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Islamic Art: An Exploration of Pattern

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Abstract

As an historian of Islamic art in the Department of Art History at the Maryland Institute College of Art, I am continually learning as I endeavor to teach my students about pattern. Teaching about pattern in Islamic art has facilitated my own exploration of geometry in ways that also benefits my students. This visual presentation explores the results of a single assignment that pertains to coloring a linear plate reproduced in Bourgoin's classic work [6], *Arabic Geometrical Pattern and Design*.

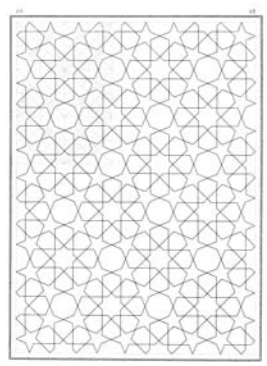

Figure 1. Bourgoin [6], pl. 48.

This visual presentation explores the results of an assignment to students in a class on pattern in Islamic art taught at the Maryland Institute College of Art in Baltimore. The assignment pertains to a single pattern, reproduced as plate 48, among 190 plates showing linear drawings by Jules Bourgoin [6] that document Islamic monuments of Cairo in 1879 (**figure 1**). Bourgoin's book (minus the original French text) has been reprinted many times as one of the Dover Pictorial Archives; it is both inexpensive and readily available.

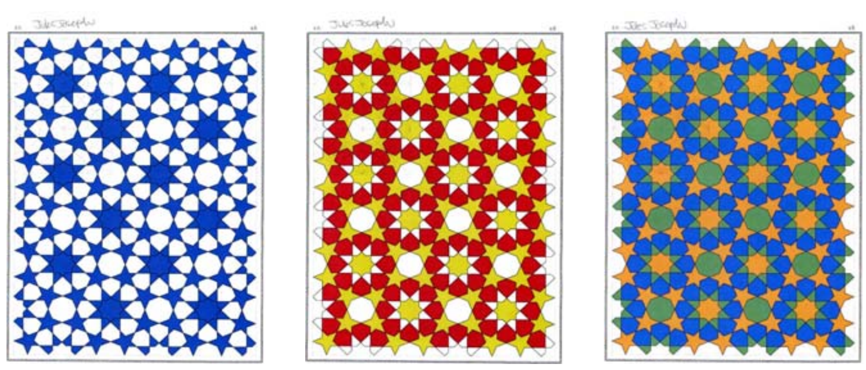

Figure 2. The assignment is to color the same linear pattern (Bourgoin [6], fig. 48) in three different ways: using a single color (*left*), using two colors (*middle*), and using three colors (*right*). Jules Joseph.

The approach I take with the students is intended to introduce them to the manifold possibilities and ambiguities inherent in pattern-making and to the underlying geometric framework for 2-D patterns in Islamic art [2].

The students are asked to reproduce Bourgoin's plate 48 (**figure 1**) three times and color the pattern using one, two, and three or more colors (**figure 2**).

At first, the assignment seems to be restrictive and highly repetitive. But there is no specification as to color or medium. Students tend to respond to the assignment, selecting different colors but using only one medium for each of the colorings. They have used crayons, colored pencils, pastels, water colors, opaque water colors, crayolas, colored markers, and digital paint media.

By restricting the choice of pattern to a single line drawing, with thirty-five students I may receive as many as one hundred and five results, which are usually all different, and significantly so.

The next step is to post the colorings on the wall of the classroom, initially arranged by grouping together each student's work (e.g. **figure 2**). The range of colorings and patterns invariably surprises the entire class, but the implications are immediate. They visually recognize the inherent possibilities for patterns within patterns, rendered apparent by this exercise.

We then explore what I call the attributes of pattern (**figures 2-7; 10-13**). One by one, the students identify such attributes as color, scale, shape, style (that of an individual), medium, grid, combinations of shapes, combinations of colors, and combinations of colors and shapes.

