



BIOPHILIC DESIGN AS AN APPROACH TOWARDS INTEGRATING NATURE INTO THE DESIGN OF RESIDENTIAL UNITS TO IMPROVE HUMAN MENTAL HEALTH AND WELL- BEING

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Abstract:

Humans are biologically connected to nature physically, psychologically, and spiritually. biophilic design is a new design approach to integrating natural elements into built environments to enhance human mental health, productivity, and well-being. There is still a need for more application of biophilic design in residential units and to enhance communication between humans and nature due to its positive effects on human health. This is due to the importance of the effective role of interior design by incorporating biophilic design elements into the design of residential environments. The author conducted a systematic review and analysis of the literature to understand the relationship between the application of biophilic design and its impact in various built environment activities on human health, well-being, and productivity. This study focused on using the descriptive analytical approach to collect information on biophilic design, its elements, and its various applications, and to study and analyze the opinions, needs, and suggestions of the respondents on the questionnaire survey to reveal the differences and similarities in detail through the author's use of the five-point Likert scale to measure the responses to the sections of the questionnaire survey. The results of the data analysis indicated the effectiveness of integrating bio-design in the design of housing units to improve human mental health and well-being, given the existence of a statistically close and direct relationship between man and nature. This study proposes to support positive interaction between man and nature in order to encourage a sense of responsibility towards society and nature and to continuously improve the quality of the indoor environment in residential units by integrating biophilic design elements for a healthy indoor environment.

Keywords: - Natural elements; Biophilia; Biophilic interior design; Environment quality; Mental health; Well-being.

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INTRODUCTION

The gap between humans and nature is increasing as cities become more urbanized and there are more skyscrapers. According to studies, the separation of man and nature has a negative impact on human physiology and well-being, leading to a variety of stress-related illnesses. It is important for humans to feel safe and comfortable, as connection with nature enhances concentration and more effective functioning. Architects create projects that connect nature with their architectural ideas based on biophilia theory and psychology, keeping this in mind and adopting an environmentally friendly and human-centered mindset. It is important to integrate the elements of nature into the interior design of residential spaces and avoid isolating the internal environment from the connection with nature because it positively affects physical and psychological health. Biophilia is a concept based on the idea of man's innate tendency to communicate with nature, as nature is the natural home of man, providing him with shelter, food, drink, treatment, and everything he needs. There is a close relationship between humanity and nature, and the quality of this relationship is determined by the thought, culture, and health of individuals. Nature has a clear role in the design of built spaces. [1] Biophilic design is an architectural approach that seeks to closely connect the occupants of a building with nature. Buildings designed through biophilic design incorporate elements such as natural lighting, ventilation, landscaping features, and other elements to create a built environment that is more productive and healthy for people. [6] The natural world is important to human well-being. However, human interaction with nature is often lacking in modern societies [7]. Biophilic design has its origins in several theories from environmental psychology that interpret humans' need for nature as an instinctive sense of the natural elements. [2] The term "biophilia" was first used in the 1960s by Erich Fromm, to describe the tendency of humans to be attracted to everything that is alive and energetic. The idea of biophilic design arises from the growing realization that the human mind and body have evolved in a rich sensory world, a world that still represents people's health and productivity. To maintain their physical and mental health, as well as their social interactions in society, humans need to stay connected to nature. The architects took the idea and tried to use it in the field of architecture in the 21st century. The first step is to build environmentally responsible and human-

centered ecosystems to sustain human well-being. Secondly, it aims to reduce the effects of degrading human behavior. Emotional and even spiritual well-being. [3] Biophilic design is rapidly evolving to become a vital part of the design of modern environments, whether in workplaces or residences. [4]

A human belonging to nature represents an innate feeling known as vitality, and it has a direct and strong relationship to human health and well-being, which is affected by the quality of the internal environments, whether they are residential environments in which we live or work environments, as we spend most of our time in these environments. Most people feel better and more comfortable when they are surrounded by nature. As the integration of nature into the built environment supports health and well-being, reduces stress and positively affects the mood, nature is also a source of creativity and innovation. This aims at the importance of linking the interior design of residential units to the natural environment and creating built environments that enhance communication between man and nature and contribute to achieving psychological well-being and physical comfort by applying vital design elements in the interior design of residential units to enhance the positive impact of the relationship between man and nature and counter the negative effects of modern urban life.

The importance of biophilic design is to reconnect people with the natural environment and the importance of its role in improving people's mental health and well-being by integrating it into the design of housing units, directly or indirectly, in the built environment, which reduces stress, blood pressure levels and heart rates. It also has positive effects that encourage increased productivity and creativity and improve general health.

The problem of the study lies in the lack of an interior design for the residential units that meet the psychological and physiological needs of its occupants in its design. Man spends about 90% of his life in built environments with various functional activities in general and housing units in particular because of their multiple benefits with positive effects on man. The study examines how to connect people with nature by incorporating bio-design elements into the design of residential units to improve their psychological and physiological health, reduce stress, blood

pressure levels, and heart rates, and increase productivity, creativity, and well-being.

The author set the study determinants represented in the specific time of the study: the second semester of the academic year 2022-2023 was chosen to implement the study tool. Sample size: The study was limited to a random sample of faculty, staff, and students at King Faisal University. Location: Al-Ahsa, Kingdom of Saudi Arabia. Subject: Biophilic design as an approach towards incorporating nature into the residential design to improve human mental health and well-being. So that these determinants help in answering the following study questions:

- What is the reality of the current interior design of the housing units from the point of view of the random sample of King Faisal University on the electronic questionnaire?
- Is the study sample aware of what biophilic design and its elements are?
- What are the effects resulting from the integration of biophilic design elements into the environments of the residential units from the point of view of the beneficiaries?
- What are the health benefits to incorporate biophilic design in built environments?
- How can the characteristics of biophilic design be integrated into the residential interior space?

Buildings can have biophilic designs by incorporating natural shapes and patterns. These aspects of nature may directly use elements such as light, air, water, or plants or they may use images, colors, simulations, natural forms, etc. which are influenced by nature. The biophilic design introduces a sustainable design strategy that seeks to reconnect people with the "natural environment". By applying this theory, its principles, and building environment design processes. [5]

LITERATURE REVIEW

There is a lot of scientific research about why the deep desire to connect with nature affects physical and mental conditions. This led to the development of design theories on how biophilic design can help improve human health and well-being. These theories also explained the physical and psychological reactions to natural elements within built or natural environments, and the use of these responses in creating positive interior spaces. There are many recent literature reviews on biophilic design and healthy home environments. In this study, we reviewed several studies that benefited from its most prominent

features. It should be pointed out that the reviewed studies were published between 2014 and 2022 in several countries, indicating their temporal and geographic diversity. In the following, we present a summary of these studies, then we explain what the current study offers by identifying the differences between it and previous studies, and finally note the aspects of previous studies that benefit the current study.

Cleveland (2014) aimed to show the interdependence between humans and nature. Human evolution depends on the natural environment in order to feel general well-being. This interdependence enhances the closeness that people experience with life, as research has shown that this relationship is a crucial element in promoting human health and general well-being, and the interdependence between people and the natural surroundings is one of the things that are analyzed and studied to reach the appropriate design. Design can enhance this relationship through built environment solutions that encourage interdependence between people and natural elements. In return. The environments that were designed did not take into account in the design the preservation of the integrated relationship between the user and the natural elements surrounding him. This underlying interdependence has hindered and affected the overall health and well-being of the users. [8]

Kaan, & Yoon (2019) showed an evaluation of the customer experience of different car showrooms using 3D virtual reality. The experiment was carried out on 18 participants by presenting two showroom designs, one showing the current design standards of a car manufacturing company, and the other showing an experimental showroom whose design depends on integrating biophilic design elements into its interior design to see the effect of each. A design in which the participants evaluated their experience for each design environment and measured some factors such as stress, brand experience, purchase intention, and re-visiting the store again. Then, the survey responses were compared to the design of each showroom, and the results of the experiment showed that the lively experimental design led to significant improvements in the consumer's perception of the brand. It also indicated their willingness to return and purchase intent to consumers, and the study contributed to clarifying evidence regarding the effects of biophilic in-store design. [9]

Aly (2021) pointed out that the design of office workplaces has witnessed many changing stages of development over the past decades, in addition to the continuous technical development that changed design methods, especially after the emerging Coronavirus pandemic, when workers all over the world switched to working remotely during the home quarantine period. The research discussed the problem of increasing fears of the danger of this epidemic with the beginning of the gradual return to workplaces, as well as the importance of providing safe healthy environments. It aims to motivate designers to formulate future design solutions that contribute to providing safe work environments that promote health and well-being and help motivate productive workers. Where nature was an essential and pivotal factor that must be provided so that the design is oriented toward people to enhance their health and well-being, by integrating biophilic design and smart technologies in workplaces to improve user experience and create a safe, healthy, and productive work environment, so that future workplaces become healthy and smart.

