

The Book of Pygmalion

A basic rundown on how to convert and print your very own anime figurine.



Chapter 1. Proem

Whys, Whats and Whatever

If you don't want to read ramblings of a deranged lunatic, go straight to the Chapter 2.

It would be much easier to buy a factory made figure. You will not have to spend your sweet time creating your waifu in 3d, fighting with Blender to make it printable and cursing your shaking hands while painting it. And obviously it would cost you less money.

Let me speak from experience. My little brother asked me to make him a Megumin figure in 1/8th scale for his birthday, since I've already engaged in hobby and all. I spent about 2 quid worth of resin for printing it. New factory made figure costs about 80 quid. So I saved money, right? No. I spent about 3 hours designing it in Blender and 5 more hours painting the print later. Minimum hourly wage in GB is 9 pounds per hour. With the amount of time invested, I might've as well went off flipping burgers in Macca's and bought the figure. And that's not counting the upfront cost of the 3d printer and supplies. Anime figures are priced rather fairly. They're not on the same level of a rip-off as, say, Games Workshop products.

So if there's no financial gain in 3d printing your own figures, why go for it?

Absolute. Full. Customization.

You have total freedom to design a character the way you want, dress it the way you want. pose it the way you want and paint it the way you want. This total freedom is a main reason why someone would pick up this hobby. No factory can offer you this freedom.

For many years, it was a pipe dream. Sculpting in 3D is quite hard, and 3D printers with good enough print quality used to cost thousands of dollars. Nodays though, the future came and here to stay.

First, the advent of waifu creation games like Artificial Academy and Custom Order Maid made it possible to readily manifest the girl of your dreams with simple and easy to use software.

Second, resin 3d printers are absurdly cheap for the quality of a print you get. Roughly three hundred bucks is enough to get all the tools you need to start mass-producing your custom order maid dungeon masters.

With such breakthroughs in technology, it is only obvious to combine them in a singular purpose. Printing anime figures. All the effort humanity made to this day was to make it possible. And I am here to guide you through the hoops to make it a reality rather than mere possibility.

+++++

Chapter 2. The Process

A kick-start into software, hardware, terminology and skills you will need

To 3D print something, obviously you will need a digital 3D model first. Fortunately, you can easily create one in waifu creation game. There are basically two options. COM3D2 and Koikatsu. COM3D2 has an excellent Suiginsoft's [plugin](#) that allows you to export character you want in one click. Koikatsu(and other Illusion games) have less brilliant Grey's Mesh Exporter plugin or KKBP [plugin](#) that is equally not quite stellar, but both are workable. Comparing these two games, COM3D2 generally has better quality models that require less work to make printable, but Koikatsu offers a significantly higher userbase. I advise you to visit COM3D2 and Koikatsu discords respectively to get information about them.

Normally you will want to export you character pre-posed from these games, as posing in Blender is a very tedious process.

Another option is to use .MMD(MikuMikuDance) model. They dramatically vary in quality, from total horseshite to absolutely brilliant, so your mileage will vary. Pretty much every single anime character in existence has MMD model someone has already created, so if you're searching for a specific character it is an option.

+++

After getting your hands on 3D model, you will need Blender or 3D editing software of your choice. One extremely important thing that you need to know before you start to do anything is to know the difference between **render** and **geometry**.

Geometry is the actual 3D object composed of many flat planes([polygons](#)). It takes shit ton of computer calculating power to make an object with many polygons show on the screen, so games use as little polygons as possible to define the object's form.

Render is a 2D image projected on the screen of your monitor. It is based on geometry of the object, but it goes through many layers of graphic effects to hide polygons and make the object look good with as little computer calculations required as possible.

Simply put, render is what you see in the game and it can not be printed no matter what you do, as it is flat 2D image.

What can be printed is the original geometry that the render is based on, the 3D object itself composed from flat planes(polygons). If you're still not following, here's an example image.



Render on the left(2D image, flat, unprintable). Geometry on the right(3D object, has volume, printable).

As you can see, the geometry is very blocky. Sure, it can be printed as it is, but it is quite an uncomplicated process to add more polygons, making it smoother and approaching render-like quality.

Smoothing is the main fundamental task that shall be done in 3D editing software.

Yet another problem is that a lot of details exist only in render. For example, folds on cloth are universally just a flat image created with render, there's no actual geometry behind them. Such details will have to be modelled manually.

And there is a final problem. Polygons, the little flat planes geometry consists of, have no thickness. It is not a problem for closed down voluminous objects like the body of a character, but skirts bows frills and similar objects are simply impossible to print, as objects without thickness can not exist in the real world. But it is possible to fix this.

Optionally, you might want to separate the figurine in a few parts. The reason for this is two-fold. First, it allows you to print bigger figures in small printers. You can go up to about 1/4 scale even with a common 15cm print height printer. Second, it makes painting the figure significantly easier. And that's the final task to be done.

+++

When you're done cleaning up the model and satisfied with the geometry, it's time to print it. Filament printers are not going to cut it, you **absolutely** need a resin one.

Resin 3D printer works very simply, it prints layers upon layers upon layers of ultra-thin film that together combine to form the model. Think of it as a multi-layered cake, except in this case there are thousands of layers. But it can't print something hanging in mid-air. That's where supports come in, they form the basis from which objects are printed. You will use a slicer software to do it. Modern slicer software has functions to automatically place all supports for you. It's not perfect and some manual oversight is required, but the whole process takes less than 15 minutes. Personally I use CHITUBOX as my slicer software of choice as it is free and does the job adequately, but there are many other options. After placing supports, the model is ready to be printed.

If you don't have 3D printer yourself, they are very common among tabletop wargame enthusiasts and you can ask someone locally to print a figurine for you. It would cost you about six-pack of beer or a goon sack on average, but obviously it depends.

If you have 3D printer, just print slicer's output. The newest water-soluble resins barely produce any fumes and require no chemicals to work with, making it a very satisfying experience. Don't get me wrong, resin is toxic **when consumed directly**, but the fears that resin will turn your house into a Fukushima Nuclear Power Plant Disaster are absolutely overblown. Keep your hands clean, don't print in your bedroom and you'll be totally fine health-wise.

+++

After the printer did its magic and manifested the figure in reality, two-thirds of the work was complete. All that's left is to remove supports, cure the print, sand prime and paint.

Removing supports is very simple. Submerge the print in hot water, let it soak for a bit for resin to warm up, and gently peel the supports off. Another option is to use a hobby knife to cut through them.

To cure the figurine, just place it under direct sunlight for an hour. There are UV-lamps or entire resin cure stations for sale that can also be used if sunlight is not available.

There is no way around not sanding. Some parts will require it, either to remove marks left by supports, smooth a surface, or to add some extra details that you didn't want to create in 3D editing software. Resin dust is not the healthiest thing to inhale, but once again don't do this in your bed and you'll be fine.

If you want to paint your completed figurine, there are 2 main styles. I'll call them 'japanese' style and 'western' style.

'Western' style is based on wargaming miniature techniques. It is characterised by sharp highlights and harsh shading done mostly with brush and heavy use of washes and filters. Information about it is readily available everywhere if you search for miniature painting in english. Mostly done with brushes.

'Japanese' style started from the same wargaming roots, but sharply diverged into its own thing in the 90s. Very subtle shading and highlighting in an attempt to emulate the flat colours of anime is the main characteristic of it. Finding information about it on english side of the web is quite hard, as it's japan-only thing for obvious reasons. Mostly done with airbrushes.

If you're just starting out, I strongly advise you to go with airbrushing and acrylic paints.

If you don't want to paint the figure yourself, once again wargaming enthusiasts come to your rescue. It is very easy to find someone who will paint the figure for you in this community. Costs of painting vary wildly depending on the quality you want, so I can't give you a ballpark figure for this.

+++++

Chapter 3. Blender

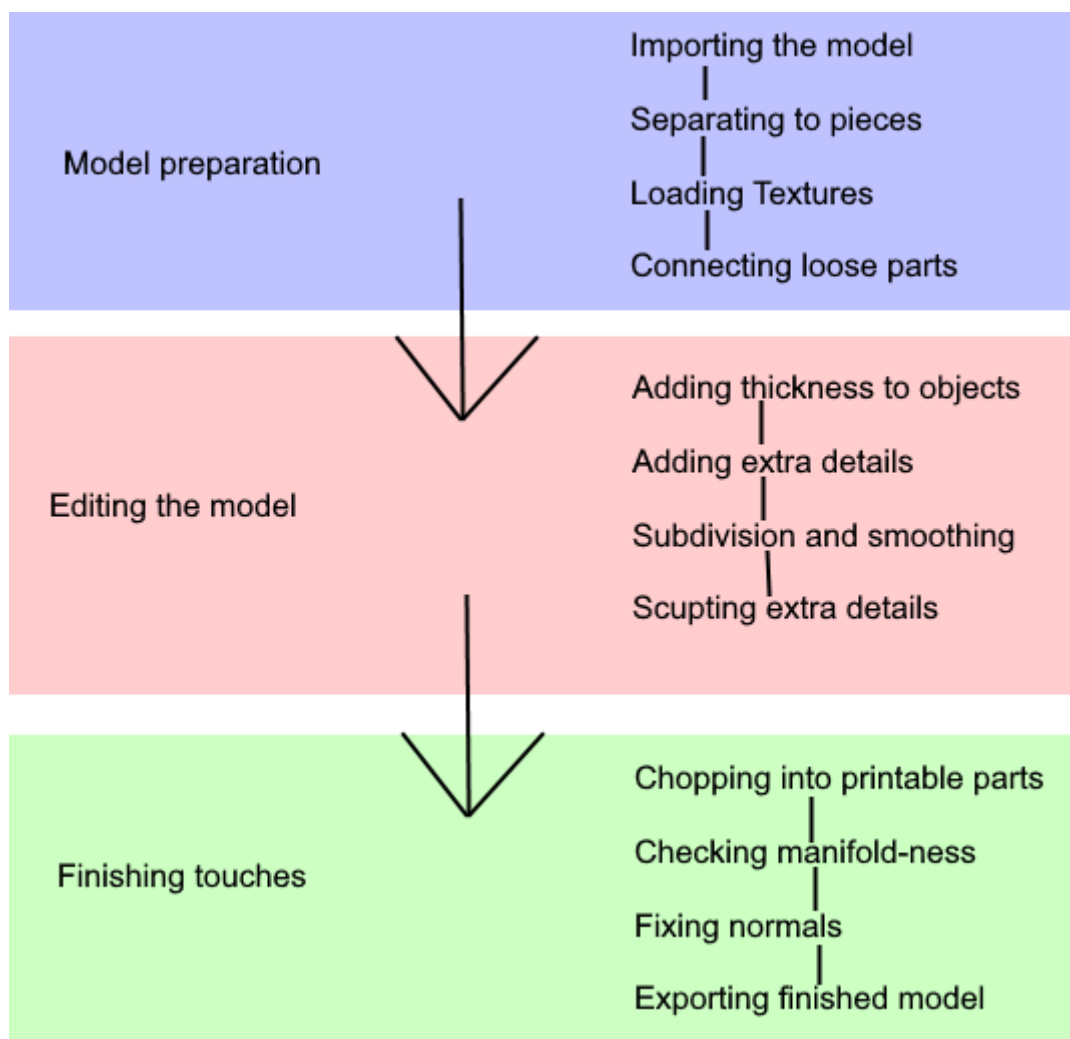
Direct instructions for processing 3D character model into printable sculpt.

