

Origami, Shapes, and You!

MIT Splash 2019

Modular Origami

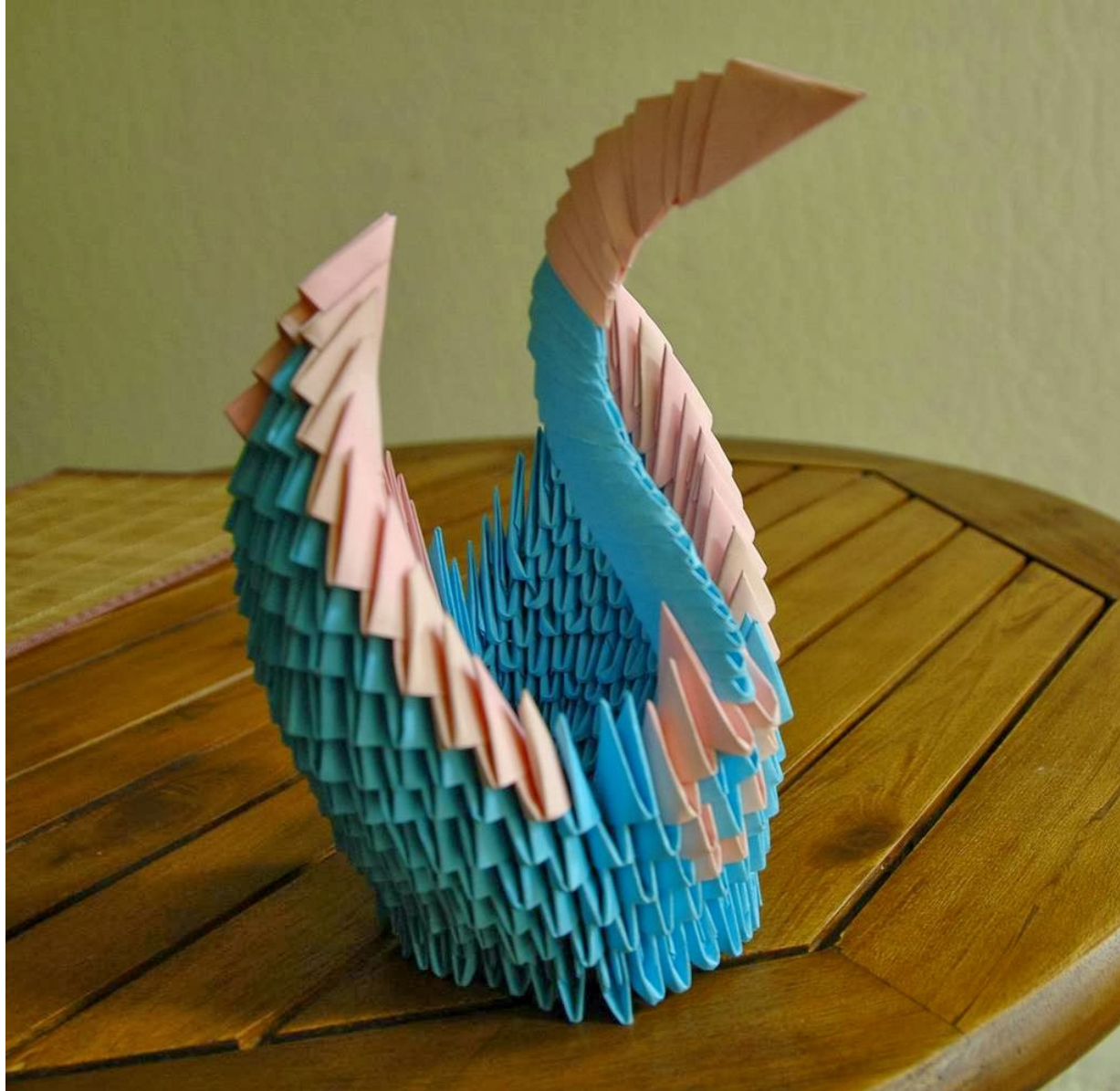
- ▶ Modular origami is a form where a person puts a number of identically folding paper together that eventually forms a completed model. The individual pieces are often simple, with the true challenge in putting together the model.