The research followed the deductive approach by studying the concepts related to biophilic design and the types of smart technologies, then some design strategies for future workplaces were presented based on the principles and patterns of biophilic design supported by smart technologies. [10]

Ghaziani et al (2021) present strategies for biophilic design to benefit designers. The study also demonstrated the need for the importance of applying biophilic in school design because of its impact on children's health and well-being. The application of biophilic in schools is also unexplored in many countries. Whereas, the aim of its application in the design of schools is to increase communication between the built environments and nature to enhance children's well-being. The study focused on ten patterns of life-loving design through two categories. The first is nature in space, and the second category is its natural analogues. Application of biophilic design patterns in primary schools and children's participation in the design process. [5]

Samir (2021) focused on how patients suffer from anxiety during their long stay in the hospital as one of the built environments that may be separated from the natural environment, where nature is a source of stress reduction, health

improvement, psychological treatment, and recovery from diseases. The green spaces inside the hospital help the healing process, reduce stress, feel pain, and psychological pressure, and reduce dependence on medication. The study also aimed to clarify the effect of applying biophilic design in hospitals and healthcare facilities on the functions of human organs and the cognitive functions of patients by finding the relationship between natural systems and neurological and physiological functions. To produce the best designs for the healthcare environment and to use biophilic design strategies to reduce the length of stay of patients in hospitals. [11]

Esan & You (2021) The study indicated that the application of biophilic design in the interior design of stores helps to achieve visual quality and the desire to spend more time shopping in stores, and retail stores. The study used quantitative research tools with the electronic questionnaire, and 177 participants participated in the questionnaire. The responses of the respondents to the questionnaire were analyzed to show the positive impact on consumer responses in the case of visual contact with nature and the application of biophilic design in the shop environment. The t-test showed that the purchase response to consumers is higher when applying the characteristics of biophilic design in stores. [12]

Huntsman, & Bulaj (2022) aimed to identify the benefits of biophilic interior design in healthcare facilities. The study also showed that residential environments for people living with chronic diseases receive relatively less attention with regard to their health. The COVID-19 pandemic caused restrictions for people to stay in their homes to preserve their health from infection. Hence the importance of creating interior spaces that support physical and mental health. The study discussed how to integrate elements of nature into the interior design of residential spaces to enhance health care for patients with light therapy, relaxation, mental meditation, listening to music, some physical activities, aromatherapy, sleeping well, and improving symptoms of depression, with the aim of combining biophilic design with internal healing environments to improve patient care outcomes. [13]

Almusaed et al (2022) study focused on understanding the role of the school in society, with the need to evaluate its function and importance after the COVID-19 pandemic. An

educational environment is a powerful tool for students' motivation, creativity, focus, and absorption. The study used the assessment survey tool as a powerful tool for students' opinions about teaching places. And the educational environment to improve educational institutions and schools. And through the necessity of applying the concepts of biophilic design and integrating the components of nature completely into the educational environment. [14]

Zhong et al (2022) study indicated that "nature" and biophilic design have received great attention in architecture and the growing environmental challenges, open questions, and controversies still exist regarding the perception, treatment, and, integration of "nature" in design. The study conducted a literature review to discuss biophilic design as a theoretical framework for the interpretation of "nature" in engineering architecture. Some questions represented in the first question: How did the concept of biophilic design emerge, and what is its definition? And the second question: What are the ways in which biophilic design can contribute to the goals of sustainable architecture? And the third question: What are the main design strategies in biophilic design? The main frameworks of biophilic design and its elements were compared and their benefits in promoting health, well-being, productivity, and sustainability were analyzed. The results indicated that biophilic design is more complex than just using the plant element in the built spaces, but rather expanding the integration of different types of nature in the built environments and increasing biophilic design practices. [2]

By reviewing literature reviews, we note that the current study agrees with previous studies on the main topic and its general objective is that it differs from it in several aspects that this study seeks to address, namely:

- The research problem included the opinions of the beneficiaries of faculty members, students, and employees at King Faisal University about the reality of the current interior design of residential units and with regard to the availability of biophilic design elements in their housing units or not.
- This study used the descriptive analytical approach to collect real information about the physiological and psychological effects of biophilic design on humans from the point of view of the beneficiaries.
- The appropriate tool was chosen, which is a questionnaire to survey a sample of faculty

members at King Faisal University, students, and employees about their views on biophilic design. The required data were collected through their answers to the questionnaire and benefit from their opinions and recommendations.

- The researcher benefited from previous studies on points related to biophilic design and its elements and the importance of its application in built environments with different functional activities and to identify its positive effects on enhancing the mental health of a person and his ability to recover in addition to increasing his productivity represented in the workplace.

MATERIALS AND METHODS

The author used the descriptive analytical method which is defined as a meeting of two methods with each other, namely the descriptive approach and the analytical approach, where the descriptive approach is the basic approach adopted in the study. It is one of the most famous study methods used in scientific research. It is characterized by flexibility and comprehensiveness. to study the phenomenon accurately and comprehensively. [45]and study and analyze the opinions, needs, and suggestions of the beneficiaries in the paragraphs of the questionnaire survey about biophilic design and its elements, as well as to reveal the current reality of the interior design of the residential unit in which they reside, in addition, to survey their awareness about the physiological and psychological effects of biophilic design on humans. Which was answered by a random sample of faculty members, students, and employees at King Faisal University.

STUDY TOOL

An appropriate tool, a questionnaire, was chosen to survey a random sample of KFU staff including faculty members, students, and staff. About their views on biodynamic design as an approach to integrating nature into the interior design of residential units to improve human psychological and mental health. The author designed the questionnaire divided into five main sections. Each section of them consists of a set of data. The first section is entitled: Participant Characteristics / Demographic Data. The second section is entitled: The current reality of the interior design of the housing units of the Respondents. The third section is entitled: Biophilic Design and the fourth section is: Incorporating biophilic design elements into the interior design of residential units. The fifth section is entitled: The Physiological and psychological effects of biophilic design on

human housing units. Then the required data was collected through the respondents' responses to the questionnaire. The author used the five-point Likert scale to measure responses to the questionnaire items and analyze the data, which is widely used in most fields of science to measure tendencies, desires, and attitudes, as well as to measure behaviors and preferences in

psychological tests [15]. They were scored from 1 to 5, where 5 indicates "strongly agree" and 1 indicates "strongly disagree". Scores were used to calculate arithmetic indicators and averages by computer analysis programs to draw conclusions from questionnaires and research. The scale in this study is shown in Table 1.

Table 1. The 5-point Likert scale

Response	strongly agree	disagree	neutral	agree	Strongly agree
Degree	1	2	3	4	5

The Biophilia Hypothesis It is "the innately emotional affiliation of humans and other living beings". After humans transitioned to the built environment, the need for nature then evolved into "thinking about nature." [16]

TERMINOLOGY

• Natural elements

They are the elements based on nature that have a major role in human beings' association with it, whether directly or indirectly, or symbolically. When included in the internal environment, these natural elements help to love the place, attach and positively relate to it, while the connection was with a natural or built environment, as this positive association helps and enhances the mood, psychological state, and healing. [17]

• Biophilia

The origins of the word "biophilia" go back to the ancient Greek language. The word "bio" means life and "philia" means love. The whole world is an expression of love for life. Biophilia literally means love of nature, and this is due to the fact that humans have the instinct to connect and be close to nature. It is that human tends to belong to the natural systems and processes and the life and vital features of the non-human environment surrounding human. [8] The term biophilic design appeared in 1965. The German/American social psychologist Erich Fromm worked on the term biophilia and defined it as "the love of life" or "living things." The American biologist Edward Wilson hypothesized that people have a genetic need to be in harmony with nature. it aims to make optimum use of natural resources. Stephen R. Kellert, a professor of social ecology with academics, took up this idea and coined the term "biophilic design" the idea of connecting humans with nature within their built environment. The concept of biophilia is not limited to interior design or architecture but is found in other

sciences such as biology and sociology, all of which are related to nature.