Figure 2, for example, represents the style of one individual's response to the assignment. **Figure 3**, however, isolates different shapes as an attribute distinct from style. Soon the students begin to recognize differences in effects due to the use of an outline, fill techniques, framing, relationships between figure and ground, color juxtapositions, and negative space. **Figures 4 and 5** isolate these other possible attributes of pattern.

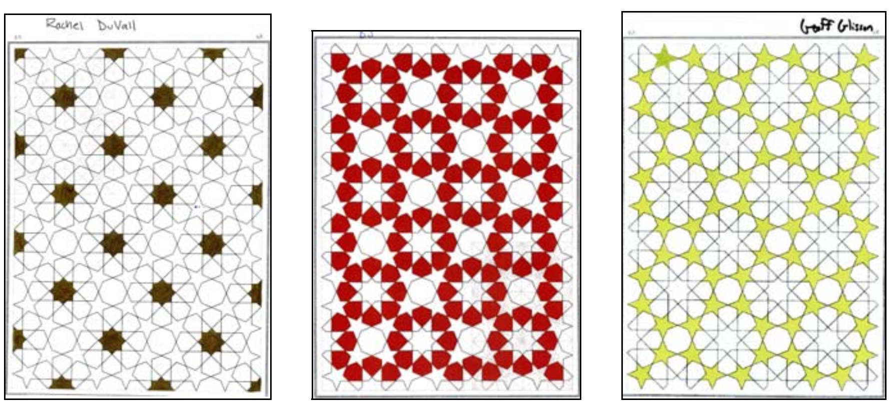

Figure 3. Attributes of pattern (shapes). Eight-pointed stars (*left*), Rachel DuVall; hexagons (*center*), DJ William; five-pointed stars (*right*), Geoff Glisson.

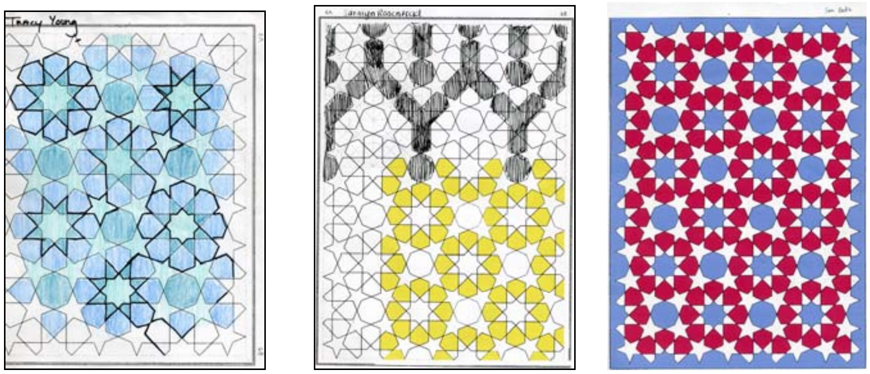

Figure 4. Attributes of pattern: outlines (*left*), Tracy Young; fill techniques (*center*), Saralyn Rosenfield; framing (*right*), Sam Ortiz.

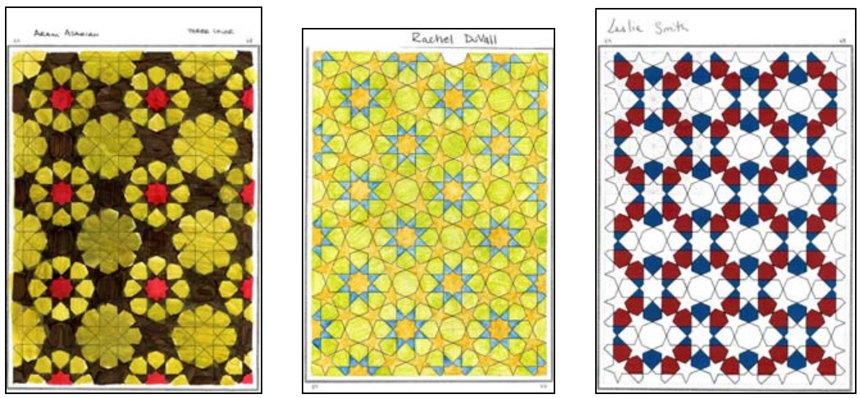

Figure 5. Attributes of pattern: figure/ground relationships (*left*), Aram Asarian; color juxtapositions (*center*), Rachel DuVall; negative space (*right*), Leslie Smith.

