ALIS-SHBAITA

A METHODICAL FRAMEWORK OF BIOPHILIC INTERIOR DESIGN IN TRADITIONAL CONTEXT: THE CASE OF THE KINGDOM OF SAUDI ARABIA

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Alis Saad Shbaita

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Alis Saad Shbaita

Abstract

A Methodical Framework of Biophilic Interior Design in a Traditional Context: The Case of the Kingdom of Saudi Arabia

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The concept of biophilia deals with the humans' innate connection to nature. The sustainable design umbrella also includes the approach to biophilic design, which is essential in the current urban development agenda. Saudi Arabia, as a Gulf country characterized by a wealthy local diversity of traditional architecture, also needs to implement strategies to establish sustainable development goals. Through the values of traditional architecture, evaluating biophilic design in the interior design environment is a positive step towards reconnecting the built environment with nature in the country. Within this framework, after theoretically evaluating biophilia and biophilic design and existing biophilic design frameworks, the Biophilic Interior Design Matrix (BID-M) was used to evaluate biophilia in the traditional Saudi architecture. A total of twelve traditional buildings was assessed. Based on the findings, these traditional buildings have a remarkably high degree of biophilia. As such, these findings indicate that the values of heritage buildings can be used in order to increase biophilic design in the country. Therefore, several features reflecting country's religious, socio-cultural, environmental and aesthetic values are suggested to be added or embedded for each of the BID-M elements in order to make the existing one more efficient. 'Vernacular materials', 'religious connection to place', local bright colors', 'diverse (dynamic) ratios and scales' are among the items to be added. This new approach has the potential for integrating sustainability into modern construction in the region.

Keywords: sustainability; biophilia; biophilic design frameworks; traditional buildings; assessment; Kingdom of Saudi Arabia

Özet

Geleneksel Bağlamda Biyofilik İç Mekân Tasarımı için Yöntemsel Bir Çerçeve: Suudi Arabistan Krallığı Örneği

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Biyofili kavramı, insanların doğayla olan içgüdüsel bağını konu alır. Sürdürülebilir tasarım şemsiyesi, mevcut kentsel gelişim gündeminde önemli bir yeri olan biyofilik tasarım yaklaşımını da kapsamaktadır. Suudi Arabistan'ın da, geleneksel mimarinin zengin yerel çeşitliliğine sahip bir Körfez ülkesi olarak, sürdürülebilir kalkınma hedeflerini gerçekleştirmek üzere stratejiler uygulaması gerekmektedir. Geleneksel mimarinin değerleri aracılığıyla, iç mekân ortamında biyofilik tasarımı değerlendirmek, ülkede yapılı çevrenin doğayla yeniden ilişkilendirilmesine yönelik olumlu bir adım olacaktır. Bu kapsamda, biyofili ve biyofilik tasarım ve biyofilik tasarım çerçeveleri teorik olarak değerlendirdikten sonra, geleneksel Suudi mimarisinde biyofiliyi ölçmek için Biyofilik İç Mekân Tasarım Matrisi (BİT-M) kullanılmıştır. Toplam on iki bina değerlendirilmiştir. Bu geleneksel binaların dikkate değer derecede yüksek bir biyofiliye sahip olduğu belirlenmiştir. Dolayısıyla bu bulgular, ülkede biyofilik tasarımın arttırılması amacıyla miras yapılarının değerlerinden yararlanılabileceğini göstermektedir. Bu nedenle, mevcut olanı daha kullanışlı hale getirebilmek için ülkenin dini, sosyo-kültürel, çevresel ve estetik değerlerini yansıtan bazı unsurların matrise eklenmesi veya mevcut unsurlara dâhil edilmesi önerilmektedir. 'Yerel malzemeler', 'mekânla dini bağ', yerel parlak renkler', 'çeşitli (dinamik) oranlar ve ölçekler' bu eklenecek öğeler arasındadır. Bu yeni yaklaşım, sürdürülebilirliği bölgedeki modern yapılarla bütünleştirme potansiyeline sahiptir.

Anahtar Kelimeler: sürdürülebilirlik; biyofili; biyofilik tasarım çerçeveleri; geleneksel binalar; değerlendirme; Suudi Arabistan Krallığı

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List of Abbreviations

BD:	Biophilic Design
BDM:	Biophilic Design Matrix
BID-M:	Biophilic Interior Design Matrix

CHAPTER I
Introduction

In this first section, research background and objectives were discussed. First, the emergence and significance of biophilia and biophilic design were evaluated. Later, problem statement and purpose of the study are elaborated. In accordance, research questions and hypothesis were determined. Afterwards, significance of the study and limitations were discussed. Lastly, main headlines of the study as the definition of terms were shared.

Despite the importance of humans' connection with nature, urbanization has led to a direct isolation of humans from nature. In addition, technological development, especially life inside buildings, has weakened humans' connection with nature, hurting their health, physical, mental, and emotional well-being, and daily performance (Harper, 2017). In addition, "in the twentieth century, technology and industrialization developed, which further complicated humans' relationship with the physical world." (Salingaros, 2017).

Humans have less direct contact with the outside as they spend much time indoors interacting with technology (Klotz & Bolino, 2021). More than half of the Earth's population lives in urban areas (Barragán & De Andrés, 2015). Therefore, their interaction with nature is less. How can architecture reconnect people with nature to improve their health and well-being? By looking for ways to incorporate natural materials or processes into their designs, transferring natural characteristics to the built environment is the most common method (Kellert, 2012).

The emergence of sustainable development in the late 1980s is one of the reasons for re-exploring nature as an inspiration for architecture (Zhong et al., 2022). Sustainability has become a major concept since the 1990s, with sustainable architecture gaining prominence in the last few decades. Many approaches to environmentally-based solutions are being applied to achieve this new and crucial agenda. For built spaces, a new design framework has emerged, incorporating aspects such as holistic design, biophilia, and ecology, which help occupants of these spaces respond to multifaceted psychological, physiological, and physical needs (Altomonte et al., 2020). This human-centric approach to architecture fosters a sense of connection and engagement. The umbrella of sustainable urban development includes new terms such as zero-carbon homes and green buildings. An emerging

approach is biophilic design, which addresses the diverse interactions between humans, buildings, and nature, and is based on the biophilia theory (Barbiero & Berto, 2021; Hung & Chang, 2022).

Multiple cultures have used natural representations in their designs throughout history. One of the sources of inspiration for humanity throughout the stages of history is the harmony in nature that surrounds and immerses it, as this has appeared in various ways (Ryan, 2014). See Figure 1.

Figure 1

Biophilic green urban design elements in cities

(Beatley, 2011)

Biophilia has only recently appeared in architecture and interior design. However, it was introduced by psychologist Erich Form in 1964 and confirmed by biologist Edward O. Wilson in the 1980s, who investigated humans' loss of contact with

nature due to urbanization (A. B. Mohammed, 2023). Biophilia is a symbol of humans' appreciation of nature and may be utilized to influence architectural spaces of various types. Incorporating nature into space design may improve the experience of space occupants while contributing to sustainable design (Zhong et al., 2022). Biophilia is the connection with the natural environment. It is a natural human desire. It is considered a basic physical and mental health desire in our modern world (Bolten & Barbiero, 2020).

Humans' innate need to interact with nature and its systems is called biophilia (Hung & Chang, 2022). Love of life is the description of biophilia in ancient Greece (Barbiero & Berto, 2021). In an interview with Dezeen, Oliver Heath is a sustainable architect and interior designer. His work focuses on biophilic design to improve health and well-being. He defines the biophilic designer as "a person who promotes the human relationship between nature and building" (Altomonte et al., 2020). Biophilic design relies on three fundamental ideas to get started. First, direct contact with the natural environment is achieved by incorporating the actual sensory forms of nature into the building. That includes clean water, fresh air, sunlight, and plants and trees. Second: An indirect connection to the natural environment by simulating nature with the built environment by using colors, materials, patterns, textures, and natural shapes to stimulate the feeling of nature. Third: Human spatial response by building environments that nourish and support us. It focuses on designing environments that enhance human well-being (Ergan et al., 2018).

Humans' innate sense of belonging to the natural environment has broad implications for their mental and physical health and performance. With the help of connection to nature, the heart rate and blood pressure level can decrease (Apaolaza et al., 2020). Contact with natural environment helps individuals feel pleased and cheerful. It improves mental and physical health (Garrett et al., 2023), and reduces stress, anxiety, and sadness (Cox et al., 2017). In addition, developing a spiritual relationship with the natural environment in specific locations lays the foundation for lasting, meaningful relationships that last a lifetime (Day, 2017).

As cities continue to expand due to people continuing to urbanize, attempts to renew and strengthen the relationship between the natural environment and people have become increasingly important (Hung & Chang, 2022). There is excellent and extensive evidence documenting the spaces and habitats that have a therapeutic effect on the human body (Salingaros, 2019). Extensive studies have confirmed and

identified architectural methods that support or reduce mental and spiritual health and well-being. However, current architectural methods influenced by Western architecture ignore these methods and direct architects and city planners to ignore the integration of vital elements into the design (Kellert, 2018). Knowing human evolution led us to the concept of biophilia. That explains that during more than 99% of our human history, we evolved not for artificial stimuli or those created by humans but rather from a physiological standpoint for an adaptive response to natural stimuli (Pretorius, 2021).

Statement of the Problem

The importance of linking the built environment with nature has been acknowledged in the Western architecture in recent years. However, the potential benefits of biophilic design in non-Western contexts are immense and promising. Therefore, the need for evidence-based theoretical research incorporating biophilic design is urgent and of utmost importance for Middle Eastern countries to work towards a transition to more environmentally responsive and sustainable nature-based architectural solutions.

As a Gulf country with valuable traditional architecture and rich local diversity, Saudi Arabia needs to implement strategies to work towards creating sustainable development goals. There has been circumstantial and contextual ignorance of sustainable housing design strategies, isolation from local practices, and a lack of practical and theoretical interest (Yahya, 2022). From the 1930s to the 1990s, Saudi Arabia experienced unprecedented urban growth due to oil discoveries, including the modern development of cities with high-tech structures (Mazzetto, 2023). The 1970s saw the adoption of "imported" models. In the past few decades, there have been apparent government attempts to value heritage values, local culture, and resources to develop new sustainable economic strategies and even a post-oil economy. However this trend needs urgent support and diversification towards a sustainable approach that reflects the architectural heritage of this country.

Within this framework it can be hypothesized that the Arabian Peninsula has an architectural heritage rich in local identity. This heritage displays unique environmental, ecological, aesthetic, social, and religious values specific to the country. These values are not only unique but also hold the potential to be integrated into a biophilic design theory that is sustainable and unique for the country.

Purpose of the Study

Biophilic design attempts to connect humans with the natural environment in the built environment; increasing research and studies support nature-based integration into the built environment, but there needs to be clear guidelines on how to do this (Bolten & Barbiero, 2020). Biophilia, when incorporated into architecture, is a potent tool architects employ to leave a lasting imprint on individuals' consciousness (Rukwaro, 2021). It extends beyond simply beautifying spaces and structures to enhance the aesthetic. Instead, biophilic design is a multifaceted approach in the world of architecture. It entails incorporating green elements into spaces and harmonizing people with the natural world. This design philosophy seeks harmony between nature and human environments, weaving nature into the environment surrounding humans (Ahmadi et al., 2019).

The connection of people to the systems of nature has become apparent through biophilic design, as it was found in some of the oldest structures built and inhabited by humans, such as Roman civilizations, Gothic architecture, Byzantine architecture, and Mesopotamia civilization. We must not forget the Renaissance in the Middle Ages. All of the above is conclusive and solid evidence of the authenticity of biophilic design (Ramzy, 2015). All of the above confirms that throughout human history, architecture has been built and formed from the inspiration of nature, where local shapes and materials were used according to the site's conditions and decoration (e.g., the carving of fruits and plants in Greek ornamentation) (McGee et al., 2019).

The Kingdom of Saudi Arabia also needs to integrate the concept of biophilic design into the built environment for the fulfillment of sustainable development goals. Because of its large size and varying geographic and climatic conditions, the country is notable for its distinctive and varied traditional architecture. Significant government efforts have been made in recent decades to recognize local culture, values, legacy, and resources through the creation of new sustainable economic strategies and a post-oil economy.

Therefore in this study, the degree of biophilia in the traditional architecture of the Kingdom of Saudi Arabia was evaluated and assessed. Through this approach, a new framework of biophilic interior design that can be used effectively and specifically in the context of the Middle East can be developed.

Research Questions / Hypotheses

Research Questions

For the fulfillment of the purpose of the study, the questions below are asked for measuring biophilia in traditional Saudi architecture for understanding the potential to develop a new understanding of biophilic interior design in the Middle Eastern context.

*How can biophilia as a concept be defined?

*What are the dimensions and components of biophilic design in built environment?

*What are the existing theories developed for conceptualising biophilic design?

*What is the degree of biophilia in traditional buildings in Saudi Arabia?

*Are there components to be added or revised for BID-M in order to develop a new understanding of biophilic interior design in the country?

Hypotheses

The Arabian Peninsula has an architectural heritage rich in local identity. This heritage displays unique environmental, ecological, aesthetic, social, and religious values specific to the country. These values hold the potential to be integrated into a biophilic design theory, creating a future of unique and sustainable architecture.

Significance of the Study

The study first theoretically handles the issues of biophilia, biophilic design and BD frameworks. This theoretical evaluation has the potential to contribute to the current research dealing to bring natüre into built environment. Second, the study seeks to assess the level of biophilia in traditional buildings in order to find environmentally based features for incorporating into existing architectural context in Saudi Arabia. The second part of the study has benefits to deliver evidence based data for the path towards implementing sustainable design in the region.

Limitations

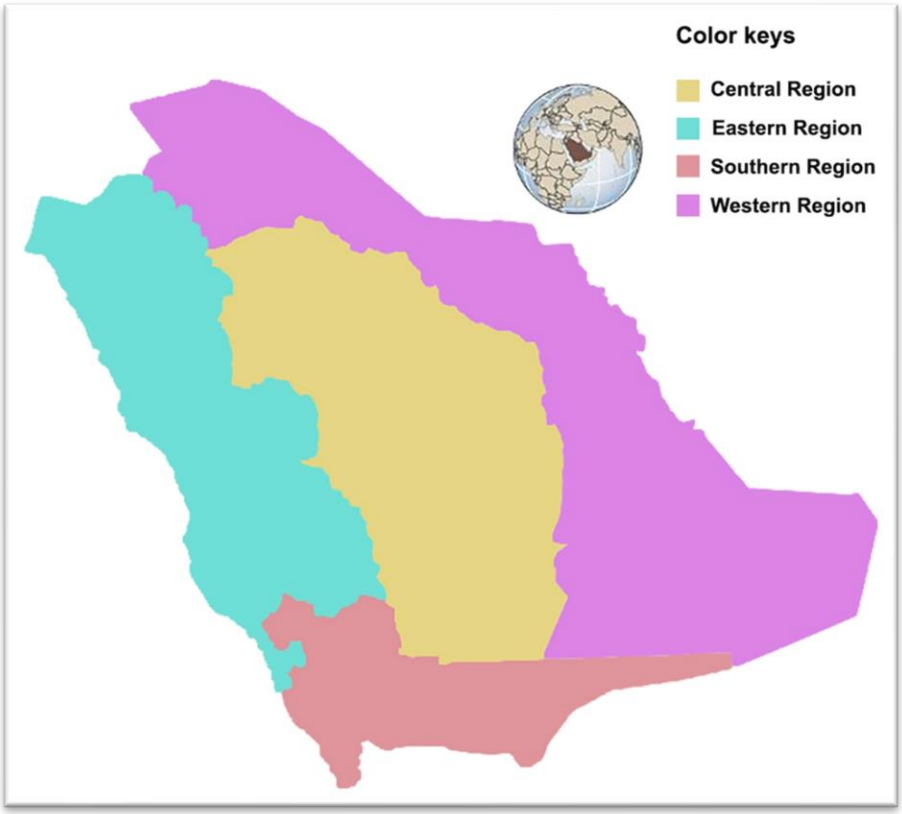
The study aims to evaluate the concept of biophilia in the traditional Saudi architectural environment. A rich local identity characterizes the architectural heritage of Saudi Arabia, and it has a clear potential for adoption in a new framework for biophilic design. However, the number of buildings selected for biophilic evaluation is a limitation of this research, and the number of buildings could be

increased in subsequent studies. This highlights the need for further research in this area.