• Biophilic Interior Design

It is the design in which nature is integrated into the space designed by designers, whether architects or interior designers, to improve and enhance the health and well-being of its residents. [3] To integrate natural shapes into the interior design and furniture elements, it must be taken into account that the design is irregular in shape and does not have straight lines or sharp angles, inspired by the shapes and designs of natural elements, and that it be made of natural materials.

• Built Environment

Is the places and spaces that have been built, created, or modified by people so as to provide environments suitable for the types of human activity. [18]

• Quality of Life

Quality of life is a broad concept concerned with the general well-being of society. It has many large dimensions such as the physical, social, cultural, psychological, and environmental dimensions. There is no agreed-upon definition of the term quality of life. Some definitions include that quality of life reflects not only the well-being of life but also the ways in which people respond and feel about their lives in those areas. Environmental quality is one of the most important components of quality of life. It is a qualitative and effective measure. Where environmental quality can be assessed by evaluating some values such as beauty, clean air, noise, fumes, and crowding. [19]

• Mental Health

The World Health Organization (WHO) defines mental health as "a state of well-being in which an individual is aware of his or her own capabilities, can handle the normal stresses of life,

can work productively, and is able to make a contribution in the community by positive emotions and positive functioning.” [20]

• **Well-Being**

The World Health Organization (WHO) defines health as a state of complete physical, mental, and social well-being. Well-being includes several aspects: physical and emotional health, daily functions, financial status, and social interactions with the community. [21] Nature and its Relationship to Human Health and Well-Being Nature improve human mood and contribute to reducing stress, as shown by research studies through some controlled experiments or field studies. Through different ways of contacting nature. Also, contact with nature has therapeutic benefits that affect the results of patients in hospitals, as it was found that patients whose rooms overlook landscapes full of trees use fewer and more moderate analgesics, which indicates a decrease in the feeling of pain. They also shortened their hospitalization time and recovered positively in general, better than patients whose rooms were overlooked by a brick wall. [44]

BIOPHILIC DESIGN DIMENSIONS

The dimensions of biological design are divided into two dimensions that are linked to six elements of biophilic design, namely (environmental features, shape, natural patterns, light, space, the relationship between man and nature, and the relationship based on place). And the two dimensions are:

- Organic or natural dimensions (forms of the built environment, whether referring directly or indirectly to nature or symbolically).
- Place-based dimension (when the built environment refers to the culture of a particular area). [22]

There is a relationship between biophilic humans and design, and interior design helps to provide the appropriate environment for the occupants of the free space, whether the space represents a home, an office, or any other function in order to help meet their psychological, mental, and physical needs. And to promote health and safety. Biophilia values based on connection and

dependence on nature for survival and biophilic design have nine values which are "utilitarian, naturalistic, scientific, aesthetic, symbolic, humanistic, ethical, controlling, passive". [23]

THE PRINCIPLES OF BIOPHILIC

• **Environmental characteristics.**

In order to promote the connection between people and nature, biophilic design makes use of elements of the natural world such as water features, sunshine, genuine vegetation, etc. In the constructed environment. Natural surroundings ease stress, increase comfort, and aid in occupant healing. They improve the times of fellowship, introspection, and rest.

• **Natural forms and shapes.**

Another crucial component of biophilic design is the utilization of organic shapes and forms. Ovals, arches, shells, spirals, botanical themes, and biomimicry are a few examples of these elements. Straight lines and right angles are uncommon in natural formations.

• **Natural processes and patterns.**

Clear boundaries, patterned wholes, and primary focal points are used in the building design to create the desired sensory experience.

• **Space and light.**

This idea focuses on using various kinds of lighting throughout the area. The area is transformed into fascinating, dynamic, and sculptural forms thanks to the extensive use of natural light.

• **Relationships depend on location.**




The relationship to ecology and notable physical characteristics like mountains, deserts, rivers, and flora is the focus of this biophilic factor.

• **Links between humans and nature have developed.**

This idea highlights the natural connection between people and the environment. A good biophilic design takes into account our inclination toward nature. [24]






BENEFITS OF BIOPHILIC DESIGN

Table 2. The benefits of biophilic design

Benefits	Discription
Health benefits 	-We feel better in nature because the human body adapts to its environment by changing its neurological, immunological, and emotional systems. The healing power of nature is felt by everybody. Regular contact with nature promotes concentration, mental health, and creativity while lowering heart rate, blood pressure, and stress hormones. The healing and recovery processes of patients can be significantly altered by hospital designs that use biophilic concepts. Patients who have windows that look out onto the outdoors can handle pain better and heal more quickly. Another study found that youngsters with ADHD who spent 20 minutes in nature had considerably greater concentration than those who strolled through a normal urban setting. [25]
Education benefits 	-The design of the school has a big impact on how well children perform in class and how well they learn. Students perform poorly as a result of the classrooms' inadequate lighting, tiny size, lack of ventilation, and adverse spatial effects. [26] Due to their direct influence on students and children, administrators, school principals, architects, and designers must recognize student perceptions brought on by the architectural and material features of places within schools.
Economy benefits 	-As properties with complete views differ from homes with partial views, homes overlooking the sea are more valuable and expensive than other homes. Additionally, research by the University of Oregon found that 10% of worker absences are caused by man-made buildings that have nothing to do with nature, which results in worker absence, low productivity, and some financial losses. Even while the cost of the applications with biophilic design is initially considerable, they pay for themselves over time by lowering absenteeism and drawing in new clients with their alluring features. [25]

APPLICATIONS OF BIOPHILIC DESIGN

Table 3. Applications of biophilic design

Applications	Discription
Office units 	-Bringing and integrating nature internally into the design of office spaces increases creativity and reduces absenteeism among employees and workers. This incorporation helps to regulate the light and reduce reflections from sunsets. Whereas, botanical elements represent colorful elements in a neutral and soft image. Some studies have shown that designing vibrant offices can increase employee productivity by 8% while increasing employee well-being by 13%.
Hospitals 	-It is important to give a sense of well-being, peace, and tranquility through the design of rooms connected to the external nature through glass facades that allow the entry of natural light to enhance visual comfort ideally and the use of natural materials in internal and external treatments and the addition of plants and green spaces. Hospital workers, including doctors, staff, and nurses, feel some anxiety or depression due to their daily burdens and responsibilities toward patients. Contact with the outside nature helps to reduce anxiety and stress in addition to helping them to perform their duties better. [13]
Schools 	-The school plays a very important role in the community and many issues must be considered when designing the school such as light, noise, and mental and emotional health. This is achieved by integrating the concept of biophilic design into the interior design process of schools, as its impact on human health and well-being has been proven. Due to the strong relationship between man and nature, this integration in workspaces helps to raise the level of productivity and create and improve health conditions. It plays a vital role in the process of designing schools as part of the construction process as a theoretical base for the urban elements of the future. [14]
Retail 	-The interior design of shops and stores needs to create new ideas and innovative strategies that help create the best impression on customers. The physical environment inside the store supports the brand as it plays a vital role in enhancing the shopping experiences for customers. can be used to enhance the brand image and confirm the positive impact of the biophilic design elements in the physical environment of the store. [27] Among the effects of the application of biophilia in the design of stores, it was found that green spaces and in-store environments provide distinct strategies for stores. [9] Whereas the interior design of the store is considered a shopping strategy, and the integration of biophilic design elements into the store design.
Residential units 	-Homes that utilize biophilic design elements are more beautiful and relaxing, using natural materials in interior design such as linen, hemp, clay, and wicker, lighter, airier interior design Contact leads with nature makes people both healthier and happier. [28] Figure1. (1)(2)(3)(4)(5). shows applications of biophilic design https://www.edntech.com/blogs/news/biophilic-design-what-it-is-and-why-it-matters (accessed on 26 January2023).

APPLICATION OF BIOPHILIC DESIGN IN INTERIORS SPACES

Exposure to natural environments and features has positive effects on human health and well-being. [29] There are many elements of biophilic design, and when applying any of these elements, it is necessary to understand the needs of the beneficiaries within the spaces designed according to the different functional activities, whether they are workplaces, residences, or others. It is not possible to integrate all elements in every design, but the designer may use some of these appropriate elements. In order to enhance the internal well-being of users.

