UNIT 3

Geometric Design in Islamic Art

After reading this unit, you will be able to:

- understand the role of geometric design in the art of the Islamic world; and
- recognize ways in which the featured works of art exhibit repetition, symmetry, two-dimensionality, and an illusion of infinity.

Introduction

One of the defining characteristics of Islamic art is its abundant use of geometric patterns to adorn a wide variety of architectural and decorative surfaces. The sources of the basic shapes and patterns used in Islamic ornamentation are rooted in the artistic traditions of the pre-Islamic Byzantine and Sasanian empires. During the early spread of Islam in the seventh and eighth centuries, artists encountered a range of patterns and designs that they adopted, abstracting and adapting them into new forms and to support new uses. Although there is little historical evidence that tells us how they worked, we know that Islamic craftsmen continued to elaborate upon these forms through the centuries, ultimately creating new abstract geometric patterns that were symmetrical, proportional, and balanced. These designs were often based on the replication and repetition of a single unit in a sequence of steps to develop the overall pattern. The works of art discussed in this unit are drawn from many regions and span the thirteenth to the seventeenth century. In spite of regional variations, the areas in which the works were produced are united by a common appreciation and taste for geometric patterns.

Islamic geometric design is unique in its elevation to a primary art form—while the earlier traditions upon which Islamic art drew also utilized geometric forms, they were often relegated to the borders or were secondary to a figural composition (fig. 15). Early Islamic artists often privileged the geometric over the figural, covering whole surfaces in dense geometric designs. The reason for this change in focus is not entirely clear. It may have been due in part to the new religious community's desire to distinguish itself visually from previous empires, and in part a need to respond to Islam's avoidance of figural forms in religious or public art. Scholars have suggested other explanations for this tendency, such as an intense cultural focus on textiles in Islamic lands, where covering surfaces with geometric and other types of ornament was akin to draping them in patterned textiles. It is likely that a combination of these factors led to the continuous popularity of calligraphic, geometric, and vegetal (plantlike) ornament in the Islamic world.

FIG. 15. Mosaic (detail), Roman, about 300 A.D. Excavated at Lod (Lydda), Israel. Stone mosaic tesserae. Israel Antiquities Authority and the Shelby White and Leon Levy Lod Mosaic Center

The contributions of Islamic mathematicians and other scientists were essential to the development of this unique form of ornament, and their ideas and advanced technological knowledge are reflected in the mathematical exactitude of Islamic geometric patterns. Recent research has shown that mathematicians and artisans met on a regular basis, accounting for the transmission of mathematical concepts from theory to artistic practice. This phenomenon also provides insight into the significant relationship between medium and the technology of patternmaking; the shape and medium of an object informs how the pattern will be translated from mathematical concept into artistic reality. The prevalence of geometric ornament in Islamic art thus shows the confluence of art, mathematics, philosophy, and religious thought.

The basic instruments for constructing geometric designs are a compass and a ruler, tools that generate the circle and line, upon which all such design is based. Using these two simple forms, an artist could create endless variations of patterns and motifs by repeating a single geometric unit laid out according to a basic organizing principle. The result is an overall geometric pattern that is both mathematically rooted and visually harmonious. The circle and line are also the basis for the proportional system used in Islamic calligraphy (see fig. 12). For this reason, scholars often refer to the art of calligraphy as the "geometry of the line."

Complicated patterns are constructed from basic shapes: circles and polygons. The complex patterns found in Islamic art often include many of these shapes in a variety of spatial arrangements.

Primary Characteristics of Islamic Geometric Decoration

Repetition and illusion of infinity

Most patterns are derived from a grid of polygons such as equilateral triangles, squares, or hexagons. The mathematical term for these grids is "regular tessellation" (deriving from the Latin *tesserae*, i.e., pieces of mosaic), in which one regular polygon is repeated to tile the plane. (See activity, page 88.) No matter how complex or intricate a design becomes, it is still predicated on a regular grid. Most geometric ornamentation is based on the premise that every pattern can be repeated and infinitely extended into space. This means that a frame can appear to be arbitrary, simply providing a window onto a pattern that continues beyond the bounds of that frame.