In this study, four traditional buildings were selected from each region of Saudi Arabia (central, eastern, western, and southern). A total of twelve buildings were randomly selected. In addition, further research with larger samples can be conducted in different countries of non-Western context, including those in the Middle East, to develop new biophilic design frameworks that reflect local and cultural identity. See Figure 2.

Figure 2

Regions of the Kingdom of Saudi Arabia map.



(A.Shbaita, 2024)

Definition of Terms

Sustainability: As a term sustainability means meeting the needs of the present without compromising the ability of future generations to meet their own needs. It covers social, cultural, environmental and economic dimensions.

Biophilia: Biophilia means love of life or living things. As a concept, it suggests that humans have an intuitive and natural association with nature. As there is a human loss of contact with nature due to the urbanization, the concept can be considered as a basic requirement in modern times.

Biophilic Design: Biophilic design as a term seeks to connect humans with nature in the built environment through the use of direct nature, indirect nature and space and place relationship. The scale of the built environment for the biophilic design may vary from interior space up to the city scale.

Biophilic Design Framework: With an aim of connecting human with nature, this term means scheme including elements, dimensions, patterns, processes, experiences and/or features for conceptualizing biophilia for the design of built environment.

Traditional Building: A traditional building is constructed by local communities over many generations using local materials and culturally appropriate construction methods, all based on a sustainable knowledge.

Heritage Building: A heritage building embodies the cultural and historical narratives of societies across time. It refers to an architectural structure that holds cultural, historical, architectural, or aesthetic significance.

CHAPTER II

Literature Review

In the second chapter of the study, related literature was discussed. Within this framework, two sections were involved. First section is 'theoretical framework' and second section is 'related research'. Under the first section of 'theoretical framework', 'the concept of biophilia', 'evaluation of biophilic design', 'the biophilic design frameworks' and 'place-based relationships' as the main headlines, are evaluated. 'Related research' as the second section involved main sources used within the study within a chronological order.

Theoretical Framework

The Concept of Biophilia

Biophilia combines the term "bio," which means life, nature, and living things, and "philia," which means affinity or love. We have a term that summarizes the interaction between the natural world and the artificial environment, harnessing their benefits for human benefit. The fundamental connection between the human-made environment and nature is emphasized by this concept. It is based on the premise that humans need to connect with nature (emotionally, physically, and socially) to achieve holistic well-being (Wilson, 2003).

Human predisposition to relate to nature is an accurate description of biophilia, and it has persisted throughout human existence. From a human evolutionary perspective, biophilia arose; adaptation was not associated with human-created forces but with natural factors, and human pasts were associated with this adaptation. Humans instinctively respond to natural forces and stimuli (Öhman, 1986). Biophilia, defined by biologist E.O. Wilson, represents the innate human affinity for nature and living organisms. It suggests that humans have an inherent connection to the natural world, stemming from our evolutionary history as beings closely intertwined with nature (Wilson, 2003). Biophilia theory posits that this connection is essential for human well-being and that contact with nature positively affects physical, mental, and emotional health.

Biophilia is evident in various aspects of human behavior, from the therapeutic effects of natural environments to the preference for views of green spaces. This

affinity for nature has implications for urban planning, architecture, and environmental conservation, emphasizing the importance of incorporating natural elements into built environments (Nabhan et al., 1993). Biophilic design principles advance the goal of creating spaces that foster a strong connection between individuals and the natural world, promoting health and well-being. A growing body of research presents scientific evidence regarding humans' innate tendency to seek connection with nature and the substantial impact that nature has on human well-being, encompassing both physical and mental aspects. These studies suggest and reinforce the profound influence of nature on human quality of life (Hurly & Walker, 2019).

As per Kellert (2012), the benefits humans derive from contact with nature are strongly contingent on cultivating a habitual pattern of repeated experiences. While humans are inclined to connect with nature, nurturing and creating opportunities for such interactions are essential. Individuals' unique development and growth hinge upon their capacity to make deliberate choices, especially in biophilia. Within this framework, individuals may opt to establish a connection with nature or, conversely, sever their ties with it. In many contemporary urbanized societies, the prevalent trend involves erecting various barriers against nature, leading to a concerning and escalating disconnect between humans and the natural world—a growing diaspora. This widening gap between individuals and their environment in modern civilization manifests across multiple domains, encompassing manufacturing, agriculture, education, healthcare, and architecture (Bolten & Barbiero, 2020).

The hindrances to experiencing nature in contemporary society are evident in the design and development of built spaces in today's modern communities. This poses a challenge since humans have evolved in a natural habitat, yet contemporary individuals predominantly inhabit indoor settings, spending around 90% of their time indoors (Allen, 2020). The necessity of human-nature interaction is widely acknowledged as pivotal for well-being. However, achieving a satisfactory level of such interaction within the present constructed environment proves intricate. Modern architectural approaches often neglect nature, treating it not as a design element but rather as an impediment to be overcome. In some instances, nature is perceived as an obstacle to progress (Browning & Ryan, 2020).

The absence of nature in contemporary built environents has led to an increasing gap between humans and essential natural elements like sunlight, vegetation, organic

shapes, materials, and fresh air. Most modern spaces resemble structures that are devoid of sensory experiences for their inhabitants and can be compared to animal habitats, which have been deemed inhumane (Browning & Ryan, 2020).

In the search for the best ways to integrate natural processes or materials into the built environment, the most common method was to integrate natural characteristics into these structures (Kellert, 2012). Since human connection to nature as a basic understanding is instinctive, according to (Zhong et al., 2022), "Restoration," "Place," "Habitat and dwelling," and "Love for Nature" are considered in environmental psychology as basis perspectives related to the theoretical foundation of biophilic design. Among these, the prominent theories of "Prospect and Refuge Theory" and "Place Attachment Theory" hold significant importance in understanding biophilic design.

Since the first decade of the twenty-first century, within this framework, we find that there is a perception by scientists, theorists, and academics of various dimensions, elements, and features. In order to reconnect the built environment with nature, different frameworks for biophilic design in the field of architecture have been proposed through various scientific studies.

Evaluation of Biophilic Design

The central objective of biophilic design is to tackle the inherent difficulties that arise in today's modern architectural constructs and environments by creating robust frameworks that facilitate deep and meaningful interactions with the natural world within the confines of built settings and landscapes (Kellert, 2008). This approach recognizes the growing disconnect between humans and nature due to the prevalence of indoor lifestyles and artificial constructs. It aims to counteract this disconnection by integrating elements of nature into architectural and environmental design to provide individuals with physical and psychological benefits (Browning & Ryan, 2020). (Kellert, 2008) It highlighted the importance of incorporating nature-inspired elements such as natural light, vegetation, water features, and sensory stimuli within built environments. By doing so, the biophilic design seeks to create spaces that resonate with human biophilia – the innate connection between humans and nature – which can lead to improved health, reduced stress, enhanced cognitive function, and increased productivity (Browning & Ryan, 2020).

A well-executed biophilic design should yield a broad range of positive outcomes, encompassing behavioral, physical, and mental improvements for the individuals inhabiting the environment (Mollazadeh & Zhu, 2021).

Lowering blood pressure, improving physical fitness, increasing comfort and enjoyment, and overall health are all examples of physical well-being. Stress reduction, anxiety reduction, enhanced mental contentment, and motivation are all examples of mental well-being. Behavioral well-being includes skill mastery, improved coping, increased and enhanced attention and concentration, and decreased aggression and hostility (Kellert & Calabrese, 2015).

Develop methods prioritizing environmental sustainability, energy efficiency, waste reduction, and mitigation of harmful emissions. While these practices play a pivotal role in reducing the environmental footprint of human activities, the focus is first on the technical aspects of design and construction (Hossain et al., 2020). Thus, the sustainable design paradigm is often centered around devising methodologies to reduce environmental damage, often called “doing less harm.” This perspective is consistent with the principles of environmental conservation and resource efficiency (Foster, 2020).

Biophilia has been called the “missing link” in sustainable building design approaches because the net benefit of primarily green and sustainable buildings has a minimal and insignificant impact on the goals of biophilic design (Grobman et al., 2023).

However, this approach can sometimes ignore the potential for design practices to restore balance in the environment and foster a deeper connection between humans and the natural world. The concept of “biophilic design” goes beyond harm reduction by adopting strategies that reduce negative impacts and nurture and enhance the relationship between humans and nature (Andreucci et al., 2021).

In essence, the development of modern green design laid the foundation for addressing pressing environmental concerns. However, biophilic design broadens the horizon by promoting a more holistic and mutually beneficial relationship between humans and the environment. This evolution in design philosophy reflects a broader understanding of sustainability that includes environmental considerations, well-being, and the innate affinity between humans and nature.

The Biophilic Design Frameworks

The notion of biophilia in 1960s and. It was emphasized in the 1980s by biologist Edward O. Wilson, who investigated the loss of connection to nature caused by urban living. The underlying principle is simple: link people to nature to improve their mental health and quality of life. How may architecture do this? By searching for methods to incorporate natural materials or processes into its designs. The most common technique is to incorporate diverse (natural, cultural, psychological etc) qualities into the built environment.

In the meantime, several BD frameworks have been introduced by scholars and experts. These biophilic design frameworks have been applied from indoor to city scale in recent decades, including hospitals, healthcare spaces, office buildings, preschools, university campuses, etc.

One of these conceptualizations was initially from Kellert (2008). There were six main elements covering 72 features in this BD scheme of Stephen Kellert. The main elements were suggested as ‘environmental features’, ‘natural shapes and forms’, ‘natural patterns and processes’, ‘light and space’, ‘placed-based relationships and ‘evolved human-nature relationships’.

In this framework, Kellert (2008) proposed a more systematic interpretation of biophilic design with two primary dimensions, six elements, and over seventy attributes. Understanding the two dimensions of naturalistic/organic and vernacular/place-based biophilic designs is crucial as they significantly shape human identities. The naturalistic or organic component reflects human passion for nature in the built environment, whether through direct or indirect encounters. The second dimension, place-based, deals with the connection between a place's culture, locality, ecology, and the building or landscape. This dimension also includes the spirit of a place and its profound meaning to people in terms of their identities (Kellert, 2008). See Table 1.

Table 1

Dimensions, elements and attributes of biophilic design

Environmental features	**Natural shapes and forms**	**Natural patterns and processes**
Color	Botanical motifs	Sensory variability
Water	Tree and columnar supports	Information richness
Air	Animal (mainly vertebrate) motifs	Age, change, and the patina of time
Sunlight	Shells and spirals	Growth and efflorescence
Plants	Egg, oval, and tubular forms	Central focal point
Animals	Arches, vaults, domes	Patterned wholes
Natural materials	Shapes resisting straight lines and right angles	Bounded spaces
Views and vistas	Simulation of natural features	Transitional spaces
Facade greening	Biomorphy	Linked series and chains
Geology and landscape	Geomorphology	Integration of parts to wholes
Habitats and ecosystems	Biomimicry	Complementary contrasts
Fire		Dynamic balance and tension
		Fractals
		Hierarchically organized ratios and scales
Light and space	**Place-based relationships**	**Evolved human-nature relationships**
Natural light	Geographic connection to place	Prospect and refuge
Filtered and diffused light	Historic connection to place	Order and complexity
Light and shadow	Ecological connection to place	Curiosity and enticement
Reflected light	Cultural connection to place	Change and metamorphosis
Light pools	Indigenous materials	Security and protection
Warm light	Landscape orientation	Mastery and control
Light as shape and form	Landscape features that define building form	Affection and attachment
Spaciousness	Landscape ecology	Attraction and beauty
Spatial variability	Integration of culture and ecology	Exploration and discovery
Space as shape and form	Spirit of place	Information and cognition
Spatial harmony	Avoiding placelessness	Fear and awe
Inside-outside spaces		Reverence and spirituality

(Kellert, 2008)

Later three categories covering 14 patterns was suggested by Browning et al. (2014) in order to investigate biophilic design. The three categories were ‘nature in the space’ with seven items, ‘natural analogues’ with three items and ‘nature of the space’ with four items. See Table 2.

Table 2

14 patterns of biophilic design

Context	**14 Patterns**
NATURE IN THE SPACE	1. Visual Connection with Nature
	2. Non-Visual Connection with Nature
	3. Non-Rhythmic Sensory Stimuli
	4. Thermal and Airflow Variability
	5. Presence of Water
	6. Dynamic and Diffuse light
	7. Connection with Natural Systems
NATURAL ANALOGUES	8. Biomorphic Forms and Patterns
	9. Material Connection with Nature
	10. Complexity and Order
NATURE OF THE SPACE	11. Prospect
	12. Refuge
	13. Mystery
	14. Risk / Peril

(Browning, 2014)

In addition, Kellert and Calabrese (2015) proposed another framework. They suggested three experiential categories including 25 attributes in total for defining BD (Wijesooriya, 2023). These three categories were ‘direct experience of nature’, ‘indirect experience of nature’ and ‘experience of space and place’. See Table 3.

Table 3.

The Biophilic Design framework with three categories.

Practice of Biophilic Design Framework		
Direct Experience of Nature	**Indirect Experience of Nature**	**Experience of Space and Place**
Light	Images of nature	Prospect and refuge
Air	Natural materials	Organized complexity
Water	Natural colours	Integration of parts to wholes
Plants	Simulating natural light and air	Transitional spaces

Animals	Naturalistic shapes and forms	Mobility and wayfinding
Weather	Evoking nature	Cultural and ecological attachment to place
Natural landscapes and ecosystems	Information richness	
Fire	Age, change, and the patina of time	
	Natural geometries	
	Biomimicry	

(Kellert & Calabrese, 2015)

Later, Stephen Kellert reinvestigated biophilic design and proposed three experiences (Kellert, 2018). These experiences were ‘direct experience of nature’ involving nine feature like light, weather, views etc, ‘indirect experience of nature’ involving ten features like biomimicry, color, texture etc and ‘experience of space and place’ involving six features like organized complexity, mobility etc.

The hierarchical classification, initially ambiguous, was refined by Kellert to bring clarity to the relationship between the two dimensions, elements, and attributes. This modification, reducing the classification from three levels to two, allows us to combine the two dimensions and elements into three distinct experiences, thereby enhancing our understanding of human-nature relationships:

First: "Direct experience of nature," which involves a connection to the features and characteristics of the natural environment

Second: "Indirect experience of nature," through which thoughts, feelings, and images are projected to transform objective and empirical reality into metaphorical and symbolic forms.

Third: Kellert compared "the experience of place and place" to "spatial setting" to understand the ways humans manage and organize environmental conditions (Kellert, 2018). He explained this using the theory of biophilia and its values, taken from evolutionary psychology (Kellert, 2008, 2018). See Table 4 for the BD framework of Kellert (2018).

Table 4.

3 experiences and 25 attributes of biophilic design.