EXPERIENCE IN BIOPHILIC DESIGN

-Direct experience of nature: that is, direct contact with natural environmental elements such as air

ventilation, light, air, weather, plants, animals, water, and natural landscapes and fire. shown in Figure. 2.

-The indirect experience of nature: that is, contact with nature by images of nature, natural materials, natural colors, simulating nature, light and air, naturalistic shapes and forms, change, natural geometries, biomimicry shown in Figure.3. [30]

-The experience of the place: providing distinctive spatial features of nature that enhance human health and well-being, such as natural open landscapes, cultural and ecological attachment to place, mobility and wayfinding, and cultural and environmental elements that help to relate more to the place. [31]



Figure 2. shows natural light and natural materials as a direct experience of nature which has a positive effect on humans, as it helps reduce the sense of pain and reduced stress. [32]

(1)(2)<https://www.decorilla.com/online-decorating/biophilic-interior-design/>(accessed on 26 January 2023).



Figure 3. shows the indirect experience of nature incorporating natural materials, and natural light (1)(2)<https://willieduggan.com/about/blog/importance-of-biophilic-design/>(accessed on 15 January 2023).

BIOPHILIC DESIGN PHILOSOPHY IN BUILT ENVIRONMENTS

The concept of biophilia seeks to change how we interact with the built environment, as it requires a significant change in the way we work and live. The purpose is to captivate the senses by employing the many elements of nature, such as plants, water, scents, and light in the built environments. The philosophy of biophilic design is similar to that present in many design philosophies where biophilic design strategies must be used according to the occupants of the building, the location, and the function of the building. Therefore, consideration must be given to employing biophilic design elements in built environments in quantities that may differ from

one environment to another and may be useful in a specific activity and improve and increase productivity at other times, it may be a reason for reducing productivity, for example, the number of plants used, their types and colors, and the function of the built environment. The designer must take into account all these matters while integrating biophilic design elements into the design, as evidenced by the need for a house design for biophilic elements that may differ from the need for administrative offices in urban environments, so these matters must be taken into account while applying the principles of biophilic design. [33]

THE HEALTH BENEFITS OF INCORPORATING BIOPHILIC DESIGN IN BUILT ENVIRONMENTS

The modern built environment has greatly separated humans from the natural elements and there is a number of research that points to the benefits of incorporating biophilic design into the design of the built environment as a way to increase health and productivity. The physiological and neurological effects of nature on the human body were measured. [34] Scientists have noticed physiological changes in the human body when immersed in natural environments and away from urban environments. Biophilic design can make built environments restorative environments to support the health benefits and well-being of design. [35] Some recent studies have shown that cognitive functions can be improved through contact with nature, which helps to increase productivity in the workplace. Biophilic design has physiological effects on occupants of built environments such as experiencing positive emotions while reducing feelings of anger and stress, lowering heart rate, lowering blood pressure, restoring attention, feelings of relaxation and ensuring healthy lives, and promoting well-being. [36]

BENEFITS OF BIOPHILIC DESIGN IN INTERIOR DESIGN AND SUSTAINABLE ARCHITECTURE.

Biophilic design provides solutions to some of the challenges to reaching sustainability in interior design and architecture, such as:

- **The ability to afford housing costs**

By reducing the costs of building materials and the necessary energy, biophilic design elements such as (daylight - air - plants - materials - texture - colors) by integrating into the design of built environments help overcome this challenge. [34]

- **Promote health and well-being**

Good health and well-being are achieved through a healthy indoor environment with ergonomic design and non-toxic environmental materials that help prevent disease transmission, increase recovery rates, reduce stress, and promote positive emotions. [37]

- **Education Quality**

Quality in education is achieved through the quality of performance in learning environments as well as through attention and memory recall. Elements of biophilic design that help overcome

this challenge are air, end light, plants, and landscaping. [38]

- **Affordable and Clean Energy**

The need for energy consumption for heating, cooling, and lighting according to geographical and climatic conditions, energy consumption must be reduced, and this can be achieved through some elements such as air, daylight, plants, and weather. [39]

- **Sustainable Cities**

Cities are sustainable through safety, flexibility, affordability, mobility, accessibility, and indoor environmental quality in homes. By integrating biophilic design elements represented in water, air, daylight, plants, landscapes, weather, and connection to place, we achieve the sustainability of cities and communities. [40]

DISCUSSION

This section includes the following: a presentation, and discussion of the results related to the questionnaire filled out by employees of King Faisal University, students, and faculty members, data analysis related to the responses about the biophilic design and the current reality of interior design of the residential unit in which they reside, and the process of identifying the consistency and compatibility among the respondents' opinions about the questions and clarifying them.

The researcher carried out several procedures, as follows:

In the first step, an electronic questionnaire was designed and prepared to gather opinions on the reality of the views of the beneficiaries regarding biophilic design and integrating biophilic design elements into the interior design of residential units and know the physiological and psychological effects of biophilic design on humans. The questionnaire was made up of five sections, with each section containing a set of phrases.

The Deanship of Scientific Research at King Faisal University was consulted to approve the ethics of the scientific research and agreed to send the questionnaire via e-mail to the beneficiaries.

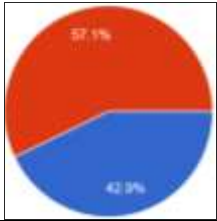
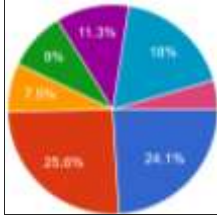
In the second step, the researcher carried out the analysis by first determining the goal, which was to reveal the views of the beneficiaries of faculty members, employees, and students of King Faisal University regarding the current reality of the interior design of the residential unit in which they reside.

by analyzing the responses to the questionnaire. Next was determining the unit of measurement or counting to enumerate the analysis categories, which was the frequency of responses to each question in each section. The total sample size

was N = 200, and 133 responded to the questionnaire.

Study sample characteristics: consists of the participant characteristics/ demographic data. (Gender -Educational level -Age categories): shown in Table 4.

Table 4. Participant characteristics/ demographic data.

No	Personal data	Discerption
1.	<p>Gender: analysis of responses shows the number of male and female respondents. Female 76 (57.1%) Male 57 (42.9%) The total sample number equals 133</p>	
2.	<p>Educational level: Analysis of the Educational level of respondents Male Faculty member 32(24.1%) Female Faculty member 34(25.6%) Male Employee 10 (7.5%) Female employee 12 (9%) Male Student 15 (11.3%) Female student 24 (18%) Other 6 (4.5%)</p>	
3.	<p>Age categories: Analysis of the age groups of the respondents according to the educational level ranged from 19 years to 59 years.</p>	

The following are the results related to the first question: **What is the reality of the current interior design of the housing units from the point of view of the respondents on the electronic questionnaire?**

The statistical analysis of the 133 responses to phrase 1, shown in the second section of Table 5, indicates that 12% strongly agreed, 54.1% agreed, 17.3% were neutral, 13.5% disagreed, and 3% strongly disagreed as shown in Fig.4. Through these responses, it can be seen that the responses of the respondents were divided into five levels in close proportion to the reality of the interior design of their residential units and related to the availability of biophilic design elements from their point of view.

From the statistical analysis of the 133 responses to phrase 3 in the second section, the questionnaire (Table 5) indicates that 14.3% strongly agreed, 62.4% agreed, 6.8% were neutral, 12% disagreed, and 4.5% strongly disagreed as shown in Fig. 4. From this analysis, there was a convergence in the response rates by the participants in the questionnaire in the five levels, which is evidence that the spaces of openings for natural lighting in rooms with small spaces are as usual.

From the statistical analysis of the 133 responses to phrase 5 in the second section, the

questionnaire (Table 5) indicates that 12.8% strongly agreed, 7.5% agreed, 6.8% were neutral, 7.5% disagreed, and 65.4% strongly disagreed as shown in Fig.4. From this analysis, we find a high percentage of those who rejected and those who strongly rejected the lack of green spaces surrounding their housing units.

