



instructables

Design and File Acquisition



by memphisaltt

Hello and welcome to the first instructables in the the 3ds of 3d printing. this one will be all about how to get your files, how to make your own, and some helpful hints to guide you in your printing journey.

fyi this guide was written for by memephis, the same person who wrote all 3(4 including the hub page) of the 3ds of 3d printing instructable. I wrote it in 3 parts for organizational reasons and I didn't feel the need to publish all of them to the contest.

Supplies:

fusion 360. it is free for students or hobbyists, so you should be ok.



Step 1: Fusion

Ok, so this is gonna be a long one, mainly because this will be focusing on how to make your own mechanical models for engineering instead of the more artsy side of 3d printing. personally, this is more the side I fall towards, so I will be able to give more insight here, but I do highly suggest looking into blender and tutorials if you are trying to get into making your own models

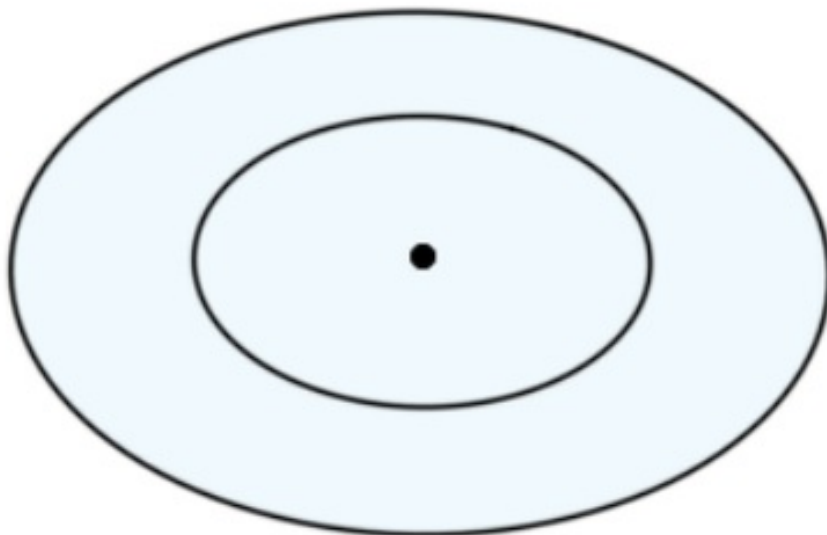
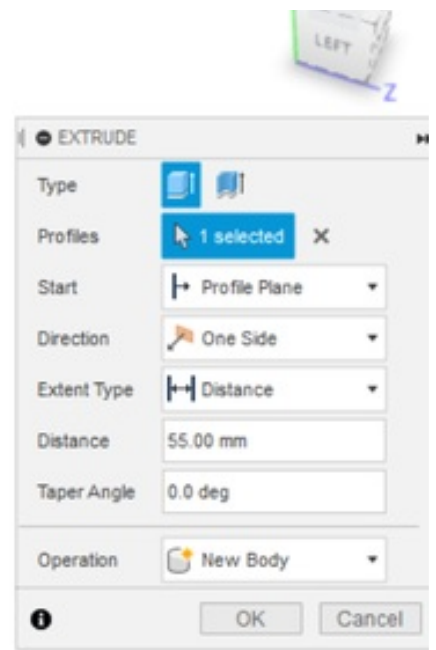
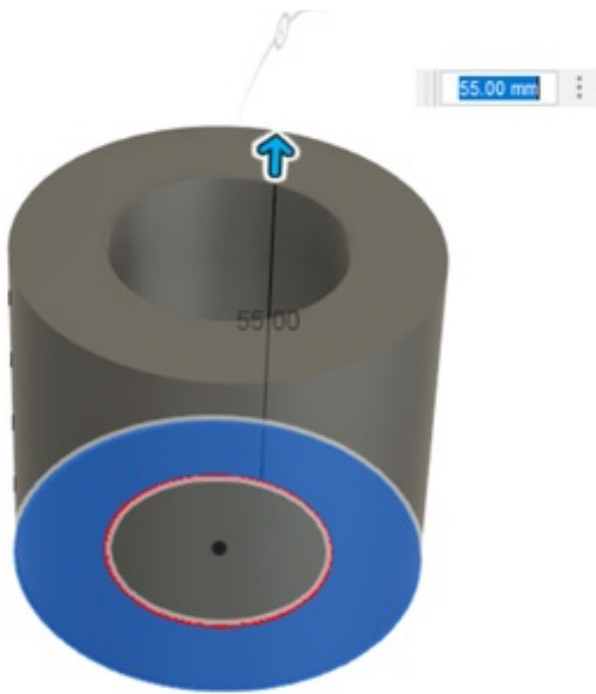
Step 2: Fusion 2 Inspiration

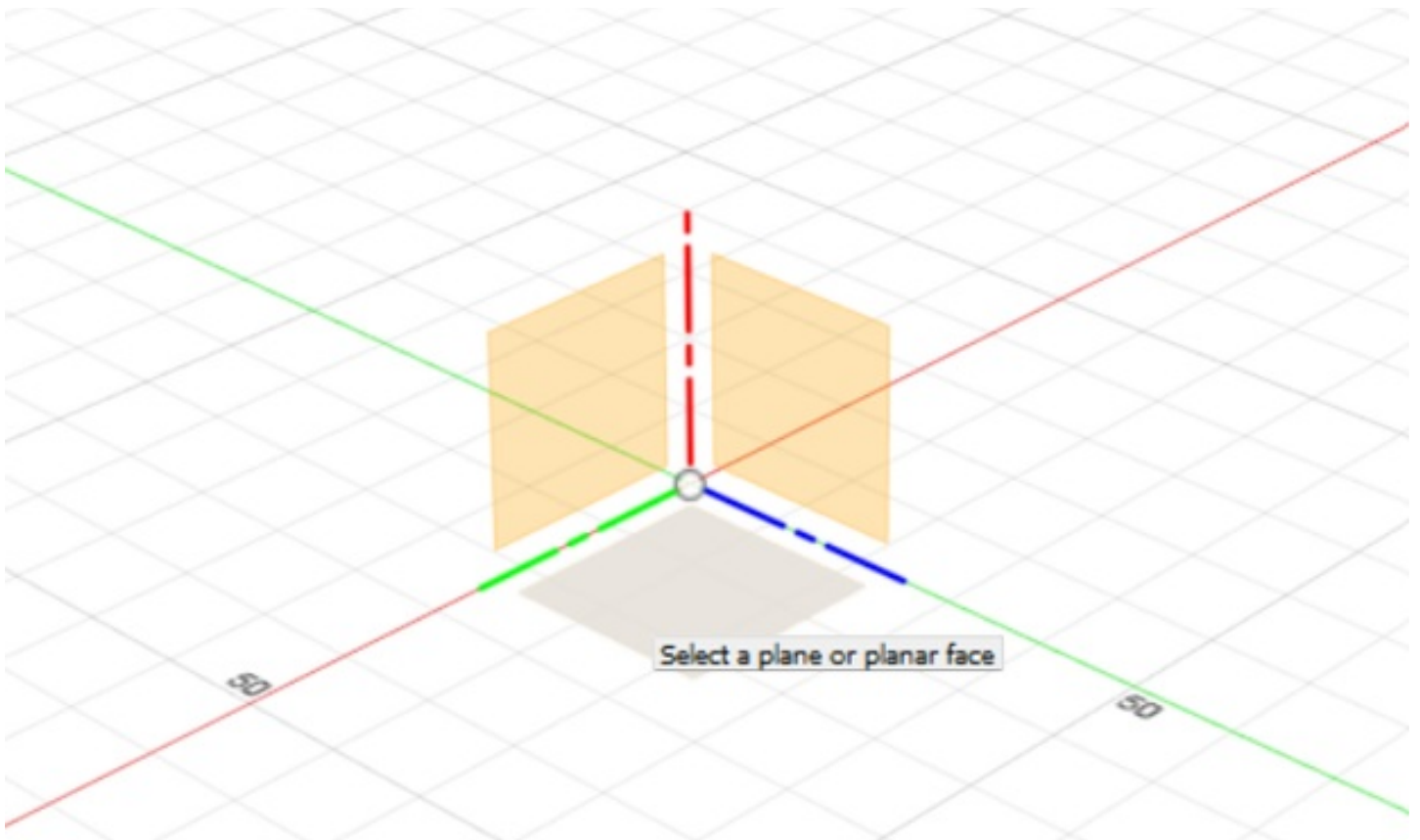
getting inspiration can be one of the hardest parts of building something cool. personally, I look to video games and my friends. you know that off handed comment about how cool it would be to build rases robot from valorant, thats and idea, glados, boom that's another, why not wheatly, or any bot from your favorite games! the other places that are great for inspiration are 507 mechanical movements, which is a website, <http://507movements.com/toc.html>, and a book that you can buy. the book is like 5 bucks on amazon, so I just bought it, but the website is the same thing. this book is helpful to see cool mechanism which you could use to build your own thing from. I did this with the mechanism 224, the expanding pully, and I turned it into one of those sci-fi doors that opens like this. <https://videohive.net/item/scifi-door-animation/20369120>. point is, you can take any mechanism and bend it to do what you want, its just a matter of figuring out what you want to bend it into.

Step 3: Fusion 3, Workflow

fusion 360 is a great tool, but it can be a little confusing sometimes. the basic work flow looks a little like this

- 1) make a sketch, this can be done by selecting the sketch tool or hitting r on the key board, then selecting a plane.
- 2) you can extrude it to pull it out into a 3d dimension, or you can revolve it around an axis. keep doing this until your part looks right and you have done it for all the parts you need.
- 3) now that you have that part, you can insert it into other files. it is common practice to make each individual part a component in a different file and then have a assembly file where you joint all the parts together and make it all look nice.
- 4) print those parts out, most likely on a fdm/filament based printer, and test them out. (this workflow is covered in step 5 of the deposition instructable)
- 5) redesign some to most of the stuff and repeat until it works.



