

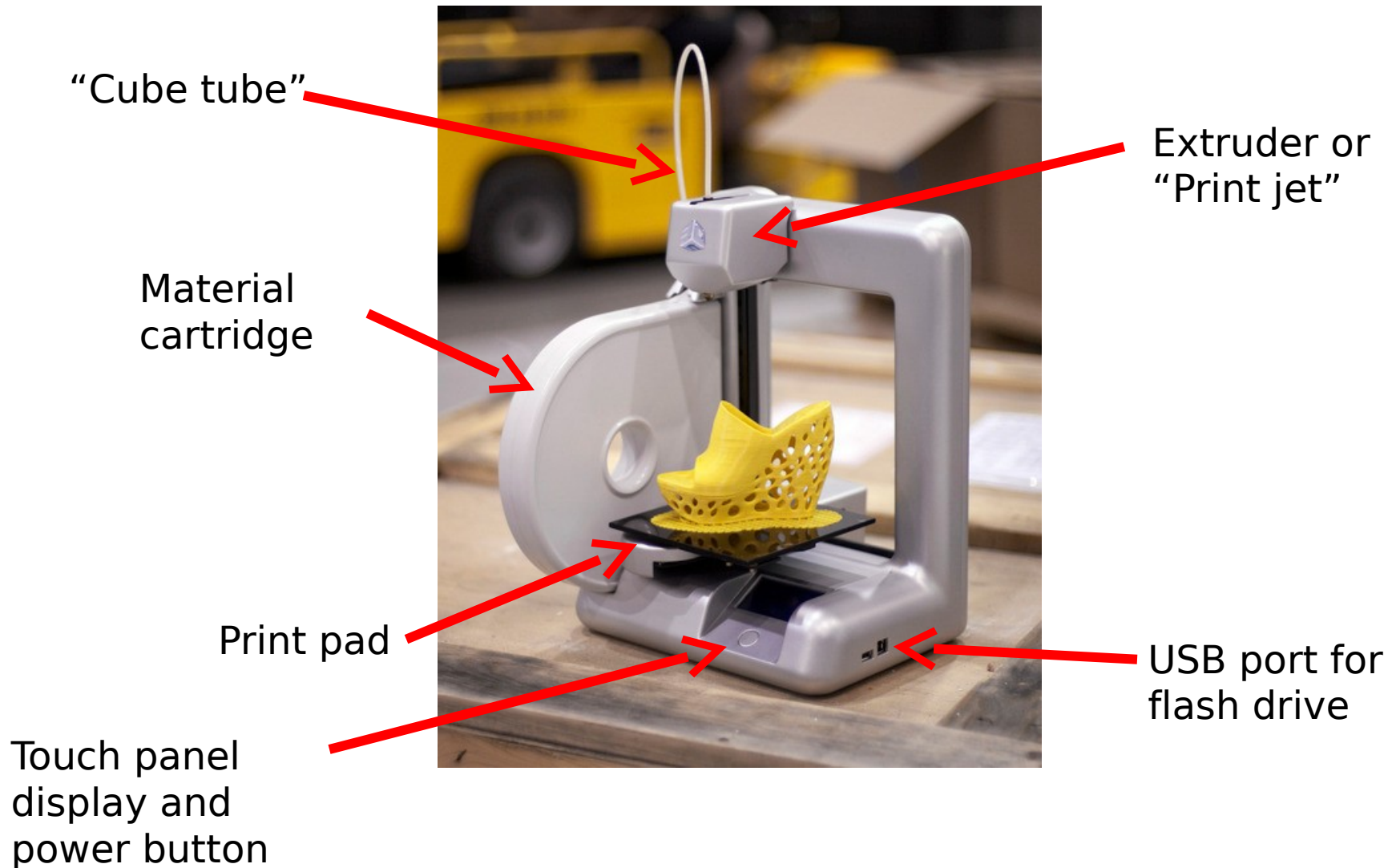
# 15-294 Rapid Prototyping Technologies:

## Molecule Exercise and Cube Intro

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# Cube Components



# 2nd Generation Cube

- Prints ABS (acrylonitrile butadiene styrene) or PLA (polylactic acid).
- Faster than original cube.
- Better precision (200 microns vs. 250 for original model.)
- No heated bed: saves time.
- Can print “hollow” or “solid” objects.
- Same cost as the original: \$1300.
- Buy it at Staples, or at [Cubify.com](http://Cubify.com).

