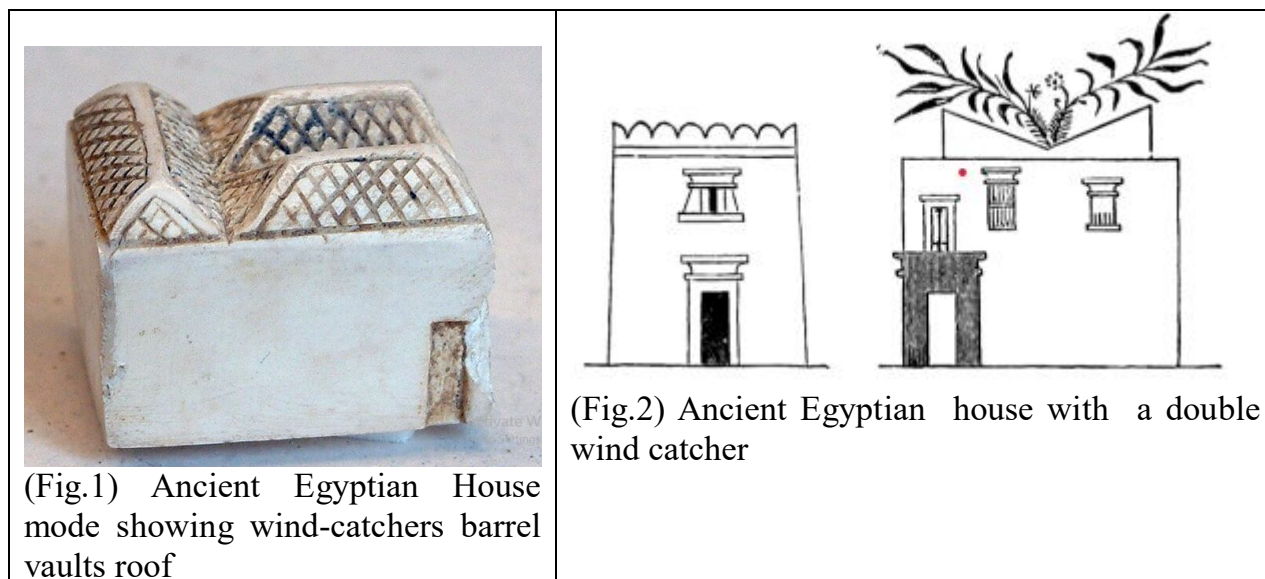
In addition to, Menageries were included in gardens. Live animals in the royal gardens reflected the king's ambition to collect the living world around him (Wilkinson, 1994, p. 4)In addition, to had animals of particular significance as his attendants. Such as Lions, the royal animal, which decorated his throne and chariot. Lions were kept in cages at the entrance to the royal gardens at Karnak. In addition, antelopes, Oryx, and ibex were kept at Karnak and Amarna (Wilkinson, 1994, p. 4) Birds illustrated at Amarna, and presumably living in the gardens, included rock pigeons, turtle dove, great spotted cuckoo, graylag goose, pied kingfishers, geese, and ducks. (Wilkinson, 1994, p. 4)

## **2-Thermal and Airflow Variability:**

In the Old and Middle Kingdoms, barrel vaults covered Mud brick rooms. Both things are used in the Control of temperature. The principal method of regulating the climate inside the house was its insulation by using thick walls usually made of bricks.

Moreover, in the old kingdom winding entrance corridors used to isolate the interior side of the house from the outside. Central Rooms were additionally protected by the surrounding side rooms, Openings were minimized, especially on the southern side of the house, which faces the sun for most of the daylight hours. (Qāsim, 2020, p.7).

In addition, evidence about the early use of wind-catcher in houses were found, such as the model of the first dynasty house now at the Louvre museum (fig.1), or a house with a double wind catcher as in (fig.2).



## **3-Dynamic and Diffuse Light:**

In Ancient Egyptian temples, light was admitted to the Hypostyle Halls by clerestory, formed by the increased height of the columns in the central aisle, while the sanctuary was left dark or only dimly lit. (Ramzy, 2013, p.220).

There was a common, solution for the lightning problem, by cutting angled slits or square holes into the roof slabs, to allow daylight to enter the space. This technology is called "clerestory" appears to originate in the temples of ancient Egypt, where the lighting was admitted to the Hypostyle Hall over the stone roofs of the adjoining aisles, through slits pierced in vertical slabs of stone. Clerestory appeared in Egypt as early as the Amarna period or even earlier (Ramzy, 2013, p.221).

The famous example that represents this category is The Hypostyle Hall in the Temple of Karnak in Luxor, as one of the earliest and the most original treatments of this type. In which the raised central nave was lined with grilled windows of clerestory (24 meters above the floor), which allowed sunlight to enter the hall while maintaining the privacy and secrecy of the space. The grills were composed of two sections, one stacked atop the other, and secured in place by being fitted tightly into grooves in the side of the bordering piers. Sunrays coming through this clearstory were further obstructed by the projection of the gorge cornice, so that the hall is mostly kept in shadows earlier (Ramzy, 2013, p.221).

**4-Presence of Water:** In houses, People valued pools as sources of refreshment and coolness. There were also cisterns, which stored water for supplying the plants in the gardens. In addition, water was the central feature of many gardens. Moreover, the temple lake was not only the water source for the temple but was also the place where rituals were performed, in the building complexes of large temples, such as at Karnak, several gardens were usually laid out including a pool. (Wilkinson, 1994, p.6-8).

#### **5-Prospect:**

Space in ancient Egypt is designed to help move people through certain areas and between individual buildings in a complex. The ancient Egyptians experienced how to control their surroundings through total spatial design and were experts at organizing labor to accomplish substantial planning projects. (Barry, 2014, p.176).

In addition, space provided by gardens was used for processions within the temple enclosure, and to accommodate large gatherings of priests and attendants. (Wilkinson, 1994, p. 4)

#### **6-Mystery:**

In ancient Egypt, The house entrance was preferably located on the northern side, frequently at the back of a portico. (Qāsim, 2020, p.7-8).

However, in the temples' Ground plan, levels, and sequence in the inner part, two principles alternate in the horizontal plan of temples: separation and connection. The spaces of the sacred center. And of the inner periphery, is closed off from one another by walls. Openings of sacred spaces are windows (rarely) and doors. The windows are not to let those within look out but rather to let in light and air. (Oxford Encyclopedia, vol.3, P.365)

#### **7-Refuge:**

Palace gardens were the setting for the ceremonial reception of foreign ambassadors as well as for the entertainment of the king and the court. (Wilkinson, 1994, p. 2).

