

Revisiting the Role of Biophilic Design in Strengthening the Sense of Place at a Traditional Mosque: A Case Study at Masjid Ar-Rahman, Pulau Gajah

Nor Diyana Mustapa^{1,2*}, Azizi Bahauddin⁵, Salmiah Aziz^{1,4}, Nur 'Izzati Mohd Amin^{1,3}, Noorul Huda Mohd Razali^{1,3}, Ismi Luqman Hamadi Ibrahim^{1,2}, Mohammed Fadzli Maharimi^{1,4}, Mohd Azri Mohd Jain Noordin^{1,3}, Nurul Izzati Othmani², Noorliyana Ramlee²

¹Department of Interior Architecture, Faculty of Architecture and Ekistics, Universiti Malaysia Kelantan, 16300 Bachok, Kelantan, Malaysia

²Sustainability, Urban Design and Well-Being Research Group, Universiti Malaysia Kelantan, 16300 Bachok, Kelantan, Malaysia

³Architectural Heritage and Cultural Studies Research Group, Universiti Malaysia Kelantan, 16300 Bachok, Kelantan, Malaysia

⁴Architectural Technology and Management Research Group, Universiti Malaysia Kelantan, 16300 Bachok, Kelantan, Malaysia

⁵School of Housing, Building and Planning, Universiti Sains Malaysia, 11800 Pulau Pinang, Pulau Pinang, Malaysia

*Corresponding author: diyana.m@umk.edu.my

Abstract

A mosque is a sacred space for Muslims, serving as a place for private and public worship, and a centre for religious events. Developing a strong sense of place within a mosque is essential, as it enhances visitors' spiritual and emotional experiences, nurturing fundamental human values and enriching the soul. Biophilic design is a key factor in contributing to this sense of place. However, research on the specific impact of biophilic design within traditional mosques is still limited. This study investigates the role of biophilic design on the sense of place at Masjid Ar-Rahman, Pulau Gajah, a traditional mosque. A sequential mixed-method research design was employed, incorporating observations, questionnaires, and interviews for data collection. Quantitative data were analysed using descriptive and inferential statistics, while qualitative data were analysed through content analysis. The results were then triangulated. The results indicate that all biophilic design patterns are crucial in creating a strong sense of place as those patterns and elements enrich spiritual connection, healing purposes and architectural appreciation. These elements contribute significantly to fostering spiritual and emotional well-being. The study provides new insights into how human-nature centered design, specifically biophilic design, can enhance the sense of place within a mosque.

Keywords: human-nature, biophilic design, sense of place, mosque, traditional

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Introduction

The mosque served not only as a sacred space for personal and communal worship but also as a hub for community gatherings (Ali & Mustafa, 2023; Bahauddin, 2021). Developing a strong sense of place within a mosque is crucial as it enhances visitors' spiritual and emotional experiences, nurturing fundamental human values and enriching the soul. When architectural style, cultural significance, and Islamic

teachings align, the mosque transforms from a mere structure into a space that embodies the 'spirit of the place', fostering a deep sense of place attachment and community engagement (Kaviani et al., 2023; Peymaei & Shahbazi, 2016). In this way, mosques can function as a third place, a communal space for social interaction that fosters companionship, freedom, community assembly, and the expression of feelings that can significantly enhance the quality of life in the local community and promote stronger social connections (Alnaim & Noaime, 2022). Beyond its role as a place of worship, the mosque should be a public space that is accessible to all and designed for longevity (Jaffar et al., 2020). Hence, a strong attachment and sense of place within a mosque is vital.

