

# APPLICATION OF BIOPHILIC DESIGN IN ARCHITECTURAL ILLUSION

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## **Abstract:**

The term 'biophilia' refers to the need to unite with other forms of life. Architectural design has various concepts related to nature and life. Biophilic design in architecture is the design of spaces uniting with the forms of life and nature. Urbanization and development have led to dense and overpopulated spaces which eliminates the natural forms of life. Due to this living elements are very less visible. Biophilic design helps to bring the visual connection between life forms and people. Although it can also be an illusion, it makes a great impact on human psychology. Living elements depict calmness, beauty and relaxation. Illusion in architecture creates various perceptions of space. Illusion can make an impact on the scale, size, pattern, height, colour, boldness, texture and many more perceptions even though it might not be true. Spaces can be designed to look bigger although the area is small. Application of biophilic design in architectural illusion is a beneficial attempt to bring the living forms in the spaces of urbanization. Unity of urbanism and living elements creates a balance and good user experience in architecture.

**Keywords:** architecture, design, biophilia, illusion

## **1. Introduction:**

Scientific study states that humans need daily interconnection with nature and various forms of life to be healthy physically and mentally. An emotional connection between nature and people has an impact on the relation of aesthetics and human comfort. The ancient architecture has been always connected with life forms and nature which can also be seen in the aesthetics. The sacred geometry and proportion of objects, structures and elements have connection with life. [6] Biophilic design is a modern concept that enquires nature and aesthetics connecting with life forms and nature. New research supports the positive impacts of biophilic design on human health, design practise and prioritize human-nature connection. This paper acts as a guidance to understand biophilic design in a new perspective of architectural illusion as less research implementation exists.

While vision is the greatest part of our senses, it makes a stronger impact on what we see than hearing or feeling. The act of seeing happens at a distance, and quick information is given to the

brain. Importance of illusion in architecture is due to this factor. [1] The user's first experience towards a building is through vision. Illusions can thus be created to make the required impact on our senses. Mental health is also a very important aspect while designing spaces for users, architects must take care of providing best experienced internal or external spaces. The best visual impact can be connected with nature. Illusion of natural elements does provide a positive curiosity and activates the senses creating awareness and interest. [6] Trying to put this in a commercial way, it may also attract users wherever commercialization is required. This paper studies the various applications of biophilic design in design of architectural illusion and its benefits along with case studies.

**Aim:** To study the applications of biophilic design in architectural illusion.

**Objectives:**

- Understand the concept of biophilic design
- Study the various applications of biophilic design in illusion along with case studies
- Analyse the benefits of designing biophilic illusion

Research Gap: Can natural forms and life be connected in the growing urban development? Can biophilic design and illusion unite living forms with built forms?

**2. Methodology:**

The methodology of this research study is reviewing various literatures and studying the concept of biophilic design and architectural illusion. Various books and journals have been reviewed to find the research gap. Cases have been studied to find the design concepts and outcomes of biophilic illusion. The applications of biophilic design state its beneficial uses in buildings. This research study is primarily based on review of literature and internet sources.

