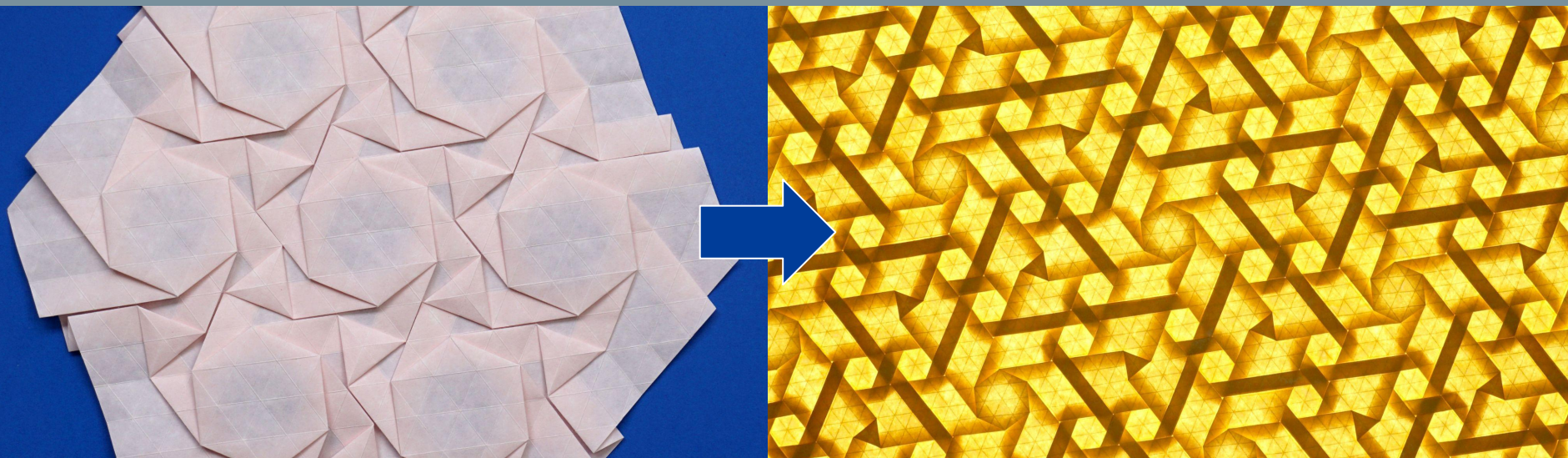


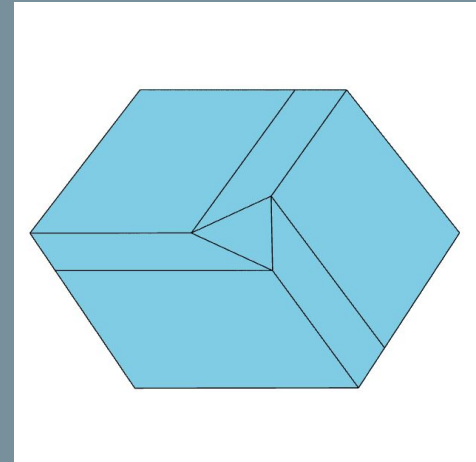
Origami Tessellation Design Possibilities from Two Simple Twists

Madonna Yoder, madonna@gatheringfolds.com



What are origami tessellations made of?

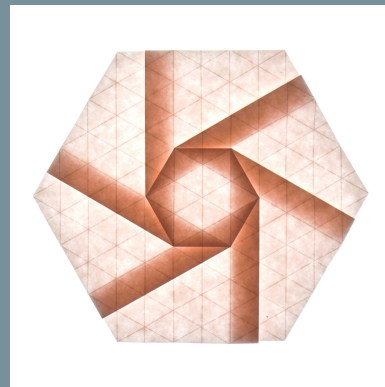
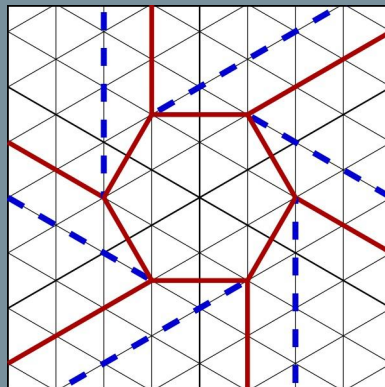
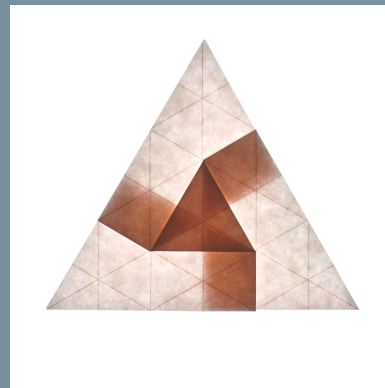
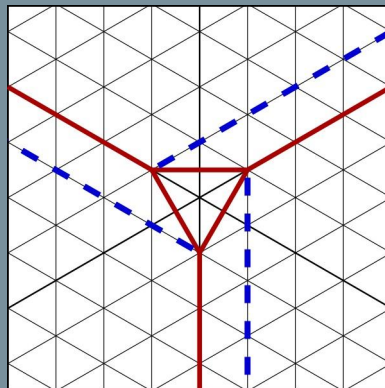
- A single sheet of paper, folded to make a repeating pattern
- Since the pattern must repeat, folds must go out and come back - forming a pleat
- These pleats run into each other, making twists that are right-handed on one end and left-handed on the other end of a given pleat
- The connectivity between all the twists in an origami tessellation is based on a two-colorable tiling