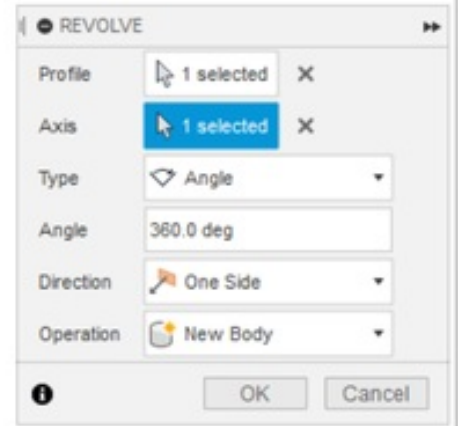
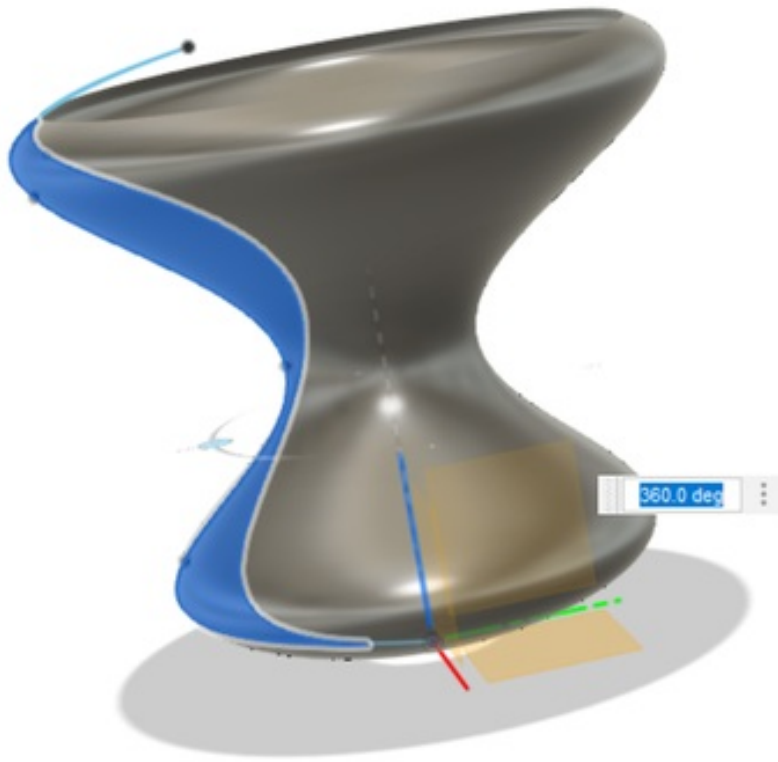


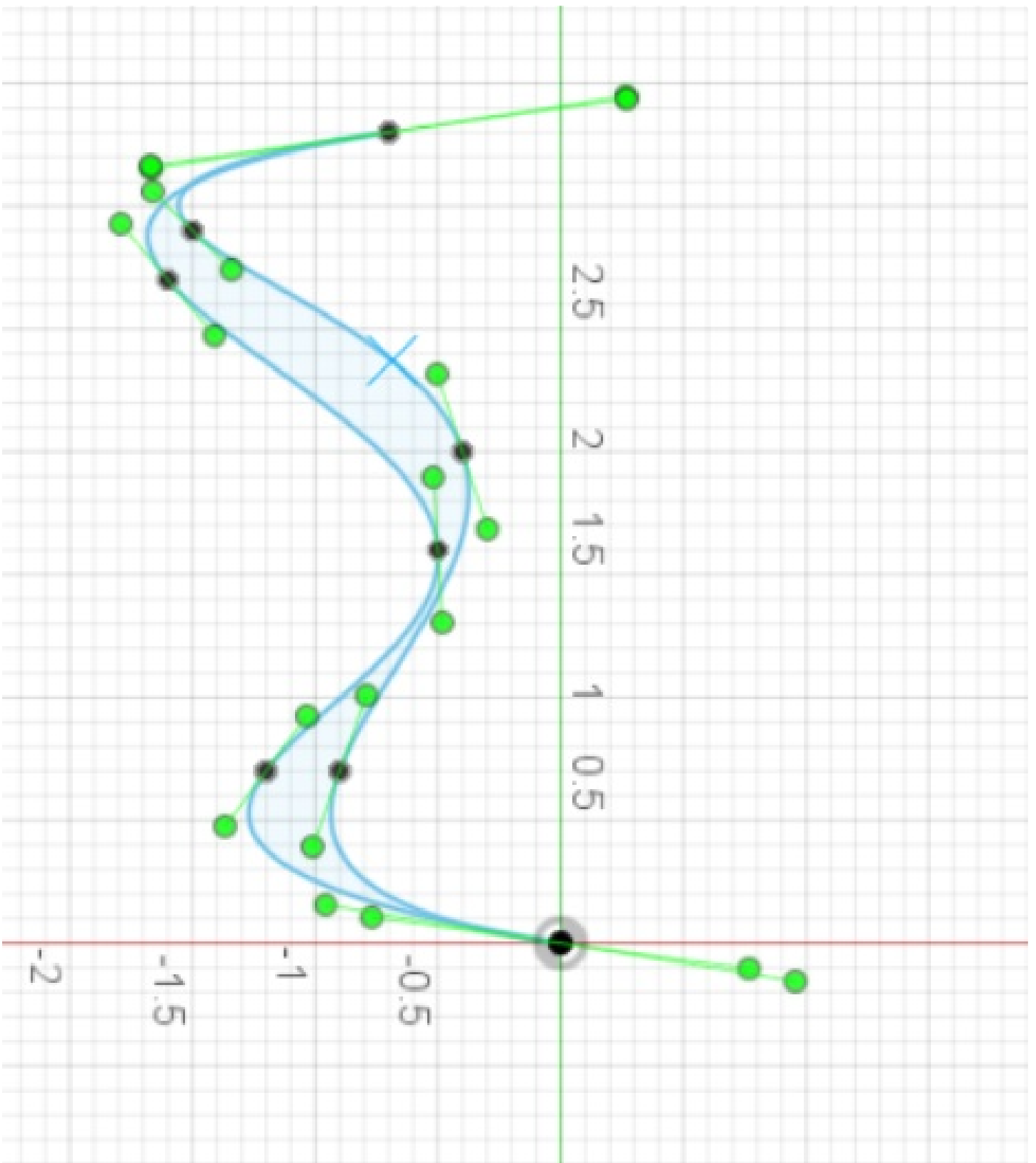
Step 4: Fusion 4, Helpful Tools

this is not really a step, but rather a header. the next steps until step 13 will all be little blurbs on helpful tools. I split them like this so I could add photos to each one.

Step 5: Revolve

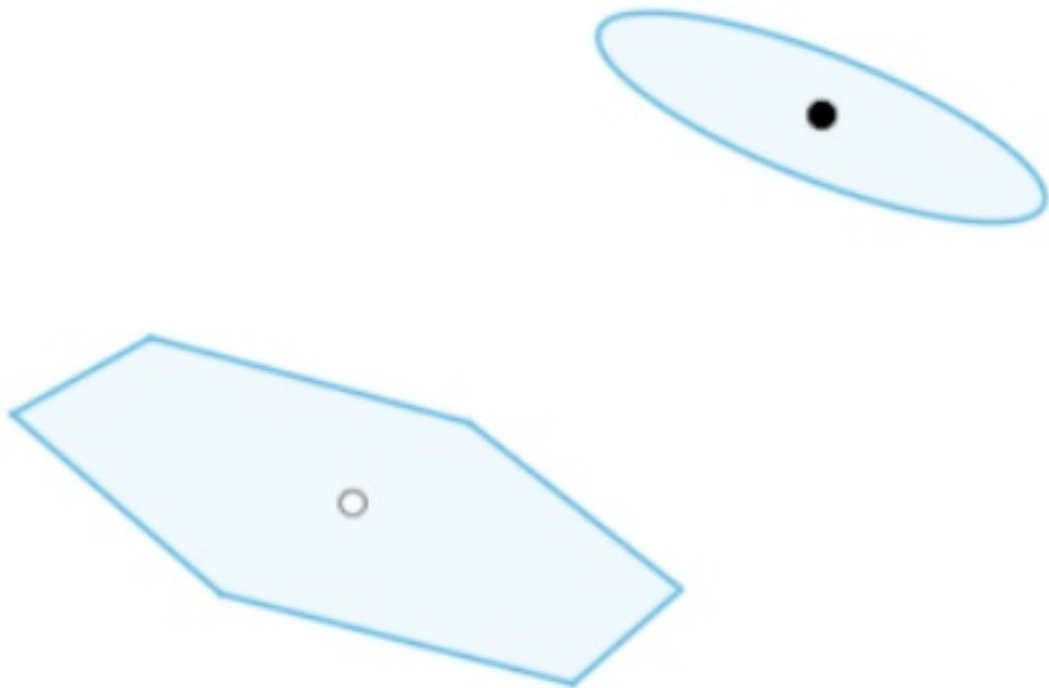
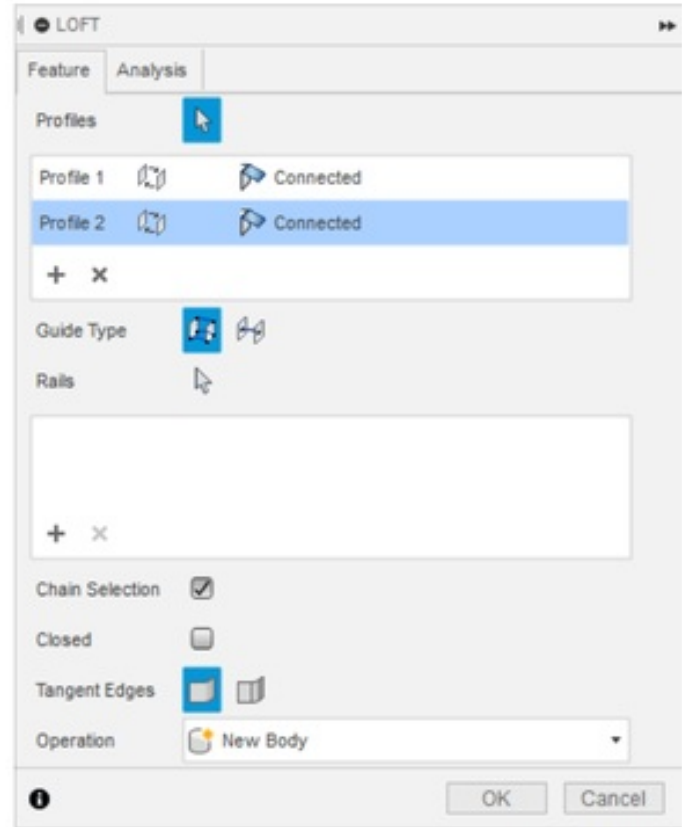
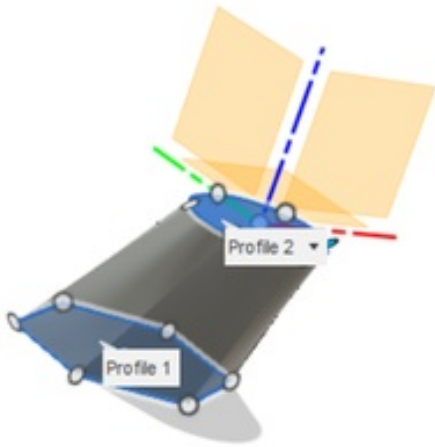
the revolve tool allows you to take a 2d sketch and spin it around a axis. everything that the sketch touches as it spins will be added to the final model. it is super helpful for making round parts, but I would recommend still using extrusions for cylinders. that's not to say you couldn't use revolve, I just think extrusion would be better