I. Introduction

I assume you already have rudimentary knowledge of Blender. If you don't, watch any of the 5 minute guides on youtube that introduce you to it and show basic functions like opening files, selecting objects, camera operation, etc. Everything else I'll guide you through.

You don't have to strictly use Blender, but it's free and readily available so I'll go with it. Any knowledge and skills you gain in Blender directly translate to other 3D editing software, so starting with Blender and eventually switching to other applications if you want more freedom and better tools is a good solution

Below is shown the basic process that you will have to follow. While it might look daunting at first, it is a surprisingly easy and quick process once you get used to tools you'll be working with.



Model preparation deals with initial steps that you do, to make editing as smooth as possible. Solid prep work makes everything following so much more easier.

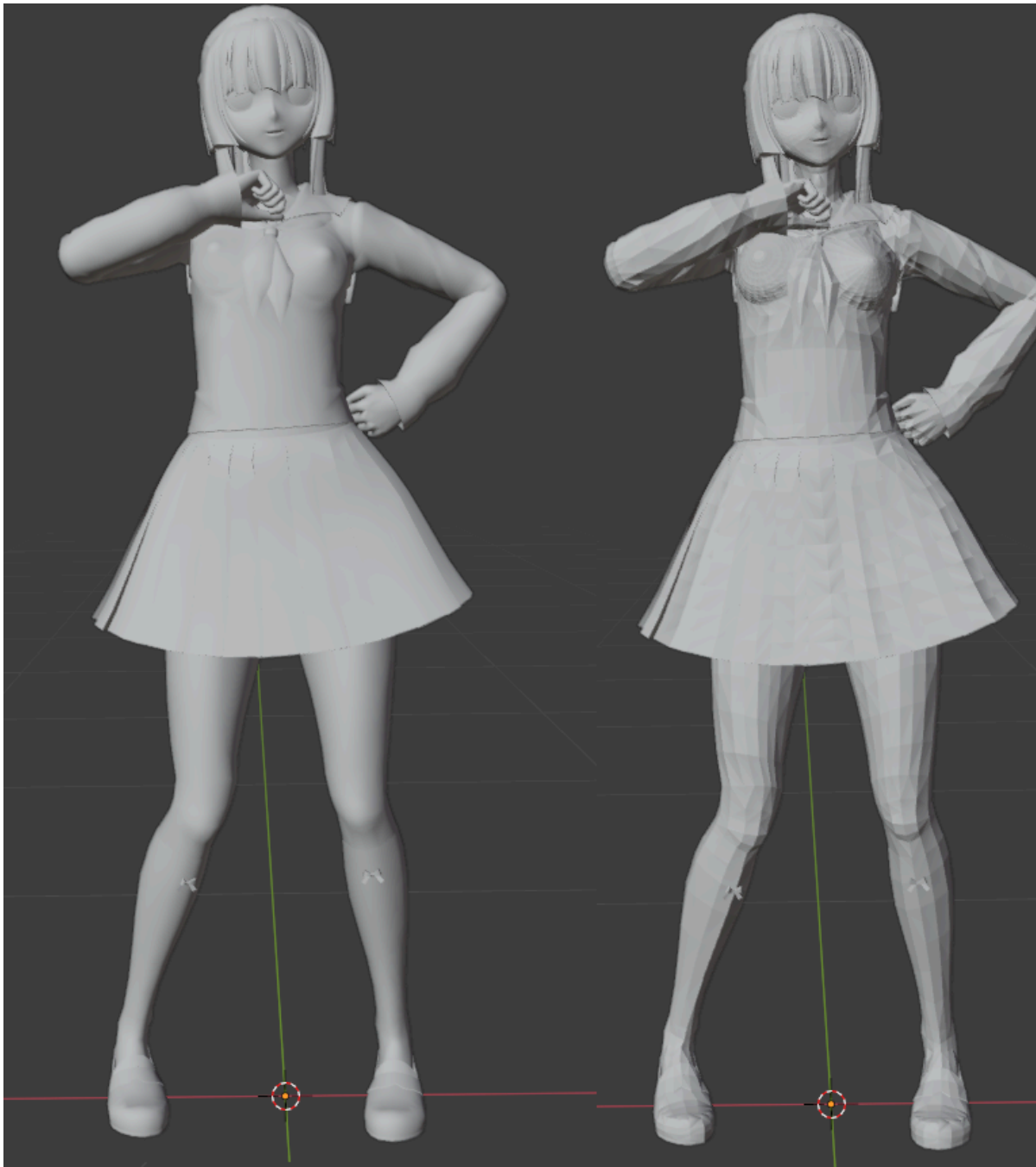
Editing is by far the most time consuming part, as you'll be directly modifying models's geometry. Fortunately, 'Modify' tools that Blender has immensely streamline the process, potentially making it just a series of clicks with little direct input from you.

Finishing touches are just that, finishing touches. The hardest part is over. Nevertheless, errors here might prove fatal and be the cause of a misprint. Do not rush the finish line.

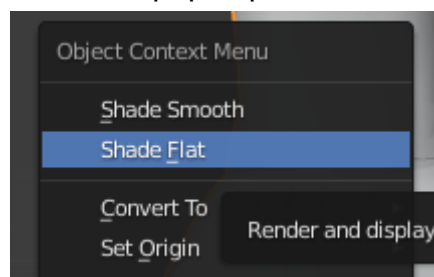
+++

II. Model Preparation

Right after opening the ripped model in Blender, it might look fine and smooth to you. **This is false. What you see is a render, not geometry.**

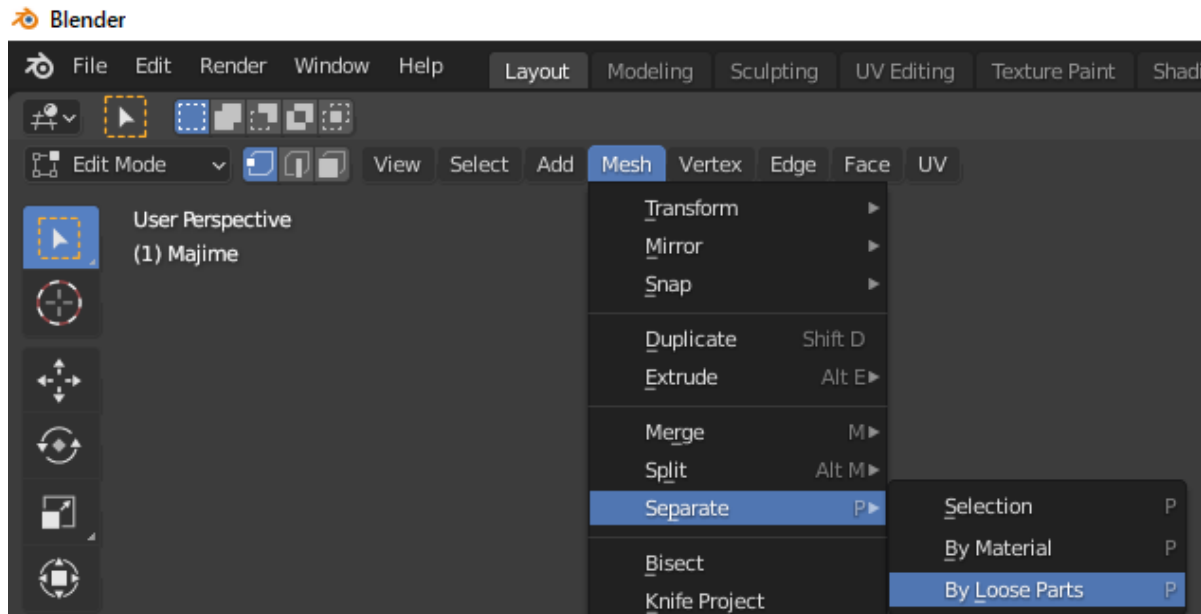


To disable this trickery, press A to select the whole model, right click on it and select 'Shade Flat' in the context menu that pops up.



Now you will be able to see the actual geometry of the object without any silly interactions on Blender's part. This is very important.

After you've set it to 'Shade Flat', enter the Edit Mode by pressing Tab key, select everything by pressing A key. The whole model should light up and you'll see the polygons comprising it glowing. Finally, select 'Mesh=>Separate=>By Loose Parts' in the upper left corner or use P hotkey and select the same thing.



Take notice of Blender Modes in the upper-right corner. Currently it is in Edit Mode

Editing the whole model in one chunk is very cumbersome and might make it impossible to do some steps later. With this action, the model would be divided into hundreds of little pieces, to make everything easier to handle later.

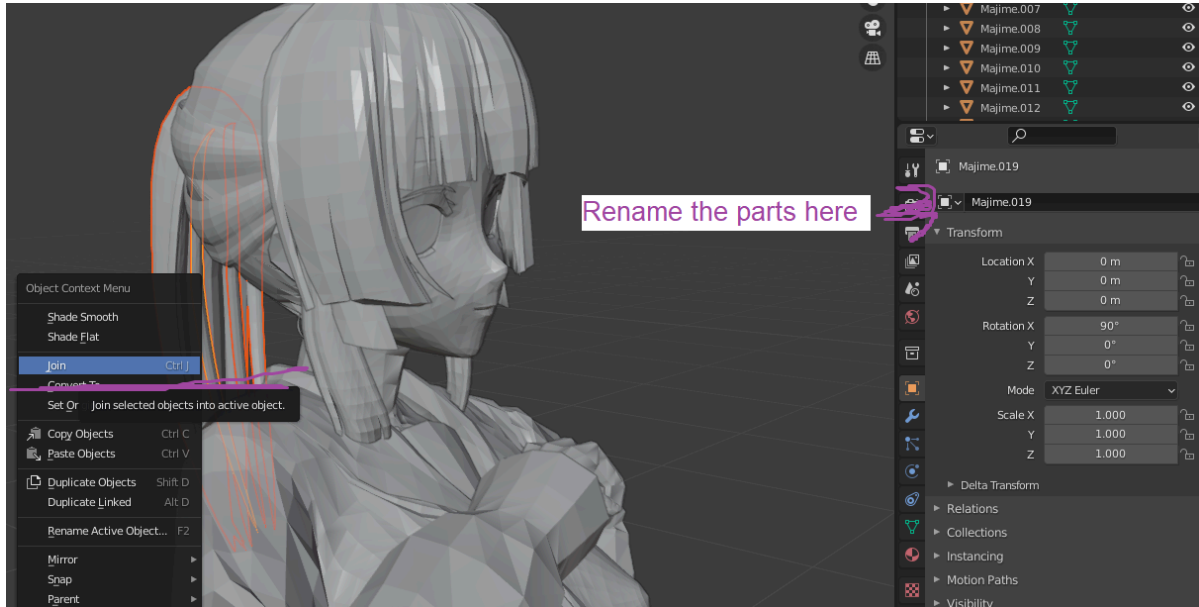
++

Next step is combining loose parts. Basically, you want to combine hundreds of loose parts of the model into easily manageable chunks that you will edit later. I usually combine all the loose parts into:

- 1) Front hair
- 2) Back hair
- 3) Hair extensions(ponytails, sideburns, etc)
- 4) Body parts
- 5) Eyes and eyebrows
- 6) Upper clothing
- 7) Upper clothing accessories
- 8) Lower clothing
- 9) Lower clothing accessories
- 10) Legwear(socks, thighs)
- 11) Legwear accessories

12)Shoes, boots, etc.