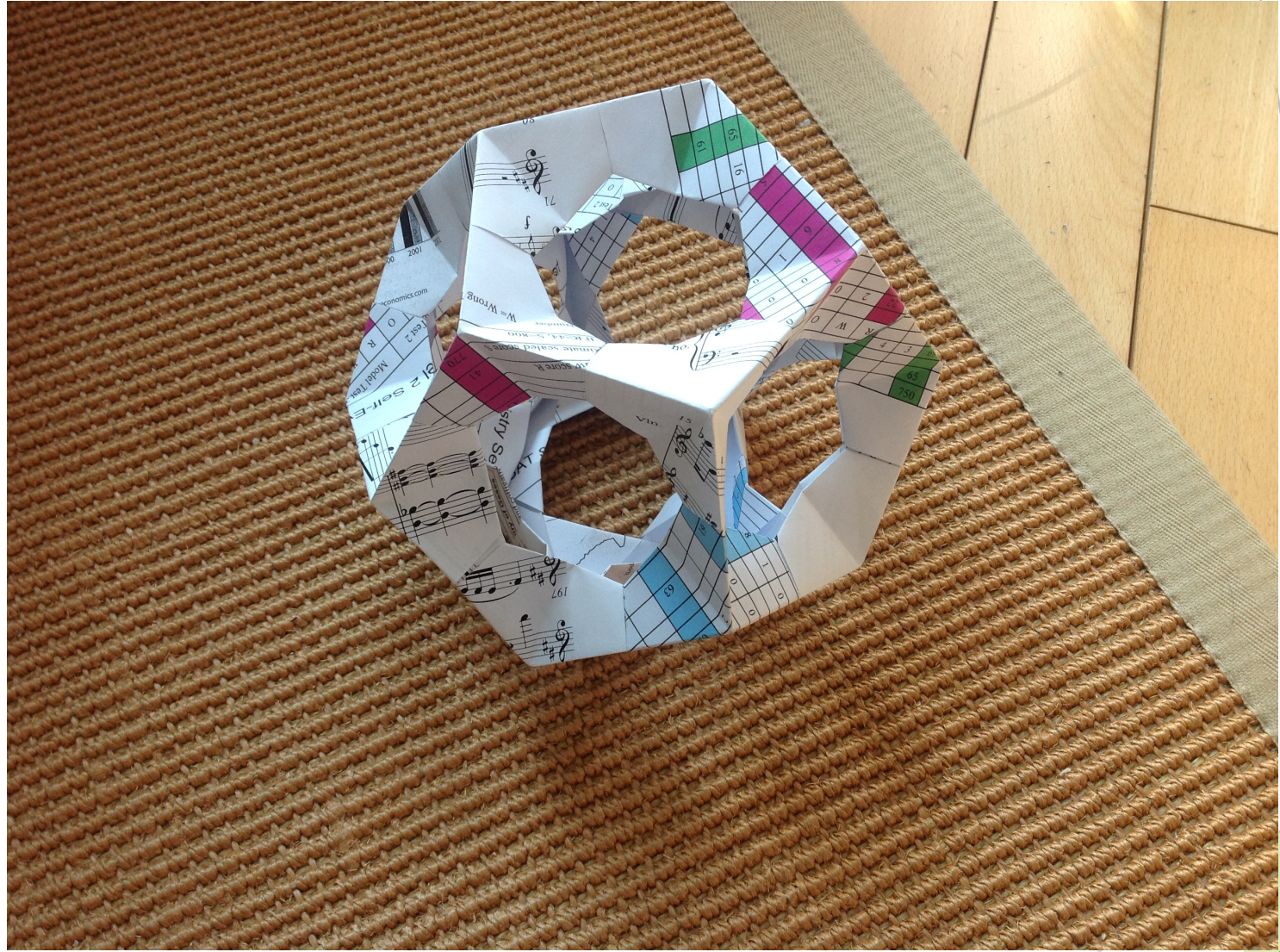


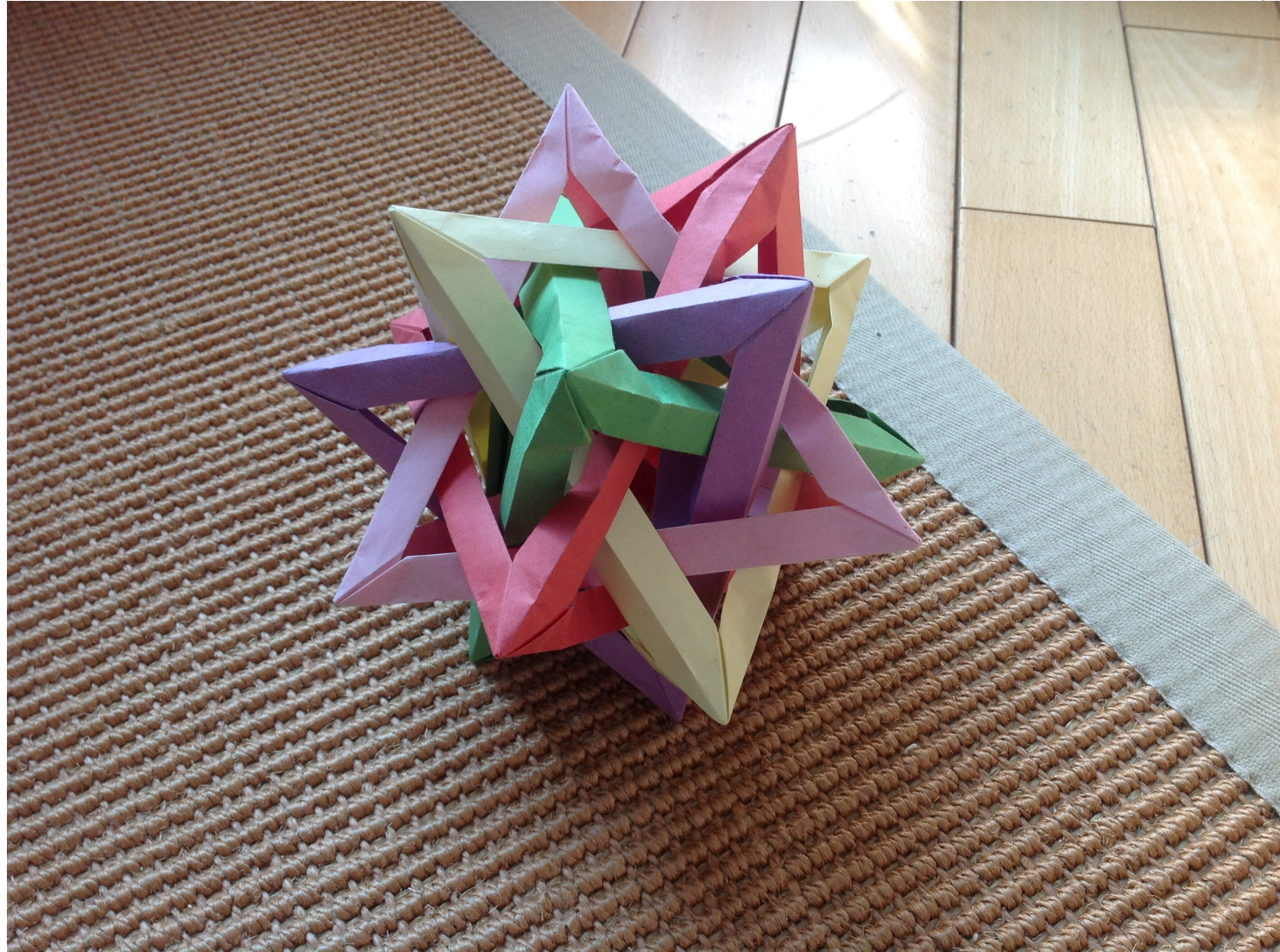
Photo © OrigamiSpirit.com









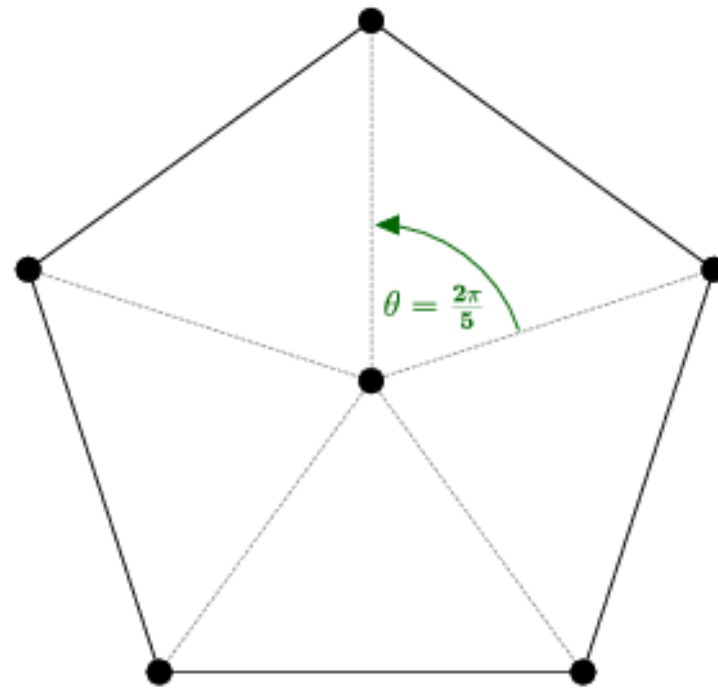
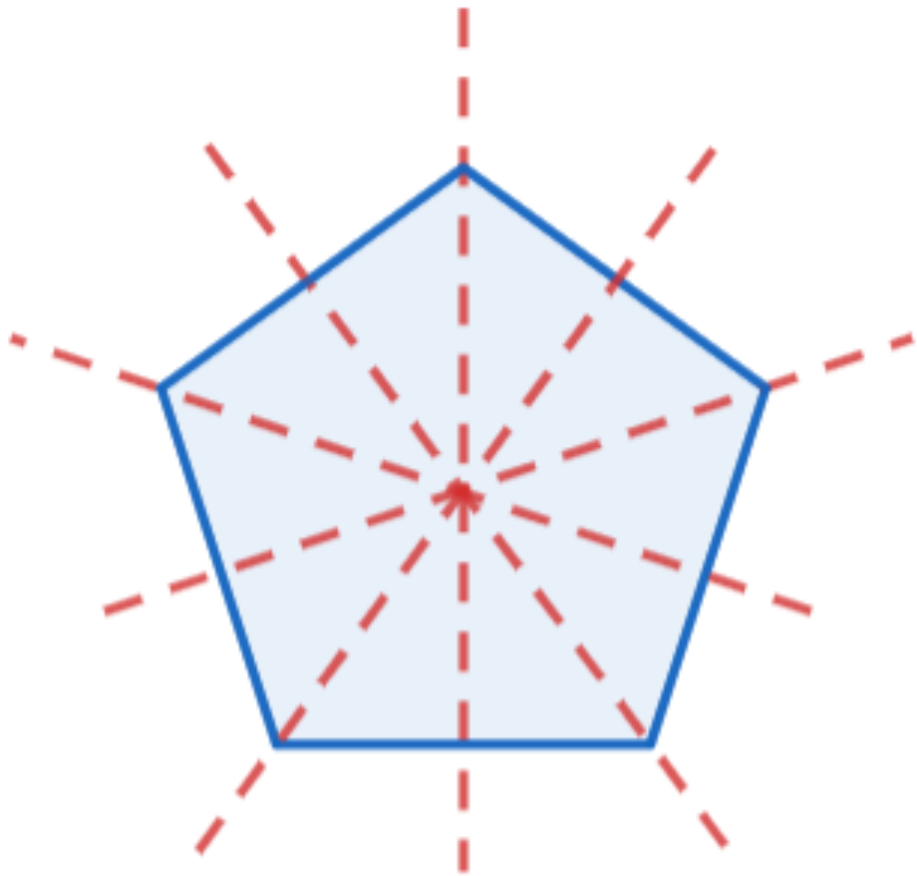




