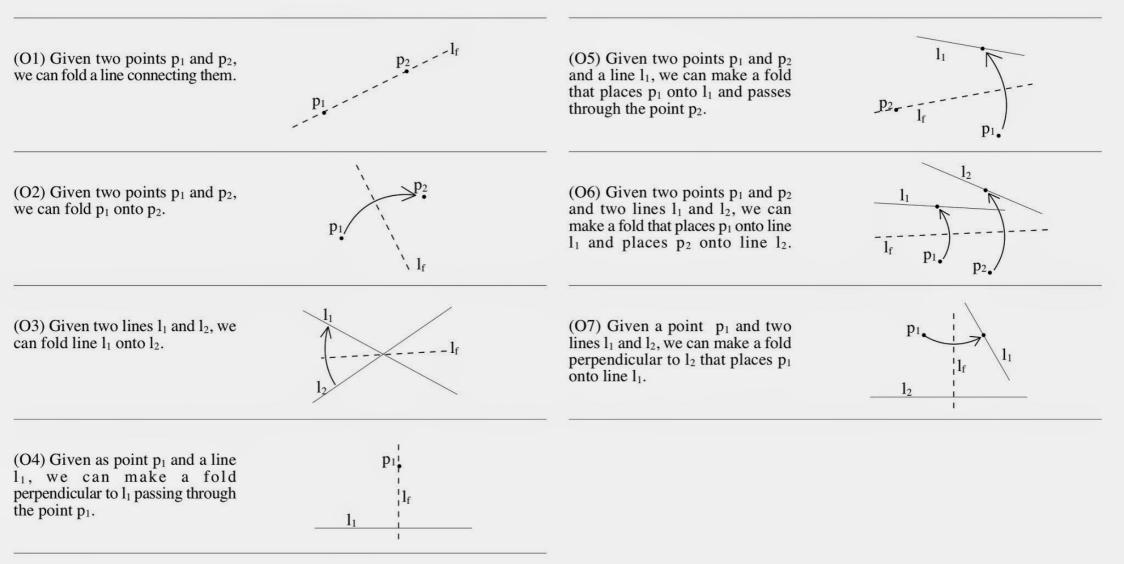
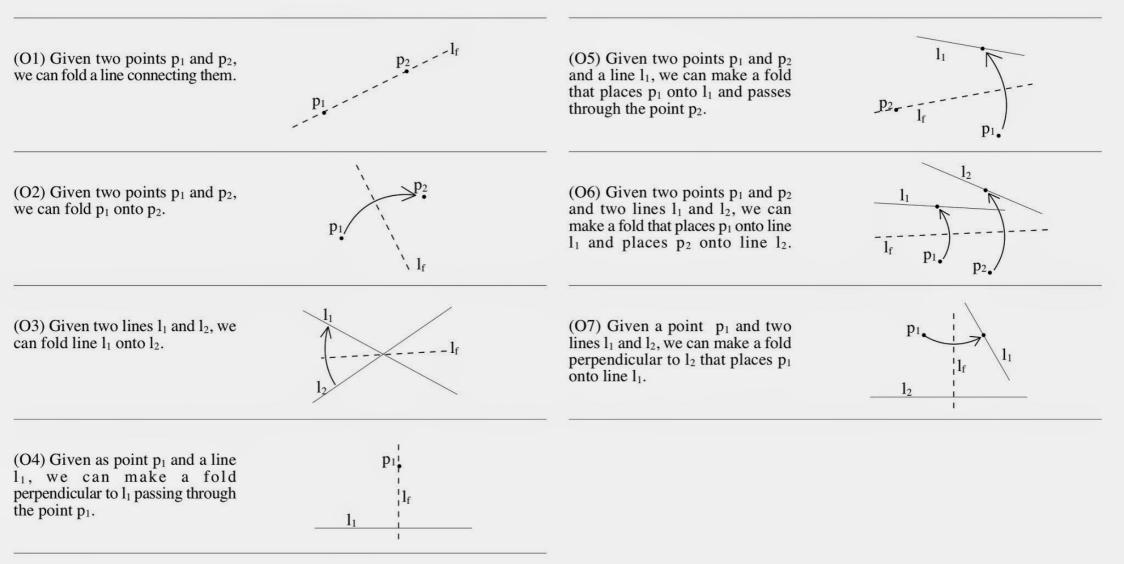


Huzita-Hattori Axioms (1)