Symmetry

Symmetry is created in Islamic geometric design through the repetition and mirroring of one or more basic design units—usually shapes such as circles and polygons. Although the design can be elaborated and made complex, the basic symmetrical repetition and mirroring of these shapes creates a sense of harmony.

Two-dimensionality

Most Islamic geometric design is two-dimensional. Not only is it generally applied to flat surfaces, but the patterns themselves rarely have shading or background-foreground distinction. In some instances, however, an artist will create interlocking or overlapping designs that create the illusion of depth and produce an aesthetically pleasing and visually playful composition.

12
The Patti Cadby Birch Moroccan Court

Created onsite at the Metropolitan Museum by the Naji family and their company, Arabesque, Inc., Fez, Morocco, in 2011
Polychrome-glazed, cut tilework, carved stucco, carved cedar wood, carved marble

Columns

About 1350–1400
Granada, Spain
Marble, carved; 86⅜ x 15¼ in. (219.4 x 38.7 cm); Diam. 6⅜ in. (16.2 cm)
Gift of The Hearst Foundation, 1956 (56.234.18–21a–d)

LINK TO THE THEME OF THIS UNIT

This tiled courtyard evokes the perfection of geometric design during the golden age of Islamic Spain under the Nasrid dynasty (1232–1492) (see page 109). The themes of repetition and infinity in particular are embodied in the complex repeating star motifs of the tiled wall panels.

FUNCTION

Tilework like this, called zilij, was used frequently in southern Spain (known under Islamic rule as al-Andalus, hence "Andalusia") and North Africa to decorate architectural surfaces similar to ones seen in this courtyard.

DESCRIPTION/VISUAL ANALYSIS

The walls are divided into three sections, as is traditional in Moroccan and Andalusian courtyard architecture. The lowest section of the courtyard wall is covered in brightly colored geometric tiles. Just above this is intricately carved plaster, and above that, in the top register, carved wood. The patterns of the tiles decorating the bottom register of the courtyard display all the common characteristics of geometric design. The design begins at the center of each star and radiates out symmetrically in a series of interlacing stars, pentagons, and other shapes. The patterns repeat infinitely outward, creating a harmonious geometric composition. The borders of the tile panel appear arbitrary—the design does not end but is simply cut off, suggesting it continues infinitely into space. Although this particular colorful design is unique to Moroccan and Andalusian architecture, similar star-based patterns can be seen in works from other regions in the Museum's collection.

CONTEXT

Courtyards like this were typical of the architecture in fourteenth- and fifteenth-century Morocco and southern Spain (fig. 16). This courtyard was inspired by these and built and decorated onsite in 2011 by a team of Moroccan craftsmen from the city of Fez. The aim was to celebrate the excellence and enduring vitality of contemporary craftsmanship in the Islamic world. Morocco is one of the few countries in this vast region that has kept these centuries-old traditions alive and maintained them at the highest level. Every element of the courtyard was created with traditional techniques and materials, including the designs and colors of the tile panels, which are based on the wall panels (dadoes) of the Alhambra Palace in Granada, Spain (see fig. 22), built under Nasrid rule (1232–1492). Tiled *dadoes* like these are commonly seen in Islamic buildings throughout southern Spain and North Africa.

FIG. 16. Courtyard and fountain, 'Attarin Madrasa, Fez, Morocco, 1323–25

KEY WORDS AND IDEAS

Spain, Morocco, Nasrid kingdom, Alhambra Palace, cultural exchange, geometric, marble, stucco, *zilij* (type of tilework)

12. The Patti Cadby Birch Moroccan Court

13
Textile fragment

14th century
Spain
Silk, lampas; 40³⁄₁₆ x 14⁵⁄₁₆ in. (102 x 36.3 cm)
Fletcher Fund, 1929 (29.22)

LINK TO THE THEME OF THIS UNIT

This textile fragment demonstrates the ease with which geometric design is adapted to the technique of weaving. Textiles like this are created on a loom and are composed of warps (yarns that run vertically) and wefts (yarns that run horizontally). Together, the warps and wefts create a regular grid that naturally lends itself to geometric design.

