

Computational Fabrication

CS 491 and 591
Professor: Leah Buechley

Final Projects and Final Project Presentations

Our final exam time: 7:30am on 12/12

Proposal: presentations last day of class
8:30am - 11:00am, Thursday 12/7

Final Project Update due Tuesday after Thanksgiving

https://handandmachine.org/classes/computational_fabrication/2023/11/16/final-project-update-5/

questions?

Camila Tiling Assignment

Generative Machine Learning Tools cont.

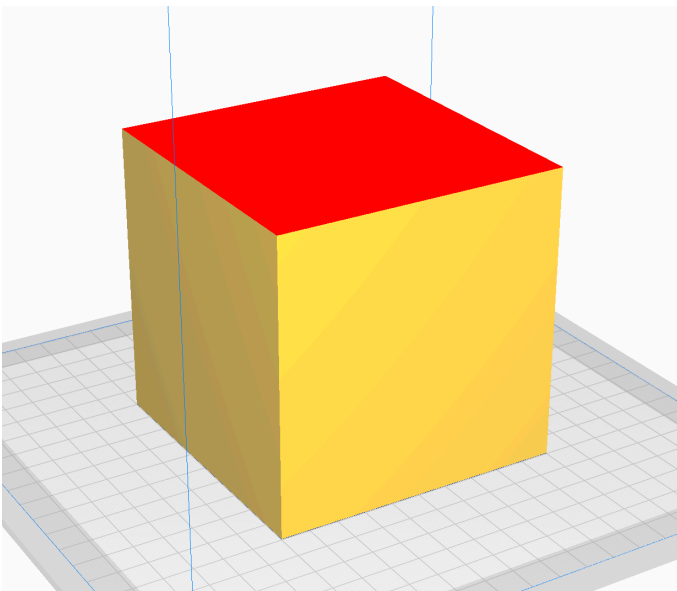
Chat GPT & text-based generators

Text generator directly to text file?

- STL file
- gcode file

Let's try!

Text generator directly to text file?



Tool that supports training a GAN
Open <https://runwayml.com/>



Train a Portrait Generator



Create your own custom Portrait Generator for Text to Image.



Train an Animal Generator



Create your own custom Animal Generator for Text to Image.



Train a Custom Generator



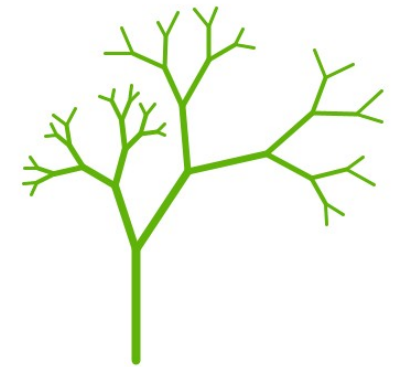
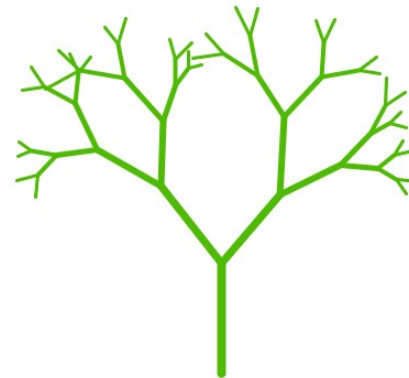
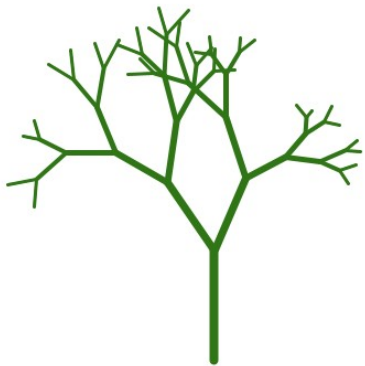
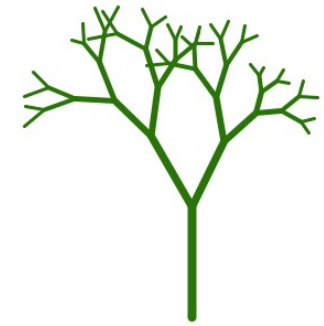
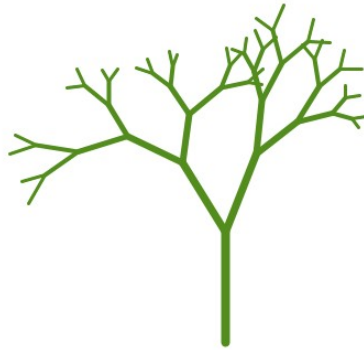
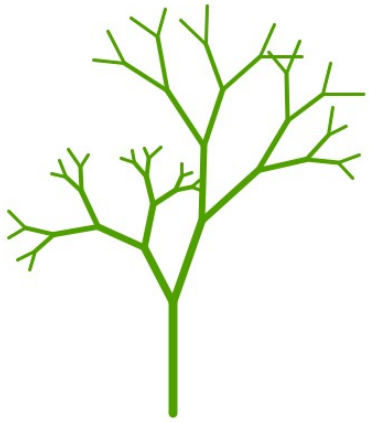
Create your own generator to use with Text to Image.