- Axiom 1: Given two points p₁ and p₂, there is a unique fold line (Ori1[p₁, p₂]) that passes through both points (Figure 5).
- Axiom 2: Given two points p₁ and p₂, there is a unique fold line (Ori2[p₁, p₂]) that places p₁ onto p₂ (Figure 6).
- Axiom 3: Given two lines L₁ and L₂, there are at most two fold lines (Ori3[L₁, L₂, flag]) that place L₁ onto L₂. There are at most two choices of folding line. We use "flag" to indicate a folding line(Figure 7).
- Axiom 4: Given a point p₁ and a line L₁, there is a unique fold line (Ori4[p₁, L₁]) that passes through point p₁ and is perpendicular to L₁ (Figure 8).
- Axiom 5: Given two points p₁ and p₂ and a line L₁, there are at most two fold lines (Ori5[p₁, p₂, L₁, flag]) that place p₂ onto L₁ and pass through p₁. There are at most two choices of folding line. We use "flag" to indicate a folding line (Figure 9).
- Axiom 6: Given two points p₁ and p₂ and two lines L₁ and L₂, there are at most three fold lines (Ori6[p₁, L₁, p₂, L₂, flag]) that place p₁ onto L₁ and p₂ onto L₂. There are at most three choices of folding line. We use "flag" to indicate a folding line (Figure 10).
- Axiom 7: Given one point p and two lines L_1 and L_2 , there is a **unique fold line** $(\text{Ori}7[p_1, L_1, L_2])$ that places p onto L_2 and is perpendicular to L_1 (Figure 11).