This sense of place is shaped by both physical and social factors, including design, accessibility, and sustainability. It comprises both cognitive and perceptual elements shaped by the environment's physical characteristics, including its morphology, spatial layout, and sensory elements (Hashemnezhad, Heidari, & Hoseini, 2013; Najafi & Shariff, 2011; Scannell & Gifford, 2014). Tactile, olfactory, auditory, and visual experiences contribute to aligning the environment with spiritual values, while community participation and cultural significance further enhance place attachment (Kaviani et al., 2023). Although numerous studies have examined the physical factors influencing the sense of place, research on the impact of biophilic design specifically within traditional mosques remains limited. While the significance of natural elements in enhancing the sense of place at mosques is recognized (Ismail & Rashid, 2023; Kaviani et al., 2023, Haerdy & Kusuma, 2022, Sobri et al., 2021), most existing studies focus on contemporary mosques and their physical characteristics, including natural elements, rather than on traditional mosques. Biophilic design, rooted in our innate affinity to nature, has been shown to positively impact psychological and physical well-being (Zhang et al., 2022). It connects individuals with nature and enhances the sense of place by fostering tranquility, spiritual reflection and a deeper connection to nature. For instance, incorporating plants and natural elements in mosque settings creates a calming, nature-connected worship environment (Ismail & Rashid, 2023). In addition, the environmental settings through the ecosystem, including the fresh air breeze and daylight, enhance the comfort and feeling connected to nature, subsequently developing a strong sense of place (Ghorbanzadeh & Nordberg, 2024).

Despite the long history of integrating natural elements into mosque architecture, there remains a gap in understanding how biophilic design specifically influences the sense of place, particularly in traditional mosques within the Malaysian context. Though biophilic design may seem like a new concept, it has long been a feature of traditional and vernacular architecture (Shbaita et al., 2024). Therefore, this study aims to investigate the role of biophilic design on the sense of place at Masjid Ar-Rahman, Pulau Gajah. This study has three main objectives: first, to identify the biophilic design elements present at Masjid Ar-Rahman; second, to examine the relationship between biophilic design elements and the sense of place at Masjid Ar-Rahman; and third, to investigate how biophilic design influences the sense of place in this traditional mosque. This study seeks to highlight potential benefits of integrating biophilic design in traditional mosque settings as a third place and enhance understanding of its role in fostering spiritual and emotional well-being.

Literature review

Sense of Place Conceptualization

The concept of sense of place refers to the emotional and psychological bond that individuals develop with a particular environment or location. This bond is shaped by various factors, including physical attributes, personal experiences, cultural significance, and social interactions (Hernández et al., 2020; Mousighichi et al., 2024). The concept of a sense of place encompasses a multidimensional

understanding of how individuals connect with their environments. This includes cognitive, affective, and behavioural aspects, as well as related constructs such as place attachment, place identity, and place dependence (Zhong et al., 2022). Place attachment refers to the emotional (affective) bond between individuals and their environment. It is influenced by both the physical characteristics of the place and the personal experiences individuals have within it. Place attachment fosters a sense of belonging and can influence people's attitudes and behaviours towards the place (Chen et al., 2024). Place identity refers to the cognitive domain and is a component of self-identity derived from an individual's relationship with a place. This concept highlights how places contribute to shaping personal and group identities (Hernández et al., 2020). Place dependence is the behavioural domain that refers to the functional and practical aspects of a place that make it important to individuals. This includes the place's ability to meet specific needs or support certain activities (Ramkissoon, 2022).

Biophilic Design Conceptualization

Biophilic design originates from the word biophilia, coined by Erich Fromm in 1964 to describe the 'love of life'. Then, biologist Edward Wilson in 1984 defined biophilia as an innate tendency to affiliate with nature in the biophilia hypothesis. Kahn (1999) proposed that culture, learning and social nature experiences mediated human connection with nature. Later, in 2002, Kahn and Kellert (2002) expanded further the biophilia hypothesis, emphasizing that humans value nature through nine key values, including naturalistic, aesthetic, spiritual, symbolic, ecologicistic-scientific, humanistic, moralistic, utilitarian, and dominionistic. Substantial studies have been conducted concerning the contribution of nature to human since the 1990s (Zhang et al., 2022; Zhang et al., 2024). At the beginning of the 21st century, the notion of biophilia was adapted to the built environment (W. Zhang et al., 2022). There are three main frameworks or conceptualization of biophilic design: two dimensions, six elements, and 72 attributes of biophilic (Kellert, 2008), three experiences and 25 attributes of biophilic design (Kellert, 2018) and three categories and 15 patterns of biophilic design (Browning & Ryan, 2020). Most researchers used frameworks by Kellert (2018) and Browning and Ryan (2020).