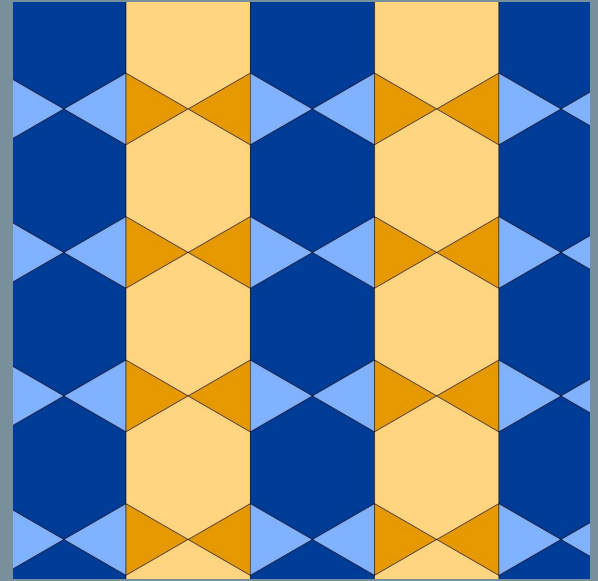
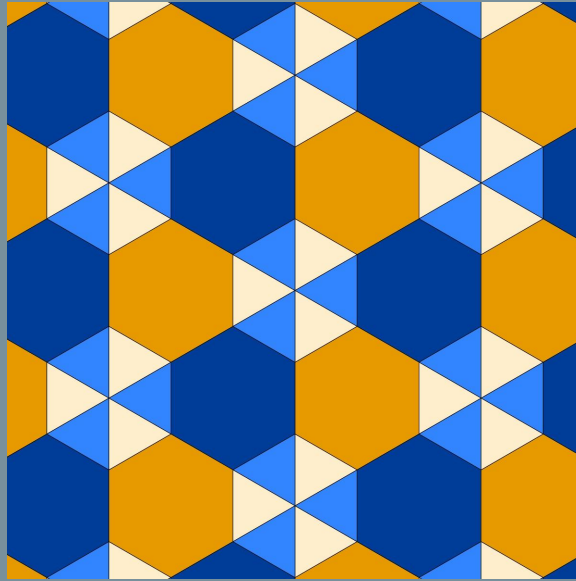
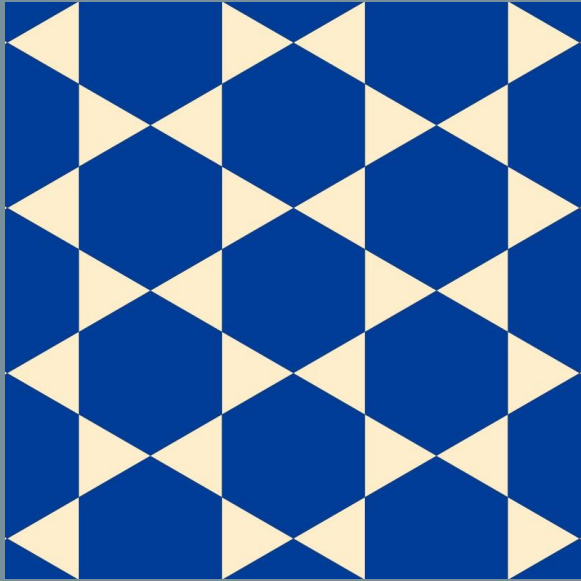
Open Hexagon and Closed Triangle Twists

Search constraints:

1. Patterns are origami tessellations
2. Patterns use only open hexagon and closed triangle twists
3. Patterns repeat within a reasonable distance on the background grid (roughly 80 divisions)
4. Non-trivial variation from other patterns in the set (not just changing the spacing between every twist)

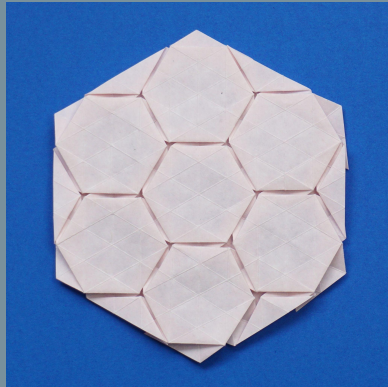
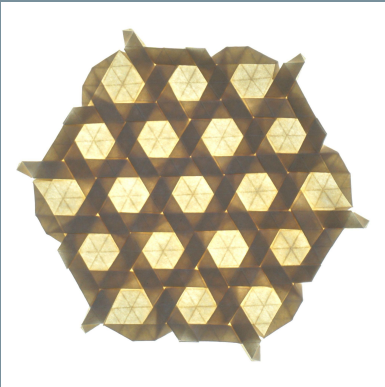
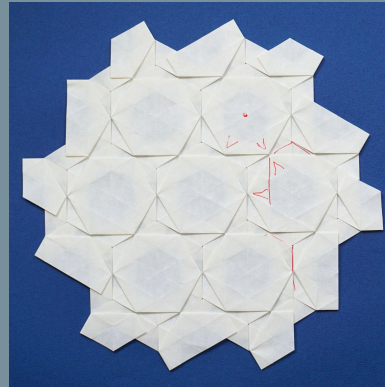
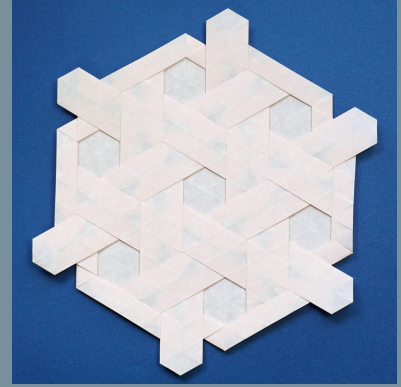
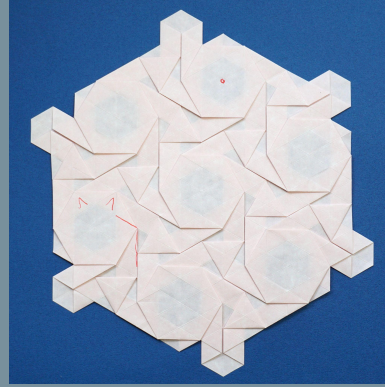


