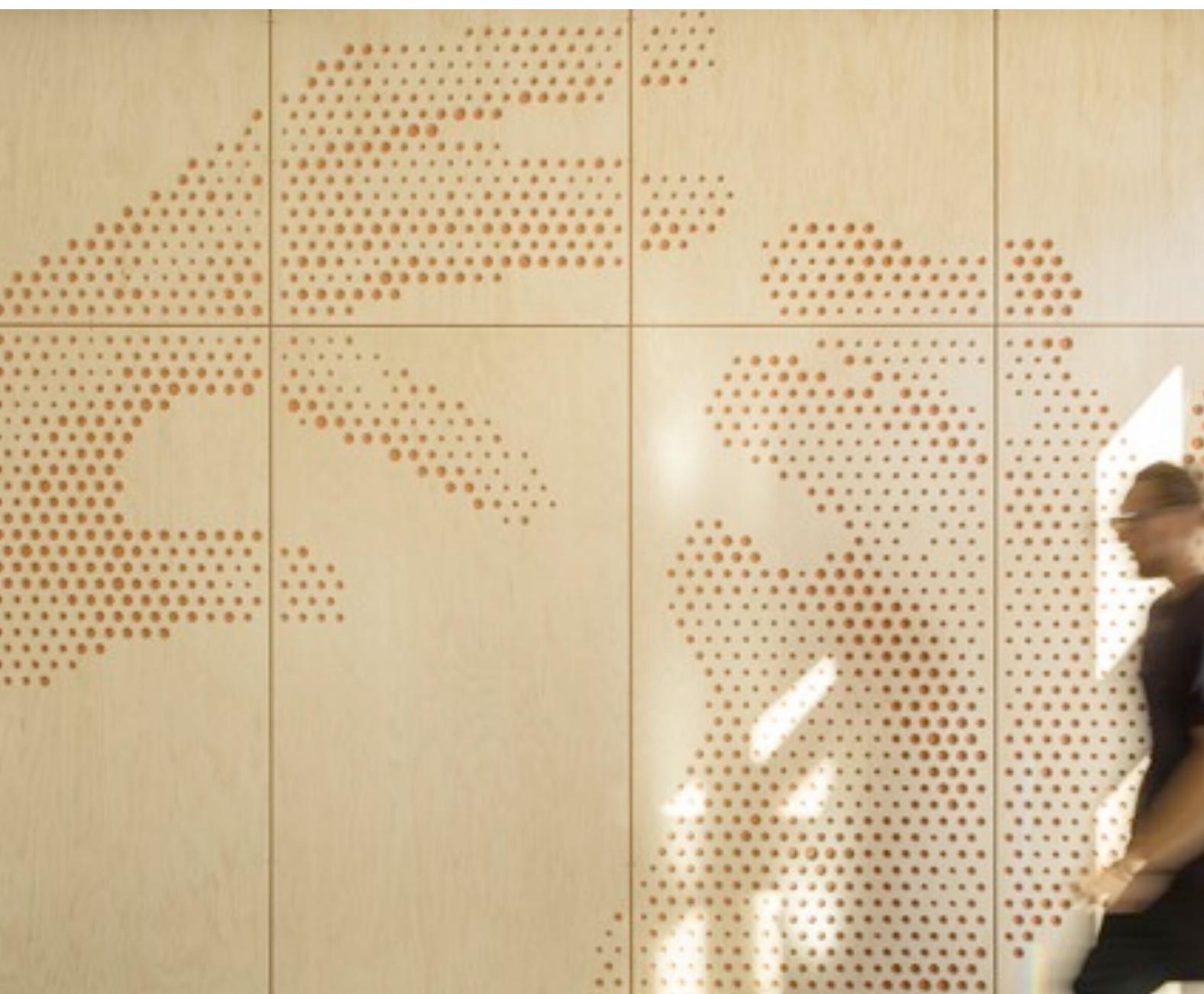


# CS122 Class 6: Digital fabrication



CNC milled wood wall boards showing hands,  
UC Berkeley Jacobs Hall



Compostable Lamp from 3D printed  
orange peels by Krill Design



Laser-cut puzzle from Nervous System

# Class 6 agenda

- ZC from River
- PM2: Sensory Cardboard crit
- Mini lecture: CAD-CAM process
- Break
- PM3 details; more on laser cutting
- Vector graphics studio

# PM2 Crit

# PM2 art walk

*Soft • Animated • Surreal*

- (2 min) **Phase I:** Place your cardboard on the table. Optional: write anything you'd like others to know (your vision, how to interact, etc.) on the post-its by your piece(s). Don't write your name.
- (12 min) **Phase II:** Walk around the room looking at your classmates' pieces. Give out at least **6** index cards of anonymous feedback. Each cardboard piece should at least have 2 index cards of feedback! Mention (1) how you think this piece is capturing the prompt (2) one thing you like and any other comments or questions.
- (3 min) **Phase III:** Take time to read your feedback. If you'd like to respond to any comments to the whole class, now's your chance.

