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Original Research Article

An Analytical Study of the Geometric Decoration Patterns (Gereh-Chini Art) of the Minbar of the Oljaito of Isfahan Jame Mosque

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ABSTRACT

Geometry in architecture is used as a tool to create diversity in designs, which is a highly significant topic. Wooden "minbars" are one of the special elements of Islamic art in Iran, showcasing creativity, innovations, and the beauty of wood craftsmanship. The Grand Mosque of Isfahan, with several wooden minbars constructed in different periods, holds special value for the study of the decorations of historical minbars. Among these is the Minbar of Oljaito, located in the Oljaito prayer hall of the Grand Mosque of Isfahan. In this research, the authors aim to analyze the structure of the wooden decorations of this minbar. Research question of this article is: 1. What are the characteristics and features of the geometric decorations of the Oljaito Minbar of the Grand Mosque of Isfahan? 2. What innovations do the Oljaito Minbar of the Grand Mosque of Isfahan exhibit based on its technical and artistic features? The objectives of this research include geometric analysis, understanding the geometry of Gereh, and examining the physical and aesthetic characteristics of the Oljaito Minbar and its innovations based on the technical and artistic features of this artwork. This study employed a descriptive-analytical method. The Minbar of the Grand Mosque of Isfahan was analyzed qualitatively using library, documentary, and field data. The findings of this article show that the Minbar of the Grand Mosque of Isfahan is decorated with "Gereh Hasht" and "Tabl", "Dahe Kond" and "Shol", ten slow knots, and "Hasht" and "ChaharLengeh". Ultimately, these geometric decorations are depicted and presented more precisely. The geometric analysis of the Gereh used in the Minbar of the Grand Mosque of Isfahan plays an important role in understanding the geometric decorations of its historical period. This analysis can lead to a better understanding of how wooden structures were constructed and designed in the past and contribute to preserving historical wooden decorations.

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Introduction

Among the artistic works of Muslims, the "minbar" stands out as one of the most important and distinguished elements. Minbars have been made in various forms of wood and stone, fixed or movable, and simple or ornate designs. Despite the primary usage of minbars in mosques, Muslim artists have always sought to embellish these works with beautiful artistic motifs. Verses of the Quran and prophetic traditions, the names of creators, and the construction dates are inscribed on the minbars.

Geometric decorations ("Gereh") are among the most distinctive and complex forms of decorative art in Islamic architecture, which have been employed in a specific and delicate manner in historical buildings in Iran, especially the Grand Mosque of Isfahan. Studying and analyzing these geometric decorations in the Minbar of the Grand Mosque of Isfahan can provide valuable insights into artistic and architectural skills. The Grand Mosque of Isfahan, one of the most significant examples of Islamic architecture in Iran, contains intricate and delicate geometric decorations (Gereh) in various sections, including the minbar, which warrants special study and examination. These geometric decorations are significant not just artistically and aesthetically, but they can provide valuable information about architectural techniques and decorations (Pirnia, 2011).

The Minbar, as a practical, spiritual, and symbolic device, has always held a special place in the art of the Islamic period. The exquisite decorations of minbar are considered masterpieces of Islamic art that have endured through the centuries in Islamic lands (Mohammadi, 1996, 5). Most studies conducted on Minbars have focused on the history of construction, wooden decorations, religious significance, and the types of materials used in them. Through the analyses and classifications conducted in this research, the researchers can extract deeper layers of the significance of the design and execution of minbars and recognize the interaction between form, function, and symbolism in Islamic architecture. This research aims to offer insights into the technical value and aesthetic evolution of decorations in geometric decorations of r in Iranian architecture.

Since Isfahan is one of the prominent Islamic cities known for its unique minbar, this research aims to analyze the geometric decorations of the Oljaito Minbar of the Grand Mosque of Isfahan. The study intends to highlight and emphasize the hidden artistic values in one of the mosque's elements and establish a purposeful model for familiarizing and categorizing its decorations.

The research objectives include geometric analysis, understanding the geometry of Gereh, and examining the physical and aesthetic characteristics of the Oljaito Minbar of the Grand Mosque of Isfahan and its innovations based on the technical and artistic features of this artwork. The questions addressed in this research are:

1. What are the characteristics and features of the geometric decorations of the Oljaito Minbar of the Grand Mosque of Isfahan?
2. What innovations does the Oljaito Minbar of the Grand Mosque of Isfahan exhibit based on its technical and artistic features?

