

Origami and Math ...

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Joel Lewis

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(This is my first talk with PowerPoint. Be gentle.)

# What is Origami?

*oru* = to fold, *kami* = paper

“Origami is a form of visual / sculptural representation that is defined primarily by the folding of the medium (usually paper).”

(“borrowed” from Eric Andersen, [paperfolding.com](http://paperfolding.com))

Folding square sheets of paper into interesting shapes, without the use of cutting, adhesives, or the like.

And what does this have to do with  
math?

# And what does this have to do with math? (Version 1)

“What kinds of surfaces can one form from a sheet of paper? If only bending is allowed -- i.e., the paper must remain smooth -- the answer is ‘developable surfaces.’ Such surfaces are well-studied in differential geometry and not hard to characterize. On the other hand, if arbitrary creasing is allowed, much more general behavior can occur; hence, little can be said about these ‘applicable surfaces.’ To convince yourself of this, find a paper you are tired of reading and crumple it into a ball. (For added stress-relief, throw it in the trash or at your office-mate.)”

(“borrowed” from Po-Ru Loh)

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- Origami as an axiomatizable (sp?) system
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- Origami as an axiomatizable (sp?) system\*
  - Huzita's Axioms
  - Additional axioms: Erik Demaine and others have worked on this question.

\* See Tom Hull's website:

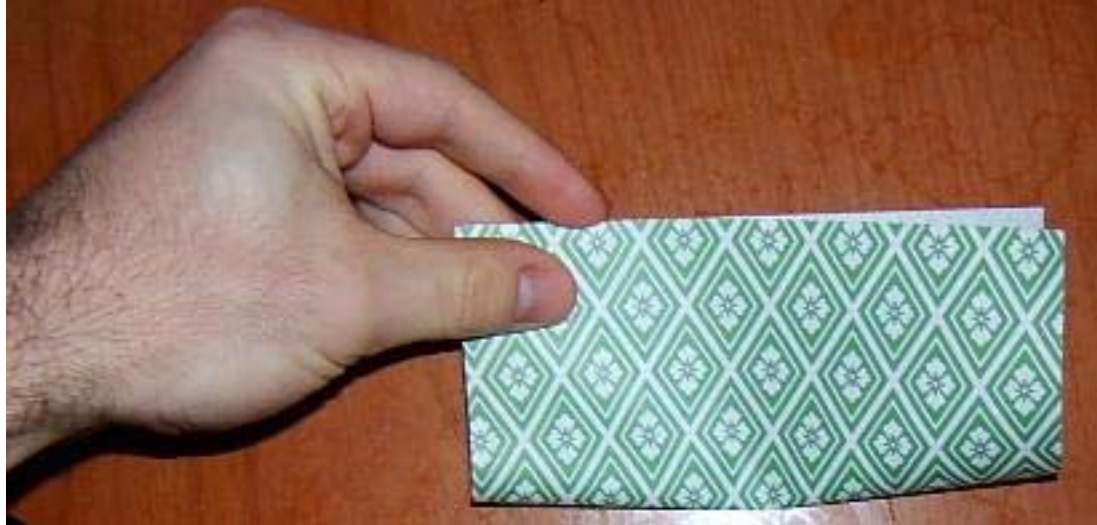
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[omfiles/geoconst.html](http://kahuna.merrimack.edu/~thull/omfiles/geoconst.html)

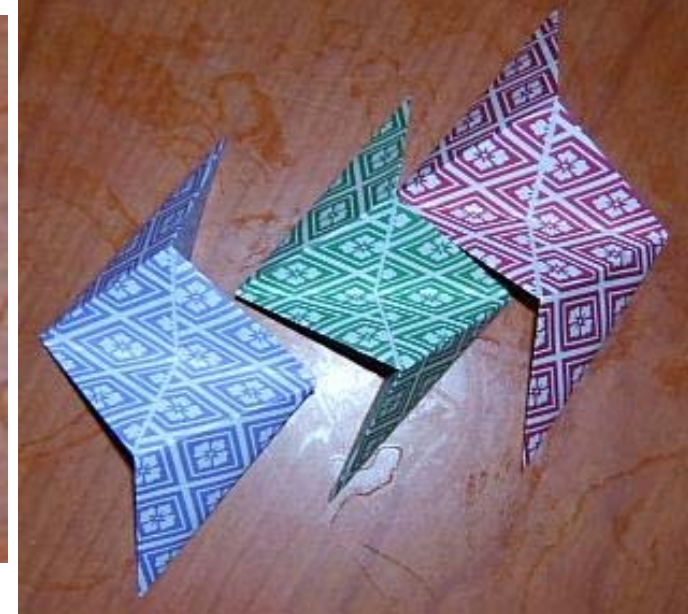
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# And what does this have to do with math? (Version 3)

- Modular origami (i.e., what this talk is really about)
  - The *Sonobe* unit







# Coloring Principles

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- The symmetry group of the polyhedron should act transitively on the color classes, and the stabilizer of each color should act transitively on the edges

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- Origami version: no two same-colored units should interlock
  - For the sonobe unit, this is equivalent to “Each face should have edges of all different colors.”
  - For other units, “vertex” instead of “face.”

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- “Everything is symmetric”
- Origami version: no two same-colored units should interlock
  - For the sonobe unit, this is equivalent to “Each face should have edges of all different colors.”
  - For other units, “vertex” instead of “face.”
- Should be aesthetically pleasing

Thanks to Deepali Malhotra for trying to teach me how to use PowerPoint.