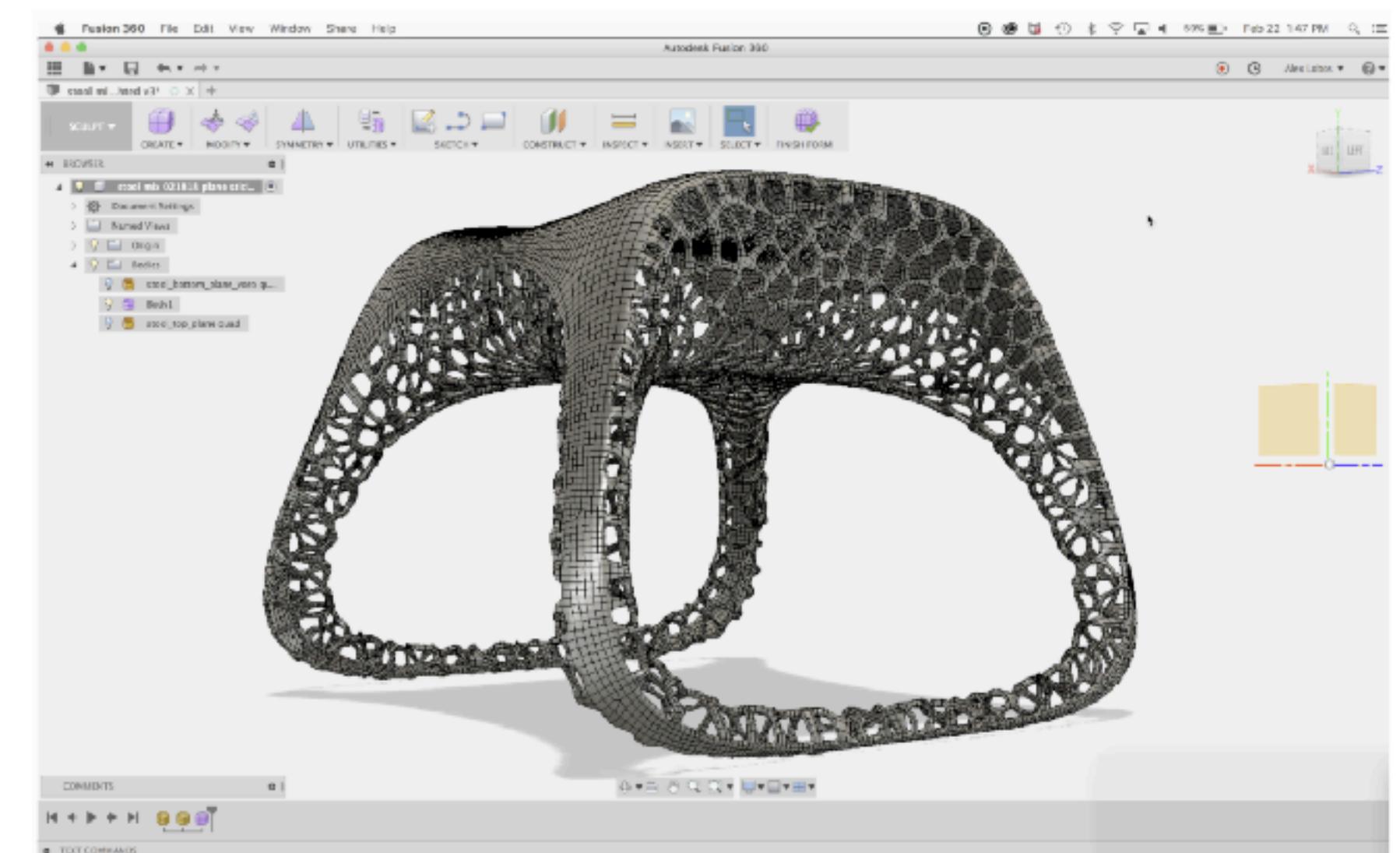
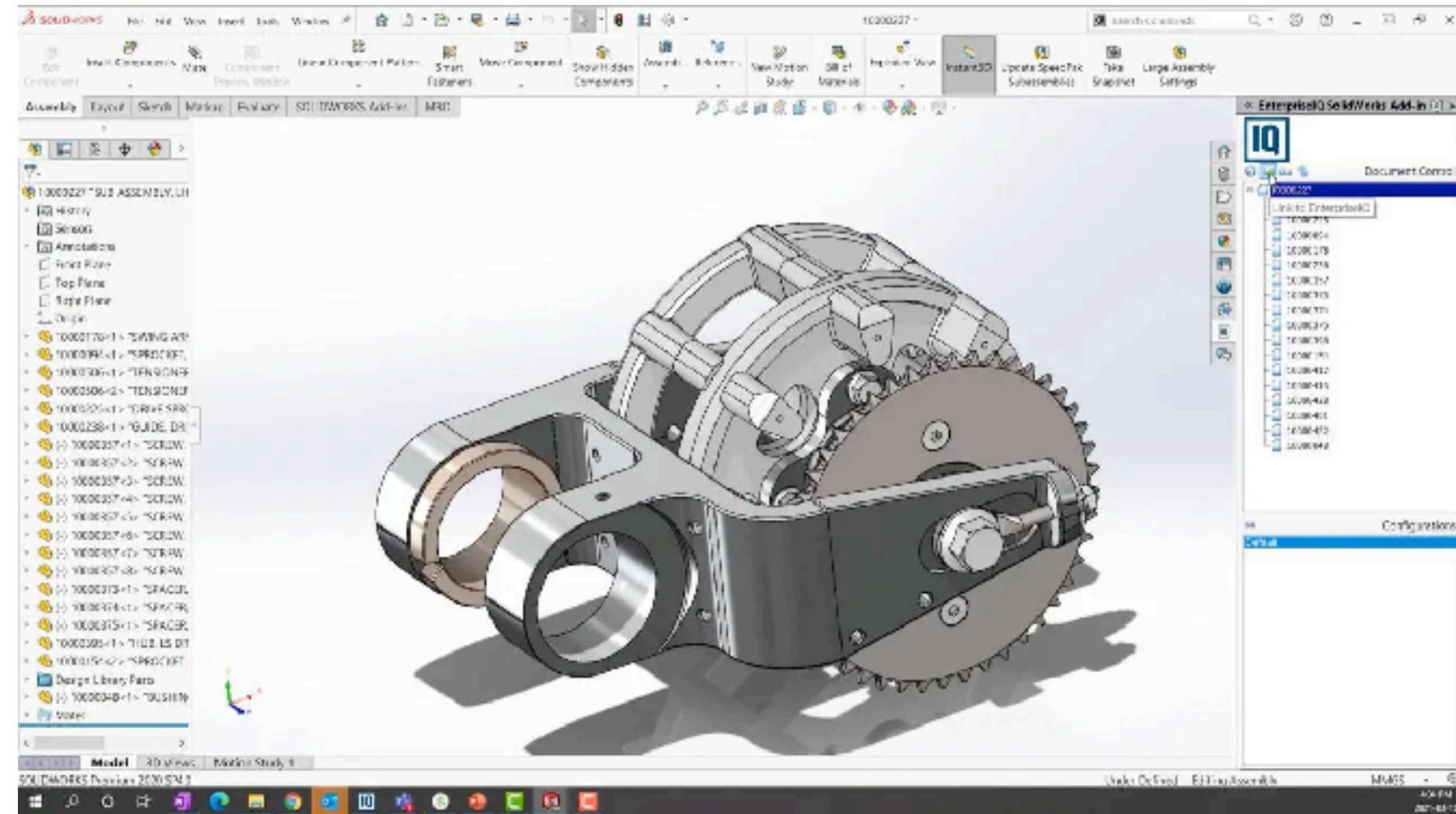
# Digital Fabrication

# Most things around you are digitally fabricated

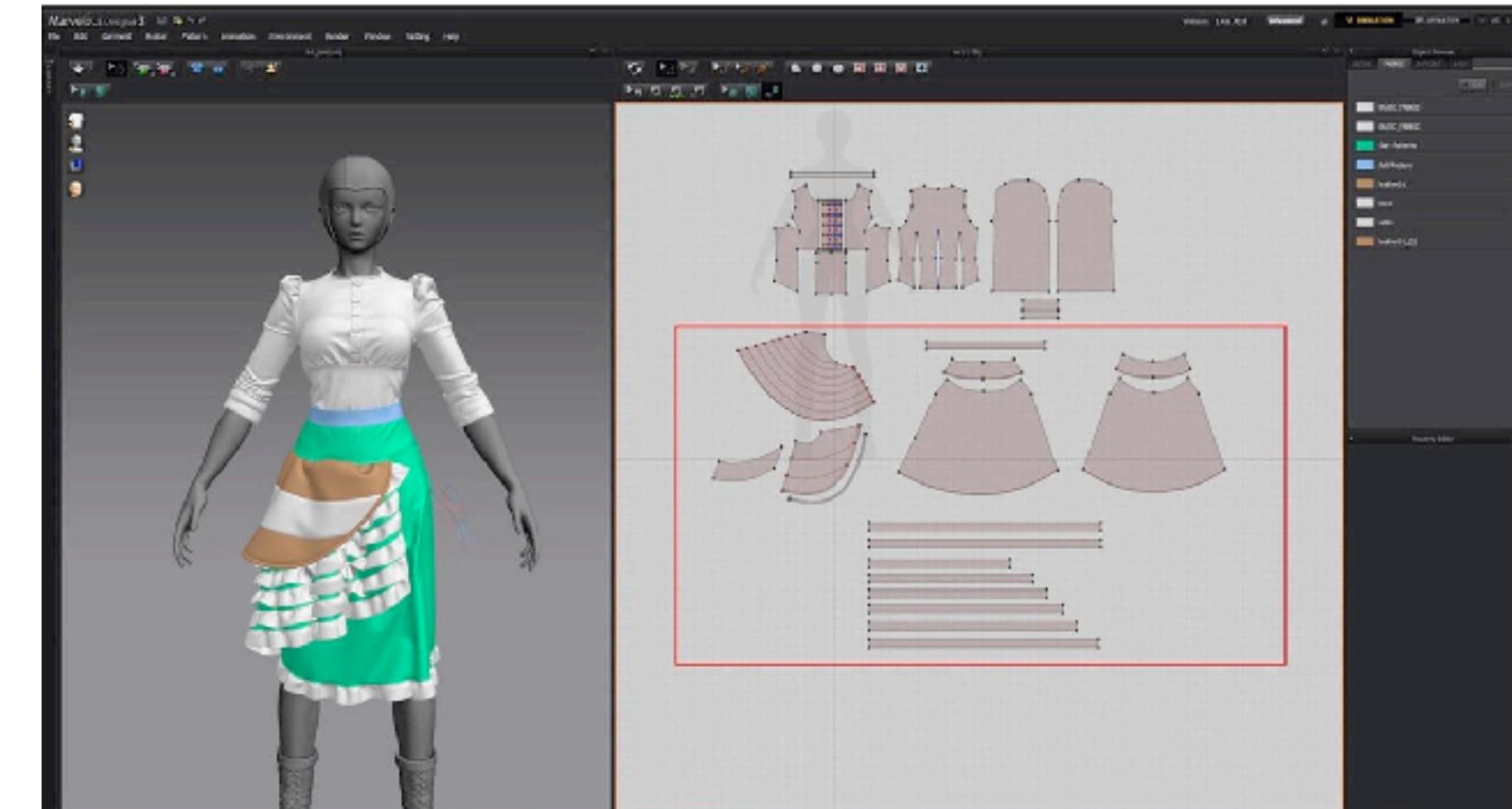


- But designed by humans, usually on computer software: computer-aided design (CAD)