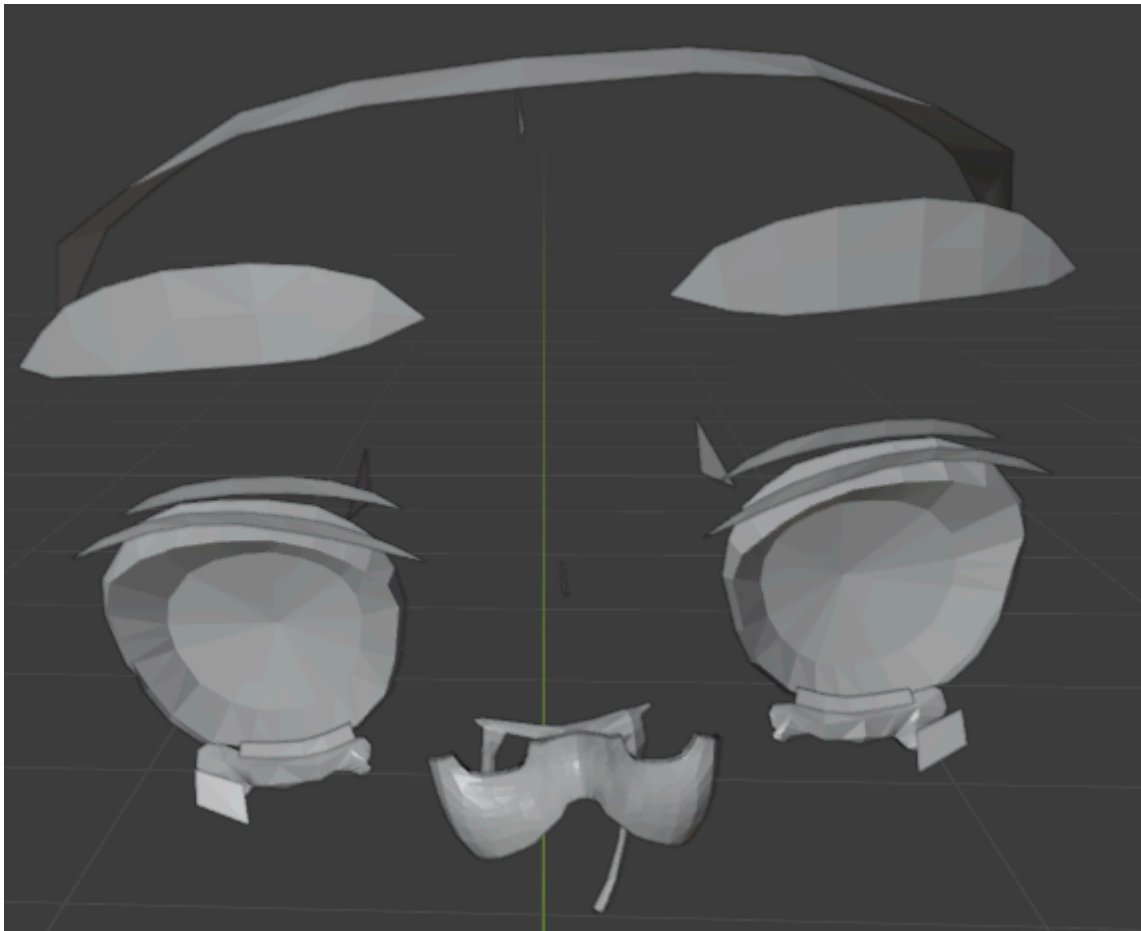
To combine parts into a single group, in 'Object Mode', simply hold shift while selecting all the parts you want in one chunk, right-click and select 'Join parts' in drop-down menu.



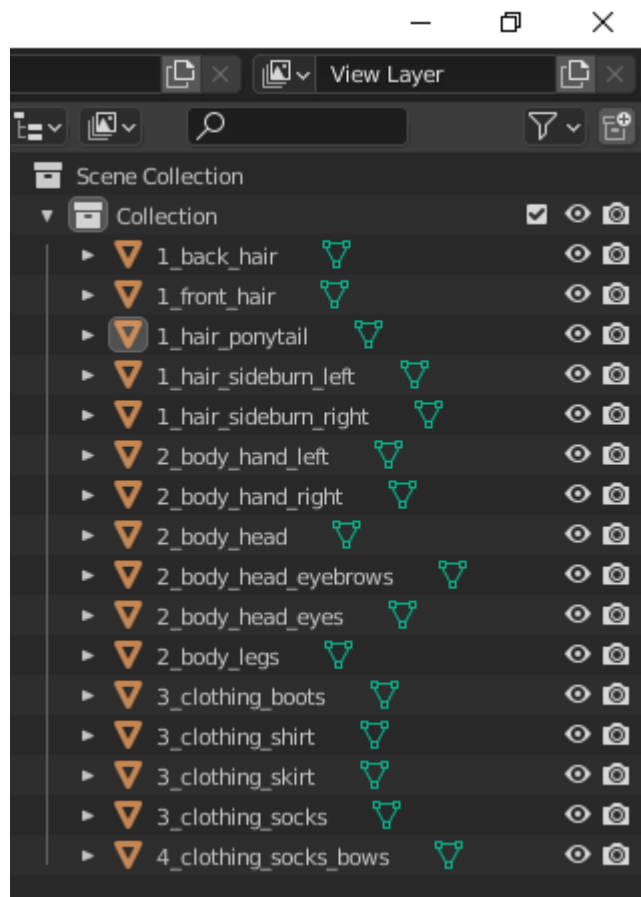
At the same time, rename the combined part so it would be easier to find and use it later down the track.

Objects might consist of many, many small parts. This is especially common with hair. To check if you joined everything, press H. It will hide the parts you have selected. If all's good, then continue with the next object. If you still see loose chunks of it flying around, press ALT+H to unhide everything and continue till you're done. It might take some time, but show proper diligence. If you fuck up and miss some parts, it might make the model unprintable.

Eventually you will find some odd parts that serve no purpose. Those are most commonly second skin around the character(used for painting textures like hot glue), random scrap inside the body of a character(used for playing emotions), random surfaces just floating midair(used for once again showing emotions). See image below for an example.



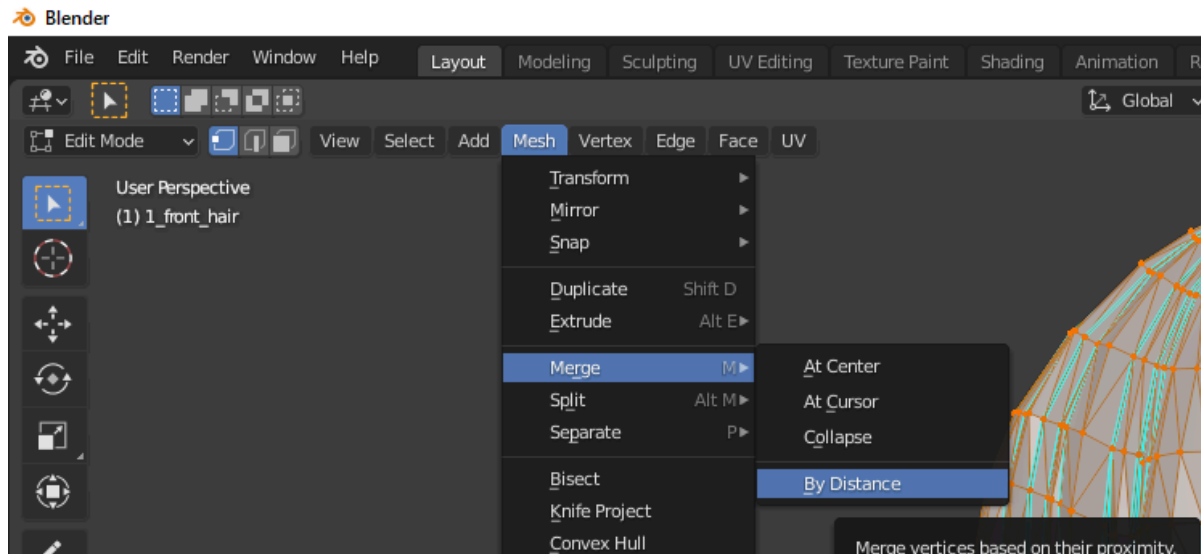
Just mercilessly delete those by pressing DEL key. You absolutely don't need those, in fact they'll likely cause trouble for the printer later.



Once you're done combing loose parts into manageable objects, you'll be left with something like this. I use numbers to make it easy to group stuff. You can work without renaming, it's sort of a small little thing to keep the workspace neat, handy and tidy.

++

Simply joining the objects is not enough though. You must make the geometry inside the object interconnected. To do this, select the object, go in the 'Edit Mode'(press Tab), make sure that every single polygon is selected, and use 'Mesh=>Merge=>By Distance' option.



This will combine the geometry of every single part in the chunk into a uniform one.

It is crucial to do this,

otherwise you will break your model later when you'll be doing smoothing.

