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Biophilic wisdom of the thirteenth and fourteenth century Seljukians' Mosque architecture in Beyşehir, Anatolia

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ABSTRACT

Modern life is becoming disconnected from nature. Yet many scientific studies suggest that people feel better at places where they can engage with nature, or in places designed with nature in mind. This study is about Biophilia, one of the new design trends that connects the built environment to nature. The studies conducted in this field show that the existing historical buildings are fascinating thanks to their biophilic characterization. The basic idea of this research suggests that this effect is high in the thirteenth and fourteenth-century's buildings in Anatolia which are influenced from admiration of nature in the Sufism belief in Seljuks. Within this scope, the conformity with the biophilic criteria was determined to examine by the Eşrefoğlu Mosque, Bayındır Mosque and Köşk Mosque. Eşrefoğlu Mosque, in particular, was found to be a reference building in terms of biophilic design and the reason behind that is its harmony with nature.

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Fondness for historical buildings through the concept of biophilia

Experience and knowledge enable people to be creative and unique and also provide them access beyond the limits of their own biology. Their development and change have been influenced by many things around them. Especially getting in touch with nature enlightens people through the experiences they live in nature. Indirect, incidental and intentional interaction with nature ensures the human's psychological well-being, cognitive ability, spiritual and social well-being, physical health, and also tangible assets (Keniger et al. 2013).

After industrialization and modern architecture, people have gained an ability to strongly isolate themselves from nature and henceforth people have once again started to actively seek out interactions with nature. Especially with the awareness of problems arising from the weakening bonds between man and nature, various architectural approaches have been emerged to restore the balance with the connection of nature. In recent years, several studies have been undertaken that bring out the user preferences to reveal the advantages of the environment (Benyus 1997; Ma 2011; Attia 2016; Ragheba, Hisham, and Ghada 2016). One of the contemporary architectural initiatives on this subject is biophilic design.

Biophilia was first introduced in 1964 and represented the opposite definition of necrophilia. Erich Fromm describes biophilia as 'the passionate love of life and of all that is alive' (Fromm 1964). Ecologist and sociologist Edward O. Wilson, who improved the concept of biophilia in the 1980s, defines this as; 'innate tendency to focus on life and lifelike process' (Wilson 1984), 'inborn affinity human beings have for other forms of life, an affiliation evoked, according to circumstances, by pleasure, or a sense of security, or even fascination blended with revulsion' (Kellert and Wilson 1993). In this direction, this idea has found its place in many disciplines including biology, psychology, environmental sciences, neuroscience, medicine and design.

The most important contribution of this concept in terms of architecture is that 'human inherited certain features in nature that appeal to be aesthetically pleasant to mankind, despite differences in demographic factors such as culture and ethnicity' (Gullone 2000; FitryRosley, AbdulRahman, and Lamit 2014). On this base, biophilic design is a new approach of design which takes the advantage of nature and natural things for creating living spaces.

Biophilic architecture suggests that it is possible to meet the basic needs of people by connecting the buildings to nature, in other words, by ensuring the harmonization of buildings with nature. In this context, Cramer and Browning (Cramer and Browning 2008) defined three basic categories to get in touch with nature and these terms can be defined as main patterns for biophilic design. The categories which are 'Nature in the Space, Natural Analogues and Nature of the Space' include 14 subtitles as seen in Table 1.

'Nature in the Space' is basically providing contact with nature through the senses in designed space. Studies in medicine and psychology have indicated that direct connection with nature reduces stress, increases the cognitive performance and causes positive emotional reactions (Kaplan and Kaplan 1989; Lohr, Pearson-Mims, and Goodwin 1996; Kellert, Heerwagen, and Mador 2008; Alvarsson, Wiens, and Nilsson 2010; Barton and Pretty 2010). It facilitates the communication and the experiment chance with nature; it brings in nature through the five senses. Atrium gardens, green walls, aquariums, vistas and

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Table 1. Main patterns for biophilic design (Cramer and Browning 2008).

Nature in the space	Natural analogues	Nature of space
Visual Connection with Nature	Biomorphic Forms and Patterns	Prospect
Non-Visual Connection with Nature	Material Connection with Nature	Refuge
Non-Rhythmic Sensory Stimuli	Complexity and Order	Mystery
Thermal and Airflow Variability		Risk/Peril
Presence of Water		
Dynamic and Diffuse Light- Connection with Natural Systems		

daylighting systems are giving the opportunity for the physical presence of nature. 'Natural analogues' can be defined as 'objects, materials, colours, shapes, patterns, and algorithms that evoke nature' (Ryan et al. 2014). The objects that resemble or are similar to nature in terms of quality, appearance and structure are used in design to enable people to communicate with nature. The use of natural materials or texture and also the use of a dynamic hierarchy of nature as an organic design pattern can be an example of this. There are also some researches on the relationship between biological response and biomorphic forms, patterns, materials connected with nature, complexity and order (Lichtenfeld et al. 2012; Salingaros 2012). The term 'nature of space' is the use of reflection of what nature makes us feel into the space design. Oversized windows, open-plan spaces, curved edges, dark shadows, etc. can be used on this pattern and human beings give the similar biological response like the direct connection with nature (Wang and Taylor 2006; Grahn and Stigsdotter 2010).

Wisdom is a cognitive ability to make a good judgment and decision, besides it is accumulated knowledge that society or culture has collected over time. Biophilic wisdom can be gained through our experience or knowledge acquired from connections with nature and other forms of life (Huelat 2008; Kakoty 2018). Besides in controlling and managing the environment, biophilic wisdom is the ability to comprehend and establish the system according to the cause–effect relationship of analyses and it synthesizes the interaction of the events occurring in the environment. Biophilia is a new concept but biophilic wisdom has already been accumulated in many communities and they use this wisdom at various points of life as a consequence of the experience gained through engagement with nature. All values, beliefs and even art products that arise as a result of interaction with the environment constitute biophilic wisdom for this environment.