# Inside the Cartridge

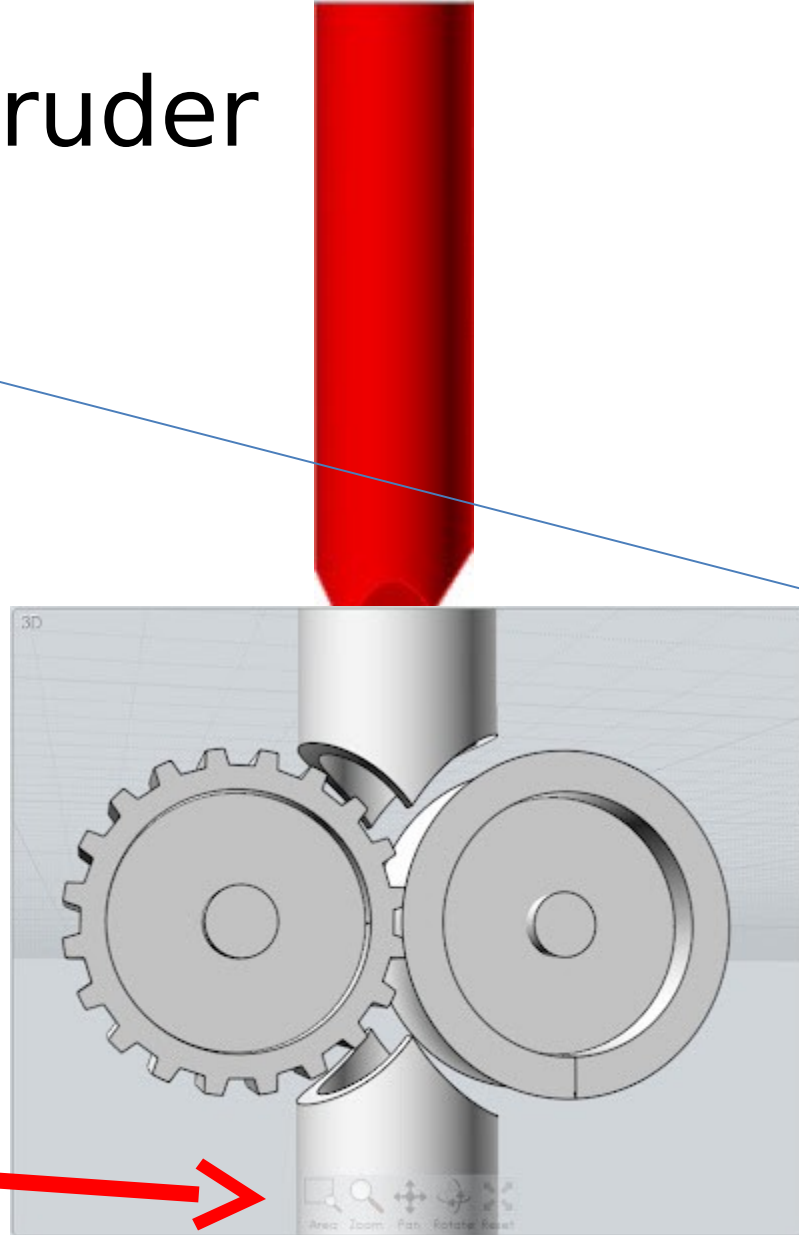
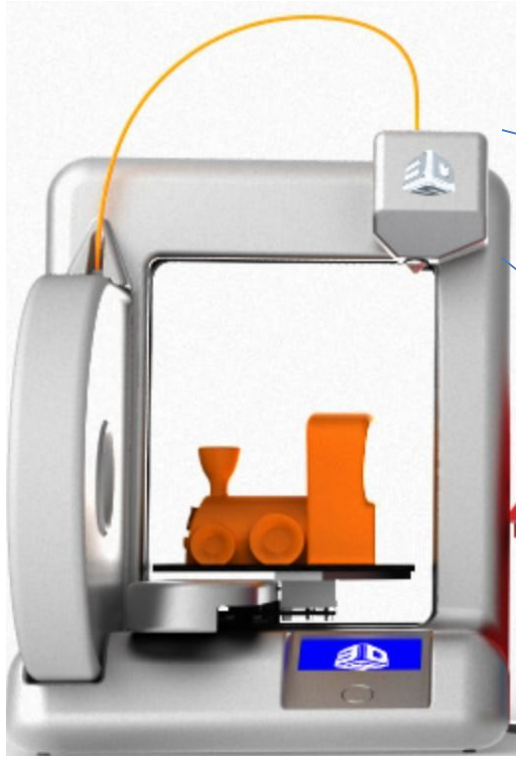


- Chip in cartridge tracks how much material used.
- No actual sensing.