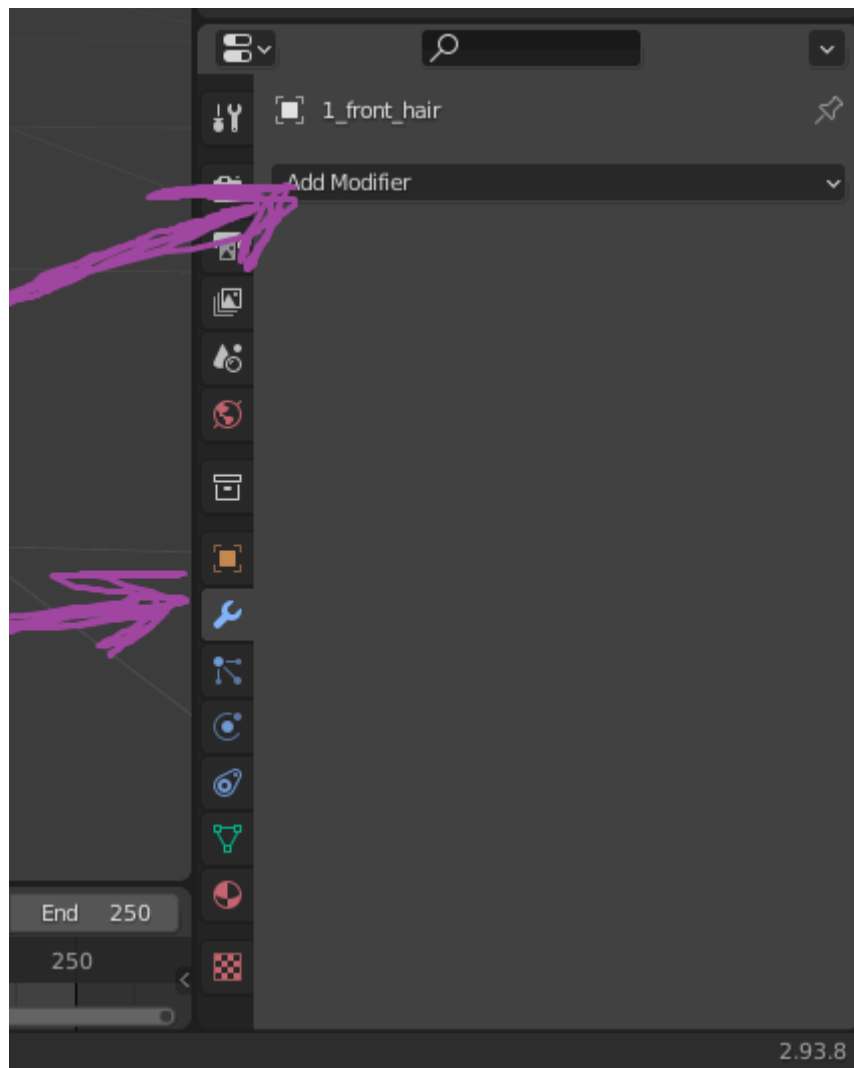
One little trick is to combine the whole model into one mega-chunk, merge the geometry, and only then separate into loose parts. It doesn't work all the time, but when it does work the model would be split into chunks that you can readily work with, skipping the manual joining part. It can horribly backfire and merge geometry you absolutely do not want merged though, so do this with caution.

With this step done, you finally have a model ready for editing.

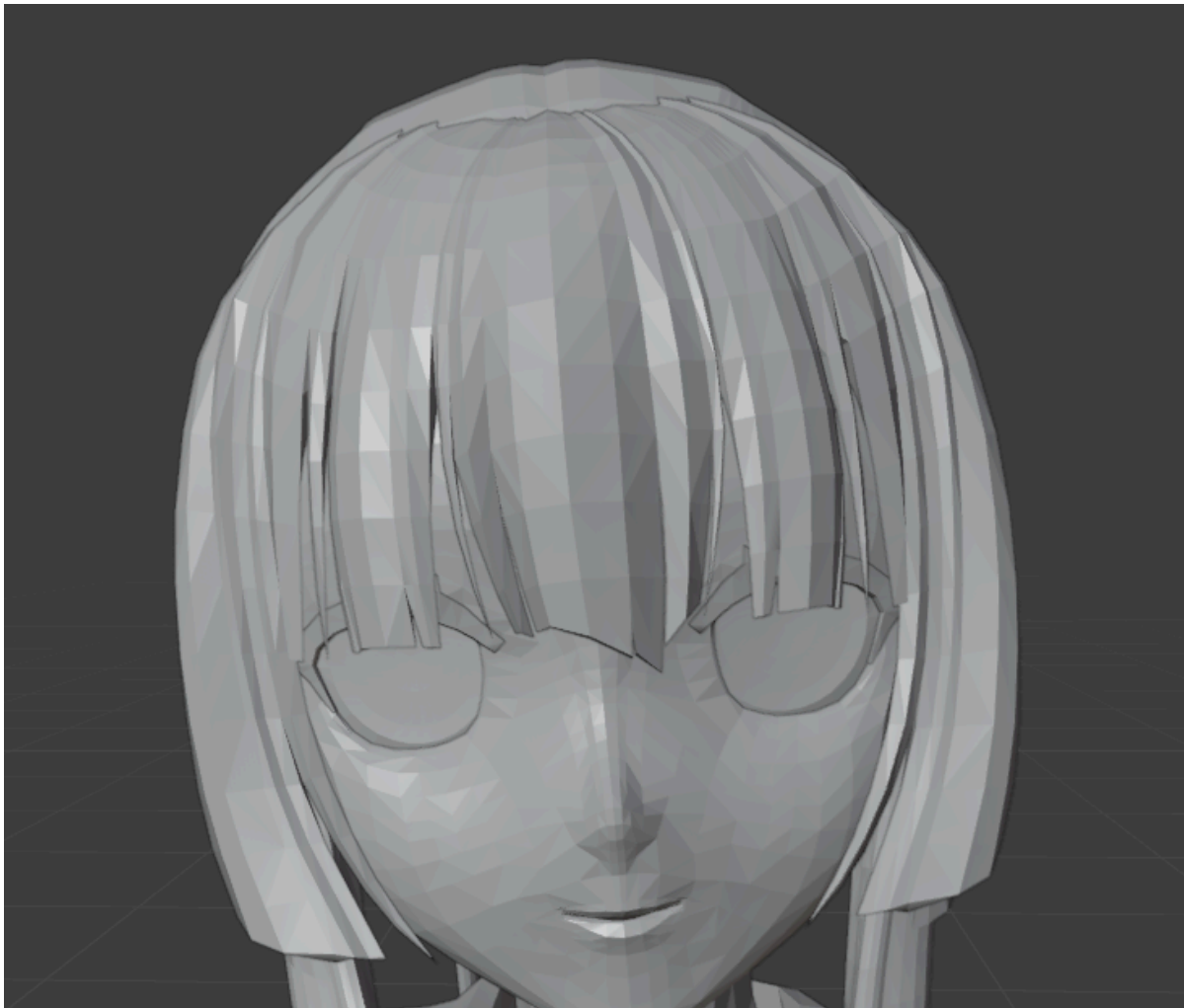
+++

III. Editing the model

Half the work will be done with 'Modifiers' tab in the lower left corner of the screen. Modifiers can be only applied in 'Object Mode'. Get familiar with those tools, as they will be doing almost all the work.



The first thing you should do is make sure all chunks are placed in the correct places. Rippers absolutely love to misplace parts like hair parts, accessories and the like.



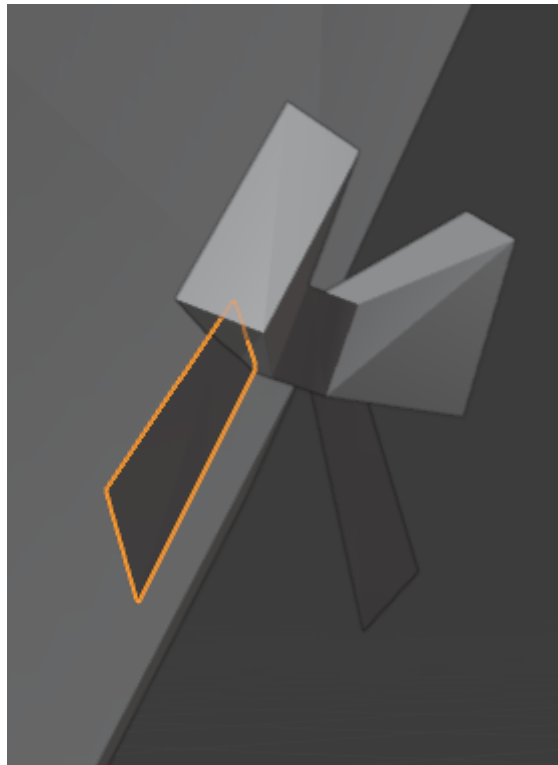
Notice how frontal bangs are placed super low in a model I've just imported. This must be addressed.

To move objects, select the chunk you want to move and press G key. Now you are able to move the geometry of the object to any position you want with your mouse. Once you're satisfied with the position, simply left click to confirm the placement.

Take a good look through the model, trying to find any misplaced chunks and place them in correct spots. At the same time, you have to be on the lookout for zero-thickness objects.

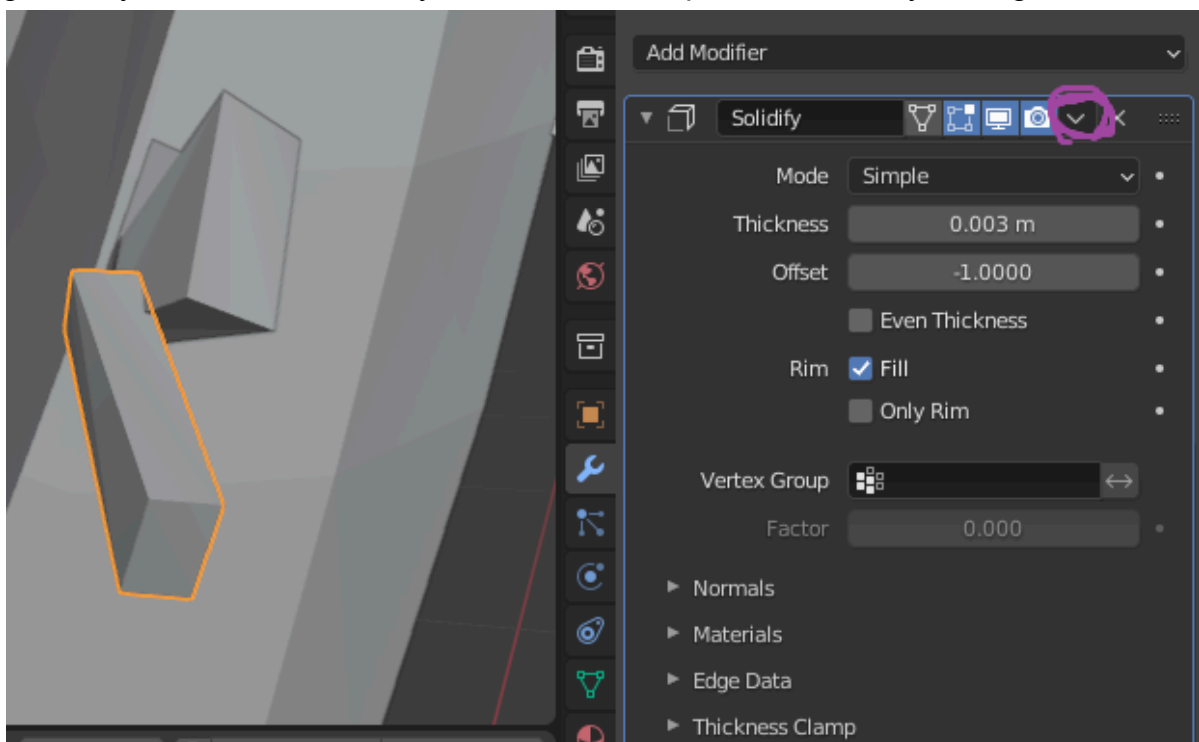
++

As I've said before, zero-thickness objects are impossible to print. Typical culprits are hair strands, ribbons, bows, skirts, sleeves and the like.



