Fold & cut software  
- **DEMO** (6.849 project)  
- **PROJECT**: improve UI, make Java applet; 
  port to JavaScript; 
  force degeneracies; or 
  compute folded state & $\psi$/unfold 
- **JOriGami**: disks  
  [Silveira, Cosentino, Coelho, Aoki]  

Odd-degree vertices? 
- even degree $\iff$ face 2-colorable 
  $\iff$ alternating above/below side assignment 
  $\iff$ uncresed cut edges 
  $\iff$ scissor cuts 
  (separate material on both sides of line) 
- mathematical/laser cuts (removing line) 
  can do odd-degree vertices 
  e.g.  

- if graph doesn't disconnect from the removal of any 1 edge 
  (planar 2-edge-connected) 
then = union of two even graphs 

[Demaine, Demaine, Luby 1998, 
thanks to Jim Geelen & Dan Younger]
- **Linear corridors** → tree
  - corridor → edge (or ray)  
  - width w → length w  
  - perpendicular (connected comp) → vertex  
  - similar to TreeMaker CP → shadow tree

- **Tree folding** → origami folding
  - expand each edge to accordion folding
  - stitch together at perpendiculars

- **Irrational ratio** happens with prob. 1? **YES**
  - but first need closed loop of perpendiculars
  - **CONJECTURE**: with prob. 1, only get loops around one cut vertex (normal circular corridor)

- Examples: students & HELL

- **Disk packing** → tri/quad decomposition
  - disk center → vertex
  - kissing disks → edge
  - 3- or 4-gap → triangle or quad.
How many disks? \( O(\int_{x \in \mathcal{P}} \frac{dx}{lfs(x)}) \)

- \( lfs(x) = \frac{\text{local feature size}}{\text{radius of smallest disk centered at } x} \)
  hitting a nonincident edge of \( \mathcal{P} \)

Disk packing method vs. tree method
- disks
- easy to place \((\text{but many})\)
- input = polygon
- regions = tri. & quad.
- both align boundaries of universal molecules

- disks & rivers
- hard to place
- input = tree
- regions = convex \((\text{tri.})\)

Straight skeleton method vs. tree method
- arbitrary polygons/graphs
- no control on tree/lengths
- polygon packing \(\approx\) combination of two
  \((\text{straight skeleton} + \text{gussets to control})\)

[Demaine, Demaine, Lang] [Origami Design Secrets 2e]

\[ \text{OPEN: fold flat & cut of fixed curvature } K \]
- make all unions of arcs of this curvature?
- intuition: \( \frac{1}{x} \)
- but:
- Flattening
  - 3D fold & cut $\Rightarrow$ flat folded state (folding motions not preserved)
  - NEW: convex polyhedra can be **continuously flattened** [Itoh, Nara, Vilcu 2011]
  - **PROJECT**: animate their motion
  - **OPEN**: nonconvex polyhedra?

- **PROJECT**: fold & cut alphabet
  - e.g. 3 or 4 simple folds/letter or CP for entire word/page

- **PROJECT**: paper cutting art via fold & cut
  - (à la Peter Callesen)