A garden mirrored the features of a mythological landscape, and of the world of the after-life. This landscape had to be as permanent as possible, and sustainable by future

generations. It was a marvel which would impress the priests and courtiers who would understand the symbolism, and amaze the general people and foreigners who would be awed by the size and splendor of the buildings and their grounds.(Wilkinson, 1994,p. 2).

Pools were stepped, so that the water could be reached when the pool was nearly dry The edges of some pools provided terraces for marsh plants Buildings could simply be bowers made out of papyrus, or pleasure pavilions providing shade and somewhere to sit, or make love, or give birth(Wilkinson, 1994,p.8)

In addition, garden in ancient Egypt may be a place for growing particular plants, it may be designed to accommodate great crowds, or it may be a space for a few people, or even just one, to sit and enjoy its sights and sounds. Meaning is the philosophy behind the creation of the garden. It can be expressed in statuary, layout, inscriptions, and in the plants, which have significance for the people that time; the Egyptians began from the mystical properties of a particular place. Every spot they selected for a sacred building was where a deity was believed to reside (Wilkinson, 1994, p.1).

**8-Complexity:** Symmetry is found in the repetition of like with like. For example, twin groves, twin trees, and twin pools. Geometry is exemplified in the arrangement of rectangles within a garden. In the illustration, which survives of a garden at Karnak, the layout consists of a rectangular walled area in the center of which is a vineyard surrounded by walled gardens, some of which are orchards. The approach to the temple of Karnak, where there was an avenue of sycamore-fig trees, under planted with vines and papyrus Gardens was laid out with a strong structure, making use of different levels linked by terraces, and often centered around pools of water. Steps and stairways emphasized changes in levels and viewpoint. Terraces, which can be the supreme expression of garden art' (Wilkinson, 1994, p.6)

### **9-Risk/Peril:**

According to the dualistic thought of the Egyptians, the enclosure wall that separates the Outer periphery of the temple, the center, and the inner periphery form the temple itself, where the cult is performed, it is the place where the chaos begins (Oaks, 2010, p.14).

**10-Biomimicry:** according to ancient Egyptian beliefs, the temple represents the mound of creation, which has risen from the primordial ocean "Nun". In the architecture of the temple, the mound was marked by the gradual rise in ground level between the entrance and the sanctuary, while the columns of the hypostyle hall represented the appearance of the first plant life on the mound. They also considered the sacred lake and the undulating mud brick wall of the temple as the primordial ocean from which the sacred mound arose (fig.3).(Oaks, 2010, p.14; Barry, 2014, p.176).

In addition, the temple symbolizes the universe; the pylon represents the "horizon" and the huge floral columns on both sides of the open court may symbolize the plants and Flowers on both sides of the Nile River. Each part of the temple was decorated in consonance with its meaning; those next to the ground were clothed with vegetation, The

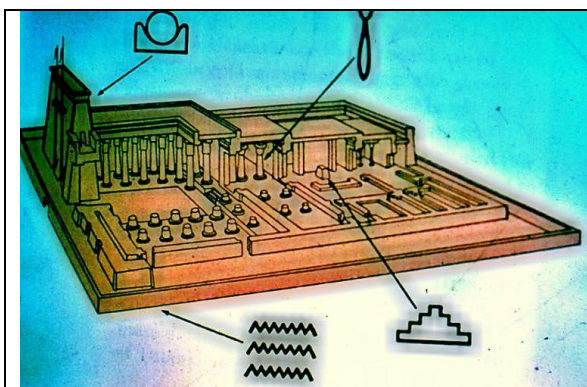
bases of the columns were surrounded by leaves, and the lower part of the walls were adorned with long stems of lotus or papyrus, in the midst of which animals were occasionally depicted. Bouquets of water plants, emerging from the water, enliven the bottom of the wall space in certain chambers. Elsewhere we find full-blown flowers interspersed with buds or tied together with cords, The ceiling was painted blue, and spangled with five-pointed stars painted yellow, occasionally (Qāsim, 2020, p.7-8; Lethaby,2004,p.39,42).

Furthermore, the temple gardens were an integral part of the cult shrine, which was itself a cosmos, representing both Egypt and the universe in ancient Egyptian beliefs. Therefore, gardens are considered as a symbol of the perfect world order. It always includes a pool. Represent the primordial water. (Wilkinson, 1994, p. 5-6; Germer, p.5).

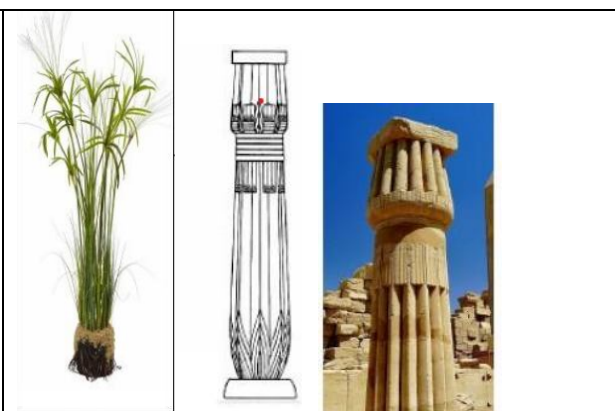
Moreover, the ancient Egyptians leveled the edges of the upper facades of buildings with papyrus fibers and fiber ropes, which developed into the Corniche. (Arnold, 2003, p.34)

**Decorations** on Egyptian cult buildings were not intended as ornaments, their purpose being to indicate function (symbolism) in addition; the different forms of the columns also frequently bear some meaning. Moreover, Ducks, geese, fish, and plants were common ornaments. Ornamental elements like the lotus blossom, the papyrus head, the palm, water plant, and then later a round shaft were surmounted by a palm tree capital or by the blossom or bud of a papyrus plant. (Arnold, 2003, p.21).

Furthermore, many buildings were aligned astronomically; Columns were typically adorned with capitals decorated to resemble plants important to Egyptian civilization, such as the papyrus plant and lotus (fig.4) (Emanuel, 2021, p.21)



(fig.3): temple as a universe concept



(Fig.4) closed papyri columns had ribbed shaft to represent multiple stems bound together and the capitals a closed papyri bud. (Emanuel,2021,p.21).