This study combines Browning and Ryan's (2020) and Kellert's (2018) frameworks. Kellert's (2018) framework includes direct experiences of nature (light, air, water, plants, animals, landscapes, weather, views, and fire), indirect experiences of nature (images, materials, texture, colour, shapes, and forms, information richness, change of time, geometrics, stimulated natural light and air and biomimicry), experience of space and place (prospect and refuge, organized complexity, mobility, transitional spaces, place and integrating parts to create wholes). On the other hand, Browning and Ryan's (2020) framework includes nature in the space (visual connection with nature, non-visual connection with nature, non-rhythmic sensory stimuli, thermal & airflow variability, presence of water, dynamic and diffuse light, connection to natural systems), natural analogues (biomorphic forms & patterns, material connection with nature, complexity and order) and nature of the space (prospect, refuge, mystery, risk/ peril, awe).

As for Browning's framework, only nature in space and nature analogues are chosen. Nature in the space refers to the combination of physical elements of nature in and from the spaces. It deals with physical entities directly for places. It includes animals and water, plant life, sound, wind, smell and related natural elements. While nature analogues refer to incorporating literal and implied representations of nature into physical space. As for Kellert's (2018) framework, the elements that are sub-elements of Browning and Ryan's (2020) framework were selected. Both types, nature in space (direct experiences) and nature analogues (indirect experiences), are valuable, with direct experiences being more important for maximising connection to nature, health and well-being (Mustapa et al., 2019; Mustapa et al., 2024).

Methodology

Research Design

This study employed a mixed-methods research design for data collection. Specifically, a sequential mixed-method approach was used. Observation, questionnaires and interviews have been conducted for data collection. This study involved the mosque community and visitors as participants and respondents. Random sampling has been employed for quantitative sampling, while purposive sampling has been employed for qualitative sampling. Observation was conducted to identify the biophilic design attributes that are present at Masjid Ar-Rahman. Meanwhile, the questionnaire was used to examine the biophilic design attributes that contribute to the development of the sense of place. Overall, 284 questionnaires have been collected for the quantitative part. Then, interviews were conducted to further understand to what extent biophilic design contributes to developing a sense of place with three participants: the Imam of the mosque and two visitors (an assistant architect and a housewife). The interviews were conducted using an interview protocol and recorded through a voice recorder with the permission of the interviewees.

Case Study

Masjid Ar-Rahman was chosen as the case study because of its architectural characteristics and physical surroundings that are close to nature. The environmental settings, enriched by the surrounding ecosystem, provide direct and indirect nature experiences through the lush mangrove greenery along the river, the proximity of water bodies, the abundance of natural lighting, fresh air breezes, and the presence of local wildlife. The environmental setting of the mosques creates a peaceful environment for religious activities. The mosque was designed with local and a hybrid of Malay Archipelago architecture (hybridized Malay and Javanese architectural styles) on the island of Pulau Gajah, Sabak, Pengkalan Chepa, Kelantan. The design of the mosque was inspired by Masjid Kampung Laut (the oldest timber mosque and traditional mosque in Malaysia) and Javanese architecture. In keeping the regional architectural heritage alive, Masjid Ar-Rahman was built using 90% solid timber (*cengal*) for construction. The ceiling is made from bamboo woven, which highlights the use of sustainable, local material. The main other details of the architecture also feature a lot of Malay Kelantanese architecture. This is the first mosque in Malaysia that has five main pillars in the centre of the prayer hall to symbolise the five pillars of Islam.

Research Instrument

For the observation, the researcher documented findings using field notes, video recordings, and photographs. An observation checklist, based on ten biophilic patterns by Browning and Ryan's (2020) framework, was developed to identify the presence of biophilic design or biophilic elements at the mosque. As for the questionnaire, items related to biophilic design were constructed using Kellert's (2018) framework, with constructs mapped to Browning and Ryan's (2020) framework. This study examined both nature in space (direct experiences) and nature analogues (indirect experiences). There were seven constructs for nature in space and four for nature analogues, totalling 28 items for direct experiences and 18 items for indirect experiences. Meanwhile, the sense of place was measured through three domains: place attachment, place identity, and place dependence, representing the affective, cognitive, and behavioural dimensions, respectively. Overall, the sense of place included a total of nine items.