Example training a custom model

One Example Workflow

- Use one computational design method to generate 100s-1000s of examples
ie: Processing program generates images of trees
- Use these examples to train ML model
Upload images to Runway and train
Note: takes several hours
- Runway starting model generates images based on Biodiversity Library drawings of birds:
<https://www.flickr.com/photos/biodivlibrary/sets/>

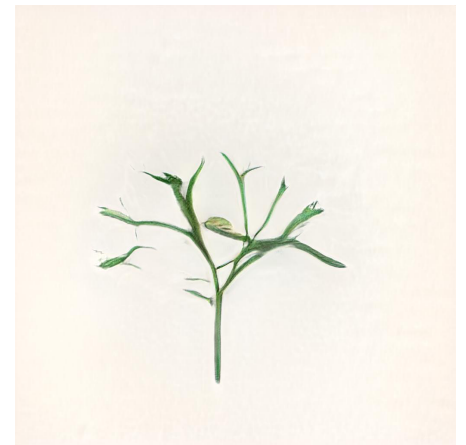
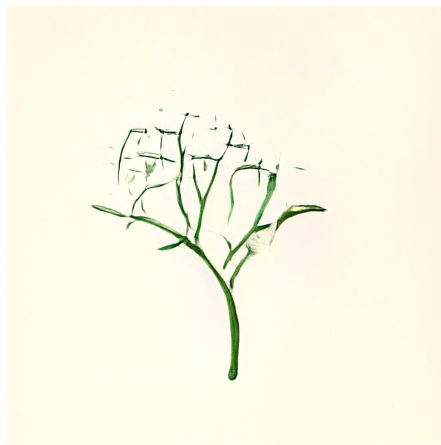
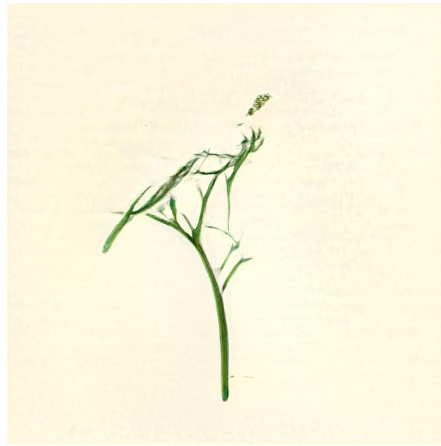
Training Images



Starting Model Training Images



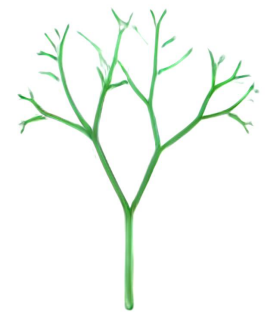
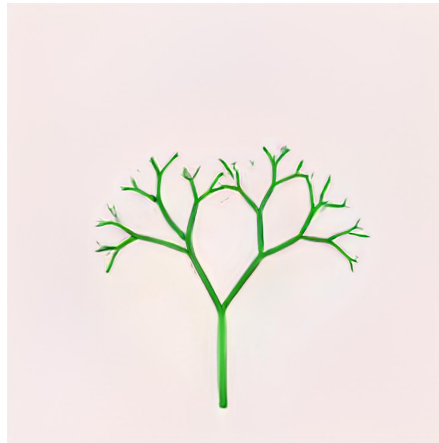
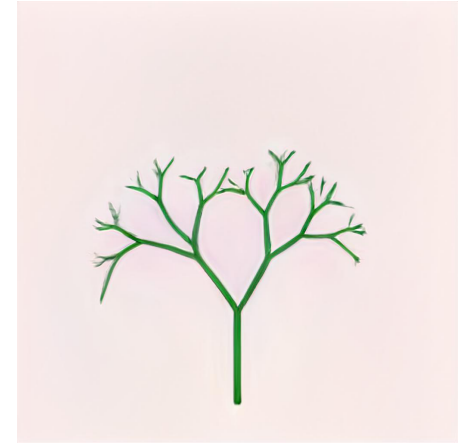
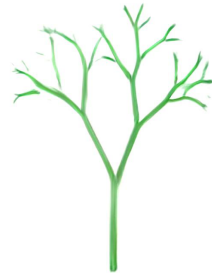
After 500 Training Iterations