## **b)-During the Greco-Roman Period:**

The relationship between the condition of the environment and physical and mental health was mentioned in different genres of literature, and Romans referred to clear, pure, or good air as a beneficial aspect of the environment. However, they considered Cooking smells were also harmful. For example; Seneca the Younger (1st AD) wrote in a letter that he had a fever and left his city to recover from it because the city had a bad atmosphere and terrible odours from kitchens. He also complained the kitchens created steam and soot. Therefore, the relationship between natural spaces and the body was key to Roman conceptions of health (Baker, 2018, p.404-410).

### **1-visual connection with nature:**

**-Gardens and landscape:** Household gardens offered similar experiences and benefits as public gardens because they shared the same features such as greenery and flowing water. Therefore, the relationship between natural spaces and the body was key to Roman conceptions of health (Baker, 2018, p.406).

**2-Thermal and Airflow Variability:** The Greeks discovered the thermal advantage of courtyard buildings and then, they designed their homes in a manner to allow low winter sun in the courtyard, while blocking the high summer sun by the overhanging eaves on the portico (Taleghani, 2012, p.119).

**3-Presence of Water:** Moving water was a desired feature in gardens. They range in size from elaborate examples with waterfalls that emptied into pools to smaller pools, and fountains with water jetting out of the mouths of animal statuettes. (Baker, 2018, p.413).

**4-Refuge:** Gardens served a variety of functions. They were used as spaces for social interaction, and dining. Moreover, Cisterns of fresh water were commonly placed in the gardens, possibly for household use (Baker, 2018, p.412-413).

**5-Prospect:** in Roman houses, toilets and kitchens were commonly placed next to each other. Toilets were also used as trash receptacles for kitchen scraps, not only for human waste. The reason that toilets and kitchens were located together in houses, is to allocate bad smells to one spot in the home. Therefore, they did not affect the pure air of other rooms, such as dining areas. In addition, kitchens and toilets were not placed near gardens However; there were some instances where a latrine was positioned in a room off to the side of a garden, they were blocked with doorways, to prevent bad smells from entering into other areas. (Baker, 2018, p.406).

**6- Non-Visual Connection with Nature:** The sound of moving water and likely the light rustling of branches and leaves brought about through breezes were beneficial sensory experiences. The Romans wrote that music and calming sounds soothed the mind and induced sleep (Baker, 2018, p.415).

Romans used sensory experiences to identify pure air. They understood it to have little to no smell or a sweet scent. It was visually identified by the colors such as; blue, green, and

white along with moving and transparent water. It was heard by harmonizing sounds that signified movement. In turn, in accordance with ancient philosophical theories on sensory functions, the sensory perceptions in the gardens helped balance the humors, therefore an active sensory experience was the vital link between nature and the body, explaining how air balanced the humors. (Baker, 2018, p.416)

**7-Biomimicry:** Paintings on garden walls were common, especially in the houses. They were important for the viewer, possibly because they provided a form of green space that made the dwelling seem healthier than a place without any form of garden. Even if that was real or a depiction The scenes of the gardens tend to be similar and usually have low fences painted in the foreground with the greenery depicted behind them, gardens were intended to be imitations of natural environments; Jetting fountains, birdbaths, are usually portrayed. (Baker, 2018, p.412).

The background color of the garden painting tends to be blue, as a representation of the sky. Bird life and lush flora and greenery are always depicted (Baker, 2018, p.412).

Some pools were painted in blue possibly to imitate the colour of the sea or a clear lake. Views of the colors and moving water, combined with the sounds created by it would have signified that the water was fresh (Baker, 2018, p.413).

### **C)-During the Coptic period:**

**Daylight:** Early Christian, and some Byzantine, churches maintained the form of the Roman Basilica with a central nave flanked by lower aisles and a wall pierced by clerestory windows in-between. However, the most preferable system was a ring of windows at the base of the dome, with openings grouped in the gable ends or within the semicircular arch beneath the dome (Ramzy, 2013, p.221).

**Biomimicry:** Animal motifs depict a view of running down animals and there is a depiction of hanging vines (عطية، 1950، ص11).

### **d)-During the Islamic period:**

The Islamic architectural edifices are considered as the pride and assets of the state and the means of achieving well-being. (Azab, 2015.p.26). furthermore, In the Islamic period, we can say that the theory of Biophilia in architecture starts from the choice of the site of founding cities and towns” which could be the root of “Biophilic cities design”.

According to Ibn Khaldun, there are criteria that the statesman should take into consideration when selecting a site to Establish cities and towns. Based on two essential objectives, which should be pursued in all matters, related to cities, the avoidance of harm and the quest for interest. In this regard, harm falls under two categories: a physical one related to the land, and this harm can be prevented by surrounding the city with a wall or building it in a naturally protected location that would be hard to reach by the enemy. The second one is related to the atmosphere and can be prevented by choosing sites blessed with clean air. (Azab, 2015.p.30). Some of these conditions are:



- 1- The town or the city should be surrounded by a wall, to ward off harm and damage.
- 2- It should be located in a naturally protected site such as a place on a hilltop, near a river, or along a bay, etc.
- 3- The site chosen should provide plentiful clean and fresh air to Prevent diseases.
- 4- Water should be within easy access such as from a river or water springs.
- 5- Grazing lands should be available for cattle.
- 6- Farming lands must be available to provide food and sustenance (Azab, 2015.p.26).

Moreover, when we trace the root of biophilic design patterns, we will notice the following:

### **1-visual connection with nature:**

**-Materials Connection with Nature:** stone, mud, brick.

- **Gardens and landscape:** Generally, Islamic garden is a place for rest and view to remind of paradise. In Al-Quran, Allah has promised those believers a garden for life in paradise the Eden under which run rivers is the ultimate promise of eternal happiness, Compared with English gardens, which are designed for walking, the function of the Islamic garden would be as a place for rest and contemplation (Darkhani. et.al, 2019, p.544; Azab, 2015.p.49).

**-Animals:** One of the rulers of Cairo, the son of Ibn-Tulun, who succeeded him in 883, seems to have set himself to rival the garden of delights in a paradise , which was filled with lilies, gillyflowers, saffron. with palms and trees of all sorts, the trunks of which he coated with copper gilt, behind which leaden pipes supplied fountains which gushed forth to water the garden. Peacocks, guinea fowls, doves, and pigeons with rare birds from Nubia, had their home in the garden and aviary. There was also a menagerie, and especially a blue-eyed lion, who crouched beside his master when he sat at table, and guarded him when he slept. However, the chief wonder remains to be described. It was a lake of quicksilver; on the surface of this lake lay a leather bed inflated with air, fastened by silk bands to four silver supports at the corners; here alone the in somnolent sovereign could take his rest (Lethaby, 2004, p.104).