Then as the students focus their attention on lines, or axes, and sets of lines (**figure 6**), they begin to ascertain whether the sets are parallel or perpendicular, and if they are orthogonal, whether they are oriented vertically and horizontally or obliquely, or if they cross at other than right angles.

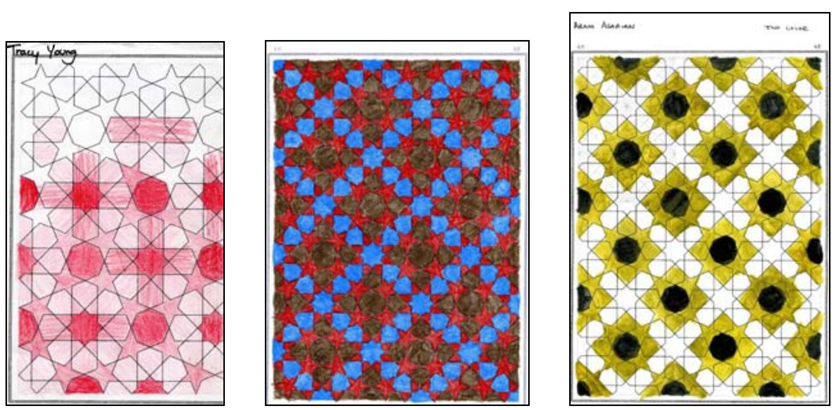

Figure 6. Attributes of pattern (grids): sets of parallel lines and perpendicular lines oriented vertically and horizontally (*left*), Tracy Young; sets of parallel and perpendicular lines oriented horizontally, vertically, and diagonally, with the diagonal axes emphasized by the choice of color, highlighting an oblique grid (*center*), Johanna Regalado; oblique grid (*right*), Aram Asarian.

They begin to recognize orthogonal crossings and oblique grids. They enumerate rows and columns, and notice that some of the rows are offset (**figure 7**). By highlighting individual shapes (octagons) or reserving shapes in negative space (octograms), our perception of the same pattern of form can be affected by the use of color so that we see alternating octograms and octagons (**figure 7**, *left*) or so that we see alternating octograms (**figure 7**, *center*) without referencing the octagons visually. By the further manipulation of color, shape, and negative space, the same linear pattern can again be adjusted so that we see different combinations of stars (**figure 7**, *right*). Through the manipulation of shape in relation to color, one may highlight two forms in alternation (**figure 7**, *left*). By such manipulation of color through alternation, one may highlight the horizontality so that offset forms are not even immediately apparent (**figure 8**, *left*).

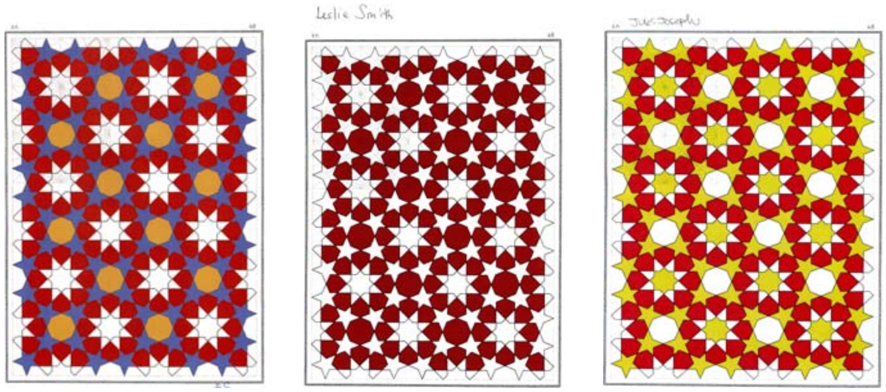

Figure 7. Attributes of pattern (alignment of axes): offset rows + columns of octagons and octograms (*left*), DJ William; octograms (*center*), Leslie Smith; multiple stars (*right*), Jules Joseph.