After 1000 Training Iterations



After 1500 Training Iterations



Videos, Exploring Search Space



After 500 Training Iterations

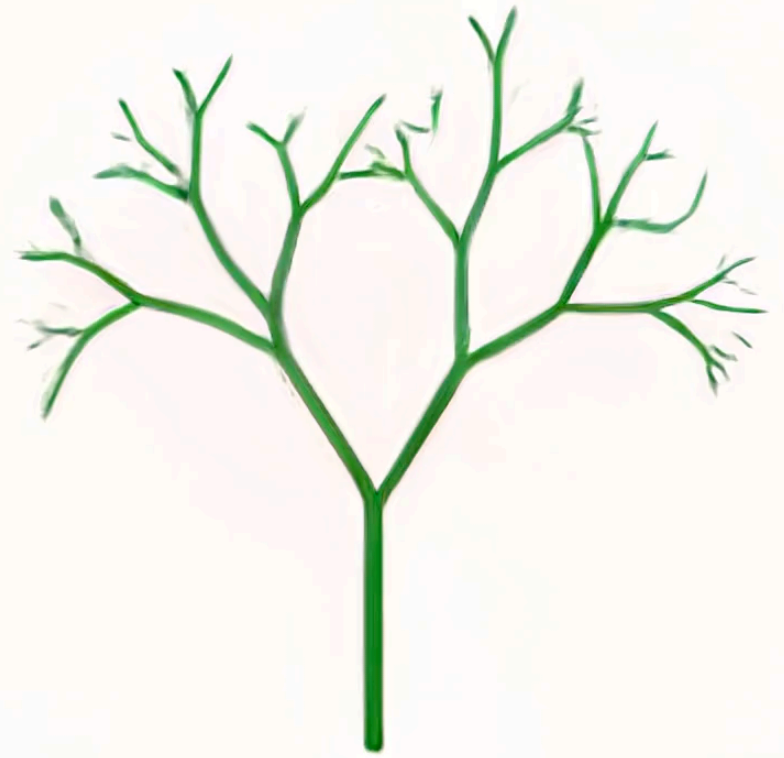


After 1000 Training Iterations

Videos, Exploring Search Space



After 1000 Training Iterations

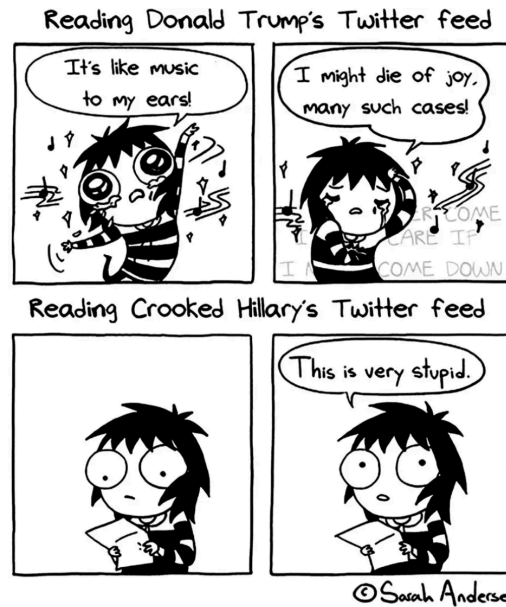


After 1500 Training Iterations

Impact of AI on Artists



Artist Work



Manipulation & Unauthorized Use on Social Media



AI Generated "in the style of"

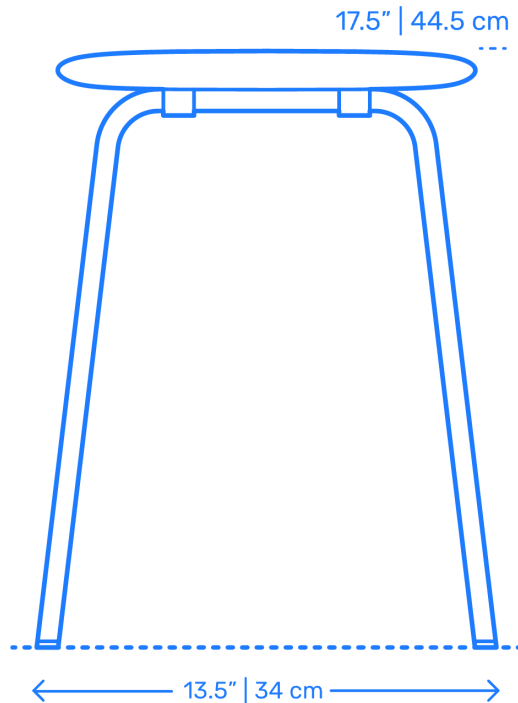
questions?