1. Direct Experience of Nature	**2. Indirect Experience of Nature**	**3. Experience of Space and Place**
Light	Images	Prospect and refuge
Air	Materials	Organized complexity
Water	Texture	Mobility
Plants	Color	Transitional spaces
Animals	Shapes and forms	Place
Landscapes	Information richness	Integrating parts to create wholes
Weather	Change, age, and the patina of time	
Views	Natural geometries	
Fire	Simulated natural light and air	
	Biomimicry	

(Kellert, 2018)

Recently, Browning and Ryan (2020) developed another pioneering BD framework with three main categories. These three categories were ‘nature in space’, ‘natural analogues’ and ‘nature of the space’. See Table 5.

Table 5.

3 categories and 15 patterns of biophilic design

1. Nature in the Space	**2. Natural Analogues**	**3. Nature of the Space**
Visual Connection with Nature	Biomorphic Forms and Patterns	Prospect
Non-Visual Connection with Nature	Material Connection with Nature	Refuge
Non-Rhythmic Sensory Stimuli	Complexity and Order	Mystery
Thermal and Airflow Variability		Risk / Peril
Presence of Water		Awe

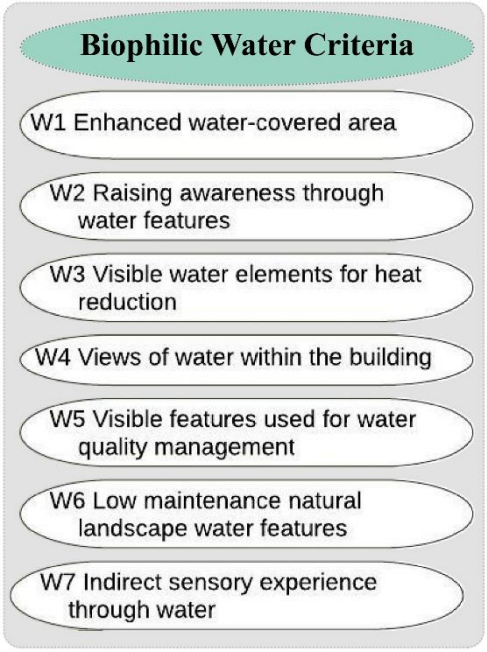
Dynamic and Diffuse light
Connection with Natural Systems

(Browning & Ryan, 2020)

Furthermore, there are biophilic design frameworks that have been developed specifically. There are various valuable BD schemes suggested for university campuses, preschools (Fadda, 2023; I. O. Mohammed, Z.; Ça˘gnan, Ç., 2023), clinical environments, hospitals (Tekin, 2023; Totaforti, 2018; Ulrich, 2008) etc. In addition, Wijesooriya et al. (2021) have developed a biophilic water criteria. This framework had a goal to link the environmentally sustainable design and BD approaches (Wijesooriya, 2023). See Figure 3.

Figure **3**

The biophilic water criteria.



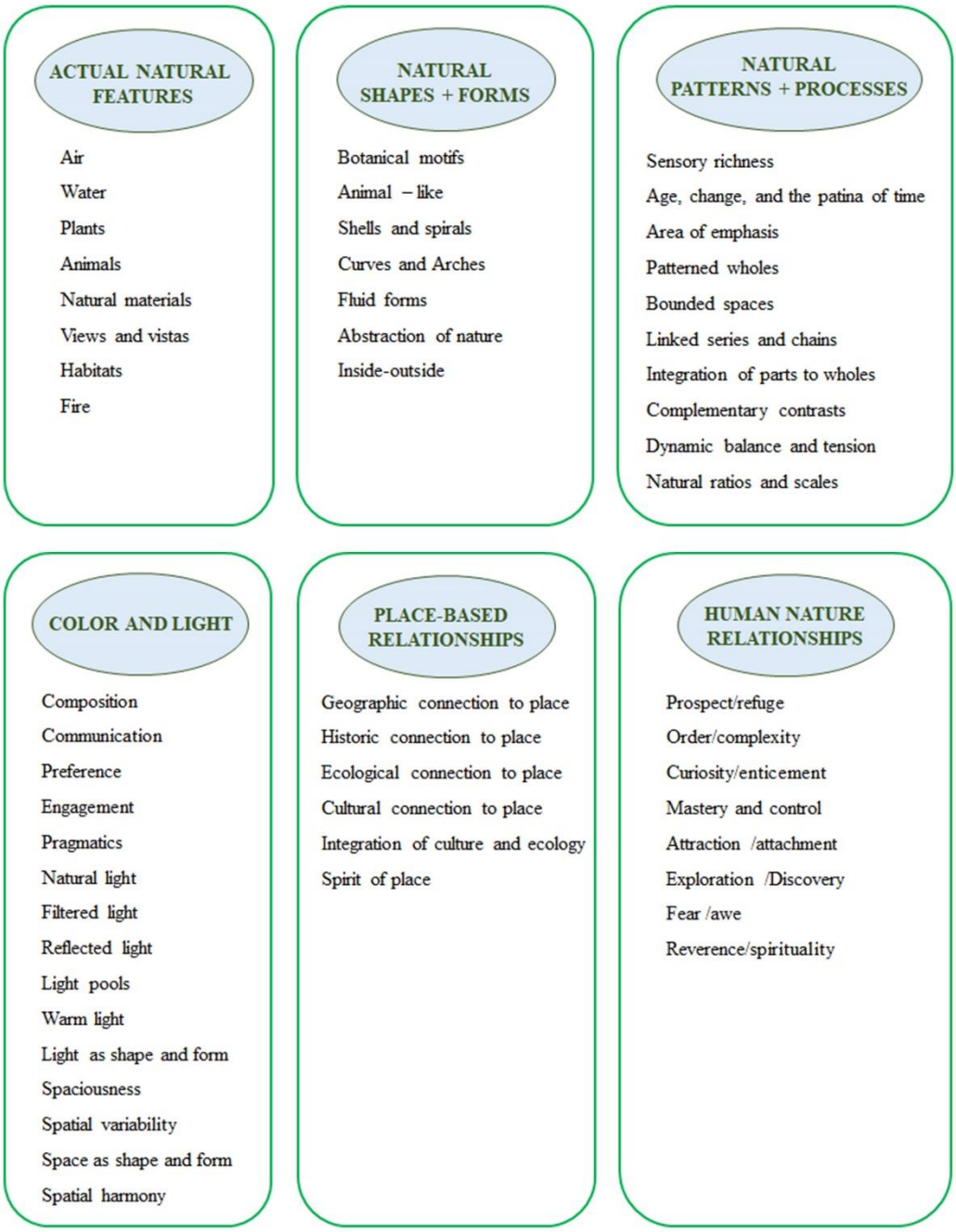
(Wijesooriya, 2023)

It can further be suggested that biophilic design is also highly required and even crucial for interior architecture in particular. As such, there are several scientific evidence-based and theoretical studies investigating BD for the interiors. One of these remarkable frameworks was developed by McGee et al. (2019) as the Biophilic Interior Design Matrix (BID-M). Initially, McGee and Marshall-Baker (2015)

proposed the Biophilic Design Matrix (BDM) to operationalize biophilic design for interior design applications with the help of examining a scoring procedure to indicate the variety of biophilic design features present in interior pediatric hospital playrooms. Consequently, some items on Kellert's list of 72 biophilic design attributes were eliminated, and 52 features were suggested. Later, BDM was revised in order to make it more valid and reliable, after considering the findings of pre- and postquestionnaires, and thus, BID-M was developed, now containing six elements and 54 attributes (McGee et al., 2019). See Figure 4 for the BID-M.

Figure 4.

Biophilic interior design framework.



(McGee et al., 2019)

The Biophilic Design Matrix (BDM) was developed by (McGee, 2015) to identify biophilic features in children's healthcare setting (I. O. Mohammed, Z.; Ça˘gnan, Ç., 2023). Another setting type was used in order to make it more reliable and valid. Thus for the development of BID-M, the goal was twofold. First, interior design

practitioners' perceptions about biophilic design was explored. Second, in order to increase the usability, BDM was tested to develop an updated one for the interior environments (McGee et al., 2019).

Place-based Relationships

Place based relationshios as a dimension is one of the main elements of biophilic design. The harmonious integration of ecology and culture within a specific geographic setting is encompassed by the concept of "place-based relationships" as a fundamental element of BD. It reflects the human inclination to establish connections with places and assert a sense of belonging or control over environments. This facet of biophilic design, place-based relationships, encapsulates the enduring human need for security within a space, the fulfillment of the longing for a sense of home, and it continues to be a profound requirement for most individuals in the present era. According to (Kellert, 2008), place-based relationships comprise eleven distinctive attributes, which are outlined as follows:

-*Geographic connection to place:* This quality is described by emotions of connection to a specific geographic region of a built environment, frequently created by emphasizing the geographic elements around the built environment.

-*Historic connection to place:* This attribute is linked to the passage of time and how individuals establish meaningful connections with a place over its history. It involves fostering a sense of participation in a place's historical narrative by properly representing its past and present and connecting the visible future to create a holistic sense of its history.

-*Ecological connection to place:* Achieving an ecological connection involves carefully incorporating a place's dominant ecological characteristics into its natural environment. While constructing a place may inevitably lead to modifications in the local ecology, the key is to ensure these changes are made in a manner that doesn't diminish the ecology but promotes the ecological development of the place.

- *Cultural connection to place:* As a characteristic of place-based interactions, cultural connection combines three attributes: history, ecology, and geography. Cultural connection to a place stems from the human desire for communal and individual identity, perpetuated overtime via the history of many characteristics such

as architecture. Cultural connection to a place is intricately woven with the history that unfolds within its bounds.

-*Indigenous materials:* Local and indiginous materials have the potential to boost a positive relation to place. These kind of materials also help energy efficiency regarding transport and manufacturing.

-*Landscape orientation:* The connection of building and surrounding landscape taking advantage of biometeorological conditions such as sunlight, slope, wind direction, can improve sense of place.

-*Landscape features that define building form:* Landscape elements, particularly geological features, natural objects and water can shape the building form integrating the built environment with the biophysical context.

-*Landscape ecology:* Consideration of landscape structure, pattern and process like ecological boundaries, biological corridors, biodiversity and other natural systems can reinforce place based relations.

-*Integration of culture and ecology:* The effective fusion of ecological and cultural attributes of the place-based relationship element of a biophilic design is critical to the long-term sustainability of the design because it guarantees the enrichment and transformation of the two attributes.

-*Spirit of Place:* This attribute encapsulates the significance bestowed upon a place by the individuals who interact with it, whether in a natural or built environment. The spirit of a place embodies the metaphorical and enduring connection that a built environment shares with its natural surroundings, emphasizing the long-term stewardship and responsibility that ensure the preservation of ecology and culture throughout history (Kellert, 2008).

-*Avoiding placelessness:* Whenever possible, placelesness needs to be eliminated. As such, current modern trends in architecture mostly involve motivations to undermine the requirement of connection to the culture or ecology of place.

Historical events, traditions, and narratives create a shared identity that unites individuals across generations. The stories of the past, whether they are tales of triumph or tribulation, shape the way people perceive themselves and their place in the world. The architecture that dots a landscape often is a tangible testament to this history, bearing witness to the footprints of time and evoking a deep sense of continuity. Cultural practices, rituals, and belief systems often mirror the rhythms of nature, reinforcing a symbiotic relationship between humans and their environment.

Architecture, too, is deeply influenced by the ecological dynamics of a region. From traditional building materials sourced locally to design choices that respond to climate and geography, architecture embodies the harmonious dance between human culture and the natural world.

Historical buildings and structures serve as visual reminders of the past, invoking a connection that transcends mere physical presence. Ecological contexts provide a rich tapestry against which cultural connection to a place unfolds. The natural environment, including its flora, fauna, and landscapes, not only shapes the physical setting but also influences how communities interact with their surroundings. Therefore, it can be suggested that historical buildings including the heritage of that particular setting harmonized with the ecological and local features, has the potential to be integrated with the biophilic design concept. It can further be argued that architecural heritage of the Arabian Peninsula possess a rich vernacular identity reflecting the unique values that can be integrated with BD concept. Such an integration can be used to develop a new understaning of biophilic design framework that is tailored specifically for the Saudi Arabia.

Related Research

Kellert (2008) developed one of the most pioneering BD frameworks. There were six main elements (‘environmental features’, ‘natural shapes and forms’, ‘natural patterns and processes’, ‘light and space’, ‘placed-based relationships and ‘evolved human-nature relationships’) covering 72 features in this BD scheme of Stephen Kellert.

Browning et al. (2014) suggested three categories covering 14 patterns in order to investigate biophilic design. The three categories were ‘nature in the space’ with seven items, ‘natural analogues’ with three items and ‘nature of the space’ with four items.

Kellert and Calabrese (2015) proposed another BD framework suggesting three experiential categories including 25 attributes in total. These three categories were ‘direct experience of nature’, ‘indirect experience of nature’ and ‘experience of space and place’.

McGee and Marshall-Baker (2015) proposed the Biophilic Design Matrix (BDM) to operationalize biophilic design for interior design applications with the help of examining pediatric hospital playrooms.

McGee et al. (2019) revised BDM in order to make it more valid and reliable after considering the findings of pre- and postquestionnaires and suggested the Biophilic Interior Design Matrix (BID-M) with 54 features in six main categories.

Kellert (2018) reinvestigated biophilic design and proposed three experiences. These experiences were ‘direct experience of nature’ involving nine feature like light, weather, views etc, ‘indirect experience of nature’ involving ten features like biomimicry, color, texture etc and ‘experience of space and place’ involving six features like organized complexity, mobility etc.

Browning and Ryan (2020) developed another pioneering BD framework with three main categories. These three categories were ‘nature in space’, ‘natural analogues’ and ‘nature of the space’.

Wijesooriya et al. (2021) have developed a biophilic water criteria in order to link the environmentally sustainable design and BD approaches

CHAPTER III
Methodology

In this third chapter of the study, first, materials and method of the research design were described. Later, data collection process and data analysis were discussed with related tables and figures.

Research Design

Materials: Three heritage buildings were identified for each of the four regions of the Kingdom of Saudi Arabia: the Central, Eastern, Southern, and Western regions. Each building was comprehensively identified (building mass, exterior facades, interior design, doors, and windows) for evaluation, ensuring a thorough and reliable process. The total number of buildings evaluated for all regions was twelve, three buildings for each of the four regions. See Tables 6 and 7 for the central region, Tables 8 and 9 for the western region, Tables 10 and 11 for the eastern region and Tables 12 and 13 for the southern region selected heritage buildings.

Table 6.

List of selected heritage buildings for the central region

Region	Selected Traditional Buildings
Central	1. Al Bassam Heritage House—Unayzah 2. Al Salhi Heritage House—Unayzah 3. HeritageVillage—Ushaiqer

With a deep respect for the environment, traditional buildings in the central region were constructed (Al-Anbar, 1999). The houses, one, two, and rarely three stories high, are characterized by their inner courtyards. This practical and comfortable feature not only meets the inhabitants' need for privacy but also creates a homely atmosphere with ample light and ventilation. The upper floors, designed without external openings, further enhance privacy, while the ground floor features small openings (CPD, 2000).

Table 7.

Selected building characteristics in the central region

Central Region	Building Massing	External Facades	Interior	Door	Window
Building (1) Al Bassam Heritage House—Unayzah					
Source: (Commission, 2021)					
Building (2) Al Salhi Heritage House—Unayzah					
Source: 1- (Qpedia, 2015) 2- Taken by the author					
Building (3) Heritage Village—Ushaiger					
Source: 1-(Arabia, 2021) 2-(Min, 2017) 3-(King, 1976 (1977))					

Table 8.