Our focus on alignment and the relationships of rows and columns to each other (**figure 7**) yields to a discussion of symmetry in nature and art [15]. The students learn about translation, rotation, reflection and glide reflection. We examine which rigid motions rely on vectors and axes, and which rely on points (**figure 8**). We look for vectors of translation, axes of reflection, and points of rotation. Sometimes these occur when they are not initially expected. Eventually, the students can recognize local and global symmetries in the plane [14] as well as symmetry-breaking [3].

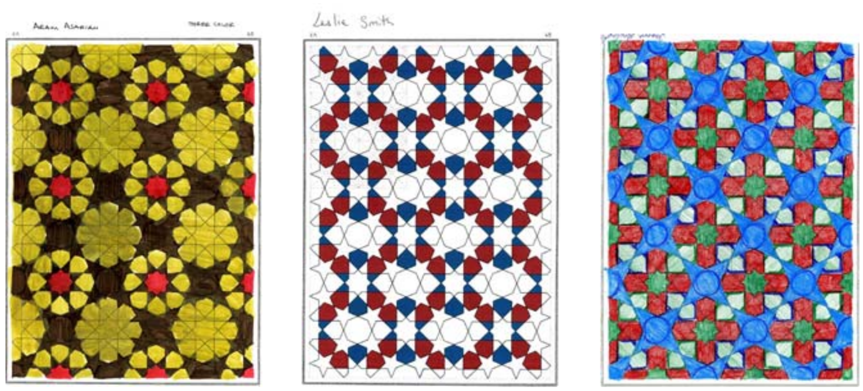

Figure 8. Playing with pattern: horizontality emphasized through alternation (*left*), Aram Asarian; variations in negative space (*center*), Leslie Smith; four colors using different tonalities and outlines brings out even more relationships (*right*), Johanna Regalado.

Soon enough they realize that our play with colors affects not only the patterns we produce, but that we are also playing with perception; that is, we are doing things with the various attributes of pattern, including color, shape, lines and axes, grids and negative space, which all interact to affect our perception [13]. Dark colors tend to appear as if they recede (**figure 8**, *left*), while bright colors seem to project, playing with our perception of the plane. Different colors affect our perception of different shapes, which relates this exercise also to that of Albers' *Interaction of Color* [1].

For this particular pattern the students identify five shapes: eight-pointed stars, five-pointed stars, hexagons, quadrilaterals, and octagons. They notice that the octagons are regular (equal sides and equal angles), but that the hexagons are not. Then they recognize that the five-pointed stars are effectively negative space, defined by the limits of other shapes, and that the eight-pointed stars (octograms) may be extended by the use of color juxtapositions to form other types of octograms (**figure 9**), emphasizing rotational symmetry. But by looking closely they may recognize that although the rotational symmetries visually dominate, it is the axes of reflection that govern the orientation of the five-pointed stars.

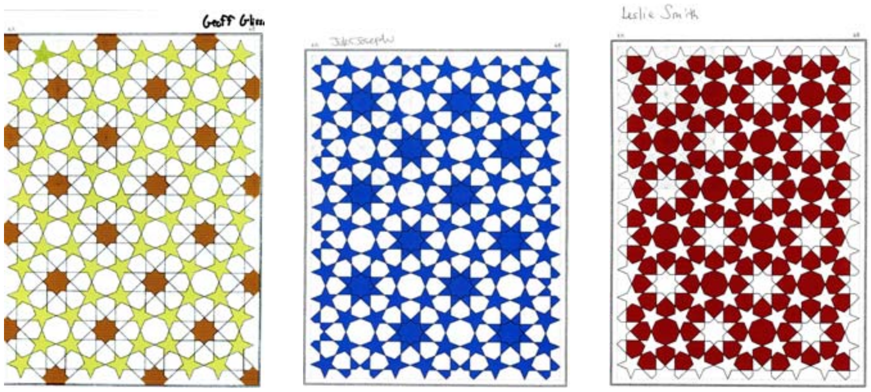

Figure 9. Playing with pattern: eight-pointed stars (octograms) with order 4 rotational symmetry, Geoff Glisson (*left*), Jules Joseph (*center*), Leslie Smith (*right*). These colorings highlight rotational symmetries within the pattern.