Fusion 360

AutoDesk: Fusion 360

- Modeling for engineering
- Many Features not in Rhino:
 - Geometrical Constraints
 - Timeline
 - Materials
 - Electronics
 - Simulations:
 - Stress and strain on different materials
 - Forces
 - Fluid Flow

Designing two stools



Dimensions:

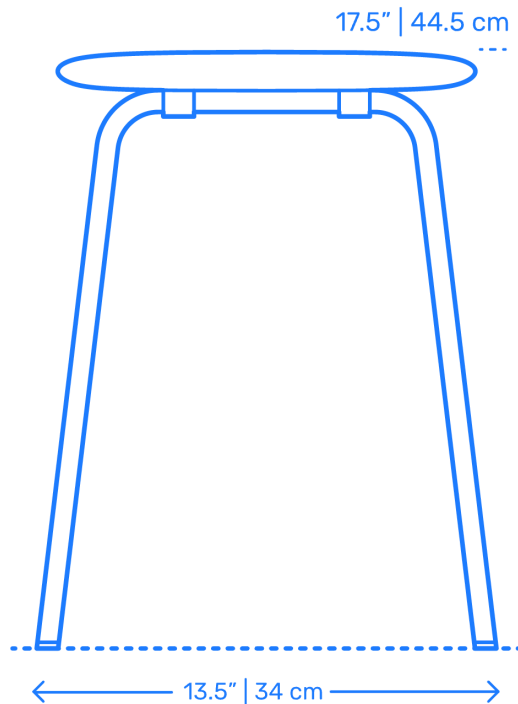
Height: 18" (45cm)

Seat Diameter: 14" (35cm)

Bottom Diameter: variable

using ML tools built into Fusion 360

Stool 1 Using Topology Optimization



Dimensions:

Height: 18" (45cm)

Seat Diameter: 14" (35cm)