**2-Presence of Water:** The Islamic perception of water is based on its status as the source of all life, a gift from Allah, and sustenance for knowledge. In addition, water has a purification function since it cleanses Muslims physically and spiritually. Moreover, watering another human being or an animal is considered a form of charity -zakat- in Islam. The Muslim uses water to cleanse himself before praying, which confers on water's vital importance. Therefore, No house, building, or place was devoid of water in Cairo, or any other Islamic city. Furthermore, the concept of water as a means of purification merged with aesthetic and even poetical ideas that took body in the water architecture that adorned the cities of the Islamic world, (Azab, 2015.p.48).

The contemplation of water in its natural environment or between the walls of a house heightened the feeling in the Muslim's soul of the greatness of Allah who give us this blessing. The sound of water was a source of serenity and inspired a feeling of safety. (Azab, 2015.p.48).

Water transferred the living and dynamic nature into closed architectural structures and converted them into gardens of marble, tiles, and plaster. Water also enhances the light element of the small architectural creation by receiving and reflecting the light that falls on it and on its surroundings like a celestial body with no clear source of light (Azab, 2015.p.48).

### **3-Non-visual connection with nature:**

The live nature existing outside the walls of the palace, (for example; Alhambra palace), in the form of trees, flowers, fruits, sky, and water, was rivaled by another garden within the walls with trees in marble (columns). fine flowers and fruits in mosaic (floral decoration), domes on Muqarnass, then water, the only element that maintained its live nature as no artist could convert it into a dead nature (Azab, 2015.p.49).

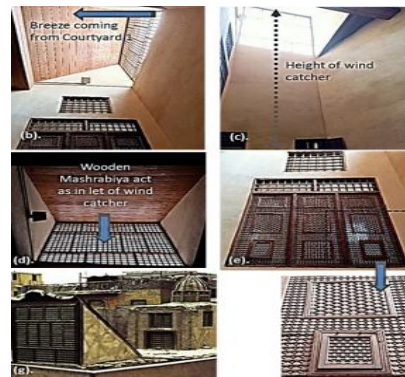
**4-Thermal and Airflow Variability:** In medieval Islamic houses, the dome and the wind-catcher were very important elements. That was employed, together with the courtyard in a unified ecosystem that kept the temperature in these houses moderate. Wind catchers in these houses are oriented to catch the fresh breeze from the north and lead it into the house and court (fig.4). On the other side, they lead away the warm air, maintain steady ventilation, and thus by low air pressure trace fresh cold air into the buildings. Here, the courtyard functioned as a temperature regulator (Ramzy, 2015, p.256).

Therefore, the application of passive ventilation from historical architecture is the Badgirs (Farsi) or Barajeels or Malkaf (Arabic), which are wind-catchers that catch the wind from different directions with two to eight openings; the air is then cooled as it travels down the tower, and cools the rooms below. When there is no wind, the hot air in the tower rises up, which draws cooler air from any other openings into the house (Ramzy, 2015, p.254).

The dome or the lantern, over the central part of the house or the court, increases the velocity and results in a difference in pressure that creates airflow from high to low pressure "Venturi Effect", where the openings in them act as an outlet for hot air. A water fountain is often added in the middle of the court for a more refreshing effect. Water tanks or food containers were also put under the wind catchers as a method to cool drinking water and store food (Ramzy, 2015, p.256).

A further element in this passive system is the thermal mass, which refers to materials that have the ability to store thermal energy for extended periods such as stone, mud, brick, water, and ceramic tile. The walls of traditional Arab houses were mainly made of brick and were very thick. During the day, the walls absorb daytime heat, reducing the

amount of heat that reaches the interior space, and resulting in a cooler interior air temperature. The thermal energy absorbed by the thick walls is then negated at night through the airflow of the passive ventilation system (Ramzy, 2015, p.254).



(fig.4) wind catcher ventilation process (Zaki, 2022, fig.4, p.50)

**4-Dynamic and Diffuse Light:** Mashrabiya screens permit the low-angled winter sun to bring daylight and warmth to the interior spaces during the cooler months of winter and gives shade and protection from the high-angled hot summer sun, while allowing the cool air from the street to flow through it (Ramzy, 2015, p.260).

**5-Complexity:** In Mosques, The condition of centrality in the building of mosques is explained by the need for ease of access to a facility used by people five times a day (Azab, 2015.p.33).

**6-Refuge:** In addition, the Arab houses has also several biophilic qualities that are not found in the system of the East Gate Centre. The form of the dome is believed to have been inspired by the shape of the egg and, in this sense, it provides a sense of shelter to the inhabitants. Its canopy-like structure is factor of the biophilic quality of refuge. (Ramzy, 2015, p.258; Pawlyn, 2011),

Mashrabiya also provides also prospect through a wider horizon with three-sides-view. A row of projected Mashrabiya screens would also provide shelter and refuge for those in the streets. (Ramzy, 2015, p.254).

According to Nasser Rabbat. Overlooking a courtyard, garden, or some other setting, Manazir and Maqa'id dotted the medieval basatin's waterfronts in Rawda Island and elsewhere, but it is very difficult from the available information to imagine whether they stood alone or in some prescribed formation and to what, if any, kind of structures they were attached. Moreover, the exact architectural difference between Manazir and Maqa'id is difficult to ascertain, although they were to become very distinct in later times when they both migrated to the urban residential architecture and became integral components of the Cairene courtyard house (fig.5)(Rabbat,2004,p.74)



(Fig. 5) Early 19<sup>th</sup> C. Courtyard-garden of the palace of Qasim Bey as depicted in the *Description de L'Égypte* in the (Rabbat, 2004, p74)

**7-Mystery:** The benefits of passive engagement with courtyard space include increased socialization, and environmental stimulation meanwhile increased exposure in the courtyard area relates to each by interlocking the spaces. As with interior common spaces, the ability to control social interaction and privacy is important in courtyard space (Darkhani. et.al, 2019, p.544).

**8-Biomimicry:** Stalactites is an Islamic architectural ornament, that imitates honeycomb, it overlays the transitional zone between domes and the squinches or brackets under them. Later on, it became also a usual decoration for door heads, and niches, and was used under cornices and minaret galleries. In addition to these functional aspects, the fractal patterns of the stalactites and the Enticement in their complexity and richness of details evoke their biophilic character. It was also found that they could function as acoustic baffles to decrease echo sound reflection. (Ramzy, 2015, p.260).