Research Background

Muslim historians have mentioned the Prophet's minbar in Medina as a trunk of a date palm tree placed in the mosque where he leaned while speaking. Another minbar from the early Islamic period is the Minbar of the Grand Mosque of Girvan, dating back to the Umayyad period, with pieces of it preserved in the Cairo Museum (Hillenbrand, 2008, 85) (Fig. 1).

The Minbar of the Grand Mosque of Abyaneh, dating back to 466 AH, belongs to the Seljuk period (Khansari, 1999, 222), making it the oldest existing minbar in Iran (Fig. 2). This minbar, however, also features inscriptions from two other dates, 1009 and 1310 AH, on its support base and the third step (Mollazadeh & Mohammadi, 2000 58). Only fragments of the Seljuk era's minbar remain and were incorporated into the newly established minbar during the Safavid period; this minbar was also substantially restored during the Qajar period. A remarkable wooden minbar from the Ilkhanate era has been identified in the Grand Mosque of Naein (Mehrpouya, 1997, 200). The Minbar features beautiful inscriptions in Naskh script with the date 711 AH carved into its base, indicating that it was added to the building complex in the 8th century AH and still displays influences from Seljuk art with geometric and floral decorations (Maurice Sven, 1977, 123). The Minbar of the Grand Mosque in the village of Surian in Bavanat, Fars, is the most significant wooden work with geometric designs, perforations, and wood carvings from the Timurid period. This Minbar, constructed upon the orders of Khwaja Mozaffar Al-Mulk in 771 AH, contains inscriptions from the Holy Quran, the date of its construction, the name of the builder, and the

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Fig. 1. The Minbar of the Great Mosque of Kairouan, 1929 CE. Source: www.collections.vam.ac.uk.

Fig. 2. The Minbar of the Great Mosque of Abyaneh, 1397 SH. Source: www.lastsecond.ir.

names of the donors (Sarikhani, 2005, 63). Among the notable remaining minbars from the Safavid period is the intricately carved wooden Minbar of the Grand Mosque of Eqlid in Fars Province, which features an inscription with the date 1008 AH (Maleky Gholandoz & Mohammadi, 2012, 8).

Despite the rich history of arts related to Gereh in the architectural decorations of Iran and the artistic and architectural works produced during various periods, only a few studies have focused on the ideas behind sketching backgrounds, motifs, structural and technical characteristics, and their artistic values. For this reason, this research aims to analyze and discuss the subject from a different perspective regarding geometric Gereh, proportions, placement logic, and execution techniques employed. Among the published research in this field are articles such as "An Analysis of Contributory Factors in the Formation of Carpentry Latticework," by Majid Fathizādeh (2021) and "Analysis Geometric knots used in the tomb of Shah Ismail Safavid," by Moradian Gojehbaglo & Abdullahi Fard (2021), " The Technology of Wooden Knot-Making in the Historical Houses of Gorgan," by Gholami et al. (2016), and "Study of Geometric Patterns of Qajar Windows in the Shafahi House of Amol" by Shamekhi & Magholi (2021), alongside books collecting and reviewing decorative motifs and their execution, such as "Gereh-Chini in Islamic architecture and handicrafts" by Hossein Zomorshidi (1986), " Revival of lost arts: Basics of traditional architecture in Iran according to Professor Hossein Lorzadeh," by Raeeszadeh & Mofid (2005), " Grate lignee nell'architettura safavide: studi e restauri a Eṣfahān," by Roberto Orzai (1976), which provides a report on the restoration of geometric artworks from the Safavid period by an Italian group, and "Workshop of Wooden Handicrafts" by Ghobad (2015), which discusses construction techniques.

For minbars, research such as "The Research of the Features & Esthetic of Mshkol Pulpit, the Masterpieces

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of Wood working in Islamic World" by Maleky Gholandoz & Mohammadi (2012) addresses one of the minbar containing artistic, technical, and historical values, and " The Wooden Minbar of Pachenar Veshnoeh Mosque in Qom " by Kazem Arab (2016), which reviews the physical characteristics, technical features, and inscriptions of the Minbar.