Basic Tilings: Use Hexagons in 6-fold, 3-fold, or 2-fold positions



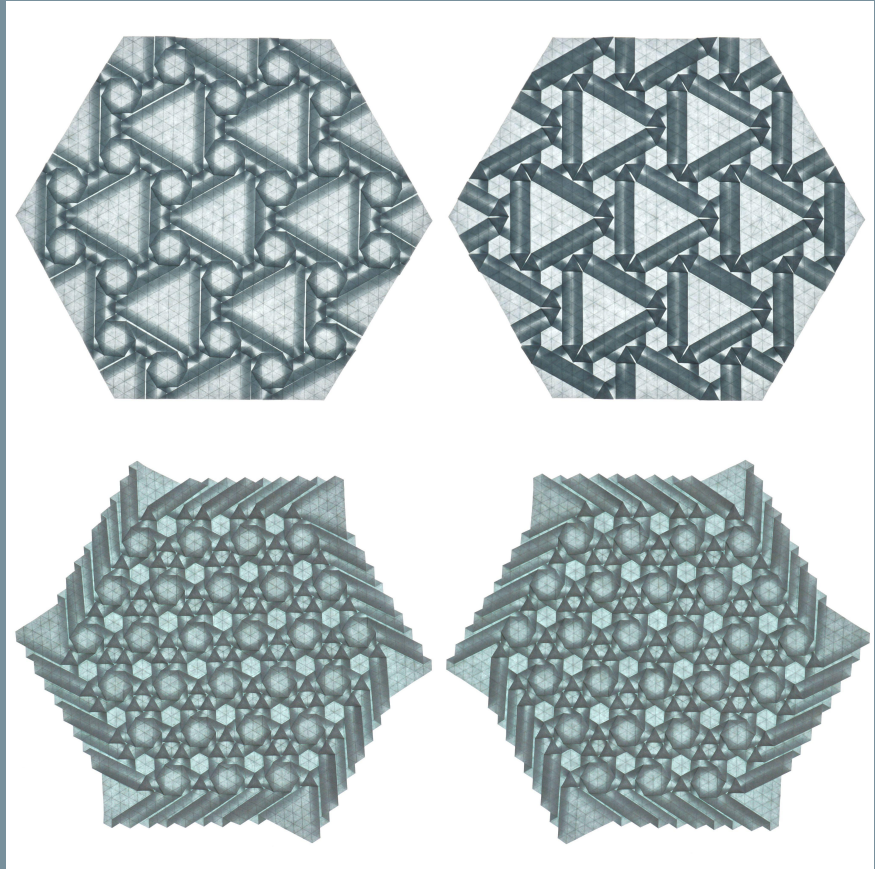
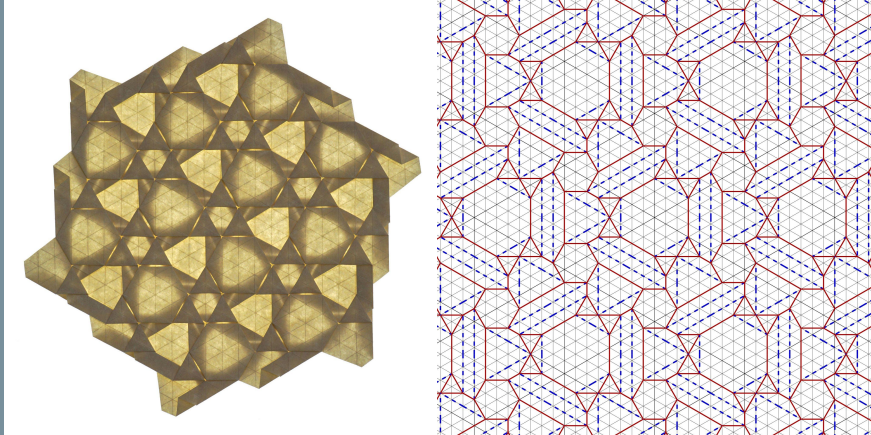
Alternating Twists in Hex-Tri 6-fold

1. Choose whether the twists are on the same or opposite sides
2. Choose the spacing



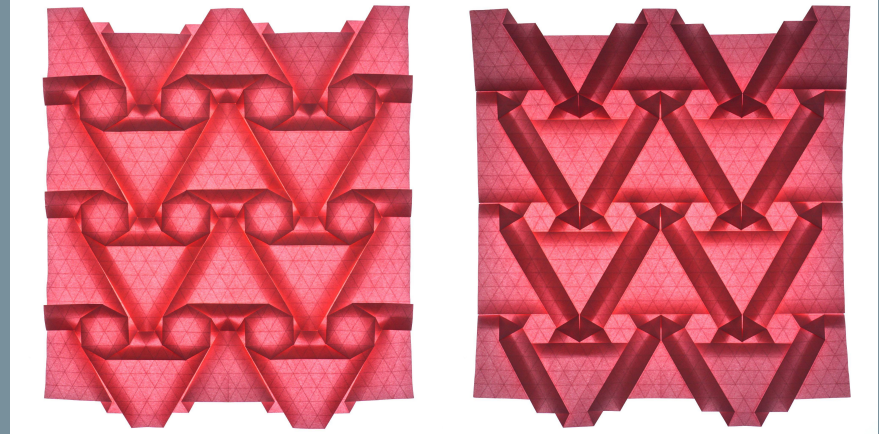
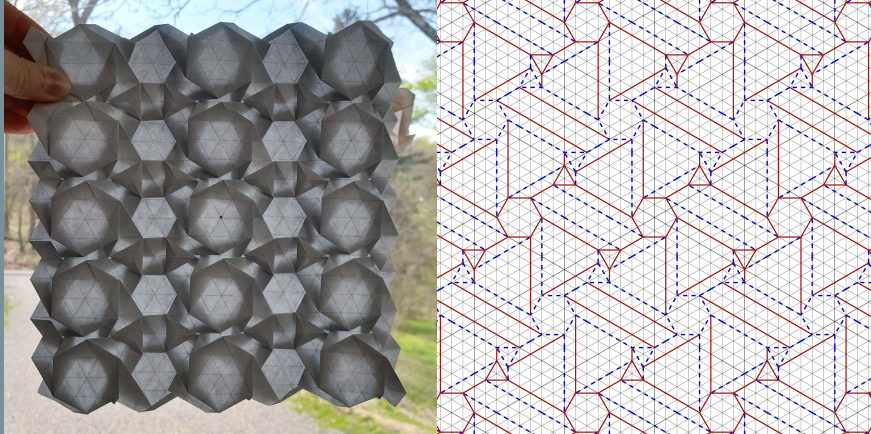
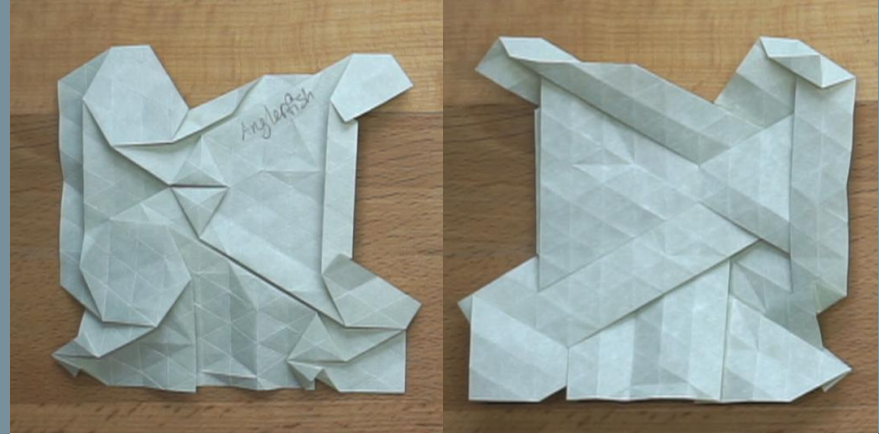
Alternating Twists in Hex-Tri 3-fold

