

Islamic Art and Geometric Design

ACTIVITIES FOR LEARNING

The Metropolitan Museum of Art

Islamic Art and Geometric Design

ACTIVITIES FOR LEARNING

The Metropolitan Museum of Art

Contents

Introduction and How to Use These Materials	8
Introduction to Geometric Design in Islamic Art	10
Selected Works of Art in The Metropolitan Museum of Art	12
Pattern-Making Activities	19
Resources and Glossary	43

Copyright ©2004 by The Metropolitan Museum of Art, New York
Published by The Metropolitan Museum of Art, New York

**This resource for educators is made possible by
the Mary and James G. Wallach Foundation.**

Education, The Metropolitan Museum of Art

Project Manager: Catherine Fukushima
Senior Managing Editor: Merantine Hens
Senior Publishing and Creative Manager: Masha Turchinsky
Illustrations and design by Tomoko Nakano

Color separations and printing by
Union Hill Printing Co., Inc., Ridgely, New Jersey

All photographs of works in the Museum's collection are by
the Photograph Studio of The Metropolitan Museum of Art
except for the following: nos. 14 and 20 by Schechter Lee;
nos. 17 and 18 by Malcom Varon, N.Y.C.

ISBN 1-58839-084-5 (The Metropolitan Museum of Art)
ISBN 1-300-10343-3 (Yale University Press)
Library of Congress Control Number: 2003110847

Preface

In 1976, Jane Norman—with help from Harry Bixler, Stef Stahl, and Margit Echols—wrote *The Mathematics of Islamic Art*, a groundbreaking Museum publication responding to the needs of math teachers eager to use the Museum’s resources in their classrooms. It became one of the Met’s most popular educational publications and has long since been out of print. This new iteration, *Islamic Art and Geometric Design*, which includes current scholarship on Islamic art as well as expanded activities developed in Museum workshops, remains indebted to Jane Norman’s work. We therefore dedicate this publication with gratitude, affection, and admiration to Jane, whose inceptive vision and passion for this project has inspired all that has followed.

Acknowledgments

We are extremely grateful to the Mary and James G. Wallach Foundation, whose grant enabled us to publish *Islamic Art and Geometric Design* and make it available to the many math, humanities, and science teachers who have requested it for use in their classrooms.

The creative vision and leadership of Jane Norman—an educator at the Metropolitan Museum for twenty-five years—are behind the original version of this publication. Over the years, other educators at the Museum, including Evan Levy, Betty Rout, Alice Schwarz, and Lena Sawyer, refined and expanded upon the initial concepts. We are indebted to Stefano Carboni, curator, and Qamar Adamjee, research assistant, both of the Department of Islamic Art, who revised the “Introduction to Geometric Design in Islamic Art” and ensured that the information about the selected works in the Museum represents the latest scholarship. Educators Nicholas Ruocco and Deborah Howes offered insight and encouragement. Emily Roth and Naomi Niles refined the bibliography. Catherine Fukushima shepherded this project, together with Merantine Hens, who coordinated the many steps of editing. Philomena Mariani edited the manuscript and Tonia Payne provided meticulous proofreading. Sue Koch of the Design Department provided valuable guidance. Masha Turchinsky art directed and managed the various aspects of production, working closely with Tomoko Nakano, who created the effective illustrations and the handsome design.