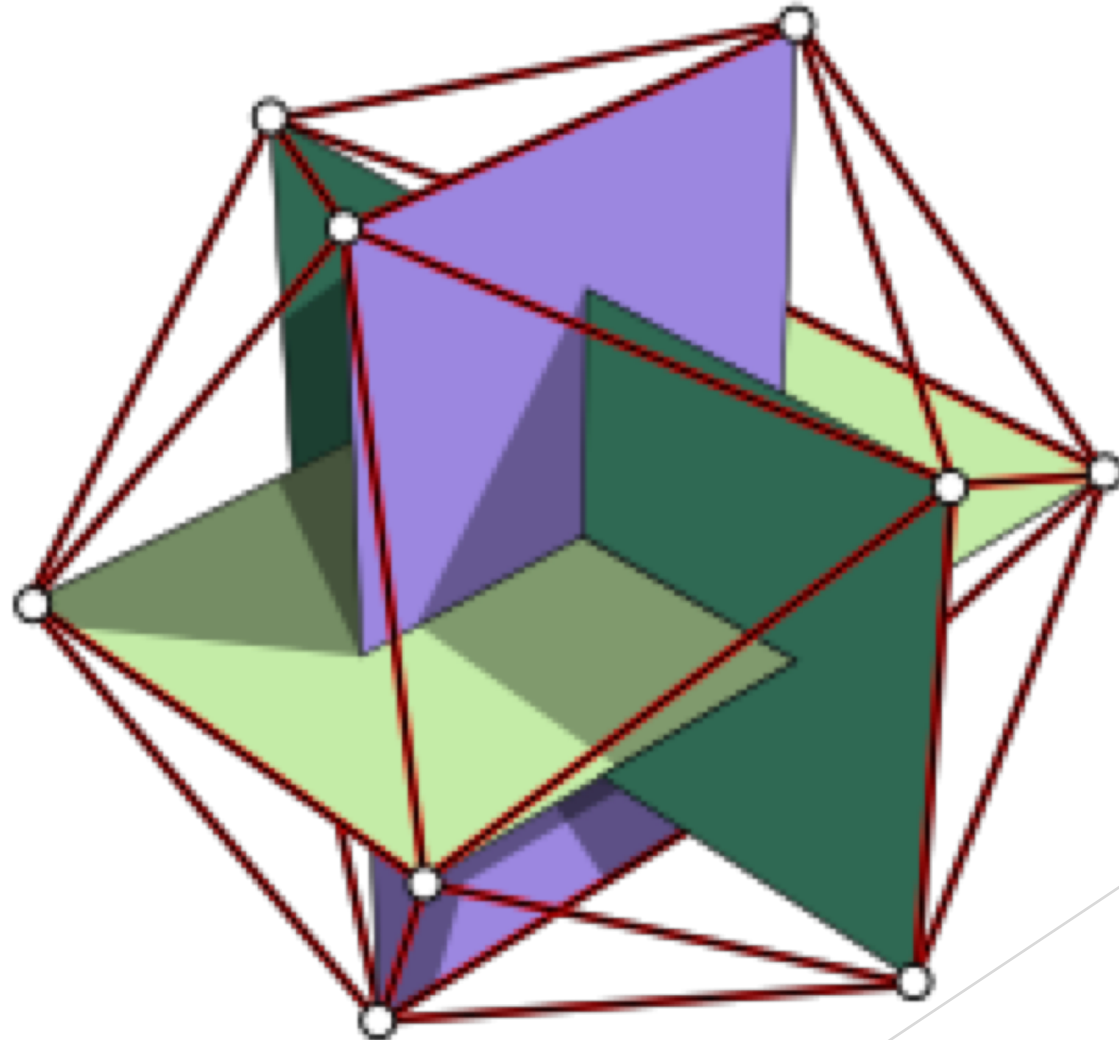
How many faces?