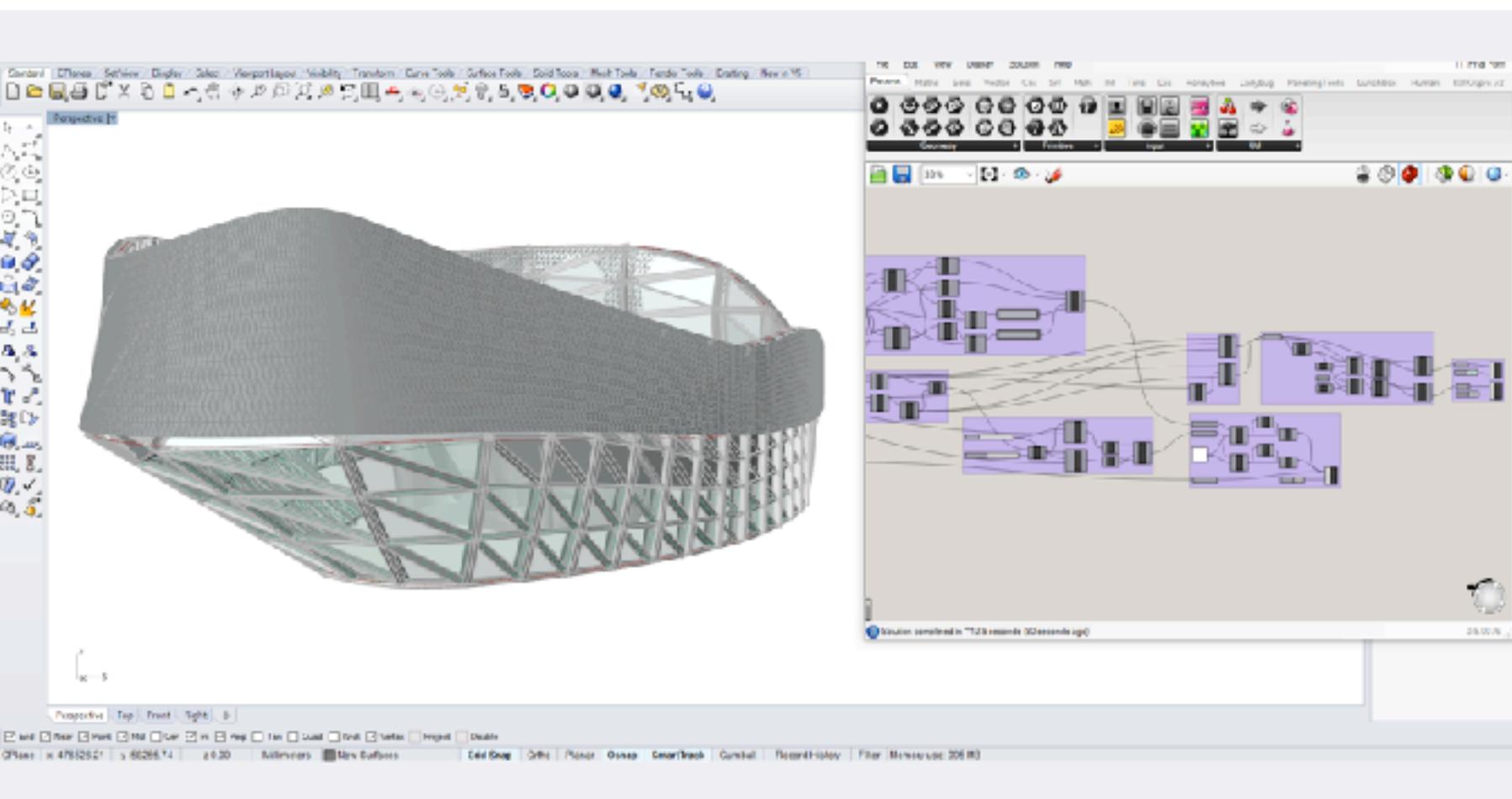
# CAD abstracts design from manufacturing



Solidworks, Fusion360 (3D models)

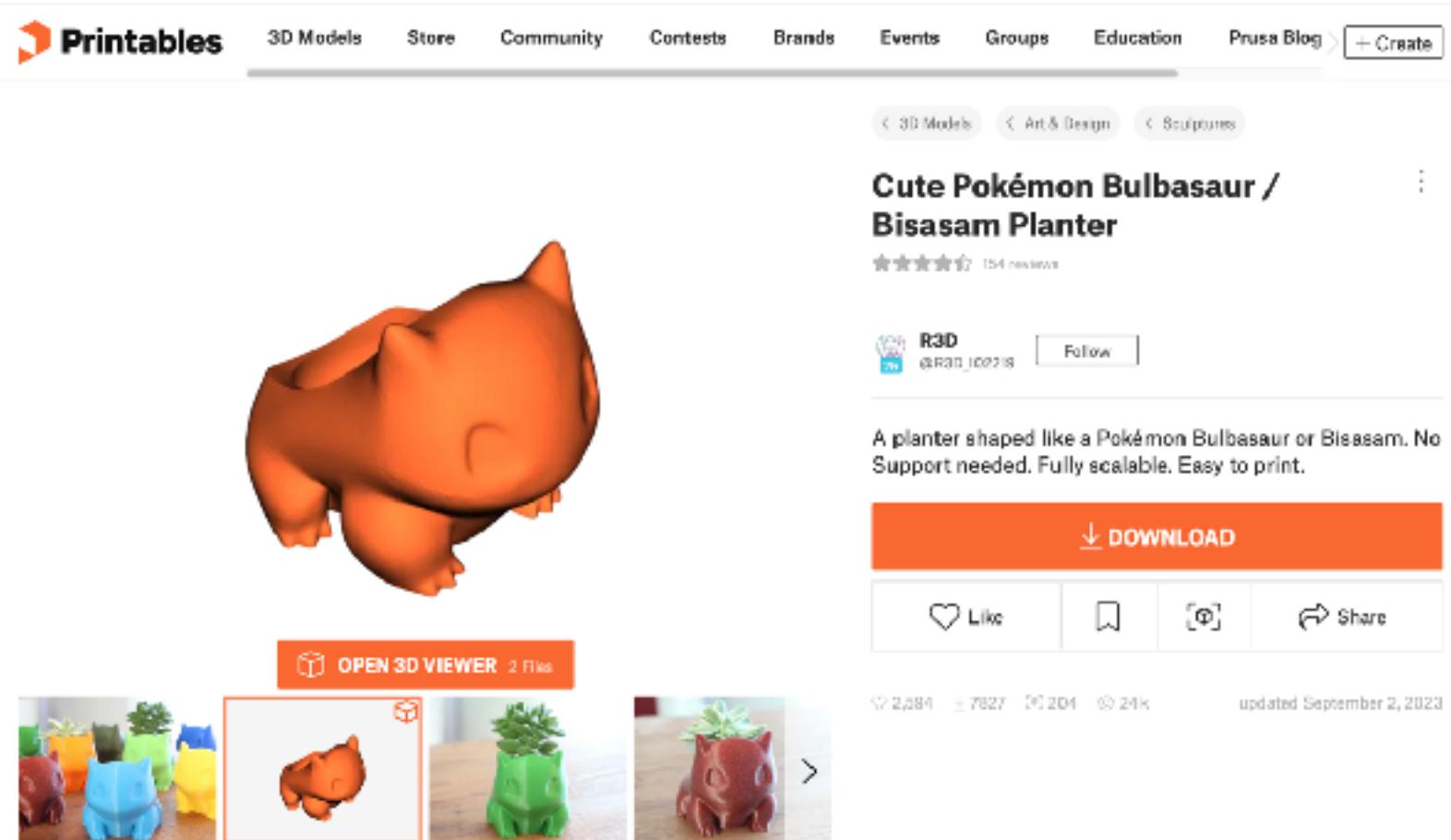


Marvelous Designer (fashion)



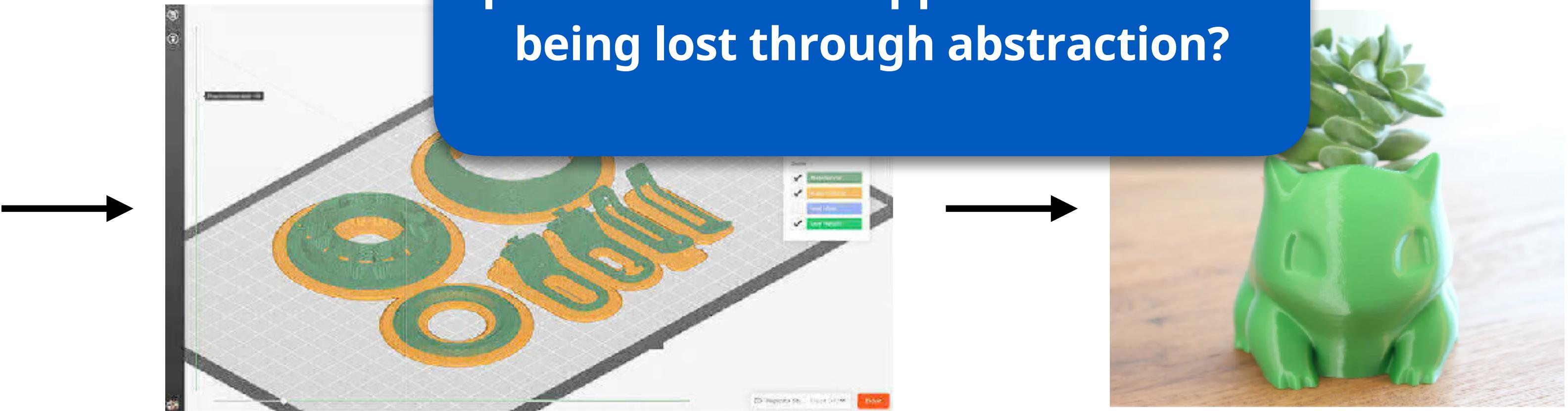
Grasshopper (architecture, generative art)

# CAD → CAM cycle



Design a software representation of what we want to make

**Computer-aided design (CAD)**



What are some advantages and pitfalls with this approach? What's being lost through abstraction?