Kent Lydecker
Associate Director for Education

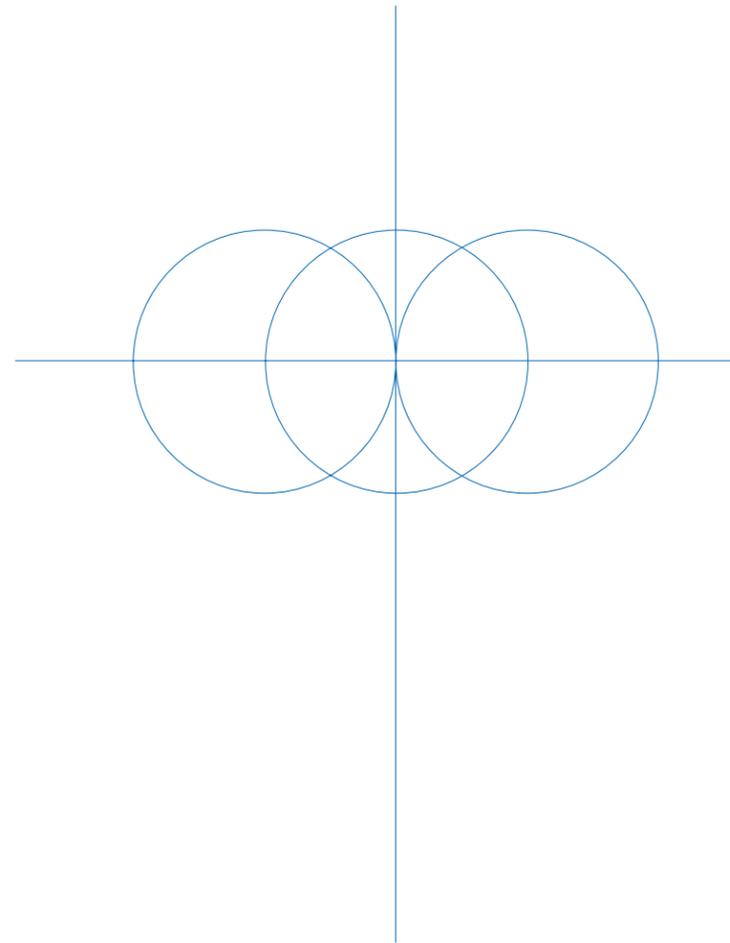
Foreword

Surface patterns on works of art created in the Islamic world have been prized for centuries for their beauty, refinement, harmony, intricacy, and complexity. Fine examples of Islamic art, from the seventh to the nineteenth century, can be seen in the Metropolitan Museum’s collection. This publication features a selection of those objects in which geometric patterns predominate. By using these materials teachers will be able to show their students how Islamic artists applied their imagination to an underlying geometric framework to create the patterns in these outstanding works of art. Students will also learn the principles of geometric patterns and be able to create their own. We hope that these activities will spark in your students a life-long interest in art and design.

We are fortunate indeed that these educational materials are supported by the Mary and James G. Wallach Foundation. Their contribution underscores their high commitment to art, to students, and to teachers. We are deeply grateful for their generosity.

Philippe de Montebello
Director

Kent Lydecker
Associate Director for Education



Introduction

Works of art can be stimulating starting points for interdisciplinary investigations leading students to explorations of history, social studies, geography, and culture. Less commonly, but no less intriguing, art may be a stimulus for exploring concepts in math and geometry. This resource provides the means for teaching about the history and providing an introduction to Islamic art while learning about the variety of geometric patterns employed by artists to embellish a wide range of works of art, including textiles, ceramics, metalwork, architectural elements, and manuscripts. Through the activities, students will learn the design principles and techniques by which the artists created these beautiful and intricate patterns.

How to Use These Materials

These materials may be used by a single teacher, or a team of teachers may collaborate, each working in his or her own discipline. The activities may be adapted to all levels of instruction.

We begin with an introduction to geometric patterns in Islamic art. Slides of works from the Metropolitan Museum's collection are included to show the variety and originality of these designs. A brief overview of Islamic art and individual object descriptions prepare the teacher to lead a discussion of the slides. For a chronological survey of Islamic art, teachers may refer to the *Timeline of Art History* at www.metmuseum.org/toah.

A series of activities follow. Working only with a straightedge and a compass, students will discover how to create many of the geometric shapes and patterns that Islamic artists preferred. They will also learn how the underlying grid structure serves as the foundation upon which these patterns may be infinitely repeated.

The humanities teacher will find that close study of works of art will lead students to a greater understanding of artistic and cultural concepts. Math teachers can use the activities to reinforce geometric principles. Art teachers will find that students become absorbed in the creation of their own geometric patterns. And science teachers will recognize that many underlying principles of these patterns have corollaries in the natural world.