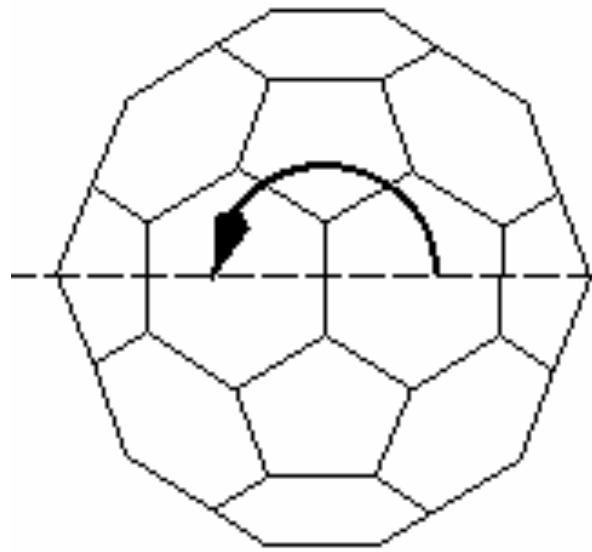
Symmetry in shapes



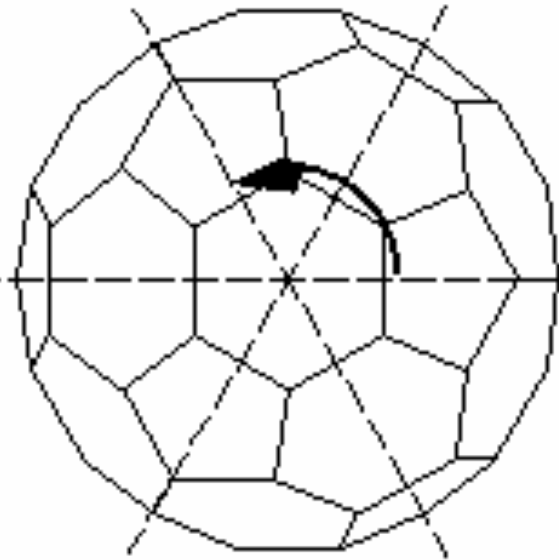
Symmetry in 3D shapes



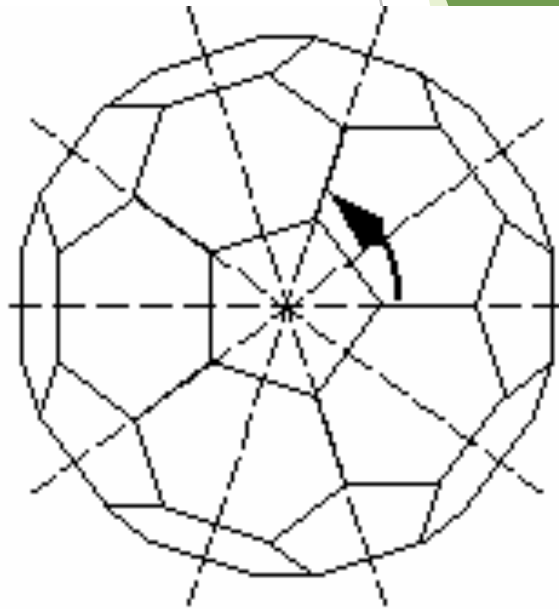
Symmetry in 3D shapes



2-fold

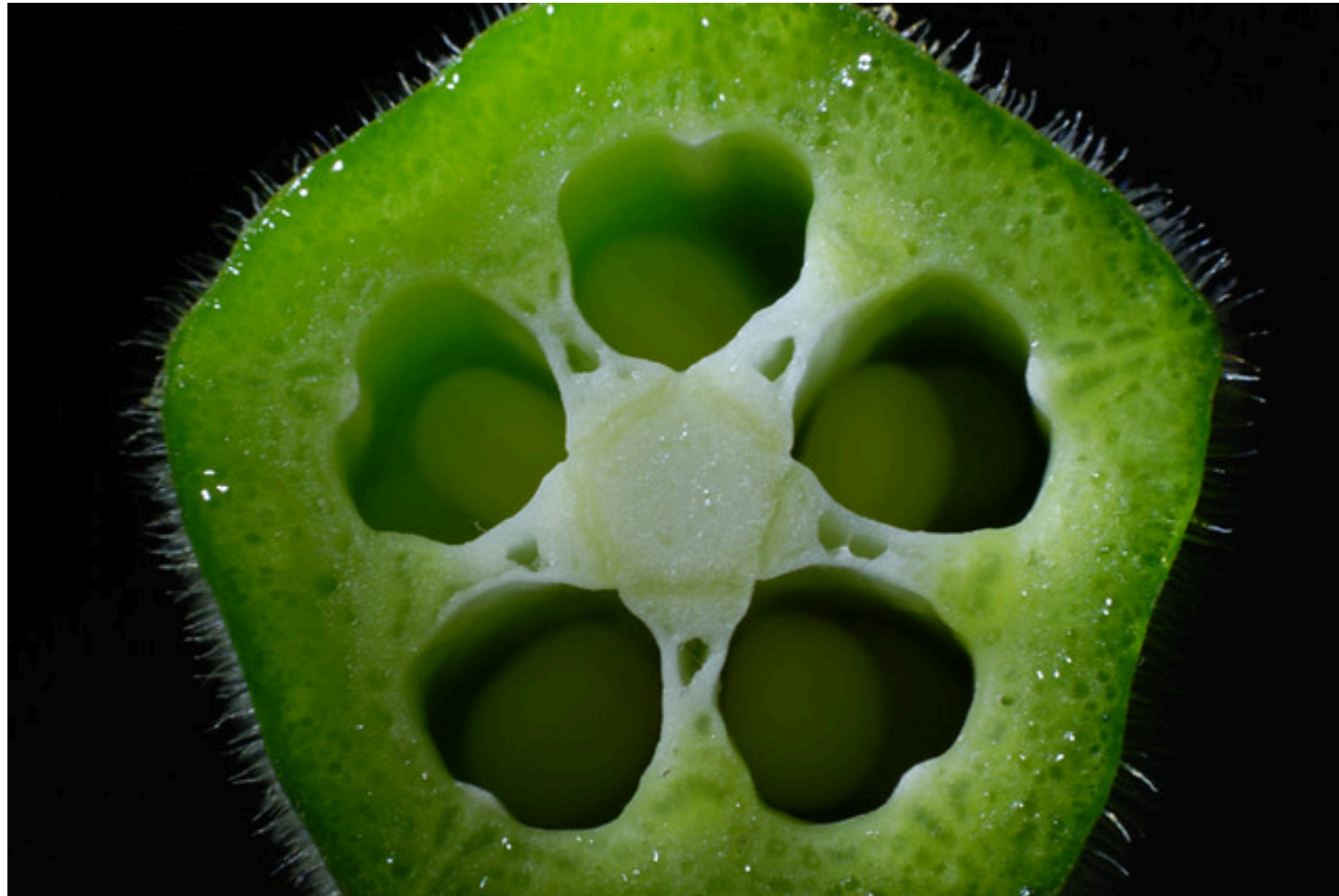


3-fold

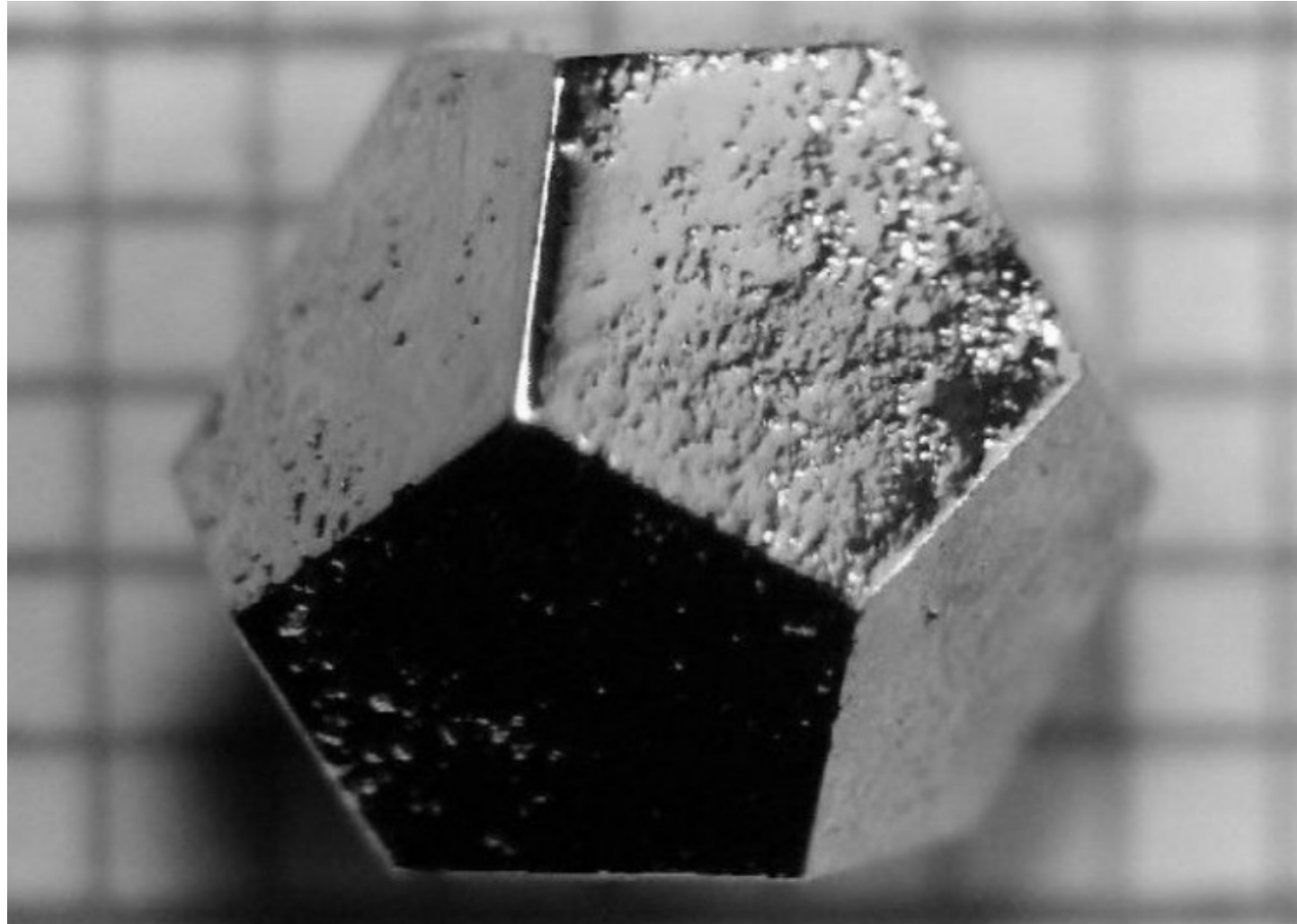


5-fold

Symmetry in nature



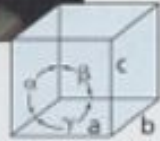
Symmetry in nature



Seven Basic Crystal Systems

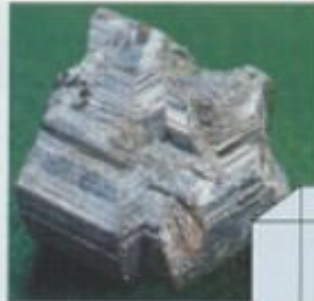


Fluorite



$$a = b = c$$
$$\alpha = \beta = \gamma = 90^\circ$$

Cubic



Rutile

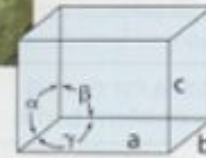


$$a = b \neq c$$
$$\alpha = \beta = \gamma = 90^\circ$$

Tetragonal



Barite



$$a \neq b \neq c$$
$$\alpha = \beta = \gamma = 90^\circ$$

Orthorhombic

Crystals are classified into seven categories based on their overall shapes.