Figures 10 – 13 isolate color as an attribute of pattern. The single color exercise accustoms the students' eyes to perceive shapes (**figure 3**) and relationships among shapes. As the students proceed to use two colors, the question arises as to whether white is considered a color. Generally, I then ask if white is a color, and we may discuss differences between pigment and light. Some reply that it is the absence of color, so we begin to discuss the effect of negative space (**figure 10**). What if they really colored in the pattern using only one color? What would happen to the page? What effect would the outlines then have?

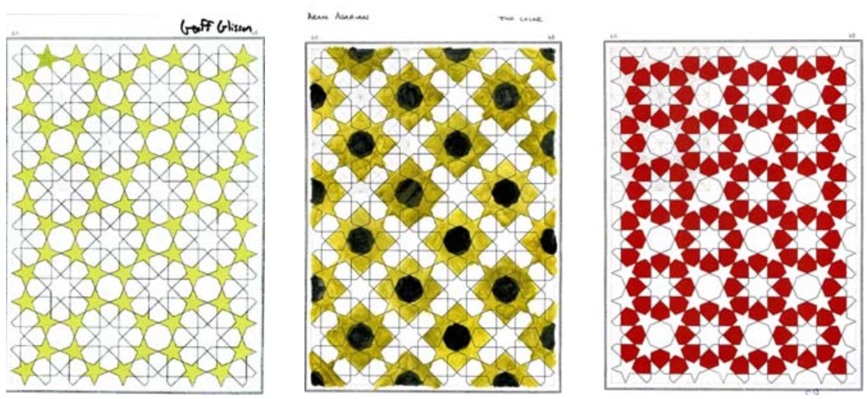

Figure 10. Attributes of pattern: negative space, Geoff Glisson, Aram Asarian, DJ William.

If white is not a color, it may still be considered as negative space, reserved from color. In this case it serves as ground, establishing different relationships between figure and ground (**figure 10**).

The two-color exercise (**figure 11**) emphasizes relationships among shapes. The development of an algorithm, which once established, carries the student through by means of iteration.

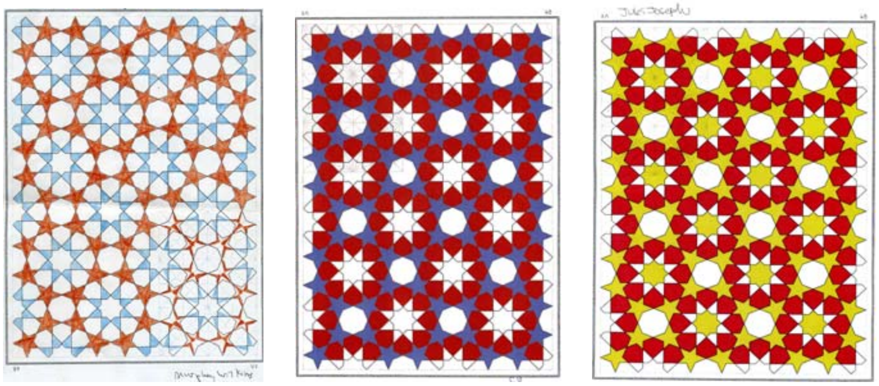

Figure 11. Attributes of pattern: relationships among shapes (using two colors). Eight-pointed stars + five-pointed stars (*left*), Murphey Wilkins; hexagons + five-pointed stars (*center*), DJ William; hexagons + five-pointed stars + eight-pointed stars (*right*), Jules Joseph.

The three color exercise (**figure 12**) enables them to explore other combinations of colors and shapes within a wide range of possibilities.