List of selected heritage buildings for the western region

Region	Selected Traditional Buildings
Western	1. Baeshen's Heritage House—Jeddah 2. Noor Wali's Heritage House—Jeddah 3. Bayt Nassief Heritage House—Jeddah

The western region was affected by the difference and diversity of cultures (Babsail & Al-Qawasmi, 2014); the density of architectural blocks distinguished the region

and led to interconnection in the urban fabric, which helped to form narrow and winding streets, which provided shade and cool air for road users (Bahmam, 2000). According to (Authority, 2020), the traditional houses of Medina have wide open courtyards surrounded by rooms, while in Mecca, the traditional houses have outdoor courtyards, and Jeddah's traditional houses do not have courtyards.

Table 9.

Selected building characteristics in the western region

Western Region	Building Massing	External Facades	Interior	Door	Window
Building (1) Baeshen's Heritage House—Jeddah					
Source: 1-(Hisham Abulnaja, 2021)					
Building (2) Noor Wali's Heritage House—Jeddah					
Source: 1-(Abdelkader, 2018) 2-(Attia, 2021) 3-(Attiah & Alawad, 2021) 4-(Ruiz, 2023)					
Building (3) Bayt Nassief Heritage House—Jeddah					
Source: 1-(Mortel, 2020) 2-(Mohamed, 2018) 3-(Siraj, 2009)					

Table 10.

List of selected heritage buildings for the eastern region

Region	Selected Traditional Buildings
Eastern	1. Al Mulla Heritage House—Al-Ahsa (Hofuf) 2. Almelhem Heritage House—Al-Ahsa 3. Traditional Souq Market—Al-Ahsa

Over the course of history, the urban fabric of the region has been deeply influenced by the climate, which is humid and hot in summer. The density and proximity of the building blocks provided shade and protection from dust storms and winds. The surrounding environment also provided local sources of building materials such as coral stone, clay, and plaster, shaping our urban spaces to connect us to our past (GAS, 2010).

Table 11.

Selected building characteristics in the eastern region

Eastern Region	Building Massing	External Facades	Interior	Door	Window
Building (1) Al Mulla Heritage House—Al-Ahsa (Hofuf)					
Building (2) Almelhem Heritage House—Al-Ahsa					

Source: 1-(Fokharia, 2024)
2-(Alobailan & alawad, 2022)
3-Taken by the author

Source: 1—Taken by the author

Building (3) Traditional Souq Market—Al-Ahsa					

Source: 1-(Peterson, 2023)
2-Taken by the author

Table 12.

List of selected heritage buildings for the southern region

Region	Selected Traditional Buildings
Southern	1. Al Aan Palace—Najran 2. Al-Muftaha Art Village—Assir, Najran 3. Almaa Village—Assir, Najran

The diversity of urban heritage patterns in the region was influenced by the diversity of the region's natural factors, according to its geographical location, climate, and distinctive topography, which affected the materials and methods used in construction (Bahmam, 2000).

Due to the natural influences, the region was characterized by three urban patterns, including thatched houses, mud houses, and stone houses, each with its construction methods and unique characteristics (Bahmam, 2000).

Table 13.

Selected building characteristics in the southern region

Southern Region	Building Massing	External Facades	Interior	Door	Window
Building (1) Al Aan Palace-Najran					

Source: 1-(Al-Fares, 2021)
2-(Authority, 2024)
3-Taken by the author

Building (2) Al-Muftaha-Art-Village-Assir-Najran	

Source: 1-Taken by the author

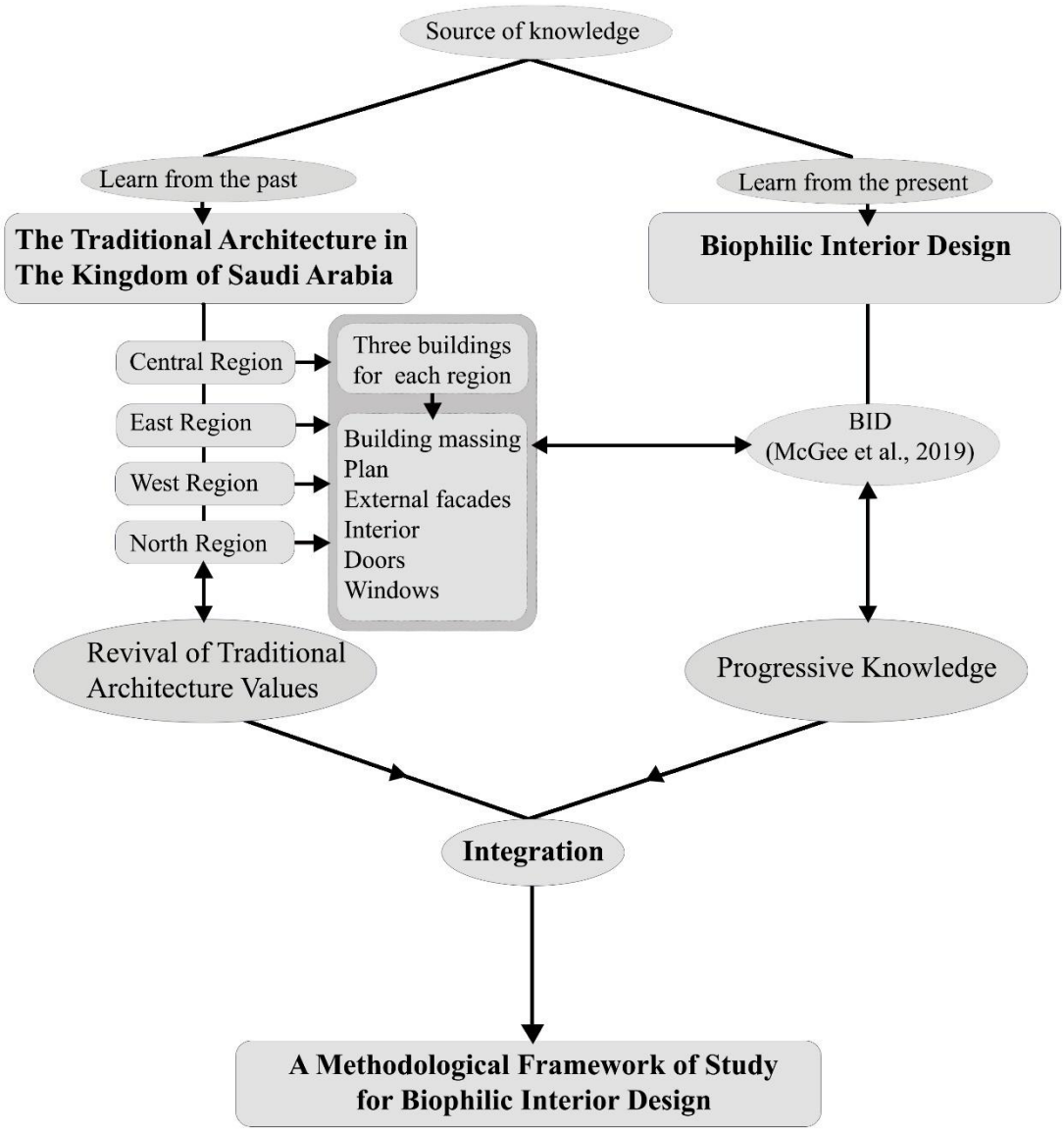
Building (3) Almaa-Village–Assir-Najran	

Source: 1-(Al-Kalawi, 2020)
2-Taken by the author

Method: The study used the BID-M, the framework for interior design developed by (McGee et al., 2019) to determine the score of biophilia in traditional Saudi architecture. After qualitatively evaluating heritage buildings listed in this research for regions in Saudi Arabia, a total of (0) or (1) was quantitatively measured for each of BID-M's 54 listed features. We collected data for three traditional buildings in each region and calculated the biophilia score for each region. See Figure 5 as the research design framework.

Figure 5.

The flow chart of the research design.



Adapted from McGee et al. (2019) by the author

Participants/Population & The Sample / Study Group

The questionnaire was not used in this research so we do not need to fill out this section.

Data Collection Tools/Materials

Data were collected from each of the Saudi Arabia's four regions (central, eastern, southern, and western). Three traditional buildings were chosen for each of these regions. For the data collection, a table was prepared as the data collection tool.

Architectural features were listed in a row and the three chosen buildings were listed in a column within this data collection table. This table includes the following as the architectural features:

- Architectural massing
- External facade
-Interior
-Door
-Window

Data Collection Procedures

A table representing a matrix was used for the assessment of each of the Saudi Arabia's four regions. This matrix involves all three chosen buildings in a row and all 54 features in a column. Twelve heritage buildings in total were assessed in order to examine biophilia in these traditional buildings. The required data about chosen traditional buildings in the Kingdom of Saudi Arabia was collected from a variety of sources, some of which were internet sites (the government and tourist) or articles and books, while others were obtained individually by the researcher. Each heritage building was assessed for each of the BID-M features (54 in total) and (0) if not present or (1) if present was recorded for each feature on the matrix.

Data Analysis Plan

The study examines traditional buildings in all four regions of the Kingdom and calculates biophilia using the BID-M (McGee et al., 2019). This matrix was used as a tool in our research to enable us to quantify the presence of biophilic elements in traditonal environments.

To achieve the study's objectives, first, a comprehensive systematic review on the literature was conducted, covering the stages of development of the biophilic design frameworks. Later, a quantitative methodology was then developed to determine the presence of biophilia in each region's traditional architecture.

We collect data for twelve traditional buildings in Saudi Arabia's four regions (central, east, south, and west). Building massing, external facades, interior design, doors and windows were recorded on a table in each region. The BID-M as a framework, which contains six elements and fifty-four characteristics, was used to measure the presence of biophilia in each building.

In a duration of two months, all twelve buildings were assessed according to BID-M features and findings were recorded in four different tables (one table for each region). The scores for each region were later evaluated in order to understand the degree of biophilia in these chosen buildings.

Subscores for each of the six elements and in addition total scores for each of the three chosen buildings were assessed in all four regions. Further, average scores were also calculated for each of the four regions. These findings were discussed and evaluated for proposing a new approach of BD for the country. In other words, the findings were discussed in order to develop a new approach that can be suggested specifically for the Saudi Arabia context.

CHAPTER IV

Assessment of Biophilia in the Traditional Saudi Architecture

This chapter involved a thourough analysis of the research context. Architectural heritage and architectural values in the Kingdom of Saudi Arabia were discussed within this chapter before findings and discussion.

Architectural Heritage in the Kingdom of Saudi Arabia

The Kingdom of Saudi Arabia, a country with a unique geographical position, ranks fourteenth among countries in the world in terms of area, with an area of 2.15 million square kilometers. It is one of the largest countries in the Middle East in terms of area, as it constitutes 80% of the area of the Arabian Peninsula (Schuster, 2019). Irregular and scarce rainfall and dry winds characterize the country's climate, with an average of 70.5 mm annually.

The evaporation rate could be higher, leading to a scarcity of fresh water and limited areas of vegetation (Gazzeh & Abubakar, 2018). This is largely due to the country's unique geographical position, which exposes it to dry winds from the desert and limits the amount of rainfall it receives. Saudi Arabia is the meeting point of three continents (Europe, Asia, and Africa), adding to its geographical significance. It is bordered on the western side by the Red Sea with a coastline of 1760 km. On the north-eastern side it is bordered by the Arabian Gulf coast with a distance of 560 km. On the eastern side, it is bordered by Qatar, Bahrain, and the United Arab Emirates. In contrast, on the southern side, it is bordered by the Republic of Yemen and the Sultanate of Oman, and finally, on the northern side. It borders the Hashemite Kingdom of Jordan and the State of Kuwait (Gazzeh & Abubakar, 2018).

In 2018, Saudi Arabia's Population Increased to 33.1 Million, with a significant 83.8% residing in urban areas. In 2025, the urbanization trend is expected to continue, with the population expected to reach 37.6 million. This rapid growth, based on an approximate average growth rate of 2.7% per year, underscores the dynamic nature of the country's demographics. The population is not only diverse in terms of its geographic distribution but also in terms of its cultural and linguistic diversity. Diverse ethnicities inhabit the Kingdom, each with its distinct language and culture, which characterizes Saudi Arabia's diverse and rich cultural heritage (Abubakar & Dano, 2020; GAS, 2010).

The diverse and unique traditional architecture of the Kingdom of Saudi Arabia, due to its vast area and diverse climatic and geographical conditions, is reflected in society because the environment shapes human life and is the reason for the diversity of unique architectural styles for each region. As a result, anyone exploring the rich architectural heritage of Saudi Arabia will be struck by the stark differences between the various regional styles (Al-Faisal, 2014).

Heritage buildings are sustainable because of building skills that have been passed through generations and these buildings involve stability of environmental and climate factors for each region (Al-Sheikh, 2010). The architectural styles of heritage buildings are the reason for dividing the four regions in the Kingdom of Saudi Arabia (King Fahad National Library: Riyadh, 2015). At the end of 2021, King Salman's Charter for Urbanism was held aiming to improve the urban environment so that it is compatible with local nature and culture while emphasizing that diversity in heritage buildings (King Fahad National Library: Riyadh, 2015). There are four distinctive regions as central, western, eastern and southern in the country.

Central Region: The central region, a historical crossroads of transportation routes and caravans, is the pulsating heart of the country (Bahmam, 2000). Circle for Publishing and Documentation (CPD, 2000). The central region's terrain is a living testament to the diversity of its geography by Saudi Commission for Tourism and Antiquities, 2010 (Al-Sheikh, 2010). It boasts plains, plateaus, and mountains, each significant in the region's captivating history and development. The Nafud Desert to the north, the Dahna Desert to the west, the Hijaz Mountains to the west, and the Rub al-Khali Desert to the south all have contributed to the region's distinct and fascinating character (Alobailan & alawad, 2022). The desert climate has left its mark on the central region's urban structure, with its narrow, winding streets and buildings situated close to each other. This design provides ample shade, protecting pedestrians from the harsh sun (Bahmam, 2000; CPD, 2000).

With a deep respect for the environment, traditional buildings in the central region were constructed (Al-Anbar, 1999). The houses, one, two, and rarely three stories high, are characterized by their inner courtyards, a practical and comfortable feature that not only meets the inhabitants' need for privacy but also creates a homely atmosphere with ample light and ventilation. The upper floors, designed without

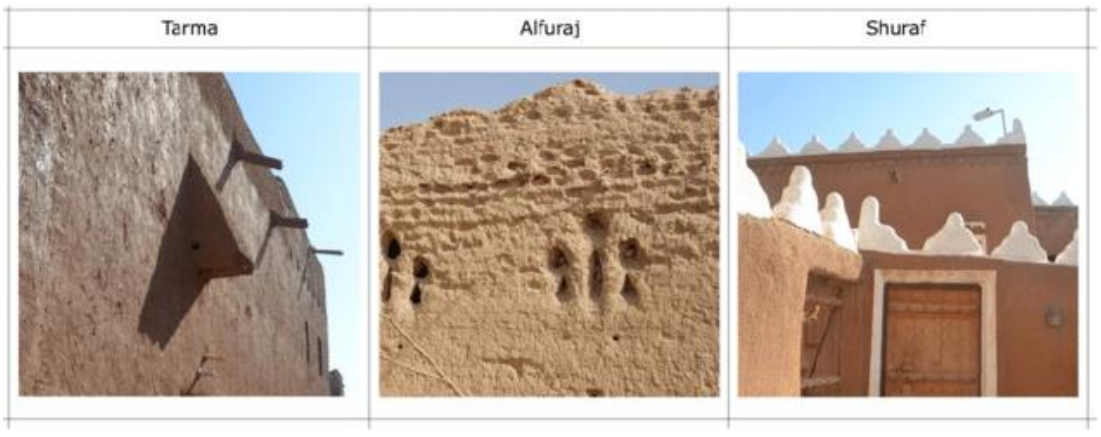
external openings, further enhance privacy, while the ground floor features small openings (CPD, 2000).

