

ROLE OF BIOPHILIC DESIGN IN QUALITY OF HOSPITAL PATIENTS ROOMS

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Abstract- The psychological satisfaction of patients is an important and effective role in the completion of the therapeutic process. The patient room design certainly plays an active role in contributing to the achievement of psychological satisfaction, but we note that there is a lack of attention to this important aspect when designing hospitals. Psychologists and designers assert that trying to provide a good environment for patients results in countless benefits. The application of biophilic strategies and the linking of the internal environment of nature transforms it into a renewable and inspiring place that helps to improve health, raise mental state, recover, improve relationships and foster a sense of psychological satisfaction, happiness and harmony. According to TBG Terrapin Bright Green, as part of their efforts to identify biophilic design elements they have developed patterns of biophilic design. Many hospitals around the world have used these patterns to upgrade the quality of their hospitals. Patients flock to these hospitals from around the world for treatment. We will investigate a group of patients in hospitals, so as to identify any of their more favorable biophilic design patterns in order to follow this preference when designing patients' rooms.

Keywords: Biophilia, Biophilic Design, Psychological Satisfaction, Patients Hospital Rooms.

1. INTRODUCTION

Relaxation methods, such as deep breathing, guided perception and gradual relaxation of muscles, are among a number of different synchronized treatments that can help patients adapt to sucking symptoms. Different ages can adapt to relaxation strategies. These methods can reduce suffering and help patients cope with side effects, such as: Pain, fatigue and nausea, but must provide a suitable environment for relaxation and characterized by thermal, olfactory, auditory and visual comfort [1]. Interest in biophilic design has emerged, or natural ingredients have been incorporated into the buildings to design space to the good feeling that can upgrade patients' health and welfare, since the beginning of the twenty-first century [2].

According to psychologists and medicine in all their disciplines biophilic design can upgrade the quality of hospital design [2].

Nature is a powerful tool in architecture whose positive impact on the human condition and on improving physical and mental health, promoting positive feelings and reducing negative feelings is undeniable, because patients spend most of their time in an environment surrounded by stress and psychological anxiety, they always stay in the rooms. And their constant sense of being inside the walls of the deadly disease prison, there are a lot of opportunities that contribute to improving the indoor environment within the accommodation rooms to fit psychologically with the condition of patients. Health and well-being ", helping to complete healing by integrating biophilic design principles and incorporating natural elements into the promotion of health and well-being of patients [3].

1.1. Research Problem

The designer always cares when designing hospitals to upgrade the external environment and reception entrances; To attract many patients for treatment in this hospital, but there is a lack of interest in many hospitals to care of the rooms where the patient spends most of his time isolating alone with a nurse and the future of the deadly disease, affecting his mental and therapeutic health.

1.2. Aims and Objectives

The research aims to achieve the psychological satisfaction of patients within his hospital room by devising criteria that can be used to achieve the principles of biophilic design in the refurbishment and construction of patients' rooms within hospitals.

1.3. Research Hypotheses

The research assumes that the psychological comfort and therapeutic complementarity of patients can be achieved through the use of biophilic design principles in the design of hospital rooms which contributes to the spread of psychological comfort, a sense of belonging and a lack of lasting thinking about the future of their disease within the residential rooms.

2. BIOPHILIC DESIGN

The biophilic design is concerned with the effect of nature that surrounds patients in hospitals and significantly affects the improvement of the psychological health of hospital patients, commensurate with the patients and their orientation and its reflection on raising their spirits and bringing comfortable to them while the period of treatment, and increased the rate of treatment [4].

Physical activity in green areas creates a positive mood and increases self-esteem, and using an indoor environment that achieves various vital elements that increase the relationship between nature and man, improving mental and physical well-being and improving therapeutic status. Table 1 shows the most important elements affecting biophilic design [5].