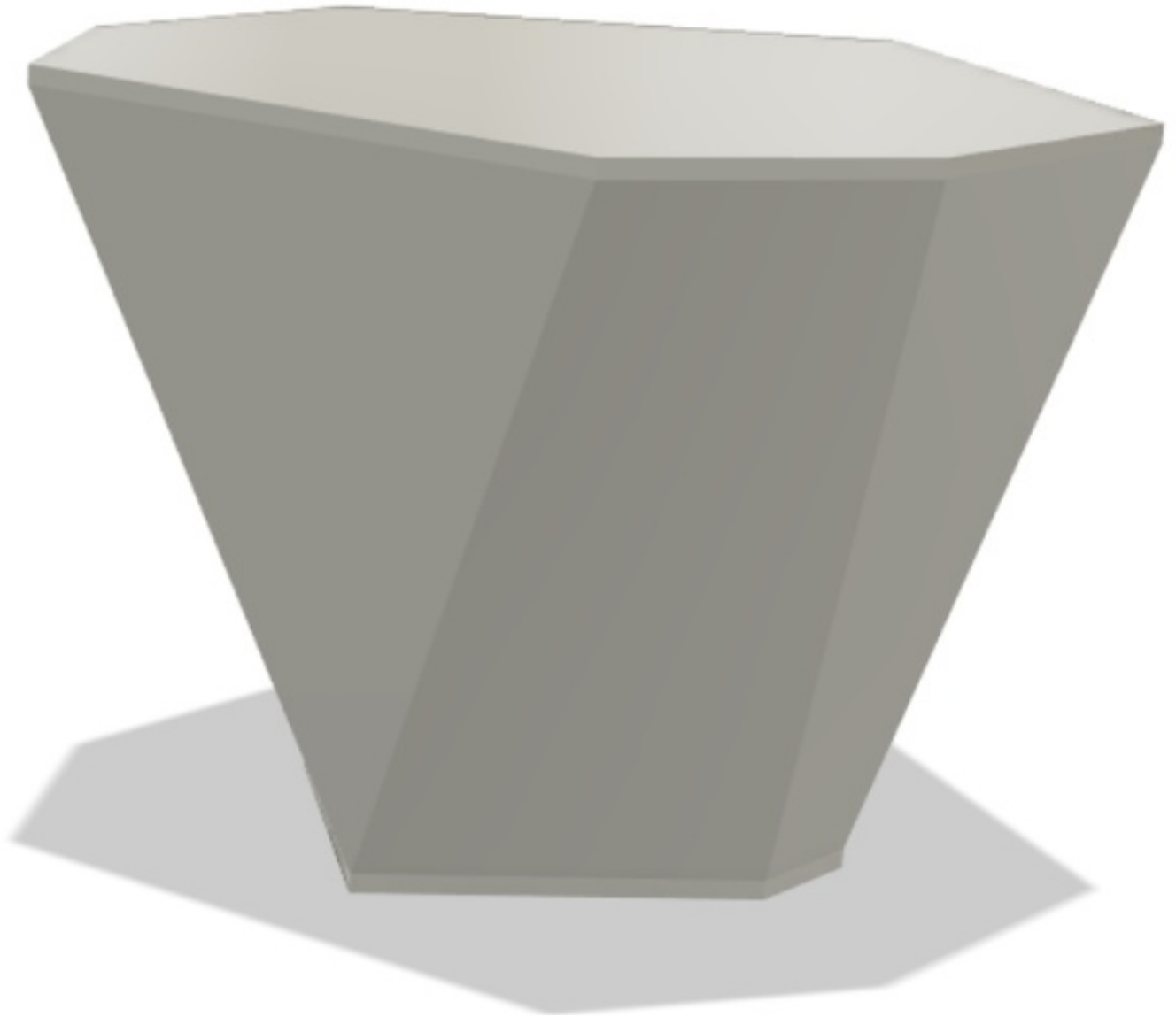


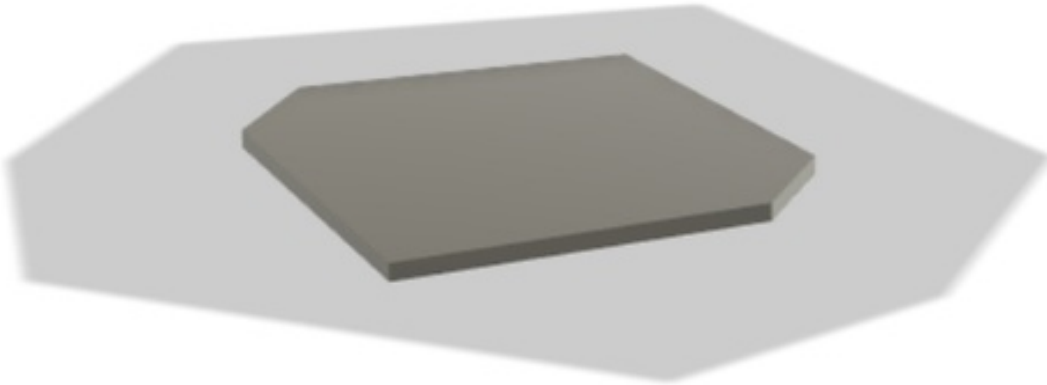
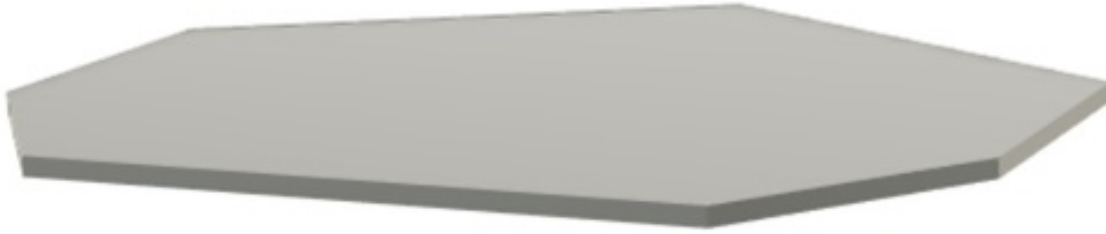


Step 6: Loft

the loft will transition from one face to another. it is situational, but amazing when you need it. for instance, I was trying to make razes boom bot from valorant. I ended up wanting to a very funky shape for the chassis and it would have taken me hours with out the loft tool.