**3. Literature Review:**

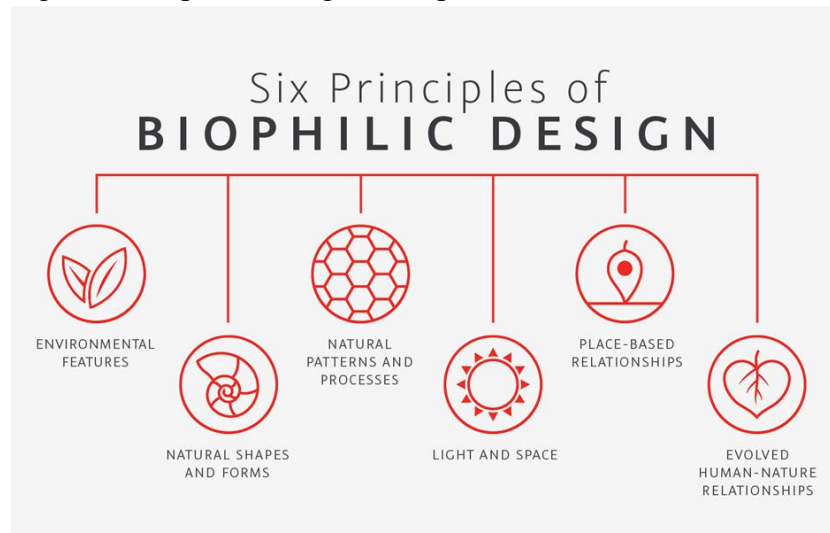
A paper by Paul Downton, David Jones, Josh Zeunert, and Phillip Roös titled 'Biophilic Design Applications: Putting Theory and Patterns into Built Environment Practice', demonstrates a valuable approach towards Built environment patterns and new biophilic design patterns. Biophilic design relates human science and nature to the design of the built environment. Virtual biophilia experience can be designed through patterns in spaces like transportation spaces, commercial and many more where the natural environment is less seen. A virtual connection can be established connecting natural elements, living systems and processes. Fundamental conditions for the effective practice of biophilic design are mentioned in the research study. It states that biophilic design encourages emotional attachment, positiveness and interconnection to the natural world. The practice and applications of biophilic design are elaborated and simplified. A paper by Farhan Asim and Venu Shree titled 'Biophilic Architecture for Restoration and Therapy within the Built Environment: A Review' demonstrates design implementations and mental health issues under built environment and indoor environment. The connection of spaces

with nature does affect mental health. Sick building syndrome is one of the mental issues that happen due to discomfort in indoor spaces of certain buildings, person, place, time. Biophilic design creates a space more comfortable, visually appealing and helps improve human mental health conditions. The authors state that the process of design must shift towards a healthy and sustainable environment which must involve natural systems and biophilic architecture. The authors define biophilic design and its concepts with domains of nature contact. Basic elements that can be connected with nature increases the bond between human and immediate natural surroundings. As people spend most of the time in built environments the mental health is affected directly and indirectly. Human mental illness is one of the major psychological issues. Temperature, illuminance, noise, air quality, etc. are some of the aspects which were analysed in the paper and how mentally get affected. Visual connection with nature is one of the major aspects of biophilic design to function visual comfort and relaxation. Various ways of design are elaborated in the paper for a successful biophilic design.

#### 4. Applications

Biophilic design can be used in various elements of design. [5] Nature in the space can be introduced by designing visual/non-visual connection, thermal comfort and airflow, presence of water/illusion of water, dynamic and diffused light, plantation, landscape design, indoor decoration with natural materials, etc.[4] These can be basic sustainable design solutions given by an architect in a building space. Further biophilic design can be introduced in spaces where sustainable design is not possible, for example, designing water bodies in a railway station does not happen. Illusions of water patterns or colour can be introduced in the design of walls, partitions, flooring or ceiling.

Figure 1: Biophilic Design Principles



Perception is an ability to perceive things through visual senses i.e. eyesight. [2] Many of the elements in building design may not be touched physically but before that it is visually perceived. Since ancient times, illusion has a dominance and known as wonders of design. The Taj Mahal is one of the examples of best illusion which has an elegant perception when viewed from a distance. The landscape designs, presence of water, material selection altogether are examples of biophilic design as they connect human and nature. Any visitor first perceives the scale, beauty, elegance and connectivity to sky, ground and water. This gives mental peace and also attracts huge number of visitors. Such inspirations should also be implemented in modern design. Various new materials are available to use in interior spaces.