Table 1. Factors influencing the realization of biophilic design [7]

Direct Nature	Natural Analogues	Form of the Space
Lighting	Nature photo	Horizon and sanctuary
Climate Factors	Materials from natural	Complexity and organization
Water	Nature Colors	
Plant	Simulation of natural light and climate	Cultural and ecological connection to the place
Animals	Forms and models of nature	
Fire		

All these biophilic design factors are affected by vision, hearing, taste, texture, smell, and action. A Vision is the best to connect people to their natural environment and care about it, psychological satisfaction and cognitive responses are achieved when people watch vegetables, animals, hydric, scenery and other mark of the nearby environment [6].

Aesthetically nature causes us to be interested, curious, imaginative and creative. By contrast, when we lack of contact with the natural world, like a window-less space, without nature. We are often annoyed and tired, despite our human tendency to prefer the visual feeling. Other natural responses are very important to us. Especially, hearing, taste, texture, smell, and action, often driven by hearing water, touching plants, smelling flowers, feeling the movement of the air emotionally and intellectually. The multiple use of senses with nature in a highly constructed environment contributes to comfort, satisfaction, enjoyment and cognitive performance, so that, to the extent possible, it should be encouraged [7].

2.1. Factors Influencing Realization of Biophilic Design

2.1.1. Direct Nature

2.1.1.1. Lighting

Natural light is essential for human health and well-being, empowerment, a day, night and season orientation according to the location and the cycles of the Sun. A natural light help action, and lend to luxury and pleasure. Besides simple exposure, natural light can take aesthetically attractive forms through the creative interaction of light and shade. scattered and variable light, and the integration of light with spatial properties. Natural light can be brought to the depth of interior spaces through ways such as glass walls and clerks. the use of reflective materials and colors, and alternative design strategies [8].

2.1.1.2. Climate Factors

Naturally occurring ventilation plays an important role in the patient's comfort, the natural ventilation experience in the building's surroundings can be enhanced by differences in air flow, temperature, humidity and air pressure. This can be achieved through external access through simple means, such as operable windows, or through more complex engineering technologies and strategies, consciousness and climate response have continued a necessary feature of people's experiment of nature across history, critical to the physical fitness and survival of humans [10].

2.1.1.3. Water

Water is necessary for life, and it can reduce stress, boost pleasure and foster health and achievement. Attractiveness of water principally apparent while connected with different senses like eye, ear, touch. A design may find the wish for aquatic connection included fountains, aquarium, waterfall, and others, Water can used by fountains, aquarium, waterfall, and others, Water is often more enjoyable when watched clean, motor and tested through multiple senses [7].

2.1.1.4. Plants

Plants, in particular Floral plants, are a best effective strategy for bringing first-hand experience of the nature of the built environment. Plants can help decrease stress, contribute to physical health, increase comfort, and improve performance and productivity. However, the application of single or isolated plants is rarely beneficial. Flora in buildings and landscapes is expected to be bountiful on native species rather than alien and invasive species [14].



Figure 1. Healing through nature at Khoo Teck Puat Hospital [14]

2.1.1.5. Animals

The existence of nonhuman animal life has been element people's finds throughout human history. But its attendance in the hospitals can be problematic. Figure 2 shows favorable connection with animal life achieved by aquariums and an animal park at the Royal Children's Hospital [11].

2.1.1.6. Fire

Fire controlled is a great accomplishment of mankind. That has achieved it possibility to harness energy beyond creature life. And help with the change of elements to

another. The fire can be simultaneously an origin of comfort or anxiety, the suitable fire may be used in the building can be achieved through fireplaces, also simulated through the creative use of light, color, motion and Building materials that help heat change by time [5].



Figure 2. Animal at Royal Children's Hospital [15]

2.1.2. Natural Analogues

2.1.2.1. Nature Photo

The photo of nature in the building plants, creature, landscapes water and topographical features may be healthy for patients. These photos may happen through the applied of the photograph, sculpture wall, natural simulations by video and other means. Individual or isolated images of nature usually have little effect. Representative expressions of nature must be repetitive, objective and abundant [9].