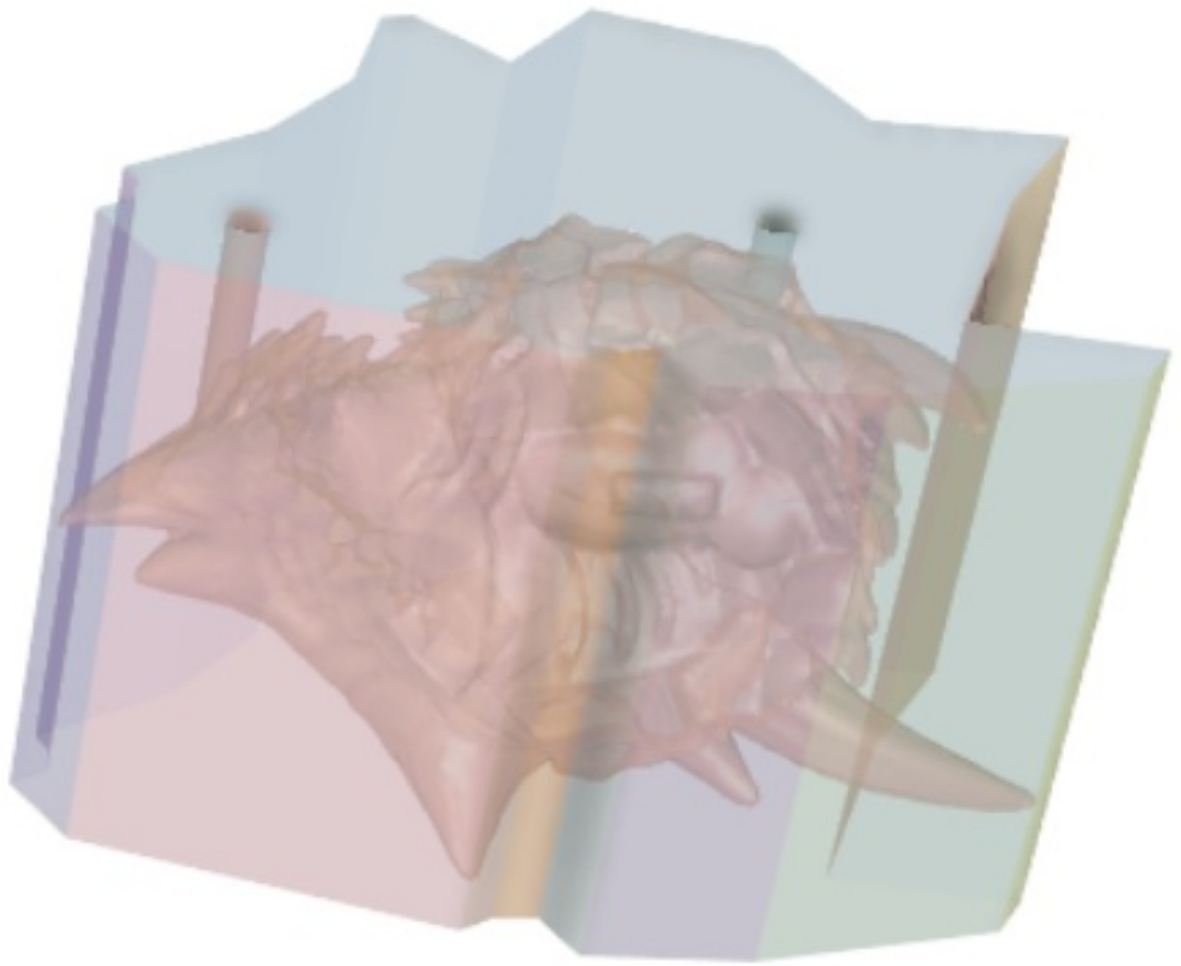


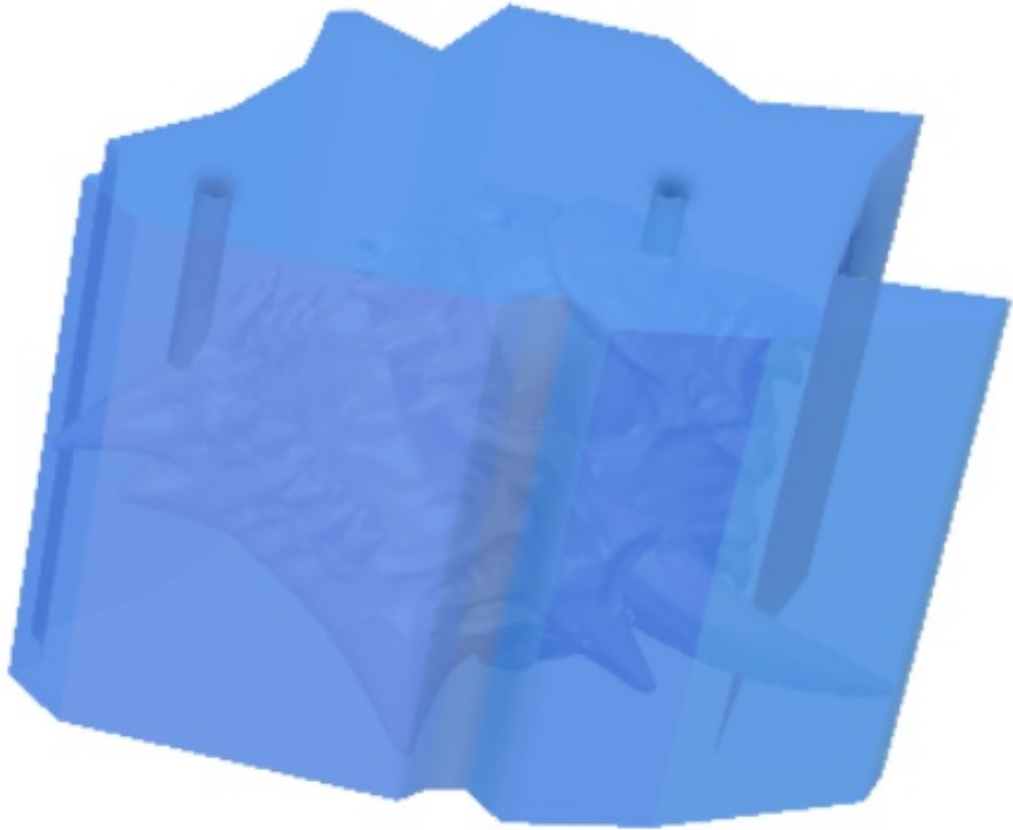


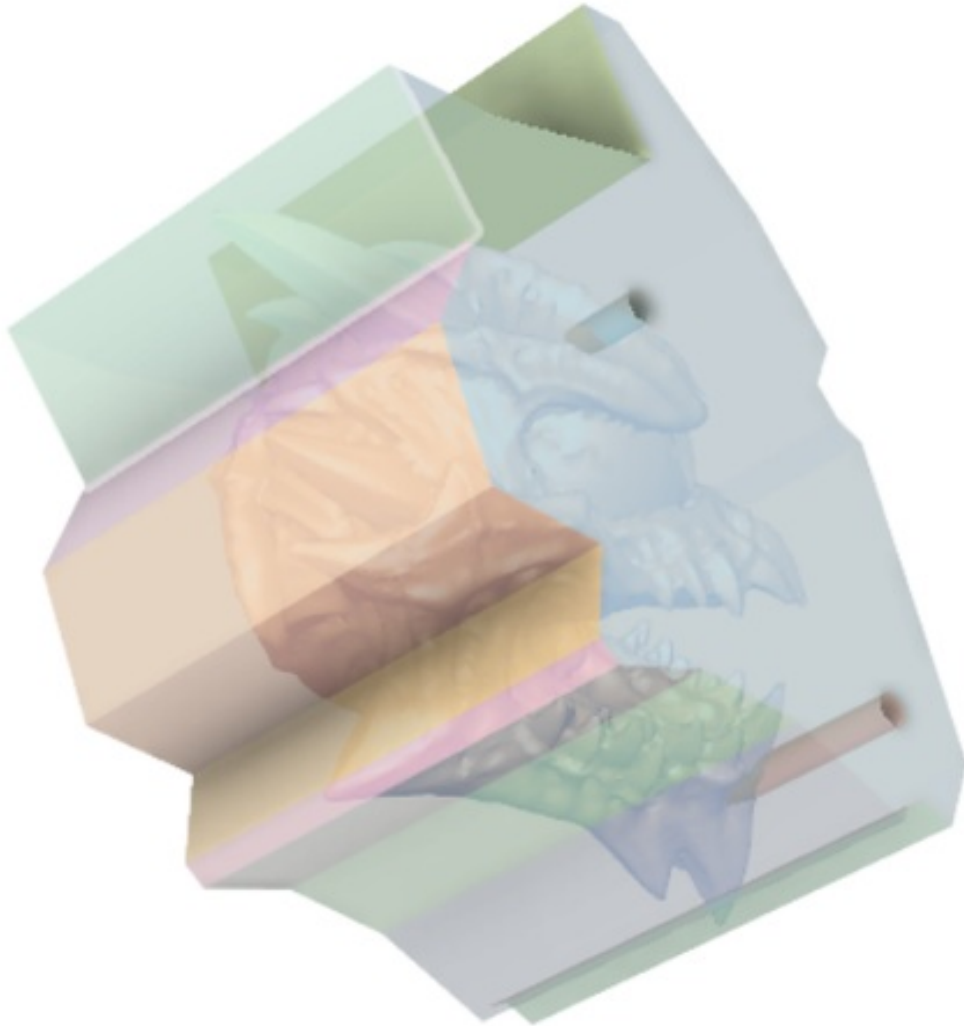


Step 7: Combine

you can use this tool to combine two bodies. It seems simple, but you can use it to cut, meaning you can make a hollow interior of a part for casting, or combine on intersections which means that the only parts left are parts that both models have. this means you can make 3d objects that have different 2d images depending on what side you are looking on. I used this to make a mold to cast wax models of a beholder from dnd. this was for the candle making instructable and you can check it out if you want a better tutorial on the combine tool

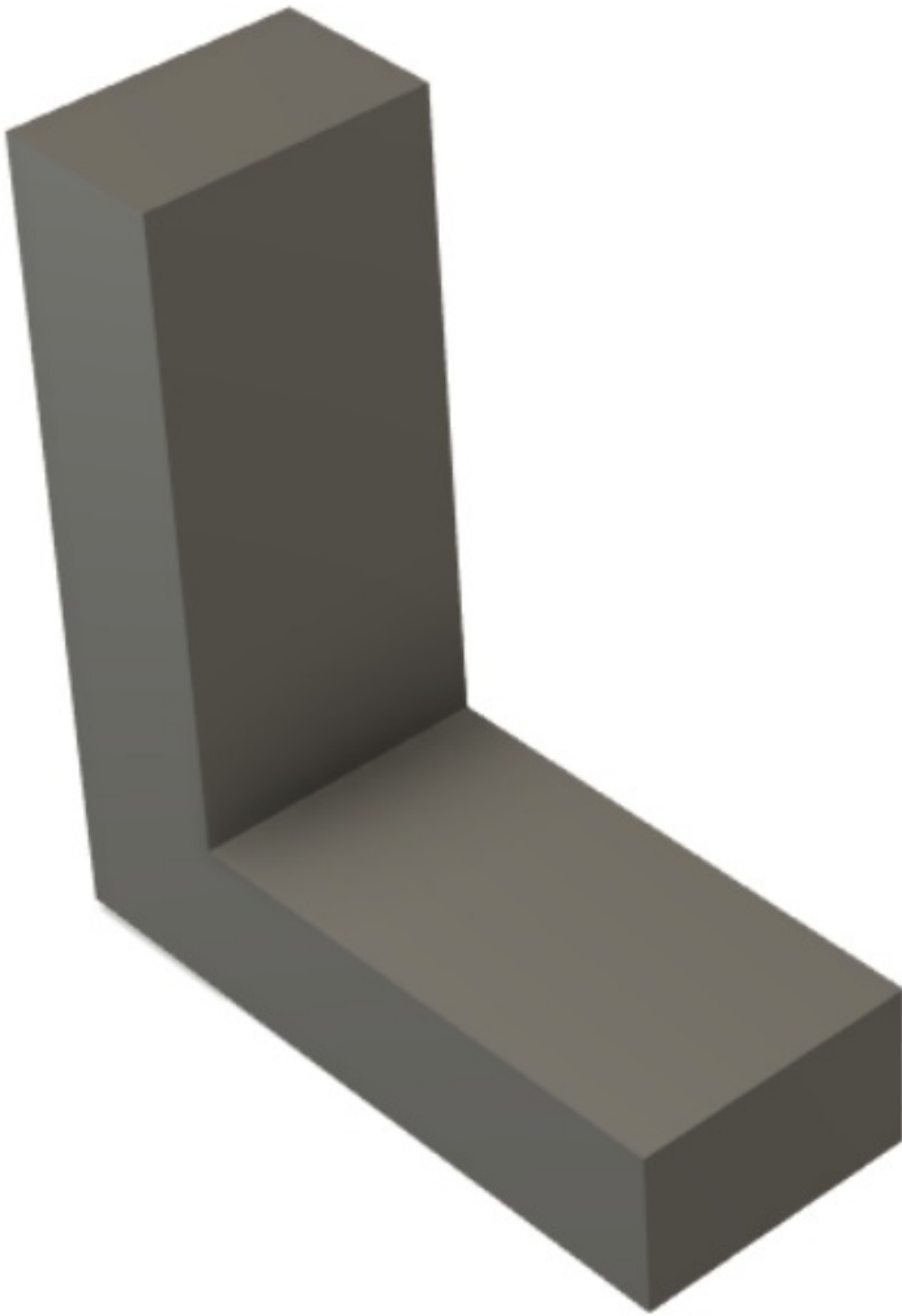


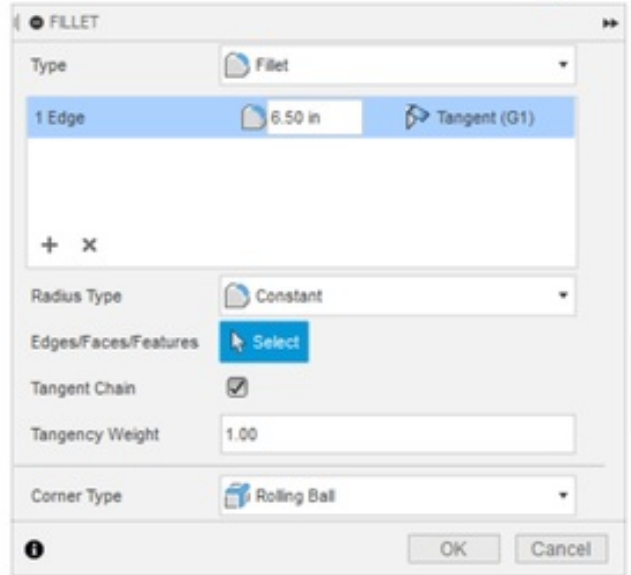
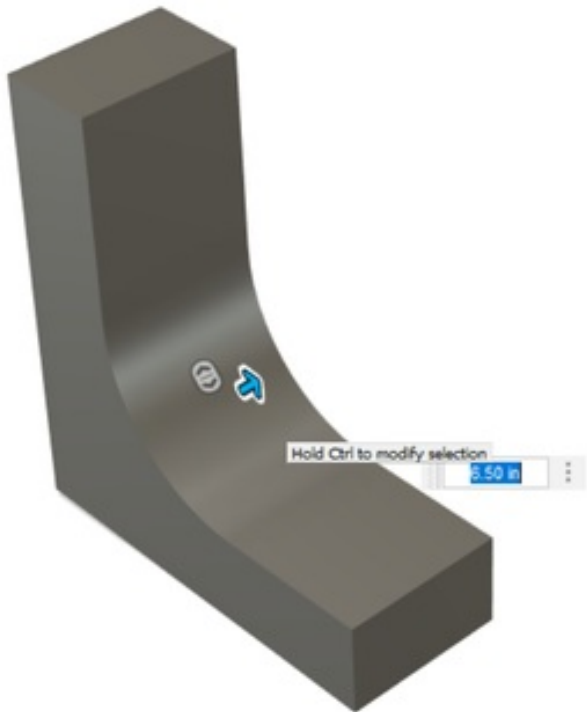
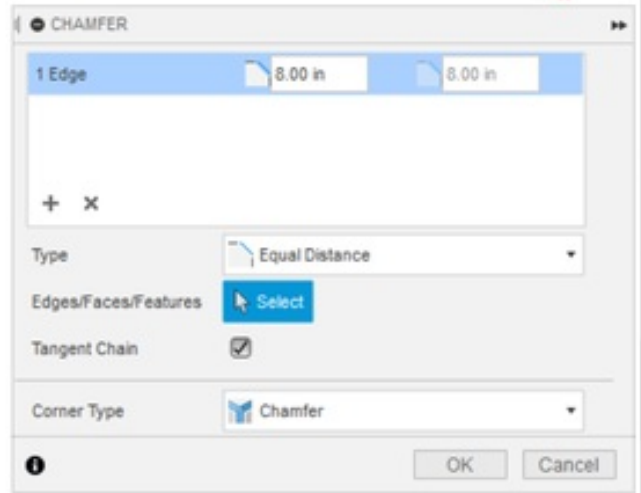
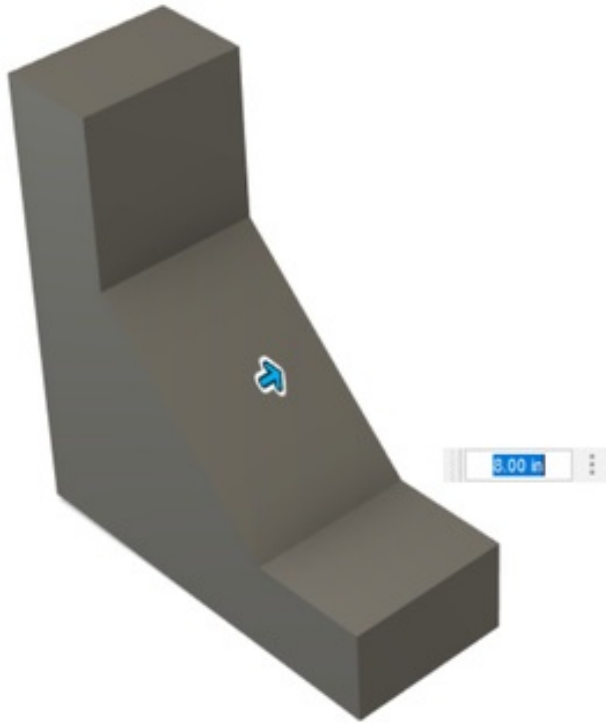