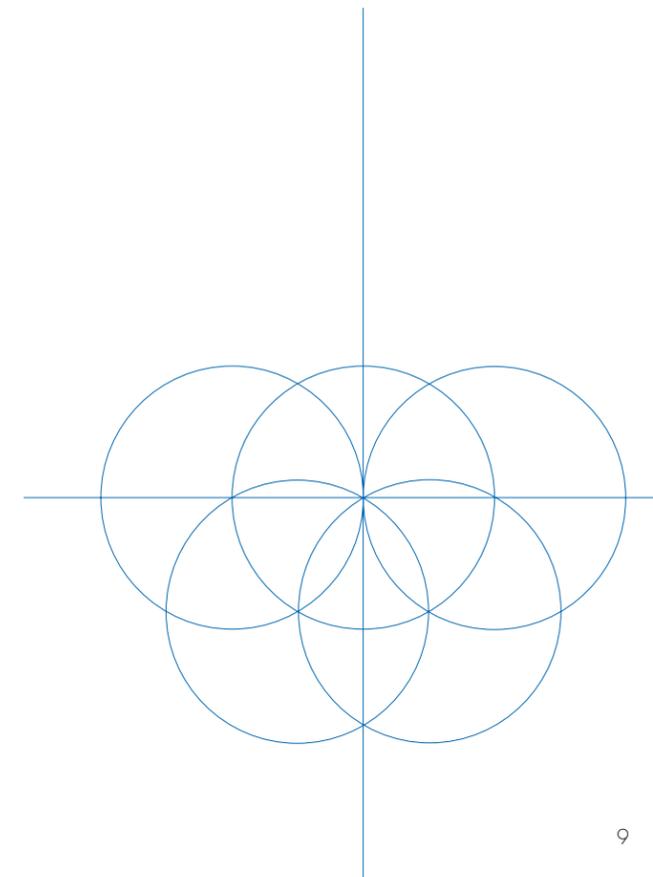
The following suggestions are offered as guidelines when using these materials:

- Become thoroughly familiar with the materials before you use them with your students.
- Use the slides as a starting point. As students view the visual materials, they will become interested in the designs and curious about how they were created.
- Explain the traditions of Islamic art to your students. A brief introduction to Islamic art and more detailed information about the individual works of art, including title, purpose, origin, and materials, are provided.
- When viewing the slides, call attention to the intricate patterns used in the decoration

of the objects. Let your students know that they will have the opportunity to create many of these patterns themselves.

- Lead your students through the pattern-making activities. You may choose to do one, some, or all of them. A set of overhead transparencies of the activity grids in this booklet is provided for your convenience.
- After the class has completed the activities, return to the slides for a more in-depth discussion of the patterns and effects of the designs. Help the students find patterns similar to the ones they created themselves.

We hope that this publication will inspire new projects that combine visual art and mathematical and geometric concepts.



Introduction to Geometric Design in Islamic Art

The principles and teachings of Islam as a way of life, a religious code, and a legal system were promulgated by Muhammad (ca. 570–632 A.D.), an Arab merchant from Mecca. These teachings were revealed to him over a period of many years beginning in 610 and were subsequently codified in the text known as the Qur'an. The word of God, as set out in the Qur'an and handed down in the sayings of Muhammad (known as *hadith*, or Traditions), forms the core of the religion.

The primary premise of the Islamic faith is monotheism, a renunciation of all deities except one, Allah, who alone is the creator, sustainer, and destroyer of life. *Islam* is Arabic for "submission," here to the single entity of Allah. The recognition of Muhammad as Allah's last prophet, a prophet like Abraham, Moses, Jesus, and the others that preceded Muhammad, is also a key element of the belief.

Neither the Qur'an nor the Traditions contain specific mandates against figural representation in art. However, both sources take a firm stance against idolatry and the worship of images. These precepts were interpreted strictly by early Islamic religious leaders and exegetes as an injunction against the depiction of human or animal figures, although extant examples of architectural decoration, objects in all media, and illustrated manuscripts belie that stricture. Four types of ornamentation can be found in Islamic art: calligraphy, figural forms (human and animal), vegetal motifs, and geometric patterns. These patterns, either singly or

combined, adorn all types of surfaces, forming intricate and complex arrangements.

While geometric ornamentation may have reached a pinnacle in the Islamic world, sources for the basic shapes and intricate patterns already existed in late antiquity in the Byzantine and Sasanian empires. Islamic artists appropriated key elements from the classical tradition, then elaborated upon them to invent a new form of decoration that stressed the importance of unity, logic, and order. Essential to this unique style were the contributions made by Islamic mathematicians, astronomers, and other scientists, whose ideas and technical advances are indirectly reflected in the artistic tradition.

