Understanding Geometric Pattern and its Geometry Part 7 – What can go wrong?

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Abstract

In the first paper[1] of this series, we discussed selected geometric concepts related to the class of patterns referred to as gereh[2]. The creation of these patterns followed the rules of gereh (axioms). Constructions of such patterns follow three steps: construction of the contour for the pattern template, construction of tessellation inside the contour, and designing a pattern for each tessellation tile.
In this part, we will discuss why some patterns are considered incorrect and what are the fundamental features of a geometric pattern that make it acceptable?

Introduction

Geometric patterns often confuse their admirers. Many of them look very simple. Just a few segments form a star or a rosette. Thus many people believe that drawing a geometric pattern is a very straightforward task. They start fiddling with segments and circles, and as a result of this activity, they get something that looks like a pattern they have seen somewhere. It looks like, but a good observer may notice many differences and inaccuracies. In their pattern drawing, people often forget about the geometry and geometric properties of a pattern. This paper will show a few of such patterns and explain what is wrong with them.

There is also another case. Some people consider themselves pattern gurus, and they often criticize other people's works, including patterns made by famous designers from the deep past. In this paper, we will show such patterns and explain the possible mistakes made by these gurus.

Finally, this paper will discuss a few controversial designs, and we will show how these patterns were constructed.

Problems with terminology

Authors in the West often had problems with the terminology of the eastern things and concepts. The famous book by Edward W. Said (see [8]) discussed this phenomenon in relation to culture and politics. Here we will look only at terms related to the geometric patterns. Let us look at names used by some authors. We have:

- Islamic art, geometric patterns in Islamic art (d'Avennes, 1827),
- Les Éléments de l'Art Arabe (Bourgoin, 1879),
- Arabic geometrical pattern (Bourgoin, 1973),
- Geometric patterns in Saracenic art (Hankin, 1925),
- Geometric ornament in Central Asia (Balkanov, 1940),

[1] Understanding Geometric Pattern and its Geometry (part 1), eJMT, vol. 14, Nr 2, pages 87-106.
[2] Gerehs, or gereh patterns, this is only one group of geometric patterns. There are many other patterns that can be created using different approach, e.g. patterns on square grids, triangular or other types of grids.

- Герих (Gierih), (Balkanov, 1947),
- Гирих (Girih), (Rempel, 1961),
- Gereh (Encyclopedia Iranica, 2001),
- Islamic geometric pattern (Broug, Bonner, …).

As we can notice, some of these terms are wrong or confusing. The problem is that these authors tried to squeeze all geometric patterns under one umbrella and have a global term for them. This cannot work for many reasons.

First, let us notice that Arabs were not creators of geometric patterns. Geometric patterns came from Persia and Central Asia. Persians are the ones who created a very rich class of patterns and methods for drawing them. But no one mentions Persians.

The term 'Saracen' is quite vague. Various sources attach to this word many different meanings. So, which Saracens were involved in geometric patterns creation?

What about 'Islamic geometric patterns? This term was invented in the West and is completely wrong. While talking with Uzbek or Iranian people, I never heard anybody mentioning this term. They strongly object to this term. They say, "this is our traditional art, and it has nothing to do with Islam." In fact, geometric patterns were known in Persia before Islam came to this region (see [2]). Iranians use the term 'gereh.'

The most proper are terms used by Russian scientists. They use the terms 'girih' or 'gierieh,' which are Central Asian versions of the Persian term 'gereh.'

We observe that in the West, people often believe that there is religious symbolism in the term 'Islamic geometric patterns,' and they try to associate with them some symbolic meaning.

There is still missing geometric meaning in any of the examples mentioned above. What is a geometric pattern from a geometric point of view? How do we classify them? From a geometric point of view, it could be convenient to use the forms of symmetry existing in these patterns. For example, a decagonal geometric pattern means a pattern with decagonal local symmetries or shapes derived from the geometry of a regular decagon. The group of decagonal geometric patterns is still huge. But at least we get a more concrete and still vague description. What about geometric patterns using local symmetries 5, 10, and 20? Are they still decagonal? Why decagonal but not pentagonal? Probably the safest could be notation listing all local symmetries of a pattern, e.g. [5,10,20]. However, none of the above names or definitions will satisfy a mathematician. They do not give us the precision required in a mathematical theory.

Correct or incorrect pattern?

Let us consider what we mean by a correct geometric pattern? Do we have rules allowing us to decide when a geometric pattern is correct and when it is not? One of the Turkish kundekari makers once said, "*a good pattern must not hurt your eye and be doable*." What does this mean?

The first argument is a reference to our sense of aesthetics. We like some things, and we do not like others. We used to deal with some forms, and we have never seen others. We like regular shapes with at least one symmetry line. We like lines crossing smoothly without unnecessary or strange bending. Many old patterns follow our taste. But, there are still old patterns with unusual shapes and strange line bending. Are they correct or incorrect?

We will understand the second argument when we look at a work of woodworking or ceramic tiling artisans. The material they use creates some limitations on pattern design. Patterns with unusual shapes can be big trouble for a ceramic tiling craftsman. For him, it is much easier to deal with a limited number of uniform shapes in his work. He can prepare a template for each shape and then order or make hundreds of tiles, ceramic or wooden, following these shapes. The symmetry of each shape helps a lot. Let us examine two such examples.