Step 8: Fillet and Chamfer

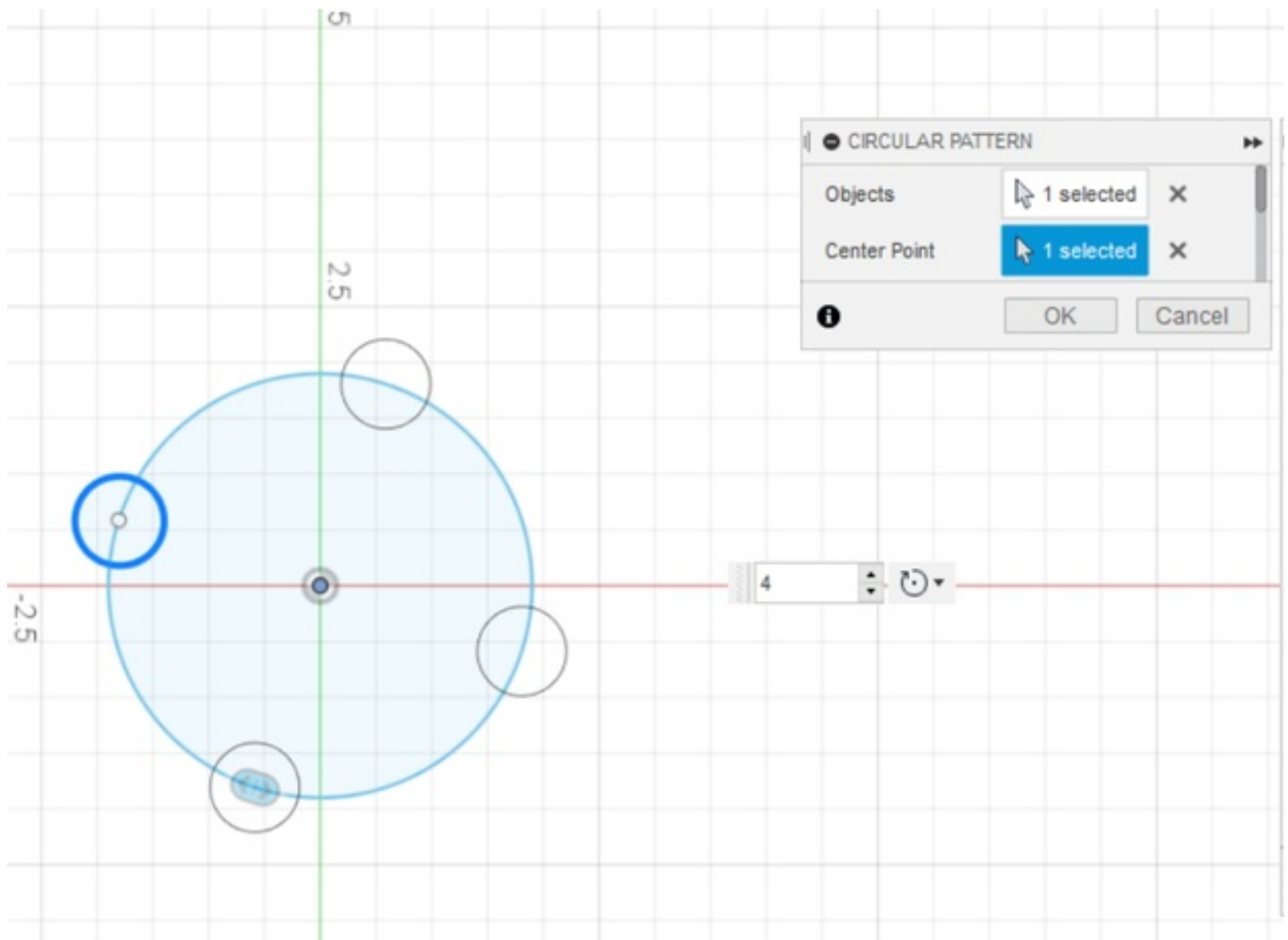
this helps make corners smoother. its not super helpful, but it makes thing look better. fillet makes a sharp angle from the corner, where as chamfer rounds it out.

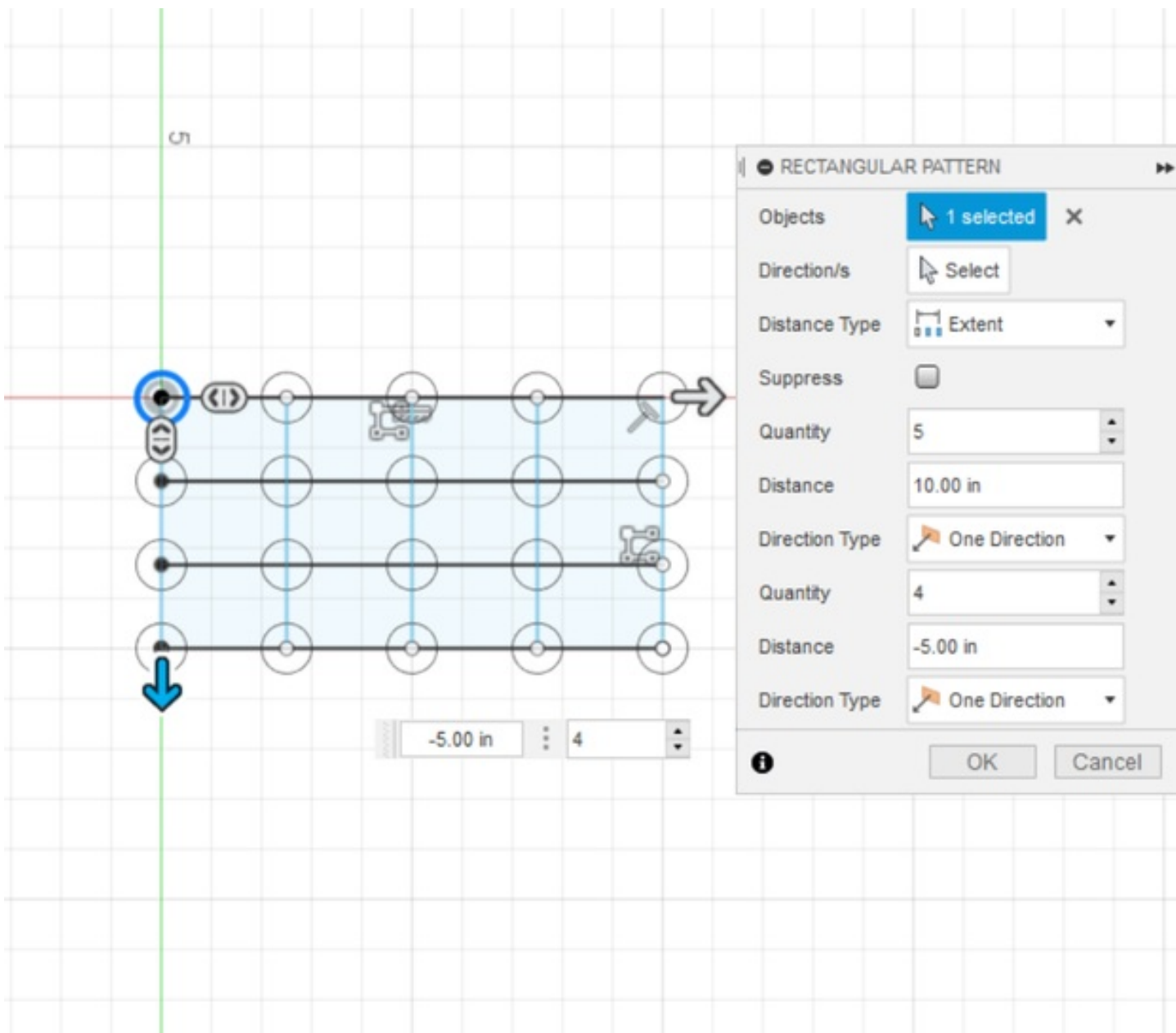


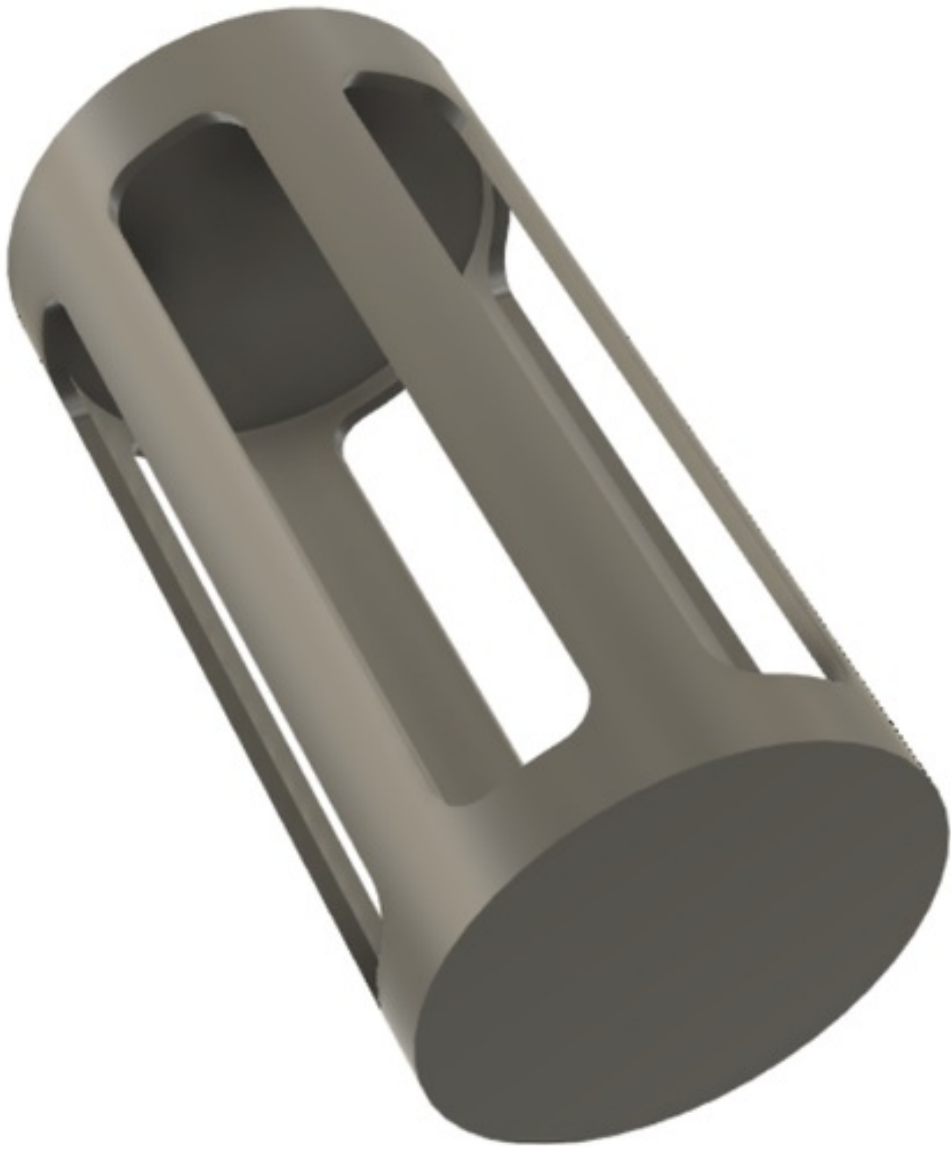


Step 9: Circular and Rectangular Patterns

this tool helps you make things in a circular or rectangular pattern. give it the radius of a circle and it will copy as many objects along that circle as you would like. the rectangular pattern will make a grid of the object. the really fun part is that the object copied can be a sketch or a body, meaning you can make some really fun designs by copying holes around the surface of a part to make it have some flare, or you can use it to just save some time. I did this exact thing to make a cool water bottle holder for my bike









