INTERNATIONAL JOURNAL OF CONSERVATION SCIENCE
ISSN: 2067-533X Volume 14, Issue 2, April-June 2023: 417-434 www.ijcs.ro
DOI: 10.36868/IJCS.2023.02.03

LEARNING FROM THE PAST: THE RECONSTRUCTION OF THE MINBAR OF SALAH AL-DIN IN AL-AQSA MOSQUE

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Abstract

The Minbar of Salah Al-Din is considered a masterpiece of traditional Islamic arts and crafts heritage. It stood in Al-Aqsa Mosque in Jerusalem for nearly 800 years until it was burned down completely in 1969. In 1993, King Hussein of Jordan gave instructions to initiate the process of reconstructing the Minbar based on old photos of the original one and small wooden pieces that remained after the fire. The reconstruction job was commissioned in 2002 and finished in 2006 as a replica of the original one. This paper discusses the lessons learned from the reconstruction process through the analysis of geometric principles and features of the design process and construction of the Minbar, towards the rekindling of this artistic heritage. The Minbar geometric patterns are constructed of many interlocking pieces of wood, each carefully carved to fit together like a three-dimensional puzzle. The novel contribution of this study is in the relationship between the geometric construction of the patterns and the Interlock (ta'sheeq) construction methodology. Which will hopefully provide a deeper understanding of the structure of the Minbar, allowing architects and craftsmen to achieve improved control over their new design's compositions and structure.

Keywords*: Minbar; Islamic geometry; Islamic pattern; Traditional craft techniques; Al-Aqsa Mosque; Salah Al-Din*

Introduction

The story of building the Minbar (pulpit) of Al-Aqsa Mosque in Jerusalem goes back to the Zangid Sultan Nur Al-Din (1118–1174 AD). Historical sources show that Nur Al-Din was connected to Jerusalem with a special status, both religiously and spiritually. For Muslims, Al-Aqsa Mosque is a site of special reverence as it marks the place from which prophet Mohammad ascended to heaven, making it the third most holy site in Islam. Instructions to construct a Minbar by Nur Al-Din (1160–1168 AD) to be placed in Al-Aqsa Mosque in Jerusalem were the plan of his preparation for liberating Jerusalem [1, 2]. Evidently, some inscriptions that have been found on the original Minbar revealed Nur Al-Din's eagerness and vision for liberating Jerusalem and bringing it back to Muslim rule. One of the inscriptions on the Minbar states that the construction of the Minbar had been commissioned by Nur Al-Din, as it reads: "Its construction has been ordered by the servant, the one needful of His mercy, the one thankful for His grace, the fighter of jihad in His path, the one who defends against the enemies of His religion, the just king, Nur Al-Din, the pillar of Islam and the Muslims, the dispenser of justice to those who are oppressed in the face of the oppressors, Abu Al- Qasim Mahamad bin Zangi bin Aq Sunqar, the helper of the Commander of the Faithful". The two dates engraved on

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the Minbar, 564 AH/1168–9 AD and 572 AH/1176 AD, state that the construction began at the time of Nur Al-Din and was completed in the reign of his son Al-Salih Ismail.

The work on the original Minbar started in the year 1168 AD by the master craftsmen of Al-Halawiyya craft School in the city of Aleppo/Syria and was finished after 8 years with full ornamentation. The craft school was famous for constructing Mihrabs and Minbars, which are spread in some mosques in Syria, Palestine, and Egypt [3, 4]. The master craftsmen of this school engraved their names on the original Minbar: "Made by Salman bin Maali, Hamid bin Dhafer, Abu Hassan bin Yahya, and Abu al-Fada'il bin Yahya Al-halabi" [3-5]. Historical references record that the Maali family was one of the most famous craftsmen involved in the construction of many rare Mihrabs and Minbars known for their outstanding design and construction (i.e., the Mihrabs of Nur Al-Din Zangi's Shrine (Aleppo), Al-Shafiee's Shrine (Cairo), and Prophet Abraham Shrine Mihrab and Minbar (Aleppo) [6, 7].

Geographers and historians recorded that the Minbar was rare in its "form and strangeness of manufacture", which have a distinctive artistic masterpiece with no match in the world and are regarded as the zenith of Islamic Art. This masterpiece of Islamic art heritage with a 4-metre width and 6-metre height was a rare monument formed from different kinds of wood, including Pine and Cedar for the main structure and Teak, Ebony, Mother of pearl, and Ivory for the intricate inlay work (Fig. 1). Ibin Jubair (a famous traveller from Andalusia, 1145–1217 AD), who visited Aleppo in 1184 AD, illustrates the uniqueness of the Minbar as one of the most famous Minbars ever made, best designed and constructed, and finest ever seen, crowned with stalactites (muqarnus) and fully carved and inlayed with ivory and ebony. He writes: "I have not seen in any other country a Minbar which resembles its shape and the uniqueness of its manufacture. It raises like an enormous crown above the Mihrab until it reaches the ceiling" [8].

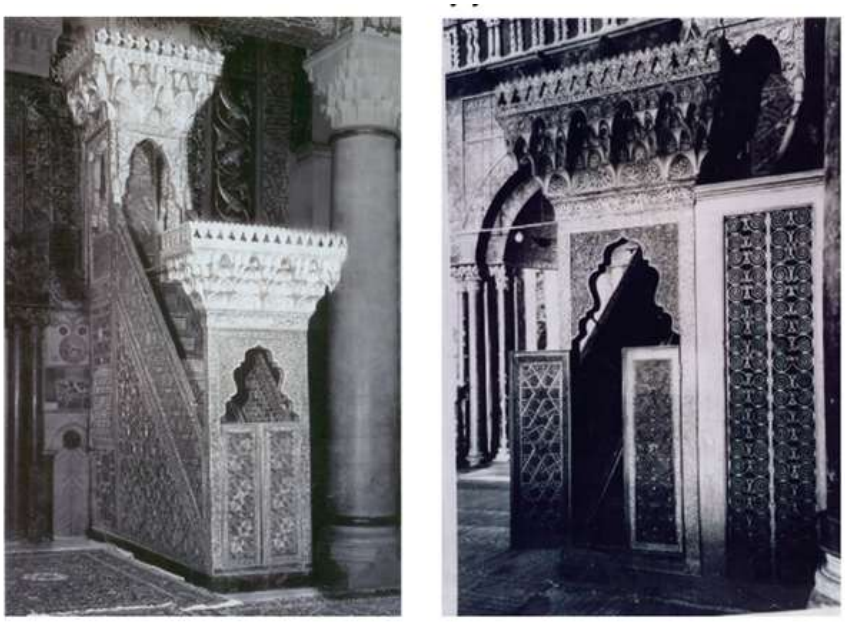

Fig. 1. Pictures of (the original) Nur Al-Din's Minbar at Al-Aqsa mosque - Jerusalem (Photograph in 1900). (Faculty of Islamic Arts and Architecture at WISE visual library)