1. Choose whether the twists are on the same or opposite sides in a cluster
2. Choose whether the clusters mirror (always possible) or alternate (not always possible) sides of the paper



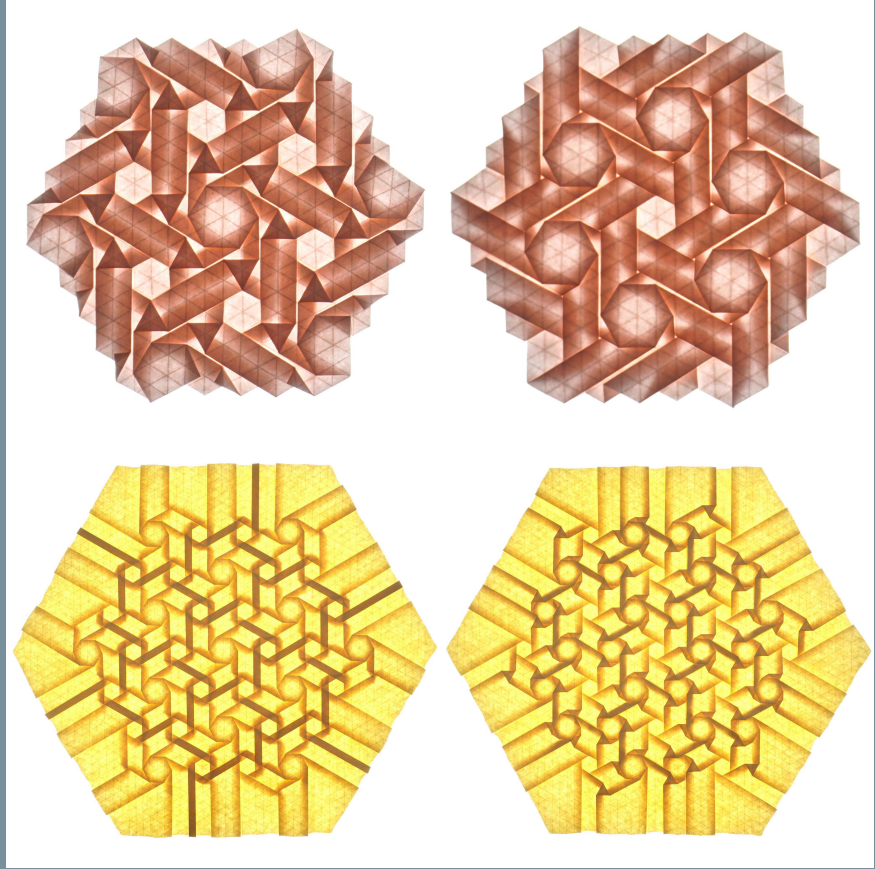
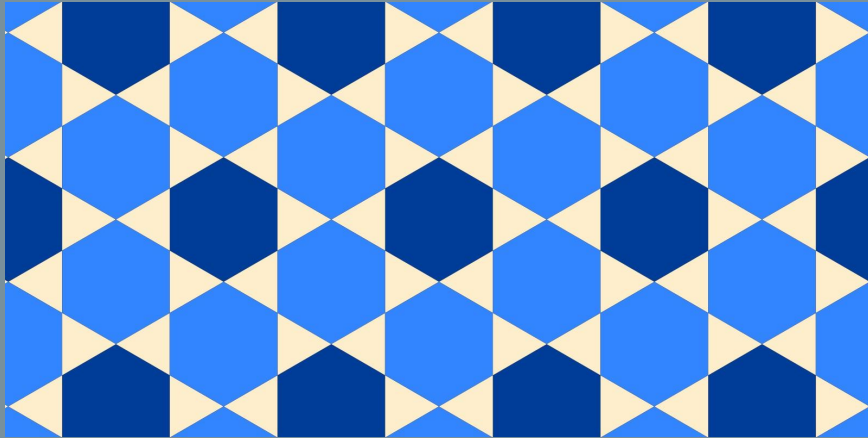
Alternating Twists in Hex-Tri 2-fold

1. Choose whether the twists are on the same or opposite sides in a stripe
2. Choose whether the stripes mirror or alternate sides of the paper