#### 1) Environmental Features:

Landscaping around the built environment is the best environmental feature. Outdoor interaction spaces are preferred while designing environmental features. Now, trying to connect biophilic design applications in illusion, there are many ways architects can design biophilic illusions. 3d artwork is one of the examples of designing environmental art in the interior or exterior to provide a perception of a 3d object in front of user. It can be designed in private offices and building facades as well. Use of perspectives and artwork together can create a visual 3d image and optical illusions of environmental features. [See figure 2]

#### 2) Natural Shapes and Forms:

Forms of nature can be used as conceptual design in furniture, walls, ceilings, façade and many elements in architectural design. Organic shapes have a variety of appearances and perceptions to every individual, yet they are pleasing to the mind. We have all studied about the golden ratio in architecture. It was also found in heritage structures, as well as natural forms. Some examples are parallax effect- this effect is a random object or collective objects whose shadow casts into a thing. Natural shapes and forms can be designed in such a way to create a parallax effect of a natural element.

#### 3) Natural Patterns and processes

Illusions are mainly based on the patterns and its process. Since ancient times, flooring patterns, ceiling patterns, wall decorations, etc. have visual impact on the viewers. Patterns show a certain natural process and interconnectivity. The honeycomb structure is the most common pattern and naturally found in nature. Graphical illusions can be created using patterns and its processes to create a natural perception. The pattern of pentagons connected with each other form a polygonal pattern and also gets perceived as an isometric view of a cube. Such illusions can be designed in natural patterns for architectural design of interiors and exteriors. Texture and use of natural materials such as wood, stone, etc. in design should be done in the interiors.

#### 4) Light and Space:

The play of light and space is beautiful phenomenon while designing buildings. Many architects experiment with the light and shadows to create interesting spaces. Illusions can also be created using light and space. Penetration of light and its shadows helps to visualize the depth of space in a place. Natural light is most preferred in biophilic design. The view of light of the sunset is also designed in some heritage structures which look magnificent. Artificial lights installed and some

objects placed below it can create shadow illusions of natural life and forms. Thus illusions of light and shadow can also help enlighten the space with environmental experience. Places which are dark or not safe, shadow illusions can help creating shadows of people to perceive the feel that you are not alone.

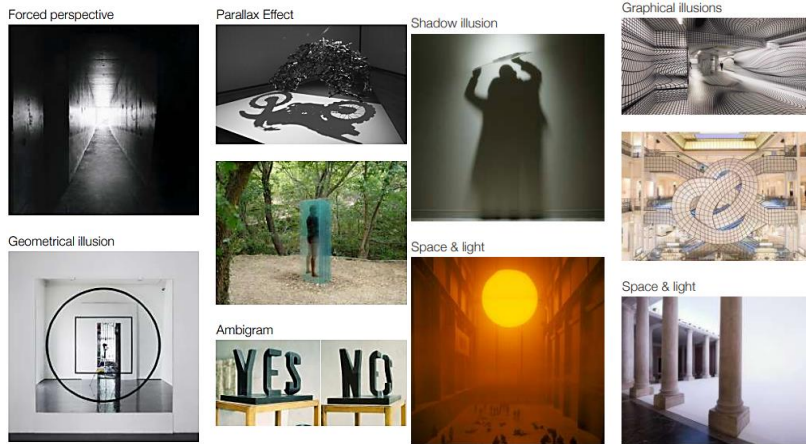
#### 5) Place-based Relationship:

This principle of biophilic design is associated with connectivity of culture and ecology for individuals to develop emotional attachments. Culture of India is diverse at every place and every occasion a wide number of people participate in the festivals, decoration, art and culture. Places such as temples, meditation centres, cultural museums, sacred pilgrims, worship and stay places can be designed with this principle. Artwork illusions of cultural decorations, sacred symbols and many more designed in the interiors or exteriors give an emotional perception to visitors. Domes with artwork or sculpture are one of the spectacular features seen in such places. Teaching of peace, positivity and sacred conveyed through illusions is a goof effort done by architects and designers. Such designs can also be done in gardens with landscape. Geographic connection to a place is also a place based relationship designed to connect natural geographic features in built environment. Ecological connection can also be established by enhancing features of forest, desert, marine, etc. into an interior design or exterior façade. By use of 3d artwork, graphical illusions, patterns light and shadow illusions and parallax effects, biophilic principles can be applied to architectural illusion. [See figure 2]

