

# Notes on printing Addison Library students' "things"

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5/9/14 jw

Printing the objects we didn't have time to print at the Library was an interesting task, and I learned a lot while doing it. I was also able to bring them to Workshop 88 to share and discuss with the other 3D printer folks there.

Aside from the unpleasant failure of the printer for the first half of the session, the biggest surprise was how well the students did with Tinkercad. My initial response to the goal teaching a 3D CAD program and having students actually use it to produce a keychain or whatever in 2 hours was: "No way!". But Tinkercad made it not only possible but very successful. Many thanks to Andrew from Workshop 88 for pointing me to this tool!

The things are just as they came from the printer – rafts (for some), extra threads, the drizzle when the head lifted after the print. A little work with an Exacto knife is in order for each one. The rafts stick much more aggressively than I'd like – sorry. Some objects were printed two at a time, others by themselves. Several show resolution limitations of the printer. One of the most common manifestations is with features about 2mm wide. The slicer software (that determines the exact path of the extruder head) will make the outside walls, but can't fit 2 more passes (it has to go to one end and back) between the walls, and so leaves it empty. I don't know any way around that except to avoid features that size.

It's worth taking a closer look at each one just for fun being observant and thinking about what the printer must have been doing and why. For example, what we perceive as holes really have what the slicer software perceives as exterior walls (which are printed 2 threads thick when possible). And the failed prints give a good look at the pattern of 10% infill for solid places. There's lots to see!



Unfortunately, you can't print parts that are just hanging out in space with nothing to support them.

There is a "support" mechanism in the software that prints extra fill material where needed to hold such things up, which is to be cut away later. I've never tried it, so decided to use this part as a guinea pig. I split it in half with a horizontal slice half way up, dropped it to the surface, and tried it to see what would happen.

I tried printing with no raft, but it didn't stick well at all, despite having swabbed the bed with "ABS juice" (ABS dissolved in acetone) just before printing. I tried again with a raft. The raft printed slightly imperfectly – didn't stick in one area. (I don't think I'd seen it do that before.)

It was an interesting experiment. The support mechanism looks like it's fairly effective. The extraneous stuff doesn't look like it would be hard to remove, and it allows printing things that would otherwise be impossible.

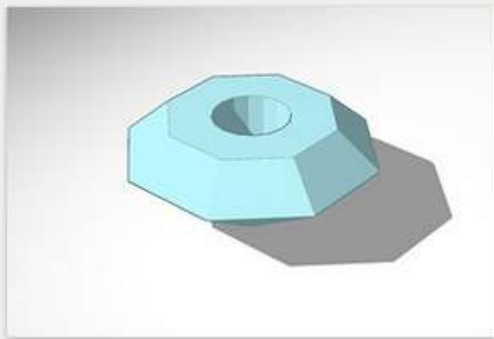
In hindsight, I should have scaled the whole part down to half or 2/3 the size. The features would still have been well within the resolution abilities of the printer and – it wouldn't have taken so long time to print (66 minutes)! I didn't notice until I was taking pictures that the 2 doesn't actually touch the main surface.

## ADPL3's Things



I didn't include the satellite hovering way above this one. Otherwise it was easy. Oops – only noticed the X was not connected after it was done printing ☹️

## ADPL4's Things



You can't print out in space with nothing underneath, so I cut the model in half horizontally. (I duplicated it and used a big rectangular box 'hole' to remove half of each one, then flipped the bottom.) Sorry about the hole – it somehow disappeared in the top half ☹️. The bottom point collapsed, as the hole gave it nothing to support it.

## ADPL6's Things



Because I hope to print this in 2 colors, I raised the ring on the left so it would be high enough to show the new color (I hope).

## ADPL7's Things



I thought this one would be easy. It was – except for the part about having to move it down a mm or so to touch the ground! Oh – and since I mounted the green spool to take a picture of the possible screw head/support hangup, I left it in that orientation as this started to print. Fortunately I noticed it while it was still printing the raft and was able to reverse the support before it hung and made the extruder motor climb the filament again!

### ADPL9's Things



This one ran into limitations of the resolution of the printer, especially on the 'E'.