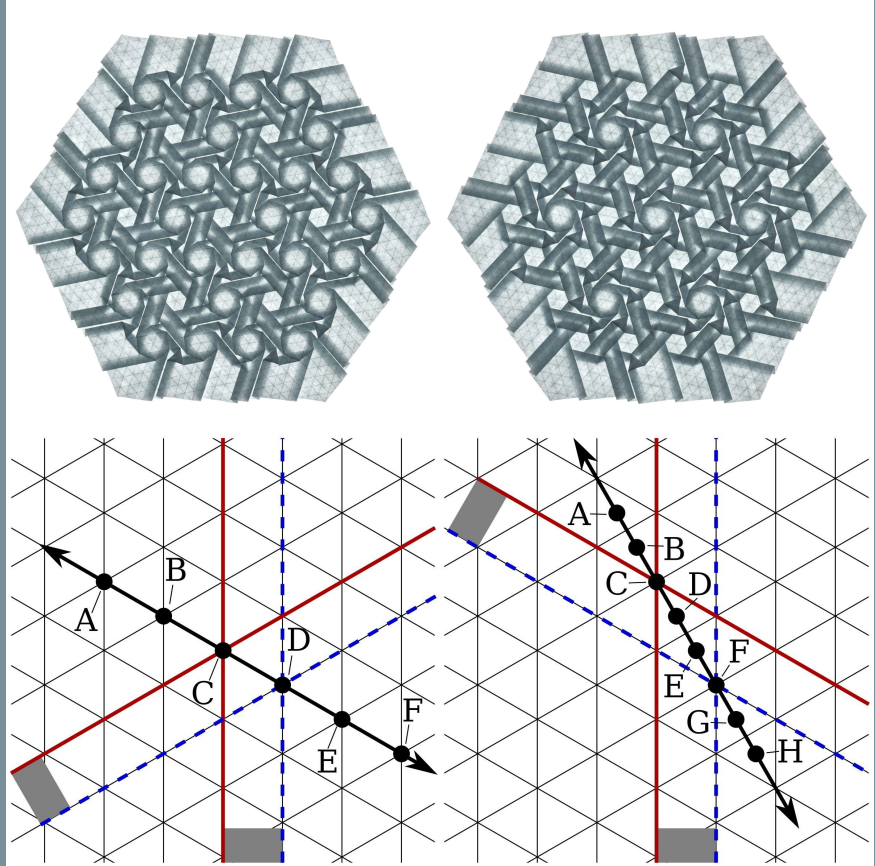
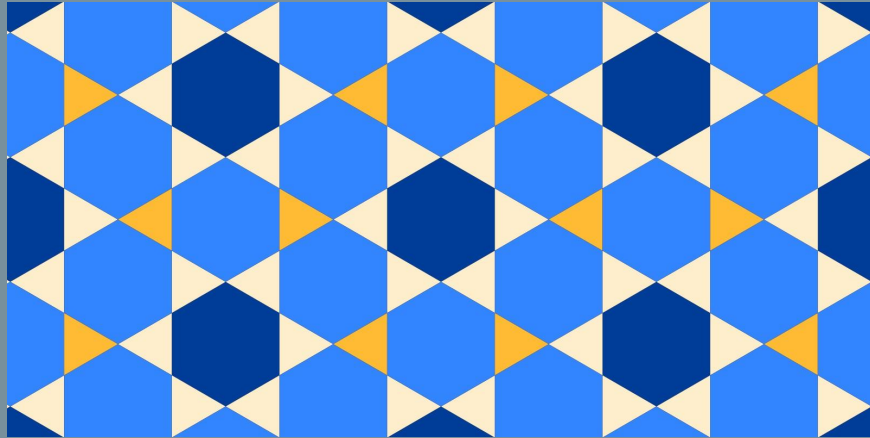
Other Applications of Symmetry to the Hex-Tri 6-fold Tiling

1. Choose whether the triangle is on the same side as the central hexagon
2. Put the next hexagons on the opposite side of the paper and use them as the positions of 3-fold symmetry

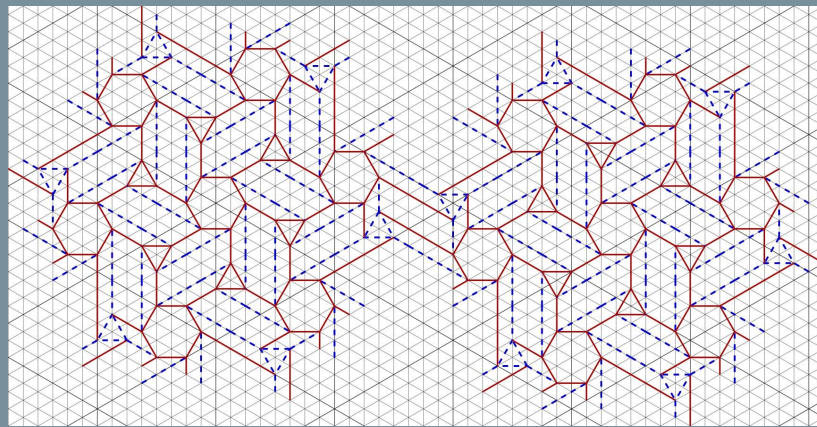
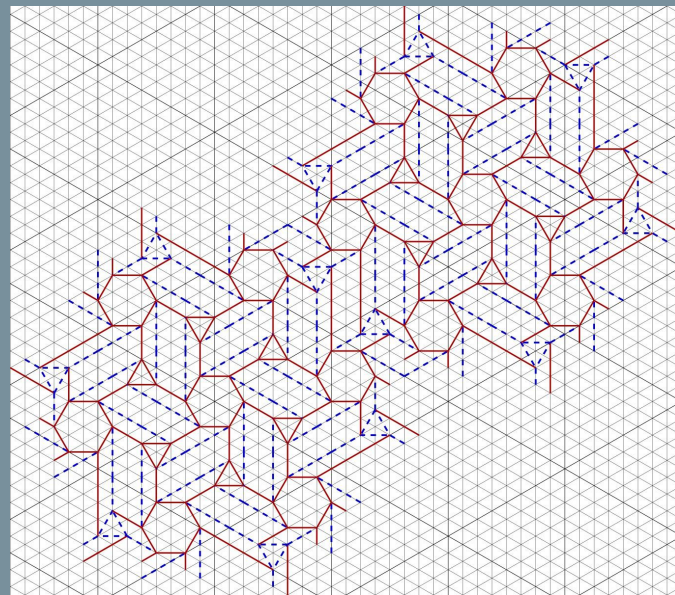
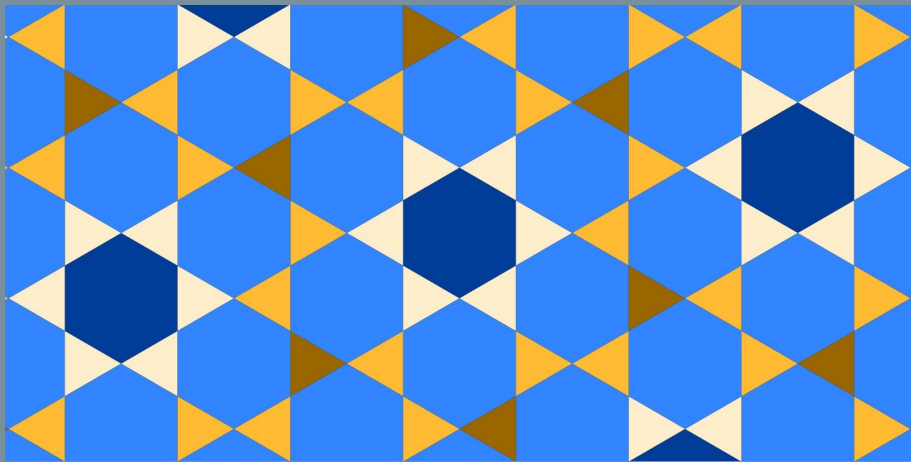
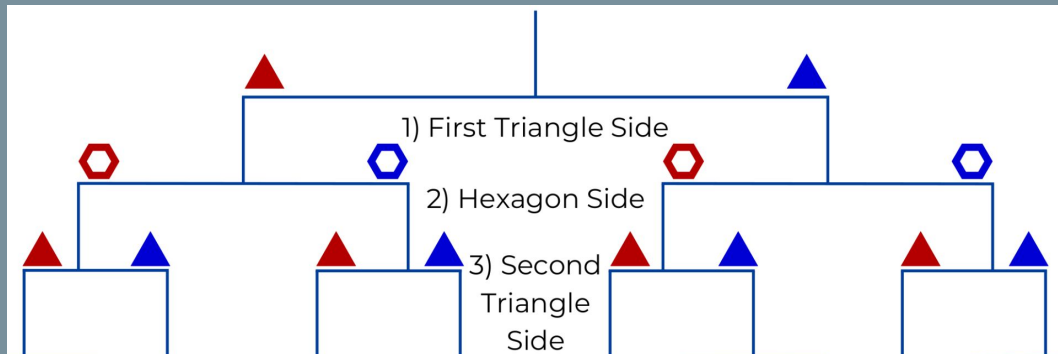