# Changing Cartridges

- Takes several minutes for the extruder to heat.
- Never yank filament out of the extruder!
  - Can damage the mechanism.
  - If a piece breaks off, the extruder will clog.
  - Once it heats up, the filament comes out easily.
- Always reinstall the thumbscrew to protect the cartridge.

# The Cube Extruder



Heated section

Image from [cubifyfans.blogspot.com](http://cubifyfans.blogspot.com)

# Cutting the Filament

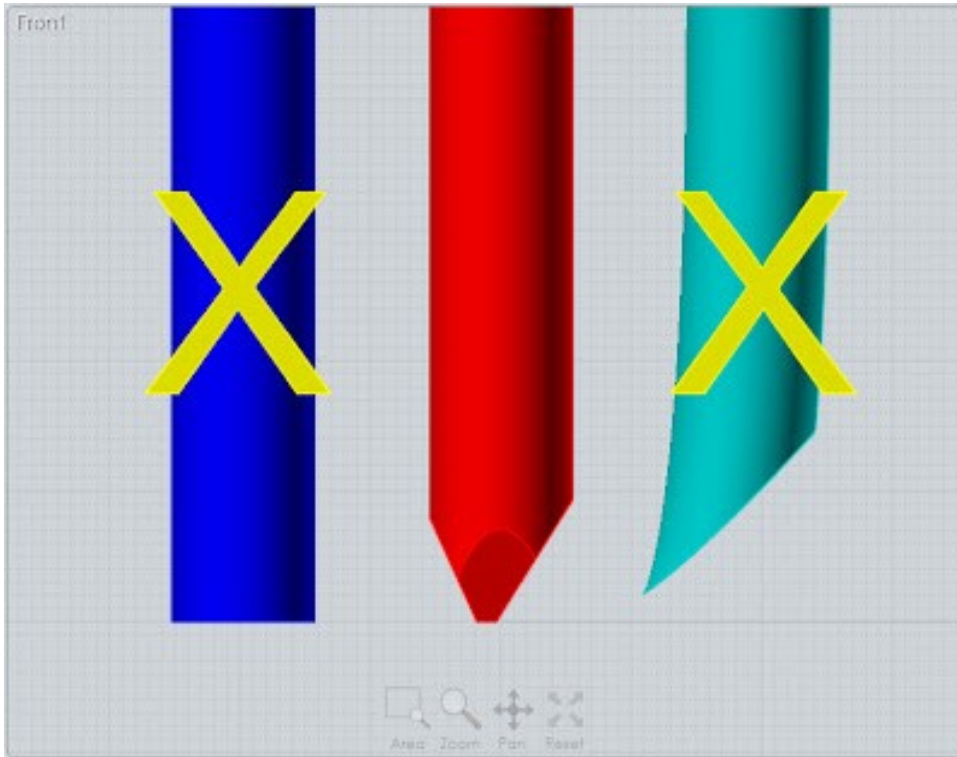


Image from [cubifyfans.blogspot.com](http://cubifyfans.blogspot.com)

A simple 45° cut will help to prevent jams in the extruder.



# Preparing to Print

- Check the extruder gap?
- Coat the print pad with the “cube stick”.
  - Not too thick a layer, but aim for uniformity.
  - Keeps the object from shifting or warping.
- Insert flash drive with your Cubify Print file.
  - Flash drive must be FAT32 (Windows95) format.
- Select your file using the Print menu.
- 5 minute warm-up before printing starts.
  - Extruder becomes very hot!



# After Printing

- Brief cool-down period for the extruder.
  - 20 minute cooldown on 1st generation (heated bed).
- Your object needs to cool as well.
- Printer will announce when cool-down done.
- Object might not come easily off the bed.
  - Soak in water to dissolve the glue.
- Run the bed under the faucet in the sink to get all the glue off.
- Dry the bed and reinstall on the printer.

# Post-Processing Steps

- Wash any residual glue off the object.
- Snap off any supports or raft.
  - Cutting tools are useful for this.
- Use a hot knife to remove stray material and retouch plastic that turned white.
- Sanding or filing might also be helpful.
- Machining? Painting? Gluing? Fake fur?
  - It's up to you!