Figure 3. Nature photo at Royal Hospital for Children [9]

2.1.2.2. Materials from Nature

Materials from nature may be notably encouraging resulted the wealth of a natural issue in a flexible estimation to the underlining living and solving its problematic. The modification of materials causes vision and touchable, which few materials made by man can replicate. Building materials from nature such as wood, stone, wool, cotton and leather can use in a widely extensive of decorations in interior or exterior [5].



Figure 4. Use of materials from natural at patient rooms [17]

2.1.2.3. Nature Colors

Color has long been an important means of promoting motion and sitting. Successful application of colors in hospitals may be useful, granted the modernistic capability to produce synthetic colors, principally shining colors. The bio-successful appeal of color needs usually favors the special quiet earth colors of soil, rocks and plants. Operation glowing paints should be enforceable, accentuation good-looking environmental forms such as flowers, sunsets, and clouds, and animal. Greatly synthetic, opposition and vibrating paints need to be solved [12].

2.1.2.4. Simulation of Natural Light and Climate

Color has long been an important means of promoting motion and sitting. Successful application of colors in hospitals may be hard, granted the modernistic capability to produce synthetic colors, principally shining colors. The bio-successful appeal of color needs usually supported the special quiet earth colors of ground, rocks and flora. Operation glowing paints should be enforceable, accentuation good-looking environmental forms such as flowers, sunsets, sunsets, tint and a little flora and creature. Greatly synthetic, resistance and vibrating paints need to be solved [11].



Figure 5. Simulation of nature at the elevation cladding of Mexico City's Manuel Gea Gonzalez Hospital [3]

2.1.2.5. Forms and Models of Nature

The forms of the nature are most notably good-looking, these forms may be remarkably various from plate-similar shapes on walls, flora pattern on exteriors, and animal textile in structure or covering. The event of pattern like nature can convert a stationary place into one that possesses the forceful and nearby qualities of the living mode [5].

2.1.3. Form of The Space

2.1.3.1. Prospect and Refuge

Personality progresses in a flexible reaction to supplemental welfares of possibility and haven. Possibility relates to length of surrounding setting like help patients to accept access and dangers, while the haven supplies protection and safety locations. These complementary shapes may be up and running and acceptable in the formed. This crucial effect allows to reach via design patterns like that exterior, viewing connecting with interior spaces, and the development of secure and shielded locations [5].

2.1.3.2. Complexity and Organization

People desire the complexity as well natural and personal surroundings, aim places to be well. Even so, complexity is sometime difficult and not well for all patients. Complex shapes need to be various and differing, although conducted places allow features of connection and arrangement [8].



Figure 6. Complexity and order in wall colors and Dome glass at 57357 Hospital in Egypt [13]

2.1.3.3. Cultural and Ecological Connection to the Place

Person beings developed as a regional creature, due to the fact that it increased mastery, improved security, and made easier action. The consolidation of well familiar building considers this leaning, which may be strengthened by the development and eco-friendly mode. Culturally applicable designs increase the connection to the location and the purpose like the location has a personality.

In the same way, environmental relationship to a place may boost the zone's psychological relation, especially achievement of regional scene, native plant and creature, and feature climate. Cultural connection that are developed usually cause persons to safeguard and support nature and person surroundings [6].

2.2. Biophilic Design Patterns

Several research organizations have contributed to studies on how to combine biophilic design into building, which focuses its efforts on translating biophilic design into applications of in-house design elements and as part of their efforts to identify biophilic elements, they developed 14 patterns parted to three main categories of how to integrate biophilic design into installations, Table 2 shows 14 biophilic design patterns and psychological responses [9].

2.2.1. Nature in the Space Patterns

These patterns concerned with nature being in the place. This contains flora, animals, fire, it and also audio, smells and other natural elements. Examples like flower sinks, birds, aquariums, patio gardens, plant walls or vegetable surfaces. The patterns are realized via the making important relationship with nature, especially via variety and sensory relationships [8].