#### 6) Evolved Human-Nature Relationship:

This principle is based on the concept of bringing the outdoor environment in the interiors. Humans have been constantly relying on nature for life, resources, food and all basic necessities. Thus, the bond between human and nature should be improved in the built environment. Designing green walls in the indoors, indoor plants, etc. are some of the sustainable design solutions. Reverspective is one of the terms in illusion used when shapes or elements are directed inverse to create depth. This illusion is used to create a perception of a bigger space. The outdoor gardens or plants can be designed in reverspective windows which create connectivity of indoors and outdoors. Use of mirrors in illusion to reflect the image of a natural element perceived as many elements due to the mirror. It depend on the architect and designer to create an illusion to connect human and nature.

Figure 2: Various Illusions in Architectural Design



## 5. Cases:

### a. Kingwood Medical Centre, Houston, Texas.

This hospital is a full care service multispecialty hospital designed by Gould Turner and Associates. Its interior is well designed with biophilic concepts and the ceiling is installed with panels having 3d image of the sky. Although it not areal sky but it gives a perception of skylight or glass installed at the ceiling. By research it has been identified that when hospital spaces are designed with more connectivity to natural elements, the patients tend to recover faster. Mental health is important at recovering stage. User experience depends on the quality of space design. Positive distraction is when the active mind is diverted to biophilic engagement. Illusion helps to create a strong psychological biophilic engagement to keep the mind calm and relaxed. Hospital spaces require such design strategies to reduce stress.

Figure 3: Interior space of Kingwood Medical Centre having illusion of sky



### b. Kickstarter Commercial Headquarters, New York, USA

Designed by Ole Sondresen Architect, this case study is a commercial funding platform focusing on bringing creative projects to life. This project has accommodated many sustainable design solutions to cater the climate, temperature, ecology and nature. Local materials have been used in

the interiors. This case is not a typical example of illusion but is focusing towards biophilic design. The outdoor environment is brought in the indoors. The furniture is designed with organic shapes. The design highlights natural processes and characteristics of a functional ecosystem. The deliverables of design are non-rhythmic sensory stimuli, connection with natural systems, material connection with nature, prospect (reducing mental stress) and refuge (concentration).

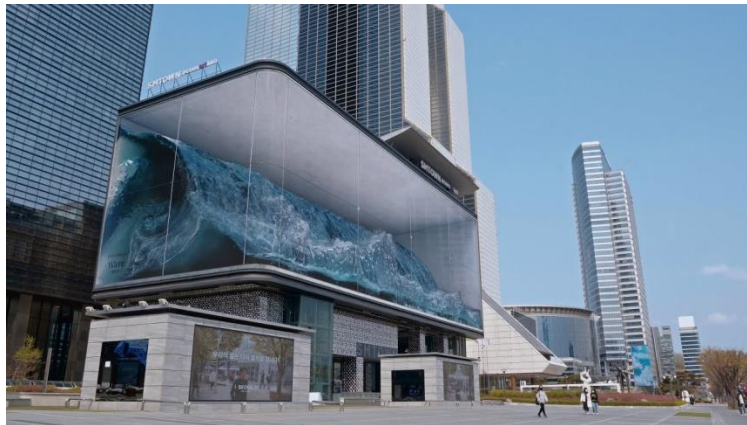
Figure 3: Organic shapes and material used and biophilic design principles



c. Samsung 8k digital signage, Seoul, South Korea

The façade of this building has an anamorphic illusion created by DOOH creative agency that's gives impression of a room containing massive volume. The ocean waves are seen as an anamorphic illusion which creates overwhelming experiences. At a certain angle, the viewers can view it as a real wave of ocean having volume of water. The ocean is a natural element of nature, without having an ocean nearby, this technology has created an illusion of having water nearby. This dominates the viewer's perception and positive psychological impact. The technology provides movement of the water, thus looks real.