Findings

• Geometric patterns

Gereh is a type of architectural decoration in Iranian art, formed based on specific rules using straight lines to create Gereh motifs. Gereh can be executed on all surfaces using various materials such as wood, ivory, plaster, tiles, bricks, and stone, either individually or in combination (Sha'rbaf, 2006, 9). The first phase, which involves the preliminary work and drawing, is considered a type of technical drawing in traditional Iranian architecture (Zomorshidi, 2006, 55).

Zomorshidi (ibid.) categorizes Gereh into three categories: architectural Gereh, woodworking Gereh, and Gereh used in handicraft and decorative arts, dividing them into two methods used in carving and latticework. The common Gereh in architecture is also used in carving, referred to as solid knotwork or motif and lax[1]. In solid knotwork or motif and lax, wood pieces are cut into various shapes and then carefully and delicately assembled through wooden joints to achieve the desired design.

- Structure

In most examples in Iran, minbars were made of wood. Wood is durable and pliable, and compared to stone types, its construction can be done in a shorter time (ibid., 302). The main advantages of wood include ease of use, availability, lightness, suitable resistance based on density, low thermal conductivity, and its natural coloring, which compensate for its disadvantages such as the possibility of breaking, burning, and, most importantly, vulnerability to moisture.

The artifact studied in this research, like most minbars in Iran's climate, is made of plane tree wood. Among the woods used in Iran, plane wood is utilized for making doors and windows due to its availability, long and uniform fibers, suitable durability, good finish, and medium hardness and strength. However, plane wood does not have high durability against insect attacks and tends to split significantly; it also has average capability in retaining nails (Fathizādeh, 2021, 4).

- Construction technology

Over the years, woodworkers have gained considerable experience and knowledge for executing these designs in the production process of wooden artifacts. Olearius (2000, 604) in his travelogue expresses astonishment at the beauty of the wooden carvings, and Jean Tavernier (1957, 596) describes Iranian carpenters as skilled in making doors and windows, stating they pair small wooden boards well and are extraordinary in this work despite not using the necessary tools. The main activities related to making wooden objects are categorized into four groups: cutting, shaping, and carving, fastening and joining, and finishing and surfacing. Moreover, these joints were made without nails and glue, allowing for the replacement and restoration of components over time.

• Isfahan's Old Grand Mosque

This mosque, with an approximate area of 20,800 square meters, is considered the largest mosque in Iran (Bamanian & Amini, 2011). Although the initial construction of this mosque dates back to the Abbasid period in 156 AH, it has undergone significant changes and developments during the reign of the Ilkhanids, Muzaffarids, Timurids, Safavids, and Qajars (Honarfar, 1971). The most important transformation in this mosque relates to the Seljuk period. During this period, the mosque deviated from the "Arab Mosque" model and established a new style by constructing four iwans in the four cardinal directions, known as the "Iranian Mosque" (Galdieri, 2013). This style was subsequently used in most grand mosques of major cities in Iran and even beyond its borders. The Grand Mosque of Isfahan contains outstanding examples of Iranian architecture, including various decorated brick piers with geometric patterns, brick columns with diverse sections, arches, and covering domes with different execution methods (Jabal Ameli, 2013).

In the north of the western iwan of the mosque, there is a small prayer hall from the Ilkhanid period, named "Oljaito Mosque." The plasterwork Mihrab of this mosque is considered one of the most exceptional examples of plasterwork in Iran. The construction of this Mihrab involved the use of floral decorations and inscriptions. According to the inscription on the central panel of the upper arch of this Mihrab, it was built during the reign of Sultan Muhammad Oljaito, on the orders of his Iranian minister named "Muhammad Savi" and supervised by Azad bin Ali Mastri in the year 710 AH (Pahlavan Alamdari et al., 2019, 3). This work was created by "Master Haidar the Plasterer from

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Isfahan." Some art critics have referred to the 8th century AH as the "Plaster Century" or "Plaster Era" (Vafaei, 2016, 87).

In this Mihrab, there are three carved wooden Minbars: one from the Safavid period, another from the Timurid period, and the third with an unclear date. The main minbar of the mosque is undated since the motif of the first Oljaito Mihrab can be seen on its body (Fig. 3), indicating that both were likely designed in the same period and by the same person.