Rhodonite



$$a \neq b \neq c$$
$$\alpha \neq \beta \neq \gamma \neq 90^\circ$$

Triclinic



Corundum



$$a = b \neq c$$
$$\alpha = \beta = 90^\circ, \gamma = 120^\circ$$

Hexagonal



Cerussite



$$a = b = c$$
$$\alpha = \beta = \gamma \neq 90^\circ$$

Rhombohedral



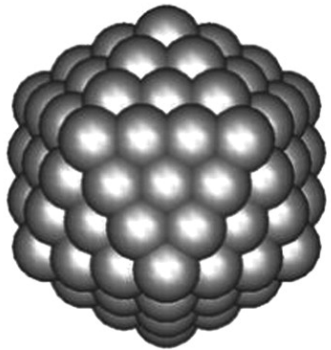
Boron



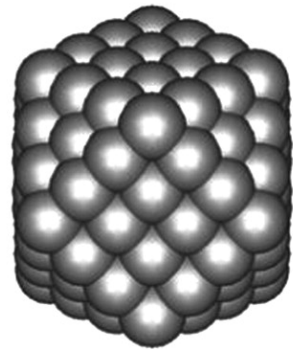
$$a \neq b \neq c$$
$$\alpha = \gamma = 90^\circ \neq \beta$$

Monoclinic

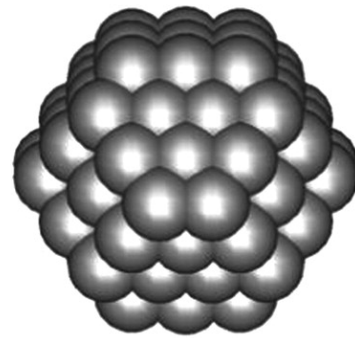
From Modular Origami to Nanotechnology



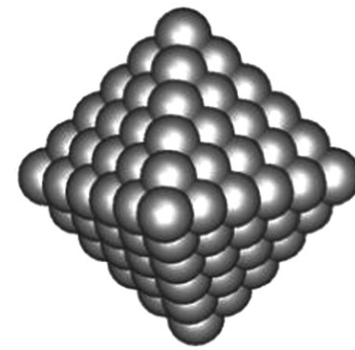
Icosahedron



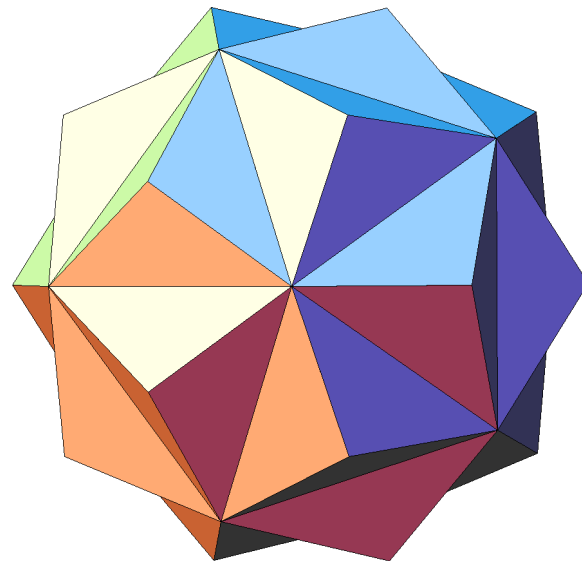
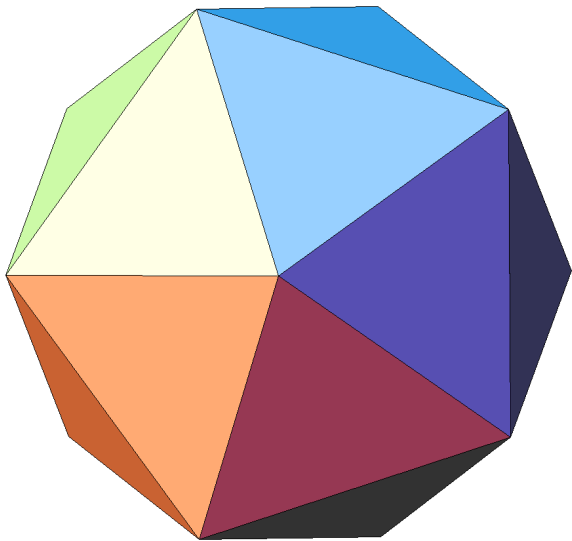
Cuboctahedron



Truncated Octahedron



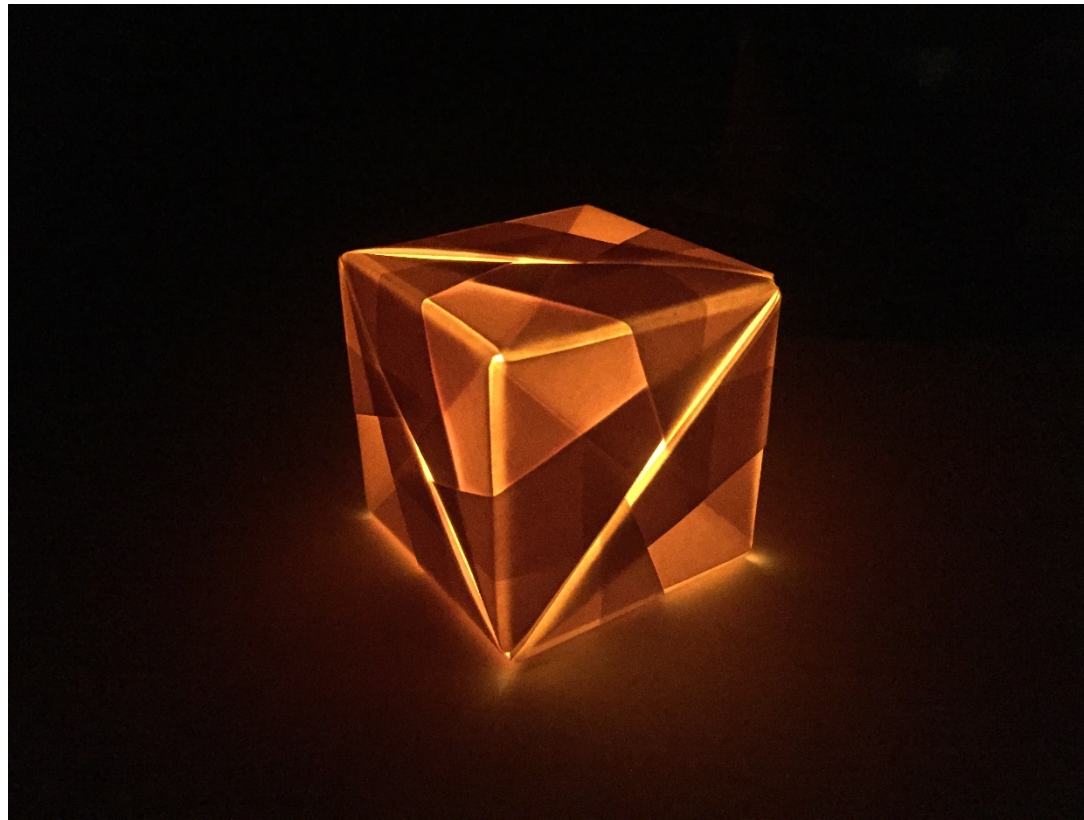
Octahedron



Nanoparticles in Real Life



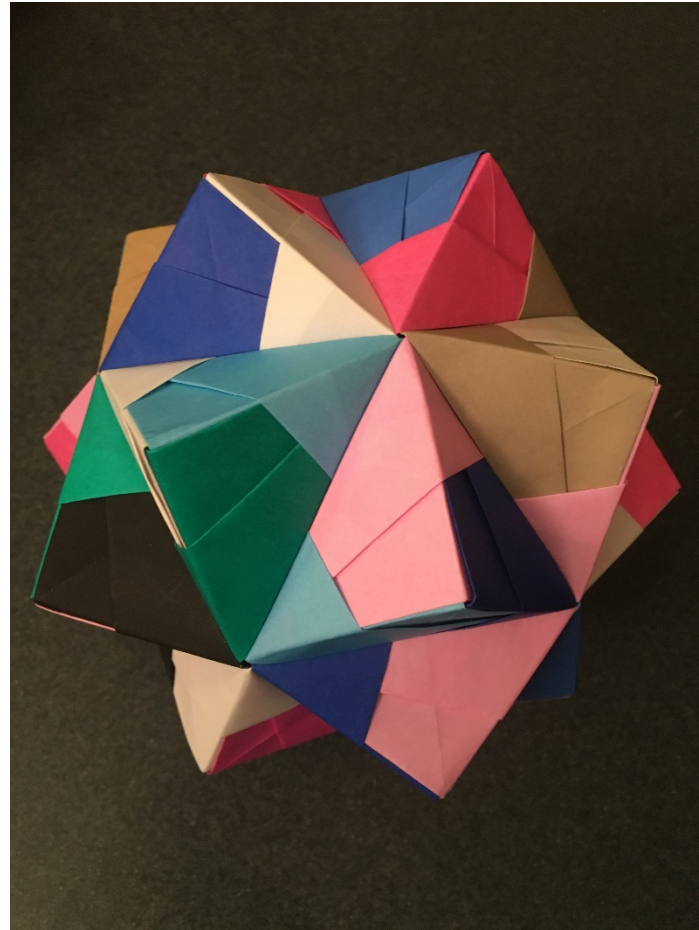
Sonobe Cube Lamp (6 Units)