From the statistical analysis of the 133 responses to phrase 7 in the second section, the questionnaire (Table 5) indicates that 12.8% strongly agreed, 10.5% agreed, 21.1% were neutral, 51.1% disagreed, and 4.5% strongly disagreed as shown in Fig.4. From this analysis, it is noted that the percentage of neutral is high and that each of the other levels is low, which indicates that the current interior design of their residential units causes a feeling of stress and anxiety.

From the statistical analysis of the 133 responses to phrase 9 in the second section, the questionnaire (Table 5) indicates that 9.8% strongly agreed, 12% agreed, 20.3% were neutral, 51.1% disagreed, and 6.8% strongly disagreed as shown in Fig.4. From this analysis, it is noted that the percentage of neutral is high and that each of the other levels is low, which indicates that the current interior design of their residential units does not enhance their positive and psychological health.

Table 5. The frequencies of the second section (The current reality of the interior design of the residential units.).

No	Second section: The current reality of the interior design of the residential units.	SD	D	N	A	SA
1.	The current interior design of the residential unit lacks biophilic design elements such as daylight, ventilation, landscapes, plants, colors, water, and natural materials.	4	18	23	72	16
2.	Opening areas for natural lighting (daylight) in rooms with large areas.	7	83	12	19	12
3.	Opening spaces for natural lighting (daylight) in rooms with small spaces is usual.	6	16	9	83	19
4.	The natural plant element is available in the interior design treatments of the residential unit.	41	48	13	19	12
5.	There are green areas surrounding the residential unit.	87	10	9	10	17
6.	The current interior design helps me feel comfortable and safe.	7	48	46	15	17
7.	The current interior design reduces feelings of stress and anxiety.	6	68	28	14	17
8.	The current interior design increases the feeling of malaise and psychological pressure.	17	20	34	57	5
9.	The current interior design promotes mental health and positivity.	9	68	27	16	13
10.	The current interior design causes a sense of laziness and isolation.	12	16	16	76	13
11.	The current interior design uses natural materials such as natural stones, natural wood, glass, and others.	19	77	8	17	12
12.	The colors used in the residential unit are derived from natural colors and help to feel lively and energetic.	25	69	9	19	11

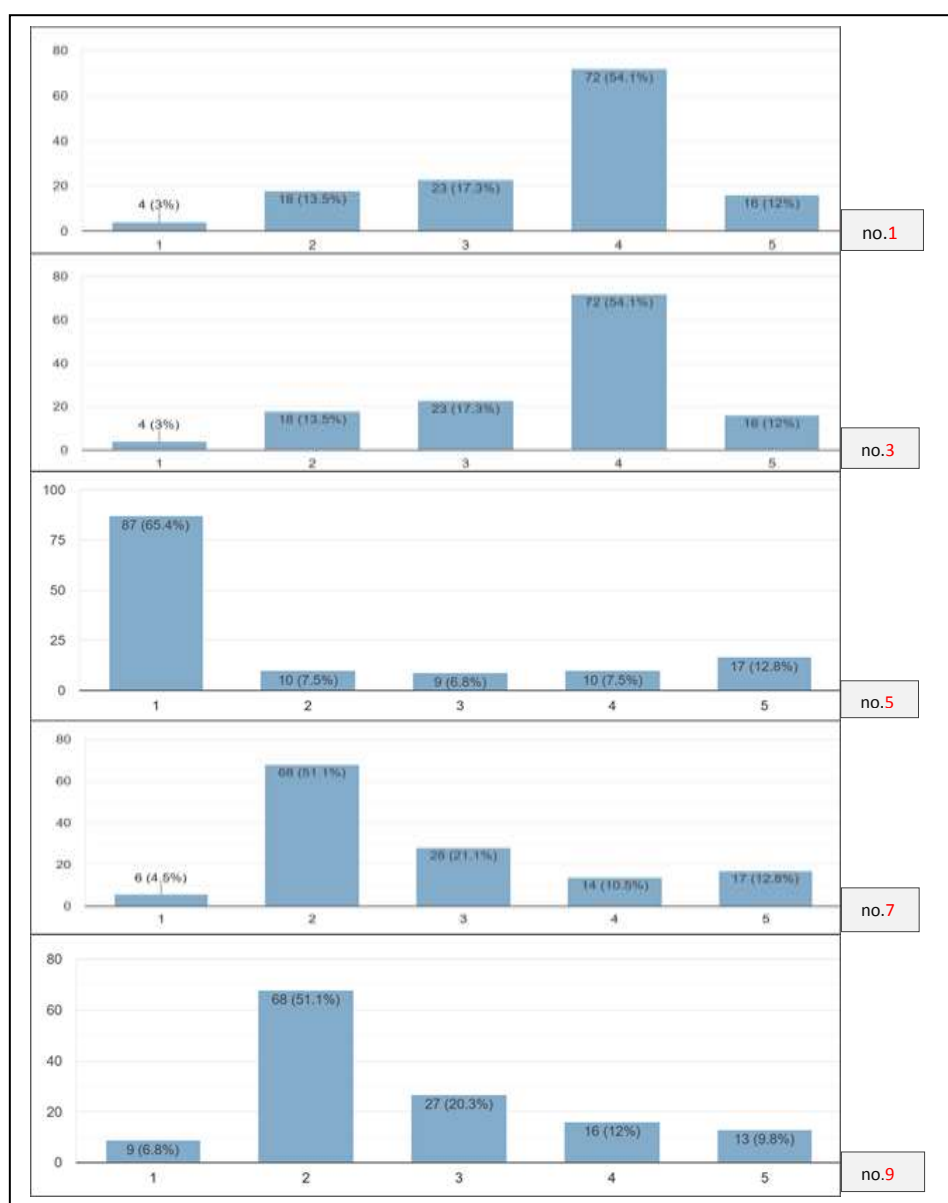


Figure 4. Analysis of responses to phrases 1,3,5,7 and 9 in the second section.

The following are the results related to the second question:

Is the study sample aware of what biophilic design and its elements are?

The statistical analysis of the 133 responses to phrase 1, shown in the third section of Table 6, indicates that 85% strongly agreed, 12.8% agreed, 1.5% were neutral, 0% disagreed, and 0.8% strongly disagreed as shown in Fig.5. This analysis indicates that the responses of the respondents strongly agreed that they love direct contact with nature.

From the statistical analysis of the 133 responses to phrase 3 in the third section, the questionnaire (Table 6) indicates that 59.4% strongly agreed, 24.1% agreed, 8.3% were neutral, 6.8% disagreed, and 1.5% strongly disagreed as shown in Fig.5. This analysis indicates that the responses of respondents strongly agreed that they are aware of the Biophilic design, while there is another percentage of respondents that are not aware of the knowledge of Biophilic design, which requires spreading awareness of the concept of biophilic design and the importance of its integration in the design of housing units and its positive effects on the occupants residential.

From the statistical analysis of the 133 responses to phrase 4 in the third section, the questionnaire (Table 6) indicates that 57.9% strongly agreed, 18.8% agreed, 11.3% were neutral, 6% disagreed, and 6% strongly disagreed as shown in Fig.5. This analysis indicates that the responses of the respondents have been divided into five levels, which indicates a significant lack of awareness among the respondents of housing units with Biophilic design elements.

From the statistical analysis of the 133 responses to phrase 5 in the third section, the questionnaire (Table 6) indicates that 66.9% strongly agreed, 21.1% agreed, 6.8% were neutral, 3% disagreed, and 2.3% strongly disagreed as shown in Fig.5. This analysis indicates that the responses of the respondents severely agreed on awareness of the positive effects of biological design on human health.

From the statistical analysis of the 133 responses to phrase 6 in the third section, the questionnaire (Table 6) indicates that 84.2% strongly agreed, 11.3% agreed, 3.8% were neutral, 0.8% disagreed, and 0% strongly disagreed as shown in Fig.5. This analysis indicates that the responses of the respondents severely agreed that a person tends to integrate into nature in an innate way.

Table 6. The frequencies of the third section (Biophilic design).