Second Symmetry Extension

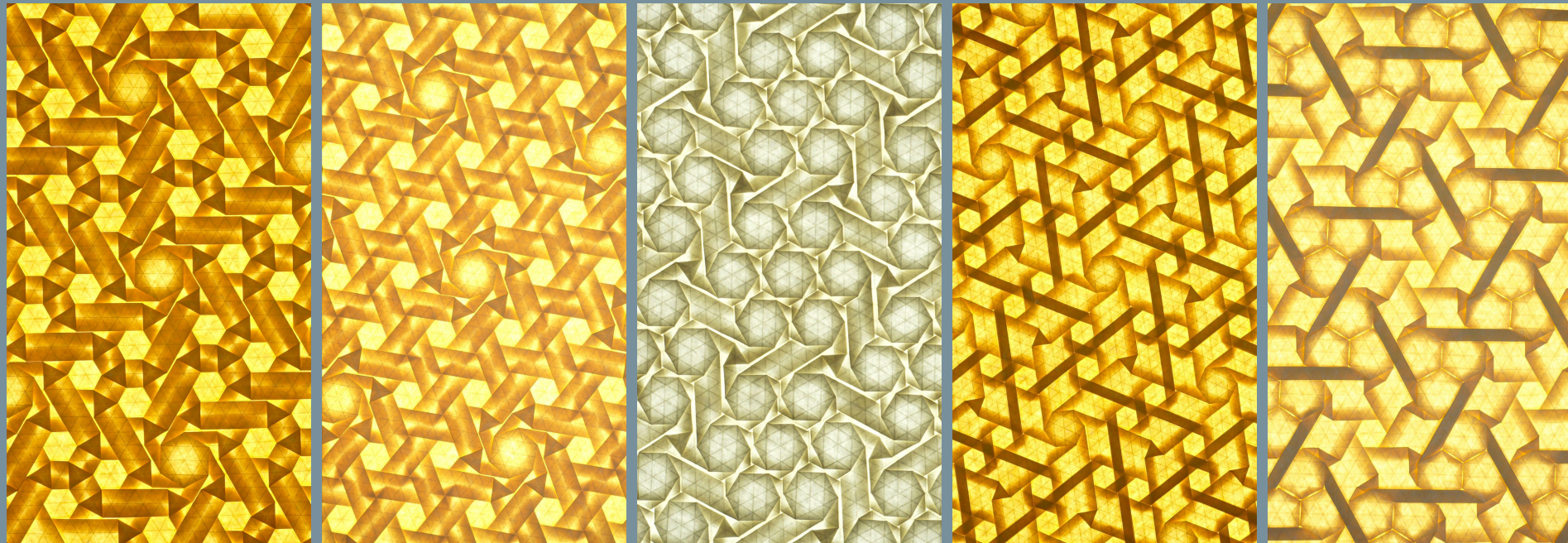
Since the open hexagons and closed triangles on opposite sides of the paper have the same number of pleat shifts to transition between them, there is one pattern in the second symmetry extension.