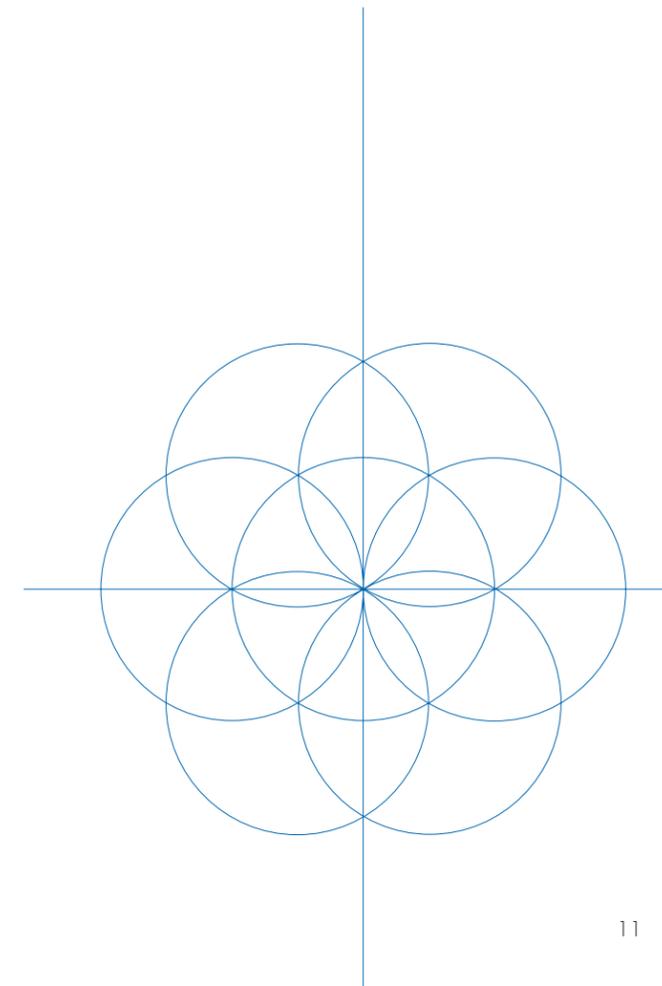
The basic instruments for constructing geometric designs were a compass and ruler. The circle became the foundation for Islamic pattern, in part a consequence of refinements made to the compass by Arabic astronomers and cartographers. The circle is often an organizing element underlying vegetal designs; it plays an important role in calligraphy, which the Arabs defined as "the geometry of the line"; and it structures all the complex Islamic patterns using geometric shapes. These patterns have three basic characteristics:

1. They are made up of a small number of repeated geometric elements. The simple forms of the circle, square, and straight line are the basis of the patterns. These elements are combined, duplicated, interlaced, and arranged in intricate combinations. Most patterns are typically based on one of two types of grid—one composed of equilateral

triangles, the other of squares. A third type of grid, composed of hexagons, is a variation on the triangular schema. The mathematical term for these grids is "regular tessellation" (deriving from Latin *tesserae*, i.e., pieces of mosaic), in which one regular polygon is repeated to tile the plane.

2. They are two-dimensional. Islamic designs often have a background and foreground pattern. The placement of pattern upon pattern serves to flatten the space, and there is no attempt to create depth. Vegetal patterns are may be set against a contrasting background in which the plantlike forms interlace, weaving over and under in a way that emphasizes the foreground decoration. In other instances, the background is replaced by a contrast between light and shade. Sometimes it is impossible to distinguish between foreground and background. Some geometric designs are created by fitting all the polygonal shapes together like the pieces of a puzzle, leaving no gaps and, therefore, requiring no spatial interplay between foreground and background. The mathematical term for this type of construction is "tessellation." The conception of space in Islamic art is completely different from Western models, which usually adopt a linear perspective and divide the picture space into foreground, middle ground, and background. Artists of the Islamic world were largely uninterested in linear perspective. Of the various styles of Islamic art, it was in Persian painting that a type of three-dimensional space was used in which figures could interact, but this space presented multiple viewpoints and simultaneously featured bird's-eye and worm's-eye views.

3. They are not designed to fit within a frame. Geometric ornamentation in Islamic art suggests a remarkable degree of freedom. The complex arrangements and combinations of elements are infinitely expandable; the frame surrounding a pattern appears to be arbitrary and the basic arrangement sometimes provides a unit from which the rest of the design can be both predicted and projected.