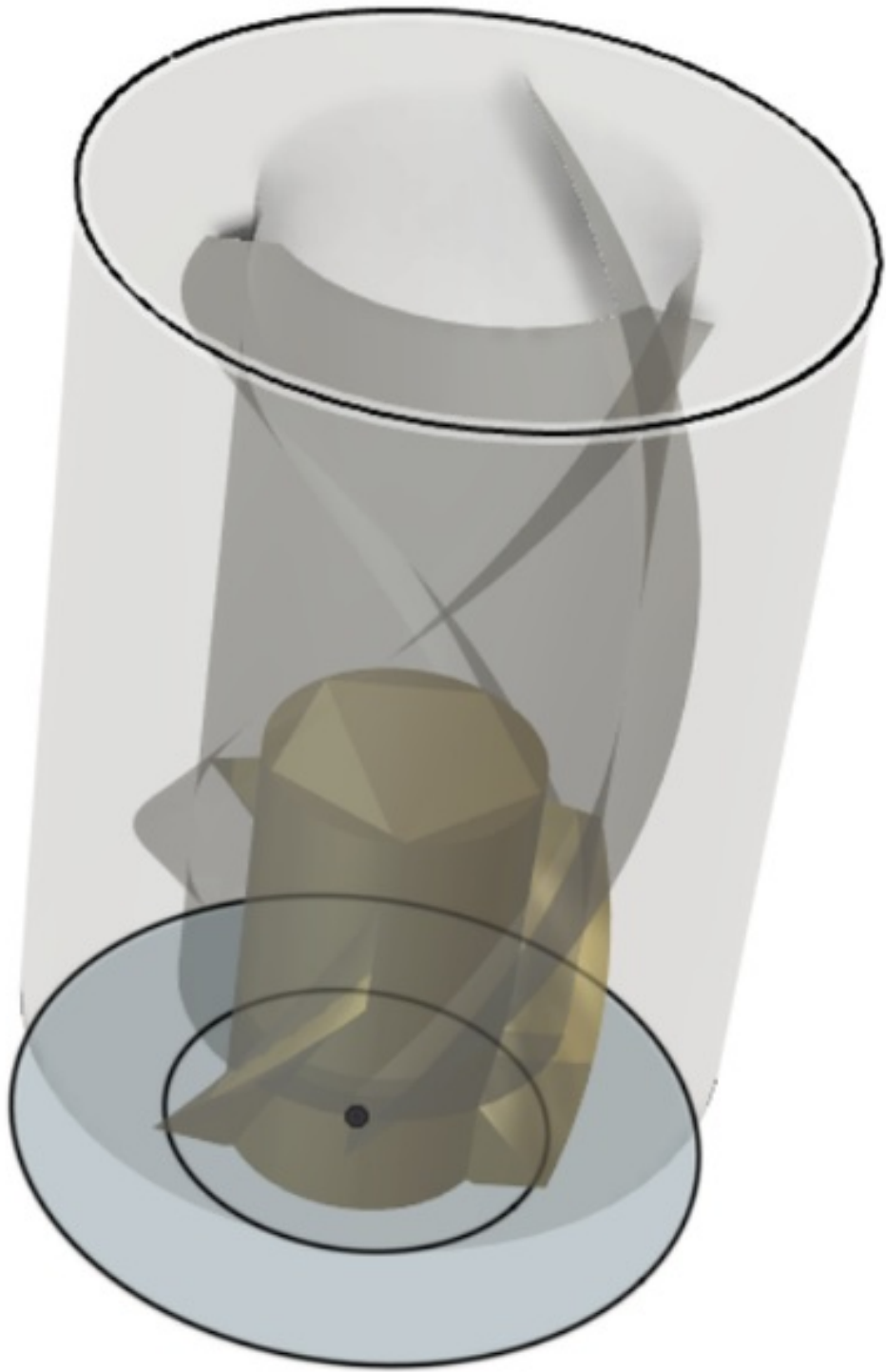


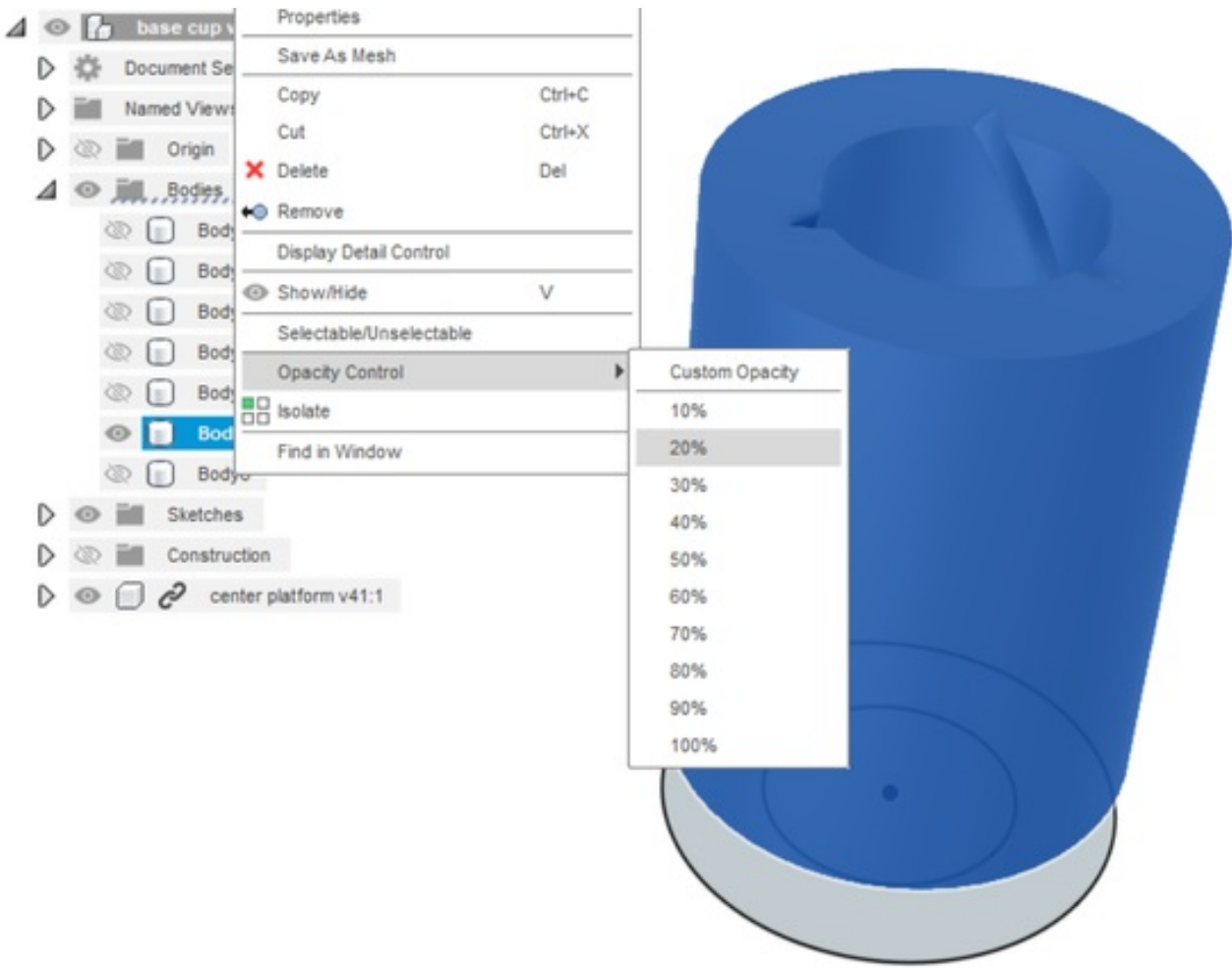
Step 10: Jointing/ Rigid Body

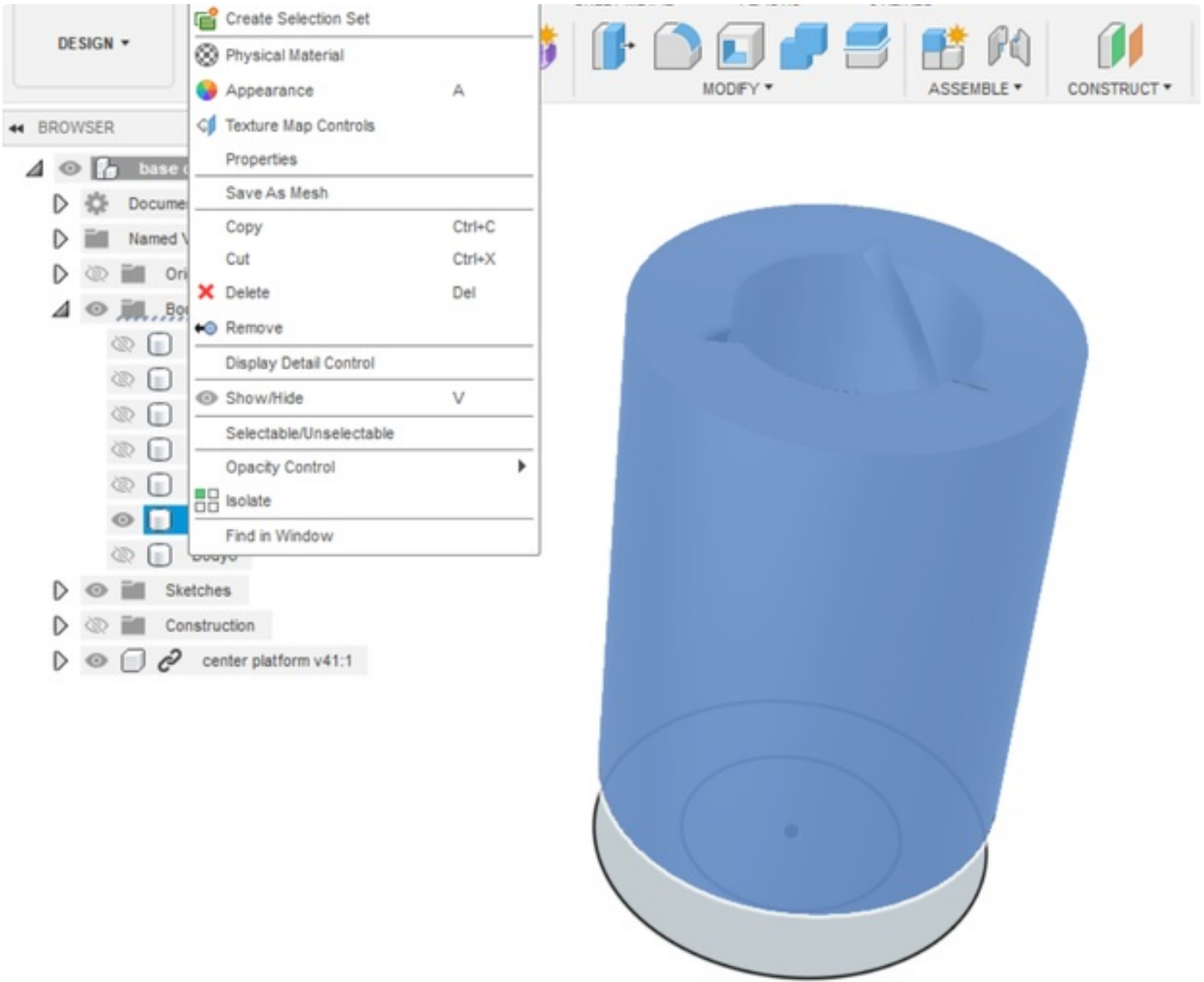
jointing is one of the best tools to get a idea of how things work in the real world, however, fusion hates them. the basic idea is that you select two points and fusion glues them together, and this part works fine. the pain comes when trying to use motion joints. motion joints allow things to rotate and slide, but fusion hates that and sometimes they will refuse to work or turn your master piece into something straight out of the inside of a fnaf suit. rigid bodying makes a part which has already been assembled or otherwise set up into one solid piece. it