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Nature, Place, and the Sacred: Biophilic Design as a Mediator of Spiritual Experience in a 13th Century Anatolian Seljuk Mosque

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Abstract

Religious buildings such as synagogues, churches, and mosques, which are central to religious, cultural, and social life, have served important purposes throughout history as sacred spaces where art, architecture and performance converge. Although these sacred spaces offer unique spatial contexts that deepen individuals' spiritual experiences through their physical, symbolic, and atmospheric qualities, empirical studies examining this relationship remain limited. This study aims to investigate the impact of biophilic design features within the Yivli Minaret Mosque, one of the oldest Islamic monuments in Antalya, constructed during the 13th-century Anatolian Seljuk Period, on the spiritual experiences of congregation members, and to identify the key psychological mechanisms shaping this relationship. The methodology of the study is based on a mixed-methods approach that combines expert assessments conducted using the Biophilic Interior Design Matrix (BID-M), which integrates proven scientific data with artistic perspective within a historical and symbolic religious structure, with survey data obtained from 359 mosque congregation members. The findings indicate that the mosque exhibits medium-to-high levels of biophilic design characteristics and that the relationship with nature is established indirectly through historical, cultural, and ecological contexts and symbolic representations rather than directly through natural elements. In this respect, the biophilic characteristics of sacred spaces are not merely an artistic and aesthetic approach, but an element that supports individuals' relationship with nature and their restorative and spiritual experience. Overall, the study reveals that spiritual experience cannot be considered independently of its spatial context and that sacred spaces related to nature support spiritual experience.

Keywords: religious architecture; sacred space design; biophilic design/art; spiritual experience; Anatolian Seljuk mosque; Yivli Minaret Mosque

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Academic Editors: Xiaohuan Zhao, Duanfang Lu and Qing Chang

Received: 11 January 2026
Revised: 29 January 2026
Accepted: 24 February 2026
Published: 26 February 2026

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1. Introduction

Spirituality is recognized as a multidimensional construct that includes not only individuals' relationships with the divine but also their intrinsic sense of peace, the existential quest for meaning, and experiences of transcendence (Underwood 2006; Underwood 2011; Koenig 2012). Within this framework, the comprehensive configuration of the physical, symbolic, and aesthetic elements inherent in religious buildings is understood to significantly influence individuals' spiritual experiences (Arbib 2025). This perspective aligns with earlier conceptual discussions that emphasize the importance of sacred space atmospheres and symbolic

coherence in the development of spiritual experiences (Durukan 2017). Throughout history, architectural structures have served not merely as spaces for shelter or storage but also as environments that provide spatial expression to human spiritual and transcendent pursuits. In this context, the physical components of space should be regarded not solely as aesthetic or functional elements but as environmental factors that actively stimulate, shape, and enhance spiritual experience. Indeed, architectural literature, particularly within phenomenological approaches, underscores that the sensory dimensions of space, including light and atmosphere, play a crucial role in generating meaning and cultivating spiritual consciousness (Hiçsönmezler et al. 2023; Durukan et al. 2025).

Numerous empirical studies have demonstrated that the interactions between architectural structures and nature offer substantial benefits to individuals across social, physical, cognitive, and psychological domains (Ives et al. 2018; Chang et al. 2020; McGee et al. 2022; Zhong et al. 2022). Accordingly, throughout the historical continuum from antiquity to the present, many religious buildings incorporate symbolic, physical, and functional design approaches that support individuals' connection to nature. From the religious monuments of Egypt and Mesopotamia to East Asian temples, and from the sacred architecture of the Abrahamic traditions to Hellenistic and Roman sacred spaces, natural elements have consistently remained central to the articulation of sanctity and spirituality. These approaches enable religious buildings to be understood not only through formal or proportional aesthetic principles, but also as spaces that allow individuals to experience spirituality at a spatial level (Kellert and Calabrese 2015; Arbib 2025; Durukan et al. 2025). The historical evolution of Christian architecture, shaped within the broader framework of the monotheistic tradition, progressed from the basilica typology of the fourth to sixth centuries to centrally planned forms between the fourth and eighth centuries, and later to Gothic architecture in the Middle Ages. These architectural transformations reflected the spiritual bond between nature and humanity at a spatial level. The soaring arches and the natural light filtered through stained glass windows of Gothic cathedrals, alongside the integration of monastic complexes with their natural surroundings, have contributed to the perception of sacred space as a locus of divine encounter (Smith 2020). Similarly, the location of Orthodox monasteries in mountainous regions reflects a long-standing tradition of retreat and prayer, in which spiritual practice is profoundly embedded within natural topographies. Islamic architecture establishes a profound association between nature and spatial design. Drawing inspiration from the paradise garden (janna), mosque courtyards and interior spaces integrate fountains, ablution basins, and vegetation, creating a harmonious connection with nature on both aesthetic and symbolic levels (Şenoğlu and Ortaçeşme 2016; Dhannoon 2021; Tayılga and Demirarslan 2022). This reciprocal interaction between architectural form and natural elements in sacred spaces facilitates the integration of spatial experience with spiritual practice.

A review of the existing literature indicates that the impact of sacred spaces on spiritual experience has been generally examined qualitatively in the fields of religious studies and environmental psychology. Moreover, empirical studies examining the effects of biophilic design in architectural settings have predominantly focused on spatial typologies such as modern educational buildings, healthcare facilities, and workplace environments. Despite these historical precedents, the existing research has not systematically investigated how biophilic design features in sacred spaces relate to spiritual experience. Specifically, the literature lacks studies that objectively measure biophilic elements in religious buildings using validated tools and statistically examine their relationship to users' nature connectedness, restorative perceptions, and spiritual experiences.

The thirteenth century represents the apex of Anatolian Seljuk civilization, during which an extensive architectural program led to the construction of mosques, minarets,

madrasas, caravanserais, and mausoleums, many of which stand today as defining urban landmarks. The Yivli Minaret Mosque in Antalya exemplifies this architectural vision with its distinctive fluted design and imposing stature (Avcı 2016). The mosque is selected as the case study due to its thirteenth-century construction representing Anatolian Seljuk architecture, its status as the city's earliest Islamic monument, its preservation of characteristic Seljuk architectural features, its symbolic significance within the urban landscape, and its continued function as an active place of worship.

This study addresses three interconnected research questions: (a) the extent to which Anatolian Seljuk religious edifices demonstrate biophilic interior design features; (b) how these biophilic elements impact congregants' connection with nature, perceived restorative qualities, and spiritual experiences; and (c) what mediating or moderating roles exist within the relationship between biophilic characteristics and spiritual experiences. To address these questions, the study identifies biophilic design features in the interior of the Yivli Minaret Mosque through expert assessments and evaluates their effects on congregants' nature connectedness, perceived restorativeness, and daily spiritual experience.

Based on this framework, the following hypotheses are proposed:

H1. *The biophilic interior design features of the Yivli Minaret Mosque have a positive, statistically significant effect on congregants' nature connectedness, perceived restorativeness, and spiritual experience.*

H2. *Congregants' nature connectedness is positively and significantly associated with their spiritual experience.*

H3. *The relationship between congregants' nature connectedness and perceived restorativeness mediates and/or moderates the relationship between the biophilic interior design features of the Yivli Minaret Mosque and spiritual experience.*

H4. *Socio-demographic variables are associated with significant variations in congregants' perceptions of biophilic design elements and spiritual experiences.*

2. Background

2.1. The Biophilia Hypothesis and Biophilic Design

The concept of biophilia, which signifies the innate and profound connection between human beings and nature, was formally articulated within a theoretical framework by Edward O. Wilson in 1984 and subsequently introduced into the scholarly literature as the biophilia hypothesis (Grazuleviciute-Vileniske et al. 2022). Based on the premise that maintaining the connection between the constructed environment and natural elements is vital for human health and well-being, this hypothesis has garnered interest across multiple disciplines, including architecture, urban design, environmental psychology, behavioral sciences, health sciences, and education (Durukan et al. 2025).

This foundational hypothesis has been reinterpreted in architecture as the concept of biophilic design and adopted as a design approach that deliberately and systematically integrates nature-based elements into the built environment. Within this framework, natural materials, daylight, natural ventilation, vegetation, water features, and organic forms are consciously incorporated into architectural design (Kellert 2008; Kellert and Calabrese 2015; Andreucci et al. 2021). The literature emphasizes that biophilic design yields positive effects on individuals' physical health, psychological well-being, and productivity, while also providing multidimensional benefits, such as stress reduction and enhanced attention and cognitive performance (ibid.).

In the twenty-first century, population growth and urban development have reached unprecedented levels, limiting access to natural environments for residents in densely

populated urban areas. In response, the biophilic design approach has emerged as a vital instrument for architects and designers seeking to reestablish the interaction between humans and nature (Gómez-Baggethun and Barton 2013; Kellert and Calabrese 2015; Andreucci et al. 2021; O'Sullivan et al. 2023). This methodology significantly advances the development of environments that foster psychological restoration, mitigate stress, and promote well-being within urban settings. Simultaneously, biophilic design transcends the simple integration of plants into interior spaces; instead, it embodies an extensive design process that considers various factors such as spatial placement, functional utility, user demographics, cultural background, and environmental conditions through an overarching, holistic approach. (Gillis and Gatersleben 2015; Marte et al. 2020).