You can see the usual suspect. A piece of ribbon is flat, with zero thickness. This must be fixed.

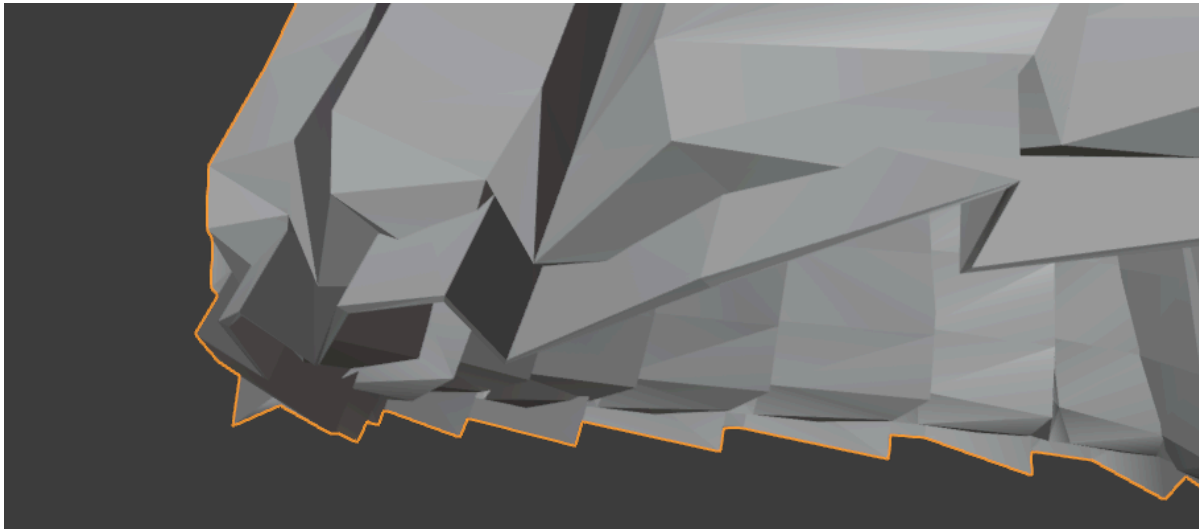
The most simple solution is to just add 'Solidify' modifier. It will create a clone of geometry some distance away and connect two parts, essentially adding thickness.



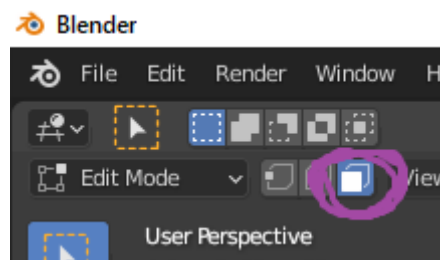
You can control how much thickness is added by editing the 'Thickness' in 'Solidify' modifier properties. I strongly advise to make objects girthy when solidifying with this tool. If there's not enough volume, the printer would not be able to replicate them.

After you're satisfied with the resulting thickness, click 'Apply' in a drop-box that pops when you press the button highlighted in purple on the image above.

Another option is to manually extrude faces. It requires a lot more hand input, but sometimes you can't escape it as 'Solidify' modifier damages geometry too much.

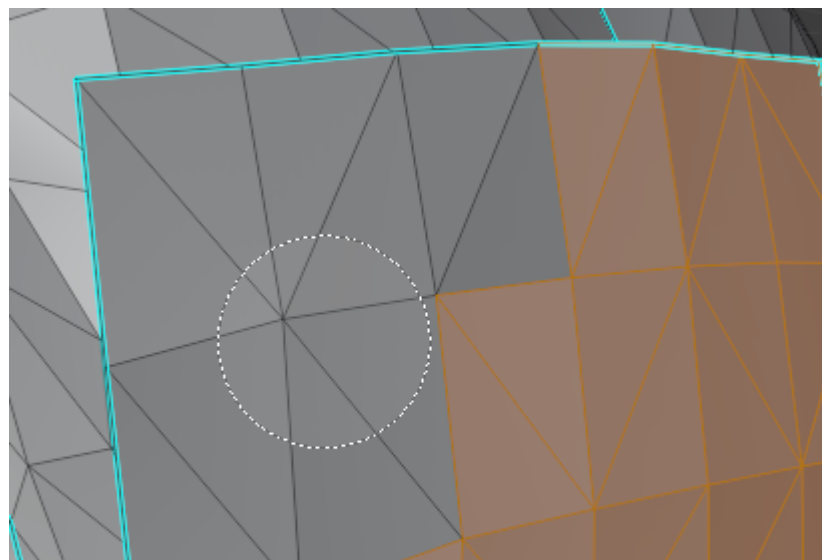


Typical geometry fuck-up that was caused by Solidify modifier.



To manually add thickness by extruding, enter the Edit Mode and press 3 on the keyboard to switch to face editing. You will see that the 3rd icon in the upper left will be glowing, indicating that you're able to edit faces.

Press C to use the 'Selection' tool. You will notice that your screen cursor changed into a circle. Hold the left mouse button and move

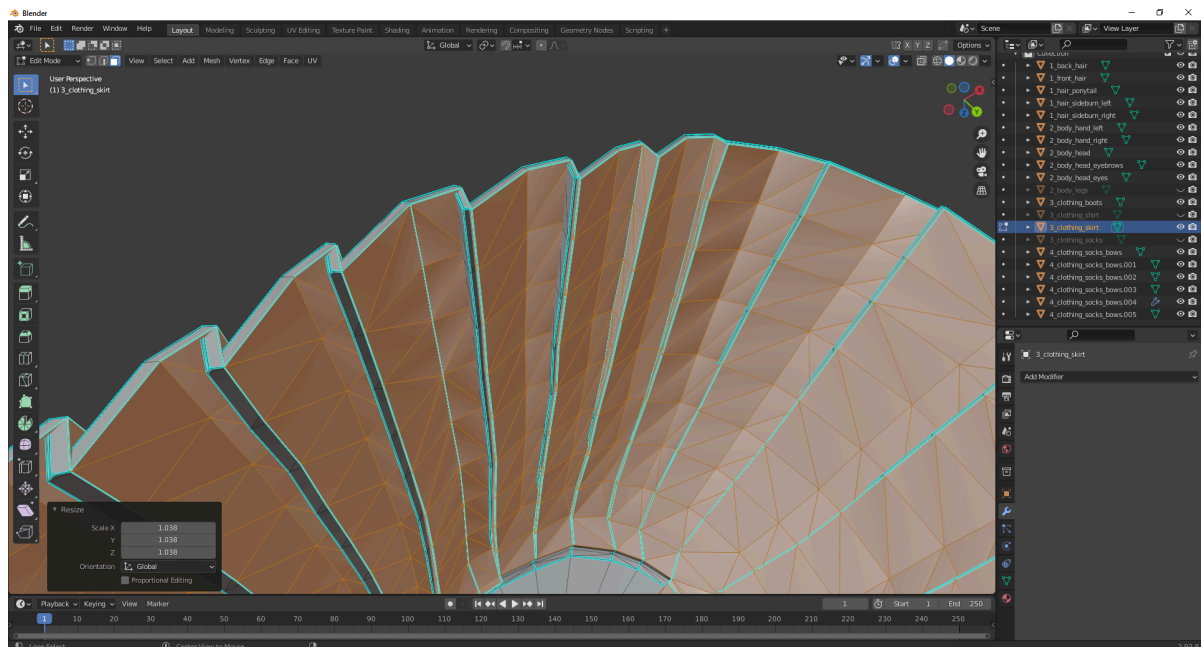


the circle around to select faces you want to add thickness. Holding the middle mouse button removes the selection instead. Right-click confirms the selection

When you have selected every face you want to add thickness, press Shift+D to duplicate them and immediately left-click to confirm. Do not move the mouse, the duplication must stay exactly in the same spot.

After you've duplicated the geometry, press E to use the 'Extrude' tool. It will allow you to move the duplicated faces while staying connected to the original surface. Thus, you'll manually add thickness.

If the object has a complex form with many curves(for example, skirt's bell shape), after extruding just a tiny bit press S key to use the 'Scaling' tool. Scale the extruded bit to be less then the original, and use 'Move' tool(hotkey G) in combination with resizing to achieve desired thickness.

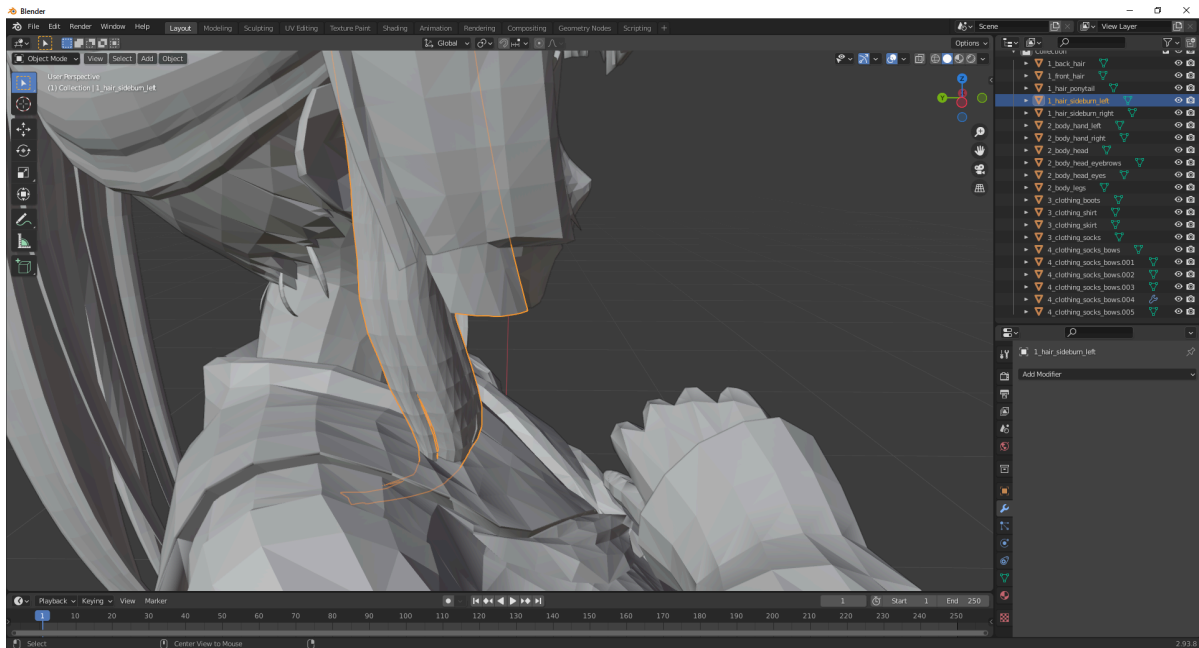


It is a rather crude method, but it works when the 'Solidify' modifier fails.

How much thickness is enough? Look at the picture above. That's about right how much you'll need for it to print properly, without any funky business.