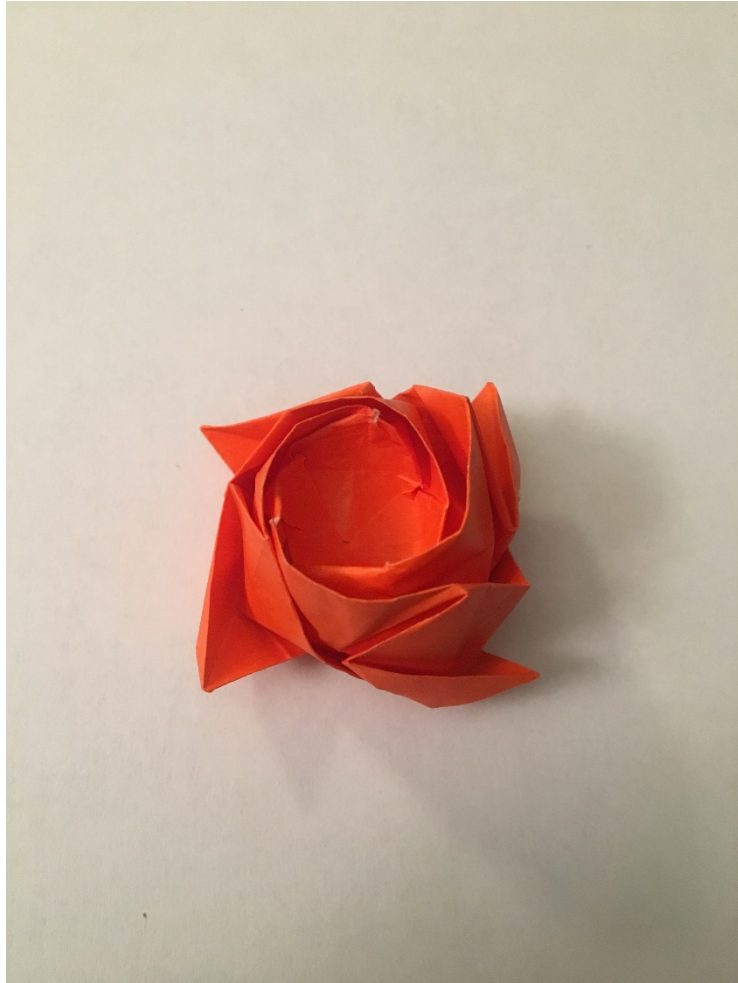
Stellated Octahedron (12 Units)



Stellated Icosahedron (30 Units)



Kawasaki Rose



Some Tips for Folding!

- ▶ The key to origami is small, uncomplicated folds.
- ▶ Precision goes a long way, especially when there are many folds!
- ▶ Fold each crease very well.
- ▶ Follow the instructions.
- ▶ Be patient.
- ▶ Have fun!

