

The Geometry of Paradise Flowers

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Abstract

When thinking about Islamic mosaics, it might seem that only mosaics that have geometrical patterns involve mathematics, however, there is an interesting amount of mathematics in floral designs too: each flower individually and all of the various connections between the flowers are based on circular patterns. In this workshop the participants will learn about these constructions step by step. Next, they will design a flower themselves, based on the fixed base shapes of the mosaics but leaving enough degrees of freedom to be creative. The newly designed flowers will be attached to a prefabricated framework to make a wonderful collaborative design.

Introduction

Walking through an Islamic city like Isfahan is the easiest way to get overwhelmed by the beauty of Islamic patterns and tilings: hundreds of square meters of walls covered with tiles and mosaics!

For that reason, the workshop starts with a virtual visit to the Shah Mosque in Isfahan to look at the blue and yellow tilings with floral patterns designed in order to make the mosque look like paradise.

Later, traveling from Isfahan to almost all other cities in Iran, it appears that these patterns are almost the same everywhere. There are lots of similarities in geometrical patterns, or even in body, tree or bird drawing, which is remarkable: the floral designs are abstractions from real flowers, and usually abstractions vary widely. It is assumed that there was a common knowledge about constructing these patterns. This can only be the case if the designs are based on rather basic principles that were used by all designers. But these principles are not recorded, we can only try to reconstruct them.



Figure 1: *Floral patterns. Right: Chaharbagh mosque, Isfahan: Left: shrine in Shahreza*

An Introduction to Floral Patterns

There is no doubt that floral patterns, what Iranian call *Tazhib* (golden) patterns, existed already in very simple shapes before the Islamic period. Patterns on old dishes from the period of the *Sasani Dynasty* (224 - 651) prove this. Comparison with how these shapes look like after the introduction of Islam shows a big growth in this art. It is assumed this happened because this style had no conflict with the religious believe that prohibited the drawing of human or animal figures. The word *eslimi* for naming a group of these patterns is a support for this idea. [1] Eslimi patterns are considered to resemble a cypress tree, bent in submission. Cypress trees make an extensive symbolic appearance in the Iranian epic poem *Shahnameh* by Ferdowsi around 1000 AD. This poem describes the history of Iran before the Islam came. In the story, a great cypress tree sprung from a branch brought by Zoroaster from paradise. The word *eslimi* is derived from the root *salama*, wich means peace and health, and *Eslam* which has also been interpreted as a derivative of *taslim*, which means submission to and adoration of the Almighty. [2][3]The eslimi patterns were used much more in the first Iranian Islamic designs than the second group called *khatai* which are symbols for paradise flowers.



Figure 2: *Eslimi* (right, light background) and *khatai* (left, dark background) patterns.

Main Parts of a Floral Design

Floral patterns have two main groups: *eslimi* and *khatai*. Any floral design can use shapes out of one or both of these groups.

The *eslimi* group contains shapes that can be used as connections: spirals and a shape with the same name as the whole group. (see figure 3) The *khatai* group contains more different structures of flowers and parts of flowers like stems, leaves and buds. This group involves flowers with names like: simple flower (گل گرد), Shah Abbasi (شاه عباسی), anari (اناری), barge mo'i (برگ مویی), parvaneh (پروانه) and bud (غنچه). (see figure 4)

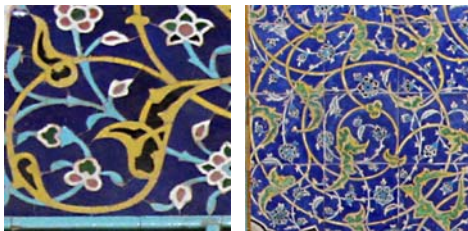


Figure 3: *Eslimi* and connection lines



Figure 4: *Khatai* flowers: simple flower, Shah Abbasi, parvaneh, barge mo'i and anari

Mathematics in Floral Designs

Searching books and documents for mathematics in Islamic designs will give you lots of information about the mathematics in geometrical patterns, but not the mathematics in the floral designs. If you are lucky you may find some information about how to use geometry for designing eslimis [2] or connections between these flowers [4]. Nothing more!

But less academic searches, going to small workshops, where artists design floral patterns for tilings, carpets, carving, etc is the way to reconstruct the designing principles. These are places you can see how even non-educated masters teach their assistants how to draw floral patterns with geometrical methods.

Most of these masters start their teaching with asking students to try to draw circles. Giving them some numbers as radius, and asking them to fill pages with circles till they can do it perfectly. The next step is teaching them how to make basic leaves and then flowers out of these circles. This is the moment you will see how almost all flowers and leaves use geometric rules to be designed.

In figure 5 different possible ways of drawing connections are shown. You can find these four methods in some art books too.

Drawing Spiral Connections

The following different spiral connections have different curve lengths to make more compact spirals. Adding more edges will make the resulting spiral less compact.