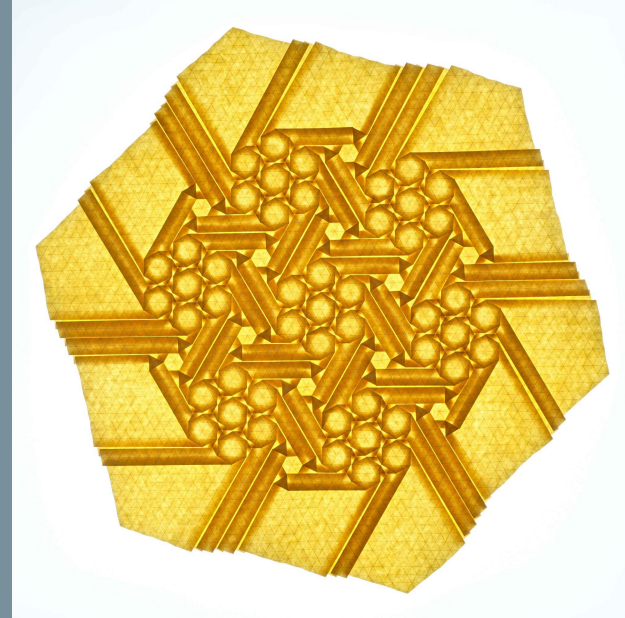
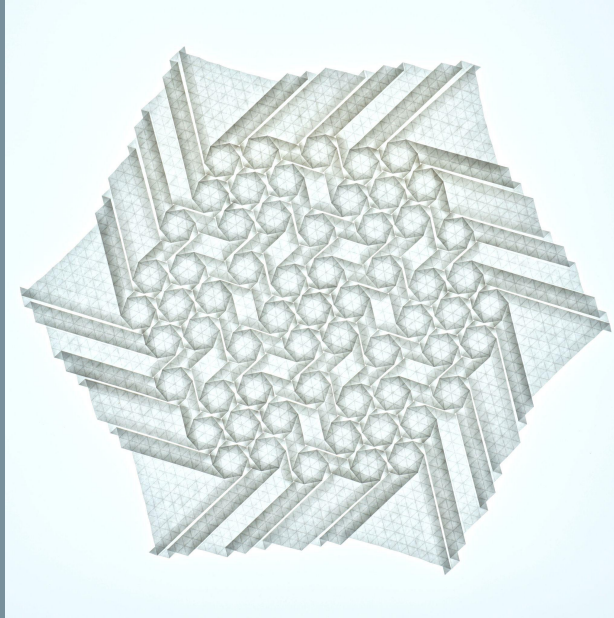
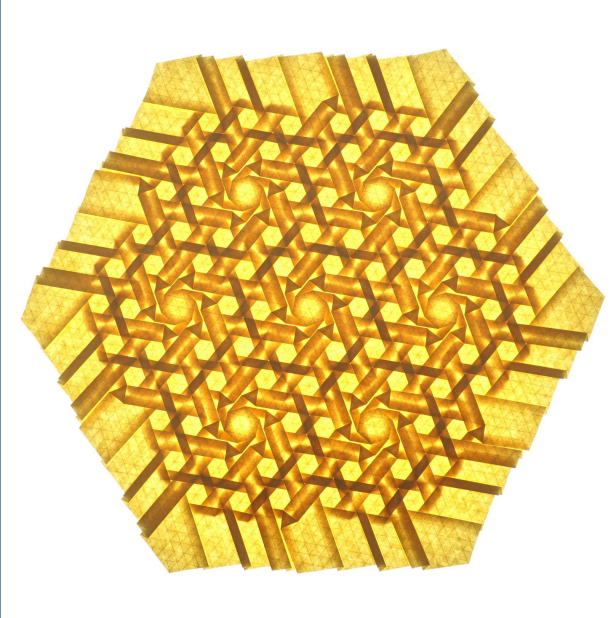
Third Symmetry Extension



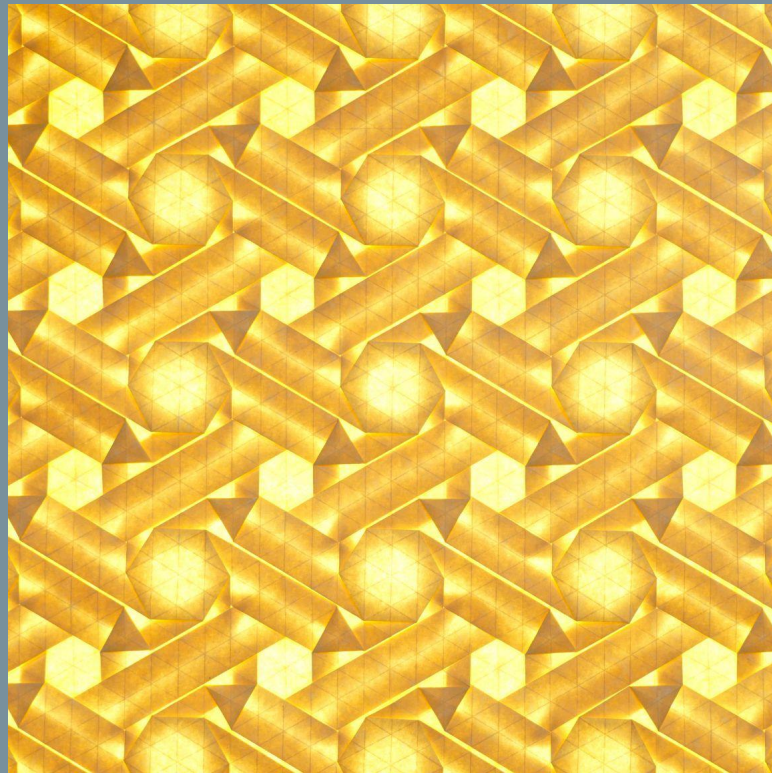
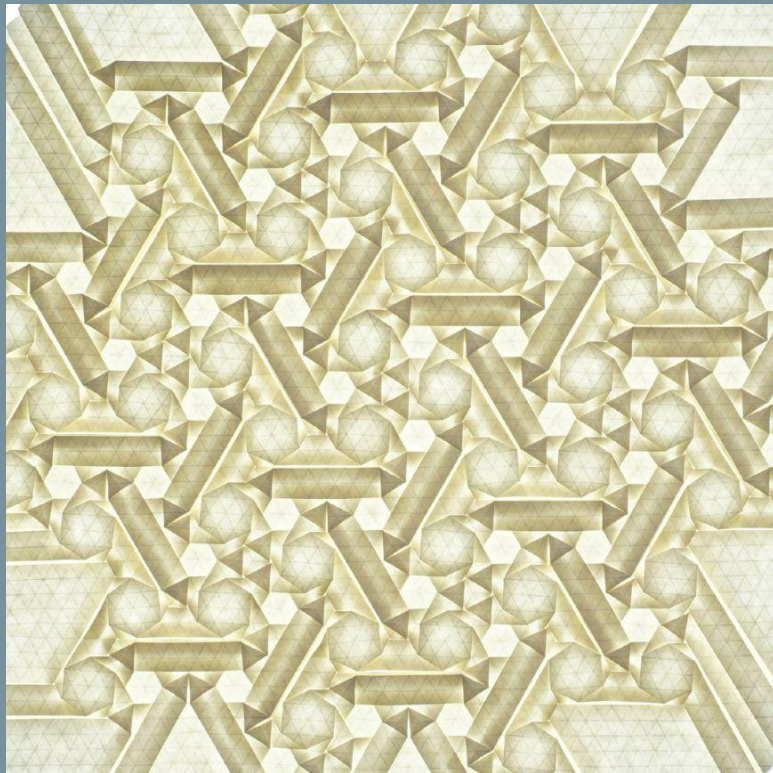
Third Symmetry Extension Examples: 18 patterns identified