2.2. The Anatolian Seljuk Period and Architectural Conception

The Anatolian Seljuk Period, spanning the eleventh to the thirteenth centuries, yielded a distinctive and enduring cultural legacy in architecture and art that transcended the boundaries of political authority in Anatolia. The architectural ideas of this era were shaped by the synthesis of Central Asian Turkic construction traditions, the enduring heritage of Iranian Islamic architecture, and local Anatolian building traditions rooted in earlier Roman, Byzantine, and vernacular construction practices. This synthesis gave rise to an architectural approach that both responded to functional requirements and conveyed symbolic meanings (Öney 1992; Kuban 2010). In Seljuk architecture, the planning approach of buildings was largely determined by functional requirements, climatic conditions, and patterns of social use. Mosques, madrasas, caravanserais, and külliyes were therefore conceived not merely as independent architectural structures but as integrated spatial focal points that sustained the continuity of social, cultural, and religious life (Aslanapa 1999; Kuban 2010). Mosque buildings, in particular, were designed not only to fulfill their religious functions but also to serve as public spaces that promote social interaction and integration. They assume both symbolic and orienting roles within the urban fabric.

Symbolic structures are architectural constructs that embody the technological capabilities, cultural values, modes of life, and material resources of the specific period and geographic location in which they were erected (Emin 2012). The fact that monumental triumphal arches built to commemorate imperial victories in Rome evoke the architectural language of their civilization, or that minarets constructed of red brick directly recall Seljuk architectural identity, demonstrates how such structures become temporal markers within urban memory (Avcı 2016). Such structures transcend their initially liturgical roles to serve as the "material supports" of collective memory, as articulated by Halbwachs (1992), and spatially establish historical continuity within an evolving urban landscape. Regarding architectural components, stone and brick are identified as the predominant materials used in Anatolian Seljuk mosques. In addition to their robustness, these materials create a serene, harmonious, and enduring ambiance within the interior space through their surface textures and tonal qualities (Necipoğlu 1995). In interior spatial arrangements, figurative representations were deliberately avoided; instead, geometric and vegetal ornamentation, abstract compositions, and repetitive patterns were preferred. This approach aligns with Islamic thought, emphasizing the representation of divine order through abstraction rather than the literal imitation of nature (Grabar 1987).

Anatolian Seljuk architecture can be characterized by five principal features, as identified by Karaçar (2025). A key characteristic of this period is the arrangement of the structural system around piers with square or rectangular cross-sections, which support arches and the vaulting system constituting the overhead covering. Columns, by contrast, were employed not as primary structural supports but predominantly as decorative elements in façade compositions, particularly flanking monumental portals, windows, and interior niches. In contrast to Eastern

Roman architecture, Anatolian Seljuk architecture favored pointed and conical forms rather than circular geometries in domes and arches, while the vertical dimensions of domes, columns, and load-bearing supports were kept relatively restrained.

Stone was predominantly utilized as the principal construction material. Interior spaces incorporated a variety of materials, including brick, wood, and plaster. In Anatolian Seljuk architecture, significant attention was devoted to the configuration of the main façade; structures featured substantial, elevated walls, and entrance features were designed in a monumental, accentuated style, most notably evident in the portals of caravanserais. In the decorative approach, geometric, vegetal, and zoomorphic motifs inspired by nature were executed with great craftsmanship, and these ornamental elements were applied within an integrated composition in harmony with the architectural elements (Karaçar 2025).

In this context, the geometric order, botanical ornamentation, use of local stone and wood, and abstracted formal expressions derived from nature seen in Anatolian Seljuk architecture show a conceptual overlap with the nature-oriented design characteristics defined in the biophilic design literature.

3. Materials and Methods

This study employed a structured quantitative research methodology to examine the relationship between the biophilic design attributes of the interior spaces of the Yivli Minaret Mosque, dating to the Anatolian Seljuk Period in Antalya, and individuals' perceptions of spirituality. Following the formulation of the research question, study objectives, and hypotheses, a comprehensive literature review was conducted. In this process, previous studies addressing the architectural and interior characteristics of religious buildings from the Anatolian Seljuk Period, as well as their effects on spirituality, nature-relatedness, and perceived restorativeness, were systematically reviewed. Based on these evaluations, survey-based user data collection and expert opinion-based assessment methods were identified as the most appropriate methodological tools for addressing the study objectives and testing the proposed hypotheses (Figure 1).

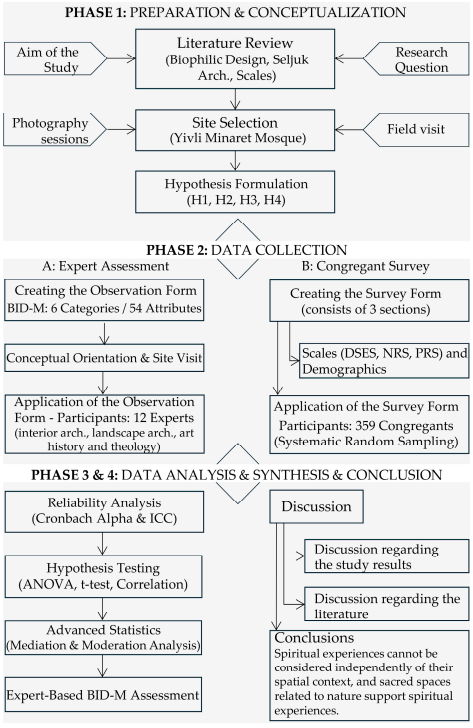


Figure 1. Flowchart of the study methodology.

3.1. Yivli Minaret Mosque

The Yivli Minaret Mosque in Antalya is regarded as one of the most significant religious monuments of the Anatolian Seljuk Period along the southern Anatolian coast. Its initial construction dates to the early thirteenth century under the reign of Sultan Alaeddin Keykubad I. Despite undergoing several phases of restoration and functional adaptation, the mosque has largely preserved its Seljuk architectural character. It thus represents both a historical monument and a continuously functioning place of worship (Umar 2002) (Figure 2).



Figure 2. Yivli Minaret Mosque.

The structure is distinguished by the fluted minaret from which it derives its name. The minaret, characterized by an eight-fluted cylindrical shaft, represents a distinctive example of Anatolian Seljuk minaret architecture, notable for its brick masonry technique and colorful tile ornamentation. It has become one of the most prominent visual elements of Antalya's urban skyline, thereby reinforcing the symbolic value of the monument at the city scale (Yılmaz and Tek 2018). Due to these unique architectural characteristics, the Yivli Minaret Mosque is included in the Tentative List of Türkiye for UNESCO World Heritage (UNESCO 2025).

A particularly significant characteristic of the structure is that, despite its historical significance, it continues to function actively as a place of worship. This active use transforms the Yivli Minaret Mosque from a cultural heritage monument preserved primarily for its historical value into a living sacred space where contemporary user experiences can be directly observed. As such, the building offers a unique research context where historical architectural features intersect with the perceptions and experiences of the present-day congregation (Umar 2002).

The building is oriented along an east–west axis and is characterized by a rectangular plan measuring approximately 17 × 27 m (Yılmaz and Tek 2018). The superstructure comprises six domes covered with traditional Turkish tiles, complemented by a single-pitched hipped roof extending along the western elevation. Access to the mosque is provided through two entrances, one located on the eastern facade and the other positioned centrally on the northern facade; however, only the eastern entrance remains in active use today (Umar 2002). The southern facade is articulated by six rectangular window openings arranged in a horizontal sequence. Above these openings, four smaller round-arched windows are positioned near the eaves cornice, approximately aligned with the midpoints of the lower windows. By contrast, the western facade is treated as a blind wall, devoid of fenestration (Umar 2002). The worship space is subdivided into six square bays defined by a structural system of twelve columns. Each bay is surmounted by a dome supported by transitional Turkish triangular elements of varying configurations. Along the western

side of the prayer hall, a longitudinal barrel-vaulted aisle extends from the southern corner toward the north. The columns articulating the interior space vary in diameter and are crowned with Corinthian- and Doric-order capitals; these are interconnected by pointed arches that contribute to the spatial rhythm of the hall. On the northern wall, two rectangular niches are symmetrically positioned, flanking the entrance. The dome covering the square bay associated with this entrance incorporates a lantern opening, which serves as a source of zenithal illumination (Umar 2002).

During restoration works carried out between 2006 and 2010, a system of water channels was uncovered within the interior of the mosque. Although the original function of these channels cannot be determined with certainty, several interpretations have been proposed in the literature. One interpretation suggests that the channels formed part of the mosque's heating and cooling system, whereby hot water supplied from a nearby bath was used for heating and cold water for cooling. These channels are estimated to be approximately 800 years old. An alternative interpretation proposes that the water channel system may have been used to distribute water from the building to other locations. Indeed, a similar conduit system was identified during excavations conducted in the 1970s on the eastern facade of the Divriği Great Mosque. The use of such systems was widespread from the thirteenth century until the late nineteenth century. In addition, it has been suggested that water was conveyed from nearby sources through these channels and accumulated in a pithos within the space, thereby forming a small-scale water cistern (Eravşar 2007; Çiftçi 2015; Şenoğlu 2015). The presence of numerous Roman Period spolia in and around the mosque indicates the existence of an earlier monumental structure on the site (Eravşar 2007). This evidence suggests that the area may have functioned as a sacred space during the Eastern Roman Period or even earlier, during the Hellenistic–Roman era, prior to the construction of the Yivli Minaret Mosque. The archaeological excavations conducted by the Antalya Museum Directorate between 2007 and 2008 were extremely limited, and a comprehensive stratigraphic sequence revealing the cultural layers of the region has not yet been established.

3.2. Data Acquisition Methods

3.2.1. Observation Form and Expert Opinions

To facilitate the visual analysis of biophilic attributes in interior spaces and to enable their systematic integration into interior design processes, McGee and Marshall-Baker (2015) conducted a series of conceptual and methodological studies. Based on these initial studies, the Biophilic Interior Design Matrix (BID-M) was subsequently developed by McGee et al. (2019) as a quantitative assessment tool intended to objectively, accurately, and reliably evaluate the presence or absence of biophilic attributes within interior environments (Marte et al. 2020). In line with these studies, the Biophilic Interior Design Matrix (BID-M) was developed by McGee et al. (2019) to quantitatively assess the presence and absence of biophilic characteristics in interiors in an objective, accurate, and reliable manner (Marte et al. 2020).