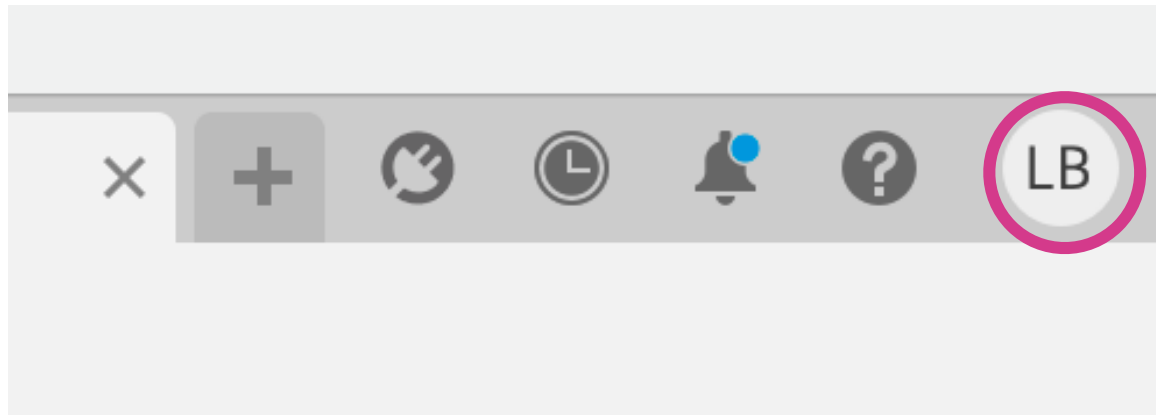
Bottom Diameter: variable

Topology Optimization

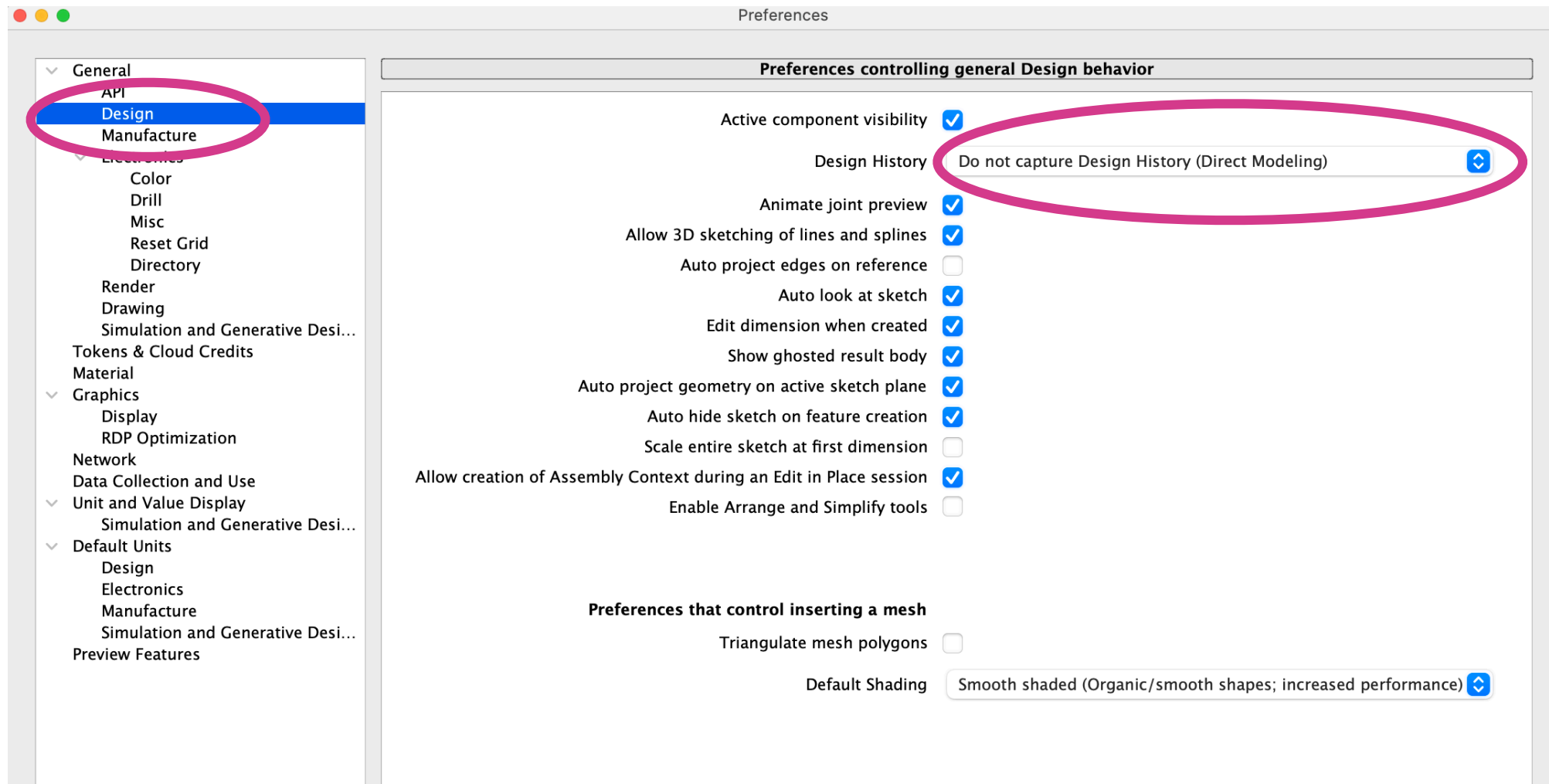
- Fusion optimizes for structural strength (stiffness) and use of material
- Given an area the design can occupy along with a set of constraints, it will use ML to carve material away to reveal an optimal design
- Produces a single optimal design.
- Provide: Large mass to carve away, contact points for feet and seat.

Open up Fusion 360

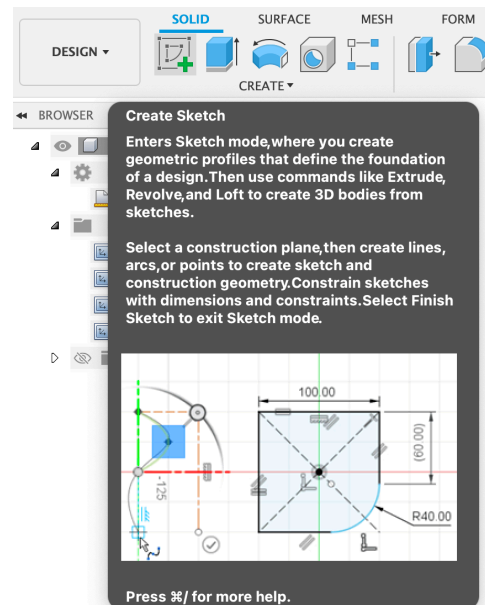
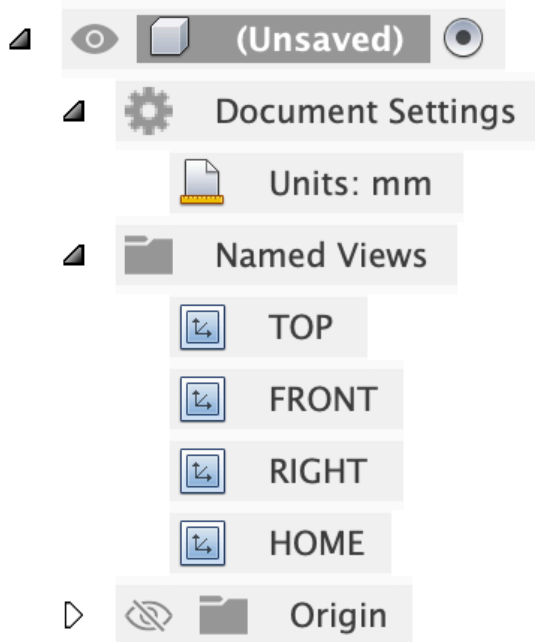
Change Preferences: Don't save history