The external facades do not contain decoration or architectural details, while inside, these details increase to show the social status of the residents (Al-Anbar, 1999). However, Al-Naim believes this is only sometimes the case, as some residents may have been wealthy but rejected this decorative wealth based on religious beliefs (Alnaim, 2021). The Sharaf are stepped units in the form of arrows, triangles, or squares covered with plaster, which characterize the exterior facades of heritage houses in the central region Publication and Documentation Department (CPD, 2000). There are Alfuraj, which are rectangular or triangular openings, to provide ventilation and lighting. The tarma element is found near the doors and in the outer walls of buildings, and it allows the outside to see while maintaining privacy and not revealing those inside(Alnaim, 2021).

The reception area is important as it indicates generosity and welcome when receiving guests. Therefore, it received special attention from the house's owners, as it was rich in diverse decorations in shapes (geometric, plant, symbolic, epigraphic motifs) and bright, natural colors (red, yellow, blue). Some decorations are prominent, and others are recessed, which adds a distinctive aesthetic harmony to the place (Alnaim, 2021; Attiah & Alawad, 2021). See Figure 6 and 7.

Figure 6.

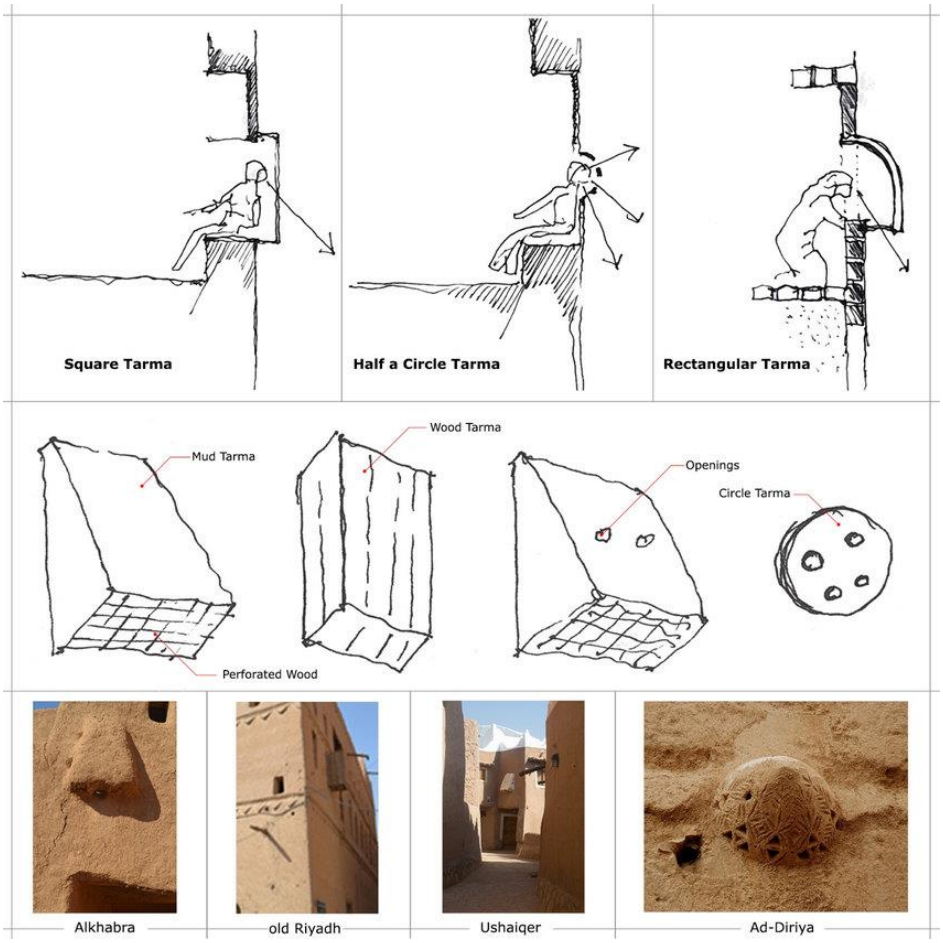
'Alsharaf, alfuraj, tarma' as architectural elements - central region.



(Alnaim, 2021)

Figure 7.

Tarma in the traditional central region built environment.



(Alnaim, 2021)

Western Region: The Western Region receives pilgrims from around the world (Babsail & Al-Qawasmi, 2014). The western region was affected by the diversity of cultures (Babsail & Al-Qawasmi, 2014). The density of architectural blocks distinguished the region and led to interconnection in the urban fabric, which helped to form narrow and winding streets providing shade and cool air for road users (Bahmam, 2000).

The traditional houses of Medina have wide open courtyards surrounded by rooms, while in Mecca, the traditional houses have outdoor courtyards, and Jeddah's traditional houses do not have courtyards, according to (Authority, 2020). In coastal cities (Yanbu, Jeddah), coral limestone was used in construction, and mountainous cities (Mecca, Taif), hard mountain stone was used (Hariri-Rifai & Hariri-Rifai, 1990). The ground floor has an entrance and a vestibule to protect the residents'

privacy, acting as a corridor to navigate between the guests and residents' regions. A staircase and a Roshan (seat) can be utilized at the entrance to welcome guests, rest, or sit. The number of rooms, which is determined by the house's location and the residents' financial circumstances, plays a crucial role in the functionality and comfort of the house. For instance, a larger number of rooms may indicate a wealthier resident or a larger family, while a smaller number of rooms may suggest a more modest lifestyle or a smaller family size by the Traditional Culture of Saudi Arabia (Hariri-Rifai & Hariri-Rifai, 1990).

Hejaz heritage architecture is celebrated for its unique features, notably the Roshan element. This architectural wonder ensures the residents' privacy and offers a discreet view of the outside world. The Roshan element refracts the intense sunlight during daylight hours casting a soft, diffused light that enhances the interior ambiance (Hariri, 1990). Importantly, it serves as a natural ventilation system, allowing air currents to pass through it (Alobailan & alawad, 2022) and maintaining a comfortable indoor environment. The capitals of the columns in Jeddah and Medina are distinguished by their rich decoration, unlike the houses of Mecca. The decoration varies between shapes (geometric, botanical) and written elements, some of which are carved on small pieces of wood, then assembled to form large pieces, and some are in relief. Limestone in Jeddah and clay in Medina are materials that can be shaped more easily than the mountain stone used in the homes of Mecca (CPD, 2000). See Figure 8.

Figure 8.

Mashrabiya (Roshan) architectural element in different historic Jeddah - western region.

(Bagasi, 2021)

Eastern Region: The eastern region, a pivotal trade route between the East and West, bears the imprints of various civilizations. The architectural influences of these civilizations, such as Iraq, India, Persia, and Greece, are evident in the region's urban features, including the distinctive arch shapes and construction methods (Bahmam, 2000). Over the course of history, the urban fabric of the region has been deeply influenced by the climate, which is humid and hot in summer. The density and proximity of the building blocks provided shade and protection from dust storms and winds. The surrounding environment also provided local sources of building materials such as coral stone, clay, and plaster, shaping our urban spaces in a way that connects us to our past. The prevalence of two-story buildings further reflects the region's unique architectural response to its climate (GAS, 2010).
The roofs, often made of Denshal wood and palm leaves, are a testament to the abundance of these materials, particularly in the Al-Ahsa region (Authority, 2020). The external facades are perpendicular geometric blocks with large openings to provide natural ventilation and light and maintain privacy. There is a Badgir element, a channel with two openings similar to air clamps. One of the two openings opens to the outside, and the other to the roof or interior rooms to provide cool air in the residence (Bahmam, 2000). The traditional homes of the region, with their open central courtyards and circular arches, are a testament to the region's unique architectural style. The main entrance, strategically distanced from the internal courtyard, was designed to ensure residents' privacy (auditory and visual). The guest rooms on the side of the house were a thoughtful design choice to preserve privacy without sound transmission. The family's social status was proudly displayed in the number of rooms, the decoration of the reception area, and the spaciousness and height (CPD, 2000). The plaster decorations, a fascinating blend of local and foreign influences, bear the mark of neighboring countries (Babsail & Al-Qawasmi, 2014), a vivid reflection of the region's rich cultural exchange.

Southern Region: The diversity of urban heritage patterns in the region was influenced by the diversity of the region’s natural factors, according to its geographical location, climate, and distinctive topography, which affected the materials and methods used in construction (Bahmam, 2000).

Due to the natural influences, the region was characterized by three urban patterns, including thatched houses, mud houses, and stone houses, each with its construction methods and unique characteristics (Bahmam, 2000).

1. Stone houses, a testament to the ingenuity of the local builders, are similar and are spread in mountainous areas. The building reaches five floors. Paving stones of equal size are used in the walls. Sometimes, the stones are covered with mud (Authority, 2020). Architectural openings (windows and doors) are small so that no one can enter them, and you need to bend to enter through the door to provide safety, protection, and warmth (Al-Zahrani, 2007).
2. Mud houses are found in the Asir region in different country regions, such as Abha, Tathlith, and Mha'il. The shapes of the houses vary, including pyramidal, rectangular, cylindrical, and square (Hariri-Rifai & Hariri-Rifai, 1990).
3. Thatched houses (Alisha, Al-Arish, Al-Sabool), which resemble a hut, are square, conical, or rectangular. Straw, clay, and tree branches were used in their construction.

There are places where straw houses (Jazan) are spread in the Tihama Plain (Bisha) east of the Asir region. Clay and plaster are used to cover the houses from the inside, and they are engraved with decorations (writing, animals, plants) using colors or quartz stone (Heritage, 2015).

The area's heritage houses, with their distinctive multi-story structure, offer a fascinating glimpse into the past. The ground floor, a hub of activity, is dedicated to livestock and storage, while also housing a private reception room for esteemed guests. The second floor, a more intimate space, features the kitchen, other rooms, and terraces (open spaces) where the family gathers and keeps a watchful eye on the outside world (Al-Qamadi, 2019).

The Asiri cat decoration, a cultural phenomenon, originated in the south in the Asir region before gaining popularity and spreading across the Kingdom. It is a distinct pattern of contrasting geometric shapes and repeating lines, adorned with colors derived from the region's nature (Alawad & Alsobahi, 2021). The names of the Asiri cat decorations, such as Al-Binah, Al-Aryash, Al-Muharib, and Al-Amshat, reflect its various forms (Abouelela, 2019). This decoration is not just a piece of art, but a symbol of Saudi women's courage, strength, endurance, and patience. It was historically women adorned their homes with this decoration, using it as a means to freely express their taste and individuality (Al-Hababi, 2012).

Architectural Values in the Kingdom of Saudi Arabia

Heritage architecture reflects the values that are the soul of a civilization, the era in which it developed, and the surroundings of its origin. It also shows the suitability of the local environment for the population, in addition to their customs and traditions (Commission., 2021). Architectural, intellectual, and physical standards constitute urban heritage values. Preserving them provides emotional, psychological, and intellectual balance, and adherence to them gives pride in urban identity, self-respect, and a feeling of safety and reassurance (Said et al., 2014).

We must all play a role in preserving our heritage architecture. Whether it's through supporting local preservation initiatives or advocating for stricter preservation laws, every action counts. The religious values of the urban heritage in Saudi Arabia are deeply integrated into the architectural design. They emphasize maintaining privacy, respecting neighbors throughout the building without revealing or elevating them, and separating the living and reception spaces and sleeping places for men and women (CPD, 2000). This harmony between religious values and architectural design is a testament to the depth of cultural integration. The practicality of the architectural solutions in Saudi Arabian heritage houses is truly admirable. By serving the residents, meeting their requirements, and protecting them from climatic conditions, a variety of heritage architectural elements were created. These elements, whose form matches their functional values, stand as a testament to the ingenuity and practicality of the architectural design (Commission, 2021).

Architectural elements have aesthetic qualities and functions that translate into decorative forms that distinguish each area, such as the characteristic of abstraction from the surrounding environment and other properties such as proportion, harmony, and rhythm (Said et al., 2014). An example is the Roshan, which is covered with wooden sculptures that allow air to pass smoothly (Hijazi, 2011). In the architecture of the central region, which is built of mud brick, there are different types of decoration, as well as some southern and eastern regions. Treating climatic conditions has proven the sustainability of this diverse decoration (Al-Qamadi, 2019; CPD, 2000).

Taking care of neighbors and guests and the space allocated to them while preserving the privacy of residents reflects social values. The small openings in the external facades in the central and southern regions emphasize the preservation of privacy and

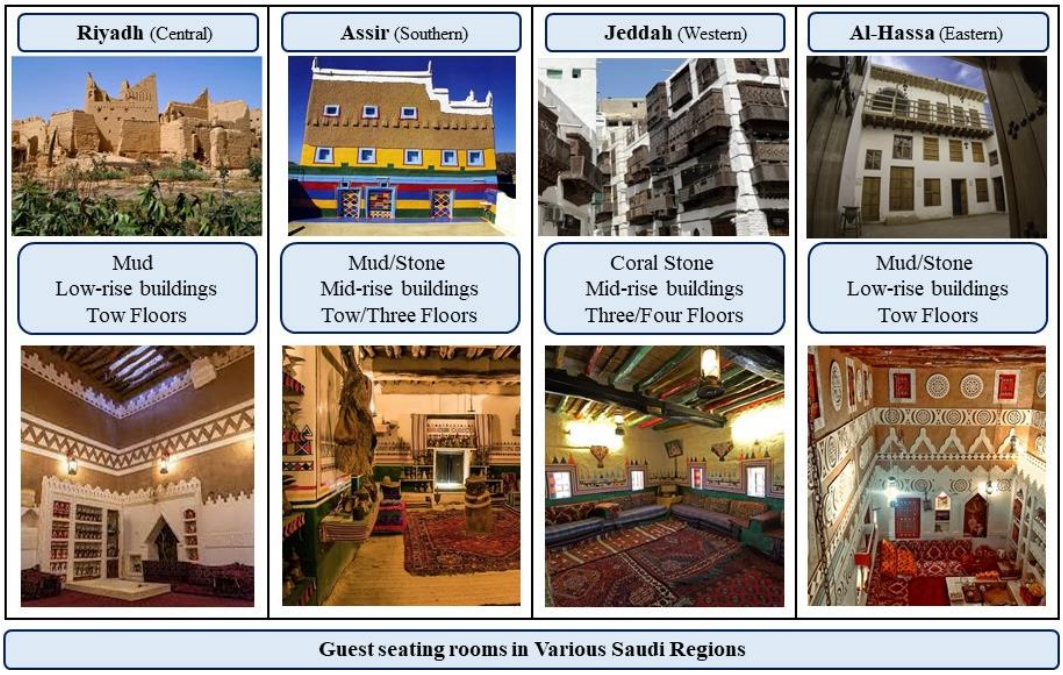
directing the openings and windows towards the inner courtyard in the eastern region or covering them with Mashrabiyas in the western region (Bahmam, 2000).

The convergence of residential blocks in the urban fabric not only increases familiarity and communication between people but also serves as a tangible reflection of our shared social values (Commission, 2021). The shadows provided by the Roshan element, which protect passersby from the sun's rays, foster mutual understanding and compassion (Hariri, 1990). The diversity of architectural styles in the Kingdom of Saudi Arabia's regions is a direct result of the unique geography, climate, and terrain, which dictate the use of different building materials from the surrounding environment.