Nur al-Din Zangi was unable to fulfil his wish to transfer this pulpit to Jerusalem. He died before it was liberated in 1187 AD. The Minbar was placed in the grand mosque of the city of Aleppo until Salah Al-Din (1137–1193 AD) recaptured the city of Jerusalem in 1187 AD,

and by that time the Minbar moved to be placed in Al-Aqsa Mosque to fulfil the promise of Nur Al-Din.

Imad al-Din al-Kateb (famous historian 1125–1201 AD) addressed the event of the Minbar when it was brought to Al-Aqsa Mosque, in which he writes: "By the light of his discernment, the just prince Nur Al-Din Mahmud bin Zangi had known in his time about the conquest of Jerusalem after him. So, he commissioned in Aleppo the making of a Minbar for Al-Aqsa Mosque in Jerusalem; architects, craftsmen, and carpenters laboured on it for years, and they made it outstanding in its solidness and decoration. That Minbar remained installed in the grand mosque of Aleppo, sheathed like a sword in the scabbard of protection, until the sultan (Salah Al-Din) conquered Jerusalem and ordered the fulfilment of Nur Al-Din's vow, and the Minbar was brought to its place in Jerusalem" [9]. However, Ibn al-Athir's (historian and biographer, 1160–1233 AD) record story of Nur Al-Din's Minbar seems more provoking and admiring. He states that when Sultan Salah Al-Din liberated Jerusalem, he ordered that a Minbar should be made for Al-Aqsa Mosque. He was told that Nur Al-Din had made a Minbar in Aleppo for Al-Aqs mosque, which was unlike anything made in Islam. By that time, Sultan Salah Al-Din ordered that it be brought from Aleppo and erected in Jerusalem [10]. From then on, it became known as the Minbar of Salah Al-Din, playing its part in the life of the mosque for the coming 800 years as a symbol of Muslim triumph. The construction of the Minbar and its placement in Jerusalem took more than twenty years.

Nur Al-Din had intentionally decided to construct a Minbar for Al-Aqsa Mosque due to the fact that the Minbar represents the second most important part of a mosque in Islamic tradition after the Mihrab. In addition, the Minbar would last for centuries, and this could be the most significant monument in Jerusalem. The Minbar remained in Al-Aqsa Mosque for about eight centuries, from 1187 AD, until it was destroyed and burned down completely with some sections of Al-Aqsa Mosque in 1969 AD by an Australian fanatic. On August 21st, 1969, Dennis Michael Rohan, a Jewish extremist from Australia, set the mosque ablaze. The fire he started destroyed the Minbar completely and caused this unique artistic heritage and eternal symbol to become ashes, leaving only a few small, charred pieces of wood (Fig. 2). A temporary substitute was put in place while a solution was sorted.

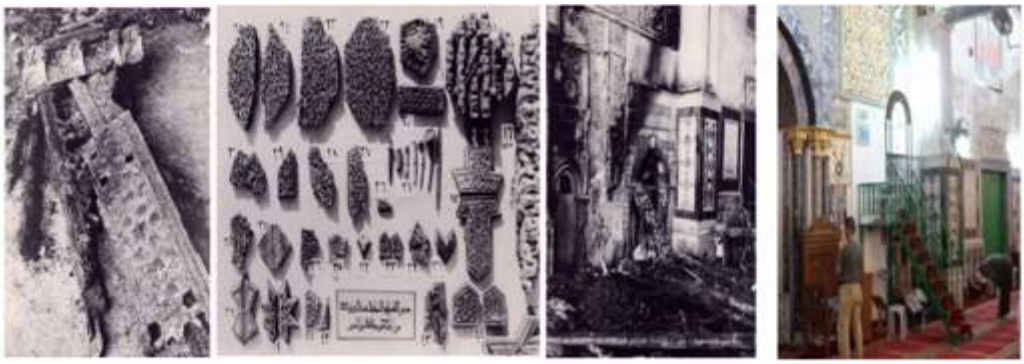

Fig. 2. A collection of panels formed from small and medium-sized pieces of interlocking cedar pinewood, presenting all that remains of the Minbar of Nur al-Din Zangi after the fire.
A temporary steel stair (Minbar) was placed at Al-Aqsa Mosque while it waited for the reconstructed one.
(Faculty of Islamic Arts and Architecture at WISE Visual Library)

There are several pertinent publications that are specific to the construction of the Minbar of Salah Al-Din. They are mostly emanating on a considerable scale from the following sources: first, studies that focus on the methodology of generating the geometric patterns in Minbar's panels. These studies present different levels of analysis for the geometric construction process of some patterns [11–16]. Second, the descriptive studies that present the

illustrations of the Minbar construction with simple geometric analysis (catalogue illustration) [17]. Third, studies with interest in the aesthetic and symbolic dimension of the Minbar's ornamentations [16-19]. None of these studies presented the story of the Minbar's construction process. Although this research will present some analytical studies for some of the Minbar's geometric patterns, its novel contribution will be in the study of the relationship between the geometric construction of the patterns and the Interlock (ta'sheeq) construction methodology. The geometric patterns are constructed of many interlocking pieces of wood, each carefully carved to fit together like a three-dimensional puzzle. Previous studies did not discuss the generation of the interlocking technique of the geometric pieces within the Minbar patterns.