# Production Steps for Cube

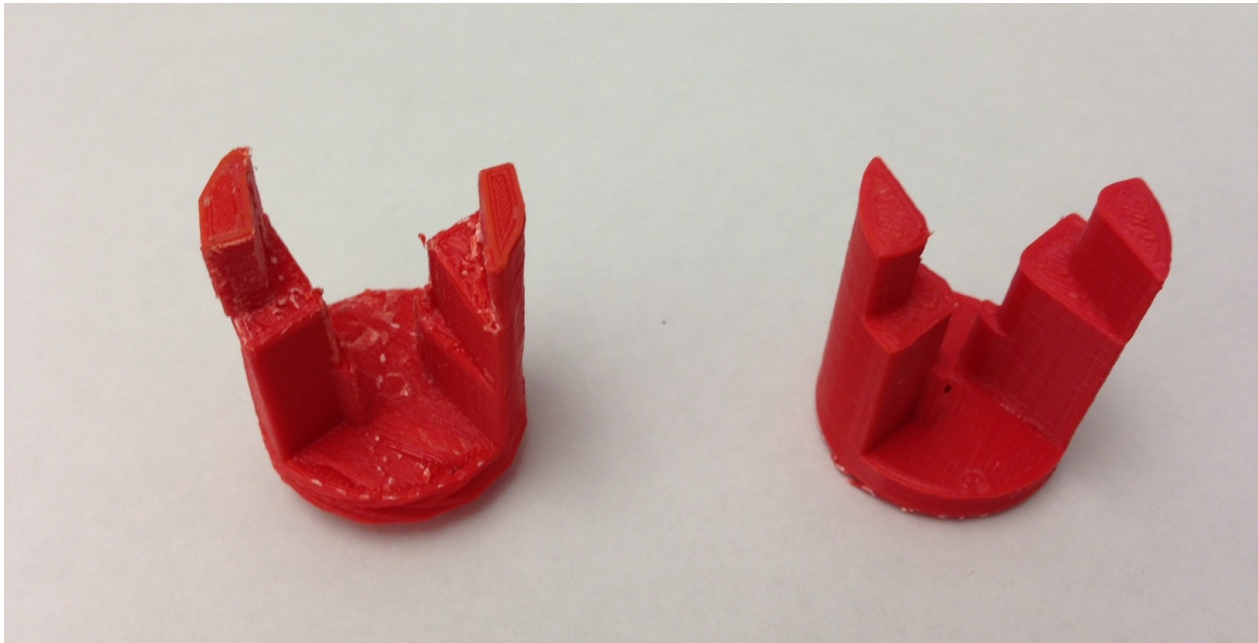
1. Design in SolidWorks or some other tool.
2. Export an STL file.
3. Load the STL file into the Cubify Client program.
4. Set print parameters:
  - a) Orientation and scale.
  - b) Material: ABS or PLA?
  - c) Do you want supports?
  - d) Do you want a raft?
5. Click “Build” to produce a Cubify Print file.
6. Check the print file for reasonableness.
7. Save to flash drive and send to the printer.

# Design Rules

- Shafts will be slightly **thicker** than intended.
- Holes will be **narrower** than intended.
- Do you want a 2.5 mm hole? On a 1st generation Cube:
  - Use 3.0 mm for a horizontal hole.
  - Use 3.7 mm for a vertical hole.
- Minimum widths for walls?

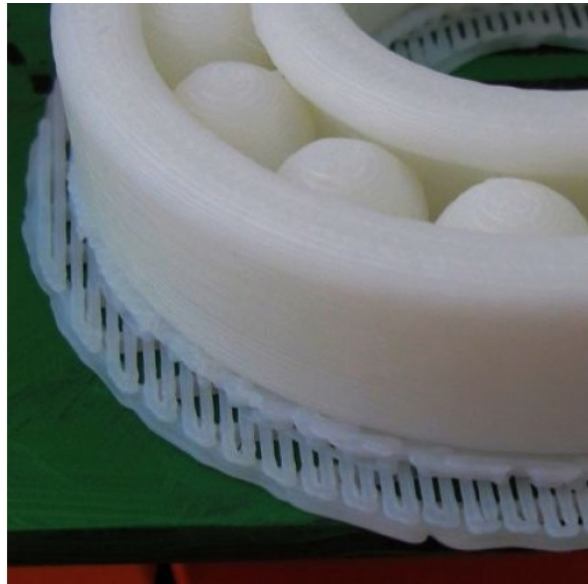
# Coarse vs. Fine STL Triangulation

- Too coarse can lose detail, but too fine can also cause features to be lost.
  - SolidWorks “fine” seems to be okay, but don’t go to “custom” and crank up resolution to the max.



# Use of a Raft

- Why use a raft?
  - Stable base of support for tall, skinny parts.
  - Prevents warping of big smooth parts (like cases) by reducing surface contact with heated bed (1st gen. Cubes only).
- Why avoid a raft?
  - Ruins the part finish (get out your sandpaper).
  - Takes more time and more plastic to print.