The BID-M is a comprehensive assessment tool specifically developed for interior design, encompassing a total of 54 attributes (design features) organized under six main categories (elements). These categories consist of the following main and subheadings: "Actual Natural Features (air, water, plants, animals, natural materials, views and vistas, habitats, fire); Natural Shapes and Forms (botanical motifs, animal-like forms, shells and spirals, curves and arches, fluid forms, abstraction of nature, inside–outside relationships); Natural Patterns and Processes (sensory richness, age, change and the patina of time, areas of emphasis, patterned wholes, bounded spaces, linked series and chains, integration of parts into wholes, complementary contrasts, dynamic balance and tension, natural ratios and scales); Color and Light (composition, communication, preference, engagement, prag-

matics, natural light, filtered light, reflected light, light pools, warm light, light as shape and form, spaciousness, spatial variety, space as shape and form, spatial harmony); Place-Based Relationships (geographic, historic, ecological, and cultural connections to place, integration of culture and ecology, spirit of place); and Human–Nature Relationships (prospect/refuge, order/complexity, curiosity/enticement, mastery/control, attraction/attachment, exploration/discovery, fear/awe, reverence/spirituality)". This matrix provides researchers and designers with a systematic, holistic, and comparable framework for observing, identifying, and evaluating the biophilic attributes of interior spaces. In this way, it contributes to the objective analysis of biophilic design at the spatial level.

In the study, the BID-M observation form was used to quantitatively evaluate the biophilic design attributes of the interior of the Yivli Minaret Mosque based on expert opinions. Each biophilic attribute was scored on a five-point Likert scale ranging from 0 (none) to 4 (very strong). The evaluation process was based on the opinions of a total of 12 experts with specializations in interior architecture (n = 4), landscape architecture (n = 4), art history (n = 2), and theology (n = 2). The participating experts received conceptual and practical guidance on the BID-M and the evaluation process before the expert evaluation process. This guidance explained the fundamental dimensions of the BID-M, the scoring scale, and the evaluation approach, thereby providing a common evaluation framework for the experts. As part of the fieldwork, the experts visited the study area on at least two occasions at different times and filled out the observation forms through on-site evaluations of the sacred space.

3.2.2. Survey Form and Scales

The survey form was used as the primary data collection tool in the study to determine the opinions and perceptions of the mosque congregation. The survey form consists of three main sections. The first section includes questions about participants' socio-demographic characteristics, such as age, gender, educational status, employment status, and income level, and determines their frequency of mosque attendance. The second section includes questions about participants' familiarity with the concept of biophilic design, their general perceptions of biophilic design, and their thoughts on biophilic design. In the final section, the biophilic design of the mosque interior was evaluated based on participants' views, and the effects of biophilic design attributes in the mosque interior on participants were measured using the DSES, NRS scales, and the PRS scale developed within the ART framework.

The survey was conducted on a voluntary basis with adults aged 18 years and older representing diverse demographic characteristics. To ensure equal selection probability among members of the Yivli Minaret Mosque congregation and to enhance the generalizability of the findings, a probability-based random sampling method was employed. The survey was administered through two modes, online and face-to-face, across different days and times throughout the week. Online surveys were conducted using the Google Forms platform.

The required ethics committee approval for this study was obtained from Akdeniz University Scientific Research and Publication Ethics Committee for Science and Engineering (protocol code: 1352519, and date of approval: 16 October 2025). Following the ethics committee's approval, data were collected from a total of 359 participants over a two-month fieldwork period. The sample size was determined based on the user density of the space and voluntary participation. To assess the statistical adequacy of the obtained sample, a post hoc power analysis was conducted using G*Power (version 3.1.9.7). The results indicated that, for an assumed effect size of r = 0.20 and a significance level of α = 0.05, the final sample size (N = 359) achieved a statistical power of 0.969.

The Daily Spiritual Experiences Scale: The Daily Spiritual Experience Scale (DSES), developed by Dr. Lynn G. Underwood in the mid-1990s based on studies conducted with various religious, ethnic, and social groups, focuses on assessing individuals' experiences of connection and engagement with the transcendent in their daily lives. Widely used in health sciences, social sciences, and spirituality research, the DSES is a 16-item self-report scale. The items on the scale cover individuals' experiences of compassion, gratitude, and awe, as well as feelings of transcendence and tenderness. The scale also measures the individual's awareness of inspiration and the level of deep inner peace they experience (Underwood 2006; Underwood 2011; Underwood and Vagnini 2022). The Turkish version of the DSES, translated by Akın et al. (2013), was used in the study.

Nature-Relatedness Scale: This scale was developed by Nisbet et al. (2009) to measure individuals' cognitive, emotional, and experiential relationships with nature. The NRS has been widely used in the fields of urban design, architecture, and environmental psychology. The scale was adapted into Turkish by Çakır et al. (2015). Consisting of a total of 21 items, the scale measures individuals' connections with nature in three basic sub-dimensions: NR-Self, NR-Perspective, and NR-Experience. NR-Self measures the individual's level of identification with nature and the strength of their connection through 8 items. NR-Perspective determines individuals' attitudes and behaviors towards nature and the environment through 7 items. NR-Experience measures individuals' interest in nature and their thoughts about being in nature through 6 items.

Perceived Restorativeness Scale: The restorative effect of biophilic attributes in the Yivli Minaret Mosque on individuals was measured using the PRS developed within the framework of Attention Restoration Theory (ART). This scale was adapted into Turkish by Özçifçi et al. (2021), and its psychometric validity and reliability were verified by the same authors for the Turkish context. Developed by Kaplan and Kaplan (1989), ART argues that interaction with nature can reduce cognitive fatigue and renew attention capacity. This theory holds an important place, particularly in fields such as cognitive psychology, environmental psychology, urban design, landscape architecture, and architecture. According to this theory, for an environment to have restorative properties, it must possess four main characteristics (Kaplan 1995). These are "being away, which refers to a psychological or physical sense of detachment from daily pressures; fascination, the effortless and naturally rewarding way attention is engaged; extent, the feeling of being immersed in a coherent and richly detailed environment; and compatibility, which indicates alignment between the setting and the individual's intentions, needs, and preferences" (Kaplan 1995; Lindal and Hartig 2015). The PRS is used to empirically test the predictions of ART, which provides a theoretical framework. The PRS scale is a psychological measure developed by Hartig et al. (1997) to measure how restorative an environment is perceived by an individual. The PRS consists of a total of 26 items that assess the four main characteristics of ART (Özçifçi et al. 2021; Lindal and Hartig 2015).

3.3. Data Analysis

The data were analyzed using IBM SPSS Statistics 26.0 software. First, participants' demographic characteristics and responses related to biophilic design were summarized using frequencies (n) and percentages (%). For scale scores and related variables, descriptive statistics were reported as the mean (M), standard deviation (SD), median, interquartile range (Q1–Q3), and minimum–maximum values. The relationships between the biophilic design score (BDS) of the Yivli Minaret Mosque and spiritual experience, nature-relatedness, and perceived restorativeness were examined using Spearman's rank-order correlation (ρ). Two-tailed significance tests were applied, and the level of statistical significance was set at $\alpha = 0.05$.

Differences in BDS, spiritual experience, nature-relatedness, and perceived restorativeness across age groups were evaluated using one-way analysis of variance (ANOVA). When the ANOVA results were statistically significant, Tukey's Honestly Significant Difference (HSD) post hoc tests were conducted to identify which specific groups differed from one another. Differences in BDS, spiritual experience, nature-relatedness, and perceived restorativeness by gender were analyzed using independent-samples *t*-tests. The assumption of homogeneity of variances was assessed using Levene's test, as reported in the relevant test outputs, and two-tailed tests were applied.

The Kruskal–Wallis H test was used to compare scores based on participants' educational status and frequency of mosque attendance, taking into account the number of groups and distribution characteristics. For variables in which the Kruskal–Wallis test was found to be statistically significant, pairwise group comparisons were performed with Bonferroni correction.

The indirect effect of biophilic design on spiritual experience was tested using (a) the Parallel Multiple Mediation Model and (b) the Simple Mediation Model. Mediation analyses were conducted using PROCESS Macro v4.2 (Model 4) (Figure 3). Confidence intervals for indirect effects were obtained using the bootstrap method with 5000 resamples. The statistical significance of the indirect effect was evaluated based on whether the 95% bootstrap confidence interval included zero. Coefficients are reported as unstandardized regression coefficients (b); fully standardized indirect effect coefficients (β) are also presented in the relevant table.