Islamic Arts in the Minbar

The Minbar was one of the most richly decorated pieces of sacred Islamic art ever conceived. It was designed and constructed at the zenith of Islamic culture in the twelfth century by the very finest craftsmen that could be found. The body of the Minbar was designed and constructed of three major sections: the entrance door, which was constructed of two leaves, important sections of which remain after the fire. The entrance opened onto the staircase with a wooden enclosure on both sides, manufactured in the turnery technique (mashrabiya). The staircase leads to a platform covered by a kiosk with layers of muqarnas (stalactites), where the Imam would deliver the Friday speech.

The Minbar is highly decorated with biomorphic and geometric patterns, in which each geometric panel with its arrangements of star-shaped pieces forms a complete decorative unit. It also has a collection of calligraphic inscriptions that contain verses from the Holy Quran and inscription praising Nur al-Din Zangi and his son Al-Salih, who accomplished what his father began. In addition, there were also inscriptions that bear the names of the craftsmen who made the Minbar. Geometry, calligraphy, and biomorphic designs, the main three key principles of Islamic art and craft, compose the surface of the Minbar form. They formed the Islamic pattern design language and its application in wood craft through inlay, wood carving (engraving), stalactites (muqarnus), interlocking (traditional wood joinery/ta'sheeq), and turnery. These elements of Islamic art combine to make a unique masterpiece of intricate workmanship (Fig. 3).

Inlay: The central composition of the geometric pieces within the designed panels were inlaid with ivory and ebony with precise integration as a reflection of the binary of lightness and darkness, heaven and earth symbolism.

Wood carving (engraving): The Minbar is rich with vegetal carvings to the extent that the whole body of the Minbar is ornate with biomorphic motifs. The designers employed the shapes of plants in a rhythmic system governed by precise proportional rules and laws. They take the eyes of the observer through the intertwining and twisting of its lines in a contemplative journey.

Stalactites (muqarnus): are a combination of regular and sequential arches similar in regularity to their repetition and arrangement of beehives or groupings of crystalline geometries. This architectural element allows and permits the clear overlap between flat and curved surfaces, and in particular the transition between the dome and its square base. It contains within its dynamic nature a repetitive rhythm, which is clearly reflected to express the moving relationship from the spherical shape to the cube, returning to its cosmic structure. The sky is expressed by its spherical nature (the dome of the sky), while the earth is linked to a polar position defined in four directions [20-22]. The muqarnus had its obvious presence in the art of the Minbar through its symmetrical rhythm in a form that allowed the transition from the straight form to the curved shape through arches called "corner arcs".

Interlock (ta'sheeq): The ta'sheeq method is one of the most sophisticated traditional joinery techniques. One of the most impressive features of this method of joinery is the

allowance for each individual piece of wood to expand and contract according to differing weather conditions and allowing large panels to be constructed without the risk of deformation. The Ta'sheeq technique is the structural system that brings all the geometric pieces into composition with their panel construction and with the body of the Minbar. All pieces fit together in such a way that there is no need for the use of glue, nails, or any other fastener.

Turnery is another method of Islamic decorative art that has been extensively used in Islamic architecture through the use of wooden screens (lattices, or mashrabiya). Like all other Islamic arts, the art of turning has a high level of symbolism in its ability to architecturally emphasise the principal concepts of privacy and openness to the interior. Wood turnery is based on interlocking parts of wooden units that are similar in shape and size (cylindrical, cubical, octagonal, or conical) and installed together in a horizontal and vertical manner by interlocking (ta'sheeq) technique.

Fig. 3. Elements of Islamic art combine to make the intricate design of the Minbar (from left to right): inlay with ivory and ebony, wood carving, muqarnas, wood turning, and traditional joinery (Ta'sheeq). (Faculty of Islamic Arts and Architecture at WISE Visual Library).

The reconstruction of the Minbar

Materials

In 1993, the journey began to reconstruct the Minbar when King Hussein of Jordan gave instructions to the Jordanian ministry of religion to initiate the process of reconstructing the Minbar. The ministry initiated a data collection methodology for all the material related to the original Minbar, which can be summarised as follows:

1- Collecting of photos and visual materials of the original Minbar from all available sources (i.e., Jordanian, Arab Islamic, and world libraries, organisations, and institutions, and from individual personal collections). Some photos were collected from the Ashmolean Museum in the UK and the Congress Library in the USA.

2- Collecting and cataloging all the remaining pieces from the burnt Minbar.

3- Collecting all the detailed plates that were drawn for the Minbar by a master craftsman from Jerusalem called Jamal Badran after the fire. Badran based his drawings of the Minbar's plates on old photos of the original Minbar and the remaining wooden pieces of the burnt Minbar. Although that there were some mistakes in Badran's drawings of the geometric panels due to the lack of understanding of the science of geometry, they were beneficial in recording the patterns design and the size of the geometric pieces and connecting pathways (Fig. 4).

4- Commissioning a Jordanian architectural office to computerise the Minbar's pattern designs and structural skeleton. These drawings enabled the reconstruction process that was commissioned by the Institute of Traditional Islamic Arts at Al-Balqa Applied University of Jordan in 2002.

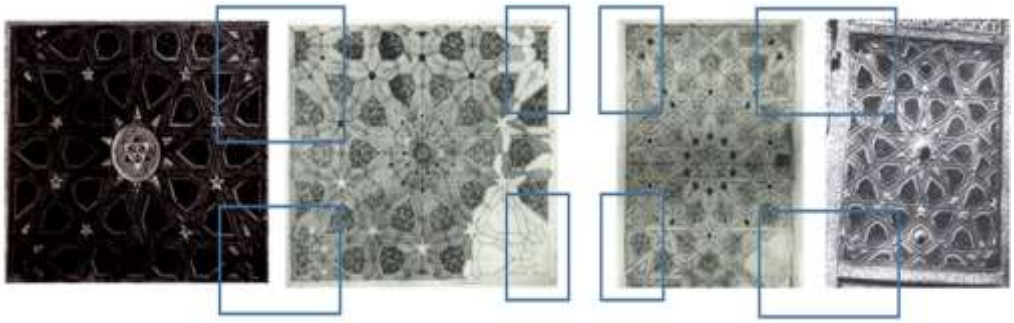

Fig. 4. A sample drawing of the Minbar panels (comparing Badran's drawings with the panel's picture from the original Minbar). As can be noticed the discrepancy in the corner geometric pieces in both drawings. (Faculty of Islamic Arts and Architecture at WISE Visual Library).