- **Minbar of the Grand Mosque of Isfahan**

The Oljaito prayer hall is located adjacent to the western iwan of the Grand Mosque of Isfahan, situated in the northern section (Fig. 4). The famous Oljaito Mihrab is placed against the middle wall of the prayer hall and the western iwan (Fig. 5). The dimensions of the prayer hall are approximately 10 × 20 meters, with its length divided into five rows of small arches along the north-south direction, each designed with distinct geometric combinations. The geometric structure of the Mihrab is precisely based on golden ratios, which are known for their mathematical precision and aesthetic balance. The overall dimensions of the mihrab measure 6.5 meters in height and 3.3 meters in width.

- **Features and physical appearance of the Minbar**

The length of the Oljaito Mihrab's minbar is 192 cm, its width is 88 cm, and its height is 265 cm. This minbar has six steps with a height of 30 cm. It includes 7,233 wooden pieces, comprising 58 pieces for the main structure, 7,159 pieces for the knotwork, and 16 pieces for the step and main seat (Figs. 6, 7, 8). For the construction of the main structure of the Oljaito minbar, plane wood was used. Plane wood has a cohesive texture and high resistance. Other woods used in the decorative knotwork of this Minbar include walnut, jujube, and boxwood. This conscious choice of materials demonstrates the knowledge and expertise of the artists constructing the Minbar. For the construction of the Oljaito Minbar, the framework and main structure consisting of bases[2], crosspieces[3], and handles were first built. The Minbar bases were made from plane wood and interconnected by using the mortise and tenon joint method (Fig. 8).

- **Introduction of the Minbar's Gereh**

After constructing the main structure, various other components of the minbar were attached to the framework using the same mortise and tenon method, crafted from plane wood, jujube, boxwood, and walnut. The dimensions of the mortise and tenons

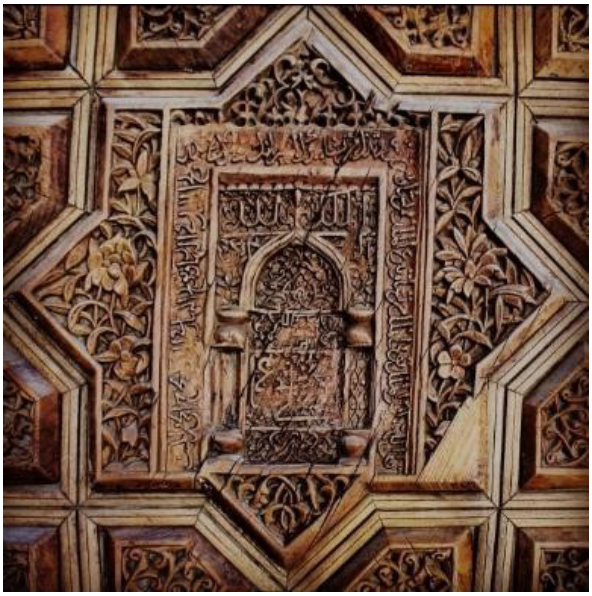

Fig. 3. The Minbar to the Right of the Mihrab of Oljaito. Photo: Reza Havaei Shamsabadi, 2022.

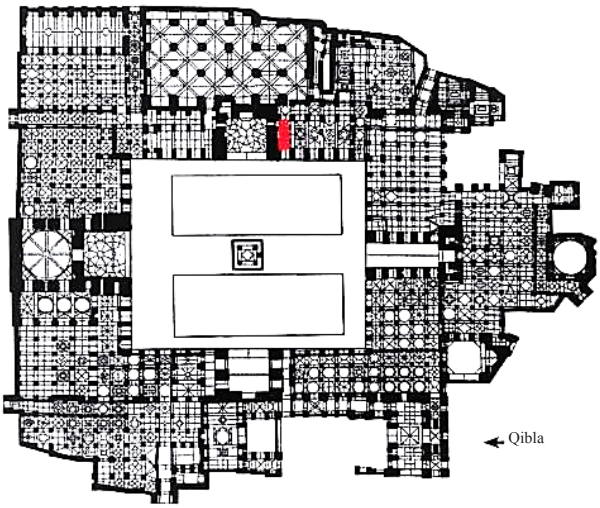

Fig. 4. Location of the Minbar in the Mosque. Source: Authors based on Pirnia, 2004.