can be super helpful as a quick fix if things are pulling apart on ya. in terms of pictures, I think it is simply better to go into fusion and look at the animations and play around with it.

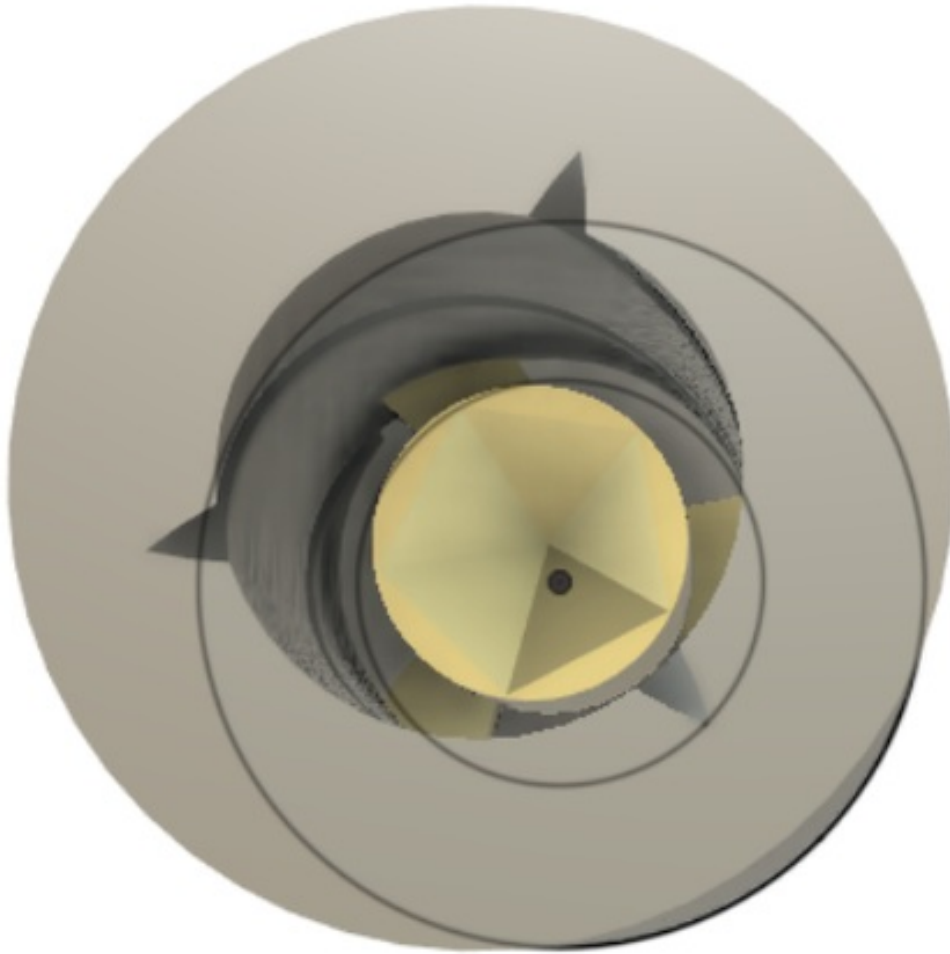
Step 11: Opacity Tool

this tool can make parts transparent. this is incredibly helpful to see if thread line up or other things in hard to see spots. all you have to do is get to the original file(not a assembly), right click on the body you want to make transparent, go to opacity, and turn down its opacity. it is super helpful.



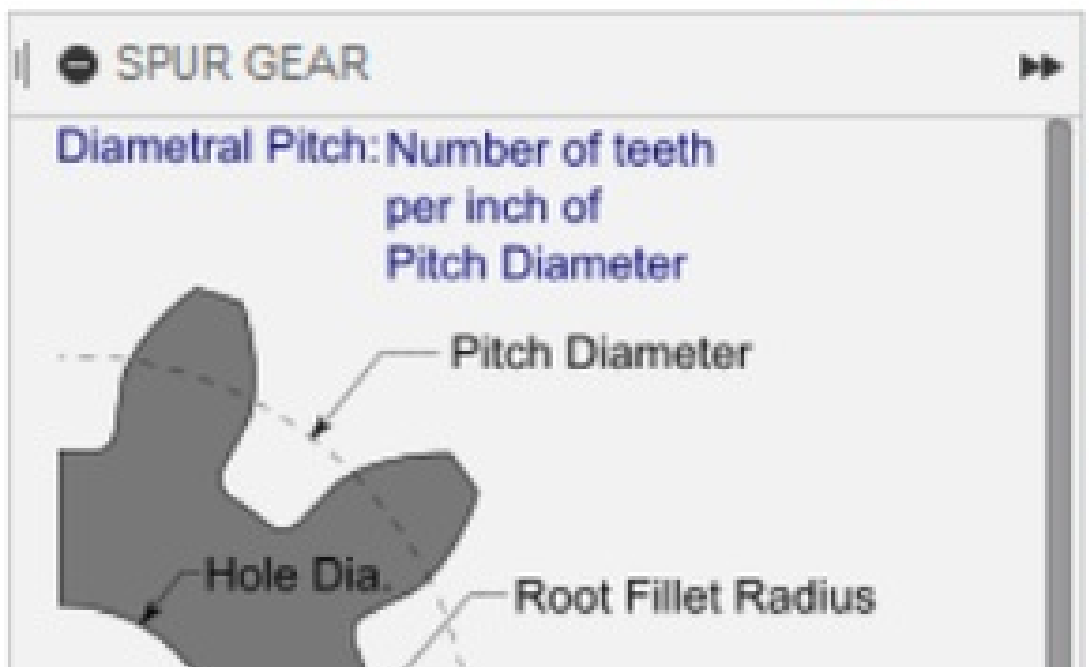






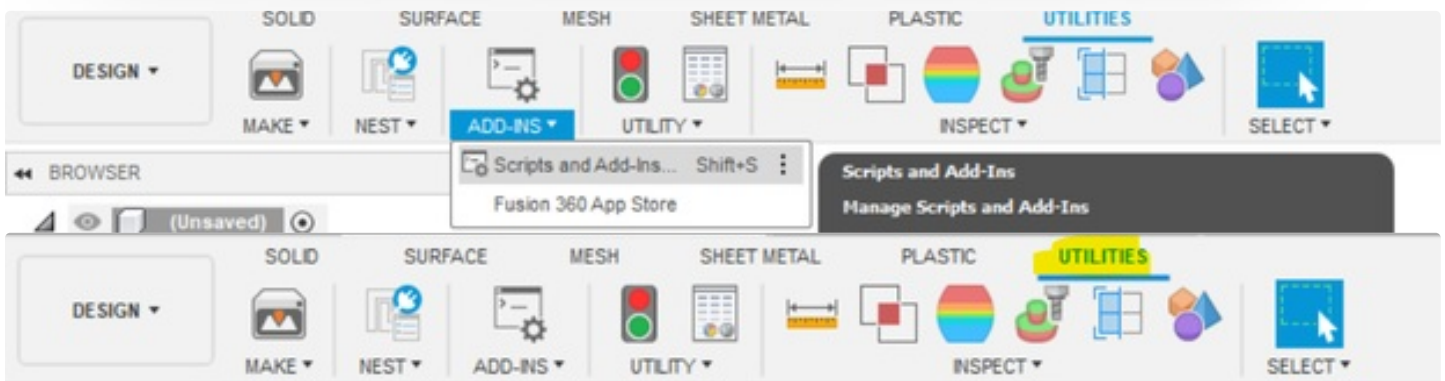
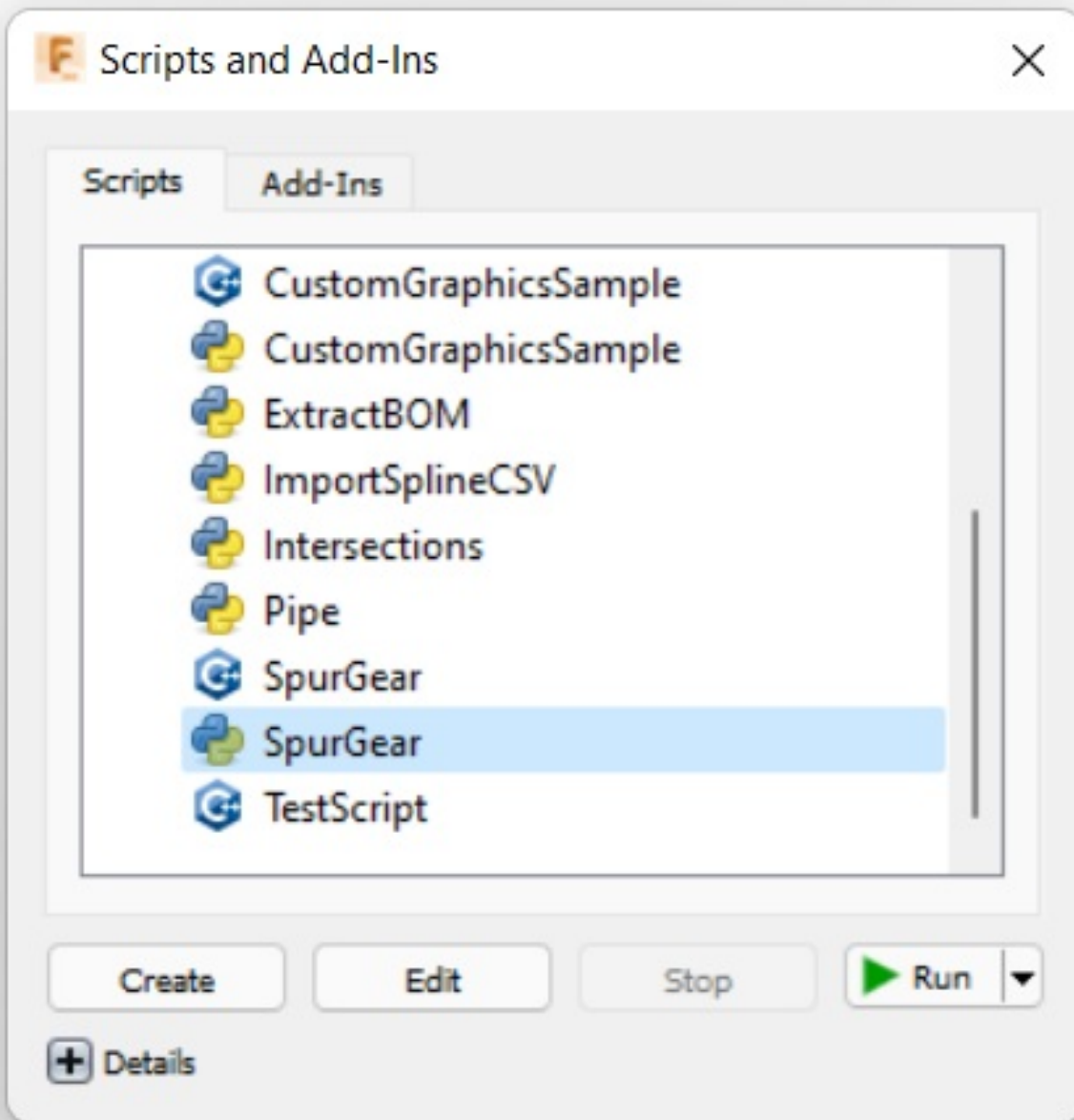
Step 12: Plug Ins

