

# **Triskelion Blocks**

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Akihiro Matsuura, Hiroshi Shirane "Triskelion Blocks" 2017, Material: VeroCyan, VeroMagenta, VeroYellow, Size: 75W x 60D x 9H (mm)

A triskelion is an iconographic pattern that consists of three legs (or spirals) having three-fold rotational symmetry. We make use of this strange but intriguing figure as a motif of our new construction toy. We present two families of triskelion blocks with/without a central equilateral triangle, where one block is connected to another at its concave parts in three directions. Such connection with some tiling properties can be effectively used in constructing various shapes using the blocks. One can also enjoy "balancing play" of physically standing constructed shapes on the ground which reminds us of coordinated group gymnastics.



Keywords: triskelion, construction toy, rotational symmetry



### 1 Basic Ideas & Figures

A *triskelion* or *triskele* is a classical iconographic pattern that consists of three spirals placed with three-fold rotational symmetry. It is frequently used with a representation of three bent human legs, which are seen for example in the flags of Sicily and the Isle of Man [1] shown in Figure 1.



Figure 1: The flag of the Isle of Man

We make use of this strange but fascinating figure of three legs as motif for our new construction toy. Two basic plane figures we use are shown in Figure 2 (let us call them figures  $T_1$  and  $T_2$ ). Both figures have three legs with distinct (RGB) colors, where the left one has no center triangle but the right one has, i.e., the yellow equilateral triangle.



Figure 2: Two triskelion-like figures  $T_1$  and  $T_2$ .







Figure 3: Connections of  $T_1$ 's or  $T_2$ 's and the gymnastic pose.



Figure 6: The family of figures for  $T_1$  (leg length = 1, 2, 3).



Figure 4: Circular connection of  $T_1$ 's and  $T_2$ 's.

Figure 5: The slilding property of  $T_1$  and  $T_2$ .



Figure 7: The family of figures for  $T_2$  (leg length = 1, 2, 3).



Figure 8: Circular connections for  $T_1$ -family (leg length = 1,3).

The common property of these figures desirable for a construction toy is that a leg can be connected to the concave part between two legs of another piece as shown in Figure 3, left. This makes the figures to connect in three directions and helps to create a variety of shapes. We also emphasize that the connected figures are just like the gymnastic pose of physically-balanced two persons, which will make the play more entertaining and imaginative. Furthermore, these triskelion-like figures have some beautiful geometric properties on tiling. Namely, six  $T_1$ 's and six  $T_2$ 's can be connected in a circular way as shown in Figure 4 and these connections are extended infinitely in a recursive way. Espe-





Figure 9: Circular connections for  $T_2$ -family (leg length = 1,3).

cially on  $T_1$ , the central black part is again the shape of  $T_1$  and  $T_1$ 's radially tile the whole plane.

The final typical property of  $T_1$  and  $T_2$  that we figured out after prototyping and playing around with the pieces is that when we try to disconnect the three pieces from the interlocking situation in Figure 5, left, we can succeed it by just sliding two of the pieces, say, green and blue ones since then the remaining red piece slides out rather automatically without direct manipulation.

Now, we show families of triskelion figures for  $T_1$  and  $T_2$  that preserve the properties of leg connection and recursive tiling. First, we illustrate the family for  $T_1$  with leg length 1, 2, and 3 in Figure 6 and the family for  $T_2$  in Figure 7. (The figures of leg length 1 are rather exceptional but since they also have the required geometric condition, here we include them).

#### 2 Software & System

3D models were made by adding a constant depth to the figures in Section 1. When the length of unit triangle is 1, the depth is set to be half of 3 squared, i.e., 0.86 (rounded off) since then the depth parts can be inserted to blocks



Figure 10: Some constructions.

vertically and construction can be 3-dimensional. All the models were designed using the 3D CAD system 123D Design of Autodesk and output in the STL format. The six models are shown in Page 1.

#### **3 Prototyping & Some Constructions**

We made prototypes of the blocks using PLA resin and the 3D printer Replicator 2. Here we show some of the constructions using the prototypes in Figure 10.

The circular connections for the figures in Figures 6 and 7 are shown in Figures 8 and 9, respectively.

#### References

[1] Triskelion, http://en.wikipedia.org/wiki/Triskelion