Fig. 5. Mihrab of Oljaito. Photo: Reza Havaei Shamsabadi, 2022.

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Fig. 6. The Minbar of the Mihrab of Oljaito. Photo: Reza Havaei Shamsabadi, 2022.

vary based on the delicacy, aesthetics, and strength of each other. The solid Gerehs are of different dimensions, with the smallest Gereh measuring 2.5 by 2.5 cm and the largest measuring 60 by 60 cm. The smallest motifs measure 1.6 cm in length, while the largest measures 178 cm (Fig. 9). The existing Gerehs in the Minbar include:

- 2 base eight-faceted Gereh on the left and right sides of the Minbar: In a base divided by angles of 22.5, 45, 67.5, and 90 degrees, it utilizes motifs such as Shamse, Tabl, Zohre, SormeDal, and Sabonak.
- 4 base ten Tond Gereh in front of the steps: This type of Gereh is drawn on a base divided by angles of 18, 36, 56, and 72 degrees, classified as Tond Gereh, utilizing motifs such as Shamseh Tond, Toranj Tond, Mako, Daneh Balut, Shamseh Tah-Boride, Shesh-Band, Taragheh, and Panj Tond.
- 1 base Ten-Kond and Shol Gereh in front of the first step: This Gereh is also drawn on a base divided by angles of 18, 36, 56, and 72 degrees, classified as Kond and Shol Gereh, comprising motifs such as Shamseh Kond, Toranj Kond, Panj Kond, Panj Shol, Sormeh-Dan, Tabl, Giveh, and Shesh Shol.
- 1 base Ten-Tond Gereh at the crown of the Minbar: This is drawn on a base divided by angles of 18, 36, 56, and 72 degrees, classified as Tond Gereh, comprising motifs such as Shamseh Tond, Toranj Tond, Mako, Daneh Balut, Shamseh Tah-Boride,

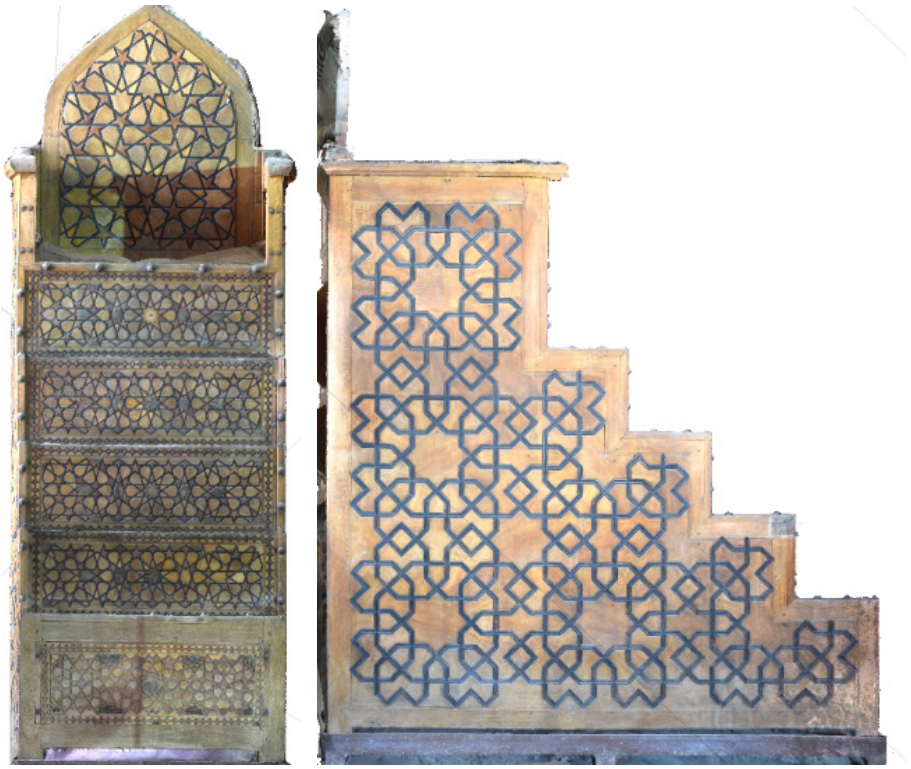

Fig. 7. Photogrammetry Scans of the Views of the Mihrab Minbar. Photo: Reza Havaei Shamsabadi, 2022.