No	Third section: Biophilic design	SD	D	N	A	SA
1.	I love direct contact with nature.	1	0	2	17	113
2.	I love indirect contact with nature.	79	12	10	14	8
3.	I know what biophilic design is.	2	9	11	43	79
4.	I know what the elements of biophilic design are.	8	8	15	25	77
5.	I know the positive effects of biophilic design on human health.	3	4	9	28	89
6.	Humans, by their innate nature, tend to blend into nature.	0	1	5	15	112
7.	Biophilic design and its applications to build environments can be used for various functional activities.	0	3	25	26	79

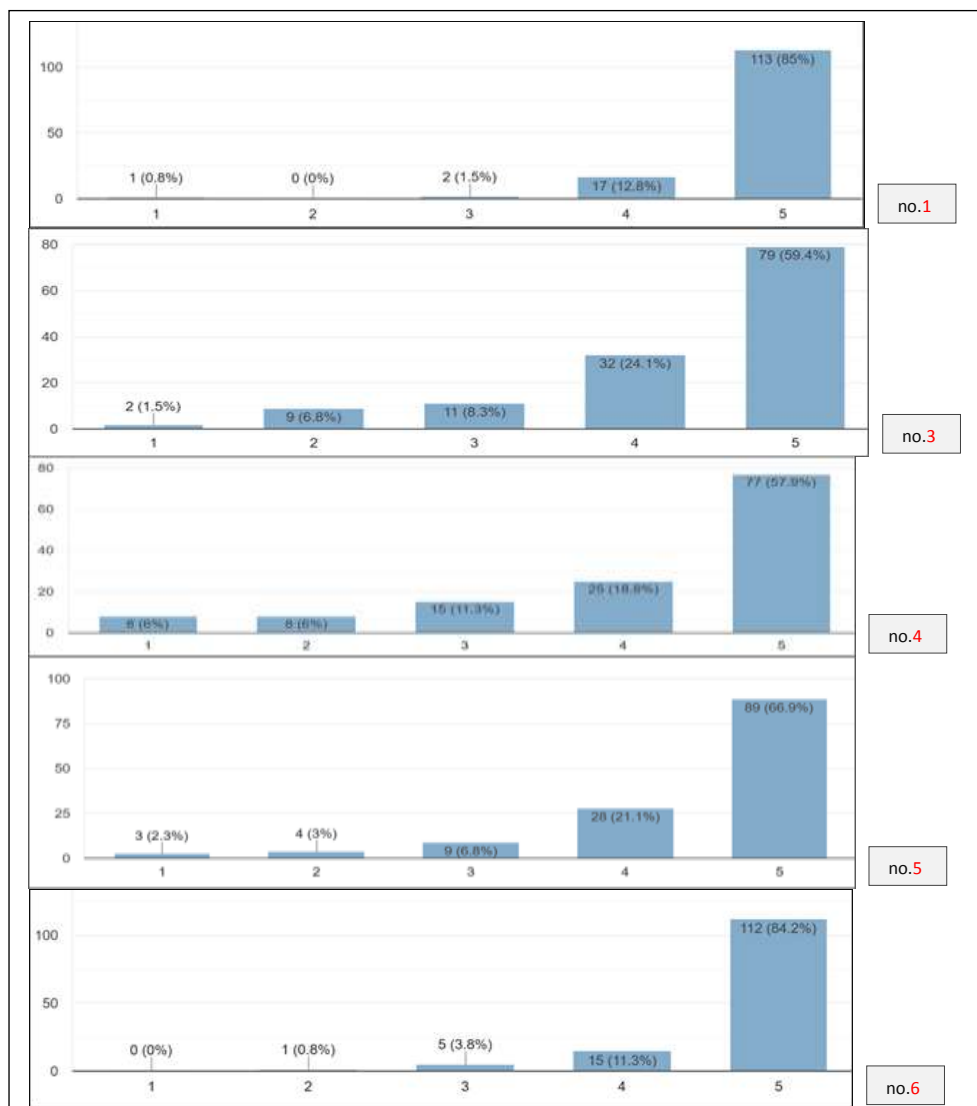


Figure 5. Analysis of responses to phrases 1,3,4,5 and 6 in the third section.

The following are the results related to the third question: **What are the effects resulting from the integration of biophilic design elements into the environments of the residential units from the point of view of the beneficiaries?**

The statistical analysis of the 133 responses to phrase 1, shown in the fourth section of Table 7, indicates that 86.5% strongly agreed, 10.5% agreed, 3% were neutral, 0% disagreed, and 0% strongly disagreed as shown in Fig.6.

This analysis indicates that respondents' responses are high and they strongly agreed that incorporating biophilic design helps to improve the health of individuals within residential spaces. From the statistical analysis of the 133 responses to phrase 2 in the fourth section, the questionnaire (Table 7) indicates that 88% strongly agreed, 8.3% agreed, 3.8% were neutral, 0% disagreed, and 0% strongly disagreed as shown in Fig.6. This analysis indicates that respondents' responses strongly agreed that incorporating biophilic

design into residential units provides safe indoor environments that promote well-being, health, and productivity.

From the statistical analysis of the 133 responses to phrase 3 in the fourth section, the questionnaire (Table 7) indicates that 88% strongly agreed, 8.3% agreed, 3.8% were neutral, 0% disagreed, and 0% strongly disagreed as shown in Fig.6. This analysis indicates that respondents' responses strongly agreed that incorporating biophilic design into residential units improves relationships and promotes a sense of psychological satisfaction, happiness, and harmony. From the statistical analysis of the 133 responses to phrase 5 in the fourth section, the questionnaire (Table 7) indicates that 86.5% strongly agreed, 9.8% agreed, 3% were neutral, 0.8% disagreed and 0% strongly disagreed as is shown in Fig.6. This analysis indicates that respondents' responses strongly agreed that integrating biophilic design into residential units

requires constant engagement with nature and its elements.

From the statistical analysis of the 133 responses to phrase 6 in the fourth section, the questionnaire (Table 7) indicates that 89.5% strongly agreed, 9% agreed, 0.8% were neutral, 0.8% disagreed

and 0% strongly disagreed as is shown in Fig.6. This analysis indicates that respondents' responses strongly agreed that integrating biophilic design into residential units supports positive interaction between man and nature that encourages a sense of responsibility towards society and nature.

Table 7. The frequencies of the fourth section (The hoped-for reality through integrating biophilic design elements into the interior design of residential units.).

No	Fourth section: Integrating biophilic design elements into the interior design of residential units.	SD	D	N	A	SA
1.	That the integration of biophilic design improves the health of individuals within residential spaces.	0	0	4	14	115
2.	The biophilic design provides safe indoor environments that promote well-being, health, and productivity.	0	0	5	11	117
3.	Improving relationships and enhancing a sense of psychological comfort, happiness, and harmony.	0	0	5	11	117
4.	It helps to relate to certain places.	0	2	6	13	112
5.	Biophilic design requires sustained engagement with nature.	0	1	4	14	115
6.	It supports positive interaction between man and nature that encourages a sense of responsibility towards society and nature.	0	1	1	12	119