Mashrabiya<sup>1</sup> screens is one of the prominent applications of the biomimetic approach in architecture, where the sun shades on the windows open and close in response to heat, just as the cactus undergoes transpiration at night rather than during the day to retain water. The operable windows. (Ramzy, 2015, p.253).

Latticework with small openings in the lower part and larger openings in the higher parts, causes the draft to be fast above the head and slow in lower parts. providing a significant amount of air moving in the room without direct uncomfortable draught on the users' level the curvy surfaces of this latticework help to overcome the difficulty of adjusting straight blinds, where the position for the optimal direction of air movement is undesirable concerning sunshine and vice versa. also have the advantage of being able to obstacle the sunrays, while allowing the largest amount of air to enter the space with the least obstruction (Ramzy, 2015, p.253).

Furthermore, the reflection of Islamic Concepts of Building and Architecture sunlight on water and its penetration into its liquid body generate the seven colours of the rainbow,

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<sup>1</sup> **Mushrabiya:** a wood barrier covering balcony places and windows consisting of small-assembled units, used to insert air and light suits and used in agencies, homes, and mansions.

like a foretaste and an ephemeral indication of heaven. And because of the diaphanous nature of water, it contributes to highlighting the beauty of decorations as its transparency does not occult the pieces of multicolored mosaics that coat the beds of fountains and ponds. The harmony of light and shadow, manifest in the carvings and Muqarnass (stalactite vault designs) adorned with floral decorations (Azab, 2015.p.48-49).

#### **e)-In Modern History:**

Inspiration from nature was in full view in the Art Nouveau designs of the late 19th Century. Scholars discovered examples of 19th-century architecture Neo-Gothic- New Greek- New Renaissance. More elaborate gardens began to be laid out in the otherwise functional courtyard. That had always existed in Cairene palaces and residences beginning with the ninth-century Fustat houses. They contained flowers and medicinal herbs, evergreen trees, palm trees, and vines. Their flowerbeds were sunk both for aesthetic and irrigation purposes. The palaces were given an introverted composition centering on the verdant courtyard, which could hardly have been seen from the street (Rabbat, 2004, p.75; Browning, 2014, p.7).

More the 19<sup>th</sup> century, saw the expansion of the city toward the river. The process began with new Basatin "orchards," established by Muhammad Ali Pasha, his sons, sons-in-law, and grandsons. These royal "Basatin" were endowed with palaces and used both as "pleasure gardens" and as orchards, plantations, and nurseries. The earliest among them appear to have been the palace and garden of Shubra, designed by the French architect Pascal Coste for Muhammad Ali in the mid-1820s. Each of the royal "Basatin" had a palace or a pavilion, and sometimes more than one, built by a member of the royal family (Rabbat, 2004, p.76).

#### **f)-In Contemporary History:**

Over the past half-century, Egypt has undergone fundamental changes in its built environment. In the name of progress and modernization, an old and homogeneous urban culture has been replaced by patterns, which were borrowed from the industrialized countries of the West, thus leading to a very alien environment (Kamel, & Abdel-Hadi, 2012, P.77).

The new urban developments of the 1960s to the northeast of Cairo city, because of land shortage, demographic explosion, and heritage of separation between public spaces and leisure may also have contributed to the little interest in providing government-sponsored, large housing projects with public green areas. This, of course, added to the pressure on the parks inherited from the royal era, which had been open to the public, (Rabbat, 2004, p.76).

Moreover, With the Open Movement and the ever-increasing population under Anwar Sadat (right. 1970-81) and thereafter Hosni Mubarak (p. 1981-2011), Greater Cairo opened up to the greed of developers and speculators who wanted to demolish every old building and allocate every open green space to make way for larger and more profitable

constructions. One unusual landscape project in the same period provided some respite for the city's thirsty green spaces. This was the 30-hectare Azhar Park donated by the Aga Khan and developed by the Aga Khan Cultural Fund between 1992 and 2005 (Rabat, 2004, p. 76). Nevertheless, despite this poor situation, some traditional (vernacular) buildings have continued to maintain the norms of the relationship between the environment, the human being, and the building, namely Biophilic design, and the most important example of it is Nubian houses. And we can trace the biophilic patterns on it as following:

### **Biophilic Design Patterns in Nubian Houses:**

Old Nubian's residential environment had characteristics, which were closely related to the surrounding ancient Egyptian monuments.

#### **1-visual connection with nature:**

**-Material connection with nature:** The Nubian houses were built of stone, clay, and sand; the flat roofs were commonly built of palm leaves (jareed) and grain stalks and the arched domes were of clay bricks. (Kamel, & Abdel-Hadi, 2012, P.79)

**2-Thermal and Airflow Variability:** Winter months in that area are quite cold with a steadily blowing north wind; hence, the living areas were placed to face south and west in order to receive as much sun as possible. On the other hand, because of the summer heat, which pours in from the south and west, the walls of the living areas were high, which created a shady patch close to the wall itself. For similar reasons, the roofed open areas in (Kamel, & Abdel-Hadi, 2012, P.80)

According to Kamel& Abdel-Hadi's interview with the Nubian people, they are still not satisfied with their houses provided by the government. Because of the thermal uncomfoting, (the construction is in reinforced concrete) in addition to the acoustical infringement on privacy even. as they do not fit the climatic considerations and the not good positioning of openings in accordance with orientation. Nevertheless, they tried to make some changes to it. By restructuring their new housing units and the adjacent exterior spaces to provide more privacy, they also redecorated and colored the empty new façades in their old style, and Divided the animal room into two small rooms, one for poultry and the other for storage. (Kamel, & Abdel-Hadi, 2012, P.80)

**3-Presence of Water:** most of the Nubian houses were built beside the Nile

#### **4-Dynamic and Diffuse Light:**

The courtyards located on the south or east end were open to the north and west to allow access to the late evening breeze; they offered an enduring living and sleeping area during the heat of the summer. "Houses varied in size but were usually composed of a big walled courtyard with rooms built at the further ends of the yard. Near the main gate, a room was usually used for male guests locally known as Madyafa or Sabeel that opens on

the outside by a terrace. Furthermore, within the courtyard, a sheltered area from the sun and wind functioned as the main living open area (Kamel, & Abdel-Hadi, 2012, P.80)