FUNCTION

Silk textiles were expensive luxury objects often commissioned by the court or other wealthy patrons. They may have furnished wealthy homes or served as charitable gifts to mosques. This silk fragment displays decorative bands of varying widths, each of which has its own complex, self-contained geometric design.

DESCRIPTION/VISUAL ANALYSIS

This textile exhibits many of the key characteristics of geometric design. Each self-contained design is symmetrical and appears as though it could extend infinitely past the edges of the textile. The thin black and white patterned bands toward the top of the piece exemplify the idea of reflection. Each black crenellation (stepped design) creates an identical and reciprocal white one, and vice versa. In the wide band at the bottom are four rows of five stars, each bordered by yellow bands that extend out, interlacing and generating a secondary repeating motif of interlocking squares. The weaver used this geometric design to play with foreground and background perception. The viewer's eye follows each yellow band as it goes under and over others, even though the composition is without actual physical depth. In addition to the seven distinct geometric designs, this textile also features calligraphic decoration in *naskh* script (see also proportional scripts, fig. 13), highlighting the decorative and proportional relationship between geometric design and calligraphy (which here reads "good luck and prosperity").

CONTEXT

This textile was created during the reign of the Nasrids, who ruled parts of southern Spain from 1232 to 1492. The reign of the Nasrids is considered to be a golden age of Islamic Spain. It was in this period that the Alhambra Palace, famed for its artistic and architectural beauty, was built in the Nasrid capital of Granada. Many of the geometric designs on this textile resemble those used in the architectural decoration and tilework of the Alhambra (see fig. 23). A present-day example of this kind of tilework can be seen in the Museum's Moroccan Court (see image 12). Textiles similar to this one were still produced after the fall of the Nasrid kingdom, indicating their continued appeal and the European conquerors' admiration for Andalusian art.

(See also image 22.)

KEY WORDS AND IDEAS

Calligraphy (*kufic* script), Nasrid kingdom, Spain, geometric ornament, silk

13. Textile fragment

14
Star- and hexagonal-tile panel

Late 13th–14th century
Iran, Nishapur
Stonepaste; polychrome tiles glazed in turquoise and blue and molded under transparent glaze; 41¾ x 24¼ x 2 in. (106 x 61.6 x 5.1 cm)
Rogers Fund, 1937 (37.40.26)

LINK TO THE THEME OF THIS UNIT

This tile panel from Nishapur, Iran, is an example of the repetition characteristic of geometric design in the Islamic world. It consists of twenty-seven hexagonal tiles glazed turquoise and seven complete six-pointed star tiles glazed blue. The artist also included many blue stars that are cut off at the edge, suggesting the design extends infinitely past the limits of the actual panel. The simple repetitive pattern of alternating hexagons and stars is typical of this period. Also evident is the Islamic interest in creating dimensionally proportional forms: the side of each star corresponds exactly in measurement to the side of each hexagon, producing internal logic and harmonious balance.

FUNCTION

It is likely that such panels decorated the interiors of residences or public buildings (see, for example, similar tilework on the walls in *Laila and Majnun at School*, fig. 17).

DESCRIPTION/VISUAL ANALYSIS

Although the overall composition is highly geometric, each tile also features nongeometric designs. The hexagonal tiles each contain a molded circular design of abstracted vegetal or floral shapes in relief. A lotus flower in relief decorates the interior of each star tile. These secondary patterns add texture to the surface of the panel and liveliness to the repetition of the overall geometric pattern.