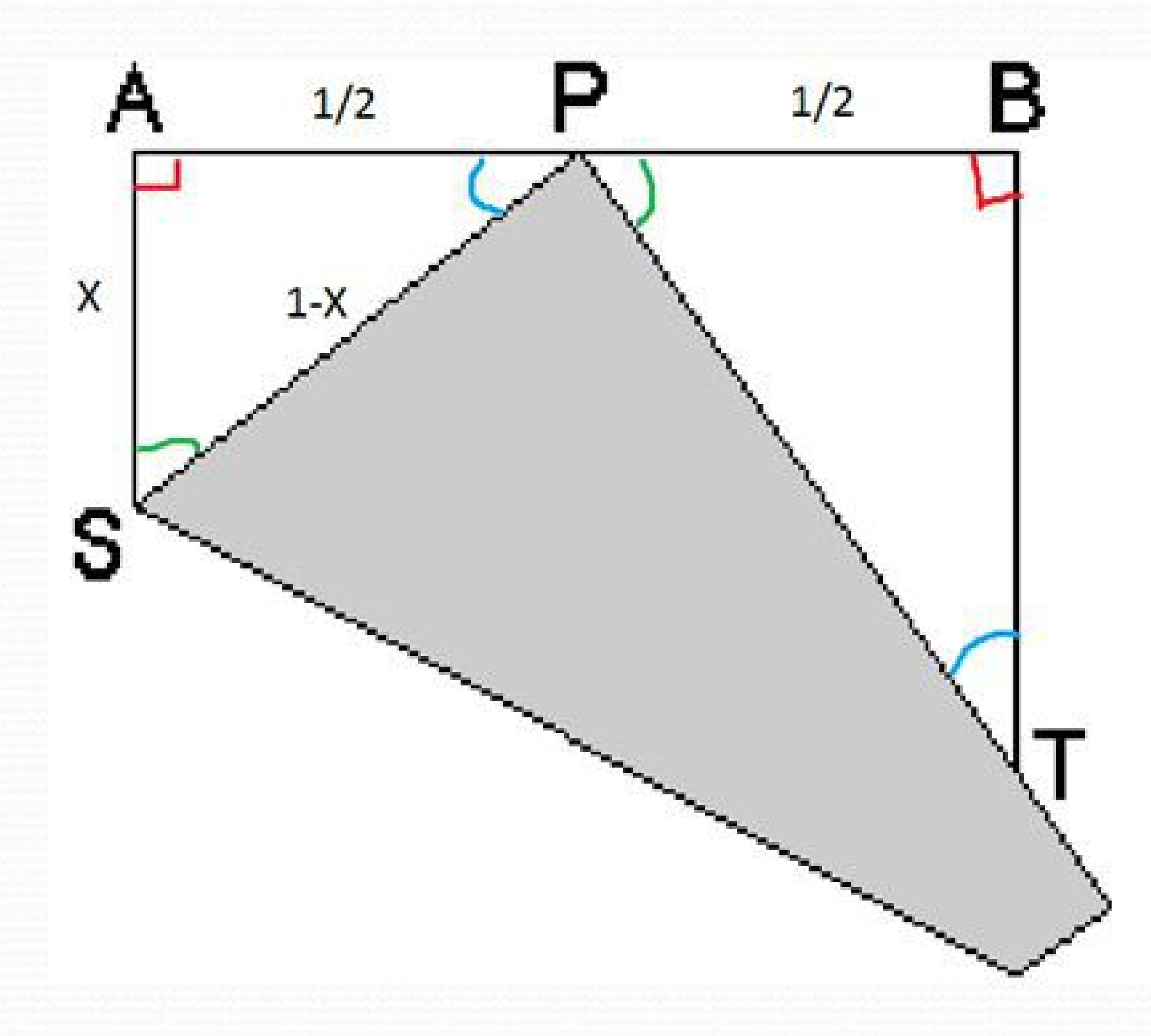


Lessons I've Learned

- Have Fun
- 2. Do More Than One Thing
- Collaborate
- 4. Cross Disciplines

Haga's Theorem

- Haga's theorem lets paperfolders fold the side of a square into thirds, fifths, sevenths, and ninths
- Proof: by construction:
 - Similar triangle
 - \bullet AP/SA=BT/PB
 - (1/2)/x=BT/(1/2)
 - BT = 1/4.x



Single-Vertex Origami without Mountain-Valley Assignment

Kawasaki's Theorem:

Without a mountain-valley assignment, a vertex is flat-foldable precisely if sum of alternate angles is 180° ($\Theta_1 + \Theta_3 + ... + \Theta_{n-1} = \Theta_2 + \Theta_4 + ... + \Theta_n$)

 Tracing disk's boundary along folded arc moves Θ₁ - Θ₂ + Θ₃ - Θ₄ + ... + Θ_{n-1} - Θ_n

I Should return to starting point ⇒ equals 0



Maewaka's Theorem

- The difference between the number of mountain creases and the number of valley creases intersecting at a vertex is always 2.
- Let M be the number of mountain creases at a vertex S.
- Let V be the number of valley creases at a vertex S.
 So, the Maekawa's Theorem states that at the Vertex S.

M-V= 2 or V-M=2

But how do we prove this ?!!

Definition of a Polygon: the sum of the interior angles of a regular polygon is (n-2) * 180 degrees. (n is the number of sides of polygon)

AND

Interior Angles of Mountain Creases is 0° of flat origami Interior Angles of is Valley Creases is 360° of flat origami.

math proof outline: Haga's theorem

$$(1-y)^{2} = x^{2} + y^{2}$$

$$1 - 2y + y^{2} = x^{2} + y^{2}$$

$$1 - 2y = x^{2}$$

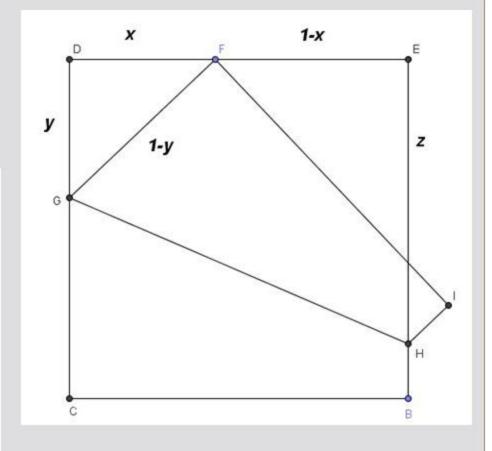
$$y = \frac{1-x^{2}}{2}$$

$$\frac{1-x}{y} = \frac{z}{x}$$

$$z = \frac{x(1-x)}{y}$$

$$= \frac{2x(1-x)}{1-x^2}$$

$$= \frac{2}{1+x}$$









Exquisite Modular Origami

Meenakshi Mukerji







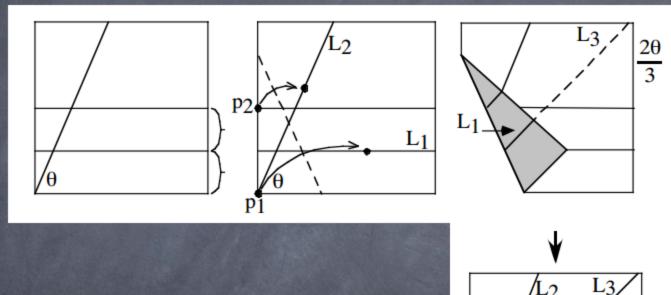




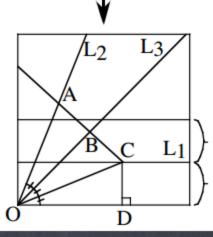




Origami angle trisection



Proof:



credit: Hisashi Abe, 1980