Selected Works of Art in The Metropolitan Museum of Art

1 Bowl, 9th–10th century; °Abbasid period

Iran or Iraq

Glass, free-blown and cut; H. 2 ³/₄ in. (7 cm), Diam. 3 ⁵/₈ in. (9.2 cm)

Purchase, Joseph Pulitzer Bequest, 1965 (65.172.1)

The simple geometric pattern that decorates this nearly spherical bowl represents one of the most common motifs that originated in Iran during the Sasanian dynasty and survived into the early Islamic period, when the new Muslim rulers came to power in the seventh century A.D. The design of disks with the raised dots in the center is generally known as an omphalos pattern, from the Greek word for "navel." The two evenly spaced, staggered rows of omphalos motifs in relief seem to grow out of petal-like forms that radiate from the base of the bowl, enhancing the sculptural quality of this otherwise seemingly weightless and colorless object.



2 Marquetry panel, second half of 8th century; °Abbasid period

Egypt

Wood inlaid with wood and bone; 18 ³/₄ x 76 ¹/₂ in. (47.6 x 194.3 cm)

Samuel D. Lee Fund, 1937 (37.103)

Possibly once the side of a cenotaph, this elaborately inlaid panel (shown in full in the slide) is a good example of the use of geometric motifs. The central section (illustrated at right) is based on the repetition of a square unit that contains a circle within two larger squares. The variations among the patterns utilizing the square demonstrate the synthesis of decorative freedom and structural balance achieved by skillful artists, with every square fitting into the overall grid.



3 "Nur al-Din" room, dated 1119 A.H. / 1707 A.D.;

Ottoman period

Syria, attributed to Damascus

Wood, marble, stucco, glass, mother-of-pearl, ceramics, tile, stone, iron, colors, and gold; 22 ft. ¹/₂ in. x 16 ft. 8 ¹/₂ in. x 26 ft. 4 ³/₄ in. (6.7 x 5 x 8 m)

Gift of The Hagop Kevorkian Fund, 1970 (1970.170)

This room was the winter reception room in the home of a wealthy Syrian man. Male guests would enter the room, leave their shoes at the step, and ascend to the reception area, where host and guests would relax on pillows placed on long benches that lined the wall. In the area in front of the steps, servants would prepare food, coffee, and a water pipe for the guests. The room also has niches for books, water pipes, and a collection of ceramics and metalwork. Closets were used to store mats and bedding. The floor is made of marble tiles and the wooden walls and the ceiling are ornamented with gesso. Every surface is richly decorated with multiple patterns and abundant use of gold. The decorations are mostly vegetal and calligraphic.



4 Fountain from "Nur al-Din" room

(detail of slide 3)

At the entrance to the reception room (see slide 3) is a fountain reconstructed following original models. Occupants of the "Nur al-Din" room relaxed to the sound of the water in this octagonal fountain. Around the center is a circular border divided into eight equal parts; surrounding this is a square border decorated with a thin band of tessellated hexagons.



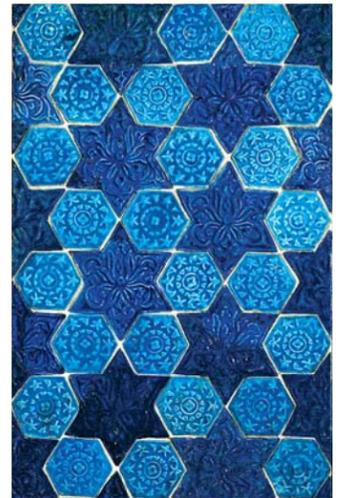
5 Molded tile panel, 13th–14th century; Ilkhanid period

Iran, Nishapur

Ceramic with turquoise and cobalt glaze; 41 ¹/₂ x 24 in. (105.4 x 61 cm)

Rogers Fund, 1937 (37.40.26, 27)

Ceramic tiles provided a perfect material for creating tessellated patterns that could cover entire walls or even buildings. A pattern such as this required only two kinds of molds to make a beautiful and interesting design, one of the most popular of Islamic tessellations. The Western eye might read this pattern from left to right and from top to bottom, the way a page of print is read; however, any star or hexagon can serve as a central figure from which the rest of the pattern radiates. A perfect expression of radiation from a central point, the star is the most popular design element in Islamic art. The six-pointed stars in this pattern are molded with a lotus design from China, an important influence on Islamic art.



6 Glazed tile panel (detail), mid-16th century; Ottoman period

Syria

Ceramic with turquoise and cobalt colors underglaze; 21 x 30 in. (53.3 x 76.2 cm)

Rogers Fund, 1923 (23.12.3)

Even simpler than a tessellation of stars and hexagons is one of hexagons alone. In this case, the tiles have been individually painted rather than molded with a design. The central flower in each tile is a six-pointed star formed by two equilateral triangles.