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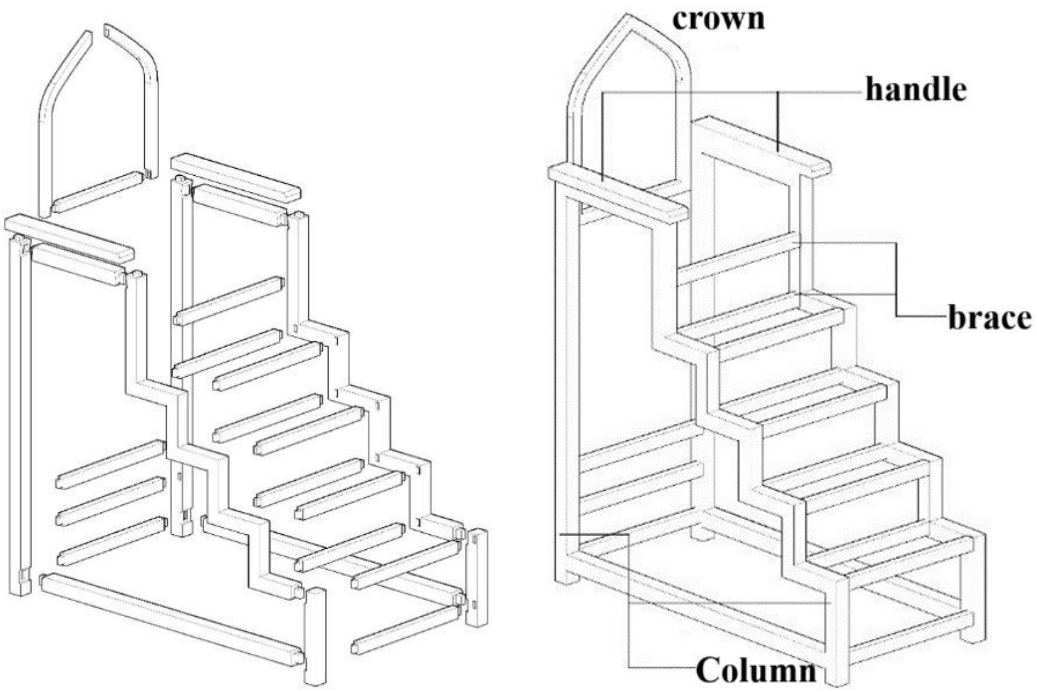

Fig. 8. 3D Modeling of the Main Structural Components of the Minbar. Source: Authors.

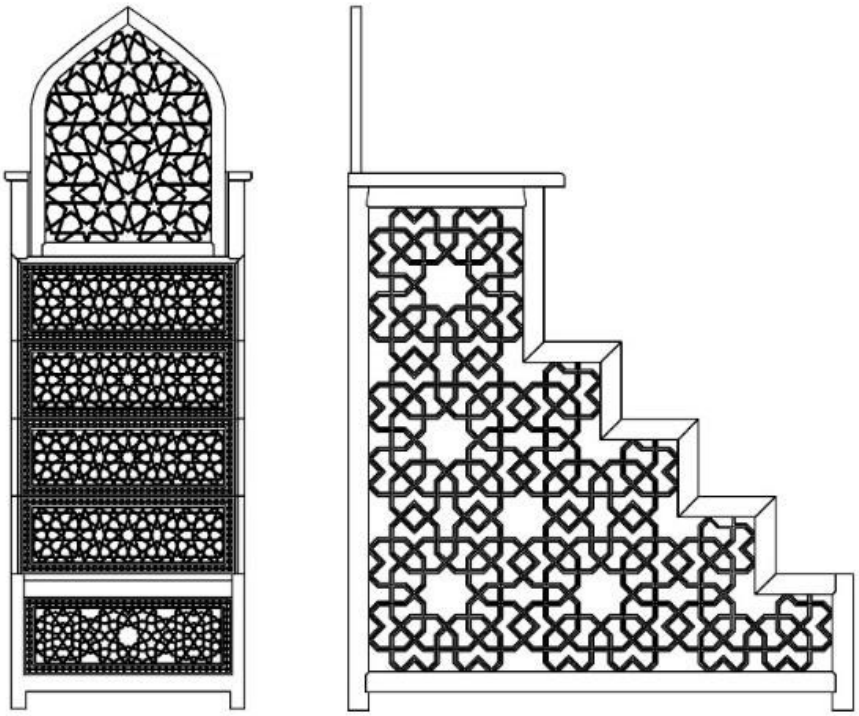

Fig. 9. Structure and Overall Form of the Minbar. Source: Authors.