Turn our software representation into machine paths

**Computer-aided manufacturing (CAM)**

The machine will do the actual “making”, humans do the “design”

*Making no longer requires physical skill (the machine will do it), but just design skill*

# Break

FIGMA FOR EDUCATION

## Free best-in-class tools for the classroom

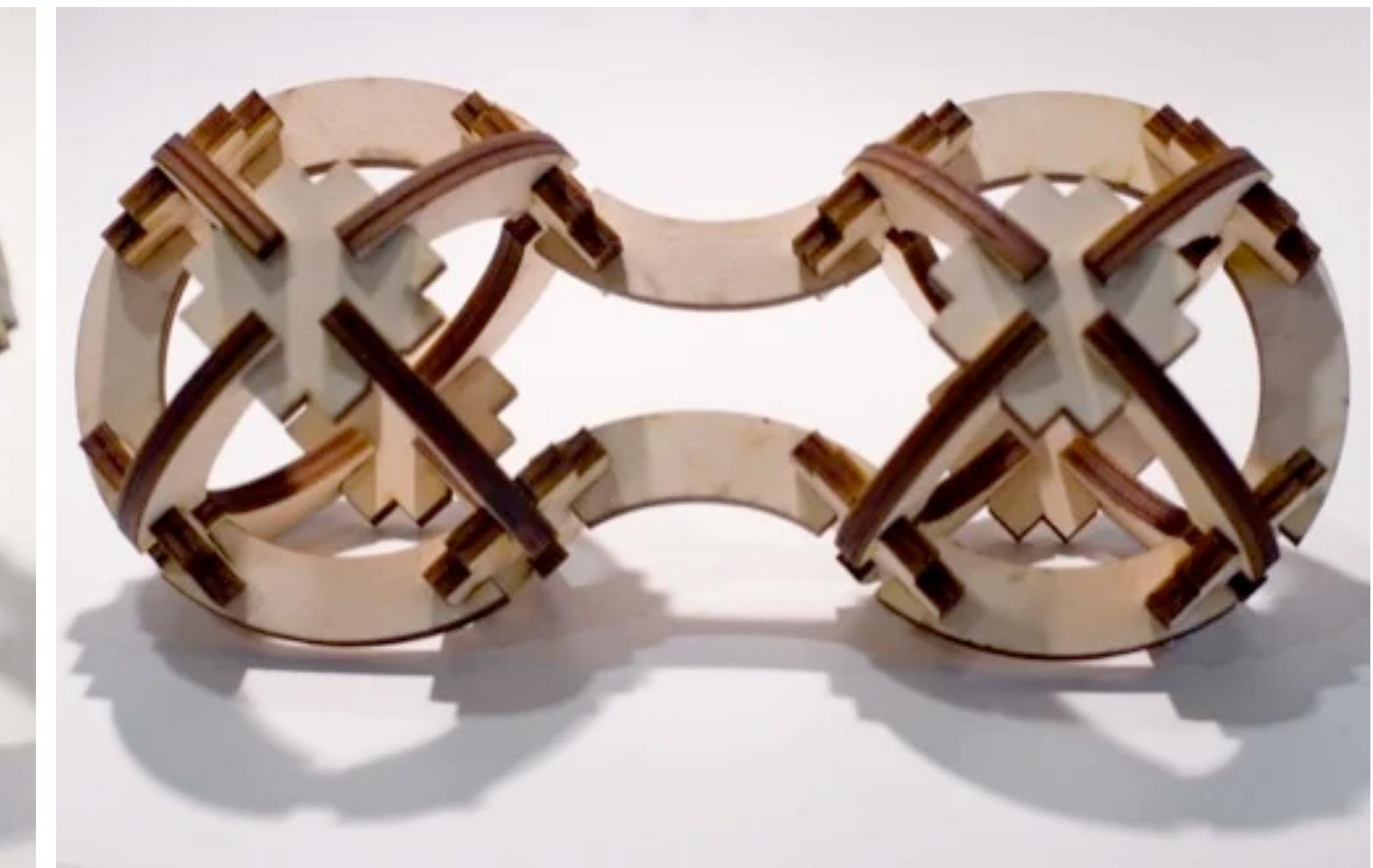