At this point, Appleton and Hildebrand, biophilia theoreticians, assess the predisposition of the human being to nature through seven elements which can be found in nature. They define these elements as prospect and refuge, order and complexity, and enticement and mystery, Savana like environment (Appleton 1975; Hildebrand 1999). Kellert, Salingaros, Joye and Christopher Alexander defined some points and strategies in order to involve them in architectural designs (Alexander 2002; Joye 2007; Kellert, Heerwagen, and Mador 2008; Salingaros 2010). According to these works, elements of biophilia-based architectural criteria are compiled and explained in Table 2 as settings. These elements, which show a biophilic character, are described in Ramzy's research taking into consideration important historical buildings and the studies conducted on them. In his research, Ramzy manifested that people have a fondness for

Table 2. Elements of biophilia-based architecture (Ramzy 2015).

	Criteria			
	Prospect and Refuge	Complexity and order	Enticement and mystery	Savanna like environment
Strategies	Larger space with raised ceilings	Connective Symmetry/Hierarchy	Opportunities for exercising imagination	Exposure to natural light
	Wide views on surrounding spaces	Universal Scaling	Details and diversity	Wide/open spaces with Topographic variations
	Elevated site and Balconies	Fractal	Kinetic systems	Real or symbolic trees
	Increased lighting conditions	Theory of centres	Partially visible areas	Deep overhanging eaves
	The geometry of Golden Ratio	The geometry of Golden Ratio	Overhanging balconies or elevated	Alcoves and recesses
	Courtyards	Quasi-crystalline structure	Passageways	Anti-Gravity elements
	Reducing lighting conditions			Petrification
	Small windows enclosed by thick walls			Courtyards
	Petrification			Column, with base, stem and crown
Settings	High ceiling in the main area flanked by lower aisles	Ornaments, mosaics, stained glass and tiling	Triforium	Canopy-like branching structures
	Courtyards with Fountains	Modular System	Automated operable systems	Palm vaulting-domes – rotundas
	Ornaments (vegetative elements)	Orders	Overhanging balconies and pulpits	Colonnaded layered terraces
	Columns and interlocking arches (tree-like)	Human scale	Grand staircases	Building into the land, not on it.
	Views to a distant scene through arches or arcade	Cascade of niches	Light/ shadow effect	Lighting through dome's base
	Enclosing windows by thick walls along lower sides while increasing lighting conditions in the central area,	Repetitive arches, domes and spires on different scales	Strong contrasts of planes that reflect and refract light	Aligning with astronomical events
		Stalactites	Drawbridges and Open elevators	Floral and foliage motives
		Domed structures	Retractable/ folding roofs	
		Volutes – Penrose pattern – Phil. symmetry	Rotating structures	

historical buildings since they present biophilic patterns (Ramzy 2015).

In this phase, when people enter in the majority of historical buildings, they feel good without knowing the reason and connected with these buildings through romantic feelings. It is hard to explain the reason behind that but many studies show that these buildings have a particular connection with nature and this connection affects us in a positive way (Milligan 2007; Birol Akkurt 2012; Mayes 2018). Throughout the history of architecture, designers searched for ways to emulate nature and create similarities of excellence captured in nature on their designs. These routes actually correspond to the biophilic design principles.

Since biophilic wisdom is the accumulation that societies have gained over time as a result of their interaction with nature, it will be guiding us in the construction of our relations with the environment in today's architecture with the knowledge how this accumulation was used and applied in the historical buildings. This study was carried out to illustrate the reflections of the consciousness of biophilic design on spatial reproduction through the beliefs that accept the superiority and healing of nature.

Background for the biophilic research related to Seljukians' Mosque architecture in Beyşehir, Anatolia

Religious buildings throughout history have been the centre of social and cultural life and occupied an important place in the life of societies. Communal life has been structured around these buildings which are reflections of their collective wisdom and cultural background. These buildings provide insights into the societies' perceptions of life.

In the ethical point of view, the relation between human and nature is discussed in anthropocentric (homocentric, altruistic) perspective and non-anthropocentric (biocentric, ecocentric, holistic) perspective (Kellert and Wilson 1993; Palmer 2017). In the non-anthropocentric point of view, human societies are seen as dependent on nature and all relations in nature are considered holistically. The idea of holism in religion is found in the philosophy of mysticism.

Sufism is defined as Islamic mysticism (Ashraf 2012) and it is not considered as a separate entity from Islam. It is the life of Islam or the realization of Islam. It is a way of looking at life. Especially in the thirteen century, the Seljuk Empire became a sanctuary for various Sufism movements escaping from the Mongol invasion. It is seen that this situation was supported by the state administration during the Seljuk period. As a result, Seljuk architecture was strongly affected by Islamic Sufism. Seljuks interpreted and represented this movement in accordance with their own cultural accumulation (Ögel 2008). Consequently, the connection with nature in Seljuk architecture is evaluated taking into consideration the impact of the Sufism movement. Sufism has the principle of establishing a love connection between man and God, who creates the universe. Nature is perceived as a work of God, and all beings are seen as a light of God that covers the universe, which is called 'absolute beauty' (Bilqies 2014). It is believed that the universe was created according to a geometric plan so this geometry is sacred and it can be observed in nature (Hejazi 2005). For this reason, especially in Islamic works, there is a tendency to use items of nature which are in harmony with the geometric rules.

In Islamic art, the mosque is considered as an extension of nature and the architecture of the mosque ought to make a return to the essence of nature with a design that is related to the principles and regularities of nature without using the forms of nature one by one. It sees ecological harmony as the nature of spirituality and uses the essential elements of air movement, temperature, light and water in building design (Nasr 1987). Seljukian art has emphasized devotion to Islam but also stylized old myths and Christian influences can be observed (Ögel 2008). An important example of this is the crown gates of the mosques in the Seljuk's architecture. It is a common belief in Muslims to see the doors of the mosque as the gates of heaven. In many verses of the Qur'an, heaven is described as a garden of trees that do not exist in the world. In the art of Seljuk, both the tree of life from Turkish mythology and the fantastic plants symbolizing heaven are seen together. One of the most beautiful examples of this is the Great Mosque of Divriği (Kuban 2001). Seljuk Architecture has an architectural manner where prehistoric images together with Sufi mystery find a comfortable living environment.

