- Origamizer folding exercise

**Tips:**
- Rhino's Face3D + Join + Weld (180) FTW
- export OBJ as Polygon Mesh
- turn on Angle Condition

- Convex vs. nonconvex vertices

\[ 3 \cdot 60^\circ = 180^\circ \]
\[ 6 \cdot 90^\circ = 540^\circ \]
\[ \sum_{i} \Theta_i \leq 360^\circ \quad \sum_{i} \Theta_i > 360^\circ \]

- DEMO of \( \theta \) in Origamizer

- Freeform Origami DEMO
- Geometric constraints:
  - Rigid Origami Simulator
    (parameterized by fold angle)
    - closure around a vertex
  - Freeform Origami
    (parameterized by 3D vertex coordinates)
    - developability
    - flat foldability
  - Origamizer
    - w/ a variable setup
    - closure around a vertex
    - convexity of paper boundary
    - convexity of edge-tucking molecule
    - tuck angle condition
    - tuck depth condition

- Solve these nonlinear constraints via sequence of linear systems to reduce error:
  1. Euler step to make infinitesimal motion satisfy constraints
  2. Newton step to correct 2nd order error
NP-completeness: what, me worry?
- local foldability seems to be enough for small rigid motions
- \textbf{OPEN:} theorem?
- amount of valid motion varies

Automatic folding:
- simple folding robot \cite{Balkcom&Mason2008}
- Printed Circuit MicroElectricalMechanical System (PC-MEMS)
  \cite{HarvardMicroroboticsLab2011}

Open problems in rigid origami?
- \textbf{OPEN:} complexity of deciding rigid foldability of a crease pattern?
  - degree-4 vertices \implies easy
    \cite{Demaine&Tachi2012}
- \textbf{OPEN:} design rigidly foldable origami (any interesting class)
- paper shopping bags
- \textbf{OPEN:} unfold from flat state with extra creases

\textbf{PROJECT:} port Tachi's software to MacOS

Multiple origami from subsets of 1 CP?
\rightarrow \textsc{Lecture 7}!