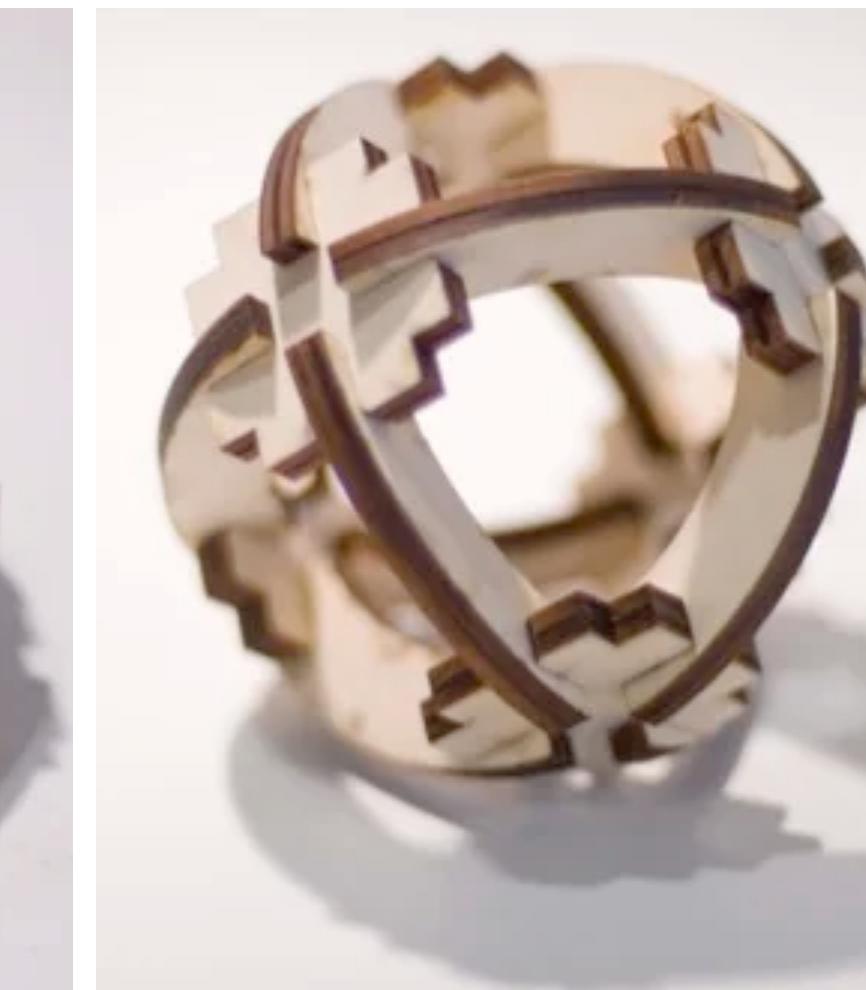
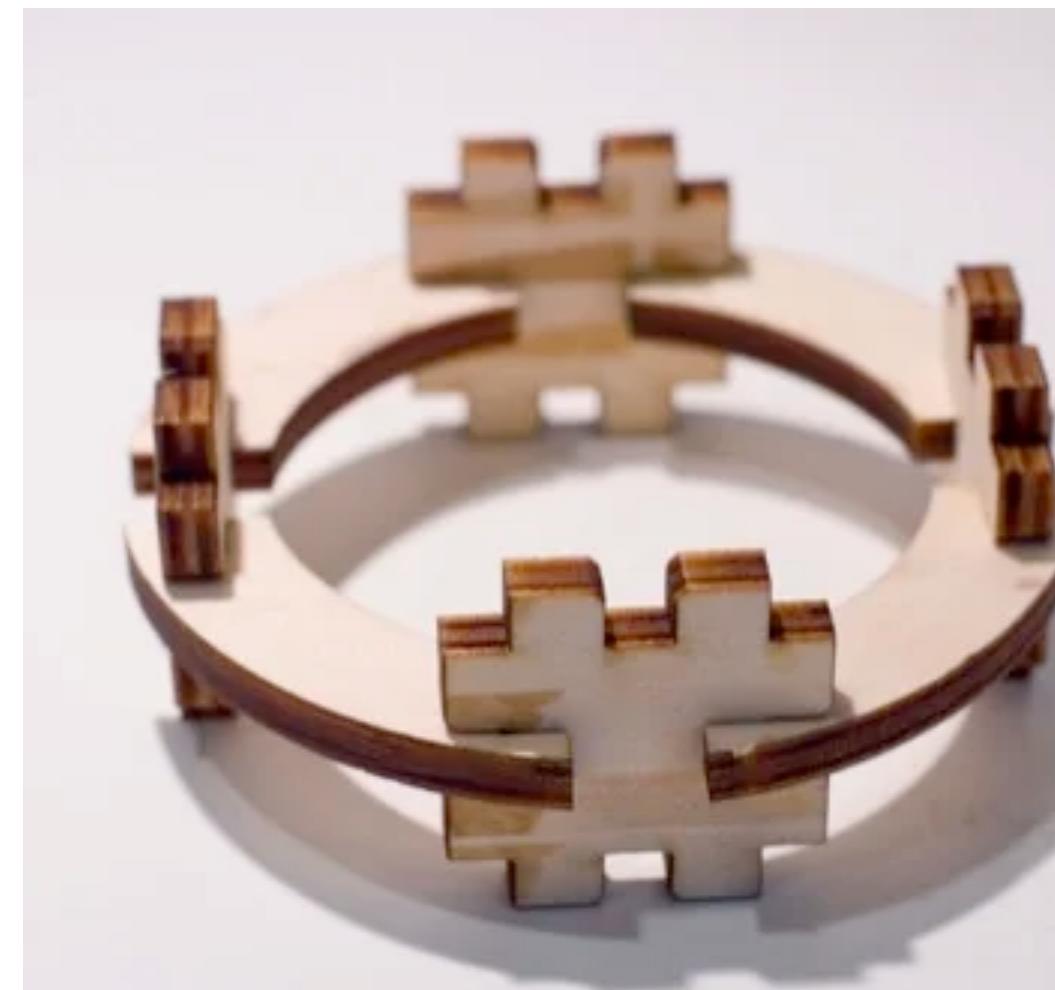
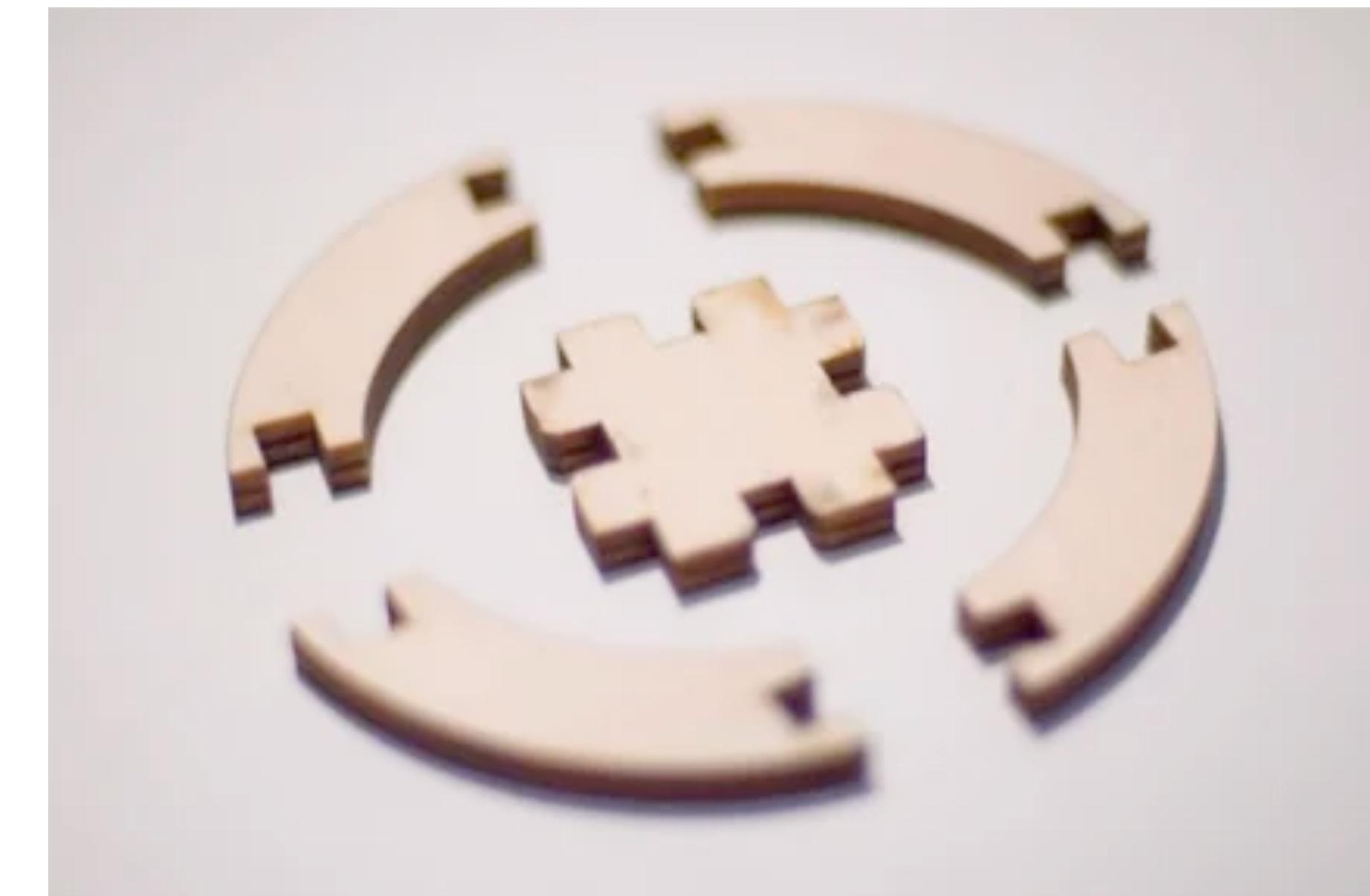
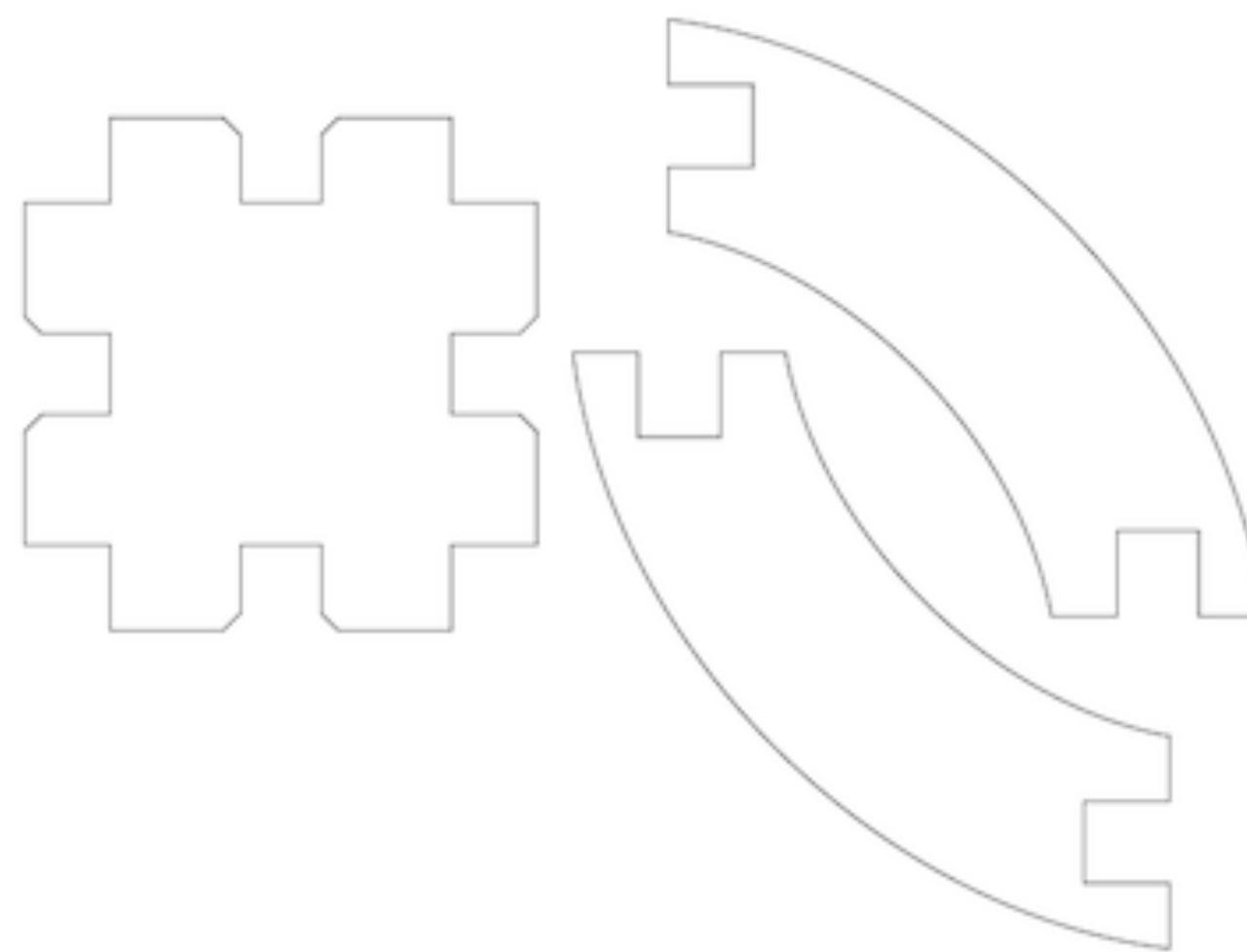
Figma and FigJam are design and collaboration software used by professional designers, engineers, and makers of all kinds. Use them to ideate, create, and share work—all free, as a student or teacher.