Data Analysis

This study analysed observation data for Objective 1 using content analysis of captured images and field notes. Quantitative data from the questionnaire were analysed with descriptive and inferential statistics using SPSS. Descriptive analysis was employed to describe respondents' backgrounds and test construct assumptions before further statistical analysis. Frequency, percentage, and multiple regression analyses were then used to address Objective 2. Interview data were analysed using content analysis to achieve Objective 3. To achieve the study's overall aim, data from both quantitative and qualitative sources have been triangulated.

Results

Biophilic Patterns at Masjid Ar-Rahman

As illustrated in Figure 1 and Table 1, all ten patterns of biophilic design and elements were found presented at Masjid Ar-Rahman through the observation conducted. The mosque's setting, surrounded by lush greenery and a river, combined with its use of natural materials, ensures that all biophilic patterns and elements are prominently visible within the mosque. Further details on each pattern are presented in Table 1.



Figure 1: Bird-Eye View of Masjid Ar-Rahman (source: Arkitek Punca Cipta)

Table 1: Biophilic Patterns at Masjid Ar-Rahman

Biophilic Pattern	
Nature in Space (Direct Experiences)	
P1 Visual Connection with Nature	P4 Thermal & Airflow Variability
    	    
The mosque's visual connection with nature is abundant as it is surrounded by the lush greenery of the river landscape and its grounds, providing a rich visual experience. This connection includes views of plants, water, and other natural elements visible from all sides of the mosque, contributing to a sense of serenity and calm.	Openings on both sides allow fresh air to flow freely. Practically, the surrounding greenery and proximity to a body of water ensure that the mosque benefits from a continuous flow of cool air. Visitors can enjoy the breeze and the surrounding views while relaxing or feeding fish in the gazebo situated within the mosque's compound. The mosque's location and open-plan design maximize natural cross-ventilation, creating a cooling effect and a calming atmosphere throughout the space.

Biophilic Pattern**Nature in Space (Direct Experiences)****P2 Non-Visual Connection with Nature**

Non-visual connections with nature involve sensory experiences beyond sight, including auditory, tactile, olfactory, and gustatory stimuli that evoke a relationship with living systems. Inside the mosque, natural materials like wood and rattan provide tactile experiences, allowing visitors to physically engage with nature. Outdoors, the sounds of birds and rustling leaves enhance the auditory experience, while the fragrance of flowers stimulates the sense of smell. The mosque's compound includes a gazebo and seating areas where visitors can feed fish and relax, further integrating sensory experiences with nature. Additionally, stones and timber in the outdoor spaces offer tactile interactions, enriching the overall connection with the natural environment.

P5 Presence of Water

The mosque is surrounded by a river, which provides a continuous water connection. Additionally, a water fountain adjacent to the mosque further contributes to this sensory experience. The combination of these water features creates a soothing ambience, amplifying the sense of tranquillity and enhancing the overall environment.

P3 Non- Rhythmic Sensory Stimuli

Because of the mosque's proximity to the river ecosystem, birds chirping exemplify this sensory pattern. The lush greenery surrounding the mosque adds to this sensory richness, with the rustling leaves of trees and the flowing river water creating a dynamic environment. Additionally, the movement of fish in the river contributes to this sense of continuous, stimulating sensory input.

P6 Dynamic & Diffuse Light

Large windows allow abundant natural sunlight to fill the interior spaces, achieving dynamic and diffused light. The design ensures that the mosque's interiors benefit from pleasant and changing light conditions throughout the day. Outdoors, natural lighting also plays a role, as the sun's movement alters the angle of light, producing shifting shadows and diffusing light across the space. This dynamic interplay of light enhances the overall atmosphere, contributing to a more engaging and serene environment.

Biophilic Pattern

Nature in Space (Direct Experiences)

P7 Connection with Natural Systems



The mosque's integration with the lush greenery surrounding the river landscape demonstrates its connection with natural systems. Its design includes openings that facilitate a seamless indoor-outdoor connection, allowing visitors to engage directly with the natural environment. This interaction with natural processes and ecosystems, including the surrounding landscape and local wildlife, enhances the overall experience and fosters a deeper bond with the place.