++

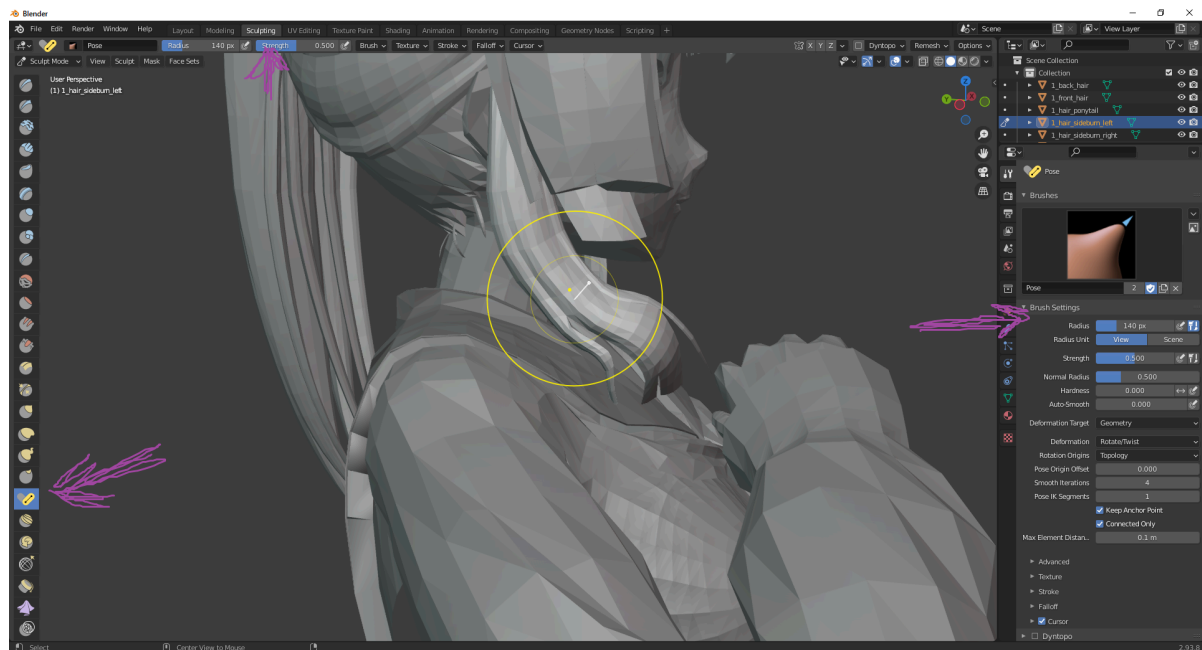
While looking around, you might have noticed some hair licks that were ripped without any transforms done to them.



As an example, look at this. Hair shouldn't go through time and space like that.

There is a tool that allows you to fix this in one fell swoop though.

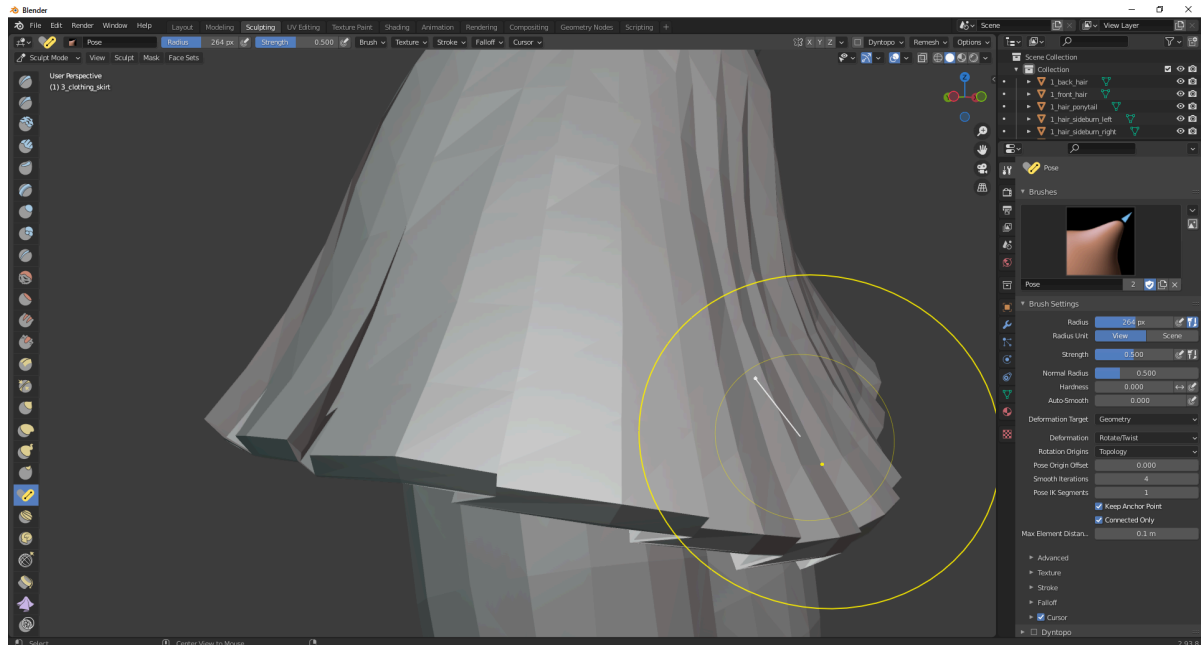
Select the part you want to edit, go to the 'Sculpt' mode in the upper-centre tab and pick 'Armature' tool.



It allows you to bend the object around a certain pivot point, akin to a lever. White line is the lever itself and you control its length by changing the 'Radius' value in the Properties tab. You can also play around with other values for that extra control, but it works just fine straight out of the box.

If you're getting loose parts stuck in the original pose and not moving, make sure you have unified the geometry with Merge.

This tool is very intuitive to use, allowing you to easily fix problems hair stuck in other objects provides. But its usefulness is not limited to just hair strands.



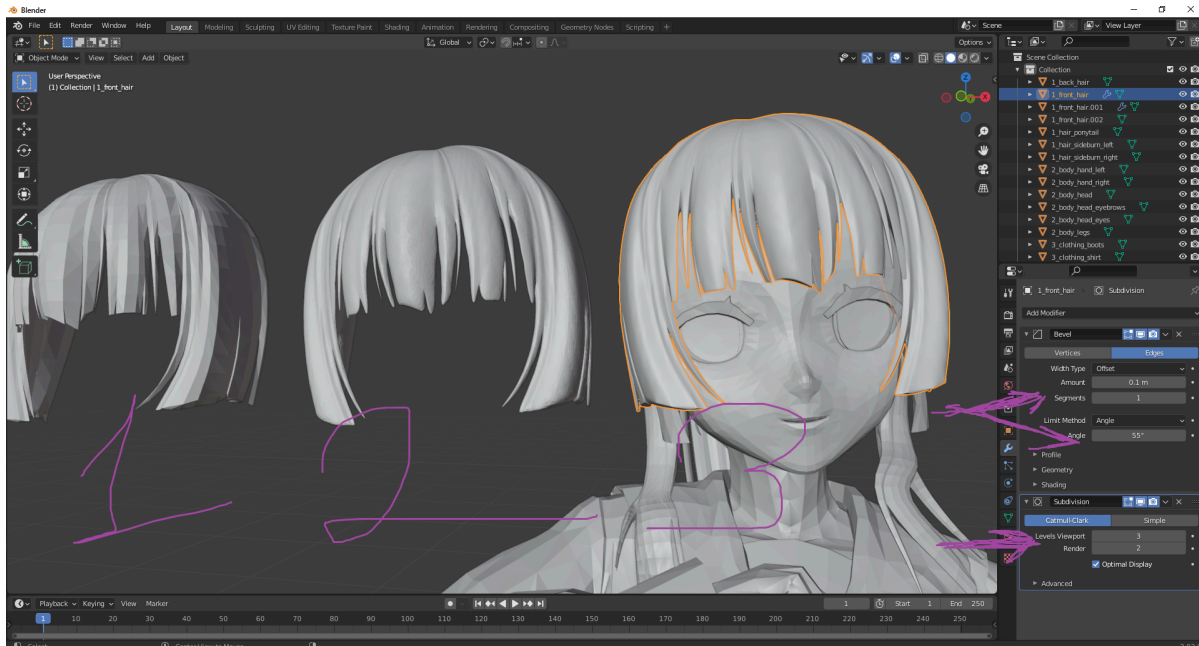
It can be used to quickly bend many objects in a similar manner. Make interesting folds on the skirt and tightly fit clothes on the character for example.

++

Finally, it is the part where we deal with the blocky shapes and smooth the model. It is done with a combo of two modifiers. 'Bevel' and 'Subdivision Surface'.

Just using 'Subdivision Surface' alone is not going to cut it. While it does wonders smoothing sharp edges and overall making the object look rounder, it absolutely destroys any sharp angles it might have had.

Thus, it is used in conjunction with 'Bevel' modifier which lets you control how many angled surfaces should remain. The order in which modifiers are applied matters utmostly. 'Bevel' first, 'Subdivision Surface' second.



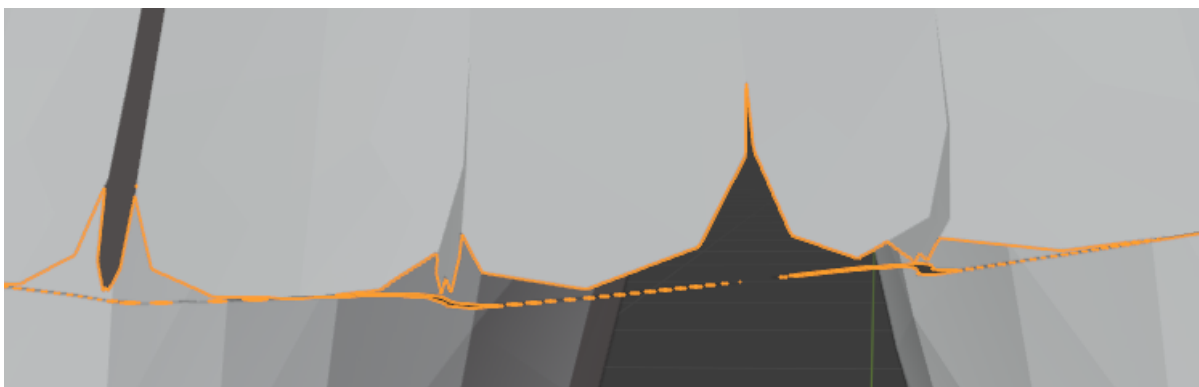
- 1 is the original ripped hair with no modifiers applied.
 2 has only 'Subdivision Surface' modifier applied
 3 has both 'Bevel' and 'Subdivision Surface' applied.

You can control the amount of smoothing done with 3 values.

- 1) 'Segments' controls how sharp the angles will be;
- 2) 'Angle' controls what angles should be retained;
- 3) 'Levels Viewport' controls how much smoothing will be applied.

And that's it, really. All you have to do is apply those 2 modifiers and play around with values a bit. As simple as that.