Materials

Preparing the designs of the original Minbar was not an easy task as the design was based on the science of geometry and traditional joinery techniques, which have to be investigated and studied in order to understand the process of pattern construction. The secrets of the original construction required not only the unravelling of its geometrical structural complex but also the revival of almost extinct crafts.

The development of mathematical and geometrical knowledge before and during Zangi's period helped to raise the standard of architectural design and construction technology, whose growth is based on these sciences, especially branches of mathematics, geometry, and trigonometry [23]. The Minbar visual expression is best represented through the discipline of geometry. Geometry is both quantitative and qualitative. Its quantitative dimension regulates the form and construction of pattern architecture. Its qualitative nature sets the proportions of architectural form and represents an aesthetic expression [16, 19, 24].

The architectural team led by Eng. Miwer Almhade started by investigating the traditional Islamic science of geometry, inspired by the work of Keith Critchlow, who in his books presented a comprehensive process of geometric construction methodologies [25, 26].

The analysis of the Minbar's geometric patterns for building a replica shows that it contained fifteen different geometric patterns in its various panels in addition to biomorphic patterns, wood turning, muqarnas, and calligraphic inscriptions. The Minbar consists of three parts, as shown in Fig. 5: the east elevation, which consists of six geometric patterns; the west elevation, which consists of seven geometric patterns; and the front door, which consists of two patterns.

Architects developed all the architectural designs for all aspects of the Minbar. More than 150 plans for all the parts of the Minbar included details of the geometric, biomorphic, and calligraphic arts in each part of the Minbar. All the geometric pieces on the plates were numbered to help during the construction phase, and nearly the entire number amounts to 16500 wooden pieces.

Case study

The geometric panel in the Minbar falls in the following categories as shown in figure (6): East elevation (from top to bottom): Calligraphic pattern praises the God's Divine name "Allah", ten-fold pattern, eight-fold pattern, six-fold pattern. West elevation (from top to bottom): Calligraphic pattern praises the God's Divine name "Allah", ten-fold pattern, eight-fold pattern, twelve-fold pattern, six-fold pattern. Triangles and handrails in both east and west elevations are based on eight-fold pattern variations. The door is composed of a six-fold pattern.

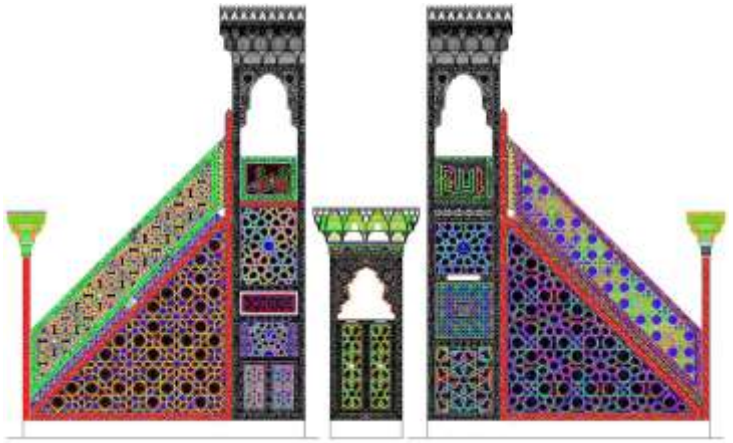

Fig. 5. The design panel of the Minbar (left: west elevation, middle: the door panel, right: east elevation).
(Faculty of Islamic Arts and Architecture at WISE visual library)

Six-fold geometric panel: (the Minbar door)

Researchers argue that geometry manifests mathematical ratios and proportions, which are central to Islamic art. In these arguments, the Islamic pattern is a manifestation of the harmonic subdivisions of the circle and its template polygon grids [12-14, 24-28]. The hexagonal geometric polygon systems are employed in the construction of Islamic pattern design variations, which correspond symbolically to the creation of the universe. It is a representation of perfection as stated in the holy Quran that God created the universe in six days "Allah created the heavens and the earth, and all that is between them, in six days" (The Holy Quran, 7:54). "We created the heavens and the earth and all that is between them in six days" (The Holy Quran, 50:38). There are four variations of the six-fold geometry in the Minbar: two in the west elevation, one in the east elevation, and one in the Minbar's door (Fig. 6).

Fig. 6. Variations of six-fold patterns in the Minbar.
(From left to right: west elevation, east elevation, the door).
(Faculty of Islamic Arts and Architecture at WISE visual library)

Geometrically speaking, the six-fold polygon is the simplest polygon to be created, as it is formed by six circles radiating from the base circle (the circle of unity) with the same diameter, so that the side of the hexagonal polygon is equal to the radius of this circle. Figure 7 shows the geometric analysis of the Minbar's door pattern, from the basic circles to the final pattern construction. It explores the evolution of pattern geometry in terms of the polygon layout of intersecting circles and lines, propagation, and linkages that affect the order, structure, and eventually the architecture of the pattern. The polygon's construction laws have controlled the geometry and architecture of the pattern. This analysis is based on the original Minbar door

that remained after the fire. These relatively simple geometrical constructions, as shown in figure 7, are easy to develop for pattern making.