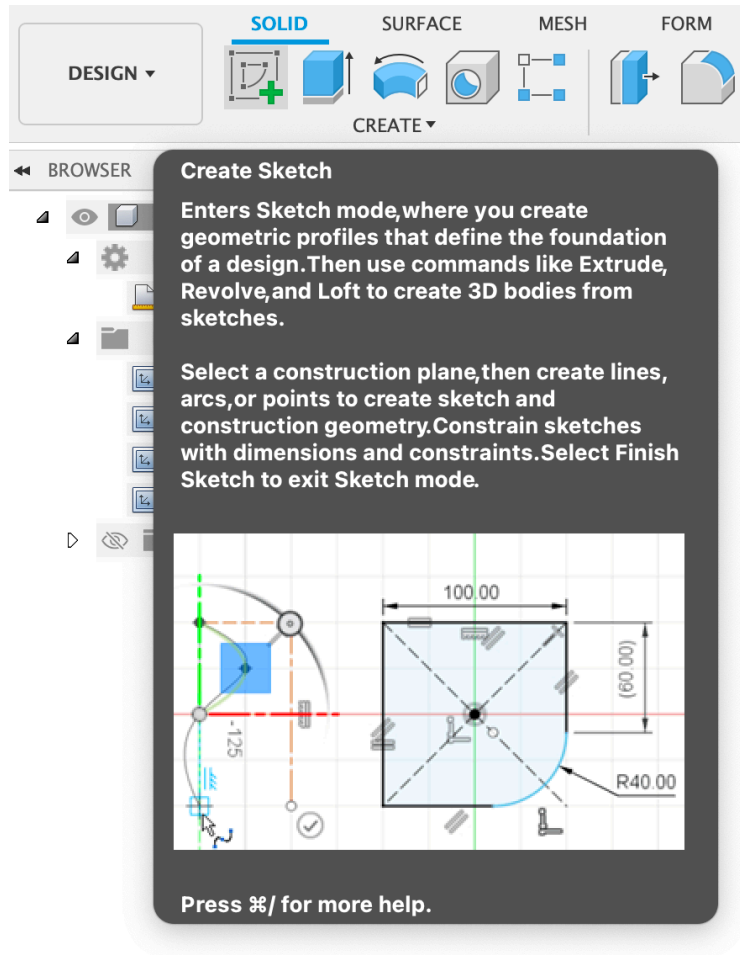
Change Preferences: Don't save history



Document Basics



2D Drawing = Create Sketch



DESIGN ▾

SOLID SURFACE MESH FORM

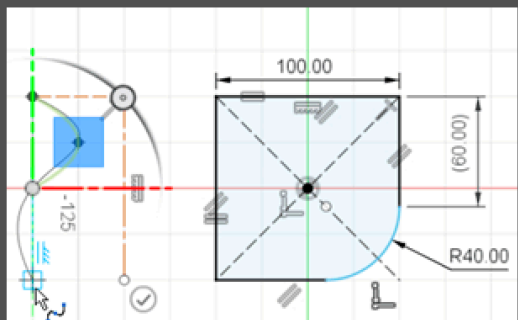
CREATE ▾

← BROWSER

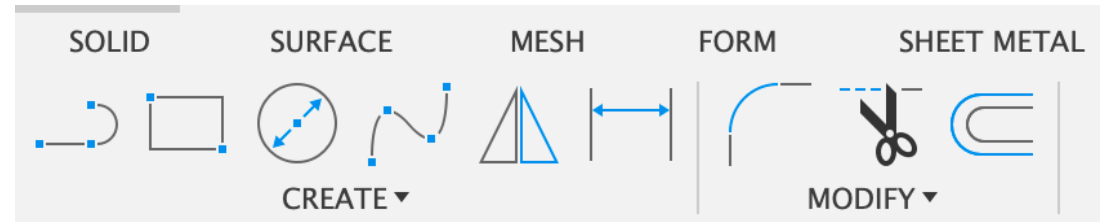
Create Sketch

Enters Sketch mode, where you create geometric profiles that define the foundation of a design. Then use commands like Extrude, Revolve, and Loft to create 3D bodies from sketches.

Select a construction plane, then create lines, arcs, or points to create sketch and construction geometry. Constrain sketches with dimensions and constraints. Select Finish Sketch to exit Sketch mode.



Press **⌘/** for more help.