2.2.2. Natural Analogues Patterns

Natural Analogues Patterns address the biological, human-made and indirect evocations of nature. matter, paints, forms and patterns set up in nature occur as element of skill, medals, ornament and fabric in the buildings. Simulating stones and trees, household goods with biological shape, and materials from nature which have been treated or changed widely (such as wood panels, granite countertops), each provide an indirect link to nature, and the most powerful natural analog experiences are managed by supply the luxury of information in the orderly and from time to time [7].

2.2.3. Nature of the Space Patterns

The patterns are focus the areal forms for places, and contain our natural and knowledgeable desire to watch outside our direct surroundings, hiding vision, at times actually the fear that boost feature while they contain a safe feature of security, the strongest adventures of the nature on the places are realized by generating kindly and good-looking, establishment combined with nature's patterns in place and natural parallel [11].

3. HOSPITAL PATIENT ROOM

Patients' rooms are one of the places where the patient spends most of his or her time. They must be very attentive, as they represent the patient's sanctuary from which he or she escapes from the surrounding environment and away from the surrounding conditions. The accommodation rooms must have a positive impact on patients and not be only content with traditional finishing [1].

Table 2. Biophilic design and mental satisfaction [11]

14 Patterns		Reduce tensions	Cognitive functioning	Emotion, Mood and Preference
Nature in the space	Visual Connection	The heart rate - The blood pressure is lowered	Improved mental involvement - attention	Enhanced comfort and safety perception
	Non-Visual Connection	Reduce the stress	Beneficial impact on cognitive performance	Perception of improved mental health and peace of mind
	Non-Rhythmic Sensory	The heart rate - The blood pressure is lowered	Improved concentration, focus and perception of safety	
	Thermal Variability	Positive impact on comfort, well-being and healing	Positively concentration	Enhanced comfort and safety perception
	Water	Low blood pressure, increased sense of calm, lower heart rhythm and blood pressure	Improved Attention and better memory Increased psychological perception and reactivity	Perceived preferences and positive emotional reactions
	Dynamic Light	Positively affected physiological system functioning Better visual vision		
	Natural Systems			Positive health responses; Changing perception of the environment Comfort and safety perception
Natural Analogues	Biomorphic Forms		Beneficial impact on cognitive performance	Better luxury
	Material from Nature			Observed vision preference
	Complexity & Order	Positive impact on sensory and physiological responses to stress		
nature of the space	Prospect	Reduce the stress	Reduces annoyance, irritation, tiredness	Enhanced comfort and safety perception
	Refuge		Improved concentration, focus and perception of safety	
	Mystery			Induces a strong response of enjoyment.
	Risk			Results in heavy reactions of dopamine or pleasure

3.1. Heidelberg Hospital for Oncology

The hospital is located in an environment full of natural plants and trees, allowing visual and invisible contact with nature. The existence of such an environment has unexpected stimuli as a result of ambient atmospheric changes.



Figure 7. The nature of the hospital's external environment [16]

Natural systems are associated with changing plant shapes by changing the seasons of the year Complexity and order occur from the spread of herbs and plants and the Figure 7 illustrates the nature of the hospital's external environment, so patients had to benefit harshly from witnessing the beauty of attractive nature while in the patient's room [16].

The Figure 8 illustrates the use of large glass windows in the patient rooms that achieve visual contact with nature as well as the realization of dynamic light, atmospheric flow and partial association with natural systems and non-

rhythmic stimuli. We also note the use of wood ores of nature. The patient room is a haven for patients to isolate from the surrounding effects of patients and enjoy the nature scene [9].