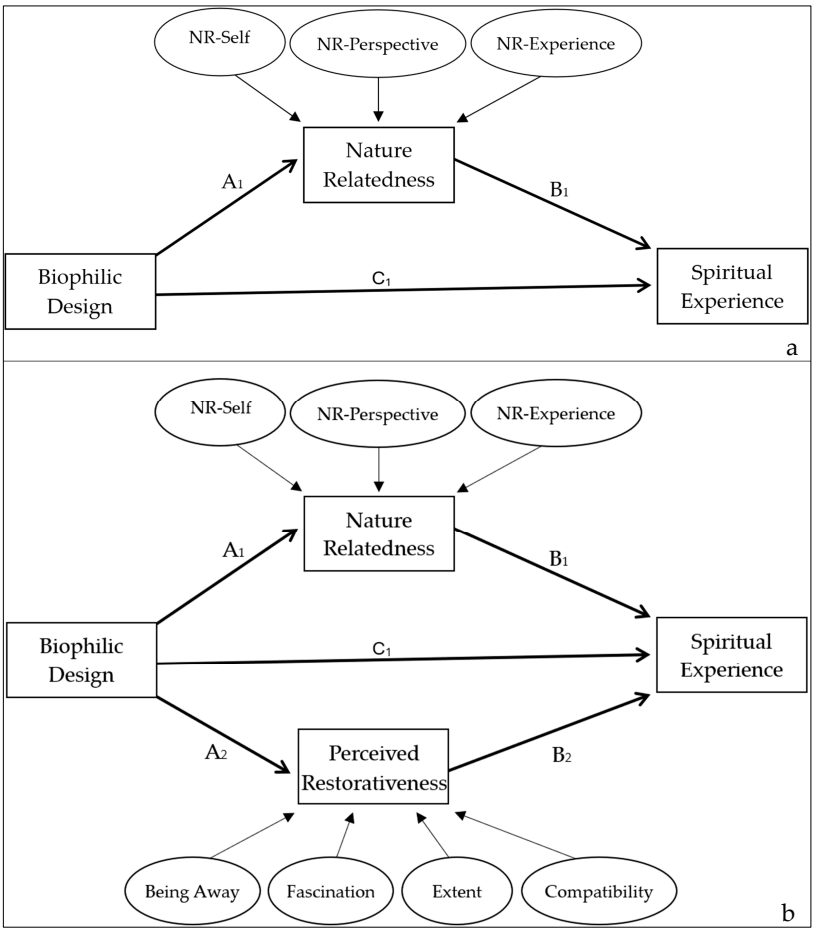


Figure 3. The mediation model created to determine the effect of biophilic design on spiritual experience: (**a**) Simple Mediation Model; (**b**) Parallel Multiple Mediation Model.

The relationship between biophilic design and the spiritual experience was examined using PROCESS Macro v4.2 (Model 1) to determine whether it was conditioned by the mosque attendance frequency and age (Figure 4). To account for potential heteroskedasticity, HC3 robust standard errors were employed in the moderation models. In accordance with PROCESS default settings, continuous variables were mean-centered before creating interaction terms. When the interaction was found to be significant, the relationship pattern was reported at the 16th, 50th, and 84th percentile values using conditional effects (simple slopes) analysis; additionally, the significance region was evaluated using the Johnson–Neyman technique. The contribution of the interaction term to the model was reported using ΔR^2. Across all analyses, the level of statistical significance was set at $\alpha = 0.05$.

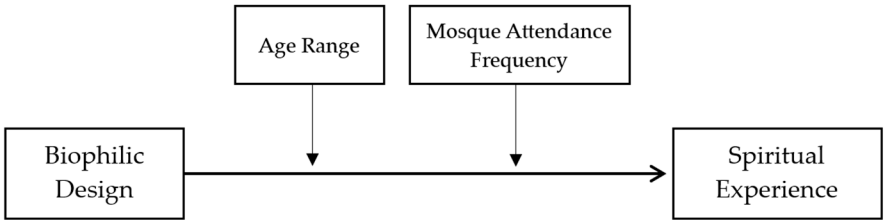


Figure 4. The moderation model for the relationship between biophilic design and spiritual experience.

Inter-expert agreement was assessed based on the total scores obtained for each section of the observation form. In this regard, the scores given to the items within each section were summed separately for each expert, resulting in section-level total scores for the six sections. Inter-expert agreement based on the obtained section total scores was examined using the Intraclass Correlation Coefficient (ICC), which is based on the assumption of absolute agreement under a two-way random effects model. In the analyses, the ICC(2,1) coefficient was reported to evaluate the reliability of the total score given by a single expert, and the ICC(2,k) coefficient was reported to evaluate the reliability of the total score based on the experts' average. ICC analyses were conducted using the psych package (Revelle 2025) in the R version 4.5.2 program. A significance level of 0.05 was accepted for all analyses. Subsequently, each score given by the 12 experts for the BID-M items on the observation form was evaluated using descriptive analyses, and a general biophilic score was obtained for the mosque.

4. Results

This section presents the findings derived from the statistical analysis of data obtained through questionnaires and observation forms.

4.1. Sociodemographic Characteristics of the Participants

The study sample consisted of 359 participants, of whom 69.4% were male, and 30.6% were female. Regarding age distribution, the largest proportion of participants fell within the 31 to 50 age group at 44.9%, followed by those aged 51 years and above at 33.4%, and participants aged 18 to 30 at 21.7%. Concerning educational background, most participants held a bachelor's degree. This was followed by postgraduate degree holders, associate degree holders, high school diploma holders, and primary education holders. The analysis of occupational status indicated that 55.4% of participants were actively employed, with retirees at 16.4%, students at 10.9%, and homemakers at 9.8%. Furthermore, 7.5% of participants were not employed (Table 1).

Table 1. Descriptive information on the socio-demographic characteristics of the participants.

Independent Variable	Category	Number (n)	Percentage (%)
Gender	Female	110	30.6
	Male	249	69.4
Age	18–30	78	21.7
	31–50	161	44.9
	51<	120	33.4
Education Level	Elementary education	44	12.3
	High school	51	14.2
	Associate degree	59	16.4
	Undergraduate	138	38.4
	Postgraduate	67	18.7
Occupation	Working	199	55.4
	Student	39	10.9
	Housewife	35	9.8
	Retired	59	16.4
	Unemployed	27	7.5
Income *	23,000>	44	12.3
	23,001–50,000	89	24.8
	50,001–100,000	125	34.8
	100,000<	101	28.1

* The currency used is the Turkish Lira.

An analysis of income distribution reveals that the majority of participants reported a monthly income ranging from 50,001 to 100,000 units. This was succeeded by 28.1% reporting incomes exceeding 100,000 units, 24.8% falling within the 23,001 to 50,000 range, and 12.3% reporting monthly incomes below 23,000 units (Table 1).

4.2. Participants' Views on Biophilic Design

Participants' familiarity with the concept of biophilic design was assessed through a survey question asking whether they had previously heard of the term. The primary aim of this question was to determine whether participants had the cognitive foundation to evaluate the biophilic characteristics of the Yivli Minaret Mosque where they worship. Within this context, 22.3% of the participants reported detailed knowledge of the concept of biophilic design, 47.6% indicated prior familiarity but lacked a detailed understanding, and 30.1% stated they had no prior knowledge of biophilic design. In line with this approach, a general introduction to the concept of biophilic design was provided to all participants before the survey was administered.

Participants' perspectives concerning the implementation of biophilic design elements in religious structures, such as natural lighting, ventilation, vegetation, water features, organic forms, natural materials, and patterns and textures inspired by nature, were assessed using a five-point Likert scale. Accordingly, 0.6% of participants assigned a score of 1, 2.2% assigned a score of 2, 7.8% assigned a score of 3, 37.9% assigned a score of 4, and 51.5% assigned a score of 5. These findings indicate that the vast majority of participants regarded the use of biophilic design elements in religious buildings as highly important.

Furthermore, as members of the mosque congregation, participants were requested to assess the biophilic design elements of the Yivli Minaret Mosque using a scale from 0 to 4. In this context, 46.2% of participants assigned the highest rating to the mosque for its biophilic design features. Conversely, 0.6% of the participants indicated that the Yivli Minaret Mosque does not exhibit any characteristics associated with biophilic design. Based

on participants' evaluations, the mean score for the mosque's biophilic design features was 3.19.

All individuals participating in the study comprised respondents who had previously visited the Yivli Minaret Mosque. An analysis of mosque attendance frequency indicated that 60.4% of participants attended the mosque once or multiple times weekly, 25.1% once or multiple times monthly, and 14.5% once or several times annually.

4.3. Data Analysis

4.3.1. Reliability Analysis

To assess the internal consistency reliability of the scales used in the mediation and moderation analyses, Cronbach's alpha was calculated. Accordingly, the Cronbach's alpha for the DSES scale was 0.879. The reliability coefficient of the NRS scale was 0.908, with Cronbach's alpha values calculated as 0.807 for the NR-self subscale, 0.714 for the NR-perspective subscale, and 0.799 for the NR-experience subscale. The Cronbach's alpha coefficient for the PRS scale was 0.961, whereas the reliability coefficients for its subscales were 0.956 for being away, 0.931 for fascination, 0.862 for extent, and 0.937 for compatibility (Table 2). Across all three instruments, Cronbach's alpha reliability coefficients surpassed the accepted threshold of 0.70 as recommended by Nunnally and Bernstein (1994), thereby indicating a high degree of reliability for the scales and their respective subscales.

Table 2. Reliability results.