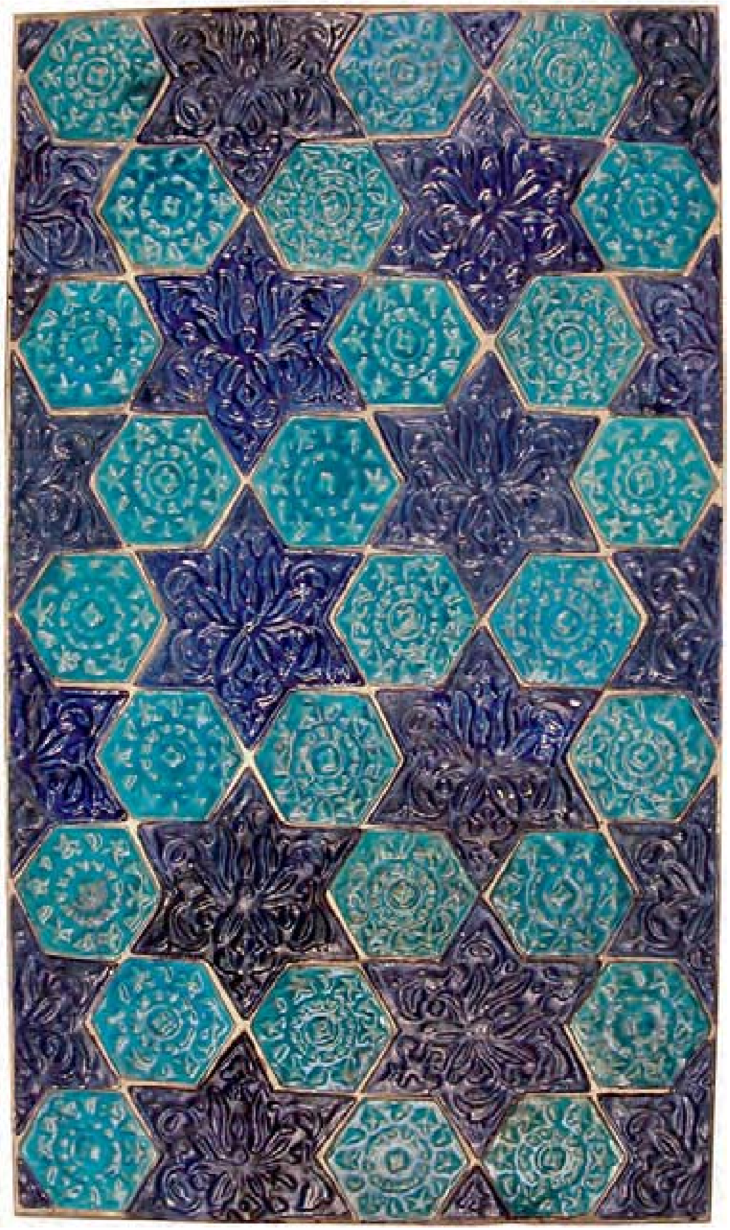
CONTEXT

This type of ceramic decoration with strong-colored glazes and bold patterns was typical of northeastern Iran in the fourteenth century. Excavations at Nishapur revealed many similar panels, as well as examples carved out of plaster and other materials. Nishapur, founded in the third century A.D., was a bustling medieval city before its destruction in the thirteenth century. Its success was due in part to its advantageous position on the Silk Road, the major overland trading route from China westward. Nishapur was also a center of production for ceramics like this tile panel, which dates from that city's later period. The Metropolitan Museum of Art carried out excavations in Nishapur in the 1930s and '40s that led to many important discoveries (see "Daily Life in Medieval Nishapur," page 167). Objects such as this panel tell scholars and archaeologists much about the development of art and architecture in Iran, such as the fact that colorful tile panels decorated not only palaces and mosques, but also people's homes.