**Prospect:** Spaces inside the house were spacious; they accommodated a few pieces of furniture that consisted of one or more beds “Angarib” used for sitting and sleeping purposes, wooden chests for storage, and straw dishes used as trays for food during meals. (Kamel, & Abdel-Hadi, 2012, P.80)

**Biomimicry:** Decorations, which spread from the portals to the walls and into the interior, especially the women’s quarters. the mud -walls, painted and plastered with ornaments such as; ships, fish, scorpions, birds, camels, date palms, and flowers; suns, moons, and stars; crocodiles and lions, etc. Color scheme; white, red and beige, red, green. However that the use of soft and light blue in interiors is dominant in the two subcultures. Kenoz and fadija” .using Cool, de-saturated and light colors because they are considered to increase the experienced spaciousness, thus, the color selection in current Nubian interiors helps increase the feeling of spaciousness in their limited spaces. Kamel, & Abdel-Hadi, 2012, P.85)

The walls of the house especially the façade were decorated with ornaments and paintings of flags, flowers, birds and animals. Crockery was often used for wall decorations and wall-mounted objects like ceramic plates, automobile headlights, mirrors, cow horns, and dried crocodiles. (Kamel, & Abdel-Hadi, 2012, P.79)




Al-Maqrizi describes many of these Basatin and reports the festive events held in them that had ceremonial, recreational, literary or amorous aims. From his and others’ descriptions emerges an image of verdant gardens with various flowers (narcissus, jasmine, roses, dog roses), shrubs and trees (palm, vine, lemon, bitter orange, prune, pear, mulberry, morning, privet, myrtle, sycamore), and some light pavilions and belvederes scattered across the landscape. ( Rabbat,2004,p.71).

wooden ceilings with painted animals and floral motifs ( Rabbat,2004,p.7o)

In old Nubia, social structure, people’s economic condition, topography, and climate were basic considerations in house designs. (Kamel, & Abdel-Hadi, 2012, P.79).



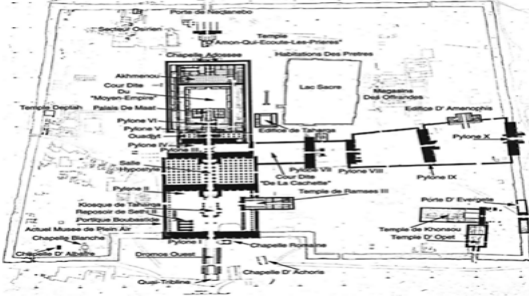
❖ **Examples of Biophilic design buildings through Egyptian architecture History:**




**1-Biophilic Design Patterns in the Karnak Temple Complex<sup>2</sup>:**

<b>NATURE IN THE SPACE</b>	<b>Visual Connection with Nature</b>	 <p>The quays, ramps, and revetments are located west of the Amun temple complex along the Nile.</p>
	<b>Non-Visual Connection with Nature</b>	<p>-sunlight in the open court.-the natural air and worm -using natural colors such as white.</p>
	<b>Non-Rhythmic Sensory Stimuli</b>	<p>-Animal sounds from Menageries were included in the gardens. -Flowers scent from gardens.</p>
	<b>Thermal and Airflow Variability</b>	<p>Cutting angled slits or square holes into a temple's roof slabs, allowing daylight and ventilation.</p>
	<b>Dynamic and Diffuse Light</b>	 <p>A view of the architraves and clerestory window in the hypostyle hall.(oaks,2010.p.15)</p>
	<b>Presence of Water</b>	 <p>The sacred lake</p>

<sup>2</sup> **Karnak temple complex:** the main sanctuary devoted to worship Amun, the temple of his wife Mut lies to the south and the temple of their son Khonsu lies within it Montu, Petah, and Osiris were worshipped also within the sacred area of Karnak. Unusually the temple was built was two axes, the original temple dated back to (Oaks, 2010, p.15).



	<p><b>Connection with Natural Systems</b></p>	 <p>Sunrise at the winter solstice in the main axis of the temple (Belmonte, 2010, p.535).</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);"><b>NATURAL ANALOGUES</b></p>	<p><b>Biomorphic Forms and Pattern</b>                  -Shapes of columns ( closed papyrus- lotus- open papyrus)                  -Sphinxes (ram shaped)                  -in addition to the concept of the temple as a universe</p>	 <p>Columns in the Shoshenq I Court</p>
	<p><b>Material Connection with Nature</b></p>	<p>Mud brick (enclosure wall)                  sandstone ( Construction materials)                  limestone ( white chapel)                  pink granite ( obelisks) (Gates,2011,p.108)</p>
	<p><b>Complexity and Order</b>                  Karnak temple has double axis (topographic and astronomical) alignments (Belmonte, 2010, p.534)</p>	 <p>Karnak temple plan with double-axis.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);"><b>NATURE OF THE SPACE</b></p>	<p><b>Prospect</b></p>	<p>The construction of spaces at Karnak and similar temples followed the movement of the symbolic earth, with each outer space rising slightly to the peak, which would have been the innermost sanctuary (Barry, 2014: 176).</p>
	<p><b>Refuge</b>                  Behind the Sanctuary lie an open</p>	





	<p>court and the Festival Hall of Thutmose III. Of the many small rooms that lie beyond the hall, one is of particular interest, the so-called “Botanical Room,” with reliefs of exotic plants, birds, and animals brought to Egypt by Thutmose III from his campaigns in western Asia (Gates,2011,p.108)</p>	 <p>Relief carving of the so-called Botanical Garden at Karnak depicting plants that Thutmose III brought back to Egypt from his military campaigns</p>
	<p><b>Mystery</b>                  -the columns are thick and tightly spaced, and it is difficult to sense the overall dimensions of the space. ( Gates,2011,p.107)                  -the sanctuary which is the most secret and sacred area and is considered as the private area “ bedroom” in the residential houses ( oaks,2010,p.14)</p>	 <p>Central passageway, Hypostyle Hall, Temple of Amun, Karnak</p>
	<p><b>Risk/ Peril</b>                  -The Karnak temple precinct was always delineated from the outside world by some type of surrounding wall, according to ancient beliefs it is the boundary between interior and chaos.</p>	 <p>Enclosure wall and gates</p>

**2-Biophilic Design Patterns in the Ibn Tulun MOSQUE<sup>3</sup>:**




<p><b>NATUR E IN THE SPACE</b></p>	<p><b>Visual Connection with Nature</b></p>	<p>Daylight and sunrays in open court and water in the fountain.</p>
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<sup>3</sup> **The mosque of Ahmed Ibn Tulun:** was built by an order of the Abbasid governor of Egypt “Ahmad Ibn Tulun”. This Mosque is one of the most important architectural monuments of the Islamic world Forms and decorative motifs of the mosque are considered amongst the finest examples of ‘classical’ Abbasid tradition of Islamic architecture