This period was marked by numerous events, cultural diversity, and initiatives that shaped the future of Saudi regionalism. The establishment of the Ministry of Culture and the Architecture and Design Commission in 2019 played a crucial role in the launch of the King Salman Charter in 2021 (Commission., 2021; Government., 2016). The Charter, with its ambitious objectives, aims to transform the Salmaniah architectural style into a more comprehensive project, thereby broadening the horizons of Saud regionalism architecture beyond the confines of (Hariri, 1990). the Najdi (central region) architectural style (Alnaim et al., 2023). See Figure 9 and 10.

Figure 9.

The exterior and interior design of Saudi Arabia's traditional architecture in different regions.



(A.Shbaita, 2024)

Figure 10.

The main wooden doors in each region of Saudi Arabia.

(A.Shbaita, 2024)

CHAPTER V

Findings and Discussion

In the fifth chapter, the results of the BID-M assessment conducted and related discussinon based on the findings were shared.

Findings of the BID-M Assessment

The study collected data for three traditional architectural buildings from each region of Saudi Arabia (center, east, south, and west). Using the interior design Framework sets this study apart (McGee et al., 2019). This comprehensive tool assesses building massing, plan, external facades, interior design, doors, and windows. Its criteria, which include six elements and fifty-four features, are used to score the rise of biophilia in every three buildings in this study's collected data. The findings of this study are significant, as they indicate the presence of biophilia in the design of these traditional buildings. For instance, the Framework was applied to the door element) in each building in the Central region, the results showed (Local material (Wood) and Local bright colors), confirming the presence of biophilia in the design. See Tables 14-17.

Table 14.

The BID-M assessment conducted for the central region

	Central Region	**Building (1)**	**Building (2)**	**Building (3)**	**Total Scores**
Actual Natural Features					
1	Air	1	1	1	3
2	Water	1	1	1	3
3	Plants	1	1	1	3
4	Animals	1	1	1	3
5	Natural materials	1	1	1	3
6	Views and vistas	1	1	1	3
7	Habitats	1	1	1	3
8	Fire	1	1	1	3
Sub score		8	8	8	24
Natural Shapes + Forms					
9	Botanical motifs	1	0	0	1
10	Animal likenesses	0	0	0	0
11	Shells and spirals	0	0	0	0
12	Curves and arches	1	0	1	2
13	Fluid forms	0	0	0	0
14	Abstractions of nature	1	1	1	3
15	Shapes that are inside-out	1	1	1	3
Sub score		4	2	3	9

Natural Patterns + Processes					
16	Sensory richness	1	1	1	3
17	Age, change, and patina	1	1	1	3
18	Area of emphasis	1	1	1	3
19	Patterned wholes	1	1	1	3
20	Bounded spaces	1	1	1	3
21	Linked series and chains	1	1	1	3
22	Integrations of parts with wholes	1	1	1	3
23	Complementary contrasts	1	1	1	3
24	Dynamic balance and tension	1	1	1	3
25	Natural ratios and scales	1	1	1	3
Sub score		10	10	10	30
Color and Light					
26	Composition	1	1	1	3
27	Communication	1	1	1	3
28	Preference	1	1	1	3
29	Engagement	1	1	1	3
30	Pragmatics	1	1	1	3
31	Natural light	1	1	1	3
32	Filtered light	1	1	1	3
33	Reflected light	1	1	1	3
34	Light pools	1	1	1	3
35	Warm light	1	1	1	3
36	Light as shape and form	1	1	1	3
37	Spaciousness	1	1	1	3
38	Spatial variability	1	1	1	3
39	Space as shape and form	1	1	1	3
40	Spatial harmony	1	1	1	3
Sub score		15	15	15	45
Place-based relationships					
41	Geographic connection to place	1	1	1	3
42	Historic connection to place	1	1	1	3
43	Ecological connection to place	1	1	1	3
44	Cultural connection to place	1	1	1	3
45	Integration of culture and ecology	1	1	1	3
46	Spirit of place	1	1	1	3
Sub score		6	6	6	18
Human–nature relationships					
47	Prospect/refuge	1	1	1	3
48	Order and complexity	1	1	1	3
49	Curiosity and enticement	1	1	1	3
50	Mastery and control	1	1	1	3
51	Attraction/attachment	1	1	1	3
52	Exploration/discovery	1	1	1	3
53	Fear/awe	1	1	1	3
54	Reverence/spirituality	1	1	1	3
Sub score		8	8	8	24
Total score		51	49	50	150
Average					50

Table 15.
The BID-M assessment conducted for the western region.

	Western Region	Building (1)	Building (2)	Building (3)	Total Scores
Actual Natural Features					
1	Air	1	1	1	3
2	Water	1	1	1	3
3	Plants	1	1	1	3
4	Animals	1	1	1	3
5	Natural materials	1	1	1	3
6	Views and vistas	1	1	1	3
7	Habitats	1	1	1	3
8	Fire	1	1	1	3
Sub score		8	8	8	24
Natural Shapes + Forms					
9	Botanical motifs	0	0	0	1
10	Animal likenesses	0	0	0	0
11	Shells and spirals	0	0	0	0
12	Curves and arches	1	1	1	3
13	Fluid forms	0	0	0	0
14	Abstractions of nature	0	0	1	1
15	Shapes that are inside-out	1	1	1	3
Sub score		2	2	4	8
Natural Patterns + Processes					
16	Sensory richness	1	1	1	3
17	Age, change, and patina	1	1	1	3
18	Area of emphasis	1	1	1	3
19	Patterned wholes	0	0	0	0
20	Bounded spaces	1	1	1	3
21	Linked series and chains	1	1	1	3
22	Integrations of parts with wholes	1	1	1	3
23	Complementary contrasts	1	1	1	3
24	Dynamic balance and tension	1	1	1	3
25	Natural ratios and scales	1	1	1	3
Sub score		9	9	9	27
Color and Light					
26	Composition	1	1	1	3
27	Communication	1	1	1	3
28	Preference	1	1	1	3
29	Engagement	1	1	1	3
30	Pragmatics	1	1	1	3
31	Natural light	1	1	1	3
32	Filtered light	1	1	1	3
33	Reflected light	1	1	1	3
34	Light pools	1	1	1	3
35	Warm light	1	1	1	3
36	Light as shape and form	1	1	1	3
37	Spaciousness	1	1	1	3
38	Spatial variability	1	1	1	3
39	Space as shape and form	1	1	1	3
40	Spatial harmony	1	1	1	3
Sub score		15	15	15	45
Place-based relationships					
41	Geographic connection to place	1	1	1	3
42	Historic connection to place	1	1	1	3
43	Ecological connection to place	1	1	1	3
44	Cultural connection to place	1	1	1	3

45	Integration of culture and ecology	1	1	1	3
46	Spirit of place	1	1	1	3
Sub score		6	6	6	18
Human–nature relationships					
47	Prospect/refuge	1	1	1	3
48	Order and complexity	1	1	1	3
49	Curiosity and enticement	1	1	1	3
50	Mastery and control	1	1	1	3
51	Attraction/attachment	1	1	1	3
52	Exploration/discovery	1	1	1	3
53	Fear/awe	1	1	1	3
54	Reverence/spirituality	1	1	1	3
Sub score		8	8	8	24
Total score		48	48	50	146
Average					48.66

Table 16**.**

The BID-M assessment conducted for the eastern region.

	Eastern Region	**Building (1)**	**Building (2)**	**Building (3)**	**Total Scores**
Actual Natural Features					
1	Air	1	1	1	3
2	Water	1	1	1	3
3	Plants	1	1	1	3
4	Animals	1	1	1	3
5	Natural materials	1	1	1	3
6	Views and vistas	1	1	1	3
7	Habitats	1	1	1	3
8	Fire	1	1	1	3
Sub score		8	8	8	24
Natural Shapes + Forms					
9	Botanical motifs	0	1	1	2
10	Animal likenesses	0	0	0	0
11	Shells and spirals	0	0	0	0
12	Curves and arches	1	1	1	3
13	Fluid forms	0	0	0	0
14	Abstractions of nature	0	0	0	0
15	Shapes that are inside-out	0	1	1	2
Sub score		1	3	3	7
Natural Patterns + Processes					
16	Sensory richness	1	1	1	3
17	Age, change, and patina	1	1	1	3
18	Area of emphasis	1	1	1	3
19	Patterned wholes	0	0	0	0
20	Bounded spaces	1	1	1	3
21	Linked series and chains	1	1	1	3
22	Integrations of parts with wholes	1	1	1	3
23	Complementary contrasts	1	1	1	3
24	Dynamic balance and tension	1	1	1	3
25	Natural ratios and scales	1	1	1	3
Sub score		9	9	9	27
Color and Light					
26	Composition	1	1	1	3
27	Communication	1	1	1	3

28	Preference	1	1	1	3
29	Engagement	1	1	1	3
30	Pragmatics	1	1	1	3
31	Natural light	1	1	1	3
32	Filtered light	1	1	1	3
33	Reflected light	1	1	1	3
34	Light pools	1	1	1	3
35	Warm light	1	1	1	3
36	Light as shape and form	1	1	1	3
37	Spaciousness	1	1	1	3
38	Spatial variability	1	1	1	3
39	Space as shape and form	1	1	1	3
40	Spatial harmony	1	1	1	3
Sub score		15	15	15	45
Place-based relationships					
41	Geographic connection to place	1	1	1	3
42	Historic connection to place	1	1	1	3
43	Ecological connection to place	1	1	1	3
44	Cultural connection to place	1	1	1	3
45	Integration of culture and ecology	1	1	1	3
46	Spirit of place	1	1	1	3
Sub score		6	6	6	18
Human–nature relationships					
47	Prospect/refuge	1	1	1	3
48	Order and complexity	1	1	1	3
49	Curiosity and enticement	1	1	1	3
50	Mastery and control	1	1	1	3
51	Attraction/attachment	1	1	1	3
52	Exploration/discovery	1	1	1	3
53	Fear/awe	1	1	1	3
54	Reverence/spirituality	1	1	1	3
Sub score		8	8	8	24
Total score		47	49	49	145
Average					48.33

Table 17.

The BID-M assessment conducted for the southern region.

	Southern Region	**Building (1)**	**Building (2)**	**Building (3)**	**Total Scores**
Actual Natural Features					
1	Air	1	1	1	3
2	Water	1	1	1	3
3	Plants	1	1	1	3
4	Animals	1	1	1	3
5	Natural materials	1	1	1	3
6	Views and vistas	1	1	1	3
7	Habitats	1	1	1	3
8	Fire	1	1	1	3
Sub score		8	8	8	24
Natural Shapes + Forms					
9	Botanical motifs	0	0	0	0
10	Animal likenesses	0	0	0	0
11	Shells and spirals	0	0	0	0
12	Curves and arches	1	0	0	1

13	Fluid forms	0	0	0	0
14	Abstractions of nature	0	0	0	0
15	Shapes that are inside-out	1	1	1	3
Sub score		2	1	1	4
Natural Patterns + Processes					
16	Sensory richness	1	1	1	3
17	Age, change, and patina	1	1	1	3
18	Area of emphasis	1	1	1	3
19	Patterned wholes	1	1	1	3
20	Bounded spaces	1	1	1	3
21	Linked series and chains	1	1	1	3
22	Integrations of parts with wholes	1	1	1	3
23	Complementary contrasts	1	1	1	3
24	Dynamic balance and tension	1	1	1	3
25	Natural ratios and scales	1	1	1	3
Sub score		10	10	10	30
Color and Light					
26	Composition	1	1	1	3
27	Communication	1	1	1	3
28	Preference	1	1	1	3
29	Engagement	1	1	1	3
30	Pragmatics	1	1	1	3
31	Natural light	1	1	1	3
32	Filtered light	1	1	1	3
33	Reflected light	1	1	1	3
34	Light pools	1	1	1	3
35	Warm light	1	1	1	3
36	Light as shape and form	1	1	1	3
37	Spaciousness	1	1	1	3
38	Spatial variability	1	1	1	3
39	Space as shape and form	1	1	1	3
40	Spatial harmony	1	1	1	3
Sub score		15	15	15	45
Place-based relationships					
41	Geographic connection to place	1	1	1	3
42	Historic connection to place	1	1	1	3
43	Ecological connection to place	1	1	1	3
44	Cultural connection to place	1	1	1	3
45	Integration of culture and ecology	1	1	1	3
46	Spirit of place	1	1	1	3
Sub score		6	6	6	18
Human–nature relationships					
47	Prospect/refuge	1	1	1	3
48	Order and complexity	1	1	1	3
49	Curiosity and enticement	1	1	1	3
50	Mastery and control	1	1	1	3
51	Attraction/attachment	1	1	1	3
52	Exploration/discovery	1	1	1	3
53	Fear/awe	1	1	1	3
54	Reverence/spirituality	1	1	1	3
Sub score		8	8	8	24
Total score		49	48	48	145
Average					48.33

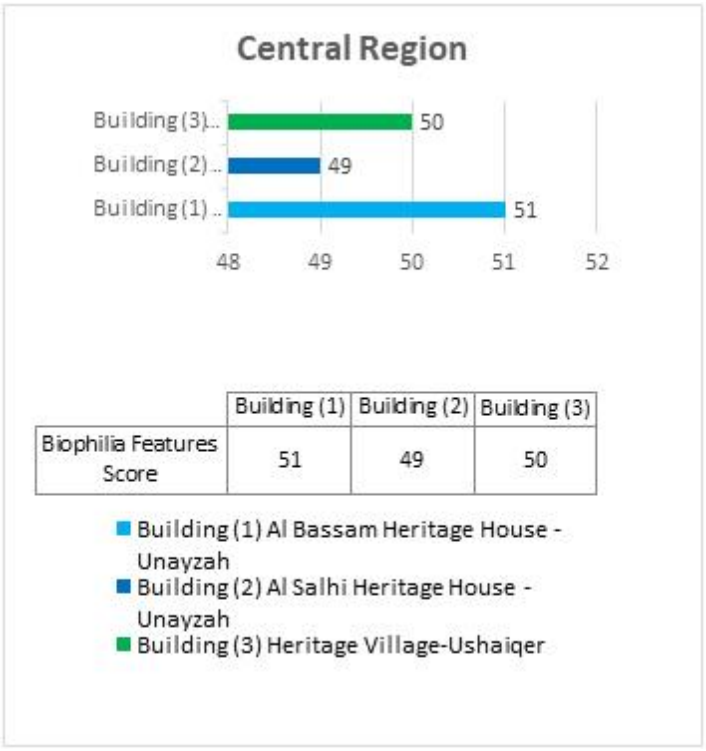
The results shown by the data tables confirm the high score of biophilia in heritage buildings, as it is a clear indication of the ability to integrate the values of traditional buildings with the features of biophilic design in interior architecture. In this study, we can find new material features from the values of traditional architecture to integrate them into the biophilic framework and adapt them to the environment of interior architecture.

The biophilia tool scores a significant rise in the environmental enrichment potential for the heritage buildings in the central regions:

1. Building (1), Al Bassam Heritage House - Unayzah, achieved a high rise score from biophilia features (51).
2. Building (2), Al Salhi Heritage House - Unayzah, achieved a high rise score from biophilia features (49).
3. Building (3), HeritageVillag-Ushaiqer, achieved a high rise score from biophilia features (49). See Figure 11.

Figure 11.

BID-M scores for the heritage buildings in the central region of Saudi Arabia.