Drawing Basics: Constraints, Measurements

Sketch cylinder and feet

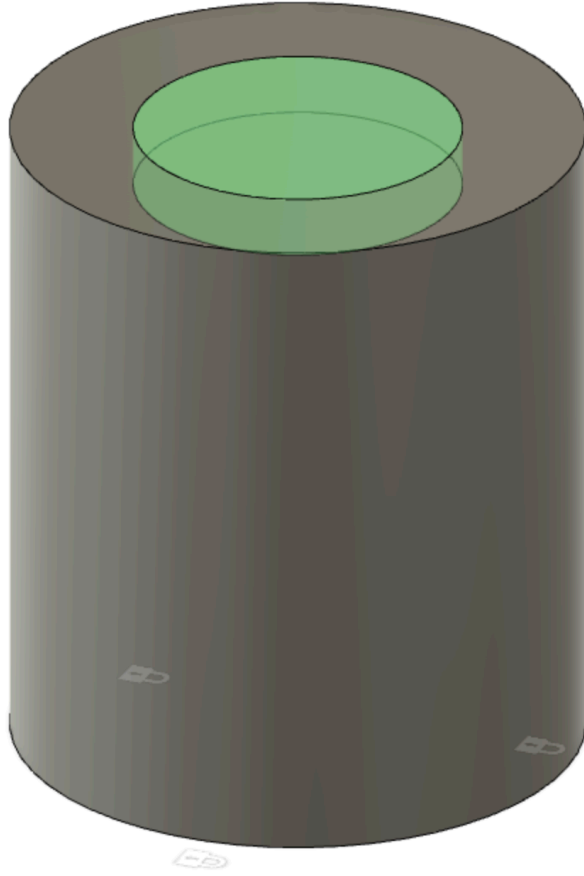
Dimensions:

Height: 18" (45cm)

Seat Diameter: 14" (35cm)

Bottom Diameter: variable

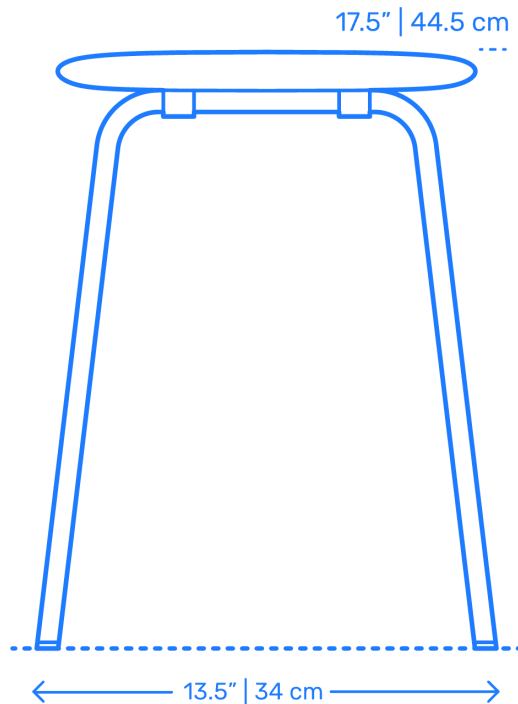
Extrude them into solids



Topology Optimization Setup

questions?

Stool 2 Using “Generative Design”



Dimensions:

Height: 18" (45cm)

Seat Diameter: 14" (35cm)

Bottom Diameter: variable

Generative Design

- Fusion connects different objects to create a set of strong designs that meet a set of defined constraints
- Given starting shapes, it will use ML to connect these shapes in ways that give rise to different functional designs
- Provide obstacles to define regions the design should not occupy.
- Produces several designs
- Provide: Seat and feet to be connected + obstacles

Sketch cylinder and feet

Dimensions:

Height: 18" (45cm)

Seat Diameter: 14" (35cm)