	<p><b>Non-Visual Connection with Nature</b></p>	<p>the natural color of the mosque and the use of wood and stone</p>
	<p><b>Non-Rhythmic Sensory Stimuli</b></p>	<p>-The sound of birds in the high openings of the mosque. -light and shadow effect from the open court to the interior part</p>
	<p><b>Thermal and Airflow Variability</b></p>	<p>Open court ventilation</p>
	<p><b>Presence of Water</b></p>	<div data-bbox="935 514 1317 825" data-label="Image"> </div> <p data-bbox="1036 825 1214 856">The fountain</p>
	<p><b>Dynamic and Diffuse Light</b></p>	<div data-bbox="922 900 1328 1205" data-label="Image"> </div> <p data-bbox="1008 1205 1243 1241">window opening</p>
<p><b>Connection with Natural Systems</b></p>	<div data-bbox="922 1285 1328 1551" data-label="Image"> </div> <p data-bbox="946 1551 1305 1587">View from the open court</p>	
<p><b>NATURAL ANALOGUES</b></p>	<p><b>Biomorphic Forms and Pattern</b></p> <ul style="list-style-type: none"> <li>-floral stone decoration” Samarra style”</li> <li>-geometric decorations</li> <li>-The doom represents the egg.</li> </ul>	<div data-bbox="727 1591 1089 1866" data-label="Image"> </div> <div data-bbox="1094 1610 1409 1866" data-label="Image"> </div>

<b>NATURE OF THE SPACE</b>	<b>Material Connection with Nature</b>	Stone – wood
	<b>Complexity and Order</b> Square plan	 <p>The courtyard “Sahn” of the mosque</p>
	<b>Prospect</b>	The courtyard “Sahn” is a square extending south of the prayer hall, It is surrounded by covered porticoes, each consisting of two aisles of pointed arcades raised on strong piers and overlooking its open Centre.
	<b>Refuge</b>	 <p>Riwaqs of the mosque</p>
<b>Mystery</b> The light and shadow effect in mosques Riwaq,	 <p>Mosque Riwaqs</p>	
<b>Risk/ Peril</b> - Built over an outcrop of rock called Jabal Yashkur near the Muqattam	 <p>A view from the mosque</p>	

**3-Biophilic Design Patterns in the Bayt Al Suhaymi” Al Suhaymi House”:**

<b>NATURE IN THE SPACE</b>	<p><b>Visual Connection with Nature</b> Open view outside Mashrabiya Daylight and sky view from open court.</p>	 <p style="text-align: center;">Mashrabiya view outside the house</p>
	<p><b>Non-Visual Connection with Nature</b></p>	<p>Cool Air from the wind catcher</p>
	<p><b>Non-Rhythmic Sensory Stimuli</b></p>	<p>Plant scent from the garden Sounds of animals from windmill court.</p>
	<p><b>Thermal and Airflow Variability</b></p> <p>-Wind catcher “malqaf”. -open court ventilation and fountain</p>	 <p style="text-align: center;">Wind catcher</p>
	<p><b>Presence of Water</b></p>	 <p style="text-align: center;">The fountain</p>




<b>NATURAL ANALOGUES</b>	<p><b>Dynamic and Diffuse Light</b></p>	 <p>Mashrabiya screen</p>
	<p><b>Connection with Natural Systems</b></p>	<p>-The open court. -the house garden.</p>
	<p><b>Biomorphic Forms and Pattern</b> -Floral and geometric decorations. -Blue tiles with floral motifs.</p>	 <p>Blue tile room at al Suhaymi house</p>
	<p><b>Material Connection with Nature</b></p>	<p>Stone-wood- ceramic tiles</p>
	<p><b>Complexity and Order</b> The house is in the ottoman style, 2 doors Salamlk and Haramlek, rooms open on the open court.</p>	 <p>The house garden</p>

<b>NATURE OF THE SPACE</b>	<b>Prospect</b>	all rooms open on the open court
	<b>Refuge</b>	 <p>takhtbush overlooking the open court garden</p>
	<b>Mystery</b>	The house has 2 open courts
	<b>Risk/ Peril</b>	According to al Maqrizi, it was built in the place of the ancient Fatimid slaughterhouse.




**. 5-Biophilic Design Patterns in the Mohamed Ali Pasha Palace at Shupra<sup>4</sup>:**





<b>NATURE IN THE SPACE</b>	<b>Visual Connection with Nature</b>	The palace gardens were landscaped to recapture much of their former beauty in the 19 <sup>th</sup> century.
	<b>Non-Visual Connection with Nature</b>	Using natural colors such as white and beige. The floor of dining room made of walnut wood.
	<b>Non-Rhythmic Sensory Stimuli</b>	-sounds of birds and water -scent of flowers
	<b>Thermal and Airflow Variability</b>	-Open Court and water fountain -Wall windows allow light and air

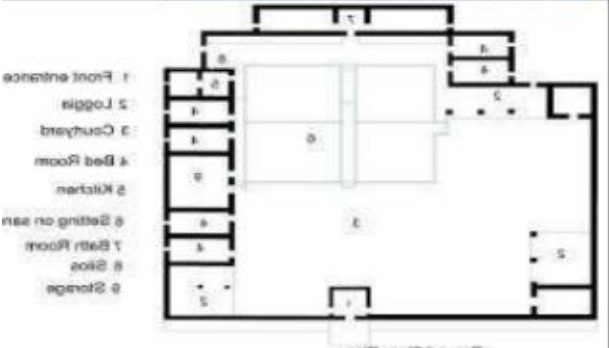



<sup>4</sup> **Shupra palace:** The Palace of Muhammad Ali Pasha (1220-1264 AH \ AD 1805-1848), founder of modern Egypt, is a rare masterpiece that brings together elements of nature, architecture and art. The palace combines elements of European aesthetics with Islamic architecture. Its construction began in 1223 AH / AD 1808, and it was completed in 1237 AH / AD 1821 its located at Shubra Suburb, which was the northern promenade of Cairo. Spanning a vast area of fifty acres across a suburb on the east bank of the Nile in Cairo. Today, this suburb is called Shubra al-Kheima and the Muhammad Ali Palace has become known as Paradise Palace or Shubra Palace.