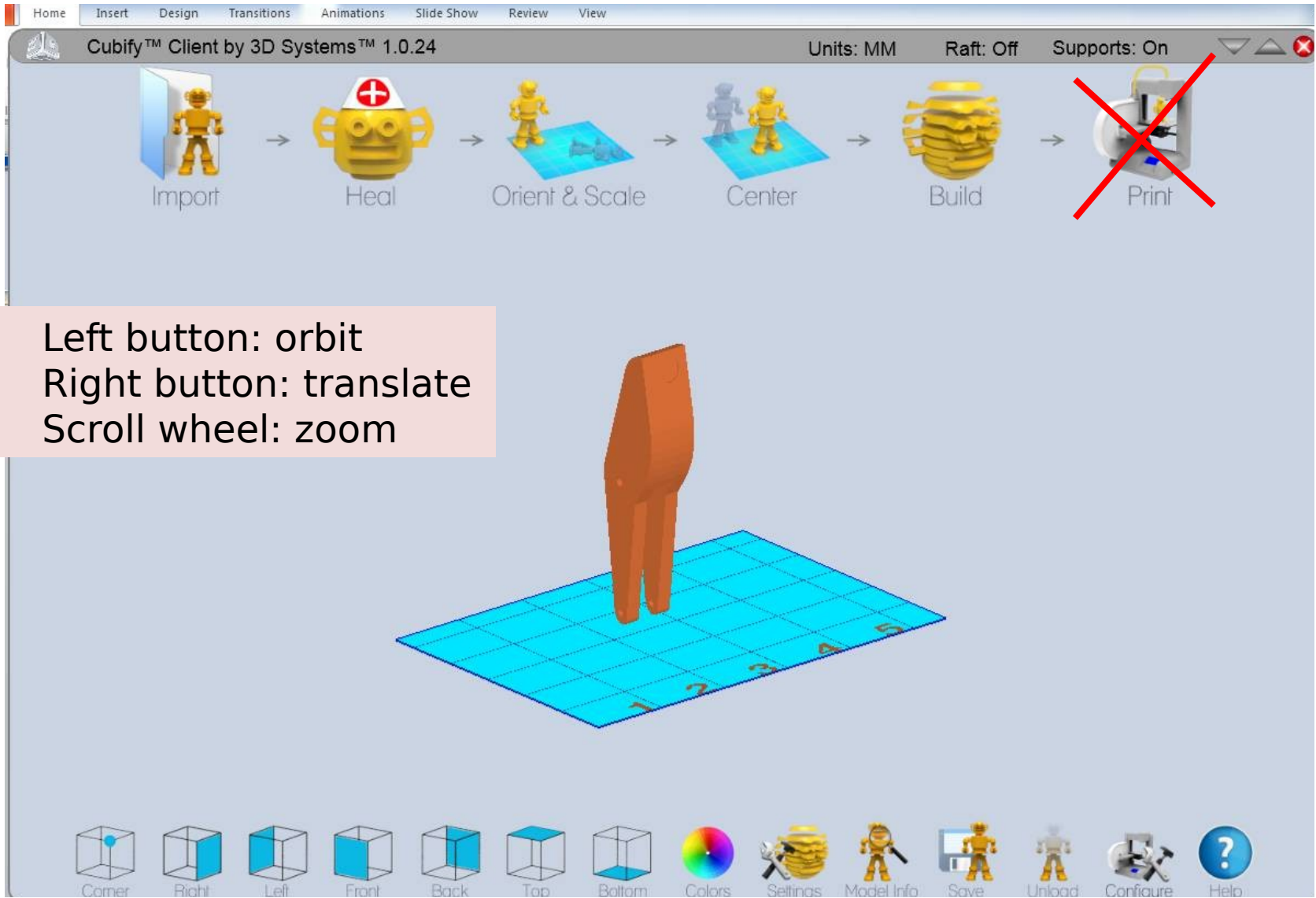


# Cubify Client Program

- Windows or Mac; you can install it yourself
- Turns STL files into Cube Print files
- Workflow:
  - Import → Heal → Orient/Scale → Center → Build
- Settings:
  - ABS or PLA
  - Strong/Hollow/Solid
  - 2nd Generation (not Original cube)
  - Support on/off
  - Raft on/off
- Import the Cube Print file to check supports.