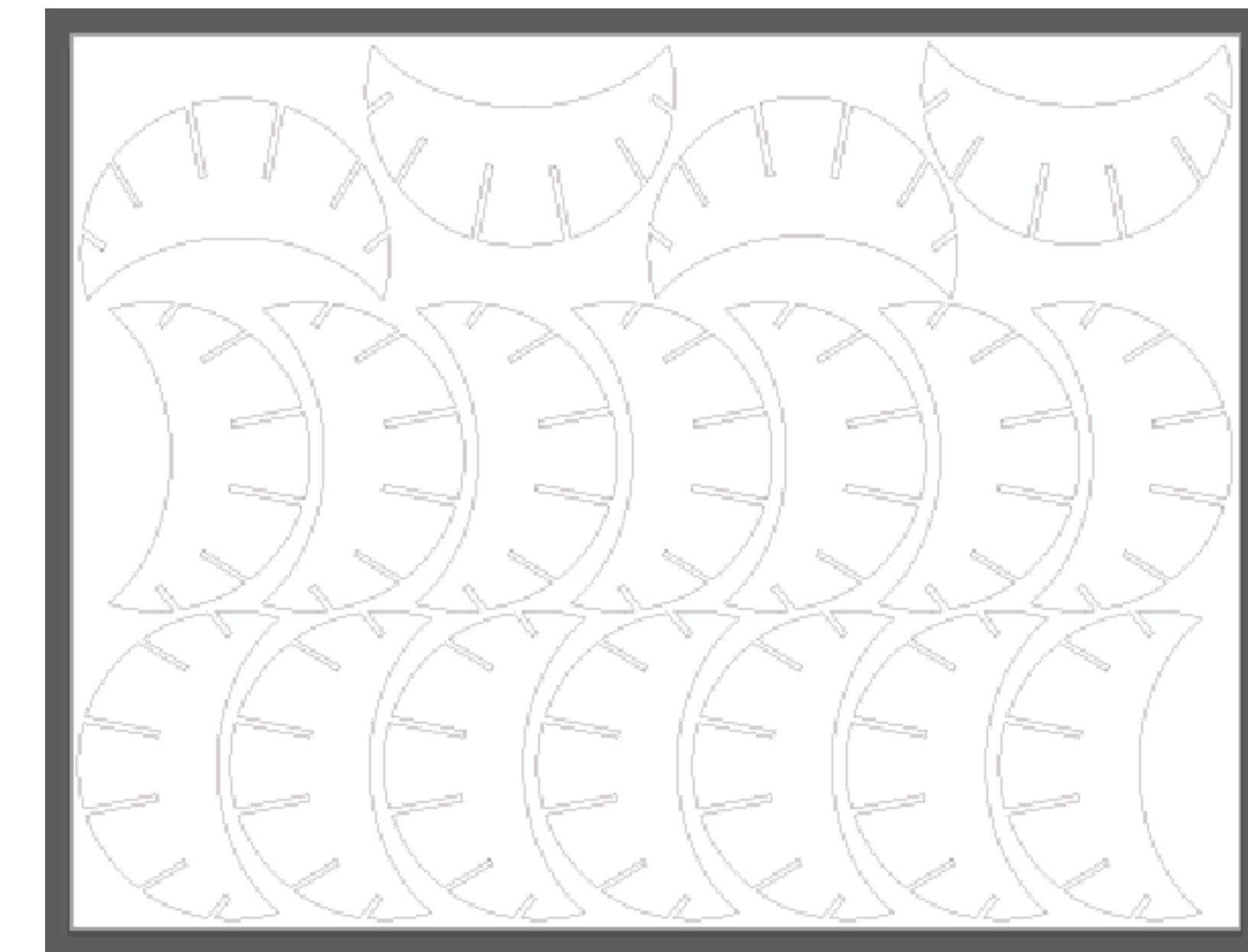
[Get verified](#) [Join a workshop](#)