Folding the Sonobe Unit



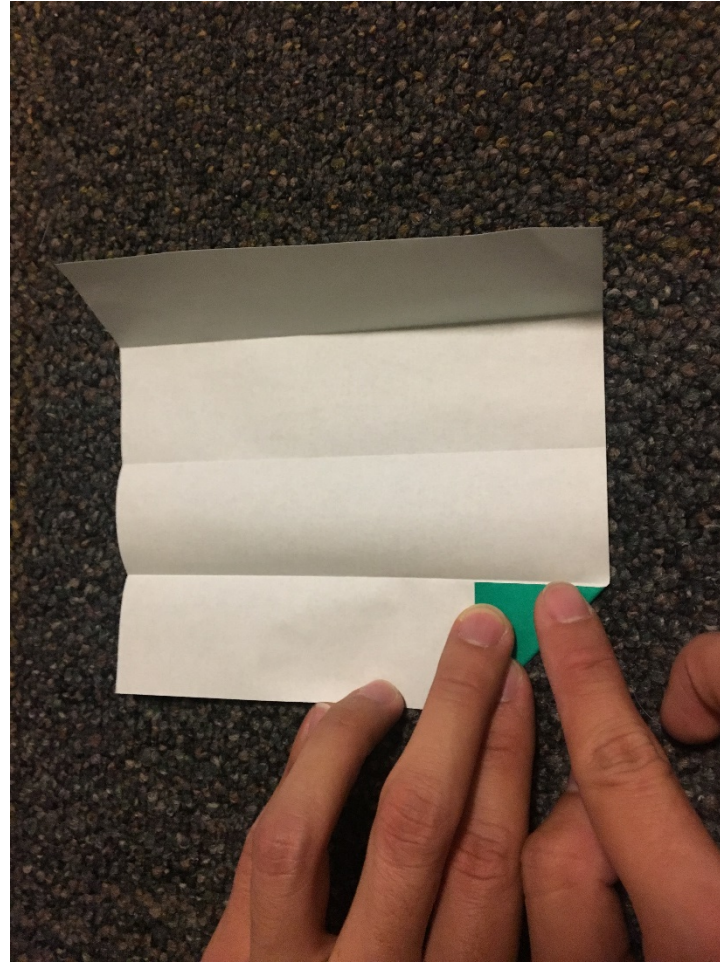
Folding the Sonobe Unit



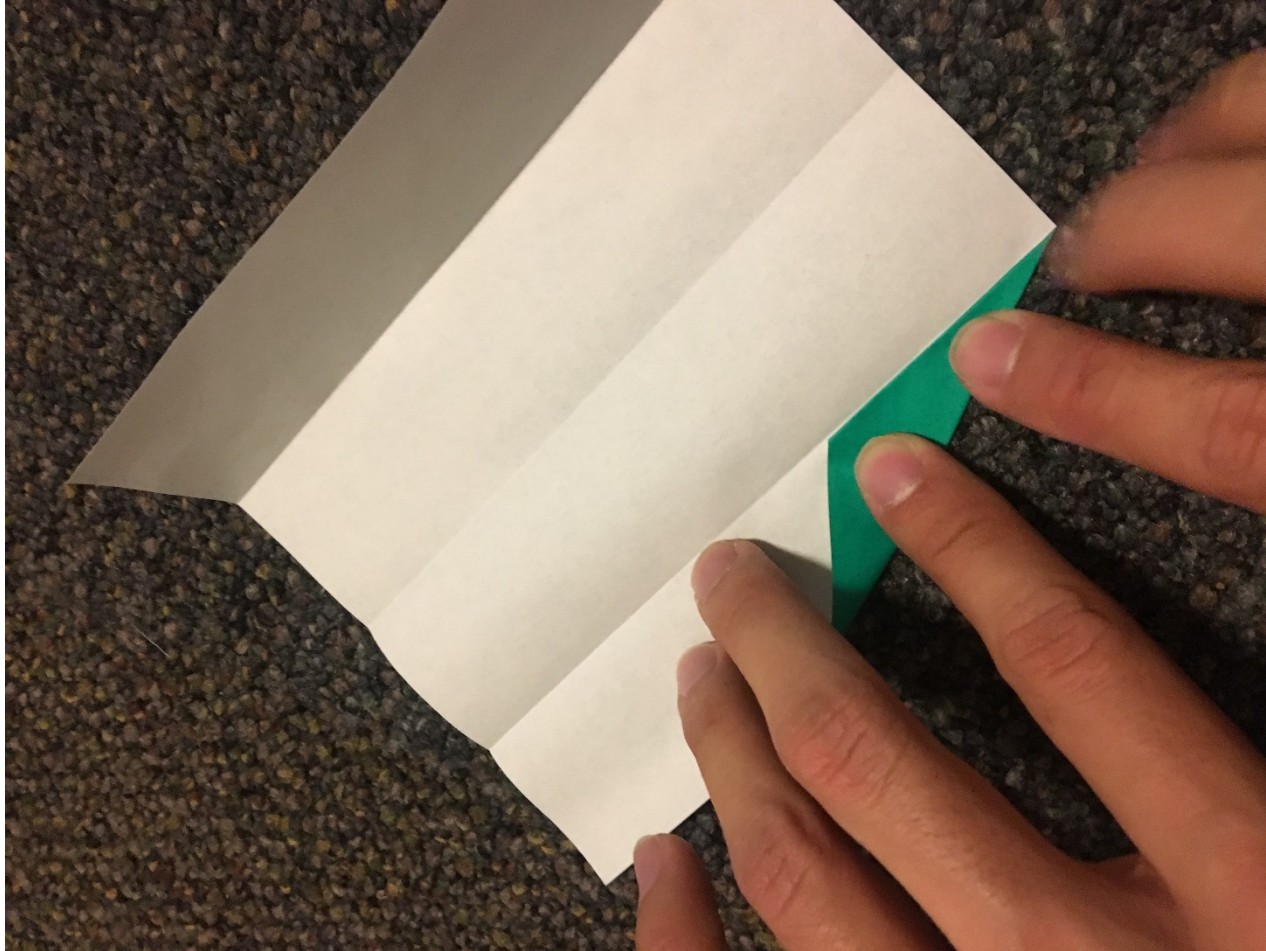
Folding the Sonobe Unit



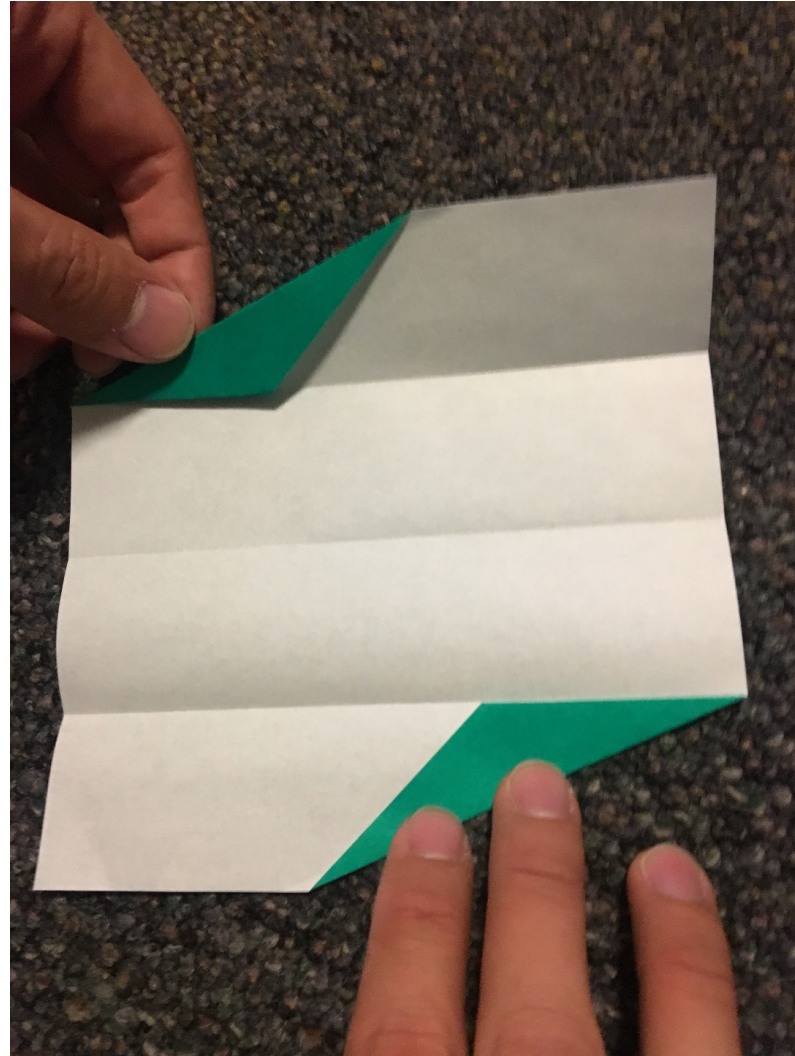
Folding the Sonobe Unit



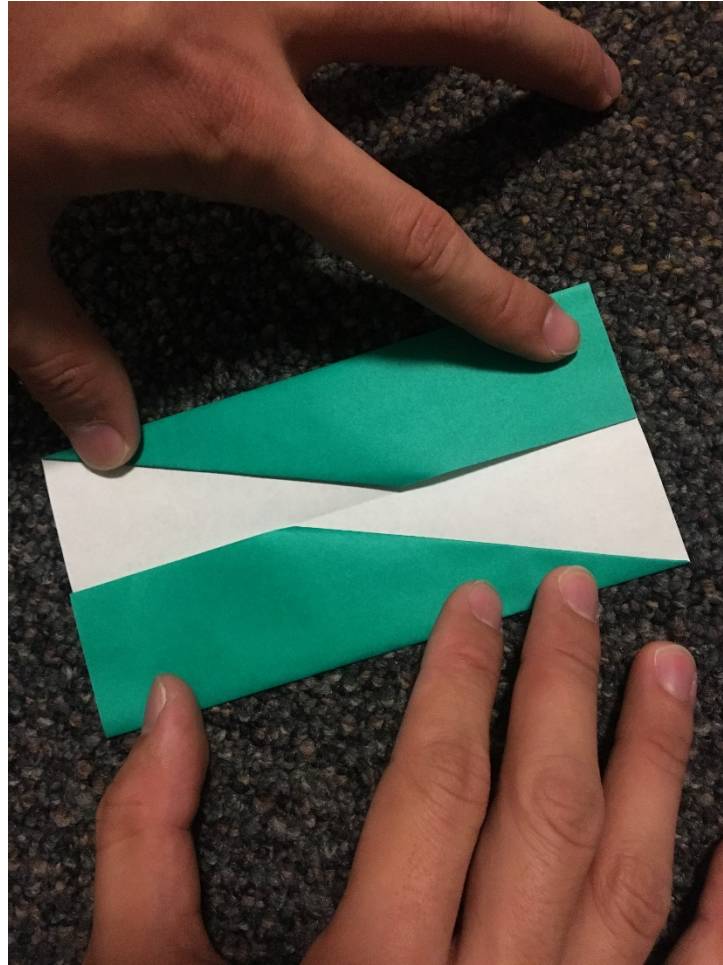
Folding the Sonobe Unit



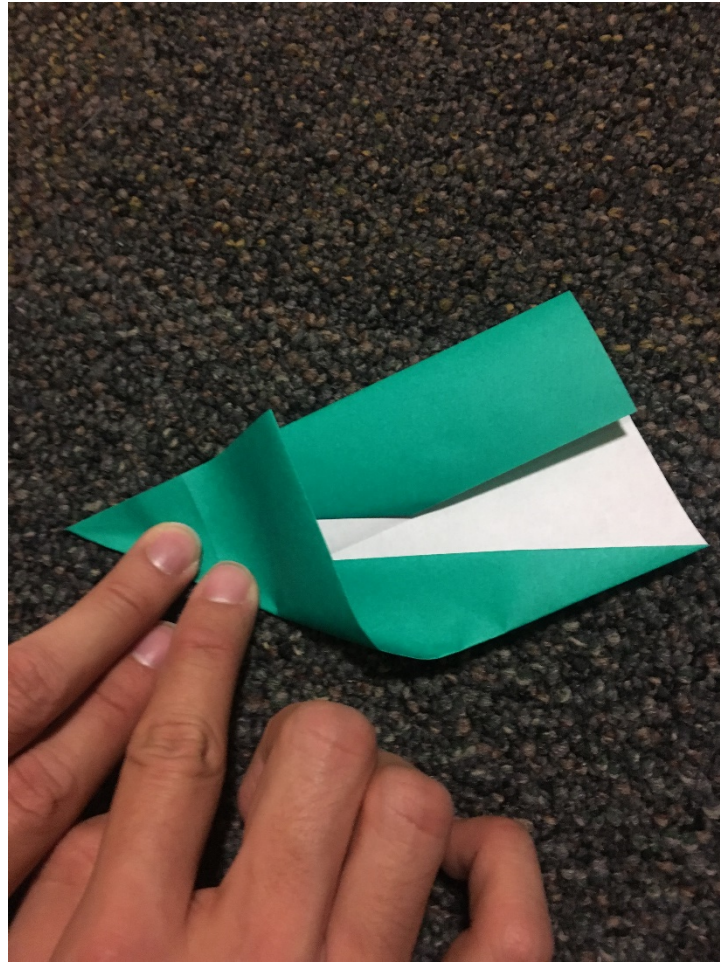
Folding the Sonobe Unit