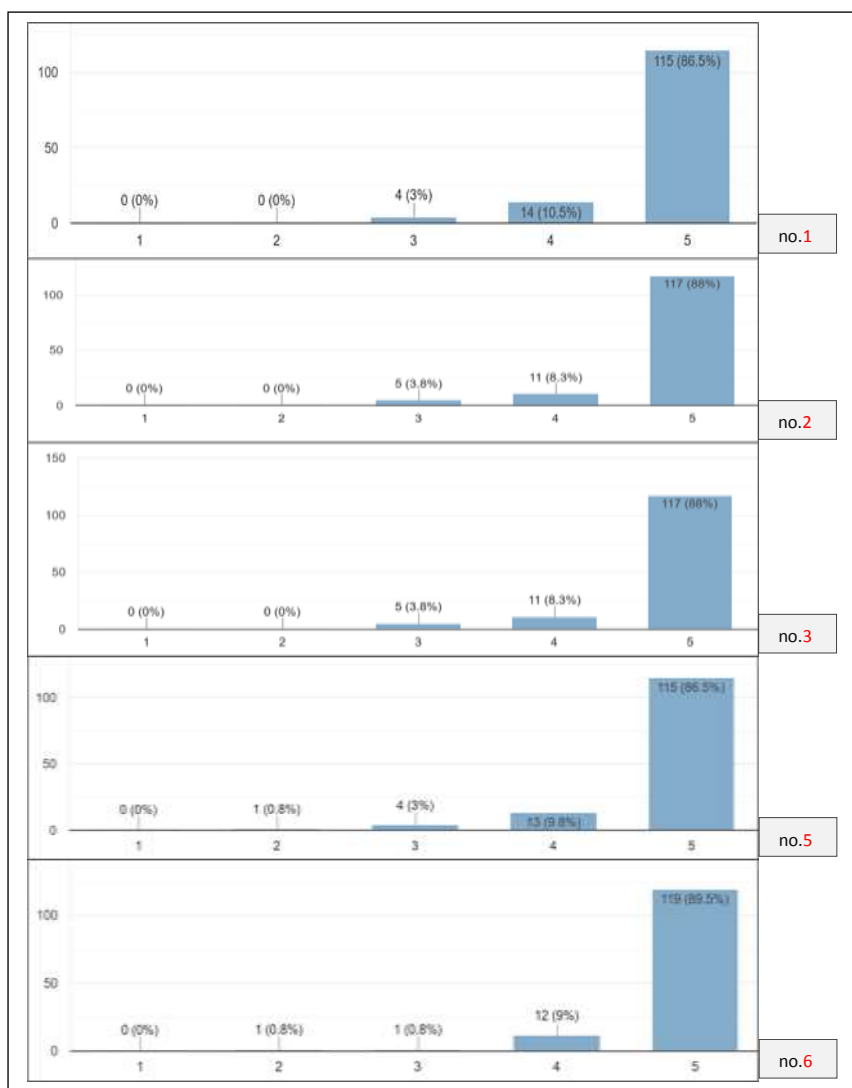


Figure 6. Analysis of responses to phrases 1,2,3,5 and 6 in the fourth section.

The following are the results related to the fourth question: What are the health benefits to incorporate biophilic design in built environments?

The statistical analysis of the 133 responses to phrase 1, shown in the fifth section of Table 8, indicates that 74.4% strongly agreed, 15% agreed, 10.5% were neutral, 0% disagreed, and 0% strongly disagreed as shown in Fig.7.

This analysis indicates that respondents' responses strongly agreed that incorporating natural elements into the design of built environments helps promote mental health.

From the statistical analysis of the 133 responses to phrase 2 in the fifth section, the questionnaire (Table 8) indicates that 69.2% strongly agreed, 16.5% agreed, 14.3% were neutral, 0% disagreed, and 0% strongly disagreed as shown in Fig.7. This analysis indicates that respondents' responses strongly agreed that incorporating biophilic design elements into the design of the built environment improves people's abilities to recover and refocus.

From the statistical analysis of the 133 responses to phrase 4 in the fifth section, the questionnaire (Table 8) indicates that 60.2% strongly agreed,

12% agreed, 26.3% were neutral, 1.5% disagreed, and 0% strongly disagreed as shown in Fig.7. This analysis indicates that respondents' responses strongly agreed that incorporating biophilic design elements into the design of the built environment strengthens the internal nervous system and the immune system of those suffering from diseases and health disorders.

From the statistical analysis of the 133 responses to phrase 5 in the fifth section, the questionnaire (Table 8) indicates that 66.9% strongly agreed, 10.5% agreed, 22.6% were neutral, 0% disagreed, and 0% strongly disagreed as shown in Fig.7. This analysis indicates that the respondents' responses strongly agreed that incorporating biophilic design elements into the design of the built environment improves overall immune function, cognitive and creative functions, and regulates emotion and mood.

From the statistical analysis of the 133 responses to phrase 7 in the fifth section, the questionnaire (Table 8) indicates that 70.7% strongly agreed, 12% agreed, 17.3% were neutral, 0% disagreed, and 0% strongly disagreed as shown in Fig.7. This analysis indicates that respondents' responses strongly agreed that incorporating neighborhood-friendly design elements into the design of the built environment helps promote calmness by reducing heart rates and stress levels.

Table 8. The frequencies of the fifth section (the physiological and psychological effects of biophilic design on humans).

No	Fifth section: The physiological and psychological effects of biophilic design on humans	SD	D	N	A	SA
1.	Incorporating natural elements into the design of the built environment helps promote mental health.	0	0	14	20	99
2.	It improves people's abilities to recover and refocus.	0	0	19	22	92
3.	Helps improve human health, well-being, and productivity.	0	2	4	21	106
4.	It strengthens the internal nervous and immune systems of those suffering from diseases and health disorders.	0	2	35	16	80
5.	It improves overall immune function, cognitive and creative functions, and regulates emotion and mood.	0	0	30	14	89
6.	Applying bio-design strategies and connecting humans with nature makes them renewable and inspiring places that help the ability to learn.	0	1	5	15	112
7.	Helps promote calmness by reducing heart rates and stress levels.	0	0	23	16	94
8.	Helps improve air quality.	0	0	3	8	122
9.	Improve learning by increasing concentration ability.	0	2	4	14	113

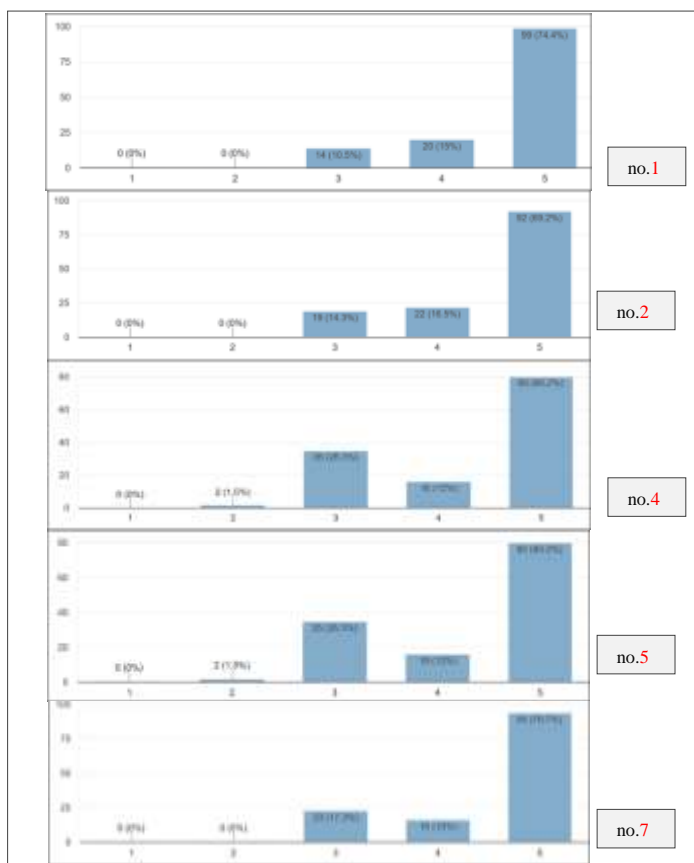









Figure 7. Analysis of responses to phrases 1,2,4,5 and 7in the fifth section.

The following are the results related to the fifth question: **How can the characteristics of biophilic design be integrated into the**

residential interior space? Through the collected data and the review and analysis of the literature, this question was answered.

Table 9. shows the integration of biophilic design elements in the design of residential units.

No	Elements	Discription
1.	Natural light 	-Daylight is better for health and psychological performance than electric light. Bright daylight also has medicinal properties as it enhances mood, promotes nervous health, and affects alertness. Therefore, he recommends integrating daylight into interior spaces. [41] Providing natural light is an important factor in achieving the well-being of the occupants of the building. Excessive light affects visual comfort, as well as lack of daylight leads to insufficient lighting in the spatial spaces. In order to get as much sunlight as possible, it is essential to check home directions. To enhance the entry of natural light, as well as taking into account the proportions of the window to the wall in the design of the building, as well as the number of windows, as it is the simplest solution in order to improve daylight or open curtains or umbrellas during the day. The design of large windows and glass walls allows plenty of natural light to enter the interior space of the residential unit. Artificial lighting can also be chosen that helps provide the appropriate color temperature to synchronize with the human biological clock to improve the productivity and well-being of the occupants of the space. [42]
2.	Natural materials 	-The use of natural materials such as wood, bamboo, cork, stone, and straw in the interior design of the residential units, as well as fabrics such as cotton and jute, pale colors, as well as textures and finishes, play a major role in connecting space users with nature. Where nature can be integrated into the space, whether with natural paint colors or scenic murals. In addition, the inclusion of sustainable materials in the design helped biophilic design play a major role in achieving sustainability through the use of environmentally friendly materials. Thus, this helps in lowering blood pressure and heart rate.
3.	Fresh air 	-Natural ventilation is important for human comfort and increase productivity. Natural ventilation in the built environment, such as residential units, can be improved through variations in air flow, temperature, humidity, and atmospheric pressure. These conditions can be achieved by accessing the outside by simple means such as windows or through some engineering technology strategies. [30]