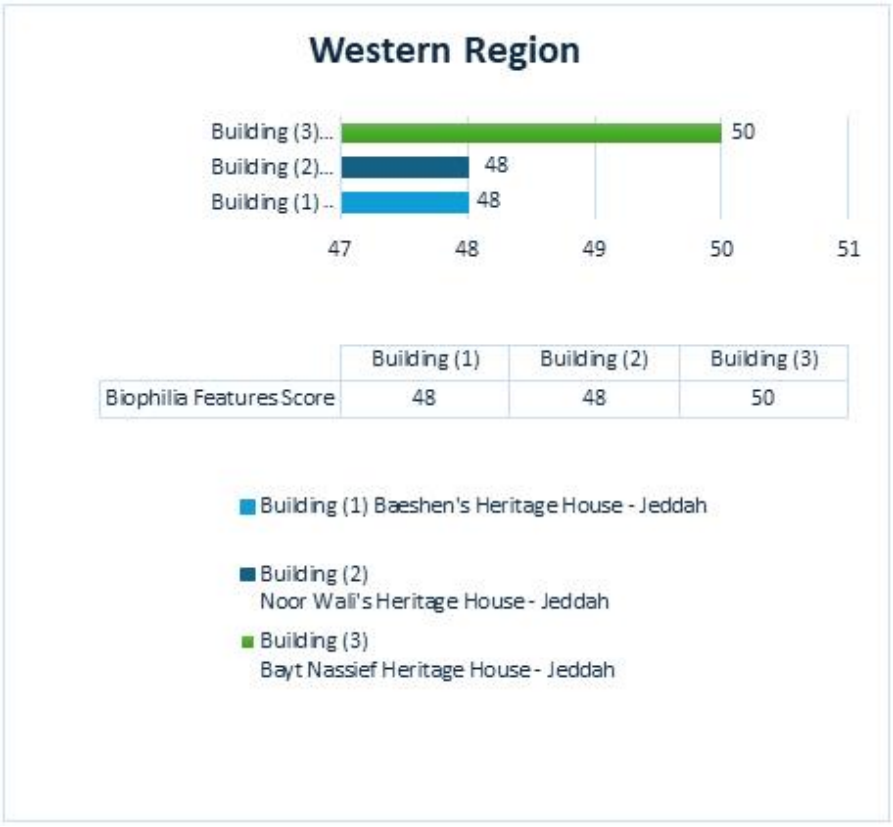
All three buildings, on average, reached an impressive 50 out of 54 features, underscoring the success of biophilic design in this area.

However, the heritage buildings in the western regions average 48 out of 54 features, indicating a promising potential for improvement in the biophilia tool scores in this region.

1. Building (1), Baeshen's Heritage House - Jeddah, achieved a high rise score from biophilia features (48).
2. Building (2), Noor Wali's Heritage House - Jeddah, achieved a high rise score from biophilia features (48).
3. Building (3), Bayt Nassief Heritage House - Jeddah, achieved a high rise score from biophilia features (50). See Figure 12.

Figure 12.

BID-M scores for the heritage buildings in the western region of Saudi Arabia.

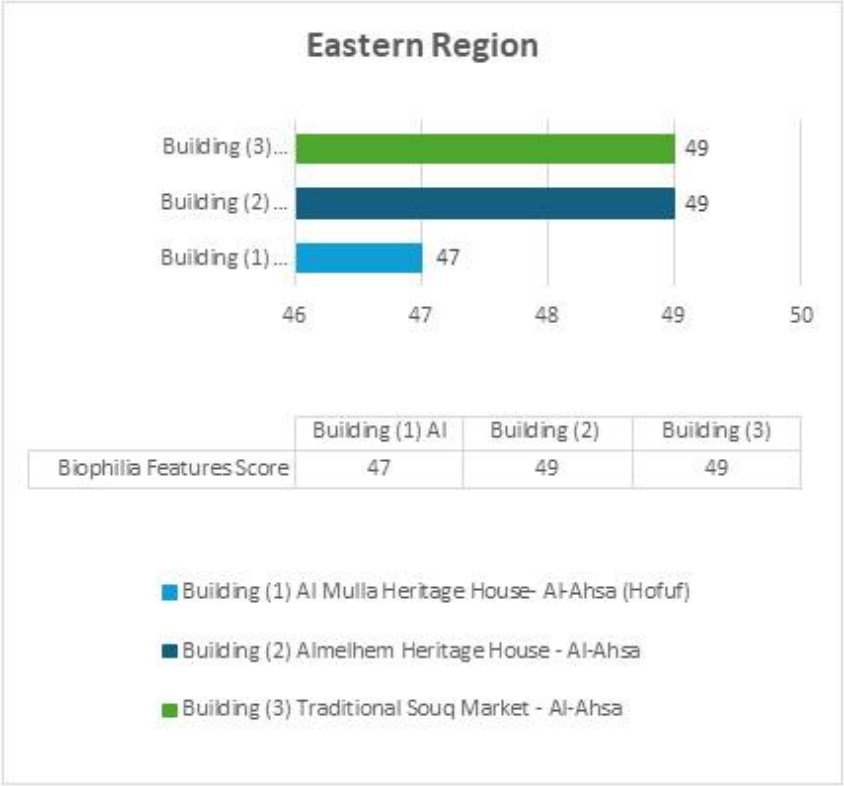


An average of 48 out of 54 features of the biophilia tool were achieved for heritage buildings in the eastern regions.

1. Building (1), Al Mulla Heritage House- Al-Ahsa (Hofuf), achieved a high rise score from biophilia features (47).
2. Building (2), Almelhem Heritage House - Al-Ahsa, achieved a high rise score from biophilia features (49).
3. Building (3), Traditional Souq Market - Al-Ahsa, achieved a high rise score from biophilia features (49). See Figure 13.

Figure 13.

BID-M scores for the heritage buildings in the eastern region of Saudi Arabia.

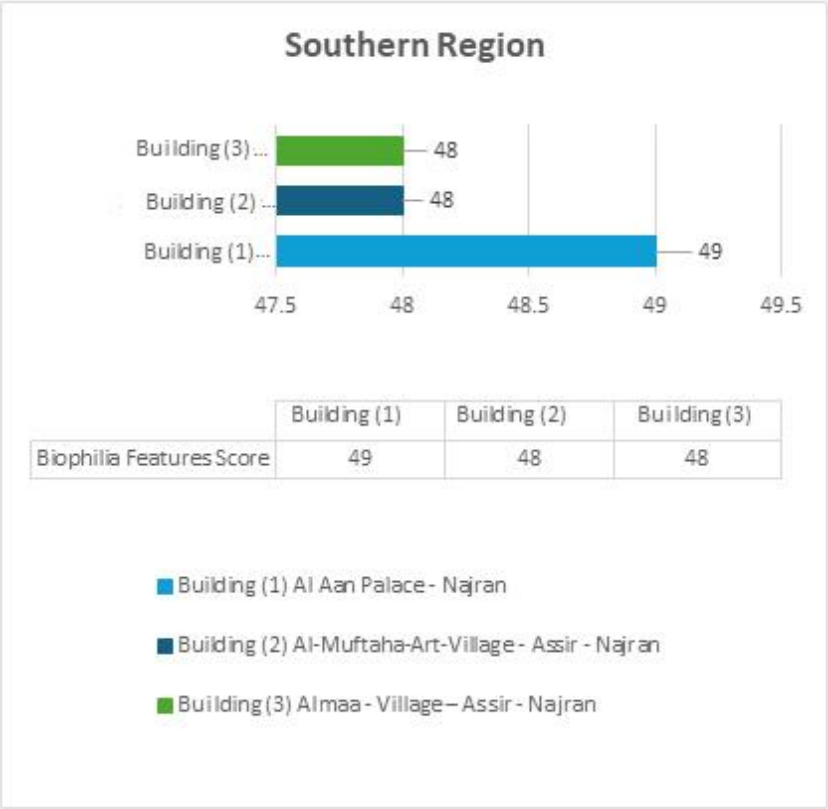


Finally, heritage buildings in the southern regions achieved an average of 48 out of 54 features of the biophilia tool.

1. Building (1), Al Aan Palace - Najran, achieved a high rise score from biophilia features (49).
2. Building (2), Al-Muftaha-Art-Village - Assir - Najran achieved a high rise score from biophilia features (48).
3. Building (3), Almaa - Village – Assir - Najran, achieved a high rise score from biophilia features (48). See Figure 14.

Figure 14

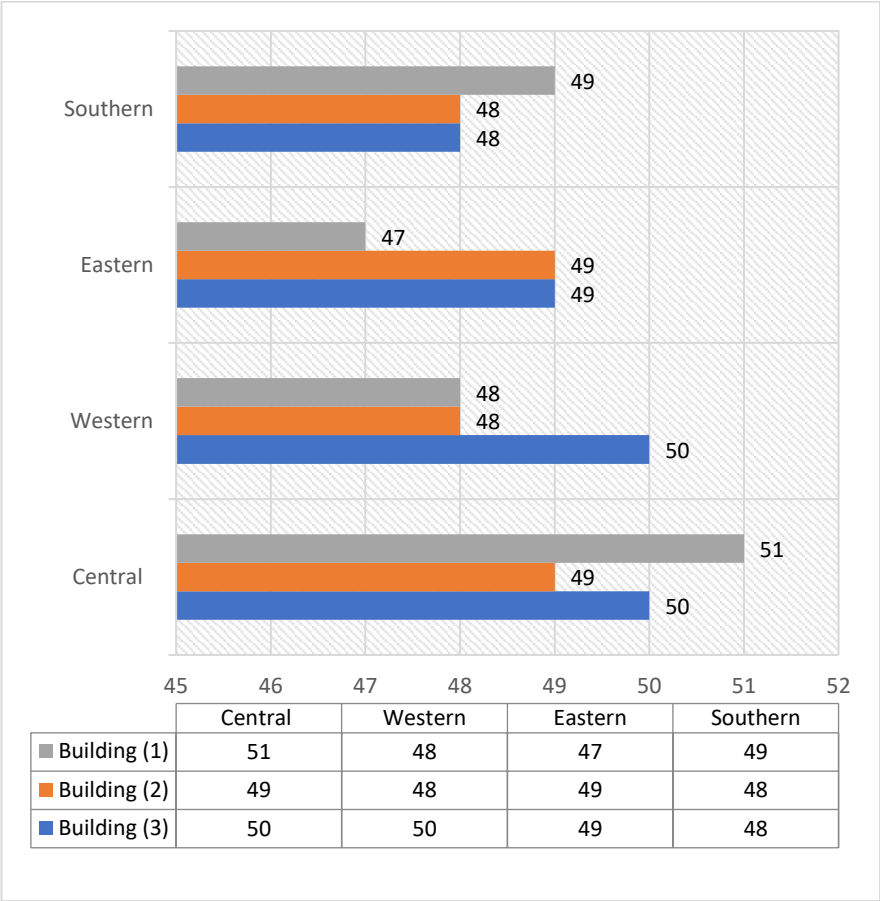
BID-M scores for the heritage buildings in the southern region of Saudi Arabia.



All the results affirm the prevalence of biophilia in heritage architectural structures in Saudi Arabia. Therefore, we must embrace the architectural values of all four regions of the Kingdom, highlighting and integrating those that are in harmony with the principles of biophilia. This not only preserves our heritage but also enriches our environment, fostering a more sustainable and harmonious relationship between our built and natural environments. See Figures 15 and 16.

Figure 15.

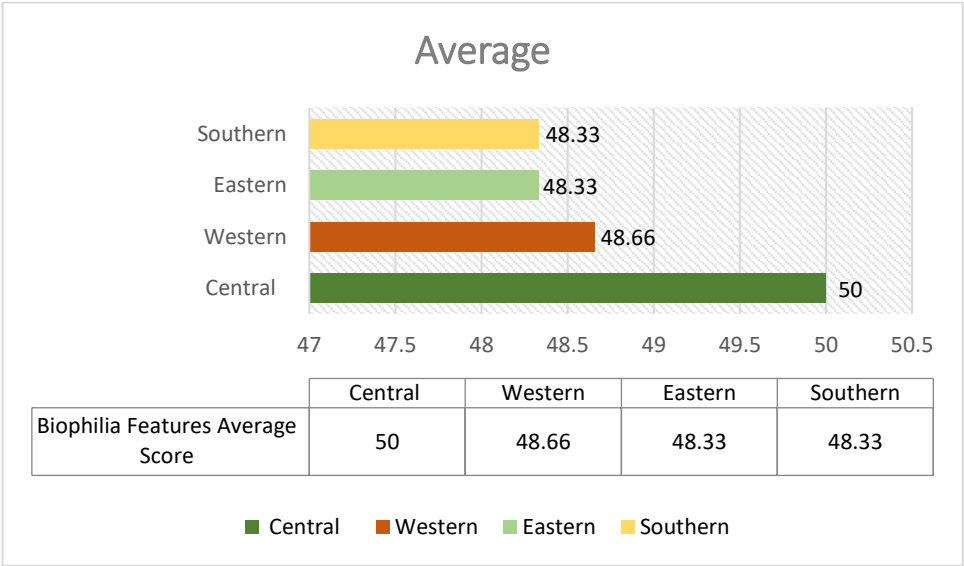
BID-M scores of heritage buildings for all four regions in Saudi Arabia.



	Central	Western	Eastern	Southern
Building (1)	51	48	47	49
Building (2)	49	48	49	48
Building (3)	50	50	49	48

Figure 16.

Average BID-M scores of all four regions in Saudi Arabia.



	Central	Western	Eastern	Southern
Biophilia Features Average Score	50	48.66	48.33	48.33

Discussion

The study aims to evaluate the biophilic design characteristics of traditional buildings with a clear goal in mind. The data from this evaluation could be instrumental in developing a new framework for biophilic interior design specifically tailored for the Middle East region. This potential contribution to the field is a testament to the forward-thinking nature of our research.

For the first element (actual natural characteristics) of the BID-M matrix framework, we find that traditional architectural buildings stand out due to their high environmental values. They achieve a significant percentage of all the features of the first element, such as water, air, plants, and views. For instance, the feature of air, ventilation, and thermal moderation is achieved through a unique blend of architectural elements.

In traditional architecture, such as the mashrabiya element and the open courtyard in the middle or outside of the building, these elements are among the values of traditional buildings (environmental, cultural, religious, aesthetic, and social). The use of traditional and local materials such as coral stone, clay, wood, and timber further enhances the environmental value of these buildings, integrating the first element of the matrix (actual natural characteristics). This practical application of our proposed design framework can inspire and motivate architects and interior designers to create sustainable and culturally rich spaces in Saudi Arabia.

(Natural forms) the second element within the biophilia framework for interior design fulfills traditional architecture's aesthetic and religious values in several ways. Among these ways, the use of curves and arches in traditional architecture reflects the natural forms and shapes found in the environment. Heritage buildings in the central region also contain circular arches for their aesthetic and religious values, and the second element (Natural Shapes + Forms) contains the characteristic of curves and arches.

The Heritage homes of the region, with their open central courtyards and circular arches, stand as a testament to the region's rich and unique architectural heritage (CPD, 2000).

Some elements embody traditional architecture's values, such as the Mashrabiya, Badgir, Tarma, The Sharaf, Faraj, and Sharaf, which are a testament to the ingenuity of traditional architects. These elements, inspired by nature, not only achieve aesthetic adaptation but also maintain the inhabitants' privacy from the outside world.

They are a reflection of both aesthetic and religious values, showcasing the brilliance of traditional architectural design.

The Badgir element, a channel with two openings resembling air clamps, is not just a design feature but a sustainable solution. Designed to adapt to nature aesthetically, this element provides ventilation and natural light, in line with the biophilia framework. One of the Badger's openings opens to the outside, and the other opens to the roof or interior rooms, providing cool air inside the dwelling naturally and sustainably (Bahmam, 2000).

Hijazi heritage architecture is distinguished by its unique architectural elements, including the Roshan element. It is a type of window designed in a geometric shape to ensure the privacy of the interior while providing a discreet view of the outside world. It also breaks the Intense sunlight during daylight hours, helping to spread soft light inside. The Roshan is an architectural wonder that beautifully mirrors the harmony with local nature, designed to adapt aesthetically to it and provide natural light as in the biophilic framework (Hariri, 1990).