<https://www.figma.com/education/> Get a Figma education account

# PM3: Press Fit Kit

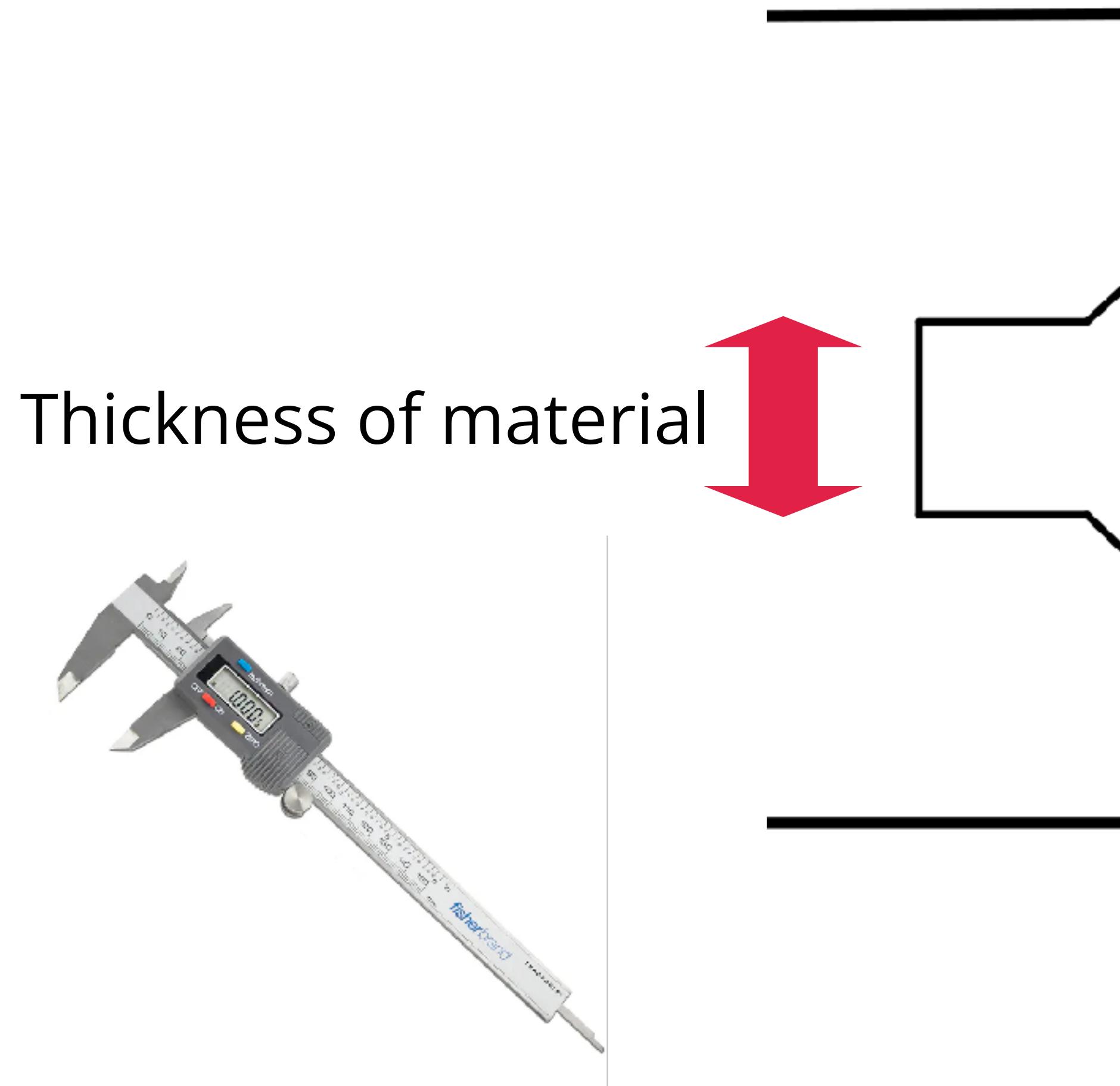




By Hannah Nursalim, <https://hcnursalim.github.io/assignment1.html>

By Kellie Dunn, <https://kelliead.github.io/assignment1.html>

# Designing accurate press fits: measure twice

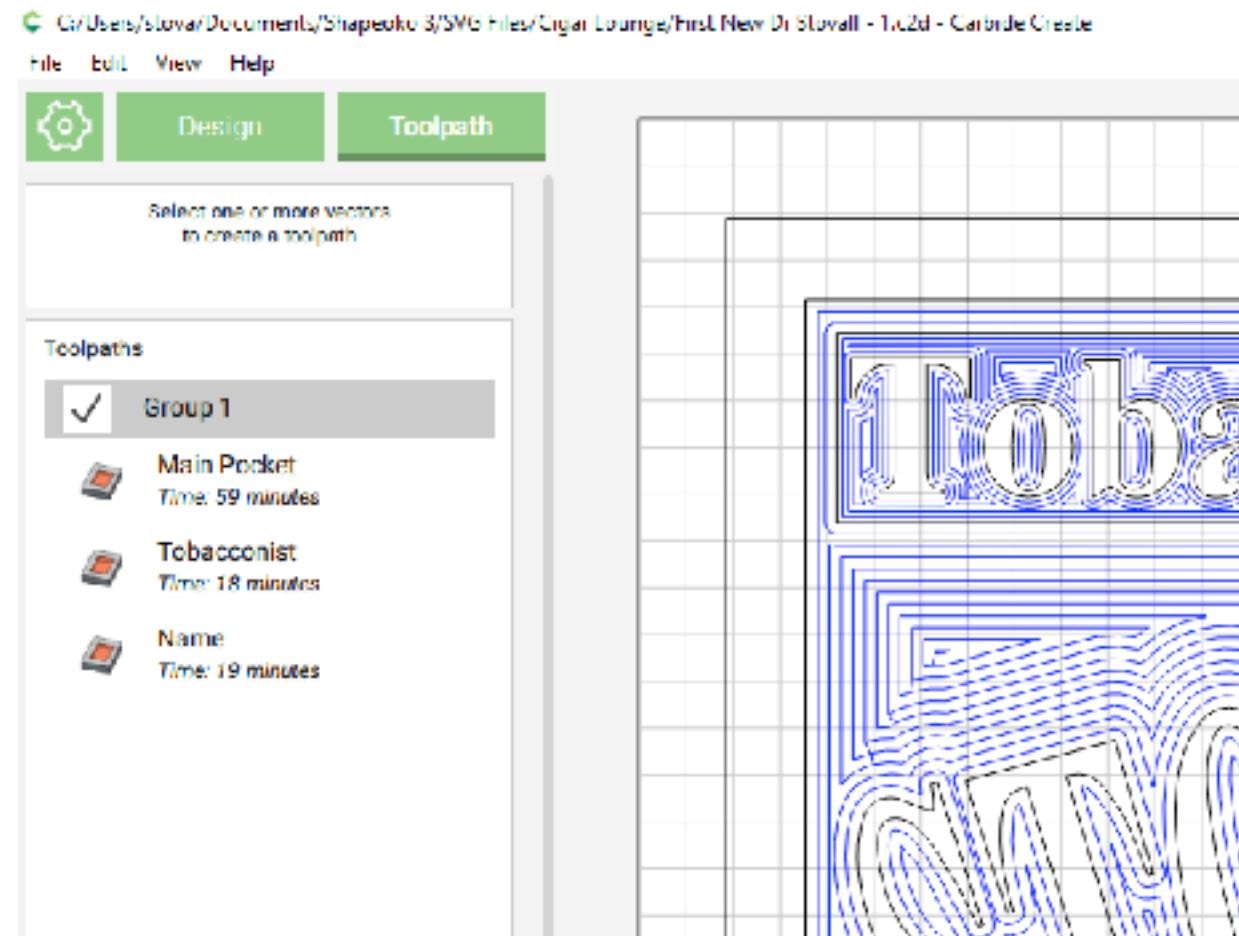


**important!!!**

45° notches (chamfer) to help guide the material in

*Cutting from 12 x 17.5 birch plywood: make sure your design fits in less space than that!*

# Studio: More on Laser Cutting



Use a vector program  
(Inkscape, Illustrator,  
Figma) to draw shapes  
we want cut

**Computer-aided design  
(CAD)**

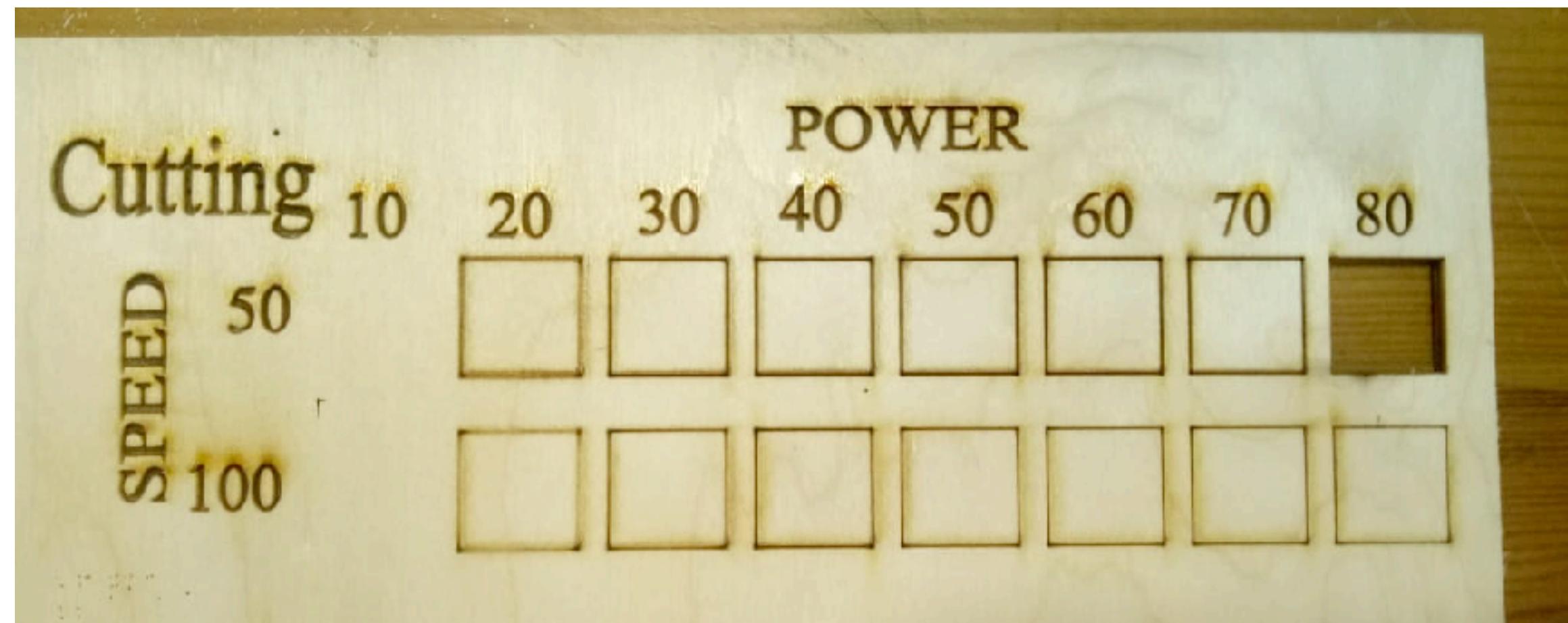
On the makerspace computer,  
convert design to toolpaths on  
the laser cutter, which converts it  
to motor movements. Also  
specify cut settings

