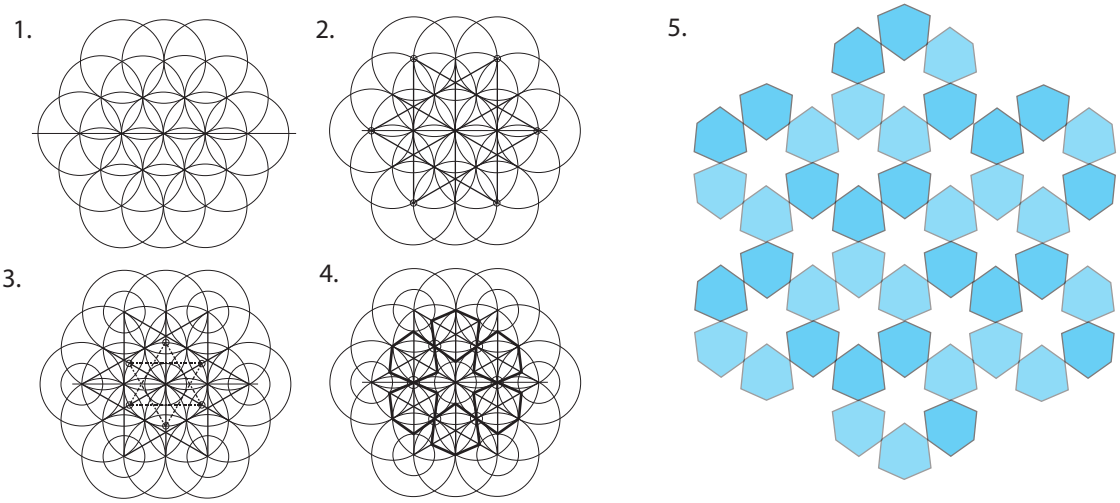
SELECTED 2009 THE ROYAL SOCIETY SUMMER SCIENCE EXHIBITION

What are the secrets of the Islamic master craftsmen?

Factsheet 2

Geometry in Islamic Art

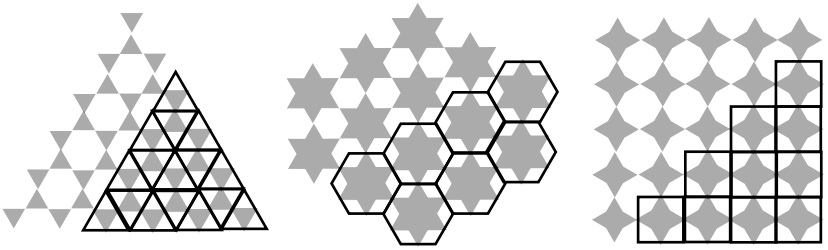
The use of geometry creates a natural harmony within Islamic art. This relates to the Islamic belief that all creation is harmoniously interrelated. In common with other traditional arts these geometric designs can created using the simple tools of compass and straight edge. Notice how the pattern below is derived from regular divisions of the circle. A regular grid of triangles is established, on top of which the design is elaborated. Note the different stages of the pattern and how this design differs subtly from the one on the main exhibition poster.



In this example it it easy to see how one might alternatively have used a regular grid of hexagons to develop a different design. How might you construct a regular grid of squares using just compass and straight edge?

Regular Tilings

There are just three regular tilings (sometimes referred to as the Platonic Tilings), in which the same regular polyon tiles with copies of itself to fill the plane. Many Islamic patterns are based on these three tilings, however the underlying grid of triangles, squares or hexagons is hidden in the final design. Can you see what the underlying tiling unit is in this *alicatado* (tile mosaic) pattern from the Alhambra (right)?



Three classical patterns shown with and without the underlying tiling.

Alicatado (ceramic cut tiles), Alhambra, Spain.

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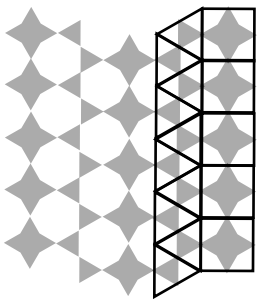
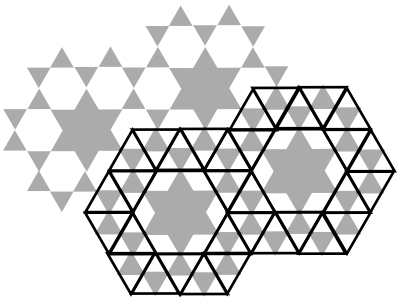
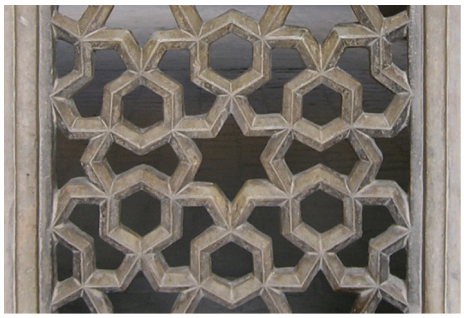
Semi-Regular Tilings