When you're done, do not forget to apply the modifiers. The order of application is also extremely important. First, you apply the 'Bevel' modifier, and only second you apply 'Subdivision Surface' one.



If you see that edges of the object are getting obliterated like on the image, you forgot to unify geometry with the Merge tool. Go back and use it.

Do note that your computer will absolutely love you while smoothing the surfaces. It takes very large amounts of computing power to process the model. Simply put, your computer will chug like hell if you go too trigger happy with the 'Subdivision Surface' modifier in particular. Usually I don't go beyond level 3 with it, as it's already good enough to have a smooth clear surface in the printed figure. Go beyond this point at your own risk.



This is how much a difference these two simple modifiers make. On the right is the original game rip, on the left is the one after going through every part applying 'Bevel'

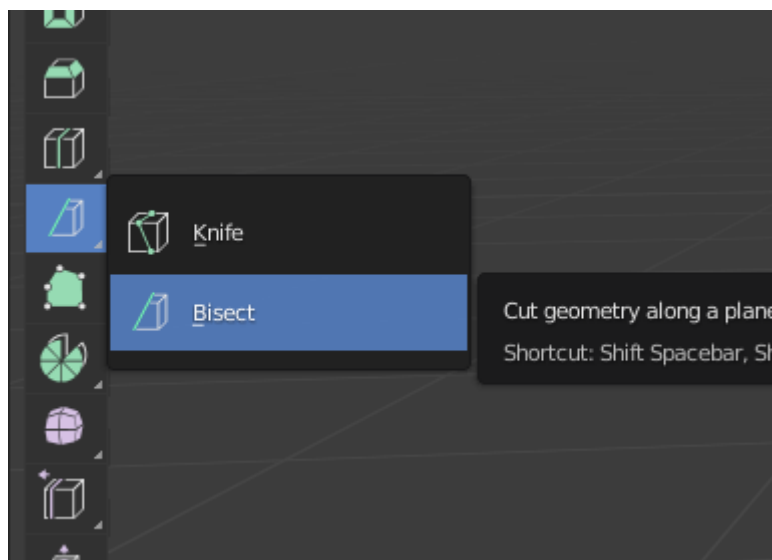
and 'Subdivision Surface' modifiers. All these going through the hoops was for this singular moment, to get a full printable, actually smooth 3d object.

++

IV. Finishing touches

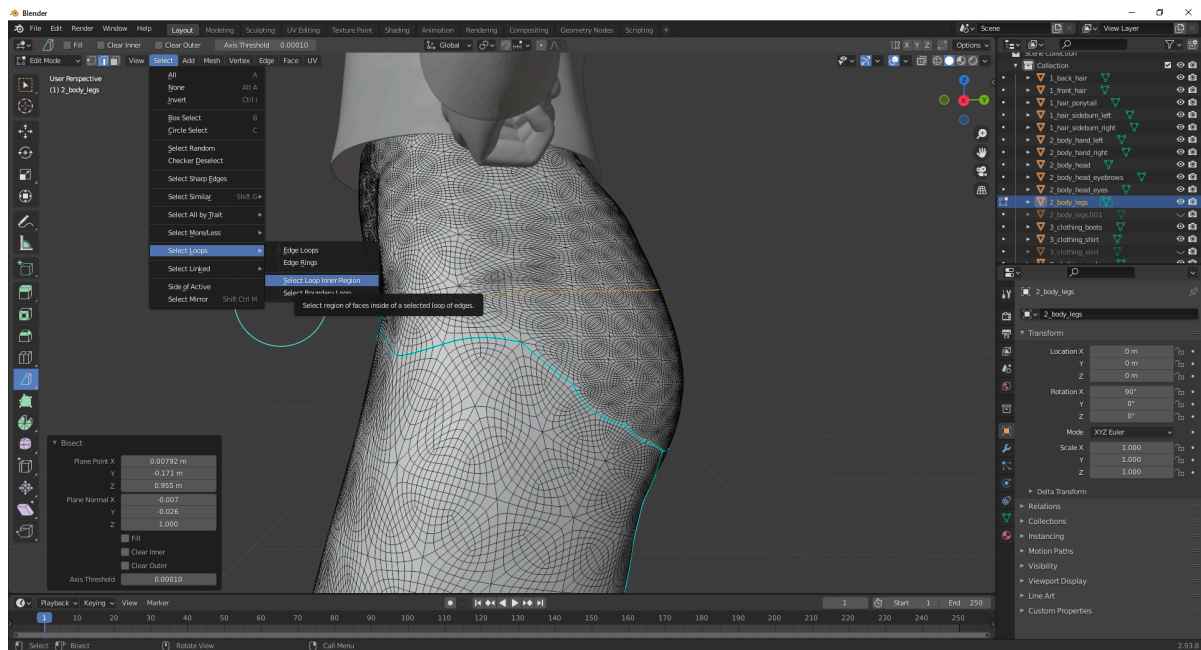
Now that you're done with editing the model, it's basically ready for printing. But if you want to make it easier to paint the printed figure or want to print a bigger figurine in a small printer, you might want to chop it to pieces.

The easiest way to increase the size of the figurine is to chop it in half. This will allow you to basically double the scale of a model on exactly the same printer.



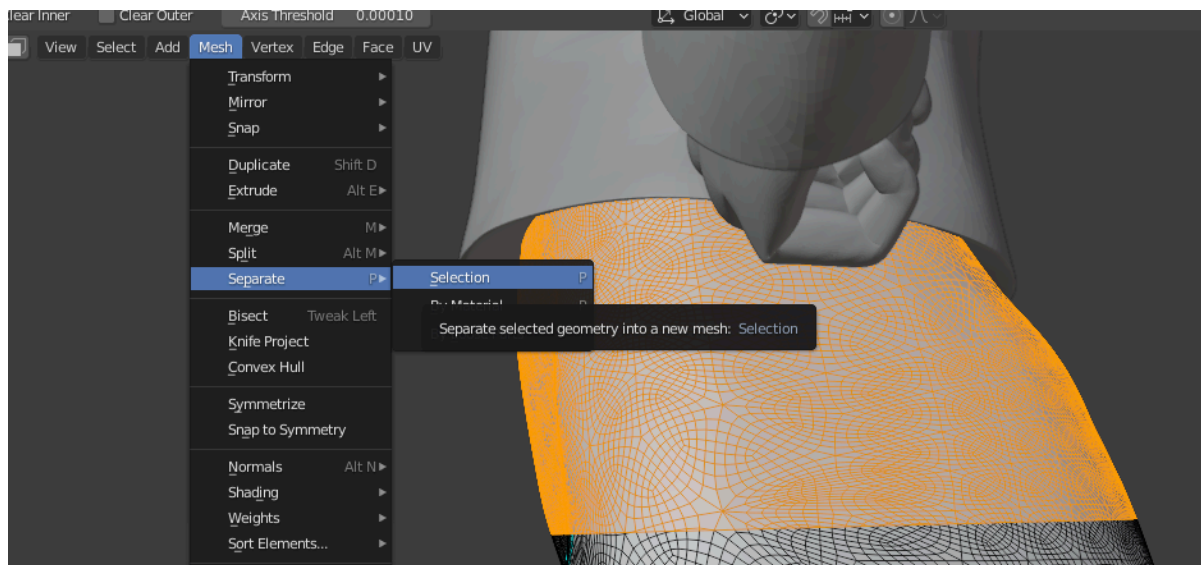
To chop the body in half, first hide every part that obscures your vision by pressing H (you can unhide them by pressing ALT+H later). Select the body of the figurine, go into the Edit Mode, select everything by pressing A, and pick 'Bisect' tool in the toolbar on the left.

Hold left-click, and cut the model right above the asscheecks with this tool. You will see the thin line appear. This will be the cut point.



Next, use the 'Select=>Loops=>Select Loops Inner Region' option. It will select everything either above or below a certain point.

With everything selected, use 'Mesh=>Separate=> Selection' to rip the part in two halves.



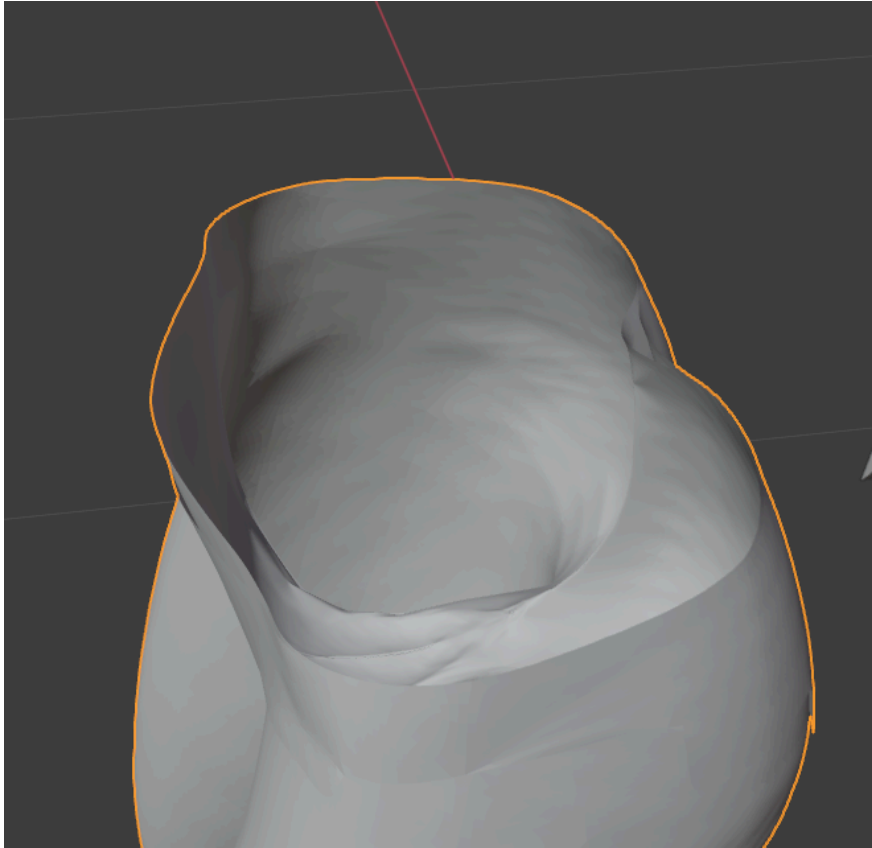
Now you have chopped the body into two parts. This point, right above the asscheeks, is perfect if your model has a skirt that will hide the seam later. If there is no skirt to hide it, you'll have to get creative and make the cut where something will hide it.