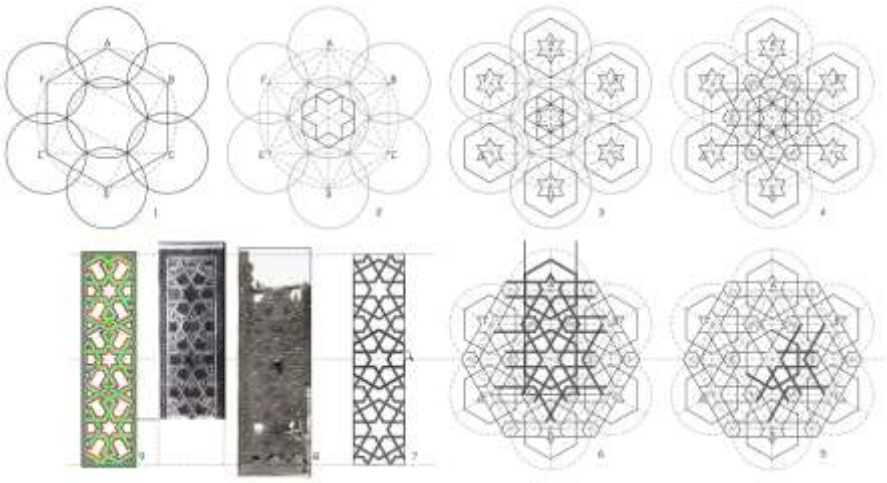

Fig. 7. The design analysis of the door is based on six-fold geometry.

By joining various intersecting lines, a variety of six-point patterns can be developed based on the natural junctions formed by the lines. This gives a series of points that can be used in the development of patterns. This type of framework forms the driving geometry for the relatively simple Islamic patterns and shows how a relatively simple pattern based on six-pointed geometry might be developed. The diagram (from 1-6) illustrates the basic construction methodology, beginning with a circle with its basic six-point division; it is these selections that create the possibilities for different patterns to evolve. Steps 1–6 show how this geometric pattern develops when they are added together following the basic rules created by the selection process. An important factor of six-point geometry is its relationship with root three ($\sqrt{3}$) proportions (step 1, rectangles A, B, D, E, and F, B, C, E). Step 7 in figure 7 shows the final construction of the pattern's geometry to match the original Minbar's door (Step 8). Step 9 shows the geometric pattern produced by the design team, in which we can note that the corner edges don't match the original pattern.

Eight-fold geometric panel (the Minbar triangles)

The triangles that constitute both sides of the Minbar are geometrically based on octagonal (eight-fold) pattern variations. These triangles appear to carry and support the load of the stairs and act as the basis of the Minbar. The eight-fold pattern in Islamic tradition represents a symbol of the eight angels who bear the Divine Throne, as stated in the Holy Quran: "And the angels will be on its sides, and eight will, that Day, bear the throne of thy Lord above them'' (The Holy Quran, 69:17). According to René Guenon, the symbolism of the octagon in sacred architecture represents the transition from earth to heaven: "an octagonal structure serves as support for a dome, thus marking the transition from the square foundation to the circular summit, that is, from the terrestrial number four to the celestial number eight" [20]. Figure 8 shows the geometric construction analysis of the two eight-fold variations of these patterns. Although they are created from a simple square base construction, the variables in design composition make them intentionally designed to have unequal sides.

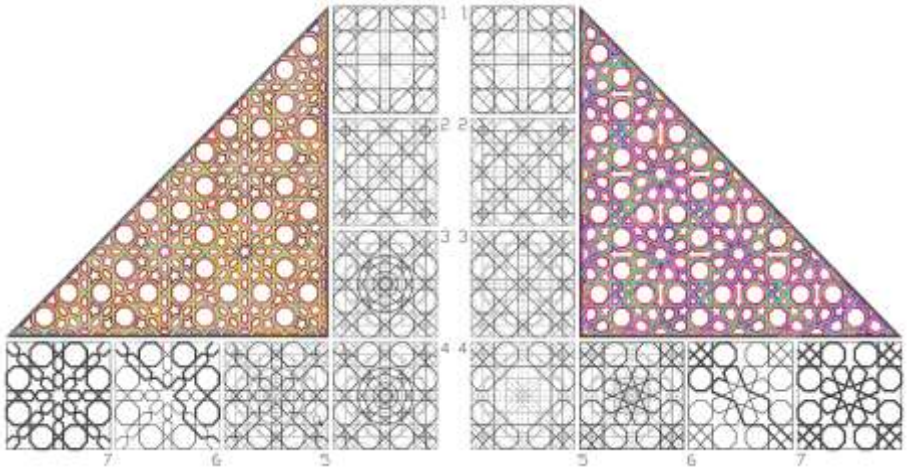

Fig. 8. The design analysis of the eight-fold geometry.

Figure 8 illustrations (1–7) demonstrate how small variations of a simple two-dimensional geometry produce very different patterns. The complexity is introduced on a relatively simple basis by the designer. The number of variations on a single geometric theme appears to be infinite. The variety being created through relatively small differences in the selection of intersected lines and nodes is based on the rhythms of the laws of eight-fold geometries.

Ten-fold geometric panel (the Minbar panels)

There are two ten-fold patterns in the Minbar; one in the east elevation and one in the west elevation. By comparing the variations on the pattern construction as shown in figures 9 and 10, it is revealed that the extent to which patterns adopted the same order was a consequence of the mathematical harmony of the travelling lines and node intersections within the parameters of the polygon's geometry.