Barg-Chenari, Shesh-Band, Taragheh, and Panj Tond. A remarkable feature of this Gereh is its design without a complete Ten-Tond Shamseh throughout the entire base.
- Hasht o Chahar-Lengeh Gereh on the margins of the front Gereh: This Gereh is drawn on a base divided by angles of 22.5, 45, 67.5, and 90 degrees, and consists of motifs such as Chahar-Lengeh and Nim-Hasht.

In Table 1, the method of drawing is generally presented and the aforementioned items are categorized.

Discussion

• Innovations based on the technical and artistic features of the minbar

On the border of the front steps, a Chahar-Lengeh

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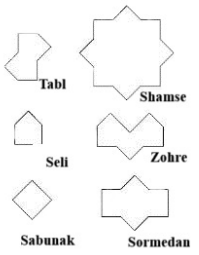
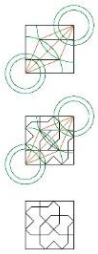
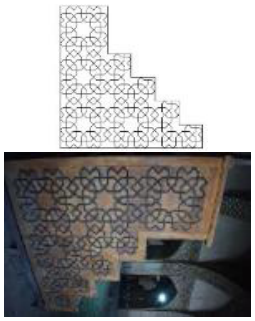
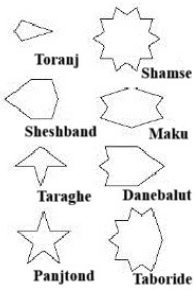
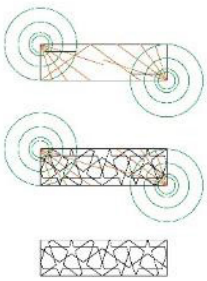
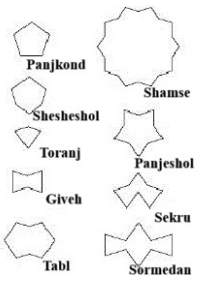
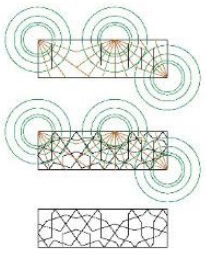
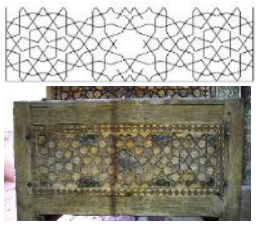
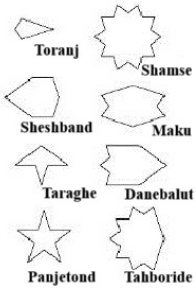
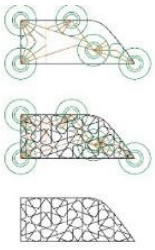
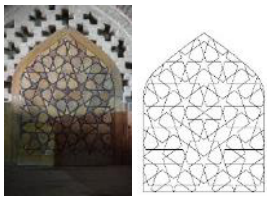
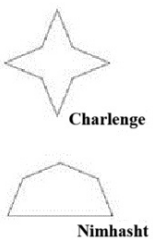
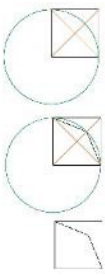
Table 1. Technical and Artistic Features of the Minbar. Source: Authors.