FIG. 17. Laila and Majnun at School: Folio 129 (detail) from a *Khamsa* of Nizami, A.H. 931 / A.D. 1524–25; present-day Afghanistan, Herat; ink, opaque watercolor, and gold on paper; 7½ x 4½ in. (19.1 x 11.4 cm); Gift of Alexander Smith Cochran, 1913 (13.228.7.7)

KEY WORDS AND IDEAS

Nishapur, geometric, ceramic, stonepaste



14. Star- and hexagonal-tile panel

15
Jali (screen)

Second half of the 16th century
India
Red sandstone; pierced, carved
Rogers Fund, 1993 (1993.67.2)

LINK TO THE THEME OF THIS UNIT

This carved screen, called a *jali*, illustrates the kind of intricate and complex geometric designs that can be created with the simplest of elements—the line and the circle. This screen exhibits three distinct geometric patterns—the star-based pattern in the interior of the arch, the interlace design above the arch, and the simple geometric border that frames the entire rectangular screen.

FUNCTION

Screens like this, typical of Mughal Indian architecture, were used as windows or interior room dividers, allowing light and air to enter the room while screening the inhabitants from the glare of the sun and the gazes of passersby. The intricately carved design would have created a subtle play of shadow and light in the interior, emphasizing the characteristics of symmetry and the illusion of infinity inherent in geometric design (fig. 18).

DESCRIPTION/VISUAL ANALYSIS

The innermost pattern is based on the eight-pointed star shape; each star is circumscribed within octagons in even rows. Between the octagons is a field of five-pointed stars within interlocking pentagons. Although displaying the basic characteristics common to geometric design, this screen is also unique in that its design makes use of the possibilities of positive and negative space. The work was created through openwork carving, a subtractive sculptural process. The remaining stone forms the *jali*'s design, while the holes (or negative space), create supplemental patterns. (See activity, page 88).

CONTEXT

Screens like this are a hallmark of Mughal architecture. The Mughals were a Muslim dynasty of Central Asian origin who ruled the north of India from 1526 to 1858 (see "The Mughal Court and the Art of Observation," page 153). Screens similar to this can be seen in their original settings in many Mughal palaces and mausoleums, like Fatehpur Sikri and the Taj Mahal. The weathered condition of this screen suggests that it was probably part of a series of similar screens used as windows set in an exterior wall.