**Computer-aided  
manufacturing (CAM)**

Cut the piece &  
don't start a fire

# Laser Cutting terminology/settings

Cutting vs engraving/scoring



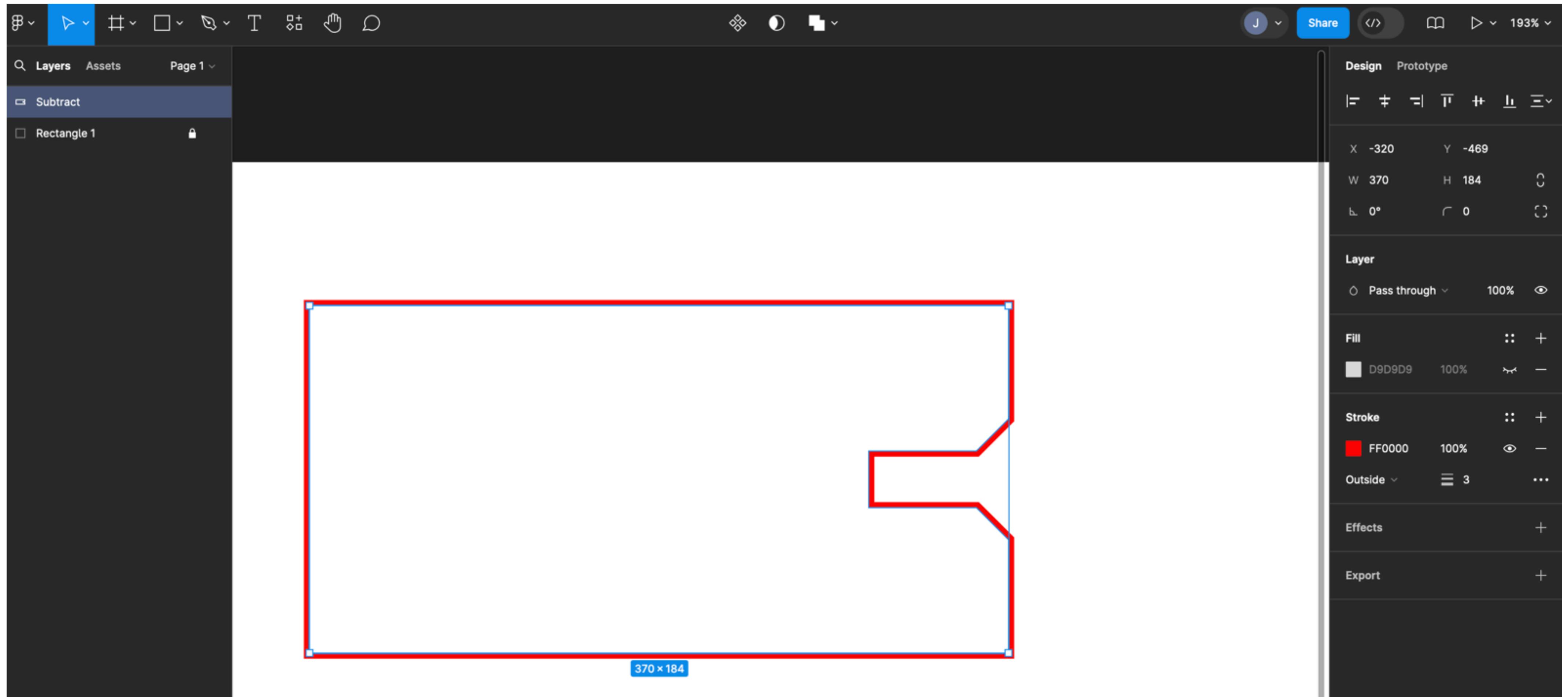
Power & speed



Kerf

How much material is actually removed by the cut

# Vector graphics tutorial (in Figma)



⌘Z Undo

⇧⌘Z Redo

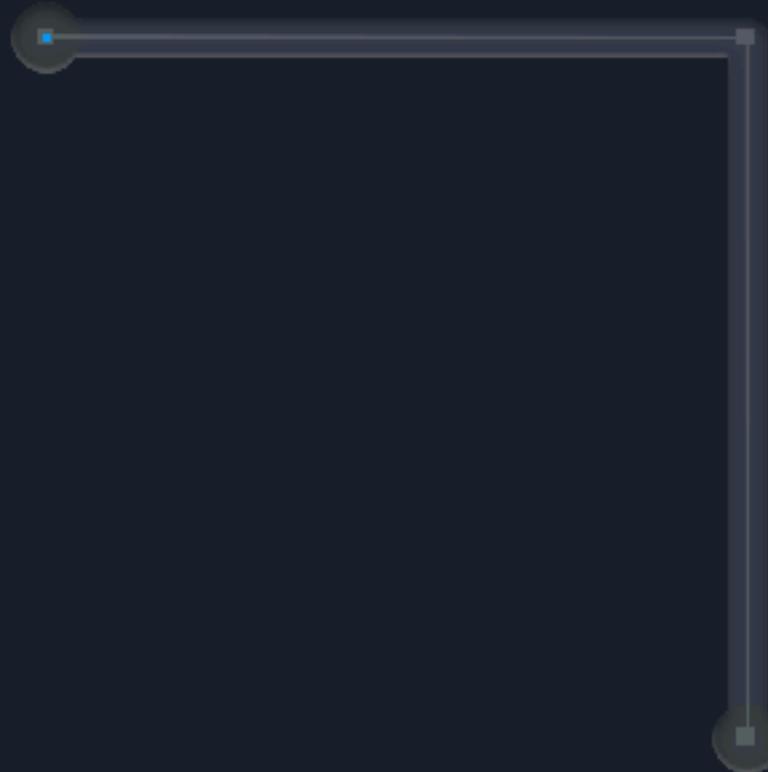
⌘X Clear Stage

⇧ Snap to Angle

⌃ Unlink Control Handles

# The Bézier Game

A game to help you master the  pen tool

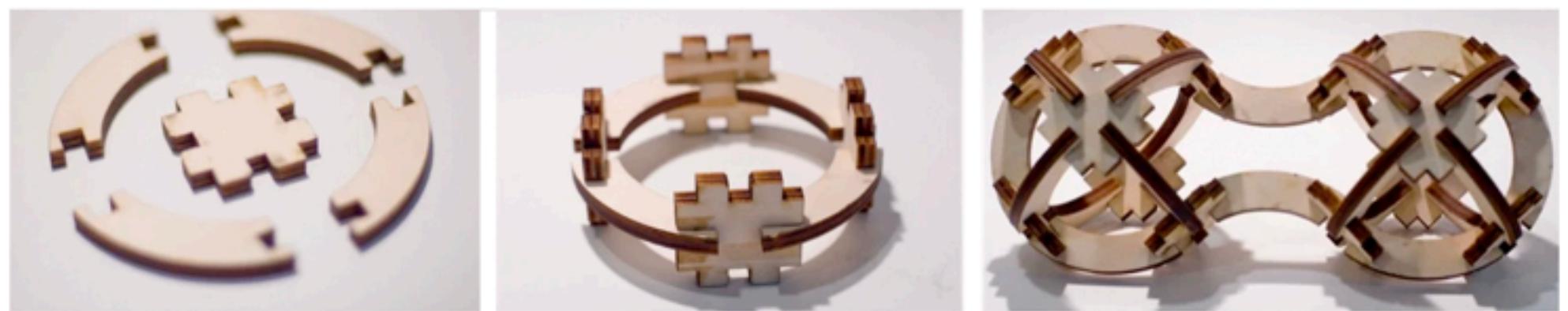


<https://bezier.method.ac/>

# Class 6 recap

- TODOs:
  - By **Wednesday's** class:
    - HMC makerspace training - [make.hmc.edu](http://make.hmc.edu)
    - PM3 is due in 2 weeks, but that's to give everyone ample time to use the laser cutter - *get started early!*
    - We can meet here and walk over together, or directly at the Mudd makerspace at 11:10 next week

## Personal Making Assignment 3: Digital Making - Press Fit Kit



This assignment is due in 2 weeks to account for time needed on the laser cutter. Please start early!

In this assignment, you are to use the laser cutter to make a **press fit kit**: an assembled 3D structure that works through friction fit joints and requires no adhesive. The goal of this assignment is to gain familiarity with the CAD-CAM cycle and digital fabrication processes. As such, in addition to your final object (and to get you to practice for Proj 1), you will also be submitting a write up and documentation of the design process as you go along.

In your documentation, please include

- Intermediate photos of the process, including
  - A screenshot of your vector file
  - (Optional but highly recommended) photos of any test cut pieces you did
  - A photo of your pieces cut out and laid flat
  - Photos of your pieces assembled in at least **two** different ways. You can have a "final vision" or intended object, but you should also show an alternate way the pieces can be fit together, even if it isn't in line with your vision.
- Settings: What power and speed settings did you use on the laser cutter? Did you have issues with fires or scorching?
- Acknowledgements: List any online resources you used, modified, or got inspiration from. List any people (such as makerspace stewards) you got help from.
- Reflection paragraph: How did this assignment match up to your initial expectations? What was the most challenging part? What did you learn about interacting with fabrication machines? Were there any parts you had to redo, or lessons you learned for the future?

Remember, the thickness of your slots will be determined by the thickness of the plywood you cut. Every piece of plywood is different so it's very important to take accurate measurements with a caliper.