Figure 8. The patient rooms in hospital [16]

3.2. The Royal Hospital for Children

The hospital is distinguished by its biophilic design standards and was certified as the "World Health Building" in 2012 [9]. Significantly element the hospital's design was stimulated by the original bush ground environments of the nearby Royal Park. The squares, the scope of variegated leaves, the panoramic horizons of the gardening, the two-level reef fish basin, large artwork and the mini animal park was among the groundbreaking architectural elements exploited. Which helped improve the patient's health within the hospital [18].

Biophilic design patterns within the patients' room of the hospital are achieved through the use of a large full-wall glass window which realizes the pattern of visual

contact with nature and enjoy the beauty of the external environment surrounding the hospital, Also note check dynamic lighting pattern due to large window size We note that part of the glass is regularly covered which achieves many biophilic design patterns such as Complexity and Order, dynamic light and non-rhythmical achieved throughout the day and over daylight time as it changes to shade over time. The sanctuary and scene pattern are checked because the room contains the patient when sitting alone in his room and enjoying the outdoor scene [9].



Figure 9. The Royal Hospital landscape and elevation [15]



Figure 10. Patient room in Royal Hospital [15]

3.3. Study of Biophilic Design and Patients' Psychological Satisfaction

A random study was conducted on 100 patients in multiple hospitals the designer used modern finishing materials in Egypt, and the study was aimed at identifying the psychological comfort of patients inside their hospital rooms, and the mechanism for using biophilic design patterns within patients' rooms was clarified to determine the extent to which each biophilic design pattern achieves psychological comfort in these patients. The factors influencing the realization of biofilm design patterns within the patient's hospital room are climatic factors, plants, water, fire, animals (fishes or pets), room finishing (walls or grounds), and window glass.

The study relied on identifying each patient by selecting (yes or no) for each of the preceding elements in each pattern. There are patterns by which some elements in the same pattern are not achieved and are excluded from the selection. When the result is drawn, selections are compiled for each pattern divided by the number of elements that can be achieved in this pattern. Therefore, Table 3 and Figure 11 show the outcome of the patient satisfaction questionnaire within the hospital in case of biofilm design patterns in the patient room design within the hospital.

Table 3. Survey results of 100 patients in a hospital in Egypt to integrate biophilic design patterns within hospital patient rooms

		Climate Factors	Plant	Water	Animals	Fire	Finishing Rooms	Glass windows	Average results
Nature in the space	Visual Connection	78%	88%	98%	12%	16%	-	100%	392/6 = 65%
	Non-Visual Connection	56%	97%	94%	42%	32%	43%	-	364/6 = 61%
	Non-Rhythmic Sensory	98%	63%	98%	62%	32%	-	83%	436 / 6 = 73%
	Thermal Variability	67%	95%	93%	-	16%	-	67%	338/5 = 68%
	Water	-	-	98%	-	-	-	-	98%
	Dynamic Light	99%	-	-	-	-	82%	100%	281/3 = 94%
Natural Analogues	Natural Systems	71%	83%	-	-	-	-	71%	225/3 = 75%
	Biomorphic Forms	-	62%	-	5%	81%	16%	2%	166/5 = 33%
	Material from Nature	-	94%	-	-	-	94%	-	94%
nature of the space	Complexity & Order	-	92%	80%	-	2%	7%	12%	193/5 = 39%
	Prospect	78%	88%	98%	12%	-	-	100%	376/5 = 75%
	Refuge	68%	97%	98%	-	-	-	82%	345/4 = 86%
	Mystery	27%	88%	11%	-	-	-	14%	140/4 = 35%
	Risk	-	-	-	-	-	-	2%	2%