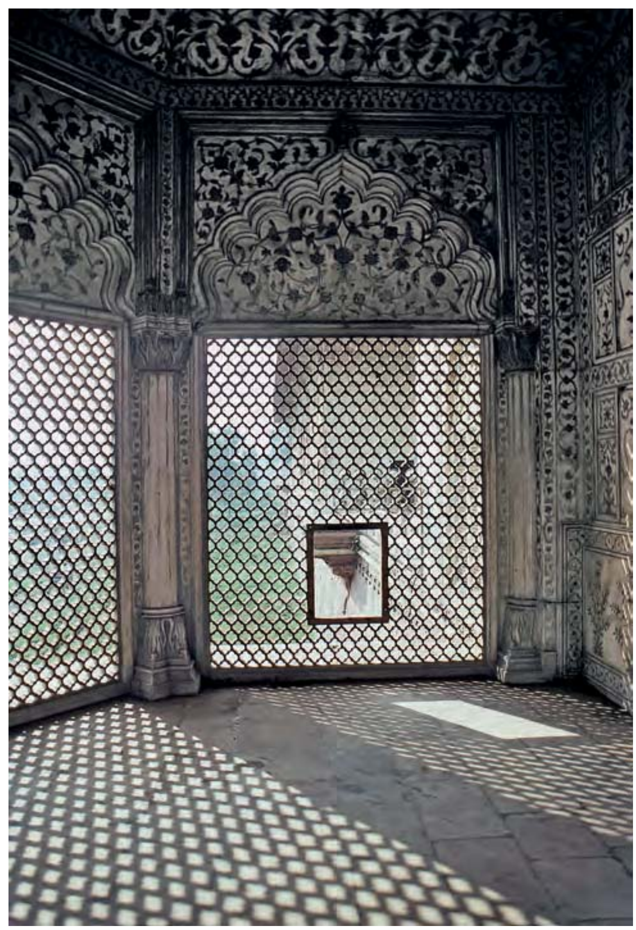
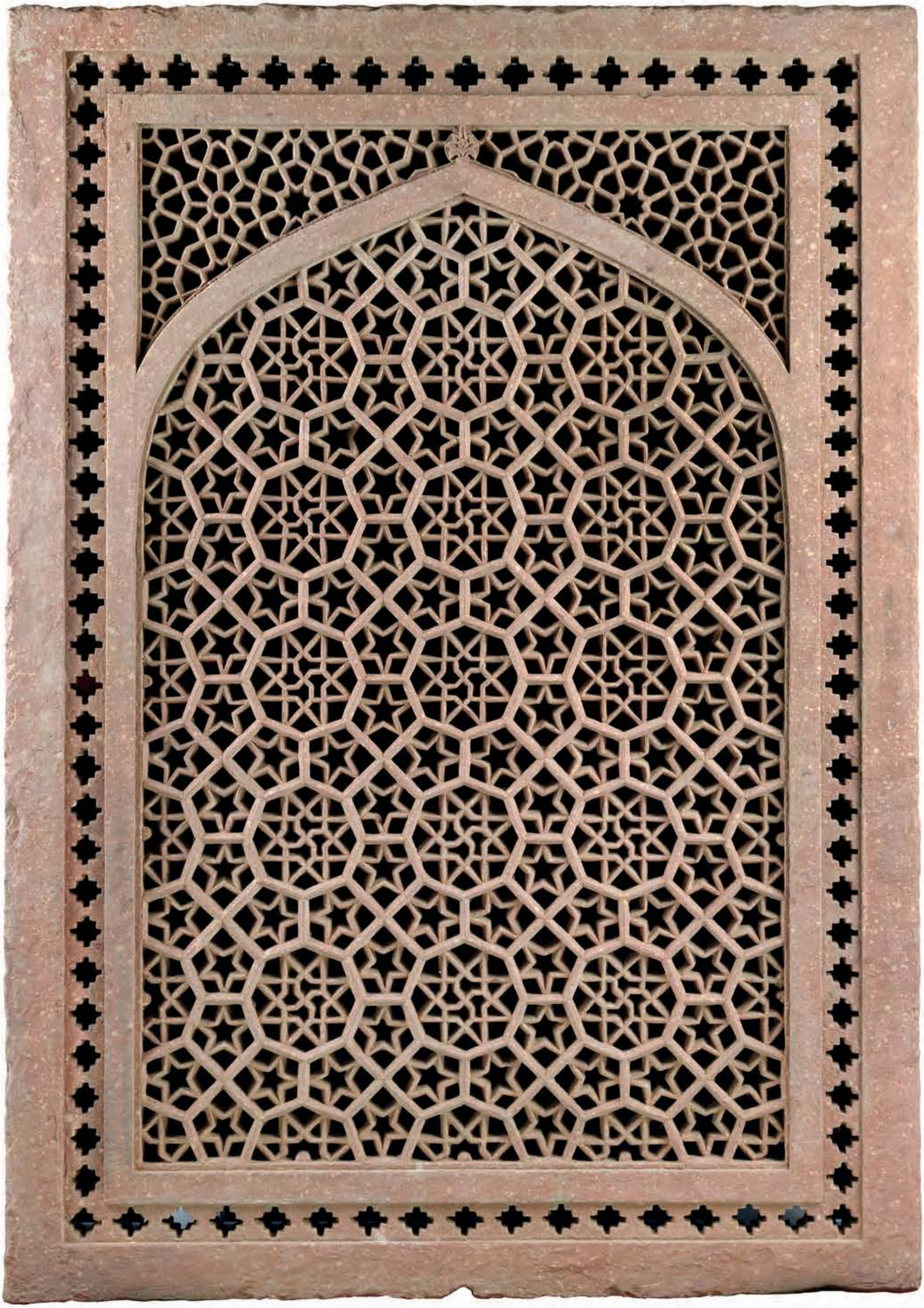


FIG. 18. *Jali* from the Khwabgah (royal bedroom) of the Lal Qil'a (Red Fort), Delhi, India, 1638–48

KEY WORDS AND IDEAS

Mughal dynasty (India), geometric, architecture, sandstone



15. *Jali* (screen)