The mosque architecture has been examined by taking into account the effects of religious perspective. There is a similarity between the interpretation of nature in Sufism and the biophilic perspective. The relation between religions and ecology were discussed in different articles and books (Foltz, Denny, and Baharuddin 2003; Grim and Tucker 2014; DeLong-Bas 2018). However, the biophilic wisdom that exists in the field of architecture has not been discussed according to this basis.

Within this context, this research was initiated with the idea that the biophilic design criteria could be observed intensively in the Seljuk Architecture. The period of Eşrefoğulları (Esrefids) principality (thirteenth and fourteenth century) is considered as Seljuk Renaissance in terms of stone, wood and hand-carved work. At that time period, Eşrefoğulları Principality gave particular importance to culture and art. They brought the best artists (stone, wood and tile masters) to work in the region. Therefore, the thirteenth and fourteenth-century mosque architecture in Beyşehir Region which brings the connection with nature prominently in Turkish-Islamic architecture was chosen as a case study, after all this architecture sets a very good example of buildings which make us feel good due to their aesthetic aspects through biophilic criteria.

Selection of the case studies

The thirteenth and fourteenth-century Anatolian Mosque Architecture was specially chosen in this study on the basis of their biophilic potential. It is not a review on historical buildings but the case studies are conducted on historical buildings. First, historical information about these buildings is given, in order to bring to light the background; afterwards the assets of these elements are examined in the buildings.

In the thirteenth and fourteenth centuries, Anatolia was in a very complicated political situation. In the thirteenth century, there were Seljuk, Ilkhanid, Byzantine and Trabzon Greek Empires in Anatolia and the Seljuk Empire was the most

dominant one. This period has been represented as the initial of Turko-Islamic style in Anatolia. After the end of the Seljuk Empire in 1243, many emirates were established in Anatolia. One of the regional emirates established in Beyşehir is Eşrefoğlu Emirate. The architectural style of this Emirate is the continuation of the Seljuk architectural style due to its vicinity to Seljuk State's capital, Konya; however, it is not the reproduction of it (Karpuz 2004).

The mosque is a place for worship in Islam, which means to gather and to tot. Seljuk architecture, before arriving in Anatolia, was influenced by Iran-Islamic architecture so the mosque architecture, as well, was influenced by this region and shaped together with the cultural richness of Anatolia. As it was in Seljuk architecture, Anatolian Seljuk era mosques have been constructed by evaluating structural and material possibilities according to the climatic conditions (Karpuz 2004). Seljuks generally constructed monumental stone buildings and they also used wood, brick and earth-based materials in some parts of the constructions. The exterior walls of the mosques were made of stone. It is seen in the Seljuk mosques' plan types that planning in the direction of kibble with multi-columns or expanding in the width with the dome in front of the mihrab.

In the thirteenth century, multi wooden columned structure mosques are seen in the western part of Central Anatolia. In the Turkish-Islamic architecture, the history of wooden mosques is based on the Turkestan region (Aslanapa 1973). Concerning the construction of wooden hypostyle mosques in Anatolia, some researches state that Mongols invasion and the political situation in Anatolia were also effective in selecting this style of construction (Hayes 2010). Seljuks introduced the first and most magnificent examples of wood-bearing and ceiling mosque in Konya; Sahip Ata Mosque has become a pioneer work in this regard (Aslanapa 1971). The mosques to be examined within the scope of this study are the mosques with multi-columned harim places (praying area) perpendicular to the mihrab wall and with outer walls made of stone.

Esrefoglu Süleyman Bey Mosque (1296–1299) in Beyşehir and later Bayındır Mosque (1365) and Köşk Mosque (mid fourteenth cent.) in Beyşehir's villages were built in line with this tradition. Plan drawings, external and internal views of mosques can be seen in Figure 1. Esrefoglu Süleyman Bey Mosque, Bayındır Mosque and Köşk Mosque were built by the same political power which was one of the Anatolian Emirates trying to control the area after the big Seljuk Empire. These mosques are evaluated within the scope of this study because they have similarities due to their construction time and typology.

Esrefoglu Süleyman Bey Mosque, built by Eşrefoğlu Süleyman Bey (1296–1299) is in the great mosque category according to literature (Kızıltan 1958). Its square plan covered with a dome is accepted as the first step towards the concept of a unifying place in mosque architecture. The mosque was built in the south–north direction in accordance with a trapezoidal plan, just because the north-eastern corner was cut off due to the city square and road (Karpuz 2009). It is accepted as the largest