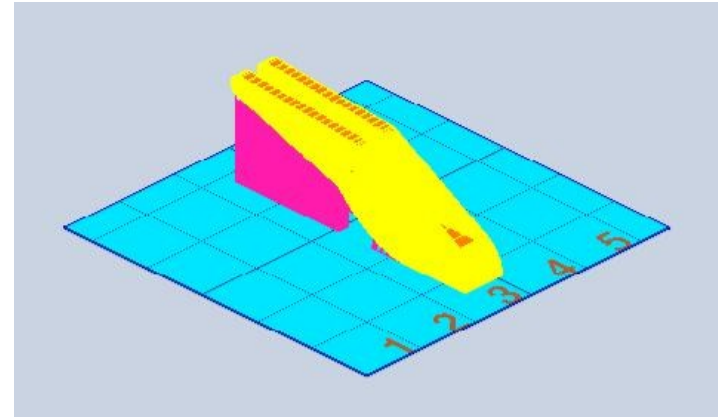
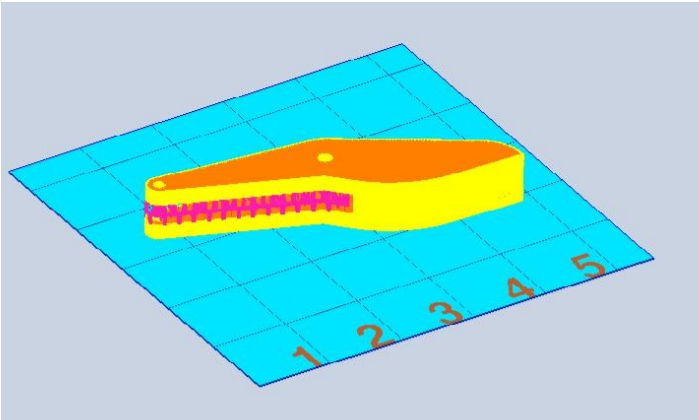


# Cubify Client



# Part Orientation

- Choose your part orientation to avoid the need for supports if possible.
- Don't put supports where they will be difficult to remove.



- Remember: supports leave a rough surface.