Lesson Plan: Unit 3 Geometric Design in Islamic Art

FEATURED WORK OF ART

***Jali* (screen)** (image 15)
Third quarter of the 16th century
India, Mughal
Red sandstone; pierced, carved; 73 x 51 5/16 x 3¼ in.
(185.4 x 130.3 x 8.3 cm)
Rogers Fund, 1993 (1993.67.2)

SUBJECT AREAS: Mathematics and Visual Arts
GRADES: Middle School and High School
TOPIC/THEME: Geometric Constructions

GOALS

Students will be able to:

- use a compass and straightedge to construct regular polygons; and
- recognize ways works of art from the Islamic world utilize geometric forms and relationships.

NATIONAL LEARNING STANDARDS

Mathematics, Geometry

- In grades 6–8 all students should recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life
- In grades 9–12 all students should draw and construct representations of two- and three-dimensional geometric objects using a variety of tools
- In grades 9–12 all students should use geometric ideas to solve problems in, and gain insights into, other disciplines and other areas of interest such as art and architecture

Visual Arts

- NA-VA.K-12.4 Understanding the Visual Arts in Relation to History and Cultures
- NA-VA.K-12.6 Making Connections Between Visual Arts and Other Disciplines

COMMON CORE STATE STANDARDS

Mathematics, Geometry

- G.CO.12 Make formal geometric constructions with a variety of tools and methods
- G.CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle

ACTIVITY SETTING: Classroom
MATERIALS: Pencil, paper, straightedge, and compass for each student (alternatively, you can use the computer program "The Geometer's Sketchpad")

QUESTIONS FOR VIEWING

- What stands out as you take your first look at this object?
- The weathering on one side suggests that this screen likely formed part of a series of windows set in an outside wall. What shapes and patterns might the light and shadows have made as the sun shone through the screen?
- Look closely at the various shapes that make up the design. How do they relate to one another and the outer frame?
- Imagine creating a work like this. What might you do first? Last? Why?

ACTIVITY

SUBJECT AREA: Geometry and Visual Arts
DURATION: Approximately 30 minutes

While geometric ornamentation may have reached a pinnacle in the Islamic world, the sources for the shapes and intricate patterns employed in Islamic art already existed in late antiquity among the Greeks, Romans, and Sasanians in Iran. Islamic artists appropriated key elements from the classical tradition and then elaborated on them to create new forms of decoration. The compass and the straightedge—tools used to generate lines and circles, the foundations for all geometric forms—allowed artists to explore countless patterns and motifs.

The featured work of art includes regular polygons (two-dimensional shapes in which all of the sides are the same length and all of the angles are equal) such as the octagon and pentagon, as well as elaborate polygons such as the five-pointed and eight-pointed star. Investigate ways you can use your compass and straightedge to create each of these polygons, and others. Share your working methods with a peer. Compare and contrast your findings with the animated drawing *All the Possible Polygons!* or the demonstration in "Geometric Construction" listed in the resource section.

RESOURCES

Aldoaldoz. *All the Possible Polygons!* Animated drawing. February 14, 2010. http://www.youtube.com/watch?v=LBgIWQcC6lM&feature=related.

Blair, Sheila S., and Jonathan M. Bloom. *The Art and Architecture of Islam, 1250–1800*. New Haven: Yale University Press, 1994.

Department of Islamic Art. "The Art of the Mughals before 1600." In *Heilbrunn Timeline of Art History*. New York: The Metropolitan Museum of Art, 2000–. http://www.metmuseum.org/toah/hd/mugh/hd_mugh.htm (October 2002).

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Weisstein, Eric W. "Geometric Construction." Interactive demonstration. *MathWorld—A Wolfram Web Resource*. Wolfram Research, Inc., 1999–2012. http://mathworld.wolfram.com/GeometricConstruction.html.

