

# Exploring Simple Geometries Using Beaded Jewelry

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## Abstract

The contribution is focused on geometry which can be observed in jewelry, especially made from the beads. Geometric patterns which can be used in making jewelry from the beads are enormously varied and based on various geometric principles. We can mention tessellations of a plane, fractals, plane and space symmetries, transformations, and many more. This article shows several proposals of a design of necklaces and bracelets with specific geometric patterns and extends the range of possibilities used in jewelry art.

## Introduction

I have been teaching Euclidean geometry, descriptive geometry and computational geometry at the Faculty of Mathematics and Physics (Charles University) in the Czech Republic for eight years. The courses are devoted to undergraduate and graduate students who study the specialization of teaching of mathematics and descriptive geometry. The basic requirement for all these subjects is the fundamental knowledge of planar and spatial geometry. When I am teaching I am always trying to show my students practical usage of geometry.

One of my biggest hobbies is handmade jewelry made mostly from the tiny colorful beads. My professional interests in teaching geometry and doing research in geometry and making jewelry perfectly complement each other. Moreover, I can say that I draw inspiration from my geometric courses and work with my students and I use it for new designs of my jewels. And vice versa, I can gain lots of inspiration for my classes from new geometric patterns based on geometric statements, properties of geometrical objects, and other geometric principles which I use in my jewelry making.

Several research questions with respect to geometry can arise when I am making jewelry from the beads. The beads are of the different shapes and sizes. When I am using them to create some flat pattern or three-dimensional structured design I have to take it into consideration. For example to make a circle from the squared or rectangular beads actually means to create an approximation of this curve. It is interconnected with the bitmap image in computer graphics which is a data structure using a rectangular grid of pixels to visualize the objects on the screen. Another research task appears itself in the geometrical pattern; it depends on which geometric principle is used.

## Geometric Principals in Jewelry

My jewelry designs are based on tessellations of a plane, fractals, plane and space symmetries, and transformations. I will introduce the topic of tessellations more precisely, i.e. its geometrical background and the applications in jewelry art which I am using. The other geometric principles can be shown in my presentation; some examples of my art work are presented in Figure 2.

### *Tessellations*

A tessellation is a tiling of a plane using one or more types of tiles with no overlaps and gaps. From the geometric point of view, tessellations are very interesting topic. There exist special types of tessellations as regular, semi-regular, or aperiodic, [1]. M. C. Escher, [2], used very often tessellations in his work for an artistic effect. Regarding the topic of tessellations I am drawing inspiration especially from Escher's work in the both classroom practice and jewelry art. In my descriptive geometry lessons at the faculty I

show Escher's tessellations to my students as an example of symmetries in the plane used in practice. It can be proved that there are only three regular tessellations composed of equilateral triangles, squares, and regular hexagons. We can create an infinite number of tessellations from these three regular ones using several rules. The design processes consist of translations, rotations, and glide reflections. In Figure 1 on the left there are these rules applied on hexagonal tiling, on the right there is the newly suggested design of a bracelet based on hexagonal tiling using three types of translations. It is obvious that I am bound by the shape and size of the beads, the geometric pattern in the tessellation has limited details. Another task what I have to deal with is the distribution of the colors in the pattern. This research area is connected with graph coloring.

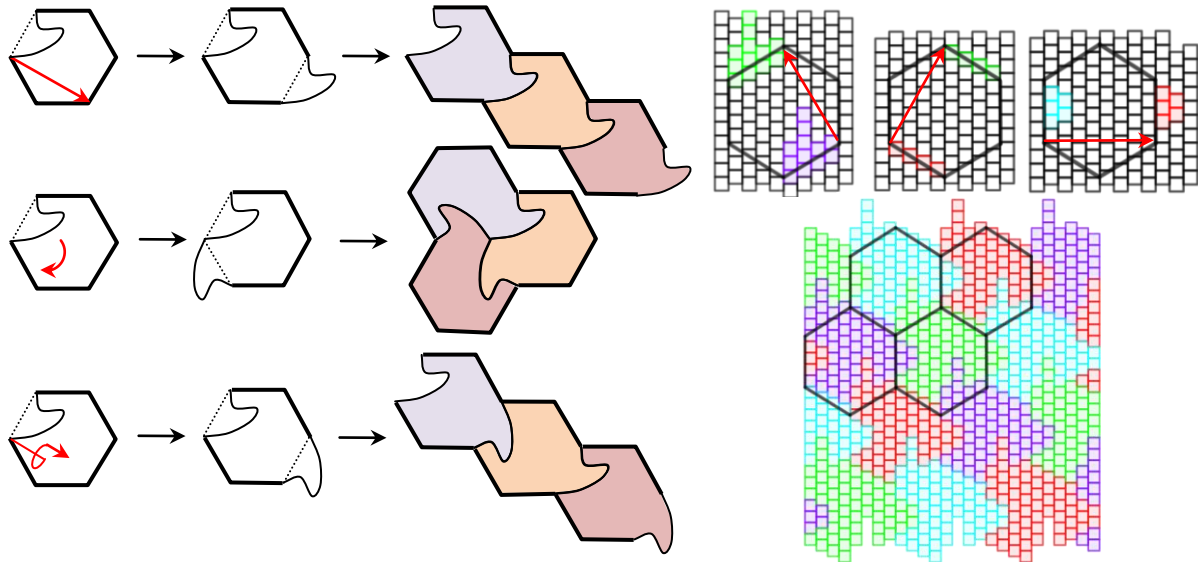


Figure 1: The geometric principle of a tessellation created from hexagonal tiling and a newly suggested design of a bracelet.



Figure 2: Examples of designs of handmade jewels based on geometric principals: (a) tessellations, (b), (c) fractals, (d) rotational symmetry, and (e) reflection.

### Summary and Conclusions

I presented the creation of a geometric pattern for a jewelry art based on tessellation. The other geometric designs which I am using for my handmade jewelry are based on fractals, transformations, and symmetries. I gain the inspiration for jewelry making from my geometric courses at university and vice versa.

### References

- [1] J. Kepler, Ch. G. Wallis. "The Harmonies of the World". Annapolis, the St. John's Bookstore, 1939.
- [2] J. L. Locker. "The Magic of M. C. Escher". Harry N. Abrams, Inc., Publishers, 2000.