Scales	Subscales	Cronbach's Alpha
DSES		0.879
NRS		0.908
	NR-Self	0.807
	NR-Perspective	0.714
	NR-Experience	0.799
PRS		0.961
	Being Away	0.956
	Fascination	0.931
	Extent	0.862
	Compatibility	0.937

4.3.2. Relationship Between Socio-Demographic Characteristics and Scales

Differences in BDS, DSES, NRS, and PRS scores for the Yivli Minaret Mosque across gender groups were examined using independent samples *t*-tests. The results indicated no statistically significant differences between gender groups in terms of BDS ($t(357) = -0.14$, $p = 0.886$), DSES ($t(357) = 0.03$, $p = 0.977$), NRS ($t(357) = -1.26$, $p = 0.207$), or PRS ($t(357) = -0.46$, $p = 0.645$). In contrast, BDS scores reflecting the biophilic design elements of the Yivli Minaret Mosque demonstrated significant variation across different age groups ($F(2, 356) = 12.39$, $p < 0.001$). Tukey HSD post hoc comparisons revealed that the mean score of the 18 to 30 age group ($M = 2.76$, $SD = 0.90$) was substantially lower than those of the 31 to 50 ($M = 3.35$, $SD = 0.86$) and 51 to 65 age groups ($M = 3.27$, $SD = 0.91$). Analysis across age groups indicated that DSES, NRS, and PRS scores did not vary significantly ($F(2, 356) = 0.01$, $p = 0.987$; $F(2, 356) = 0.82$, $p = 0.440$; $F(2, 356) = 1.22$, $p = 0.298$, respectively). DSES mean scores remained at comparable levels across the 18 to 30 ($M = 87.55$, $SD = 4.45$), 31 to 50 ($M = 87.45$, $SD = 5.34$), and 51 to 65 age groups ($M = 87.44$, $SD = 4.68$). A similar pattern was observed for NRS scores, which showed closely aligned means across the 18 to 30 ($M = 92.85$, $SD = 5.20$), 31 to 50 ($M = 93.75$, $SD = 5.23$), and 51 to 65 age groups ($M = 93.49$, $SD = 4.92$). Likewise, PRS scores did not exhibit

statistically meaningful variation across age groups, with mean values of 99.54 (SD = 20.32), 100.55 (SD = 20.18), and 103.65 (SD = 20.15), respectively (Table 3).

Table 3. Variations in BDS, DSES, NRS and PRS by age.

	Age	Mean ± SS	Min–Max	Medyan	Q1–Q3	p [1]
BDS	18–30	2.76 ± 0.9	1–4	3	2–4	<0.001
	31–50	3.35 ± 0.861	1–4	4	3–4	
	51–65	3.27 ± 0.905	0–4	3	3–4	
DSES	18–30	87.55 ± 4.45	74–95	89	86–90	0.987
	31–50	87.45 ± 5.34	70–95	89	86–91	
	51–65	87.44 ± 4.68	71–95	88	86–90	
NRS	18–30	92.85 ± 5.2	75–102	93.5	90–96	0.440
	31–50	93.75 ± 5.23	75–105	94	91–97	
	51–65	93.49 ± 4.92	78–103	93.5	91–97	
PRS	18–30	99.54 ± 20.32	52–129	104	89–114	0.298
	31–50	100.55 ± 20.18	54–130	104	86–117	
	51–65	103.65 ± 20.15	49–130	107	89–120.5	

[1] One-way ANOVA.

The educational level was significantly associated with differences in the mean scores for BDS, DSES, NRS, and PRS at the Yivli Minaret Mosque ($p < 0.001$, $p < 0.001$, $p = 0.004$, and $p = 0.006$, respectively). Mean scores for BDS were relatively similar among participants with primary education (M = 3.09, SD = 0.98), secondary education (M = 2.90, SD = 0.92), associate degrees (M = 3.05, SD = 0.94), and bachelor's degrees (M = 3.20, SD = 0.92). Conversely, participants holding postgraduate qualifications demonstrated a notably higher mean BDS score (M = 3.58, SD = 0.68). Similarly, the mean DSES scores remained at comparable levels among participants with primary education (M = 88.20, SD = 3.68), secondary education (M = 87.53, SD = 4.77), associate degrees (M = 88.90, SD = 3.80), and bachelor's degrees (M = 88.03, SD = 4.67), whereas a lower mean score was observed among participants with postgraduate education (M = 84.54, SD = 6.02). The mean NRS scores likewise demonstrated similar patterns across participants with primary education (M = 92.89, SD = 3.85), secondary education (M = 93.71, SD = 4.96), associate degrees (M = 92.41, SD = 6.33), and bachelor's degrees (M = 93.10, SD = 4.33), whereas postgraduate participants exhibited higher mean scores (M = 95.36, SD = 5.88). The mean PRS scores exhibited greater variation among participants with primary education (M = 101.68, SD = 17.48), secondary education (M = 104.18, SD = 19.43), associate degrees (M = 98.12, SD = 19.86), and bachelor's degrees (M = 98.50, SD = 21.50). In contrast, participants with postgraduate education demonstrated higher mean PRS scores (M = 107.79, SD = 18.72) (Table 4).

A statistically significant difference in mean BDS scores for the Yivli Minaret Mosque was observed across levels of mosque attendance frequency ($p < 0.001$). Mosque congregants who reported visiting once or several times per week exhibited higher mean BDS scores (M = 3.50, SD = 0.65) than those attending once or several times per month (M = 2.96, SD = 0.89) or once or several times per year (M = 2.33, SD = 1.20). Bonferroni-adjusted pairwise comparisons demonstrated that the differences among all three groups were statistically significant (adjusted $p \leq 0.026$). In contrast, no statistically significant differences were observed in the mean scores of DSES, NRS, or PRS based on mosque attendance frequency ($p = 0.177$, $p = 0.752$, and $p = 0.820$, respectively). The mean DSES scores remained consistent among mosque congregants who reported attending once or several times weekly (M = 87.84, SD = 4.69), once or several times monthly (M = 86.94, SD = 5.60), and once or several times annually (M = 86.83, SD = 4.58). Similarly, the mean NRS scores

demonstrated close alignment among mosque congregants who reported attending once or multiple times weekly (M = 93.51, SD = 4.89), monthly (M = 93.22, SD = 5.59), and annually (M = 93.73, SD = 5.30). Correspondingly, the mean PRS scores exhibited comparable trends across congregants attending once or multiple times per week (M = 101.58, SD = 21.11), monthly (M = 101.58, SD = 18.53), and annually (M = 100.13, SD = 19.52) (Table 5).

Table 4. Variations in BSPS and PRS by educational background.

	Educational Background	Mean ± SS	Min–Max	Medyan	Q1–Q3	*p* [1]
BDS	Primary Education	3.09 ± 0.98	0–4	3	3–4	<0.001
	High School	2.9 ± 0.92	1–4	3	3–4	
	Associate Degree	3.05 ± 0.94	1–4	3	3–4	
	Bachelor's Degree	3.2 ± 0.92	1–4	4	2–4	
	Postgraduate Degree	3.58 ± 0.68	1–4	4	3–4	
DSES	Primary Education	88.2 ± 3.68	78–94	88	87–91	<0.001
	High School	87.53 ± 4.77	71–94	89	86–90	
	Associate Degree	88.9 ± 3.8	76–95	89	87–92	
	Bachelor's Degree	88.03 ± 4.67	70–95	89	87–91	
	Postgraduate Degree	84.54 ± 6.02	71–94	87	79–89	
NRS	Primary Education	92.89 ± 3.85	84–100	92	91–96	0.004
	High School	93.71 ± 4.96	78–101	95	91–97	
	Associate Degree	92.41 ± 6.33	75–101	93	90–97	
	Bachelor's Degree	93.1 ± 4.33	77–102	94	91–96	
	Postgraduate Degree	95.36 ± 5.88	77–105	96	92–100	
PRS	Primary Education	101.68 ± 17.48	64–130	102.5	93–111	0.006
	High School	104.18 ± 19.43	49–130	109	91–118	
	Associate Degree	98.12 ± 19.86	53–130	100	81–114	
	Bachelor's Degree	98.5 ± 21.5	52–130	102	83–116	
	Postgraduate Degree	107.79 ± 18.72	55–129	115	99–121	

[1] Kruskal–Wallis H test.

Table 5. Variations in BDS, DSES, NRS and PRS by frequency of mosque attendance.

	Frequency of Mosque Attendance	Mean ± SS	Min–Max	Medyan	Q1–Q3	*p* [1]
BDS	Once or several times a week	3.5–0.65	4	2–4	3–4	<0.001
	Once or several times a month	2.96–0.89	3	1–4	2–4	
	Once or several times a year	2.33–1.2	2	0–4	1–4	
DSES	Once or several times a week	87.84–4.69	89	70–95	87–91	0.177
	Once or several times a month	86.94–5.6	89	71–95	85–90	
	Once or several times a year	86.83–4.58	88	71–93	86–90	
NRS	Once or several times a week	93.51–4.89	94	77–103	91–97	0.752
	Once or several times a month	93.22–5.59	94	75–105	90–97	
	Once or several times a year	93.73–5.3	94	75–104	91–97	
PRS	Once or several times a week	101.58–21.11	105	49–130	89–118	0.820
	Once or several times a month	101.58–18.53	104.5	56–129	89–117	
	Once or several times a year	100.13–19.52	103	59–130	83–116	

[1] Kruskal–Wallis H test.

4.3.3. Results of the Mediation Analysis

The effect of the biophilic design features of the Yivli Minaret Mosque on spiritual experience was investigated, utilizing the relationship with nature and perceived restorativeness as concurrent mediating variables (Table 6). Initially, the overall impact of the mosque's biophilic design features on spiritual experience was not statistically significant

(p = 0.143). Following the inclusion of the mediating variables, the direct effect of biophilic design features on spiritual experience also did not attain statistical significance (p = 0.066). However, in the model that includes both the relationship with nature and perceived restorativeness concurrently, the biophilic design features of the Yivli Minaret Mosque significantly contributed to the explanation of spiritual experience (R^2 = 0.047, p < 0.001) (Table 7).

Table 6. Regression coefficients and confidence intervals of the effect of biophilia design score (X) on spiritual experience (Y) via nature-relatedness and perceived restorativeness.

Model	M_1 (b)	95% CI		M_2 (b)	95% CI		Y (SE) b	95% CI	
		Lower Limit	Upper Limit		Lower Limit	Upper Limit		Lower Limit	Upper Limit
X (BD)	0.71	0.09	1.31	0.29	−2.03	2.64	−0.52	−1.00	−0.04
M_1 (NR)	—	—	—	—	—	—	0.16	0.04	0.28
M_2 (PR)	—	—	—	—	—	—	−0.03	−0.06	−0.01
R^2 (NR) = 0.016; R^2 (PR) < 0.001; R^2 (SE) = 0.047									

Note(s): N = 359. BD = Biophilic Design; NR = Nature-Relatedness; PR = Perceived Restorativeness; SE = Spiritual experience. The coefficients are unstandardized regression coefficients (b). Confidence intervals are based on bootstrap (5000 samples).