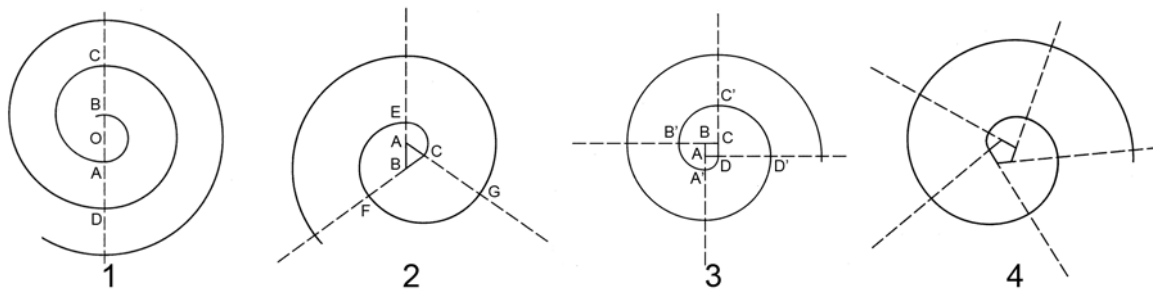


Figure 5 *Constructing spirals*

1. **Liner or circular spiral connection**

Draw a line and a center point O on it. Draw a curve from O with an optional R and name the end points A and B . Then from B with $R = AB$ and so on.

2. **The triangular spiral connection**

Start your drawing with an equilateral triangle as the base. Continue the triangle edges. Draw a curve from point A with $R = AC$ to the point E , then from B to F with $R = BE$, from C to G with $R = CF$ and so on.

3. **The square spiral connection**

First, draw a square and continue its edges. Draw a curve from point A to A' with $R = AD$, then from B to B' with $R = BA'$, from C with $R = CB'$ and so on.

4. **The pentagon spiral connection**

The method for drawing this spiral has only one difference with two previous ones. The base for this connection is an equilateral pentagon instead of triangle or square.

Drawing Khatai Flowers

Two methods for drawing flowers based on circles are shown in figure 6. In the workshop these methods will be explained using pictures of genuine tilings, as shown in figure 7.

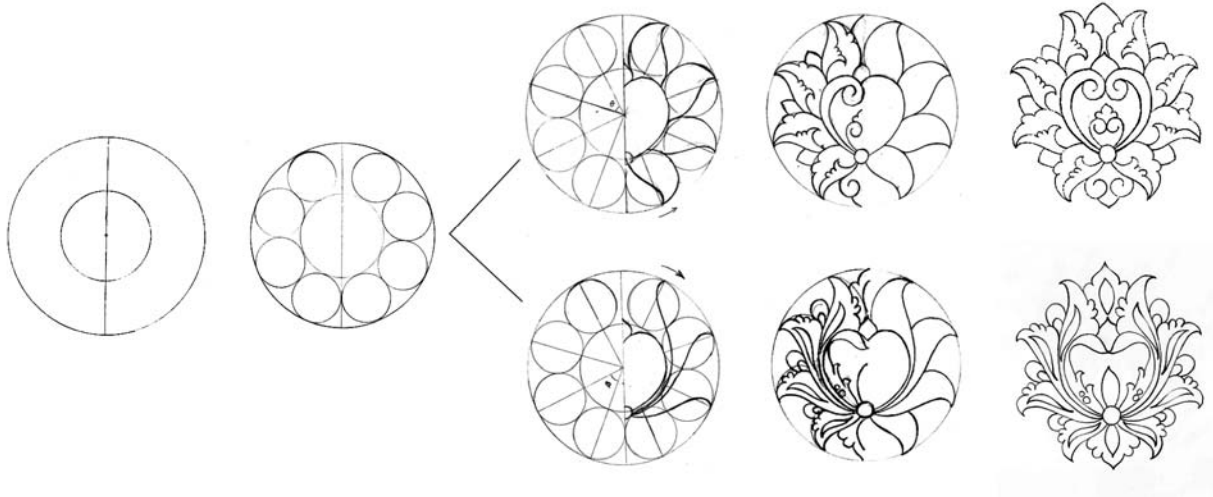


Figure 6: circle based method for drawing Shah Abbasi (2nd row) and Anari (3rd) flowers,



Figure 7: checking geometrical designing methods in khatai flowers on tiles.

The Workshop

The purpose of the workshop is to show attendants how to bring the pearls of Islamic art into the classroom. The different construction methods will be explained, after this the participants are going to design their own flower or connection. All the individual designs will be combined in a prefabricated framework in order to create a collaborative design. Depending on how elaborate the worksheets are for the individual designs, this workshop, or parts of it, can be used at a wide range of levels: from elementary school to college level.

Acknowledgements All drawings by Sarah Abdellahi, all photographs by Tom Goris.

References

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http://www.ehow.com/about_6370225_cypress-tree-symbolism.html#ixzz1JVzfHNVN
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