	<p><b>Presence of Water</b> The garden of the palace includes two fountains</p>	 <p>Artificial lake with huge fountain</p>
	<p><b>Dynamic and Diffuse Light</b></p>	 <p>Wall windows allow the daylight.</p>
	<p><b>Connection with Natural Systems</b></p>	<p>The landscape garden is full of rare trees and plants.</p>
<p><b>NATURAL ANALOGUES</b></p>	<p><b>Biomorphic Forms and Pattern</b> Lion shaped statue Further, Islamic geometric patterns are visible in the interiors of some grand salons in the palace</p>	
	<p><b>Material Connection with Nature</b></p>	<p>Stone, Wood, and marble.</p>
	<p><b>Complexity and Order</b></p>	<p>The center part of the plan is the lake and fountain- it is on the Turkish landscape palaces on the Marmara sea.</p>
<p><b>NATURE OF THE</b></p>	<p><b>Prospect</b></p>	<p>All rooms opened on the centered fountain.</p>



<b>SPACE</b>	<b>Refuge</b>		The roofed place surrounding the fountain.
	<b>Mystery</b>		Light and shadow effect of the garden trees.
	<b>Risk/ Peril</b>		-Overlooking the Nile River bank in a suburb of Cairo (currently Shubra al-Khaimah) -the huge wall with few gates.
<b>6-Vernacular Biophilic design example “Nubian houses -western Suhail island “Aswan): NATURE IN THE SPACE</b>	<b>Visual Connection with Nature</b>		Nile, desert, and Mountain views of the village houses
	<b>Non-Visual Connection with Nature</b>		Using natural colors such as white and beige, in addition to light blue.
	<b>Non-Rhythmic Sensory Stimuli</b>		-sound of water -Daylight – the sand in the open court floor
	<b>Thermal and Airflow Variability</b>		Using domes and vaults in addition to the open court.
	<b>Presence of Water</b>		-The nearby Nile -some houses have a small pool for crocodiles

	<p><b>Dynamic and Diffuse Light</b></p>	 <p>Wall openings allow the daylight</p>
	<p><b>Connection with Natural Systems</b> In addition to live crocodiles in-house, they put mummified animals out of the house entrance.</p>	 <p>Mummified animals on the entrance of the house</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);"><b>NATURAL ANALOGUES</b></p>	<p><b>Biomorphic Forms and Pattern</b>  animal paintings</p>	 <p>Crocodile painting in a Nubian house wall</p>
	<p><b>Material Connection with Nature</b>  Mud – bricks and palm leaves</p>	 <p>Palm leaves “jareed” in Nubian house ceiling.</p>

	<p><b>Complexity and Order</b></p>	 <p>Most of the houses built in a rectangular shape, with open court in the Centre</p>
<p><b>NATURE OF THE SPACE</b></p>	<p><b>Prospect</b></p>	 <p>The view from the Open court as the center of the house</p>
	<p><b>Refuge</b></p>	 <p>Loggia overlooked the courtyard with a thin roof made of reed.</p>
	<p><b>Mystery</b></p>	<p>The light and shadow effect from open court to rooms</p>
	<p><b>Risk/ Peril</b> On a Nile island Surrounded by Nile and mountain desert.</p>	 <p>Nile River marine entrance “Western Suhail -Aswan</p>

### ❖ **Results and recommendations:**

Although ancient Egyptian people did not congregate inside temples to perform rituals, except only the high priest and the king, temples reveal Biophilic design patterns. Maybe because of the ancient Egyptian belief about the temple as the residential house of the deity. Especially the Karnak temple complex. Or to satisfy the king and priests.

Back in time, we will find that ancient Egyptians knew the concepts of Biomimicry and Biophilia according to our modern terms. They imitated nature, forms, behaviors, and ecosystems for example the temple's architecture as a simulation of the universe. But that was based on their religious beliefs and symbolism.

They also knew the relationship between the environment and the building, and we can notice that in their interest in architectural aesthetics, such as gardens, menageries, and pools. In addition to biophilic design patterns such as refuge, mystery, prospect, etc.

Moreover, Greeks and Romans knew the relationship between nature and humans' mental and physical health. Referred to it as "pure air", and they took it into full consideration in their buildings and landscape gardens.

Furthermore, Islamic civilization is considered the major root of the concept of Biophilic design. For what it developed and added to the architectural history such as takhtbush, Malkaf, and the criteria for establishment.

In contrast to natural environments, modern cities are characterized by a predominance of dead structures, but we need to increase the Biophilic design patterns in our buildings especially to gain benefits in our mental and physical health as our ancestors did.

By looking into nature, we can observe that Flora and Fauna have always been able to mitigate and adapt to rapid changes and harsh environments. Therefore, we need to use biomimicry to face climate change not only imitating their forms.

From the definition of Biophilic design, we understand that it is very important to incorporate natural processes and systems into the design of living environments for the protection and improvement of human mental and physical health. So we need to take into consideration Biophilic design more than green buildings.

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## محب للطبيعة بالفطرة: العمارة المصرية بين مفهوم البيوفيليا " حب الطبيعة" ومحاكاتها منذ أقدم العصور وحتى الآن

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الملخص:

البيوفيليا هي مصطلح ظهر حديثاً في مجال التصميم المعماري، ويعنى المحب للطبيعة، والذي يهتم بالعلاقات الإيجابية والتواصل بين الإنسان والبيئة في المساحات الداخلية، كما أن هناك مصطلحاً آخر وهو البيوميكري "أي الحيوي والذي يعنى بتقليد أنماط الطبيعة ومحاكاتها. لذلك عندما نلقي نظرة على آثارنا القديمة يرد في ذهننا العديد من التساؤلات ومنها: هل بنى المصريون القدماء مبانيهم وفقاً لتلك المفاهيم؟ وماذا عن العمارة الإسلامية. لماذا يهتمون كثيراً بالطبيعة في مبانيهم؟ وماذا عن المصريون في الوقت الحاضر. هل لا يزالون يهتمون بالطبيعة أو يقلدونها في مبانيهم؟ لذلك يتناول هذا البحث مفاهيم التصميم البيوفيلي والتقليد الحيوي " محاكاة الطبيعة" في العمارة المصرية من العصور القديمة حتى الآن وذلك عبر مناقشة هذه المفاهيم ضمن بعض الأمثلة على المباني المصرية عبر العصور.

الكلمات الدالة: البيوفيليا، حب الطبيعة، محاكاة الطبيعة، مصر، العمارة