Table 7. The total, direct, and indirect effects of biophilic design on spiritual experience via nature-relatedness and perceived restorativeness.

Effect Type	b	BootSE	95% CI		β
			Lower	Upper	
Total effect (c)	−0.42	0.29	−0.98	0.14	−0.08
Direct effect (c′)	−0.52	0.28	−1.08	0.04	−0.10
Indirect effect via nature-relatedness	0.11	0.06	0.01	0.26	0.02
Indirect effect via perceived restorativeness	−0.01	0.04	−0.11	0.08	−0.00
Total indirect effect	0.10	0.08	−0.05	0.27	0.02
Indirect effect comparison	0.12	0.08	−0.02	0.28	0.02

The biophilic design score significantly and positively predicted the relationship with nature (p = 0.017). In contrast, the effect of the biophilic design score on perceived restorativeness was not statistically significant (p = 0.802). Examination of the parallel mediation model indicated that both the relationship with nature (p = 0.002) and perceived restorativeness (p = 0.008) were significantly associated with spiritual experience.

Bootstrap-based indirect effect analyses, employing 5000 resamples, demonstrated that the influence of the biophilic design score on spiritual experience was indirectly mediated by the relationship with nature, with the 95% bootstrap confidence interval excluding zero. In contrast, the indirect effect mediated by perceived restorativeness did not attain statistical significance. The overall indirect effect was also non-significant, and no statistically significant difference was observed between the indirect effects through the relationship with nature and perceived restorativeness.

Following the evaluation of the parallel mediation model, a supplementary mediation analysis was performed utilizing a more parsimonious model in which the relationship with nature was incorporated as the exclusive mediating variable. The outcomes of this analysis are documented in Tables 8 and 9.

Table 8. Regression coefficients and confidence intervals of the effect of biophilia design score (X) on spiritual experience (Y) via nature-relatedness.

Model	M_1 (b)	95% CI		Y (SE) b	95% CI	
		Lower Limit	Upper Limit		Lower Limit	Upper Limit
X (BD)	0.71	0.13	1.29	−0.52	−1.08	0.04
M_1 (NR)	—	—	—	0.14	0.04	0.24

Note(s): N = 359. BD = Biophilic Design; NR = Nature-Relatedness; SE = Spiritual experience. The coefficients are unstandardized regression coefficients (b). Confidence intervals are based on bootstrap (5000 samples).

Table 9. The total, direct, and indirect effects of biophilic design on spiritual experience via nature-relatedness.

Effect Type	b	BootSE	95% CI		β
			Lower	Upper	
Total effect (c)	−0.42	0.29	−0.98	0.14	−0.08
Direct effect (c′)	−0.52	0.28	−1.08	0.04	−0.10
Indirect effect via nature-relatedness	0.10	0.06	−0.00	0.25	0.02

The effect of the biophilic design elements of the Yivli Minaret Mosque on the spiritual experiences of its congregants was systematically analyzed, focusing on the mediating role of their relationship with nature. The overall impact of the biophilic design elements of the Yivli Minaret Mosque on spiritual experience was not found to be statistically significant ($t(357) = -1.47$, $p = 0.143$). When the variable 'relationship with nature' was incorporated into the model as a mediating factor, the direct effect of biophilic design features on spiritual experience remained non-significant ($t(356) = -1.82$, $p = 0.069$). Nevertheless, the overall model predicting spiritual experience was statistically significant ($R^2 = 0.028$, $F(2, 356) = 5.05$, $p = 0.007$). Within this framework, the biophilic design score significantly predicted the relationship with nature ($t(357) = 2.40$, $p = 0.017$). Furthermore, the relationship coefficient with nature as a mediating variable within the spiritual experience model was statistically significant ($t(356) = 2.81$, $p = 0.005$). As indicated by bootstrap results based on 5000 resamples, the influence of the biophilic design score on spiritual experience was mediated by a relationship with nature, yielding an indirect effect of ab = 0.10 (BootSE = 0.06, 95% bootstrap CI [−0.00, 0.25]).

4.3.4. Results of the Moderation Analysis

The effect of the biophilic design features of Yivli Minaret Mosque on the spiritual experience was tested using a moderation model to determine whether it was conditioned by the mosque attendance frequency (PROCESS Model 1; HC3 standard errors). The statistical analysis revealed that the model was significant. Within this model, the primary effect of biophilic features did not achieve statistical significance. However, the main effect of frequency of mosque attendance is statistically significant. Notably, the interaction between biophilic features and mosque attendance frequency was statistically significant, with this interaction contributing an additional proportion of explained variance to the model ($\Delta R^2 = 0.015$, $F(1, 355) = 6.48$, $p = 0.011$) (Table 10).

Table 10. The moderating effect of mosque attendance frequency on the relationship between biophilic design and spiritual experience.

Model	b	SE (HC3)	t	*p*	95% CI
Biophilic design	−0.48	0.34	−1.44	0.151	[−1.14, 0.18]
Mosque attendance frequency	−1.22	0.43	−2.82	0.005	[−2.08, −0.37]
Biophilic design × Mosque attendance frequency	−0.84	0.33	−2.54	0.011	[−1.49, −0.19]
Model fit: R^2 = 0.041; $F(3, 355)$ = 4.42; p = 0.005; ΔR^2 (interaction) = 0.015; p = 0.011					

Simple slopes (conditional effect) analyses indicated that the association between biophilic design features and spiritual experience varies by mosque attendance frequency. At low levels of mosque attendance frequency (16th percentile), the conditional effect of biophilic design features on spiritual experience was not statistically significant (b = −0.03, SE = 0.44, t(355) = −0.06, p = 0.949, 95% CI [−0.89, 0.83]). By contrast, at high levels of mosque attendance frequency (84th percentile), the conditional effect of biophilic design features on spiritual experience was statistically significant (b = −0.87, SE = 0.31, t(355) = −2.79, p = 0.006, 95% CI [−1.48, −0.26]). The Johnson–Neyman technique demonstrated that the conditional effect of biophilic design features on spiritual experience is statistically significant only beyond a specific threshold of mosque attendance frequency, identified as 0.1708. In the present sample, 60.45% of participants fell below this threshold, while 39.55% exceeded it.

The correlation between biophilic design features and spiritual experiences varies with the frequency of mosque attendance. Although the conditional effect of biophilic design features on spiritual experience is not statistically significant for congregants who attend annually or monthly, it becomes negative and statistically significant for those who attend once or multiple times per week. This finding indicates that the correlation between biophilic design elements and spiritual experiences may differ based on the frequency of mosque attendance. For individuals with higher attendance, the relationship between biophilic design features and spiritual experience appears to diminish or, in some cases, even exhibit an inverse relationship (Figure 5).

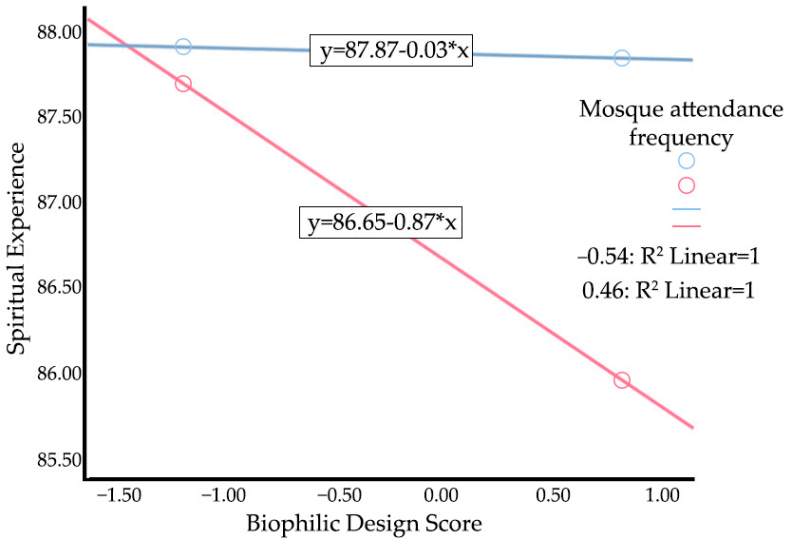


Figure 5. The conditional effect of the relationship between biophilic design features and Spiritual Experience based on mosque attendance frequency.

A moderation model was utilized to investigate whether age moderates the impact of the biophilic design features of the Yivli Minaret Mosque on spiritual experience (PROCESS

Model 1; HC3 standard errors; N = 359). The moderation model was not statistically significant (R^2 = 0.006, F(3, 355) = 1.22, p = 0.304). The primary effect of the biophilic design features of the Yivli Minaret Mosque on spiritual experience did not achieve statistical significance (b = −0.43, SE = 0.24, t(355) = −1.75, p = 0.080, 95% CI [−0.90, 0.05]). Similarly, the main effect of age was also nonsignificant (b = 0.03, SE = 0.36, t(355) = 0.07, p = 0.944, 95% CI [−0.68, 0.73]). Additionally, the interaction between biophilic design features and age was not statistically significant (b = −0.10, SE = 0.32, t(355) = −0.33, p = 0.744, 95% CI [−0.73, 0.52]), and the interaction term did not contribute to additional explained variance within the model (ΔR^2 = 0.0002, p = 0.744).