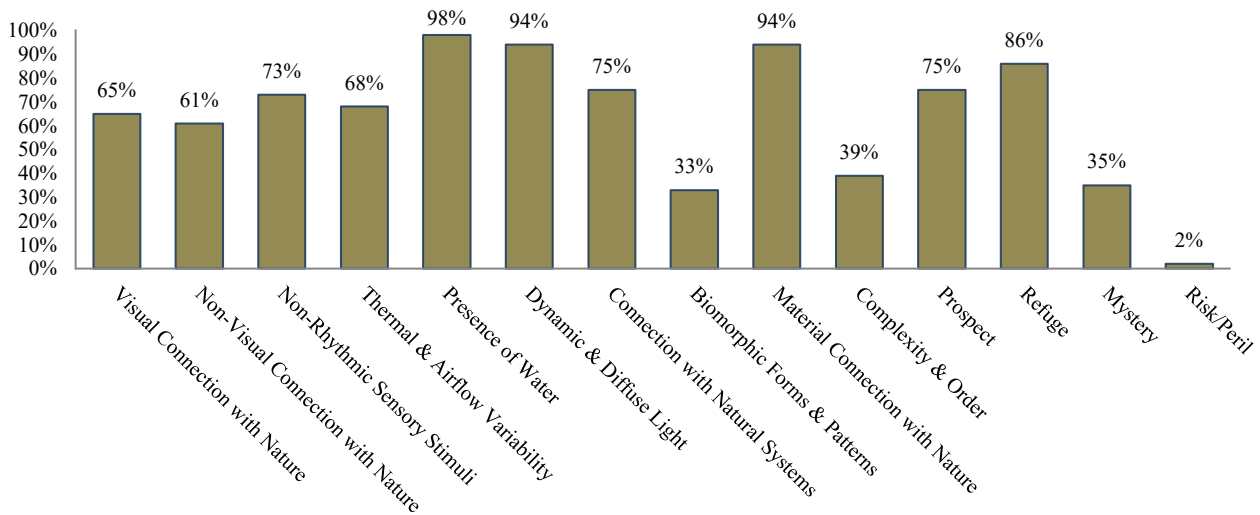


Figure 11. Survey results of 100 patients in a hospital in Egypt to integrate biophilic design patterns within hospital patient rooms

4. CONCLUSION

This study discussed one of these strategies, especially those relating to nature, and the results were as follows:

1. Psychologists and designers assert that trying to provide a good environment for patients results in countless benefits.
2. The application of biophilic strategies and the linking of the internal environment of nature transforms it into a renewable and inspiring place that helps to improve health, raise mental state, recover, improve relationships and foster a sense of psychological satisfaction, happiness and harmony.
3. Several research organizations have contributed to studies on how to integrate biophilic design into building, they developed 14 patterns of biophilic design, they can be divided into three main categories of how to integrate biophilic design into installations.
4. Biophilic design patterns in the patient rooms of global hospitals have been used to improve patients' psychological condition.
5. According to a questionnaire conducted on 100 patients in Egypt hospitals through the researcher, the following was reached:
 - a) The most important concerns of the disease with the use of glass windows, achieve communication with external nature.
 - b) Patients are very interested in the presence of water and plants within the room, and we also note a great interest in achieving visual and non-visual contact (touch, smell, audio).
 - c) patients associated with nature and moderate climate impacts such as climate changes, rainfall and cloud changes.
 - d) Patients do not prefer to use glass windows as a risky pattern, where attendance is very low as well as the lack of interest in the presence of pets or the presence of fire.

5. RECOMMENDATIONS

The research analyzed hospital patient rooms that followed the basics and criteria of hospital design, without psychological of patients. We learned about the patterns of

biophilic design and proceeded to survey patients' interests in biophilic design elements within the patient rooms. Therefore, according to the results of the research, we recommended the following:

- 1) Directing the competent authorities to include attention to the psychological dimension via the code of hospitals design.
- 2) Attention to patients' rooms and the fulfilment of sanctuary needs and communication with nature externally and internally.
- 3) Patients must be attracted through non-rhythmic stimuli in patients' rooms because patients do not think into the about their sick fate.

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BIOGRAPHIES



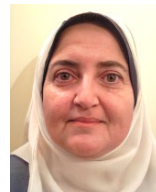
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