Figure 4: Anamorphic Illusion at Samsung signage



## 6. Analysis

Table 1: Analysis of Cases

Terms of Analysis	Case 1	Case 2	Case 3
Design	2d illusion	Biophilic design	Anamorphic illusion
Type of Building	Hospital	Commercial	Commercial
Achievements	Helps in fast recovery	Helps in creative ideas and focused mind	Helps in imagination and connection with nature

The above table analysis shows the achievement of each case. A very less attention is given for transforming illusion into a cure for mental health. Nowadays, people are very busy and modern world does not let us stop and relax for a moment. Designing architectural illusions not only give outstanding appearances but can also improve the human mentality. Thus the attempt of this research study was to connect biophilia with illusion.

Now while Architects design projects, the economy is also an important factor, to convince the clients that the project should not only be a noble one but also beneficial to make profits.

The benefits of Biophilic design are:

- People are attracted towards a property having view of nature or designed spaces with nature.
- In hotels and restaurants, natural materials and texture of interior are preferred by visitors and do pay extra for views.
- A well designed hospital with nature views and indoor plants improves health conditions of the patients.
- At office buildings, employees work efficiently with a nature based environment.
- Schools and institutes perform well with a natural campus and improve learning skills.

In some cases it is very difficult to provide nature views, landscaping or gardens if the property size has constraints. Due to urbanization, land is not sufficient to design such elements and in high-rise projects it is difficult to connect human and nature. Development is vanishing the



existing vegetation and the views obtained are built environment at all sides. In such case, illusion can be designed.

The benefits of designing Biophilic illusion are:

- Helps people cope up with stress
- Increase positivity
- Reduce sick building syndrome
- Increases quality of space and user experience
- Can be designed at congested places
- Can be designed where natural elements are not available/ less possibility to design
- Existing buildings can be transformed.
- Improve Human-Nature connection.

## 7. Conclusion

This research study is important to highlight a positive way of designing illusion in architectural buildings and spaces. It is the responsibility of an architect to design for the wellbeing of people. Mental wellbeing is the best service given. We strongly state that designing biophilia with illusions will create awareness of nature and improve the mental health. It is not always possible to provide sustainable solutions due to rising construction. The view of a forest is only possible when a forest exists nearby, but illusion of a forest does not need a forest nearby. Natural elements are important part of our life to regulate human well-being. Illusion is transforming from still objects to moving objects as seen in the case 3. Spaces like bus stands, railway and metro stations, airports, complexes, malls, offices, etc. have very less amount of natural designed elements. In such cases, illusion can be created. By the study done above, it is recommended to apply biophilic design into architectural illusion.

## 8. References

- Dorđe Đorđević, Gordana Vujić, 'Visual Illusion of the Change of the Size of Architectural and Urban Objects Observed upon a Change of the Observer's Distance: Parameters That Influence It Phenomenologically' *Spatium International Review UDC 72.012 No. 22*, July 2010, pp. 38-46
- Baird, J.C. (1970) *Psychophysical analysis of visual space*, Oxford, London: Pergamon Press
- Farhan Asim, Venu Shree, 'Biophilic Architecture for Restoration and Therapy within the Built Environment: A Review' *Research Gate*, July 2019
- Maryam Mollazadeh and Yimin Zhu, 'Application of Virtual Environments for Biophilic Design: A Critical Review' *MDPI, Buildings 2021, 11, 148*. <https://doi.org/10.3390/buildings11040148>
- Paul Downton1, David Jones, Josh Zeunert , and Phillip Roös, 'Biophilic Design Applications: Putting Theory and Patterns into Built Environment Practice' *DesTech Conference Proceedings The International Conference on Design and Technology (2017)*, Volume 2017, 9 February 2017, pp. 59–65

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Simona Totaforti, 'Emerging Biophilic Urbanism: The Value of the Human–Nature Relationship in the Urban Space', article in Sustainability 2020, 12, 5487, MDPI, 7 July 2020