Nature Analogues (Indirect Experiences)

P8 Biomorphic Forms & Patterns



Biomorphic elements are present throughout the mosque's interior, including in the ceiling design, columns, carvings, and ornamentation on door handles and lamp shades. Notably, the Mimbar area features two pillars crafted from date tree trunks, reflecting the mosque's connection to natural forms and enhancing the aesthetic appeal and symbolic resonance of the space.

P9 Material Connection with Nature



The extensive use of timber comprising 90% of the construction materials imbues the space with a cool, rich, and warm atmosphere. Natural wood is employed for various interior finishes, including the floors and walls, while timber frames the doors and windows. Additionally, woven bamboo ceilings highlight the mosque's commitment to sustainable, locally sourced materials.

Nature Analogues (Indirect Experiences)**P10 Complexity & Order**

Complexity and order are evident in the design of Masjid Ar-Rahman, where structural elements are thoughtfully arranged to create both visual and functional harmony. The columns, for example, facilitate movement in various directions while maintaining an organized arrangement that reflects the building's structural hierarchy. This design ensures a coherent and aesthetically pleasing structure, contributing to the overall sense of balance and order within the mosque.

The integration of all patterns that are prevalent at Masjid Ar-Rahman enhances the overall ambience, promoting tranquillity and a deeper sense of peace. Together, all patterns and elements create a vibrant and refreshing atmosphere that enhances the overall experience. Such connections not only increase attachment to the mosque but also contribute to the well-being of its visitors.

Demographic and Background of the Mosque Visitors and Community

Descriptive data for the demographic and background of the mosque visitors and community from the questionnaires is provided in Table 2.

Table 2: Background Data of the Respondents

Background	Number of Respondent	Percentage (%)
Age		
20-29	103	36.3
30-39	61	21.5
40-49	42	14.8
50-59	50	17.6
60-65	28	9.9
Gender		
Male	153	53.9
Female	131	46.1
Frequency of Visit		
Every day	47	16.5
Once a week	65	22.9
Once a month	38	13.4
Once a year	98	34.5
First time	33	11.6
Second time	3	1.1
Main Purpose of Visit		
Worship (Prayer)	192	67.7
Stopover (Rest and Treat)	32	11.5
Involve in mosque's activities	10	3.5
Observe the mosque's architecture	42	14.8
Enjoy the natural scenery	1	0.4
Others	7	2.5

As shown in Table 2, for age, one-third of the respondents (36.3%) are in the group of 20 to 29, followed by 21.5% in the group of 30 to 39 of age, 17.6% in the group of 50 to 59 of age, 14.8% in 40 to 49 of age and 9.9% in the group of 60 to 65 of age. Regarding gender, half of the respondents (53.9%) are male and another half are female (46.1%). As for the frequency of visits, about one-third (34.5%) of the respondents visit the mosque once a year, followed by 25.9% of respondents who visit once a week, 16.5% who visit every day, and 13.4% who visit once a month, 11.6% who is the first timer and 1.1% is the second timer visits. Regarding the main purpose of visits, about two-thirds (67.7%) of the respondents visit the mosque for worship (prayer) purposes, followed by 14.8% visit to observe the mosque architecture, 11.5% stop at the mosque as a rest and treat area, 3.5% involve in mosque's activities, 2.5% visit for other reason such as for marriage ceremony (nikah) and 0.4% visits to enjoy the natural scenery.

The Relationship Between Biophilic Design and Sense of Place

Multiple regression was used to examine the relationship between biophilic design and sense of place. All the preliminary analyses for multicollinearity, outliers, normality, linearity, and homoscedasticity meet the assumptions; hence, the regression model is appropriate. The coefficient determination for the developed model is 0.330 ($R^2 = 0.330$). Thus, 0.330 (33.0%) of the sense of place can be explained by the independent variables. The model has a significance level of 0.000 ($p < 0.005$). Therefore, this model is appropriate for predicting a sense of place.