# Hollow, Strong, and Solid Modes

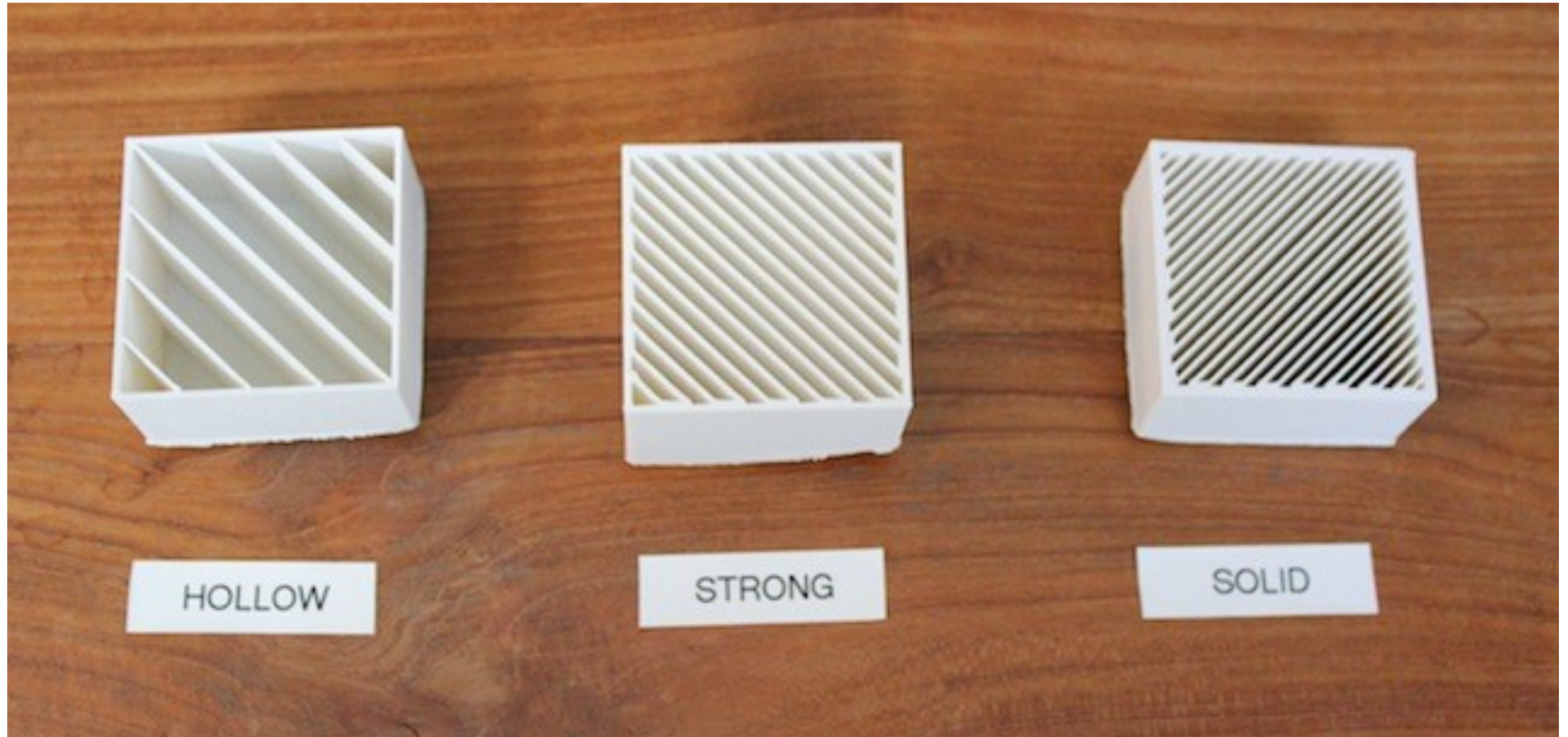
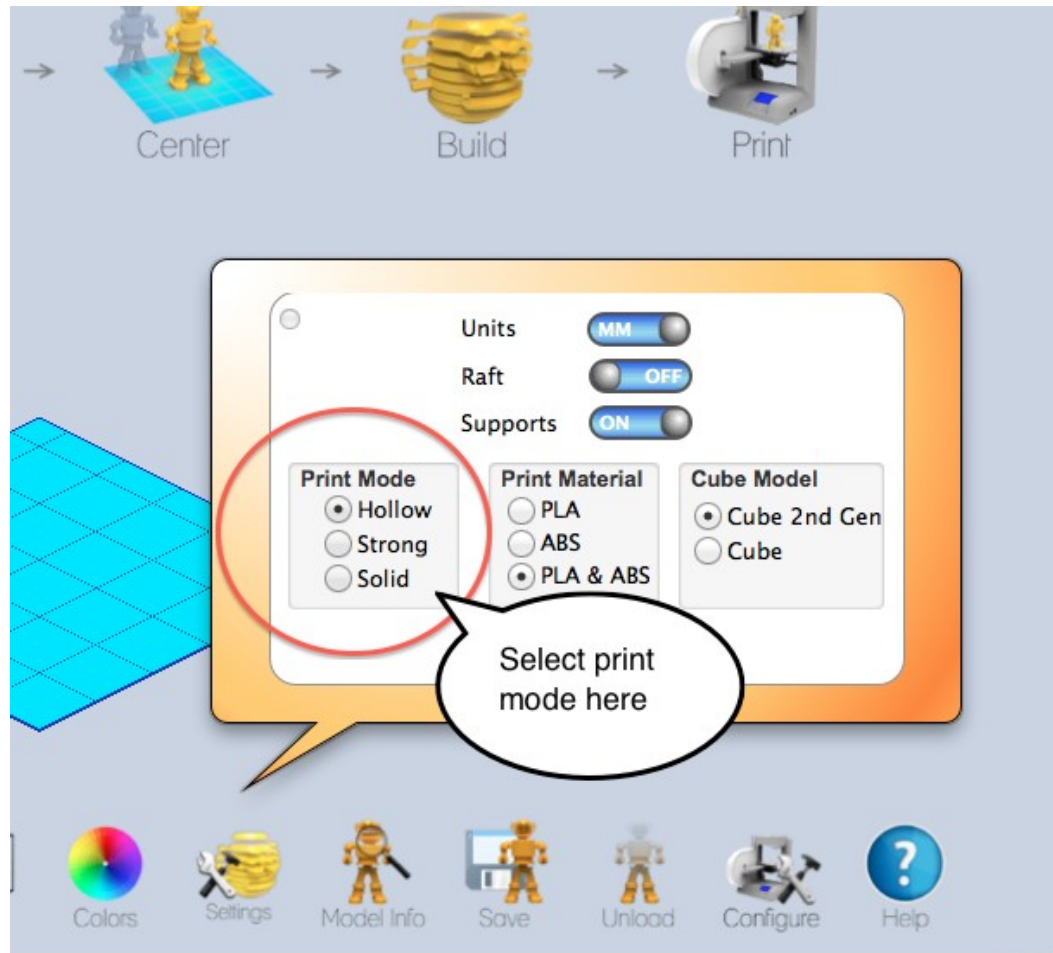
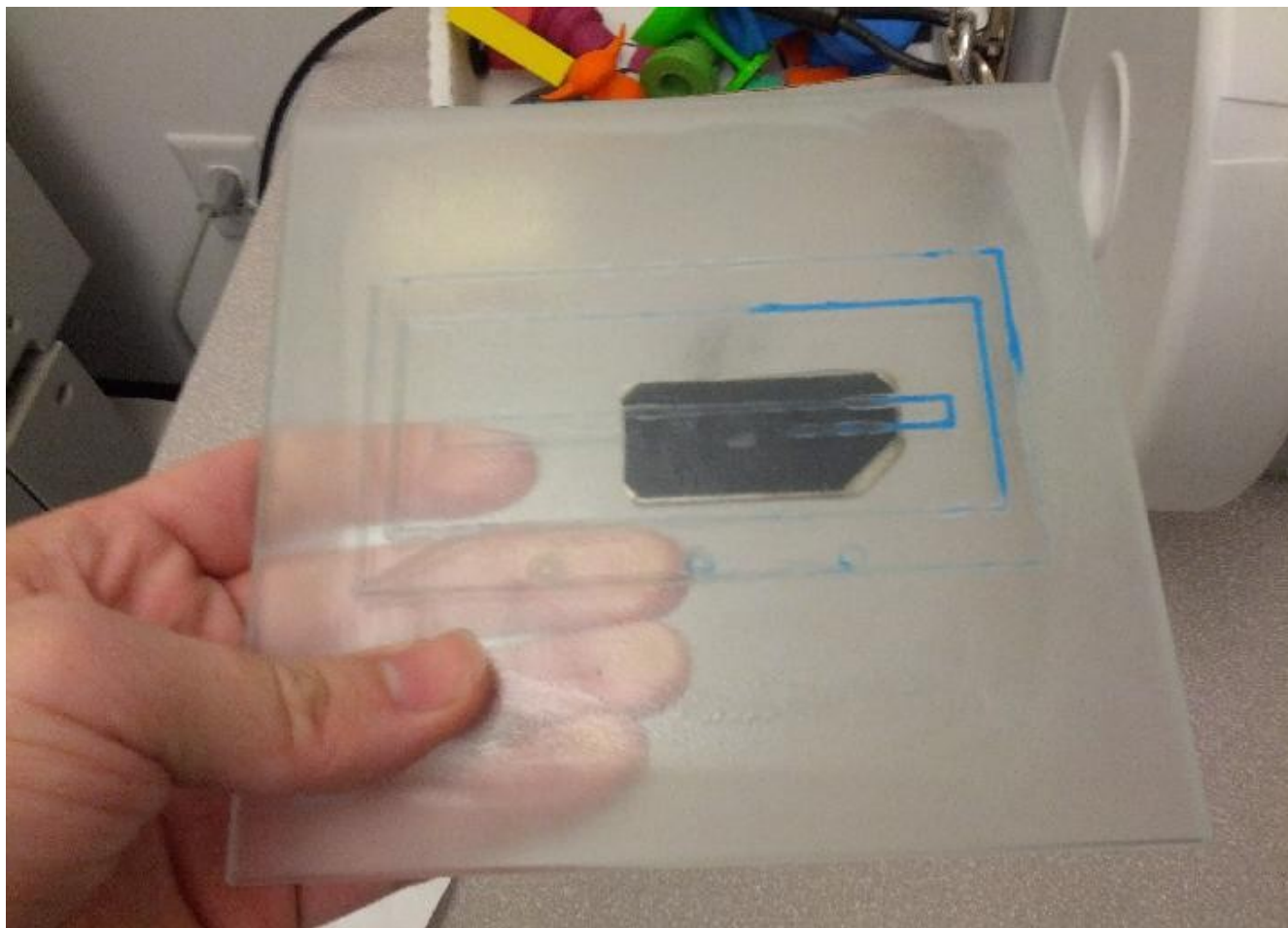


Image from [cubify.com](http://cubify.com)

# Setting Print Mode



# When the Bed Isn't Perfectly Level



# Cubify Client Annoyances

- Needs write access to its own directory, so you must fix the directory permissions if not running as Administrator.
  - C:\Program Files (x86)\3D Systems Corporation\Cubify
- Tells Windows that all STL files are “Cubify 3D Model” files.
- Creates a bunch of auxiliary files with every Cubify Print file.
  - VMF file has triangulation information



# When Things Go Wrong