Mosque attendance frequency significantly moderated the relationship between biophilic design features and spiritual experience (interaction p = 0.011), whereas age did not demonstrate a statistically significant moderating effect within this relationship (interaction p = 0.744).

4.4. Expert-Based BID-M Assessment

Inter-expert agreement among experts was assessed based on the aggregate scores of six biophilic elements, which were derived from 54 interior design-specific attributes, employing a two-way random-effects model with absolute agreement (Table 11).

Table 11. Inter-expert agreement based on the total scores of BID-M elements.

Criterion	ICC	95% CI		F	df1	df2	*p*
		Lower	Upper				
A expert (absolute agreement)	0.98	0.94	1.00	551	5	55	<0.001
Average of 12 experts (absolute agreement)	1.00	0.99	1.00	551	5	55	<0.001

This finding indicates a high degree of consistency among experts' ratings of the total scores for each section. In other words, the sections of the observation form yield comparable total scores regardless of which expert conducted the evaluation.

The ICC(2,1) coefficient of 0.98, derived from assessments by a solitary expert, signifies that the aggregate scores of the section demonstrate exceptionally high reliability, even when the observation form is administered by only one expert. When the experts' ratings were averaged, the ICC(2,12) coefficient of 0.99 indicates that the section scores derived from the combined evaluations of multiple experts achieve an almost error-free level of measurement.

The findings obtained from BID-M indicate that the interior of Yivli Minaret Mosque exhibits moderate to high levels of biophilic design features (overall mean = 2.92, SD = 0.580). Among the six main categories, the highest average score was achieved in the Place-Based Relationships category. This category underscores the significance of the mosque's relationship with its historical, cultural, ecological, and spatial context within the biophilic evaluation (Table 12).

This was followed by the categories of Color and Light and Natural Patterns and Processes. These findings suggest that natural light, spatial coherence, rhythmic repetition, and part-to-whole relationships are important factors in the mosque's biophilic qualities. The Actual Natural Features category obtained a moderate mean score of M = 2.76 with a standard deviation of SD = 0.347, signifying that the mosque is primarily characterized by indirect biophilic strategies rather than direct natural elements. Relatively lower average scores were observed in Human–Nature Relationships and particularly in the Natural Shapes and Forms category.

Table 12. BID-M values for Yivli Minaret Mosque.

BID-M Elements	No. of Items	Mean Score (0–4)	SD
Actual Natural Features	8	2.76	0.347
Natural Shapes and Forms	7	2.06	0.187
Natural Patterns and Processes	10	3.08	0.103
Color and Light	15	3.28	0.114
Place-Based Relationships	6	3.74	0.166
Human–Nature Relationships	8	2.62	0.284
Total	54	2.92	0.580

Note: Scores range from 0 (absent) to 4 (very strong) and represent the mean ratings of twelve experts.

5. Discussion

5.1. Biophilia and Spatial Symbolism in Sacred Architecture

Religious buildings are not merely spaces of worship but also serve as social centers, places of learning, and environments where individuals seek and attain inner peace (Aslanapa 1999; Kuban 2010). The design elements and principles employed in these settings, including form, texture, materiality, light, color, and symbolism, can profoundly influence users' psychological states and spiritual well-being (Durukan et al. 2025). In this context, Anatolian Seljuk architecture, developed through a comprehensive understanding of the Central Asian Turkic building tradition, the longstanding legacy of Iranian–Islamic architecture, and construction techniques unique to Anatolia, resulted in architectural works distinguished by characteristic and era-specific qualities (Öney 1992; Kuban 2010). In this regard, within the architectural discourse of this era, the application of geometric order, the utilization of light, vegetal motifs, and the predilection for natural materials exemplify both formal and symbolic representations of nature. The biomorphic forms, materials, and ornamental elements incorporated into these structures facilitated users in establishing a perceptual and experiential connection with nature within the built environment.

Concurrently, the architecture of Anatolian Seljuk mosques exemplifies an indirect and symbolic portrayal of nature, not solely through its association with locations and cultural contexts but also through its material composition, illumination, patterning, and rhythm. Academic literature additionally emphasizes that geometric motifs within architectural design can be viewed as abstract representations of the mathematical precision and rhythmic cycles inherent to the natural world (Department of Islamic Art 2001; Umar 2002; Kuban 2010). In this regard, the biophilic components observed in the Yivli Minaret Mosque can be evaluated within the framework of Browning et al.'s (2014) "14 Patterns of Biophilic Design," particularly under the categories of Natural Analogs and Nature of the Space. It can be argued that the biophilic experience in the Yivli Minaret Mosque is not established through direct contact with nature, such as living vegetation or water features commonly found in contemporary architectural settings, but rather through a symbolic and phenomenologically mediated atmosphere.

Expert assessments of the Yivli Minaret Mosque indicate that the structure demonstrates moderate to high levels of biophilic design characteristics. The highest score awarded to the Place-Based Relationships dimension suggests that the biophilic quality of the building is predominantly influenced by its historical, cultural, ecological, and spatial connections to its environment, rather than by direct representations of nature. This context-based relationship significantly contributes to the overall spatial experience.

This context-based relationship encompasses elements such as the continuity maintained between the structure and its geographic surroundings, the employment of local materials, cultural memory, symbolic importance, and the perception of spatial belonging (Kellert 2008, 2018). Indeed, Kellert (2018) emphasizes that place-based relationships in biophilic design serve to enhance individuals' emotional attachment to their environment and foster a sense of belonging. Furthermore, this relationship becomes especially significant in structures distinguished by historical and cultural continuity. Consistent with this perspective, the scholarly literature on Islamic architecture indicates that the mosque functions not only as a physical structure but also as a symbolic hub that embodies and conveys its community's religious, cultural, and social heritage (Grabar 1987; Kuban 2010).

5.2. Mediating Psychological Mechanisms: Nature-Relatedness and Restorativeness

Most participants consider the incorporation of biophilic design elements in religious structures, including natural lighting, ventilation, vegetation, water features, organic forms, natural materials, patterns, textures, and ecological connections to the environment, to be of considerable importance (51.5%). According to the perceptions of the mosque congregation, 46.2% of respondents attributed the highest rating to the biophilic design features of the Yivli Minaret Mosque, with an aggregate mean biophilic design score of 3.19. Indeed, prior research indicates that integrating natural elements such as daylight, vegetation, and water features into sacred spaces can augment and deepen the spiritual experience. For instance, research on colonial-era churches in India has demonstrated that worship spaces incorporating biophilic elements, such as green areas, natural materials, and natural light, are associated with greater spiritual fulfillment and enhanced attentional focus among visitors (Rai et al. 2019). Likewise, it has been recognized that incorporating historical monastic gardens with natural elements has contributed to the improvement of mental, physical, and spiritual well-being among early urban residents (Pretorius 2021). Research in environmental psychology underscores that interaction with nature enhances human well-being, alleviates stress, and improves attentional capacity (Kaplan 1995; Ulrich 1984). Accordingly, biophilic design in religious buildings serves a multifaceted role that extends beyond mere aesthetic and ecological considerations, enriching users' psychological and spiritual experiences (Durukan et al. 2025).

The impact of the biophilic design attributes of the Yivli Minaret Mosque on spiritual experience was examined using a parallel mediation model that incorporated nature-relatedness and perceived restorativeness as mediating variables. When evaluating the mediational framework comprehensively, it was concluded that the impact of the biophilic design score on spiritual experience does not operate through a direct pathway; rather, it is transmitted indirectly via the perception of a connection with nature. The observation that the total and direct effects of biophilic features on spiritual experience lack statistical significance in a historic place of worship such as the Yivli Minaret Mosque, while the relationships between biophilic features and nature-relatedness, as well as between nature-relatedness and spiritual experience, are statistically significant, suggests a mediation-based pattern of association. This outcome aligns with a substantial body of existing research. This is attributable to research indicating that nature serves as a fundamental source of spirituality for individuals. For example, the study by Kamitsis and Francis (2013) demonstrated that engagement with nature and a sense of proximity to the natural environment significantly enhance individuals' spiritual well-being. Similarly, Rai et al. (2019) demonstrated that natural architectural elements (e.g., pointed arches, stained-glass triple lancet windows, vertical emphasis, rich colors, decorative features, and locally sourced natural materials) in churches significantly enhance visitors' perceived spirituality and restorative experience. Likewise, a study on historic monastic gardens revealed that spaces enriched

with natural features can promote not only mental and physical well-being but also spiritual well-being among individuals living in urban environments (Pretorius 2021). In this context, as articulated in the biophilia hypothesis, the bond established with nature plays a critical mediating role in shaping spiritual experience. Furthermore, the finding that the perceived restorative qualities of the mosque interior alone do not fully account for spiritual experience is noteworthy. Both this study's findings and the extant literature suggest that although restorative effects promote mental tranquility and attentional restoration, enhancing spiritual experience requires individuals to establish a meaningful connection with nature. Therefore, in the architectural design of religious buildings, it is essential to integrate approaches that, beyond aesthetic considerations, enable users to form a bond with nature and cultivate a sense of belonging to the natural environment.