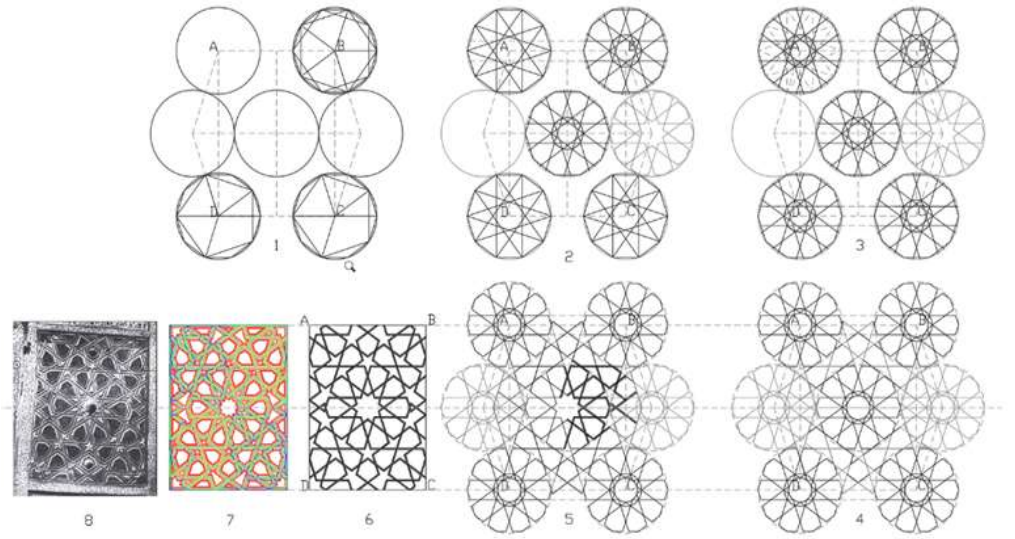

Fig. 9. The design analysis of the ten-fold geometric patterns in Minbar's west elevation. It shows that the patterns variations depend on the topological characteristics of the geometry of the intersecting polygons

This is knowledge about the order and structure of pattern variation behaviour and its dependence on topological characteristics of the geometry that can create variations in the pattern architecture.

This geometric study in figures 9 and 10 shows the construction of two ten-fold panels. Ten-fold has the aesthetic advantage of being related to the Golden Section. Its geometry lends itself to a wide variety of design possibilities through relatively small variations in the underlying relationships. The ways of altering the relationship between the elements of the geometry appear to be relatively simple, but every decision results in complex patterns that can appear quite different from each other. These differences are based on the selection of intersecting lines and nodes based on the rhythms of the laws of ten-fold geometries.

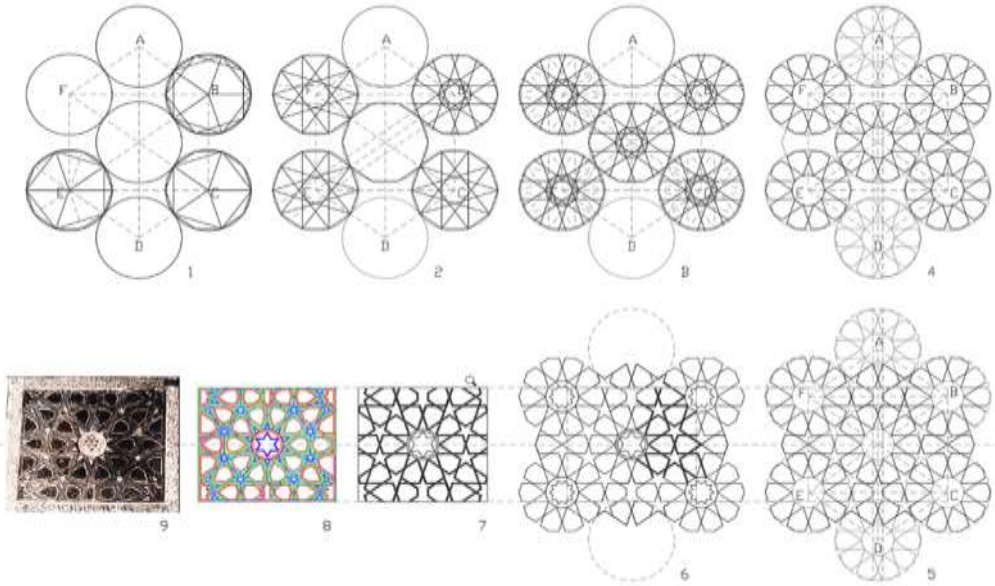

Fig. 10. The design analysis of the ten-fold geometric patterns in Minbar's east elevation. It shows that the patterns variations depend on the topological characteristics of the geometry of the intersecting polygons

The traditional joinery (interlock technique)

In order to understand the traditional joinery techniques (ta'sheeq) and look for their laws and principles, similar Minbars design and construction from the same period as the construction of Minbar Salah Al-Din were investigated and studied by the architectural team. Some of these examples were in Cairo during the Mumluk period, such as Sultan Qaitbay Minbar, Sultan Al-Saleh Tala'i Minbar, and Sultan Al-Ashraf Barsbay Minbar. Figure 11 shows pictures from Sultan Al-Ashraf Barsbay Minbar, in which the geometric panel design and structure are very similar to the ones in Salah Al-Din Minbar. By investigating the back side of the geometric patterns as shown in Fig. 11, a clear understanding of the traditional joinery system could be formed. This system of traditional joinery (interlocking, or Ta'sheeq) is found to be based on the geometric pathways that connect the geometric pattern pieces. Though the circles and intersecting lines could no longer be seen once the patterns were completely drawn, they still exerted an influence and became the basis for the Ta'sheeq joinery that holds everything together. The geometric pathways are integral to the very structure of the Minbar, unifying the panels form and function.

Based on this study and analysis, the architectural team was able to prepare the structural working drawings for the Minbar's geometrical panels based on the panel's geometry laws of order. The polygon intersecting lines that formed the panel architecture were its configuration and construction structure. The relationships of the elements to each other and the relationships within all elements address and reflect the natural laws that direct the basic design of the pattern's structural (ta'sheeq) configurations. These unseen laws are the structural language that springs mainly from the intersecting lines and forms the traditional construction joinery technique's structure.