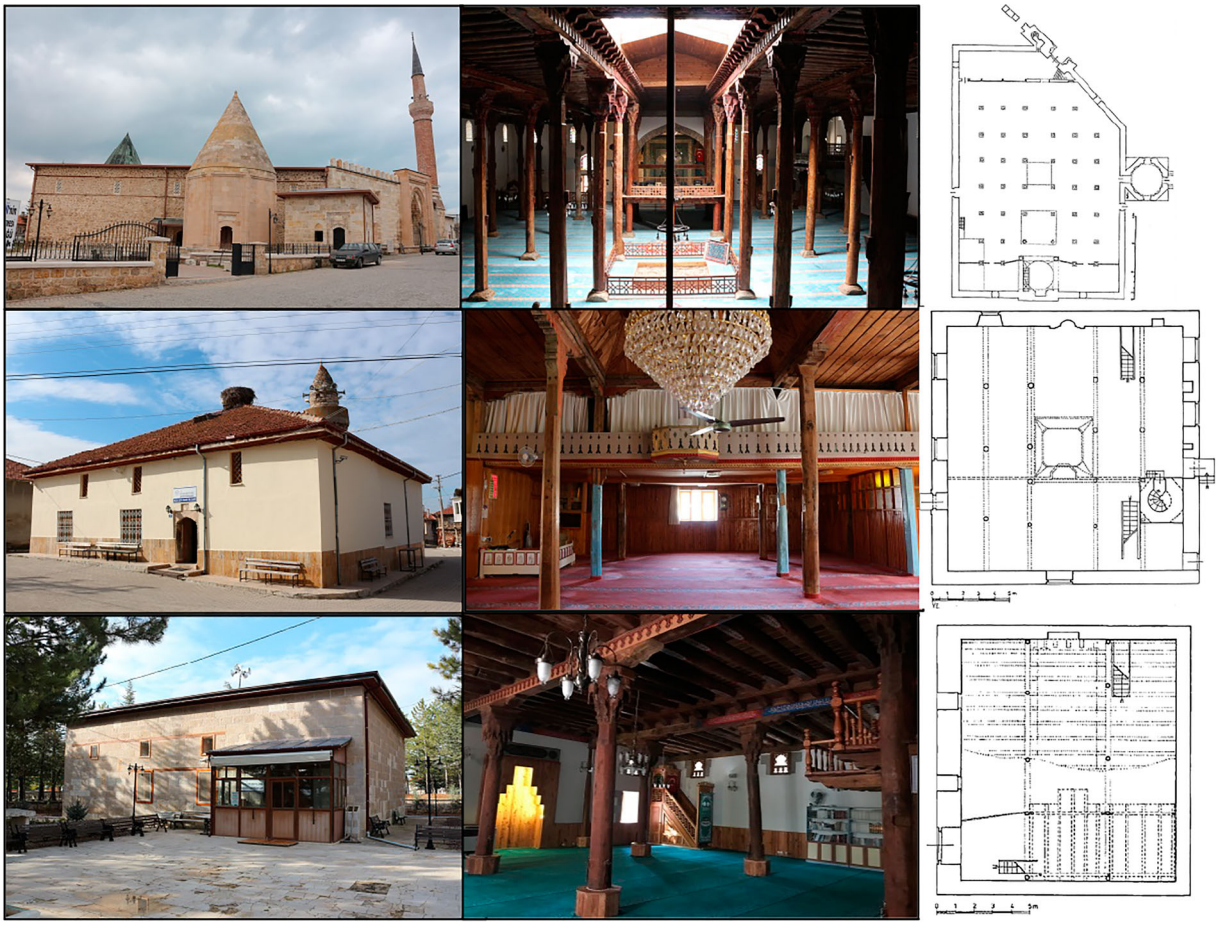


Figure 1. Plan drawings (Çaycı 2008), external and internal views of Esrefoglu Suleyman Bey Mosque, Bayindir Mosque and Kosk Mosque (top to bottom).

mosque of the wooden columned flat-ceiling in Anatolia with the dimensions of 31.77 × 46.55 m. It has three entrances from east, west and north direction. The main entrance to the harim place is a crown gate measuring 7.05 × 10.10 m in the north-east (Çaycı 2008). The decorative arts such as stalactites (muqarnas), floral decoration and geometric compositions which are formed by cutting stone give monumental value to the crown gate. East, West, South facades are built with rubble stones and bounding beams are used to increase the resistance. The windows for the lighting of mosque area are arranged in 2 rows, 4 at the bottom and 31 at the top, and also there is roof lighting with a roof lantern. The roof of the mosque was built as a flat earth-sheltered during the first construction period but after restoration, it was covered with a slightly inclined metal roof (Karpuz 2009). The interior plan of the mosque was designed by separating the seven naves with six support lines placed perpendicular to the southern wall (mihrab) and also adding the portico courtyard. After the north-east crown gate, the nostalgic interior door of the portico courtyard serves as the main entrance to the harim area. The harim part of the mosque is made up of 44 wooden columns of pitch pine or spruce wood and they are 7.50 m long. The linear effect of the central nave of the harim is particularly noticeable since it is wider and heavier than the others and also the hand-carved ornament enriched on top of this nave and snow pool under the roof lantern are remarkable (Seçkin 2002). This snow pool located in the middle area serves as a water tank (şadırvan) to meet the water need. In the south-western corner of the structure, the wooden gathering place of sultans (sultans' mahfil) is located and it is reached through wooden stairs. Rectangular shaped, glazed tiled mihrab with muqarnas qavsara, geometric and vegetative composition ornament is placed on the southern wall of the central nave and its exterior dimensions are 4.60 × 6.05 m. Eşrefoğlu Mosque seems like a Turkish wood art museum in terms of rich wood and tile workmanship (Çaycı 2008).

Bayındır Mosque (1365) is located in Bayındır village, which is about 5 km far from Beyşehir. The Bayındır Mosque has a square plan with 17.10 × 17.15 m dimensions (Karpuz 2009). There are two entrances on the eastern and western facades which open to the harim area. The main entrance on the eastern wall is made of flattened arched and ashlar stone. The windows are arranged as five on the east wall, three on the western wall and two on the south wall. The minaret of the mosque is located next to the western door of the harim and is made of rough ashlar stone; it has an octagonal body and a conical cone. The mosque is covered with a rubble roof on top of stone walls and has a flat earth ceiling (Erdemir 1985). The interior design of the mosque was created by dividing five naves with wooden columns that extend perpendicularly to the mihrab wall. As it is in Eşrefoğlu Mosque, the central nave appears to be more widespread when compared to the side naves. The load-bearing wooden columns are about 4.50 m high; the columns in front of the mihrab have a stone pedestal and a muqarnas head and others have profiled head. Half cylindrical niche carved on the southern wall forms the mihrab. The women gathering place (women's mahfil) is situated in the north (Karpuz 2009). In the centre of the harim, a lacunar ceiling is placed to symbolize the dome. The ceiling beam is covered with wood and stands on wooden columns and the body wall of the mosque. Inside the building, there are wooden hand-carving decorations and painted samples with herbal and geometric motifs (Erdemir 1985).