The investigation into how the influence of biophilic design features of the Yivli Minaret Mosque on spiritual experience is moderated by participants' age and frequency of mosque attendance was conducted employing a moderation model. The findings demonstrate that the association between biophilic design elements and spiritual experience differs substantially by mosque attendance frequency. The conditional influence of biophilic design features on spiritual experiences is not statistically significant among participants who attend the mosque infrequently (e.g., a few times per month or per year); however, it is negative and statistically significant among individuals who attend the mosque once or multiple times per week. This pattern can be interpreted in two ways within established theoretical frameworks. First, according to Kaplan's (1995) Attention Restoration Theory, the more familiar and routinized a place becomes, the more limited the individual's capacity to experience a sense of "being away," that is, to mentally disengage from cognitively demanding environments and to attain psychological restoration within that setting. In this regard, for individuals who regularly attend the mosque, the biophilic elements of the space may become familiar and ingrained in everyday experience. This habituation could diminish the sense of awe and tranquility that such elements might otherwise inspire. Additionally, in sacred environments, environmentally salient features may occasionally be perceived as potential sources of distraction during worship (Abidin 2004; Kassim et al. 2014; Kassim 2015). This tendency may be particularly evident among individuals who emphasize spiritual depth in worship, potentially providing a plausible explanation for the observed pattern in the current findings. Alternatively, for individuals who frequently attend mosques, the assessment of spiritual experience may primarily focus on inner peace or a sense of social belonging, leading the biophilic attributes of the space to be perceived as secondary or less influential in shaping their overall spiritual experience. Age, as with the other examined variable, did not moderate the relationship between biophilic design features and spiritual experience. This finding implies that the principal factor influencing the connection between biophilic design and spiritual experience is not the individuals' chronological age but rather the continuity-based bond and the degree of familiarity they cultivate with the sacred space.

5.3. Sociodemographic Differences in Spiritual Experience

Previous research indicates that women frequently derive greater benefits from environments associated with nature, owing to their generally higher levels of environmental sensitivity and emotional awareness (Baynal and Yaman 2015; Murphy 2016; He et al. 2023; Yang et al. 2024). For example, the study conducted by Durukan et al. (2025) reported that female participants experienced higher levels of perceived restorativeness and spiritual experience in mosque interiors characterized by biophilic design features. Nevertheless, in the Yivli Minaret Mosque, perceived levels of biophilic design, spiritual experience, nature-relatedness, and restorative qualities do not differ significantly by gender. Con-

versely, statistically significant variations are observed concerning age groups, educational attainment, and the frequency of mosque attendance. Participants aged 18–30 rated the mosque's biophilic qualities lower than older age groups. This trend may be ascribed to the likelihood that younger individuals have comparatively reduced sensitivity to, or awareness of, nature-oriented design features than their middle-aged and older counterparts. Indeed, research in environmental psychology indicates that individuals' interest in and attunement to nature generally escalate with age. In particular, the study conducted by Meidenbauer et al. (2019) demonstrates that individuals' preferences for natural environments increase progressively with age, and that predominantly natural settings are more strongly favored by adults.

Participants with postgraduate qualifications perceive the mosque as demonstrating a greater extent of biophilic characteristics than other groups. Moreover, although perceptions of spirituality within the structure, the connection to nature, and the restorative effects of the space do not differ by participants' age or frequency of mosque attendance, they do exhibit statistically significant differences in educational attainment. It was observed that levels of nature-relatedness and perceived restorativeness were higher among participants with postgraduate education, whereas perceptions of spirituality, considered as the general spiritual experience perceived by individuals within the mosque interior, were similar across other educational groups but comparatively lower among those with postgraduate degrees. This pattern suggests that environmental awareness and sensitivity to nature tend to increase with individuals' educational attainment. The scholarly literature likewise substantiates this hypothesis, indicating that an increase in educational attainment is concomitantly associated with a heightened affinity for nature, greater ecological consciousness, and an improved capacity to perceive and interpret environmental qualities (Browning et al. 2014; Durukan et al. 2025). Furthermore, when participants' perceptions of spirituality within the mosque are considered, an inverse relationship with educational level is observed. This tendency may be attributed to the possibility that higher levels of education are associated with a more critical or rational mode of interpretation. At the same time, as emphasized by Gürsu and Ay (2018) and Durukan et al. (2025), it is undeniable that spiritual experience is highly subjective in nature and cannot be explained solely by educational attainment.

5.4. Methodological Reflections and Future Study Directions

This study is based on a single-case and cross-sectional research design centered on a historical mosque from the Anatolian Seljuk period. While the single-case approach allows for an in-depth examination of the contextual characteristics of a historically and symbolically significant sacred space such as the Yivli Minare Mosque, it also limits the direct generalizability of the findings to different historical periods, geographical contexts, and mosque typologies. Future studies are recommended to adopt multi-site and comparative designs to more comprehensively examine the relationships between biophilic design features and perceptions of spirituality. In particular, comparative studies across Anatolian Seljuk, Ottoman, and contemporary mosques may help to elucidate how biophilic features are perceived within different historical and architectural contexts. In addition, comparisons among mosques located in different geographical regions would enable a clearer assessment of the impact of spatial and cultural context. Furthermore, to broaden the theoretical boundaries of the concept of "sacred biophilia," it is important to conduct interfaith comparative studies encompassing different types of sacred buildings, such as mosques, churches, synagogues, and temples. Such studies may reveal how biophilic design principles function within diverse religious rituals and symbolic systems.

The data was collected over a two-month period on different days and times of the week. Therefore, environmental differences caused by seasonal changes throughout the year could not be included in the analysis. Such temporal and environmental variables have the potential to influence individuals' biophilic perceptions and sacred space experiences. Therefore, it is recommended that seasonal environmental variables throughout the year be taken into account in future studies.

6. Conclusions

Anatolian Seljuk architecture exhibits an eclectic character, shaped by various architectural traditions, cultures, and regional geographic influences. The spaces designed in this style embody architectural qualities that convey symbolic importance and functional utility. This architectural viewpoint indicates that space is regarded not merely as a physical environment for shelter or worship, but as a multifaceted, layered construct that shapes user experience and generates significant interpretive meanings.

This study set out to empirically examine whether biophilic design features in historic sacred architecture mediate spiritual experience, using the 13th-century Yivli Minaret Mosque as a case study. Three principal findings emerge from the analysis. First, the BID-M assessment revealed that Anatolian Seljuk sacred architecture achieves biophilic qualities through what we term indirect biophilia—the evocation of nature through material texture, light modulation, geometric pattern, and place-based symbolism rather than through literal natural elements. This finding necessitates a conceptual expansion of biophilic design theory, which has predominantly theorized direct nature exposure (vegetation, water, natural views) as the primary mechanism. In sacred architectural contexts, symbolic and material representations of natural order may function as equally potent biophilic stimuli. Second, the mediation analysis demonstrated that the relationship between perceived biophilic qualities and spiritual experience operates through nature-relatedness and perceived restorativeness as sequential mediators. This mechanism suggests that biophilic features do not directly induce spiritual states; rather, they first cultivate a psychological sense of connection to the natural world, which subsequently enhances restorative perception, ultimately facilitating spiritual experience. This sequential pathway has significant theoretical implications: it positions nature-relatedness not as a trait variable but as a malleable psychological state that architectural environments can actively cultivate. Third, the moderation analyses revealed two boundary conditions. The negative relationship between educational attainment and spirituality scores, despite higher biophilic perception among postgraduate participants, suggests that cognitive-interpretive frameworks shape how environmental qualities translate into spiritual meaning. Additionally, the diminished biophilic benefits among frequent mosque attendees point to habituation effects that attenuate the restorative–spiritual pathway over time. These findings indicate that the spiritual efficacy of biophilic design is contingent upon user characteristics and temporal dynamics of space–user interaction.

These findings advance biophilic design theory in three respects. First, they establish empirical grounds for distinguishing direct from indirect biophilia, demonstrating that the latter operates effectively within historically and symbolically dense architectural contexts. Second, they specify the psychological mechanism (nature-relatedness leading to restorativeness) through which biophilic features influence spiritual experience, moving beyond correlational claims toward process explanation. Third, they identify education level and visitation frequency as moderating variables, suggesting that biophilic design effects are not universal but rather interact with individual cognitive and experiential characteristics.

For architectural conservation, these findings provide empirical justification for preserving the material and spatial integrity of historic sacred structures. Interventions that

alter natural lighting conditions, replace traditional materials with contemporary substitutes, or modify spatial proportions may inadvertently disrupt the biophilic–spiritual pathway documented here. For contemporary sacred architecture, the study suggests that incorporating symbolic natural references, natural material textures, and carefully modulated natural light may enhance spiritual experience without requiring direct natural elements that may be impractical in urban contexts.

In conclusion, this study demonstrates that the biophilic qualities of 13th-century Anatolian Seljuk architecture continue to mediate spiritual experience through identifiable psychological mechanisms. The persistence of these effects across eight centuries suggests that the Seljuk architects intuitively understood principles that contemporary biophilic design theory is only now articulating systematically. In this respect, historic sacred architecture constitutes not merely a heritage to be preserved but a repository of design knowledge that can inform contemporary practice. The longstanding recognition, from antiquity to the present, that spiritual experience is inseparable from its spatial context suggests that integrating biophilic principles into the design of contemporary religious buildings can create environments that are not only restorative but also profoundly meaningful in spiritual terms.

Author Contributions: Conceptualization, A.D., R.E. and R.O.; methodology, A.D. and R.O.; software, R.O.; validation, A.D., R.E. and R.O.; formal analysis, R.O.; investigation, A.D., R.E. and R.O.; resources, R.E. and R.O.; data curation, R.O.; writing—original draft preparation, A.D., R.E. and R.O.; writing—review and editing, A.D., R.E. and R.O.; visualization, R.O.; supervision, A.D. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of Akdeniz University Scientific Research and Publication for Science and Engineering (protocol code: 1352519 and date of approval: 16 October 2025).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Acknowledgments: We are also thankful to the anonymous reviewers for their insightful comments, which helped improve this paper. The authors have reviewed and edited the output and take full responsibility for the content of this publication.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

ART	Attention Restoration Theory
PRS	Perceived Restorativeness Scale
BDS	Biophilic Design Score
NRS	Nature-Relatedness Scale
BID-M	Biophilic Interior Design Matrix

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