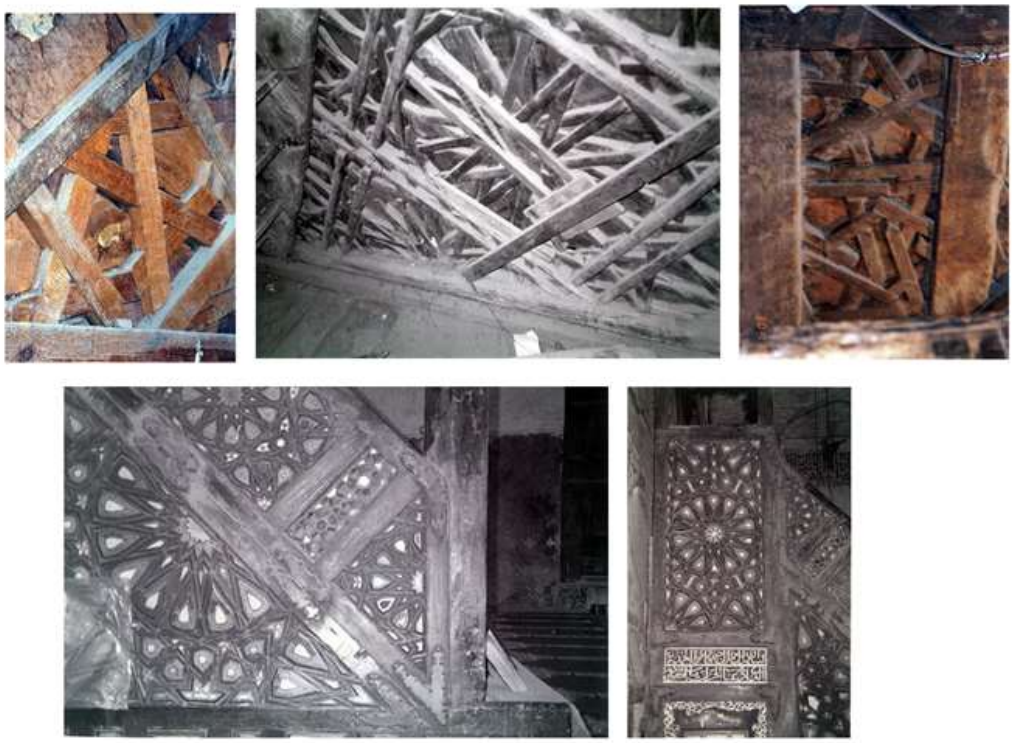

Fig. 11. Pictures from Sultan Al-Ashraf Barsbay Minbar showing the traditional joinery structure of the geometric panels, (Faculty of Islamic Arts and Architecture at WISE visual library)

Figures 12, 13, and 14 show the structure of joinery techniques based on the pattern's geometry.

Figure 12 shows two geometric panels in the Minbar's west elevation. Illustrations show how the structural lines are formed on the geometric pathways of the patterns. These sets of lines form the three-dimensional puzzle matrix that connects the geometric pattern together.

The way these lines are structured is shown in figures 13 and 14, where these structural lines are grooved on two levels: the top one is to hold the geometric shapes infills (hashwat), and the bottom one is to connect with other structural lines within the matrix. This ta'sheeq method is one of the most sophisticated traditional joinery techniques in the world. It has been used in Islamic countries for centuries. The geometric lines that underlie the decorative patterns of the Minbar are integral to its structure, unifying form and function.

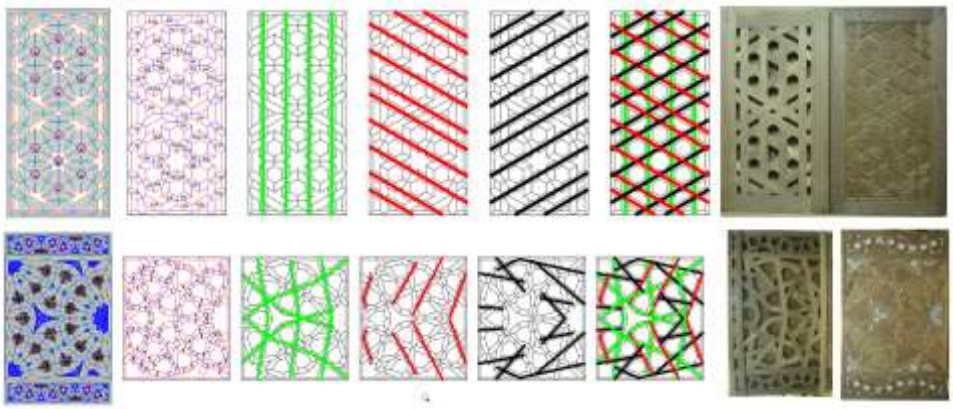

Fig. 12. Illustrations showing the traditional joinery structure of the geometric panels, (Author)

Fig. 13. Pictures showing the traditional joinery structure of the pathways of the geometric panels. (Faculty of Islamic Arts and Architecture at WISE visual library)

Fig. 14. Pictures showing the traditional joinery structure of the geometric panels. (Faculty of Islamic Arts and Architecture at WISE visual library)

Biomorphic and Inlay patterns

The whole body of the Minbar is decorated with rich biomorphic designs. All the geometric patterns are composed of geometric shape infills (hashwat); these elements are treated in turn with either carved biomorphic forms or inlay. The biomorphic shapes traditionally symbolise the contemplation journey from Islam to Iman, from the physical to the metaphysical stages [29]. Historically, we find that the decoration in which plant shapes were used was taken from the image of grape leaves, which are twisted and bended around themselves in a spiral movement, during which the laws of rhythm are represented in a visual image. This symbolises the image of the soul opening to receive the light of revelation from its Creator [20, 22]. The geometric inlay patterns are of ebony and ivory, the play of black and

white reminding one of day and night or the darkness of the soul and the luminosity of the intellect, the transcendence and immanence (Fig. 15).

Fig. 15. Pictures showing geometric shapes decorated with rich biomorphic and inlay designs, (Faculty of Islamic Arts and Architecture at WISE visual library)

Construction phase

After all the designs for the original Minbar were finished and a complete set of working drawings were created for the whole structure of the Minbar, the construction stage was initiated. The reconstruction of the Minbar started by establishing the Institute of Traditional Islamic Arts at Al-Balqa Applied University in Jordan to study and teach traditional Islamic arts and crafts. The institute was first established within Al-Balqa Applied University, and now it's part of the World Islamic Science and Education University (WISE). The mission of this institute was to initiate an academic programme dedicated to preserving traditional crafts and passing on traditional knowledge to new generations. This academic programme was founded to benefit from the qualifications and expertise of the Minbar's master craftsmen staff in training the Institute's students and Jordanian technicians on traditional crafts.