Köşk Mosque (mid fourteenth century) is located in an old cemetery at the entrance of Köşk village which is 27 km far from Beyşehir (Karpuz 2009). The mosque known as Acem Nasuh mosque is like the miniature of Eşrefoğlu Mosque. It represents the traditional mosques with the wooden column and ceiling built in the XIVth century. Köşk Mosque has a rectangular plan with an outer dimension of 13.65 × 15.60 m. The building was built in the north–south direction and there is only one entrance to the harim place from the north end of the western wall. There are five windows on the west wall, four on the east wall and four on the south wall. The properly bonded rubble stone walls are built with the support of wooden horizontal beams. In the past, there was an earth shelter but now it has a hipped roof. The harim plan of the mosque is divided into three naves with two rows of wooden columns. Load-bearing wooden columns with stone pedestal and muqarnas head are 4.15 m high (Önge 2006). The main nave is wide and one step higher than the others as a continuation of the tradition. Excavations show that the mihrab and pulpit were made from plaster. There is women gathering place (woman's mahfil) on the north side of the building. The ceiling beam covered with wood stands on wooden columns and the body wall of the mosque. Inside the mosque, there are hand-carved ornaments with herbal and geometric compositions (Karpuz 2009).

Research method: biophilic criteria considered in mosques

These three mosques are historical buildings hence they should be evaluated within the context of their history and philosophy. At this point, it is stated in Onay's research that the studies analysing historical buildings should review and evaluate these structures as a whole and then the characteristics of the interiors of buildings should be examined in detail (Onay Sağlar 2019). The contexts, tectonic orders and spatial organizations of the case studies are evaluated on a preferential basis.

Eşrefoğulları (Esrefids) principality was in fact geographically very close to the capital city of the Seljuk Empire. Mosque architecture bears particular significance for them since this type of public buildings serves as an expression of their religious beliefs. The effects of Islam religion on art and architecture can be seen dominantly in this type of buildings. Islam architecture has especially engorged itself with the beauty of nature. The perfection of natural geometry was emphasized. The buildings are generally in a simple form from outside but their insides offer very rich spaces.

Basically structural capacities of natural materials determine the tectonic order of these mosques. Architectural elements are in conformity with the principles of gravity. The envelopes of the buildings are stone and this establishes visual and ecological harmonious relation with the environment. Natural material, wood was used extensively also by Turks and became one of the indispensable building materials in Anatolian Seljuk architecture as well. The tradition of wooden construction was in fact brought by Turks from Central Asia to Anatolia and wood was used in the load-bearing system and in the other building elements as well. One of the best examples of this type of construction is the

wooden columned mosques. These mosques made of untreated timber give the impression of a forest and evoke positive feelings in people when they enter in them.

As to their spatial organization, the main praying area is arranged with wooden columns perpendicular to the mihrab wall. Special gathering areas (woman's or sultan's mahfil) are located in the side parts of the space. The place was designed only to serve for praying, therefore the plan schema was arranged to include a big praying area without any visual connection barriers.

In this study, the headings of evaluation are determined as the effects of biophilic architectural elements on space which creates the feeling of being in nature. These effects are 'prospect and refuge', 'complexity and order', 'enticement and mystery', 'Savana like environment' (Ramzy 2015). The biophilic design criteria in the conceptual background are analysed under these four titles and their relation with mosque architecture is discussed in the second part of the evaluation. The characteristics of the interiors are assessed in details, taking into account the materials and human scale. The data are obtained as a result of the field study and then it is verified by literature. The field study is based on the observation and the documentation of the observations. Moreover, the measurements were taken from the drawings.

'Prospect and refuge' theme in the mosques

'Prospect and refuge' rule, on the one hand, allows retrieving information about the environment, on the other hand, it refers to the setting that provides shelter and protection (Appleton 1975). Psychological studies have shown that space which has 'Prospect and refuge' features evoke feelings of safety or relaxation while cause stimulation and excitement (Kaplan and Kaplan 1982). This factor can be evaluated under seven titles and these three mosques are analysed according to them as seen in Table 3.

Large space with raised ceilings constitutes one of the important strategies of this rule. These mosques are high-ceiled buildings, given the ratio of ceiling height to the floor. In Eşrefoğlu Mosque the ceiling height is 7.5 m and the other mosques have more than 4 m ceiling height. The mahfil areas located above the eye level offer a big perspective from all directions to the harim area so all three mosques are arranged in a similar way on this base. As it's the case in many historical buildings, given the construction techniques applied in that time period, the stone envelope walls of three mosques are very thick (average 1 m) and small proportioned window places on those walls give the refuge effect from inside. On the other hand, water and vegetative elements bring along a satisfactory view inside the building. 'High ceiling in the main area flanked by lower aisles' is a setting which ensures the prospect and refuge view. The central nave of mosques is more widespread than the side naves and it is highlighted in the schemas.

As being the great mosque, Esrefoglu Süleyman Bey Mosque has as a snow pool with roof lantern in this nave. This snow pool in the middle of the Esrefoglu Mosque offers a nice viewpoint and also increases the lighting conditions with the open lightning area on top of it. Actually, this type of pool area can be seen as small atrium areas in the mosques. In addition, this mosque presents nice petrification examples at the entrance areas such as; palmette, lotus and gregorian motifs on the crown gate. Other petrification examples can be seen at the bay in front of the mihrab (mihrapönü) such as palmette motif. Vegetative ornaments are used in the decoration of central nave's ceiling and pulpit of the mosque appears as wooden hand carving.

'Complexity and order' theme in the mosques

Complexity is 'the quality of being intricate and compounded' and defined a measure or a criterion of detail and the diversity in which comparison and/or selection is possible (Kaplan 1988). The order is described as a desire for pattern, structure, arrangement and symmetry that collect these details in one whole (Salingaros 2010; Ramzy 2015). Regarding this criteria, connective symmetry/hierarchy, universal scaling, fractal, theory of centres, the geometry of golden ratio, quasi-crystalline structure can be seen as ornaments, mosaics, stained glass and tiling, modular system, orders, human scaling, cascade of niches, repetitive arches, domes and spires on different scales, stalactites, domed structures, volutes – Penrose pattern – philotaxian symmetry in buildings. This organized complexity tools connect the observer visually, emotionally and viscerally with the buildings (Salingaros 2014). The evaluation of these criteria is presented in Table 4.