On Factsheet 1 you were asked to find all possible tilings in which the same regular polygons meet at each vertex. These are known as the semi-regular tilings and they are hidden beneath more complex Islamic patterns. Two examples are illustrated (right). Can you find the underlying tiling in the patterns below?



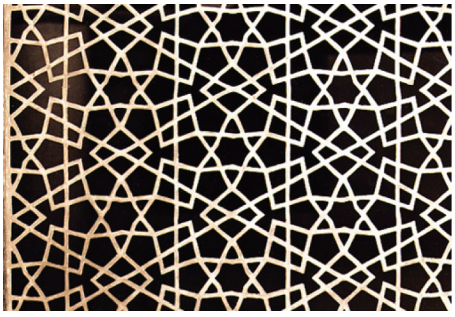




Pierced stone screen, Isfahan Iran.

Ceramic floor tiles, Morocco.

Ceramic *zillij* (cut-tile), Meknes, Morocco.



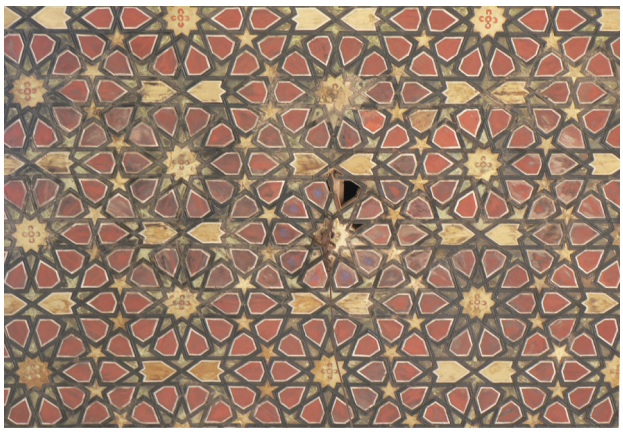
Iron grill, Ibn Tulun mosque, Cairo.

Cut-stone floor, Cairo (Photo: P Marchant).

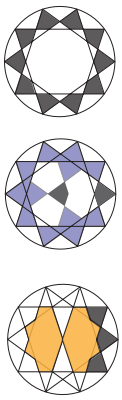
Cut-tile mosaic, Kerman, Iran.

Non-Archimedean Tilings

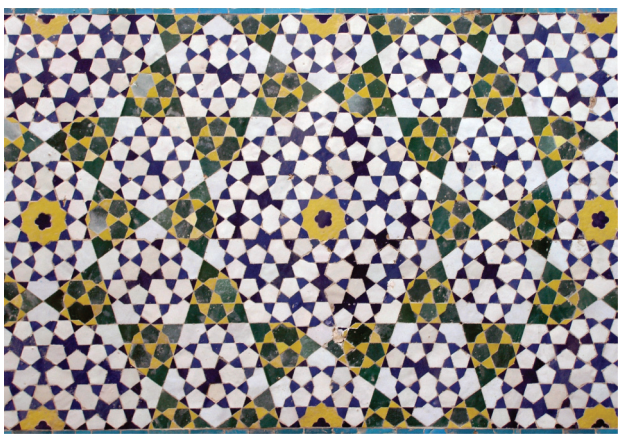
As you will have observed, not all polygons will tile the plane. The pentagon presents particular problems, but Islamic designers showed great ingenuity in overcoming these. The pattern below left is a slight variation on one that you can create with the wooden tiles. What additional tile/tiles would you need to create this pattern? The pattern below right is based on a similar underlying grid, but appears more complex as it employs different breakdowns of the decagram motif (below centre) at each vertex in the underlying grid.



Painted ceiling, Ali Qapu palace, Isfahan, Iran.



Decagram motifs.



Ceramic tile mosaic, Vakil mosque, Shiraz, Iran.

Unless otherwise indicated,
all photos and drawings by Richard Henry
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