The Sharaf element, a series of tiered units in the form of triangles, squares, or arrows covered with gypsum, is a striking feature that characterizes the exterior facades of heritage houses in the central region (Publishing and Documentation Department (CPD, 2000). In contrast, the Faraj element is practical marvel-triangular or rectangular openings that provide natural lighting and ventilation, enhancing the comfort and livability of these heritage buildings. Lastly, the tarma element, strategically placed near the doors and in the exterior walls of heritage buildings, allows who’s on the outside while maintaining privacy for those inside and not revealing them (Alnaim, 2021).

Among the aesthetic and religious values are the decorations inspired by the culture and environment of the Kingdom of Saudi Arabia, such as geometric and Islamic, as well as symbolic and epigraphic motifs and local plant decorations (palms). The concept of 'Ornamentation without animate beings' is also prevalent. These values of heritage architecture are consistent with the framework of biophilia, emphasizing the integration of natural features into the building environment. Decorations reflect the religious values of traditional architecture in the region without living organisms, a practice that underscores the cultural and ethical significance of architecture and its respect for all forms of life.

In Jeddah and Medina, the capitals of the columns are characterized by rich decorations, unlike those of the columns in Mecca. These decorations vary in shapes between geometric, botanical, and epigraphic motifs, some of which are carved on small pieces of wood to be assembled into large pieces, and some are in relief (CPD, 2000). The Asiri cat decorations, a cultural phenomenon that originated in the southern region of Asir, are a testament to the adaptability of art to its environment. This unique and distinctive pattern of repeated lines and contrasting geometric shapes, adorned with colors made from natural materials local to the region, is designed to aesthetically blend with the environment. This adaptability is consistent with the biophilia framework's emphasis on the importance of integrating natural elements into the built environment (Alawad & Alsobahi, 2021). The names of the Asiri cat decorations, such as Al-Muharib, Al-Amshat, Al-Aryash, and Al-Banna, reflect their diverse forms (Abouelela, 2019).

All of the above are material features that achieve the values of heritage architecture and integrate seamlessly with the framework of biophilic interior design. The second element designates the framework to be fully compatible with the values of heritage architecture in the Kingdom of Saudi Arabia, demonstrating an innovative and enlightened approach to design.

All of the above are material features that achieve the values of heritage architecture and integrate seamlessly with the framework of biophilic interior design. The second element designates the framework to be fully compatible with the values of heritage architecture in the Kingdom of Saudi Arabia, ensuring a culturally sensitive and respectful design. The third element of the biophilia interior design framework (Natural Patterns + Processes) is particularly significant in our research on biophilia interior design in heritage buildings. This element, which aligns with heritage buildings' aesthetic and religious values, is not just a spatial constraint but a reflection of religious values. It segregates residents' spaces from guests' spaces in various ways, such as through boundary spaces to preserve residents' privacy and by separating male spaces from female spaces in the sleeping area.

The inclusion of open courtyards, a physical feature that aligns with the values of religious and social heritage architecture, is not just a design choice but a practical and cultural element that significantly enhances the livability of the space. These courtyards, a common feature in traditional houses in Medina, serve as a central gathering space and provide natural ventilation, enhancing the comfort and livability

of the space. This example serves as a powerful demonstration of how natural patterns and processes, such as the use of open spaces and natural ventilation, play a pivotal role in shaping the interior design of heritage buildings.

The diverse construction methods across the Kingdom play a crucial role in the final design of the interior spaces of heritage buildings. Our research, which provides a comprehensive understanding of the influence of building styles on interior design, reveals that these styles vary by region and locally available materials, greatly influencing the spatial layout, overall aesthetics of buildings, and material selection. This part of our research provides a comprehensive understanding of how natural processes and patterns influence the interior design of heritage buildings.

The unique geographical location of the region, characterized by mountainous terrain and special climate in addition to its proximity to the sea, played a pivotal role in the emergence of diverse patterns of urban heritage. These patterns influenced the materials and construction methods used, and these patterns in interior design were prominent as an integration with natural processes.

Natural influences have led to distinct regional urban patterns, each with unique characteristics and construction methods. Stone houses have thermal insulation properties and durability, mud houses have their natural cooling effect, and straw houses have a light and flexible structure (Bahmam, 2000). Also, these houses involve diverse ornamentation methods such as geometric, botanical and epigraphic motifs.

‘Color and light’ is the fourth element in the framework of biophilic interior design, in line with the aesthetic and environmental values of heritage buildings. These values can be combined with the attributes of the fourth element, such as the theme of bright local colors, which we often find in decorations. This enhances visual appeal and sustainability, a crucial and inspiring aspect of biophilic design.

The reception area, a crucial space that signifies generosity and welcome, has always received special attention from the house's owners. It is a rich tapestry of diverse decorations in various shapes (geometric, plant, symbolic, and epigraphic motifs) and bright, natural colors (red, yellow, blue). Some decorations stand out, while others are more subtle, creating a unique aesthetic harmony that is a feast for the eyes and a testament to the thoughtful design. This space, incorporating biophilic design elements, enhances the visual appeal of the building and creates a welcoming and nurturing environment (Alnaim, 2021; Attiah & Alawad, 2021).

Another physical feature we can incorporate is the 'color decoration methods' which involve the strategic use of colors in interior design to create a harmonious and visually appealing space. This technique is particularly relevant to the Asiri cat decoration, as it utilizes a unique palette of colors derived from the region's nature to create its distinctive patterns and forms.

This decoration is not merely a piece of art but a symbol of Saudi women's courage, strength, endurance, and patience. Historically, women used this decoration as a powerful tool to express their taste and individuality in their homes, thereby connecting deeply with their cultural heritage (Al-Hababi, 2012). Using the Mashrabiya element, also known as the Roshan, there is another feature we can incorporate (refracted sunlight); this element serves the practical purpose of refracting intense sunlight during daylight hours and adds a visually appealing aspect to biophilic design in heritage buildings (Hariri, 1990).

Place-based relationships are the fifth element in the interior design framework. It addresses the profound influence of traditional architecture's cultural, religious, and social values, highlighting the importance of these values in the design process. Cultural values, deeply rooted in their connection to the place, are pivotal in shaping the regional cultural identity. This influence is not just significant, but it is also deeply personal, as it contributes to the distinctiveness of our character. For example, the use of vibrant colors in a region's interior design is a celebration of our lively and festive cultural values, adding to our unique character.

Religious values, such as maintaining privacy, respecting neighbors' rights, and ornamentation without animate beings, are integral to interior design and fascinatingly diverse in their application across regions. This diversity, as seen in the use of Tarma in the central region and Mashrabia in the western region, is a testament to the rich tapestry of cultural influences on design.

Social values play a significant and often overlooked role in shaping interior design. They influence the distribution of public and private spaces, the attention to communication between the inside and the outside, the amount of ornamentation, and even the number of floors, all of which vary across regions. Understanding these influences adds a layer of complexity to our appreciation of design.

Through the sixth element (human relations with nature), the biophilic design framework achieves the social values of heritage architecture. We know that the Saudi person can coexist and adapt to the desert weather with strategies for

innovative solutions for architectural elements that work to improve the temperature inside the building. The mashrabiya, a key architectural element, plays a crucial role. It refracts the bright sunlight and regulates air entry into the building, contributing to innovative solutions for improving the temperature inside the building. The open spaces in the middle and outside the building also play a significant role in maintaining thermal moderation and facilitating stargazing at night.

New Features for BD in the Kingdom of Saudi Arabia

Based on analyzing the findings and reviving the values of traditional architecture derived from regions' culture and tradition, this study extracted several new physical or non-physical properties for biophilic design in the Kingdom of Saudi Arabia in particular. This integration ensures that the biophilia framework becomes compatible and a true reflection of Saudi Arabia's cultural identity.

Within this framework, new items can be embedded into BID-M in order to make the existing one more specific for the Saudi Arabia. This new proposal has tha potential to reconnect the built environment with nature and to achieve new insights into sustainable housing design solutions in the regon.

For the first element of the BID-M which is 'Actual Natural Features', *'vernacular materials'* like coral stone, clay, mud plaster and wood can be added under the item of 'natural materials' according to the region.

For the second element of the BID-M which is 'Natural Shapes and Forms', *'traditional motifs'* including geometric, symbolic, Islamic, epigraphic, botanical decorations can be added. The Al-Asiri cat decoration is one of the types that can be given as example for the traditional motif.

For the third element of the BID-M which is 'Natural Patterns and Processes', *'diverse (dynamic) ratios and scales',* achieving a contrasting harmony and rhythm can be added to the existing features. Such a dynamic influence can be seen in most of the traditional building massing.

For the fourth element of the BID-M which is 'Color and Light', *'local bright colors'* (red, yellow, blue) can added to the existing items. These colors can be used on facades including doors and within interiors. In addition, *'refracted light'* can also be suggested to be added. As such mashrabia, roshan and alfuraj are architectural elements that break the direct effect of sunlight through the interiors.

For the fifth element of the BID-M which is ‘Place-Based Relationships’, ‘*religious connection to place’* can be added. As such according to the religious values, segregating residents' spaces from guests' spaces in various ways to preserve residents' privacy, respecting neighbors’ rights and separating male spaces from female spaces in several areas are essential. For instance tarma is used to see outside, while in the western region, mashrabia (roshan) serves this purpose. In addition, ‘*social connection to place’* can also suggested to be added under the fifth element of BID-M. As such, courtyard can be given as an example of physical item for socially connecting users in interiors.

For the sixth element of the BID-M which is ‘Human-Nature Relationships’, ‘*adaptation/preservation’* can be added together to the existing features. As such, throughout hundreds of years, traditional houses have been adapted to the changing conditions while conserving the unique environmental, social, religous values. In addition, ‘*calmness/confusion’* can also be added. As the built environments can be suggested to foster calmness as a result of using dynamic, diverse and conflusing color, ornamentations together in harmony. See Table 18.

Table 18

New features to be added into BID-M for BD in the Kingdom of Saudi Arabia

ACTUAL NATURAL FEATURES	**NATURAL SHAPES AND FORMS**	**NATURAL PATTERNS AND PROCESSES**
vernacular materials (coral stone, clay, mud, wood)	**traditional motifs** (geometric, symbolic, Islamic, epigraphic, botanical decoration)	**diverse (dynamic) ratios and scales** (contrasting harmony and rhythm)
COLOR AND LIGHT	**PLACE-BASED RELATIONSHIPS**	**HUMAN-NATURE RELATIONSHIPS**
local bright colors (red, yellow, blue)	**religious connection to place** (tarma, mashrabia, roshan)	**adaptation/preservation calmness/confusion**
refracted light (alfuraj, mashrabia, roshan)	**social connection to place** (courtyard)	

CHAPTER VI
Conclusion and Recommendations

This chapter involved conclusion based on the literature review and findings of the assessment. In addition, recommendations for the future studies were added.

Conclusion

Biophilic design is a new design approach in architecture that has the potential to significantly enhance the relationship between humans and nature in interior design. This not only promotes healthy impacts and positive behaviors but also inspires creativity. The concept of biophilic design can enhance the value of spatial experiences, generating a new perspective on design that has the potential to raise the quality of construction, stimulate innovation in design, and create interior spaces that achieve sustainability.

The biophilic design frameworks, in general, have the ability to save contemporary buildings' cultural identity while enhancing connection to nature. This preservation is a safety net for the local community, ensuring their heritage is not lost in the pursuit of modernity, thereby enhancing the sense of place, in addition to creating sustainable buildings. Developing a new concept of biophilic design through the characteristics of traditional architecture in the interior design environment of the Kingdom of Saudi Arabia is a positive step.

Within this scope, to achieve the objectives of this study, a comprehensive systematic literature review was conducted on the topic, covering the development stages of biophilic design frameworks. One such framework is the Biophilic Interior Design Matrix (BID-M), which was developed by (McGee et al., 2019). This framework which contains six elements and 54 properties, was used to quantitatively measure the biophilic features of chosen heritage buildings for each region. We collected data from three traditional architectural buildings for each of the four regions (central, eastern, southern, and western) in Saudi Arabia., which evaluated the buildings included in the study as a whole and according to their external facades, massing, interior design, windows, and doors.

According to the results obtained, it is clear to us that traditional buildings of all four regions achieved relatively high scores in biophilia. Therefore heritage building characteristics can be aligned with biophilic interior design features. Furthermore,

these findings can be used to develop a new approach, uniquely tailored to the rich and diverse cultural identity of the Kingdom of Saudi Arabia, mirroring the traditional context in the Middle East. Such an approach is crucial for incorporating sustainability into modern construction in this country; it also has significant implications for the future of architecture in this region.

In other words, traditional buildings reflect certain religious, socio-cultural, environmental and aesthetic values preserved through generations. These architectural values need to be considered for developing a new approach of BD in the country. Within this framework, based on the findings, several features are suggested to be added for each of the BID-M elements in order to structure this new understanding of BD. As such, some of these features can be embedded into the existing items and some other features can be added as a new component of the related element. Lastly, this new approach has the potential to integrate sustainability into modern construction in the region.

Recommendations

Significantly, there is an urgent need for more research on the importance of biophilic (interior) design on public health. In addition, more research that sheds light on the relationship between sustainable development and biophilic design is crucial.

Expanding future studies to develop innovative biophilic frameworks tailored to local and traditional contexts worldwide is crucial. This goal can be achieved when incorporating the values of the region's local, vernacular, and traditional identity.

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Appendices

Appendix A

Similarity Report

Author	Submission ID	Similarity Index	Source
Alice Shbaita	Date: 11 Dec 2024 ID: 2548879780 File Name: Alice Thesis Word Count: 15302 Character Count: 83184	**%12**	%8 Internet Sources %8 Publications %0 Student Papers

CV

ALICE SHBAITA

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1. Professional Summary

I'm enthusiastic, optimistic, and self-motivated. I find joy in my work. I value training and continuous learning. I'm also a hardworking individual looking for an opportunity to broaden my knowledge and refine my skills to deliver.

2. Education

1999-2003	**An-Najah National University,** Bachelor's degree**:** Interior Design	Nablus, Palestine
2013-2016	**World Islamic Sciences and Education University** Master's degree**:** Interior Design	Amman, Jordan
2020-2024	**Near East University** PhD Program**:** Interior Architecture	Lefkosa-Cyprus

3. Certificates

- Leadership skills and charisma Chamber of Commerce-2010
- IELTS-2019

4. Publishing

Shbaita, AS & Gucel, S. (2022). Evaluation of Environmental Challenges of Jordan . Journal of the NEU Faculty of Architecture, 4 (1), 0-0. Retrieved from https://dergipark.org.tr/tr/pub/neujfa/issue/69951/1119081

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5. Work History

9/2018 - 9/2019	**Applied Science Private University** Lecturer – Interior Design	Amman, Jordan
9/2010 - 7/2013	**Arkan Engineering Consulting Office** Chief Interior Design	Al Khobar, K.S.A
4/2009 - 7/2010	**Alaa Hariri Engineering Office** Senior Interior Designer	Al Khobar, K.S.A
9/2004 - 4/2009	**Al Raed Engineering Consulting Office** Junior Interior Design	Al Khobar, K.S.A
7/2003 - 7/2004	**Venice Engineering Consulting Office** Junior Interior Design	Nablus, Palestine

6. Skills in Engineering Consulting Office

- Meeting with client
- Project Management
- Concept development
- Design Process
- AutoCAD
- Adobe Photoshop
- 3D Max
- Skilled problem solver
- Interior and exterior displays