Connective symmetry is the 'richness of sub-symmetries throughout different levels of a scaling hierarchy. The density of sub-symmetries and their intensity inside each scale and across all the scales are what lead to visual coherence' (Kellert, Heerwagen, and Mador 2008). In the dome of the bay in front of the mihrab in the Eşrefoğlu Mosque, there is a composition made of glazed brick-tile six-armed stars and a good example of connected symmetry. In this strategy, the stalactites on arching of the crown gate, tiled mihrab and wooden column headers in Eşrefoğlu Mosque can exemplify. When Eşrefoğlu Mosque is evaluated, it is observed that the human scale was applied according to the comparison among the double arched crown door (measured in-situ inner arch height 8.30 m, flat arch inner height 3.00 m), the tiled mihrab (width 4.60 m, height 6.05 m) and wooden stalactites of mihrab (width 1.43 m, height 2.55 m) in the portico courtyard.

The fractal term is derived from the Latin word 'fractus', which means broken or fractured. Irregular details or patterns repeat at smaller scales and they can continue to exist in abstract object forever; so when a part of each piece is enlarged, the result looks similar to the whole. It is thought that Eşrefoğlu Mosque reflects the fractal geometry with thirteen rows of stalactites in the crown gate, six rows of stalactites in the crown gates' side wings, eight rows of stalactites in tiled mihrab at harim area, third or two rows of stalactites in the columns header. Stalactites in the wooden columns header can be observed also in Bayındır and Kosk Mosques.

Cristopher Alexander defines the centre as;

> a distinct set of points in space, which, because of its organization, because of its internal coherence and because of its relation to its context, exhibits centeredness, forms a local zone of relative centeredness with respect to the other parts of space. (Alexander 2002)

Table 3. Evaluation of strategies and settings for 'prospect and refuge' theme in Esrefoglu Suleyman Bey Mosque, Bayindir Mosque and Kosk Mosque.

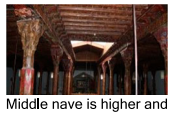
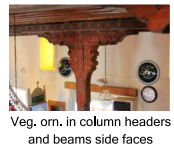
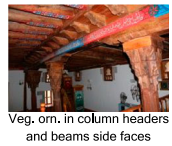
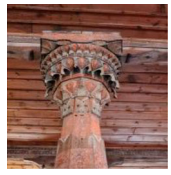
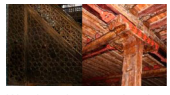
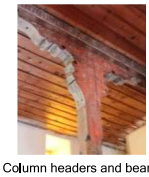
		Esrefoglu Suleyman Bey Mosque	Bayindir Mosque	Kosk Mosque
STRATEGIES	Larger space with raised ceilings	 High ceiling onto harim	 High ceiling onto harim	 High ceiling onto harim
	Elevated site and balconies	 Mahfil areas in harim	 Mahfil area in harim	 Mahfil area in harim
	The geometry of golden ratio	 Golden ratio between crown gate and mihrab	–	–
	Small windows enclosed by thick walls	 Windows above eye level on the harim wall	 Small windows at harim area	 Small windows at harim area
	Petrification	 Petrification on gates	–	–
SETTINGS	High ceiling in the main area flanked by lower aisles	 Middle nave is higher and biger	–	 Middle nave is is wide and one step higher
	Courtyards with fountains	 Under the roof latern snow pool on the middle nave	–	–
	Ornaments (vegetative elements)	 Veg. orn. in tile mihrab, wood pulpit, ceiling beam	 Veg. orn. in column headers and beams side faces	 Veg. orn. in column headers and beams side faces
	Columns and interlocking arches (tree-like)	 Coloumns and interlocking arches in Sultan mahfil	–	–
	Views to a distant scene through arches or arcade	 Entrance wiew from porticco courtyard	–	–
	Enc.wind.by thick walls along lower sides while inc.lighting cond.in the central area	 Roof latern on the middle nave	–	–

Table 4. Evaluation of strategies and settings for 'complexity and order' theme in Esrefoglu Suleyman Bey Mosque, Bayindir Mosque and Kosk Mosque.

	Esrefoglu Suleyman Bey Mosque	Bayindir Mosque	Kosk Mosque
Connective symmetry/ hierarchy	 Dome onto the bay before the mihrap	–	–
Universal Scaling	 Crown gate and coloumns from mahfil area	–	–
Fractal	 Tile Mihrab and wooden coloumn headers	 Wooden coloumn headers	 Wooden coloumn headers
Theory of centres	 Bay before the mihrab	–	 Ceiling of middle nave
Quasi crystalline structure	 Dome onto the tomb	–	–
Repetitive arches, domes and spires on different scales	 Rep. arches on diffferent scales in crown gate	–	–
Stalactites	 Skalactites from crowngate and coloumns	–	–
Volutes – Penrose pattern – Philotaxian symmetry	 Wood pulpit, column headers and beams side faces	 Column headers and beams side faces	 Column headers and beams side faces

The first step in mosques associated with the centres' theory strategy were the designs of the great mosque typology whose central courtyard was brought to a square plan and covered with a dome to central volume. The period that gave the first separation in the mosque typology and showed centripetal tendency clues to a collective place with the dome on the bay in front of the mihrab is seen in Eşrefoğlu Great Mosque. It also shows the secondary centre emphasis with the higher and wider central nave than the others. Köşk Mosque also gives a centralized emphasis with its wide and high central nave. However, this feature was not found in Bayındır Mosque.

Quasi-crystal structures are the models in which the patterns and cycles of the universe are expressed. This pattern has a transformational symmetry feature that completely fills a void but is specific to real crystals and fractals. The shifting of this image on itself in two dimensions does not give the exact same image but with the rotation, they give a similar image. The central 'core' shape on the dome of the Süleyman Bey tomb, which is connected to the Eşrefoğlu Mosque from the eastern wall, was found to be proportional to the whole of the pattern, and it is seen that the pattern does not give exactly the same image but the image becomes the same by its rotation. This structure was not found in other mosques.