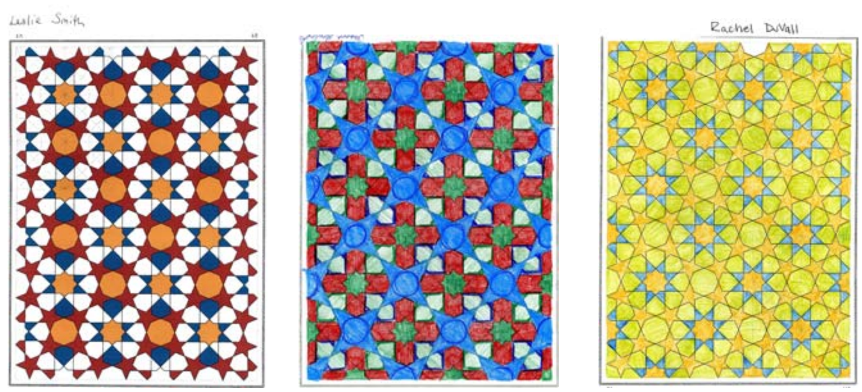

Figure 12. Attributes of pattern: explorations of colors and shapes (using three or more colors), Leslie Smith (*left*), Johanna Regalado (*center*), Rachel DuVall (*right*).

Some students have approached the exercise in an additive manner, selecting a second set of shapes added to the first group (**figure 13**), and a third set added to the second. Other students have approached the exercise in a divisive manner, subdividing areas through the use of color (**figure 14**).

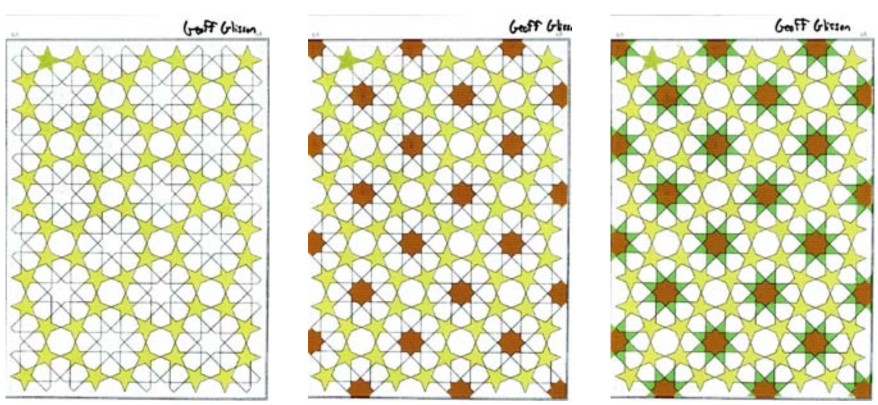

Figure 13. Attributes of pattern (colors). Here the sequence of one, two, and three colors is treated in an additive manner (one color: five-pointed stars; two colors: one color plus eight-pointed stars; three colors: two colors plus quadrilaterals), Geoff Glisson.

What students learn by this simple assignment is profound. The constructivist approach provides each of the students with an individual experience that is eye-opening, mind-bending, insightful, and fun. As a result of this exercise, the students seem to be more ready to take on the challenges of visual analysis when viewing slides of standing monuments of Islamic art, which otherwise may seem so unfamiliar. They are prepared for ambiguity and they take delight in finding patterns within patterns, focusing first on one perceived sequence, then on another, then on a third, and so on.