Table 3: Regression Coefficients

Model	Standardized Coefficients		t	Sig.	Collinearity Statistics	
	Beta				Tolerance	VIF
1 (Constant)			3.174	.002		
Nature in Space	0.474		6.329	<.001	0.428	2.337
Nature Analogues	0.125		1.664	.097	0.428	2.337

Based on Table 3, the results illustrate that only one variable significantly affects the sense of place. Nature in the space (direct experiences) is statistically significant in making a contribution to the sense of place with $p < 0.005$ ($b=0.47$, $t=6.33$, Sig. <.001). Meanwhile, the nature analogues (indirect experiences with nature) are not statistically significant in contributing to a sense of place ($b=0.125$, $t=1.66$, Sig. 0.97). Interestingly, results demonstrated that direct experiences with nature significantly affect the sense of place at the mosque.

Table 4: Regression Coefficients

Model	Standardized Coefficients		t	Sig.	Collinearity Statistics	
	Beta				Tolerance	VIF
1 (Constant)			4.066	<0.001		
Dynamic & Diffuse Light	0.033		0.453	0.651	0.437	2.289
Thermal & Airflow Variability	0.267		3.919	<0.001	0.498	2.008
Visual Connection with Nature	-0.077		-1.017	0.310	0.405	2.470
Non-Visual Connection to Nature	-0.035		-0.430	0.667	0.355	2.819
Non-Rhythmic Sensory Stimuli	0.189		2.429	0.016	0.381	2.628
Presence of Water	0.053		0.800	0.424	0.523	1.912
Connection to Natural System	0.319		4.683	<0.001	0.495	2.019

Based on Table 4, further analysis shows that only two sub-variables predict a sense of place. The results illustrate that 'thermal airflow and variability' and 'connection with natural systems' are statistically significant in making a contribution to a sense

of place with $p < 0.005$ ($b=0.47$, $t=6.33$, Sig. $<.001$) and ($b=0.125$, $t=1.66$, Sig. 0.97) respectively. Results demonstrated that thermal airflow and variability and connection with natural systems with nature play an important role in affecting the sense of place at the mosque.

The Role of Biophilic Design on Visitors and Community Sense of Place

Based on thematic analysis from the interview, three themes emerged on the role of biophilic design on the sense of place which are architectural appreciation, spiritual connection and healing and restorative environment. All themes and sub-themes as listed in Table 5 are important the factors and design elements that create visitors and community sense of place.

Table 5: Thematic Analysis of the Impact of Biophilic Design on Visitors and Community Sense of Place

Theme	Sub-theme	Examples
Architectural Appreciation	Complexity and Order • Hierarchical Roof • Structural design	...admire the mosque's roof structure. ...structural design of the mosque are also the key reasons for my appreciation.
	Other architectural elements • Large opening	... natural ventilation provides a sense of tranquillity and freshness
	Biomorphic Form and Pattern • Carving	...the intricate carvings and structural design of the mosque are also the key reasons for my appreciation.
Spiritual Connection	Connection to Natural System • Ecosystem	...the environment, reminiscent of paradise, enhances my spiritual focus during worship.
	Visual connection to nature • Greenery	
	Non-visual connection to Nature & Non-Rhythmic Sensory Stimuli • Nature senses through the surrounding landscape • Wildlife	
	Presence of Water • Waterbody	
	Thermal and Airflow Variability • Fresh air • Cross-natural ventilation	...natural ventilation provides a sense of tranquillity and freshness, focus during prayer and reflection.
	Other architectural elements • Quranic carving • Opening on both sides of the mosque	...the Quranic carvings deepen my connection to the Supreme Being.
	Complexity and Order • Structural design	The design makes me feel calm during my prayers and moments of reflection
	Connection to Natural System • Ecosystem	...surrounding landscape, which creates a healing environment and brings me peace.
	Visual connection to nature • Greenery	
Healing and Restorative Environment	Non-visual connection to Nature & Non-Rhythmic Sensory Stimuli • Nature senses through the surrounding landscape • Wildlife	
	Presence of Water • Waterbody	
	Thermal and Airflow Variability • Fresh air • Cross-natural ventilation	...natural ventilation provides a sense of tranquillity and freshness.
	Material Connection with Nature • Wood	...extensive use of wood in the mosque contributes to its calming effect.
	Recreational activities • Feeding fish • Relaxing at gazebo	...feed the fish, and relax at the gazebo, where I can appreciate the fresh air.