The geometric ornaments can be seen in the lead work of the upper stained-glass window on the outside load-bearing wall, on the wooden mahfil railings, on the wooden puller, in the dome on the bay in front of the mihrab, in the wooden columns header and beams of the Esrefoğlu Mosque. The faience mosaic tiles in the pointed arch of the harim entrance door and tiled mihrab at harim area can also be seen as an example. The domed construction on the bay in front of the mihrab is located on the southern wall of Eşrefoğlu Mosque. This maqsura is formed by one dome which is carried by arches and four-foot masonry and two of them are free. The inside of the dome is made of glazed brick and tiled material. The structural inner form was transformed from square form to dome by triangular trumps and covered with a pyramidal roof. Repetitive arches can be seen in a depressed arch entrance under the round arches in the crown gate of the Eşrefoğlu Mosque.

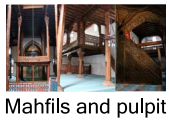
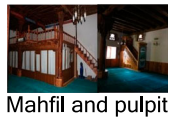
The spiral is coming from the 'Spira' in Latin. Spiral, one of the mathematical products of the Golden Ratio and its associated Fibonacci Series, is frequently encountered also in nature. Fibonacci series were found between the thirteen rows of stalactites on the crown gate and 8 rows of stalactites on the mihrab wall in Eşrefoğlu Mosque (1, 1, 2, 3, 5, 8, 13 . . . .). The spiral and curved based decoration, which forms the basis of the Ionic arrangement, is called 'volute'. The volute folds were superficially engraved between the two Rumi motifs on the third border of the side wings of the crown gate of the Eşrefoğlu Mosque. It is interpreted that the profiled pillows on wooden column headers in the mosques resemble the head of the ionic column.

Sir Roger Penrose developed the nature-based non-periodic geometric pattern with folded symmetry and the golden ratio in the form of floral design of it. There are two rhombic patterns with one's angles 36 and 144 and the other one's angular 72 and 108 (two golden triangles on the base tab). This feature emerges as 'girih' (complex wall decorations) in the mosque architecture. The Penrose patterns are located at the mihrab, at the pulpit and on the pointed arch of the harim entrance door in Eşrefoğlu Mosque. This geometric motif composition contains; half-hexadecimal on the border of the pointed arch, half-hexadecimal on the tiles of the mihrab, and eight-armed stars on the pulpits side mirror. Phyllotaxis symmetry is based on the regular arrangement of the plant's lateral organs. Phyllotaxis symmetry is divided into two types of symmetry, spiral and whorled. There is a combination of both spiral and whorled phyllotaxis also in nature. This dynamic symmetry is seen in the dome of Süleyman Bey Mausoleum, and in cosmic ornaments of stars arms at the dome on the bay in front of the mihrab. Besides, the existence of dynamic symmetry was found in the crown door's and mihrab's stalactites and in the cells of wooden columns headers.

'Enticement and mystery' theme in the mosques

Enticement describes the desire to explore and the desire to expand knowledge. Buildings provide this by offering the chance of running your imagination in response to natural details and diversity. The 'mystery' in Hildebrand and Appleton's model reflects the desire to challenge and strangeness (Kellert, Heerwagen, and Mador 2008). In architectural work 'enticement and mystery' is provided by triforium, overhanging balconies

Table 5. Evaluation of strategies and settings for 'enticement and mystery' theme in Esrefoglu Suleyman Bey Mosque, Bayindir Mosque and Kosk Mosque.

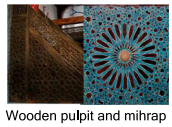
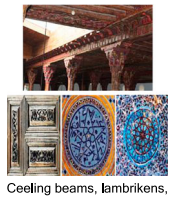
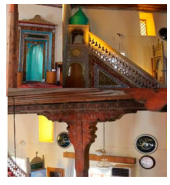
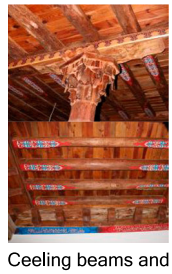
	Esrefoglu Suleyman Bey Mosque	Bayindir Mosque	Kosk Mosque
Overhanging balconies and pulpits	 Mahfils and pulpit	 Pulpit and Mahfil	 Mahfil and pulpit
Triforias	–	–	–
Light and shadow effect	 Latern on the middle nave	–	–
Grand staircases	–	–	–
Strong contrasts of planes that reflect and refract light	 Crown gate,mihrap, coloumns	 Wooden coloumn headers	 Wooden coloumn headers
Kinetic systems	–	–	–

and pulpits, grand staircases, light and shadow effect, strong contrasts of planes that reflect and refract light and some kinetic systems (Ramzy 2015). The evaluation of these criteria is presented in Table 5.

Women's, sultan's and muezzin's mahfils, portico courtyard, maqsura in Eşrefoğlu Mosque; women's mahfil in Bayındır Mosque and mahfil in Köşk Mosque generate partly visible areas through lodging and balconies arrangement. Triforium (triple arch) is not observed in the Mosques. The purpose of making the grand staircase is to invite users to go up the stairs, thus it should be designed as an attractive object but in these mosques, there isn't any grand staircase. The arrangement of light and shadow effect, which ensures that people sit in partial darkness area and have direct view lines to the centralized lighting areas, can only be seen in the ceiling rise of the Eşrefoğlu Mosque on the nave with the lantern. The light reflecting and breaking planes are created by simulating the decorative elements such as stalactites seen in Islamic architecture, impressing the light and distributing it and reflecting it on the surface with bright materials.

This feature can be seen in the stalactites of the tile mihrab, in the wooden embossment of the pulpit, on the rosette/embossment inside of the crown door arch surface, in the embossment of arch corner in the window near to crown gate, in the embossment of entrance on the west wall of the Eşrefoğlu Mosque and also the stalactites of wooden columns headers in all of the mosques. Kinetic systems such as opening and closing bridges, open elevators, swivel structures, gatherable foldable roof arrangement aren't observed in these mosques.