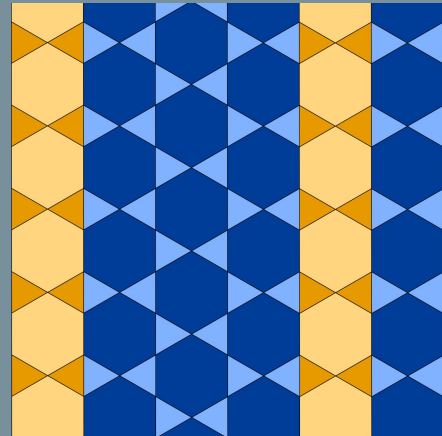
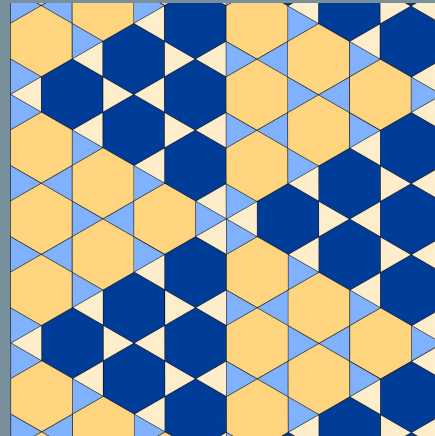
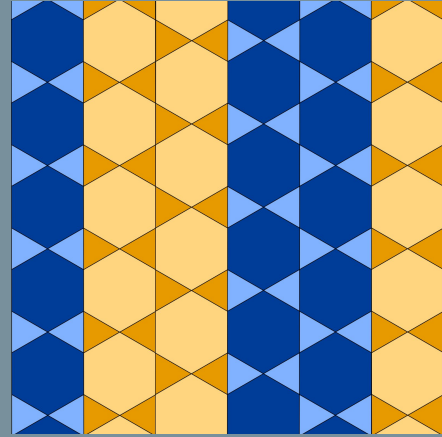
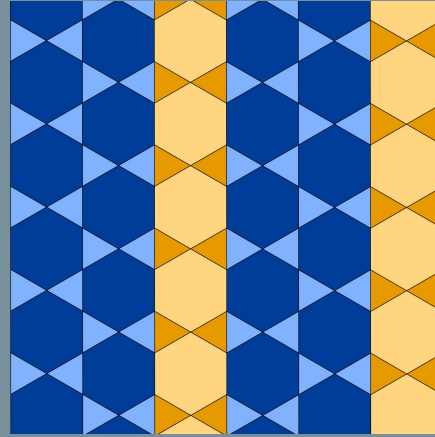
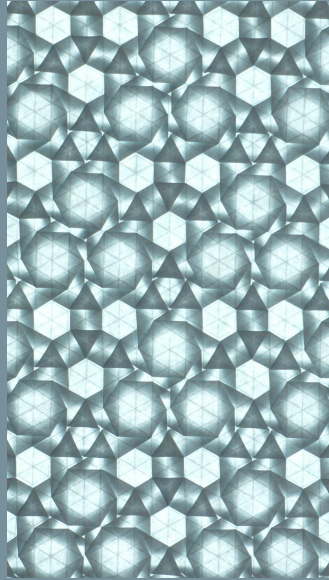
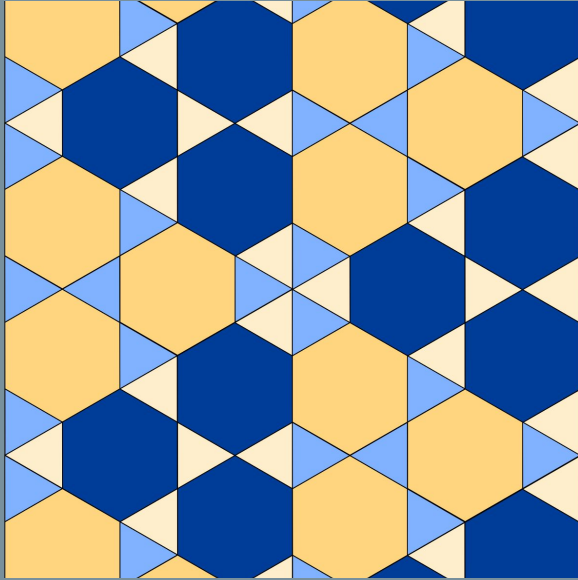
Fourth Symmetry Extension Examples: 7 patterns identified



Other Symmetry Extension Possibilities



Stranger Tilings



Total Patterns with Open Hexagon and Closed Triangle Twists

1. HT6 Alternating: 2
2. HT3 Alternating: 3
3. HT2 Alternating: 4
4. HT6 Extension 1: 2
5. HT6 Extension 2: 1
6. HT6 Extension 3: 18
7. HT6 Extension 4: 7
8. Other symmetry extensions: 2 so far
9. Triangle cluster tilings: 1 folded, infinite potential, many good folding options
10. Stripe tilings: infinite potential, many good folding options

Total: 40 documented, many more possible

How to learn more about folding origami tessellations

Tessellation Foundations

- Learn to fold basic grids, projects
- training.gatheringfolds.com/start

Advent of Tessellations

- Learn to fold 25 patterns of increasing difficulty
- training.gatheringfolds.com/advent