As for architectural appreciation, all respondents mentioned that their attachment to the mosque is related to architectural appreciation which includes: the complexity and order of the mosque including the roof design and structural design, other architectural elements such as opening on both sides of the mosque and biomorphic pattern through carving. For example, the first respondent, the housewife said *"I admire the mosque's roof structure. I will keep visiting the mosque because I like the architecture and the natural surroundings of the mosque."* The assistant architect stated, *"I come to the mosque to pray and appreciate its architecture. Additionally, the intricate carvings and structural design of the mosque are also the key reasons for my appreciation."* While the Imam highlighted, *"The mosque's design fosters a sense of peace and facilitates a closer connection to the Supreme Being."*

As for the spiritual connection, only two respondents mentioned the theme, the Imam dan assistant architect. Most of the biophilic design patterns impact spiritual connection: other architectural elements (qur'anic carving and opening on both sides of the mosque), complexity and order (structural design), connection with the natural system (ecosystem), thermal and airflow variability (natural ventilation), visual connection to nature (greenery), non-visual connection to nature (nature senses and wildlife)), non-rhythmic sensory stimuli (nature senses and wildlife) and presence of water (river and water fountain). For example, the Imam emphasized *"The natural environment with greenery and water elements in the surroundings with the flora and fauna habitats in the surroundings, reminiscent of paradise, enhances my spiritual focus during worship. Additionally, the Quranic carvings deepen my connection to the Supreme Being."* Another response from the assistant architect was, *"The mosque design and the natural cross ventilation make me feel calm during my prayers and moments of reflection."*

For healing and restorative environment, all three respondents mentioned the theme. Connection with the natural system (ecosystem), visual connection to nature (greenery), non-visual connection to nature (nature senses and wildlife), non-rhythmic sensory stimuli (nature senses and wildlife), presence of water (river and water fountain), thermal and airflow variability (natural ventilation), material connection with nature (timber) and recreational activities that create the mosque as a healing environment. The housewife expressed, *"I come to the mosque to pray. I appreciate the surrounding landscape and ecosystem, which creates a healing environment and brings me peace. I enjoy coming here to pray, feed the fish, and relax at the gazebo, where I can appreciate the fresh air. The natural environment around the mosque is unique and provides me with tranquillity."* The second respondent, the assistant architect, also highlighted *"The surrounding landscape enhances natural ventilation, making this one of my favourite mosques."* He added *"The extensive use of wood in the mosque contributes to calming effect."* While the Imam said, *"The natural air and breeze contribute to this feeling of peace and attachment."*

All three participants agreed that biophilic design significantly enhances their sense of place at the mosque. Apart from the mosque architecture itself including the material, carving and structure, they all emphasized that thermal and airflow variability and the connection with the natural systems have the greatest impact on their sense of place, aligning with the quantitative findings.

Discussion

The findings reveal that biophilic design patterns and elements are prominently integrated into the mosque. These findings support that biophilic or biophilic patterns have long been a feature of traditional architecture (Shbaita et al., 2024). Mapping the biophilic patterns with traditional and vernacular architectural elements could be beneficial in future. Findings also highlight that the mosque's environmental setting and natural surroundings have enhanced the mosque's ability to create a

sacred and meaningful space. This study supports evidence from previous studies by Ismail and Rashid (2023), Haerdy and Kusuma (2022) and Sobri et al. (2021) that the surrounding environment supports recreational activities and provides psychological benefits, and social interactions, which strengthen the sense of place at the mosque. The majority of the visitors visited the mosque for religious purposes and to appreciate the architecture and landscape of the mosque, while others visited for other activities. The findings also support the notion that the mosque can be a public space, the third place for the community to do other activities apart from religious activities, further enhancing their attachment to the mosque (Alnaim & Noaime, 2022; Jaffar et al., 2020).