SPACES/OBJECTS IN THE MUSEUM'S COLLECTION RELATED TO THIS LESSON

Image 14. Star- and hexagonal-tile panel, late 13th–14th century; Iran, Nishapur; stonepaste; polychrome tiles glazed in turquoise and blue and molded under transparent glaze; 41¾ x 24¼ x 2 in. (106 x 61.6 x 5.1 cm); Rogers Fund, 1937 (37.40.26)

Jali (screen), early 17th century; India; marble; 48⁷⁄₁₆ x 26½ x 2¾ in. (123 x 67.3 x 7 cm); Rogers Fund, 1984 (1984.193)

The Astor Court (Chinese courtyard in the style of the Ming dynasty); assembled onsite at the Museum by Chinese craftsmen in 1981; ceramic tiles; *nan* wood columns; granite from Suzhou; Taihu rocks; Gift of the Vincent Astor Foundation

Tile assemblage, first half of the 13th century; Seljuq, Anatolia; composite body, overglaze-painted; max. diam. 9³⁄₁₆ in. (23.3 cm); Gift of Mr. and Mrs. Jack A. Josephson, 1976 (1976.245)

Ceiling, 16th century; Spain; wood; carved, painted, and gilded; side 1: 99 in. (251.5 cm), side 2: 168 in. (426.7 cm), side 3: 192 in. (487.7 cm), side 4: 146 in. (370.8 cm); Gift of the Hearst Foundation, 1956 (56.234.35.2)

Author: Adapted from a lesson by classroom teacher Michael Wilkinson
Date: 2012

Unit 3 Suggested Readings and Resources

Beshore, George. *Science in Early Islamic Culture (Science of the Past)*. New York: Franklin Watts, 1998.
ELEMENTARY SCHOOL; MIDDLE SCHOOL

Broug, Eric. *Islamic Geometric Patterns*. London: Thames & Hudson, 2008. Includes CD-ROM.
MIDDLE SCHOOL; HIGH SCHOOL (can be adapted to the needs of younger students)

Department of Islamic Art. "Geometric Patterns in Islamic Art." In *Heilbrunn Timeline of Art History*. New York: The Metropolitan Museum of Art, 2000–. http://www.metmuseum.org/toah/hd/geom/hd_geom.htm (October 2001).
HIGH SCHOOL

The Metropolitan Museum of Art. *Islamic Art and Geometric Design: Activities for Learning*. New York: The Metropolitan Museum of Art, 2004. Online version: http://www.metmuseum.org/learn/for-educators/publications-for-educators/islamic-art-and-geometric-design.
Explores featured objects from the Museum's Islamic collection with related activities, a glossary, and a list of published resources.

The Pattern of Beauty. DVD. 25 min. Falls Church, Va.: Landmark Media, 1998.
Discusses the underlying meanings of curvature, lines, and forms in Islamic design.

Sutton, Daud. *Islamic Design: A Genius for Geometry*. New York: Walker Publishing Company, 2007.
HIGH SCHOOL (can be adapted to the needs of younger students)

UNIT 3 SOURCES

Aanavi, Don. "Western Islamic Art." *The Metropolitan Museum of Art Bulletin* 27, no. 3 (November 1968), pp. 197–203.

Bier, Carol. "Art and Mithal: Reading Geometry as Visual Commentary." *Iranian Studies* 41, no. 4 (September 2008), pp. 491–509.

———. "Patterns in Time and Space: Technologies of Transfer and the Cultural Transmission of Mathematical Knowledge across the Indian Ocean." *Ars Orientalis* 34 (2004), pp. 172–94.

Blair, Sheila S., and Jonathan M. Bloom. *Cosmophilia: Islamic Art from the David Collection, Copenhagen*. Exhibition catalogue. Chestnut Hill, Mass.: McMullen Museum of Art, Boston College, 2006.

Ekhtiar, Maryam D., Priscilla P. Soucek, Sheila R. Canby, and Navina Najat Haidar, eds. *Masterpieces from the Department of Islamic Art in The Metropolitan Museum of Art*. New York: The Metropolitan Museum of Art, 2011 (cat. no. 48).