Table 6. Evaluation of strategies and settings for 'Savana like environment' theme in Esrefoglu Suleyman Bey Mosque, Bayindir Mosque and Kosk Mosque.

	Esrefoglu Suleyman Bey Mosque	Bayindir Mosque	Kosk Mosque
Column, with base, stem and crown	 Load bearing wooden coloumns and stone bases	 Load bearing wooden coloumns and stone bases	 Load bearing wooden coloumns and stone bases
Canopy-like branching structures	–	–	–
Palm vaulting-domes – rotundas	 Dome on the bay before the mihrab (maqsura)	–	–
Colonnaded layered terraces	–	–	–
Building into the land not on it.	–	–	–
Lighting through dome's base	 Latern in the harim area	–	–
Aligning with astronomical events	 Wooden pulpit and mihrap	–	–
Floral and foliage motives	 Ceeling beams, lambrikens, window openings,rosebud	 Mihrap, pulpit and ceelings beams	 Ceeling beams and lambrikens

'Savana like environment' theme in the mosques

According to 'Savana like environment' theory, the human brain is designed for and adapted to the conditions of the ancestral environment in which they evolved. It is thought that the deep tendencies of people to nature come from their past based on the African Savanna Environment. The savanna environment contains low trunks, broad canopies and a moderate layering. This environment can be created in architecture with wide and open spaces, variations in the architectural topography, clusters of real or symbolic trees columns, deep overhanging eaves, alcoves and recesses, and cave-like masses of stone (Hildebrand 1999; Ramzy 2015). Floral and foliage ornaments reflect the simplest form of this strategy. On this base according to Ramzy's work, a column with base stem and crown, canopy-like branching structures, palm vaulting-domes–rotundas, collonaded layered terraces, lighting through dome's base, aligning with astronomical events, floral and foliage motives ensure this strategy in historical buildings (Ramzy 2015). The evaluation of these criteria is presented in Table 6.

Trees are the elements of nature which move in the opposite direction of gravity and they were accepted as the staircase to the sky in ancient beliefs. A column with its base, stem and crown reflects the power of a tree. Columns of most historical buildings conform with this formation. The wooden columns and beams located at the harim parts of Eşrefoğlu, Bayındır and Köşk Mosques create the forest affect with rough real pitch pine and spruce tree.

Being able to see the different colours of daylight during the day makes us feel the savanna type environment. With the roof lantern in the middle of the Eşrefoğlu Mosque, daylight changes during the day can be felt in the space. Furthermore, this place provides natural ventilation with a canopied area. The architectural arrangement connected to astronomical events such as solstice or equinoxes affects the people in a positive way. In Eşrefoğlu Mosque symbolized astronomical events can be seen on the side mirrors of the wooden pulpit and in the embossment of the tiled mihrab. The composition on the side mirrors of the wooden pulpit is thought to symbolize the whole universe with the sun, world and moon and the embossment of the tiled mihrab represent the sun.

Composition of plant motifs like; lotus, palmette, rumi, acanthus, rosebud, twisted branches, frequently seen in historical buildings, appear in Eşrefoğlu Mosque; as hand-carved embroidery on the ceiling with wooden beam; alto-rilievo on wooden beams, on the crown gate, on the face of window borders, on stone based supports and; in the form of carved plantal ornamentation on tiled mihrab and arch before entering to harim area, on the wooden platform, on its pulpit, on its railings, on column caps and on window-gate sashes. There are not any deep overhanging eaves in the mosque architecture of this area in that century. In addition, there are not any collonaded layered terraces. 'Building into the land, not on the land' techniques are not used since the mosques are on the flat areas. The maqsura is covered by one dome which provides the volume switch to centre from the four corners plan.

Conclusion

The biophilic criteria discussed in this study is evaluated through the thirteenth and fourteenth-century Eşrefoğlu Süleyman Bey, Bayındır ve Köşk Mosques located in Beyşehir. It is a well-ascertained fact that these mosques have biophilic features. This concept emerged during the twentieth century from the studies of biophilia theorist Edward O. Wilson, had been consciously implemented in the thirteenth and fourteenth¯century architectural works in line with internal impulses and building traditions. Especially Esrefoğlu Süleyman Bey Mosque is considered to have a reference building character.

It is a widely held view that the biophilic criteria found in the Anatolian Seljuk architectural works continue in the Ottoman architecture as a follow-up tradition. Thus, this matter can be examined in more details with future studies. Yesil Mosque-Bursa (1419), Selimiye Mosque-Edirne (1569-1575), Topkapi (1478) and Dolmabahçe Palace-Istanbul (1856), Sultan II. Beyazid Ottoman Hospital-Edirne (1484-1488), Mihrimah Sultan Madrasah-Istanbul (1547) and many other historical works in different functions are considered to be designed according to biophilic principles and it has commonly been assumed that the construction tradition was preserved in this direction. On the other hand, in other religious buildings belonging to the religions which have a holistic view such as Buddhism, Taoism, Hinduism may also be evaluated and some reference buildings can be defined.

The results of this study reveal the fact that the hearts of historical buildings highlight nature and space quality. In light of history, today, emphasizing nature ensures also the preservation of the environment, always in line with plan decisions.

Bringing the aesthetic image of nature in the buildings make people feel calm and comfortable. When the proportional and aesthetic qualities of nature are ignored; the work results as 'building' rather than 'architectural design'. On this base, the form and balance in natural relations can be invigorated in today's architecture, this would indeed strengthen people's relationship with nature. The strategies and arrangements of biophilic design in accordance with the historical architectural works enable the architects to find new ways in today's architecture.

The biophilic wisdom which has already been stored in our cultural root of architecture should be analysed in depth. As a consequence, the concept of connecting people to nature should be applied in our architectural work today. Climatic design decisions, minimum energy and local materials can be applied to new designs with the space quality which can be shaped with biophilic patterns such as 'nature in the Space, natural analogues and nature of the space'. Furthermore, the new age construction and design techniques or tools (such as parametric design) can help to carry the magnificent designs of nature to the architecture.

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