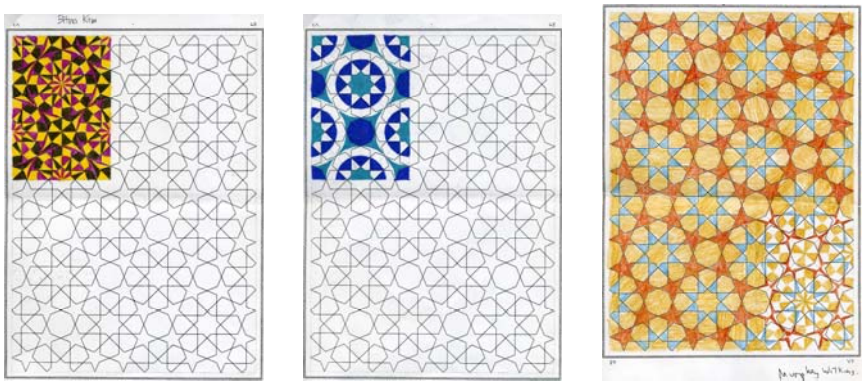

Figure 14. Playing with pattern: subdivisions of space, (*left, center*), Bitna Kim; (*right*), Murphy Wilkins.

The students seem to be more likely to respond to the complexity of Islamic art with a willingness to explore its possibilities, and a willingness to engage their minds with an exploration to realize a visual experience. They are ready for the visual challenges that Islamic art offers [8; 12] and they take pleasure in its perceptual delights (**figure 15**).

They are fascinated that such seemingly complex patterns can be created using only a compass and straight edge, or by paper-folding to create series of intersecting lines and angles with an underlying grid system. They become attuned to seeking out points and lines, calculating angles visually, and recognizing generative units and proportional relationships. As we proceed, as artists, they are introduced to terms that may be unfamiliar – orthogonal, periodic, algorithmic, group theory, set theory, combinatorics, permutations, tilings, tessellations [7; 9; 10; 14]. Although new to their vocabulary, the principles represented through language are already present in their art. Mathematical ideas expressed in art are not so much representational as they are expressive.

As we approach these concepts we attempt to describe what we experienced through this exercise of coloring. Several students mention that they would visit the Islamic galleries at the Walters Art Museum in Baltimore and see objects differently. For mathematics across the curriculum, the next steps can be transferred to other subjects as well. We begin to articulate through words what we see in the effects produced by the use of color: Color may be used to highlight, to frame, to select, to link, to fill, to contrast, to contain, to surround, to provide form, to separate, to pattern, to repeat, to divide, to establish a rhythm, to pulsate, to vibrate, to interrupt, to group together, to tie together, to deny, to imply. Color may be additive or divisive; it may simplify or complicate; it may isolate or provide focus; it may compete or complement; it may make static or it may give a sense of motion. Some other terms that describe what color does, in relation to form: it can confuse, articulate, alternate, outline, obscure, blur, relate.

Figure 15. Wall panels of ceramic tile displayed in the courtyard of the home of Doris Duke at Shangri La, Honolulu, now a museum [5, p. 256, fig. 1]. Similar tile panels were excavated at the site of Takht-i Sulaiman in Iran, dating to the late 13th century [11, p. fig. 94, cat. no. 104]. Note that the two tile panels are identical in linear outline to the pattern analyzed in this exercise, classified by Bourgoin as an "octagon" design [6]. Here, the same pattern is colored in two different ways using the same colors. Photograph by the author.

The value of this exercise is itself manifold. Students become involved in a seemingly simple assignment, which results in an exploration of the attributes of patterns, generally. They become familiarized experientially with pattern-making in a manner fundamental to an understanding of geometric design in Islamic art. They are introduced to mathematical principles inherent to the production of art in many cultures. If they are interested in metaphysics or the contemporary discourse in classical Islamic philosophy or the history of mathematics, they may pursue these subjects through independent study. Of particular relevance is the debate concerning faith and reason, based on interpretations of the works of Plato and Aristotle in the Islamic tradition. The notions of "one and many," "unity and multiplicity" are particularly relevant [4]. And the students' ability to perceive is forever changed, as they begin to recognize that the attributes of pattern interact dynamically. They are drawn into an awareness of the processes of perceiving in a manner that develops an individual visual and perceptual acuity. One student said this exercise put her "in the zone." I asked what that meant, and soon enough we established the notion that it was a zone of deep concentration and focus, one in which mindfulness and mindlessness seem to reside together. The process of repetition seems to facilitate a mindless focus, but at the same time, one must pay very careful attention to the process and nothing else in a meditative manner.

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