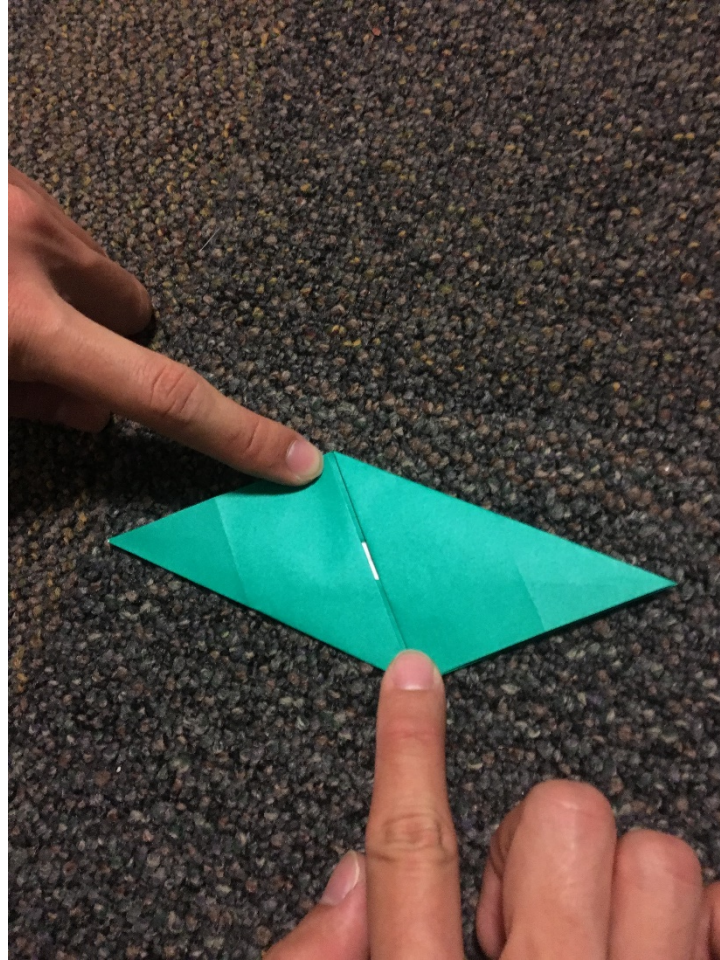
Folding the Sonobe Unit



Folding the Sonobe Unit



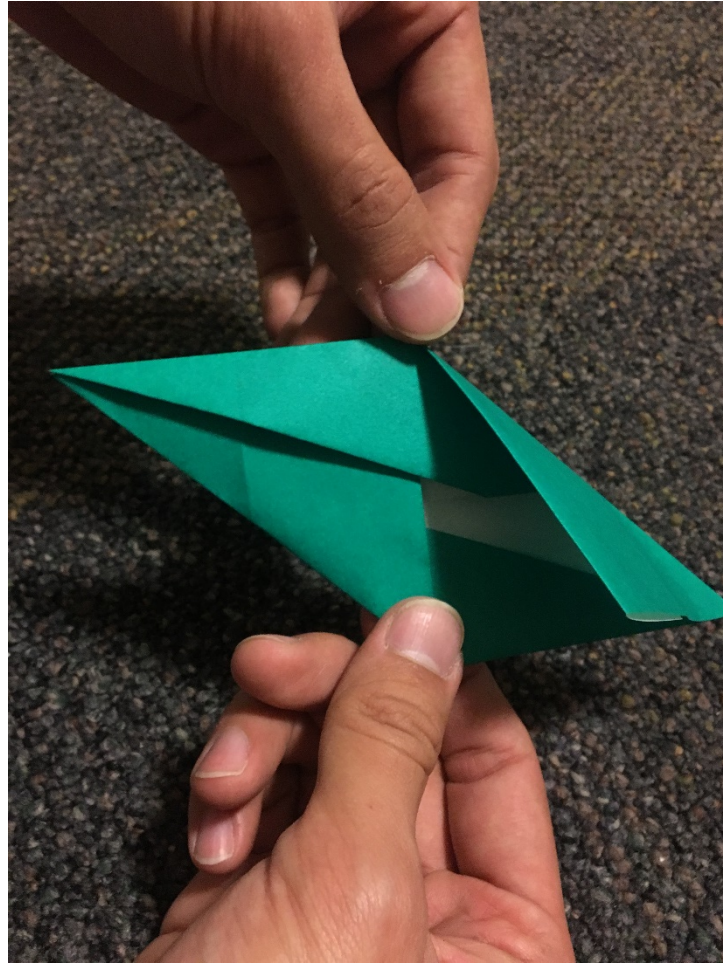
Folding the Sonobe Unit



Folding the Sonobe Unit



Folding the Sonobe Unit



Folding the Sonobe Unit



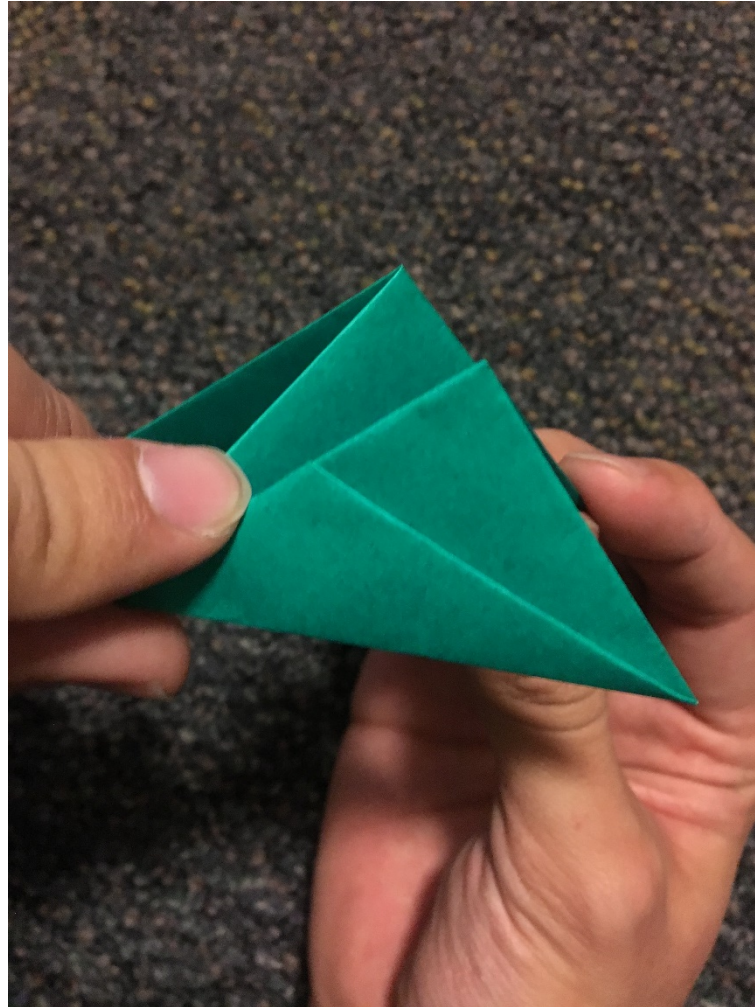
Folding the Sonobe Unit



Folding the Sonobe Unit



Folding the Sonobe Unit



Folding the Sonobe Unit - Complete!