Row	Location	Gereh Name	Introduction	Components	Drawing Method	Drawing and Image
1	Sides	Hasht and Drum	-A background divided into angles of 22.5, 45, 67.5, and 90 degrees -It utilizes motifs such as Shamse, Tabl, Zohre, SormeDal, and Sabonak			
2	Front of the Steps	Dah Tond	-A base divided into angles of 18, 36, 56, and 72 degrees, which falls under the Tond Gereh category -Utilizing motifs such as Shamseh Tond, Toranj Tond, Mako, Daneh Balut, Shamseh Tah-Boride, Shesh-Band, Taragheh, and Panj Tond			
3	Front of the First Step	Dah Kond and Shol	-A base divided into angles of 18, 36, 56, and 72 degrees, which falls under the Kond and Shol Gereh category -Comprising motifs such as Shamseh Kond, Toranj Kond, Panj Kond, Panj Shol, Sormeh-Dan, Tabl, Giveh, and Shesh Shol			
4	Crown	Dah Tond	-A base divided into angles of 18, 36, 56, and 72 degrees, which falls under the Tond Gereh category -Comprising motifs such as Shamseh Tond, Toranj Tond, Mako, Daneh Balut, Shamseh Tah-Boride, Barg-Chenari, Shesh-Band, Taragheh, and Panj Tond			
5	Border of the Front Steps	Hasht o Chahar-Lengeh	-A base divided into angles of 22.5, 45, 67.5, and 90 degrees. -Consists of motifs such as Chahar-Lengeh and Nim-Hasht			

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Gereh has been repetitively designed and executed. Both very small dimensions and complex construction techniques showcase the artisan's mastery, creativity, and the high artistic value of the piece.

- On the sides of the Minbar, the Gereh-Chini has been designed and executed with an eight-pattern. Each corner of this base is capped with a quarter Shamseh or three-quarters Shamseh, indicating a complete and enclosed Gereh base.
- The front of the first step of the Minbar features a Ten-Kond and Shol Gereh without repetition throughout the base. The reason for the difference in the Gereh design of the first step compared to the others is its different usage; typically, the first step of the minbar serves as the seating area for preachers or mourners.
- The fronts of the second, third, fourth, and fifth steps (known as the deck of the minbar or the main seating area) are adorned with Dah-Tond Gereh designed proportionately without repetition throughout the base. This means that the section[4] of each area contains a quarter of that Gereh.
- The border of the front steps consists of repetitions of the Hasht o Chahar-Lengeh Gereh. The small dimensions of the components in this Gereh present considerable challenges in execution, necessitating a high skill level.
- The crown of the Minbar, constructed separately and affixed after the main construction process is complete, is also adorned with a pattern of Dah-Tond Gereh. The design of this section has a unique feature, aligning proportionately with the Shamseh at three corners, and the Gereh itself is enclosed without repetition on this base, without overlap or rotation[5].

Conclusion

The analysis of the decorative Gereh-Chini of the Minbar of the Oljaito in the Grand Mosque of Isfahan demonstrates that this artistic work is recognized not only as a masterpiece of art and architecture but also as a testament to the geometric capabilities and artistic skills of Iranian artisans. The use of diverse and intricate Gereh such as Hasht-o-Tabl, Dah-Tond, Dah-Kond-o-Shol, and Hasht-o-Chahar-Lengeh, showcases the unparalleled creativity and ability of artisans in executing geometric patterns.

One of the notable features of this research is the examination of the selection of suitable raw materials, especially plane tree wood in the main structure and walnut and jujube woods in the decorations. These precise choices, in addition to enhancing the durability of the structure, also significantly increased the beauty of the Minbar. The use of advanced construction methods, such as nail-less and glue-less joints, reflects the high mastery of carpenters over the technical and artistic principles of construction.

This research emphasizes that the analysis of geometric patterns in historical architecture can provide a deeper understanding of design and construction methods for wooden structures. The findings of this study can serve as a model for preservation, reconstruction, and inspiration in contemporary design. Thus, this study is not only beneficial for rebuilding historical works but also plays an important role in expanding knowledge of the art and architecture of Islamic Iran.

Conflict of Interest

The authors declare that there was no conflict for them in conducting this research.

Endnotes

1. "Alat" refers to the "Chine," encompassing the lines that constitute a design or pattern, while "Loqat" denotes the elements or pieces enclosed by the "Alats."
2. A piece of wood with a square cross-section, larger in size compared to other pieces, and positioned vertically.
3. A component that connects the bases and is positioned both horizontally and vertically.
4. A repeating unit in maps and designs.
5. To deviate a design or part of it from its original and standard form.

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