Bottom Diameter: variable

Move top to correct location

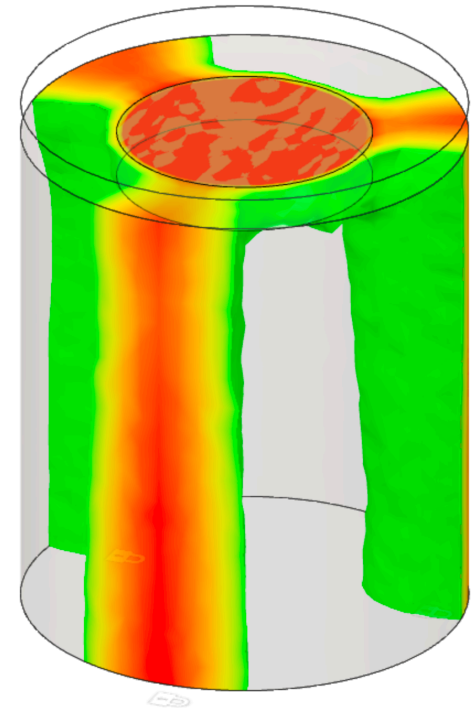
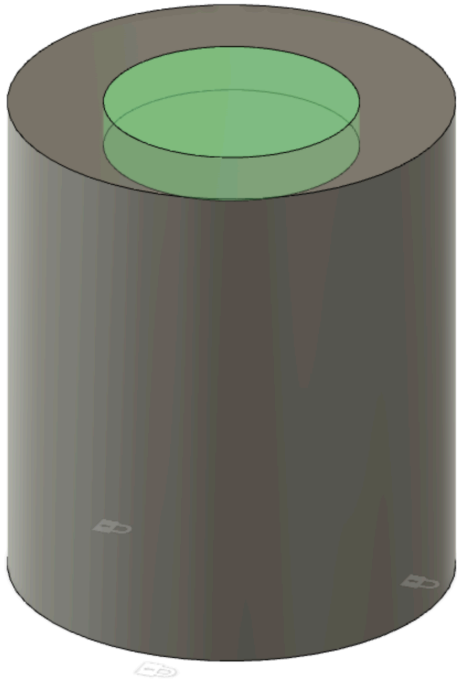
Extrude them into solids

Generative Design Setup

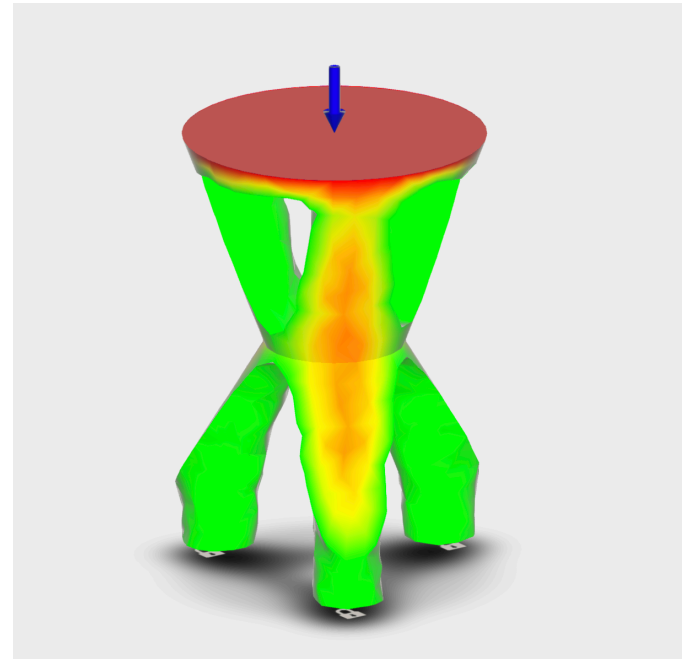
questions?

Check Back on your
Topology Optimization

Check Back on your Topology Optimization

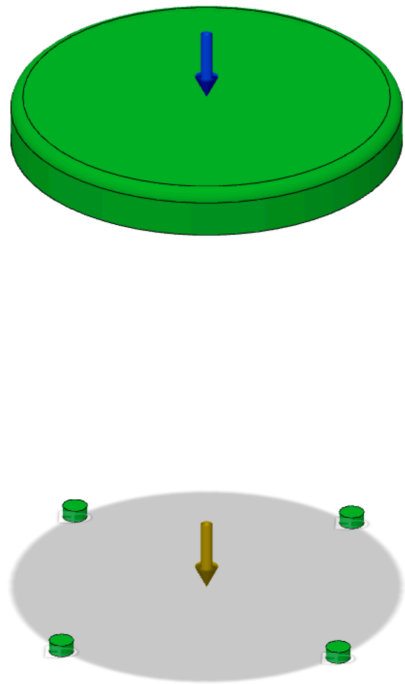


Check Back on your Topology Optimization

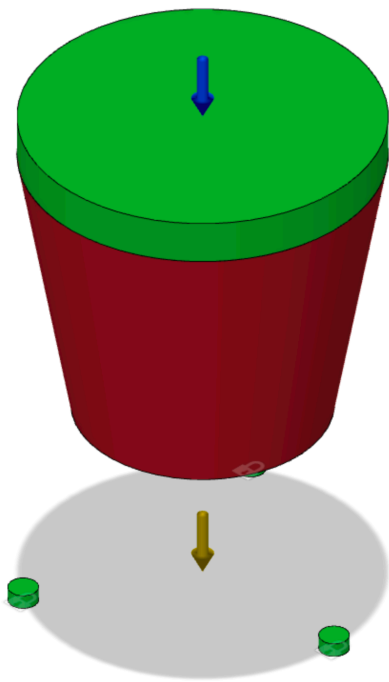


Check Back on your
Generative Design

4 legged stool with no obstacles



3 legged stool with obstacle



Thank you!

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