### ADPL16's Things



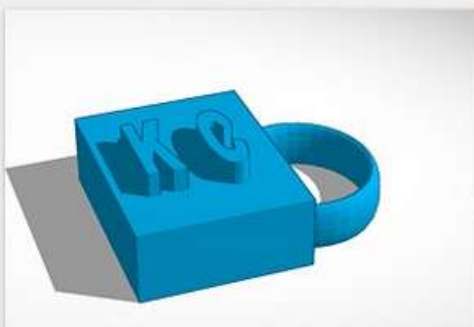
Nice and simple. I made it a little bigger and just used one color. Nice! Unfortunately, the printer jammed 2 or 3 layers in, so it took a second try to actually print it.

### ADPL11's Things



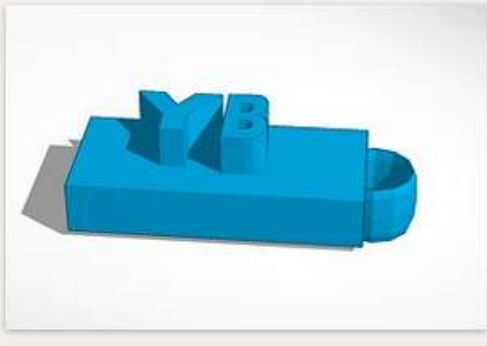
Already done at the library!

### ADPL12's Things



I reshaped and resized this some to print better. See the ADPL15 thing it was printed with for more.

## ADPL15's Things



I reshaped this a bit, and moved the main block so it touched the ground. (It was up in the air a little bit.)

Interesting failure on first attempt to print. After maybe 10 layers, I noticed the extruded plastic wasn't sticking – like the print head was too high by a few layers. One of the printer's common problems is that the plastic jams and it stops extruding – which would explain missing layers. But it was still extruding, so that wasn't it. I told it to raise the head 10mm to give some clearance, and took the bad print off the bed.

Of course it still knew exactly where the head was, so I told it to go back to zero vertically (back to just barely clear the bed to start printing again). But it stopped about 2mm above the bed! That was consistent with the printing in the air it was doing when I stopped it. Had it just mis-heard a command and moved up too far between layers?

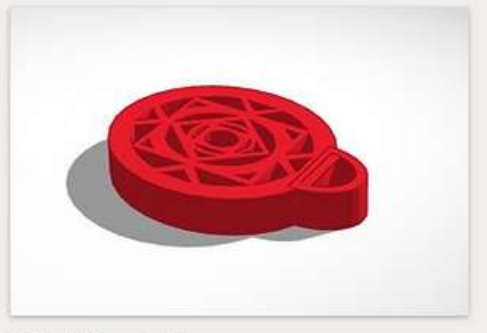
I moved it down to starting position again and restarted the print. I don't remember exactly what happened then, but somehow the whole print head jumped *down* about 2mm! It had somehow undone whatever caused it to be too high in the first place! But how could that happen?

I zeroed everything out again and restarted the print. While it was printing, I turned the spool of filament supported above the printer so it could feed freely. Then it hit me: If the filament had somehow stuck to the spool, while the print head motor was grabbing and pushing the filament down into the melting chamber, the motor would actually also make the head climb up the filament! I've never seen that happen, but it's consistent with everything I saw. Very interesting!

(Later) In thinking about what might have caused the spool of green filament to "stall" and let the print head lift itself into the air, a possibility occurred to me. The spool had been broken, and I'd patched it together with epoxy and a small plate of scrap wood screwed into the spool, both as part of the repair and to hold the broken end on as the epoxy was setting. Those screw heads might have caught on the spool support. I do recall that that end of the spool was at the end of the support that might have caught on it. Still not proved, but a possibility!



## ADPL13's Things



This is a nice design, and was interesting to watch print. The computer or printer kind of stalled a couple of times during the print, leaving blobs of plastic. It recovered and kept printing, but you can probably see where the blobs happened. You hit the resolution limits of the printer, making it even more "interesting".

## ADPL14's Things



I hacked this one a little. There was a ring-shaped hole hovering above the platform, so I pushed it down to make a hole. Looks like I changed colors a little too early, too. Oops!

## addison librarytwo's Things



The spikes were hanging out in space with nothing to support them while printing. They were also pretty thin, and wouldn't print well, so I split them in half and put them on the ground so they'd have some support. I was afraid they were too skinny to print, so I made them bigger, dropping from 6 to 4 spikes. The spikes still came out silly small. I should have cut down to maybe 3 and made them bigger.

...end...