The institute was commissioned to reconstruct the Minbar of Salah Al-Din. Again, this stage was not an easy task as the craft skills were not available to implement the design. Almost undedicated, the crafts of the past centuries had vanished. An extensive search was conducted through the Islamic world for master craftsmen to participate in the construction of the Minbar. The Indonesians were found to be better carvers than the others, while the Turkish were better at wood joining and inlay and the Egyptians were good at wood turning. This resulted in recruiting a number of master craftsmen to teach at the institute and to start the reconstruction project. These master craftsmen came from: Turkey; 8 master craftsmen in traditional wood joinery, muqarnus, wood carving, and inlay from Indonesia; 5 master craftsmen in wood carving from Egypt; and 3 master craftsmen in wood turning.

The reconstruction project began in 2002. Drawings of different aspects of the arts in the Minbar were presented and posted on the wood, and the highly qualified craftsmen would transfer the drawings onto the different pieces of wood and start their excellent and intricate work. Each panel consists of many small pieces; the arrangement of the different pieces in each panel follows the geometry of that specific panel, and they would be gathered in the traditional joinery manner (Ta'sheeq). The first panel took four and a half months to be executed, while other panels started to take less and less time as the work progressed. The work progressed panel by panel, then the panels on the same side were put together, and after that, both sides were put together with the door panel to form the Minbar (Fig. 16).

It should be emphasised that the method of construction and installation of the new Minbar followed the traditional wood craft joinery techniques, which are based on the interlock technique. This was followed in the construction of the original Minbar without the use of any adhesives or nails.

The new Minbar was finished in 2006 as a replica of the original one, and it was installed in February 2007 in Al-Aqsa Mosque (Fig. 17).

Fig. 16. Pictures showing the reconstruction phases of geometric shapes, muqarnus and biomorphic and inlay designs, (Faculty of Islamic Arts and Architecture at WISE visual library)

Fig. 17. Pictures showing the reconstructed panels and the reconstructed new Minbar in comparison with the original one, (Faculty of Islamic Arts and Architecture at WISE visual library)

The success of building the Minbar shows the science of geometry and proportions as a central and fundamental science in its design and sheds light on the universal aspects and principles in the design concepts of the various ages and civilizations. The reconstruction of the Minbar is a highlight of this sacred science and a symbol of harmony and communication between the elements of nature and the universe and their integration into creative formations of geometry.

Results and discussion

Symbolic expressions can be found in the art of the Minbar, which can be identified in the mutual and harmonious interrelationships between unity and variety, simplicity and complexity, shade and light, night and day, sun and moon, heaven and earth, and their combined reflections in building the relationship between God and man on the values of truthfulness, fear, love, and knowledge. These three values are symbolically adopted in the form of the Minbar design composition. This can be seen in the symbols of geometric ornamentations, which are sharp and fractured and bear the angles of the symmetrical relationship of the geometric polygons, which reflect in their multiple centres the principle of divine unification and represent one of the three basic Islamic principles, which is the fear of God (the concept of Islam). The floral motifs symbolise a symmetrical musical spiral rhythm of reproduction and evolution. It symbolises divine mercy as the rhythm that applies at all levels of creation, reflecting the concept of faith, and represents the principle of the love of God (the concept of Iman). The symbols of Arabic calligraphy refer to the knowledge of the divine truth, its sacred nature, and its lofty status. It is the most closely connected to the cognitive and spiritual sides and represents the principle of knowledge of God (the concept of Ihsan) [21, 29]. All these symbolic concepts are linked and integrated to form a harmonious and balanced religious art that creates a positive atmosphere of meditation and worship. Thus, this wisdom-based art is evidence of divine truth. The Muslim artist reflects this fact in his productions according to aesthetic proportions and functional standards of accurate material composition, reflecting the prophet Mohammad's saying: "God is beautiful and loves beauty".

The burning of the Minbar (pulpit) is a tragic event, but on the other hand, it raised the alarm about the importance of reviving the traditional Islamic arts on their original principles, which are becoming extinct and their knowledge is disappearing. The Institute of Islamic Art and Architecture is one of the academic institutions that undertook the mission to preserve and revive this knowledge by bridging it to academic vocational programmes.

The reconstruction of the Minbar, which consists of more than 16000 geometric wooden pieces joined together in traditional joinery techniques (Ta’sheeq) with no glue or nails, was possible due to the science of Islamic geometry, which underlines all forms of Islamic art and architecture. Geometry is the visual expression of the mathematical patterns of order, structure, and harmony inherent in creation and found everywhere in the cosmos, nature, and man. These visual codes and patterns, with their esoteric and philosophical meanings and values, are found within all aspects of the Islamic architectural process and were reflected in the design and construction of the Minbar [30-32,33].

This paper discusses the lessons learned from the reconstruction process through proportions and geometry as a tool to achieve a performance-oriented process in Minbar design and construction. The key role played by geometry in the Minbar is discussed in relation to proportions as an infra-structure to the design and reconstruction process, in which evaluations

based on spatial structure and aesthetic criteria are integrated into the conceptual phases of the design and reconstruction process. This paper analysed the geometric principles and features of the design and construction of the Minbar with regard to geometric proportion analysis and described the syntheses of the patterns of the Minbar from the dimensions of geometry. These findings support the argument that geometry constitutes one of the most important cultural symbols in Islamic architecture. Applications of this tool are presented with specific reference to Minbar in the field of modular space structure. The case of a traditional prototype masterpiece is used to explore the morphology of a traditional structural performance that deals with traditional geometric pattern space design modelling.

The completion of the Minbar has been an important challenge, and it has proved that today we can produce Islamic works based on the sciences of traditional craftsmanship and sacred art based on wisdom and that these sciences and arts are contemporary art in every sense of the word. The reconstruction of the Minbar was truly the reconstruction of many traditional Islamic arts and crafts.

Acknowledgments

The author is grateful to the Faculty of Islamic Arts and Architecture at World Islamic Science and Education University (WISE) for providing pictures of the reconstruction project for this research.

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Received: February 21, 2022
Accepted: April 24, 2023