4.	Green spaces 	-People tend to prefer natural landscapes and green spaces that contain plants and trees over artificial landscapes. Having green spaces inside a dwelling is the ideal way to feel closer to nature, since some varieties of house plants may purify the air by removing toxins, enhancing the quality of the air inside. According to physiology, green is a relaxing color that helps restore energy, clarity of mind, and less stress and anxiety.
5.	Nature shapes inspiration 	-Nature's shapes vary between curves, soft edges, and different linear patterns between straight, curved, and broken lines, and different angles. The possibility of drawing inspiration from nature's shapes and lines in the interior design of residential units contributes to reaching a natural sense and comfort through curved furniture elements, organic materials, doors, and windows. that takes the form of arches. [42]
6.	Water 	-Human existence in a place where he feels comfortable audio-visually, with a distinct presence of the water element through the sound of the flow and the ability to touch the water, leads to a sense of calm, comfort, and relaxation, an increase in a healthy response to the occupants of the space. [42]
7.	Colors of Nature 	-Nature is rich in colors, and colors inspired entirely by nature can be used in the interior design treatments of residential units, taking into account the choice of colors used due to the effect of each color on the mood of people. [43]

CONCLUSION

- The results of the study showed after the statistical analysis of the electronic questionnaire of the responses of the random sample consisting of (faculty members - staff and students) from the employees of King Faisal University, Al-Ahsa, Saudi Arabia, which aimed to investigate the opinions of the sample about their relationship to nature outside the built environments and their innate association with it and its elements. The results of the analysis showed a statistically close and direct connection with nature.
- The study aimed to clarify the positive effects of incorporating natural elements in the design of housing units on enhancing human psychological health, well-being, and productivity.
- The study aimed to reveal the current reality of the interior design of the residential units of the respondents on the electronic questionnaire about the availability of biophilic design elements or not in their homes and its impact on their psychological and physiological health and their needs to improve the quality of life, increase productivity and a sense of well-being.
- The results of the respondents' responses of different genders, ages, and educational levels also showed that there is a relationship between feelings of tension, anxiety, distress, psychological pressure, and a sense of laziness and isolation in the absence of integration of natural elements (biophilic design) within the interior design of their housing units.
- The results of the data analysis in the fifth section of the electronic questionnaire: The physiological and psychological effects of biophilic design on humans indicated that the

responses of respondents of different genders, ages, and educational levels differed in some statements related to mental health, immunity diseases, stress, and the ability to recover and refocus, as their responses were neutral in some statements. This is due to their lack of experience and educational specialization, whether it is in the psychological and medical fields, or far from other fields.

- Hence, the study sought to emphasize the importance of linking the interior design of the residential units to the natural environment and its impact on achieving psychological well-being and physical comfort for the occupants of the housing units. In addition to enhancing communication between man and nature through the integration of biophilic design elements in the treatment of interior space.
- The results of data analysis indicated the effectiveness of integrating biophilic design into the design of residential units to improve human mental health and well-being.

RECOMMENDATIONS

- Promoting a positive connection with nature through biophilic design, which is a new design direction, and learning about the many ways we help connect with nature.
- Supporting positive interaction between man and nature in order to encourage a sense of responsibility towards society and nature, whether through direct or indirect contact or by simulating the spatial characteristics of natural environments.
- Supporting visual communication with nature for the occupants of the residential units through interior design and ideas provided by the interior designers.

- Supporting a connection with nature to promote values of respect and care for the environment that is essential to sustainable societies.
- The design of the floor plans and the distribution of spaces, as well as the elements of furniture inside the space, according to allows a clear vision of the external nature to achieve the desired goal of the design.
- Integration of biophilic design elements in the interior design of residential units for low-income people, because of its positive effects on their mental health, especially for those suffering from diseases and health disorders.
- Integration of biophilic design elements in the interior design of various functional activities to increase people's creativity and productivity.
- The necessity of designing environments built in general and residential in particular, mainly depends on the environment in providing natural lighting and natural ventilation.
- Urging architects and interior designers to adopt the biophilic design approach in designing built environments and housing unit designs to achieve environmental sustainability.
- Supporting local ecosystems and plant species whenever possible in the design of built environments in general and residential ones in particular.
- The continuous improvement of the quality of the internal environment in the residential units requires the integration of biophilic design

elements into the interior design for a healthy internal environment.

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APPENDIX A

Objective: Information gathering about The reality of the current interior design of the housing units for the beneficiaries.

Description: The results of the responses of the sample of faculty members, students, and employees at King Faisal University, about this part of the questionnaire which consists of 12 phrases about the current interior design of the housing units from the point of view of the respondents.

Table A1. The current reality of the interior design of residential units.

No	The current reality of the interior design of the residential units.	SD	D	N	A	SA
1.	The current interior design of the residential unit lacks biophilic design elements such as daylight, ventilation, landscapes, plants, colors, water, and natural materials.					
2.	Opening areas for natural lighting (daylight) in rooms with large areas.					
3.	Opening spaces for natural lighting (daylight) in rooms with small spaces is usual.					
4.	The natural plant element is available in the interior design treatments of the residential unit.					
5.	There are green areas surrounding the residential unit.					
6.	The current interior design helps me feel comfortable and safe.					
7.	The current interior design reduces feelings of stress and anxiety.					
8.	The current interior design increases the feeling of malaise and psychological pressure.					
9.	The current interior design promotes mental health and positivity.					
10.	The current interior design causes a sense of laziness and isolation.					
11.	The current interior design uses natural materials such as natural stones, natural wood, glass, and others.					
12.	The colors used in the residential unit are derived from natural colors and help to feel lively and energetic.					

APPENDIX B

Objective: Information gathering about Biophilic design.

Description: The results of the responses of the sample of faculty members, students, and

employees at King Faisal University, about this part of the questionnaire which consists of 7 phrases about their knowledge of Biophilic design.

Table A2. Biophilic design.

No	Biophilic design	SD	D	N	A	SA
1.	I love direct contact with nature.					
2.	I love indirect contact with nature.					
3.	I know what biophilic design is.					
4.	I know what the elements of biophilic design are.					
5.	I know the positive effects of biophilic design on human health.					
6.	Humans, by their innate nature, tend to blend into nature.					
7.	Biophilic design and its applications to build environments can be used for various functional activities.					

APPENDIX C

Objective: Information gathering about Integrating biophilic design elements into the interior design of residential units.

Description: The results of the responses of the sample of the study members of students, faculty

members, employees, and society members about this part of the questionnaire which consists of 6 phrases about their needs to integrate biophilic design elements into the interior design of residential units.

Table A3. Integrating biophilic design elements into the interior design of residential units.

No	Integrating biophilic design elements into the interior design of residential units.	SD	D	N	A	SA
1.	That the integration of biophilic design improves the health of individuals within residential spaces.					
2.	The biophilic design provides safe indoor environments that promote well-being, health, and productivity.					
3.	Improving relationships and enhancing a sense of psychological comfort, happiness, and harmony.					
4.	It helps to relate to certain places.					
5.	Biophilic design requires sustained engagement with nature.					
6.	It supports positive interaction between man and nature that encourages a sense of responsibility towards society and nature.					

APPENDIX D

Objective: Information gathering about The physiological and psychological effects of biophilic design

Description: The results of the responses of the sample of the study members of students, faculty

members, employees, and society members about this part of the questionnaire which consists of 8 phrases about The physiological and psychological effects of biophilic design on humans.

Table A4. The Physiological and psychological effects of biophilic design on Humans.

No	Fifth section: The physiological and psychological effects of biophilic design on humans	SD	D	N	A	SA
1.	Incorporating natural elements into the design of the built environment helps promote mental health.					
2.	It improves people's abilities to recover and refocus.					
3.	Helps improve human health, well-being, and productivity.					
4.	It strengthens the internal nervous and immune systems of those suffering from diseases and health disorders.					
5.	It improves overall immune function, cognitive and creative functions, and regulates emotion and mood.					
6.	Applying bio-design strategies and connecting humans with nature makes them renewable and inspiring places that help the ability to learn.					
7.	Helps promote calmness by reducing heart rates and stress levels.					
8.	Helps improve air quality.					
9.	Improve learning by increasing concentration ability.					

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