Furthermore, this study found that nature in space through direct experiences with nature significantly enhances visitors' sense of place, while nature analogues through indirect experiences have a minimal impact, in line with the previous studies by Mustapa et al. (2019) and Mustapa et al. (2024). Specifically, for nature in space, thermal and airflow variability through natural ventilation and connections to natural systems through the ecosystems significantly impact visitors' sense of place, supporting that natural ecosystems play an important role in influencing people's sense of place (Ghorbanzadeh & Nordberg, 2024). The lush mangrove greenery with the river water body surrounding the mosque provides an advantageous ecosystem connection, contributing to the natural elements like thermal airflow and connection to the natural system, creating sensory stimuli, and visual and non-visual connection with nature that enrich visitors' experiences. In addition, qualitative findings support quantitative findings that connection to natural systems and thermal airflow variability significantly impact the visitor's sense of place. However, in contrast, qualitative findings suggest that nature analogues also have an impact on the attachment of people to the mosque, through complexity and balance, biomorphic form and pattern and material connection with nature. This can be explained by further findings that biophilic design impacts people's sense of place varies based on several factors, including their background and knowledge, supporting previous studies by Hernández et al. (2020) and Mousighichi et al. (2024). Another possible explanation is that people value nature differently in line with the biophilia hypothesis that highlighted various factors, including culture, social experiences, experiences with nature and knowledge, that shape human connection to nature (Kahn, 1999).

This study demonstrates that biophilic design creates visitors' sense of place through three main reasons, which are architectural appreciation, spiritual connection and a healing and restorative environment. These findings reflect the biophilia hypothesis that humans value nature through aesthetic (architectural appreciation), spiritual (spiritual connection) and humanistic (healing) values (Kahn & Kellert, 2002). Every pattern and element of biophilic design has a different impact on the visitors. For instance, the fresh air flow promotes calmness during prayers and moments of reflection, elevating spiritual connection, enhancing tranquillity and encouraging longer stays. At the same time, interactions with natural systems offer visual and sensory stimuli that give a healing and restorative feeling and deepen spiritual connection to the mosque. Also, the use of natural material (material connection to nature) gives a calming effect. Moreover, visitors' sense of place is created through their appreciation towards the architecture through the mosque's structural design (complexity and balance) and carving (biomorphic form and pattern). These findings support previous studies that natural environments improve psychological and physical well-being, facilitating recreational, psychological, and social interactions (Ismail & Rashid, 2023; Kaviani et al., 2023; Haerdy & Kusuma, 2022; Sobri et al., 2021). Also, this supports previous studies that mosque physical design influences a sense of place (Kaviani et al., 2023).

Therefore, integrating all elements of biophilic design emphasizing the important key design elements of thermal airflow variability and connection to natural systems (visual and non-visual connection to nature, non-rhythmic sensory stimuli, and presence of water), as well as natural material, biomorphic pattern and complexity and balance is vital in developing a sense of place to the mosque. These elements significantly affect the cognitive, behavioural, and emotional aspects of the sense of place. This study highlights the importance of integrating biophilic design to enhance the sense of place in mosques, making them not only centres for worship for spiritual purposes but also a third place as a recreational place, a healing environment, and architectural appreciation, subsequently enriching the sense of place.

Conclusion

In conclusion, biophilic design, both nature in space and nature analogues, plays a crucial role in establishing a sense of place at traditional mosques because every pattern and element has a different impact on the visitors and community. The mosque's setting, surrounded by a river and lush greenery, deeply immerses visitors in their religious experience. This environment provides a conducive setting for creating 'Sacred Places' by enhancing the 'Sense of Place'. The key elements of thermal and airflow variability and connections with natural systems (visual and non-visual connection to nature, non-rhythmic sensory stimuli, and the presence of water) should be emphasized in mosque design to enrich the spiritual journey and foster a closer connection to the Supreme Being. As a result, mosques become not only spaces for worship but also healing and recreational hubs that encourage increased visitation and spiritual engagement. Biophilic elements at the mosque enhance visitors' appreciation towards architecture and provide a healing environment, which in turn strengthens the spiritual connection. The architecture of Masjid Ar-Rahman, along with its environmental context, exemplifies a 'Sense of Place' characterized by openness and approachability. This novel approach to mosque as a third place highlights the opportunity to develop and promote mosque architecture as a significant element of heritage trail tourism. This study makes a significant contribution to how human-nature centered design can strengthen the sense of place for the visitor and community of a mosque. Future research should explore other factors that contribute to the sense of place in conjunction with human-nature centered design, specifically biophilic design.

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