plug in's can do everything you could ever want. they use custom code to build objects like gears or bolts which would be a pain to cad by hand. it might be hard to find everything you want, but you certainly can do it. this one makes a gear and comes with fusion.



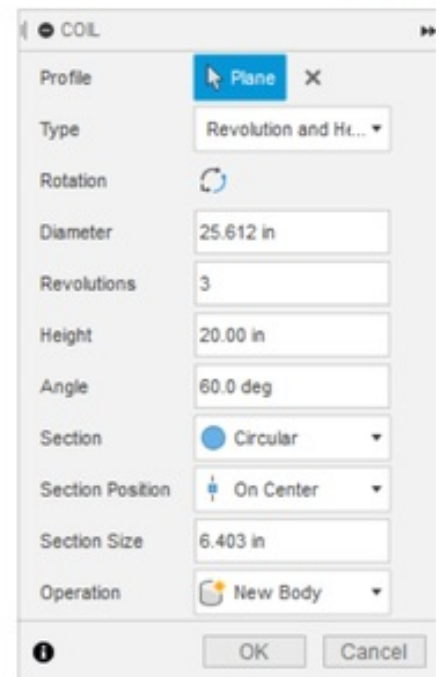
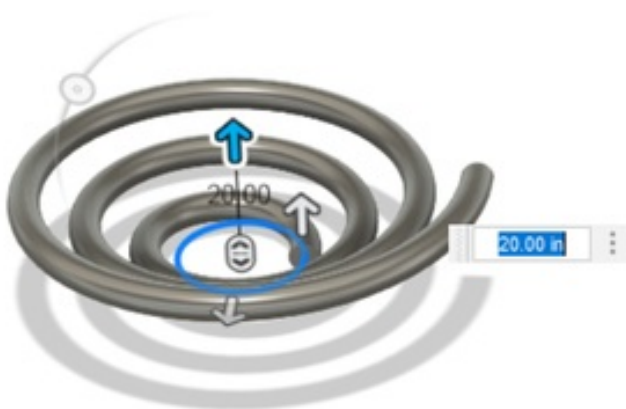
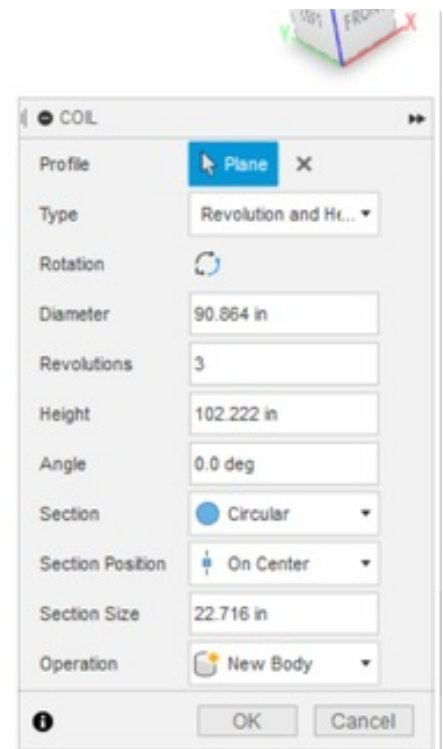
Standard	English ▼
Pressure Angle	20 deg ▼
Diametral Pitch	2
Number of Teeth	24
Backlash	0.00 in
Root Fillet Radius	0.063 in
Gear Thickness	0.50 in
Hole Diameter	0.50 in
Pitch Diameter	12.00 in

OK Cancel

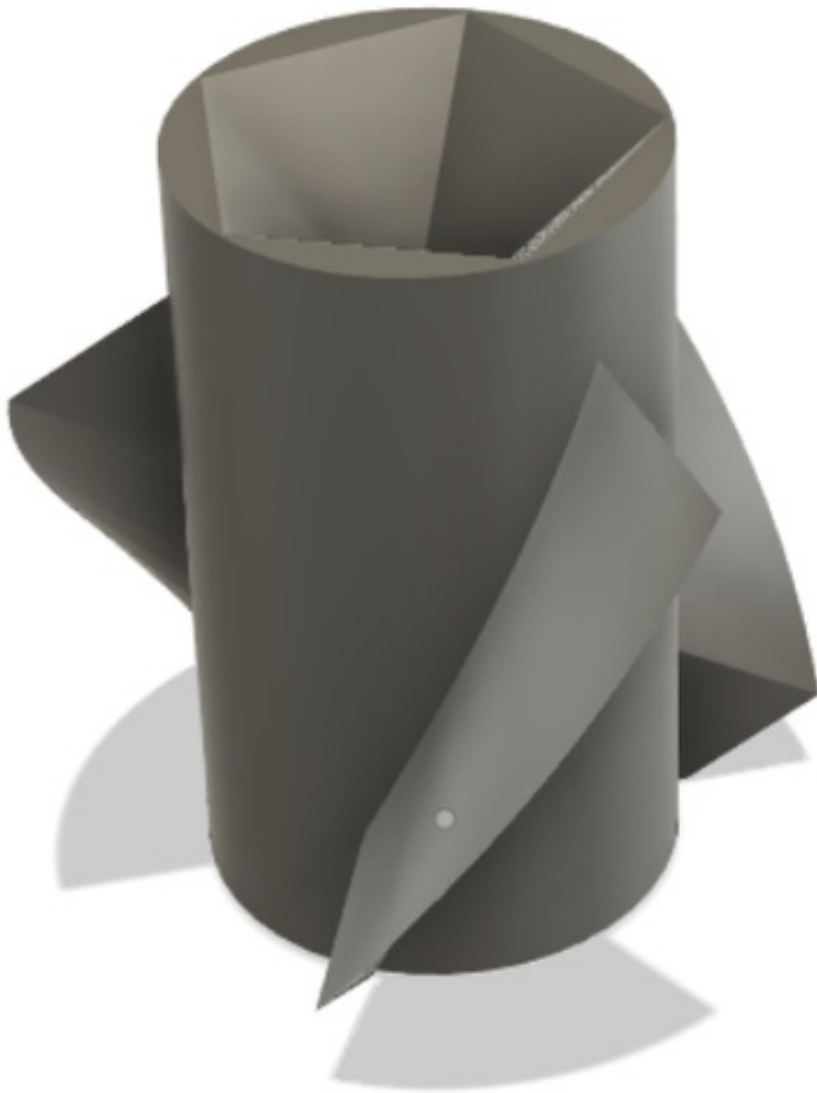


Step 13: Coil Tool

both of these are great tools for making your own threads for screws. the thread tool is great for making standard threads that a normal screw would use. you plo in the screw type and diameter, a few other details, **check the modeled box**(it will not work if you do not do this), and call it a day. the bad part about the thread tool is that it limits you to "normal sizes" that "rational people" use, so sometimes you have to crack open the coil tool, set it to cut and external triangle, and make the screws that only your part will ever use. pro tip that you will never use, you can also change the angle on it to make the coil go in or outward.







Step 14: Cults

cults is a 3d model website like many others on this list. it has some really amazing models, and is more general. you can find anything from minis to mechanical parts and everything in between (including articulated dragons). I think this is a great website for files, but the website has also come under some controversy recently due to not properly paying a seller and then leaking his personal information to the web on accident. here is a link to the site: <https://cults3d.com/en>.



Step 15: My Mini Factory

welp, the name says it all. this website will have some variety, but it is mostly focused on miniatures. Overall, there is a lot of really good stuff on here, but if you are looking for minis, I would recommend Patreon accounts.



Step 16: Patreon

patreon is one of my favorite places to look for models. they all have amazing models, granted you have to pay for each one. a typical subscription is around \$10 but a lot of them are very worth it. so far, the best one ive found is archvillian games, however, you might not like them or their art style so I have left a bunch of links to some good ones. these models are best printed on a resin 3d printer, but it is possible to print them well on a normal fdm printer.

<https://www.patreon.com/titanforgeminis>

<https://www.patreon.com/crippledgodfoundry>

<https://www.loot-studios.com/bundle>

<https://www.patreon.com/ArtisanGuild>

<https://www.patreon.com/LostKingdomMiniatures>



Step 17: Thingiverse

ok, thingiverse is a interesting one. maker bot, the company that owns it, is horrible. they have not updated the website and it got got data leaked from a while back. on the other hand, there are a lot of great models on the site and it is still very popular. good place to check for models, but try to use others first.



Step 18: Thangs

thangs is a good site and it even will search other sites for you. no bad stuff about em, just a solid site. they do also have a geometric search feature which allows you to find geometrically similar models, but I haven't found myself needing to use it ever.



Step 19: Extra Resources

fusion can be one of the best resources in itself. all of the tools have little blurbs that can help you learn.

https://www.youtube.com/watch?v=WKb3mRkgTwg&list=PLrZ2zKOtC_-DR2ZkMaK3YthYLErPxCnT- this is a good playlist of fusion tutorials. the channel itself has some good stuff as well

<https://www.youtube.com/c/MakersMuse> this channel has some great videos about fusion and model ripping, as well as 3d printing and can be a great inspiration.

one of the best ways to learn fusion is to go out and build something, so if you are just scrolling right now, go download it and try to make a cart. it can be any kind of cart, be it a shopping cart, car, or even a palace on wheels