Resin printing is not a perfect replication of a 3d model. **There WILL be imperfections.** Resin also twists and expands a little bit when it cures. You MUST

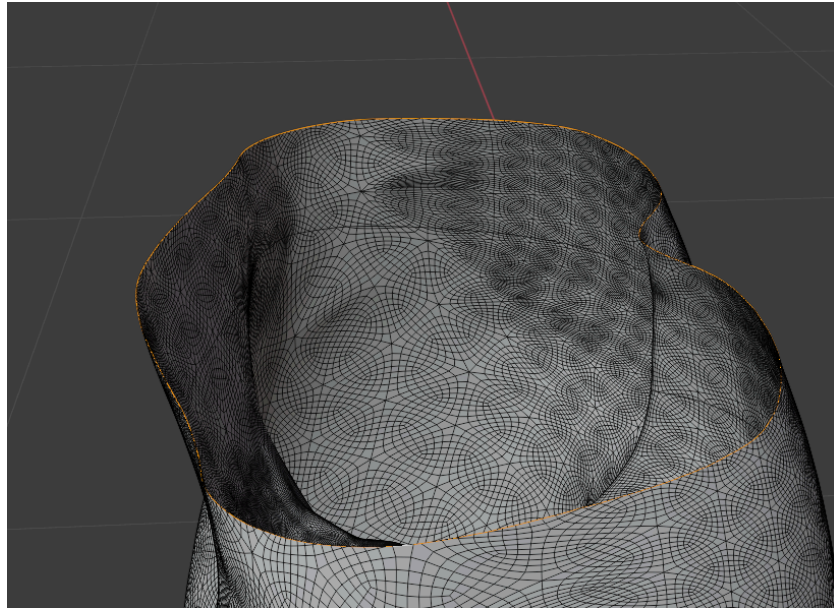
find a way to hide the seam lines between parts, or you will have to spend shit ton of time manually sanding parts to fit perfectly without any seams.

+++

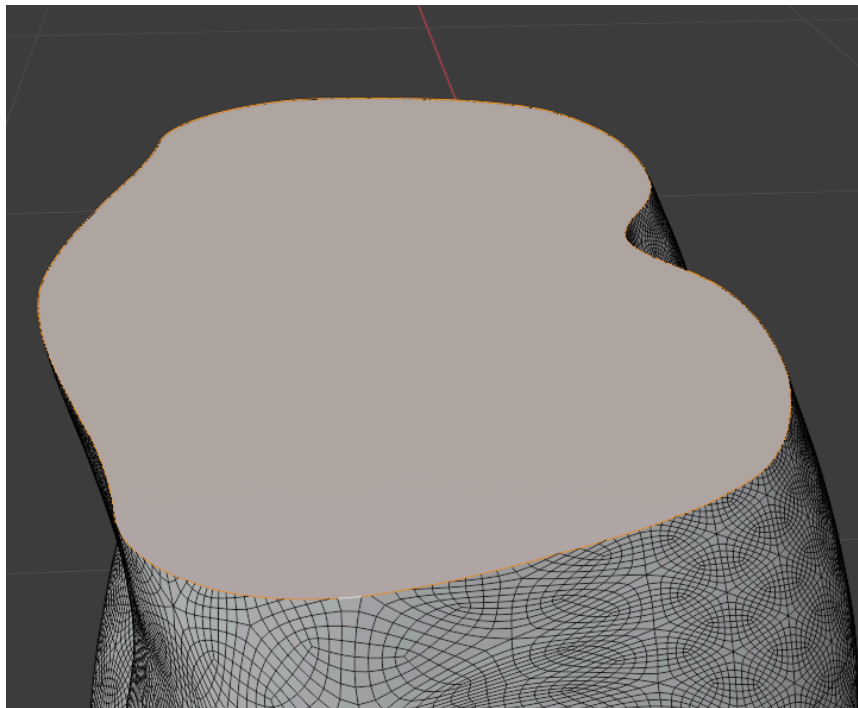
If you split your model, now is the best time to check if everything is manifold or not. Just take a good look around every part, looking for holes.



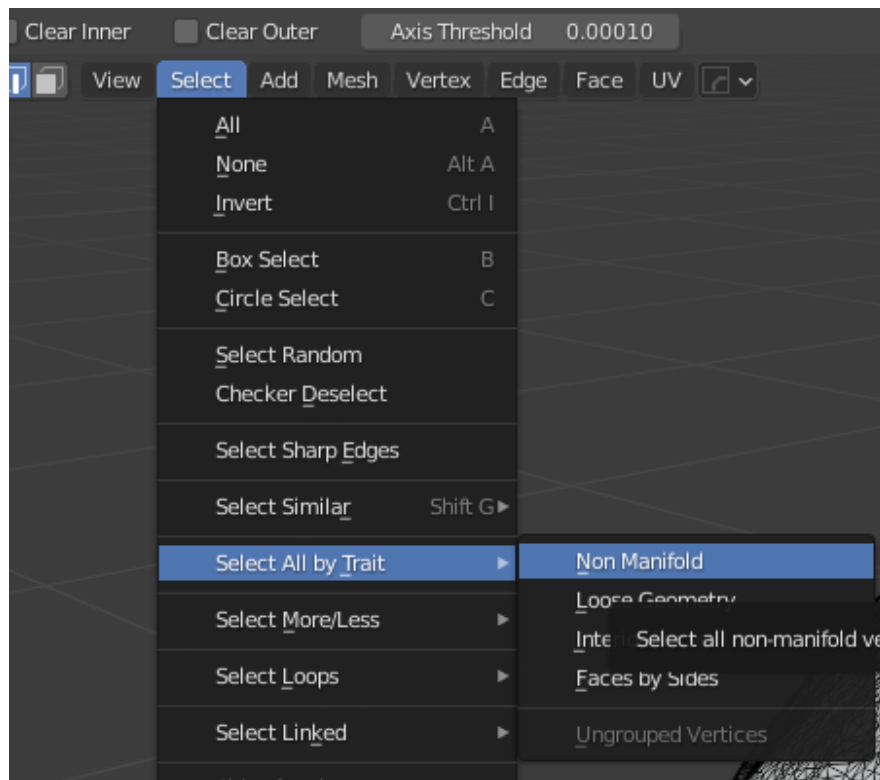
Sure enough, after splitting into two parts left a gaping hole. To fill it, go into 'Edit Mode', press 2 to enter 'Edge Select' mode, and ALT+Left click on the edge of the hole. This will automatically select the whole edge loop around the hole.



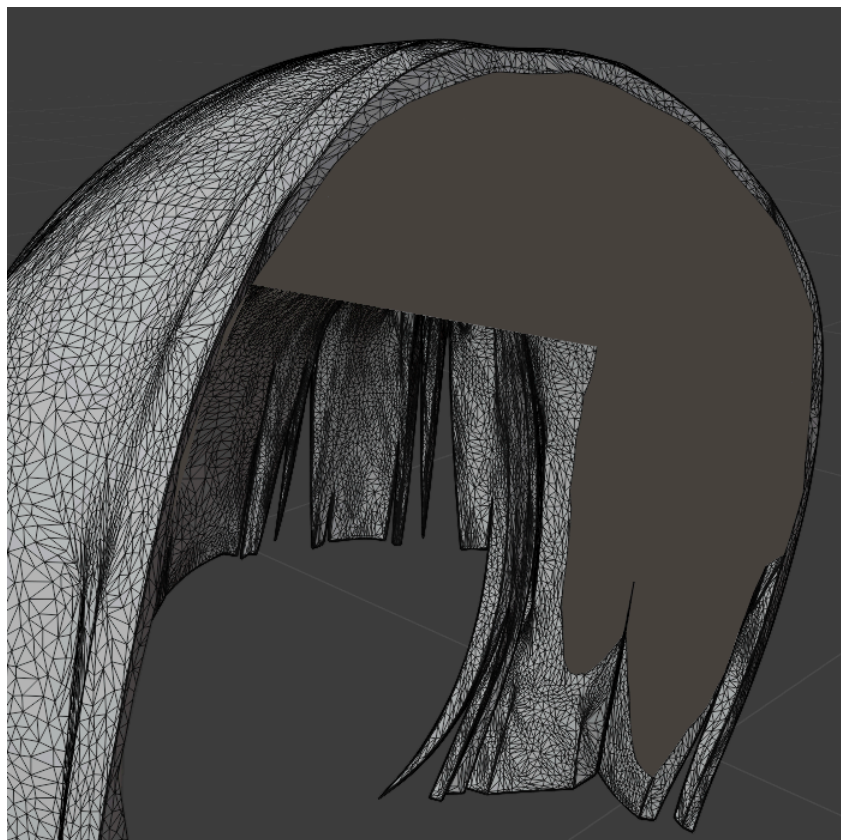
You will see it light up with orange. Now you just press F. It will be filled with one giant polygon.



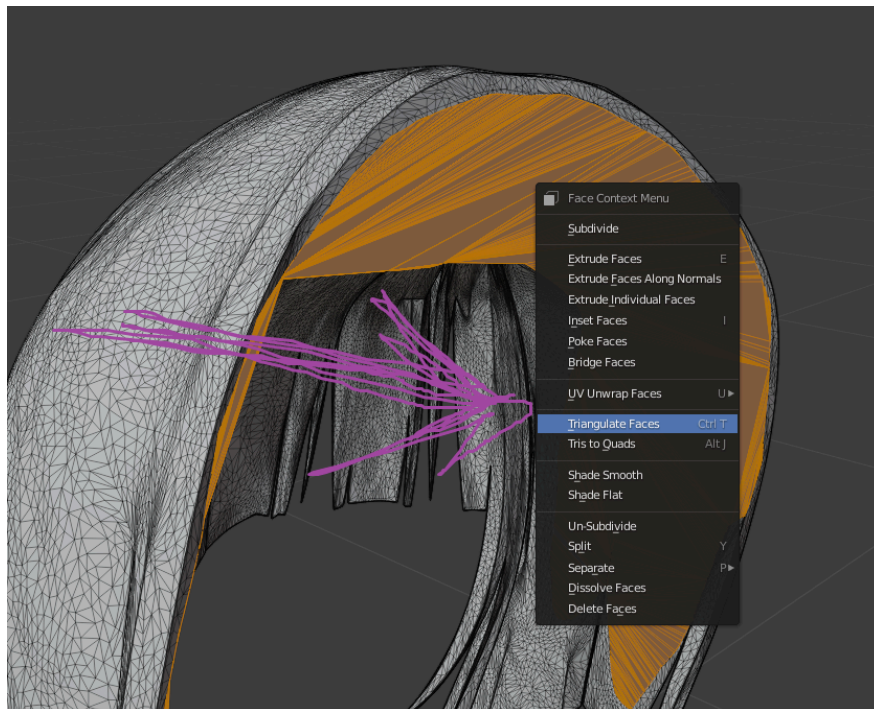
If ALT+Left Click hasn't selected the whole edge, you have two options. First one is hold SHIFT while ALT+Left Clicking, steadily selecting everything. Second one is to use auto selection with `Select=>All By Trait=>Non Manifold` option. It will select every single loop edge, so you will have to de-select ones you don't want to be filled later.



If the surface is curved, the polygon will break the geometry, making it impossible to print it. You have to cut it down into many smaller polygons first, as is in the case of image later.



Go into 'Edit Mode', press 3 to enter 'Face Selection' mode, select this one huge polygon, right click it, and in the context menu select 'Triangulate Faces'.

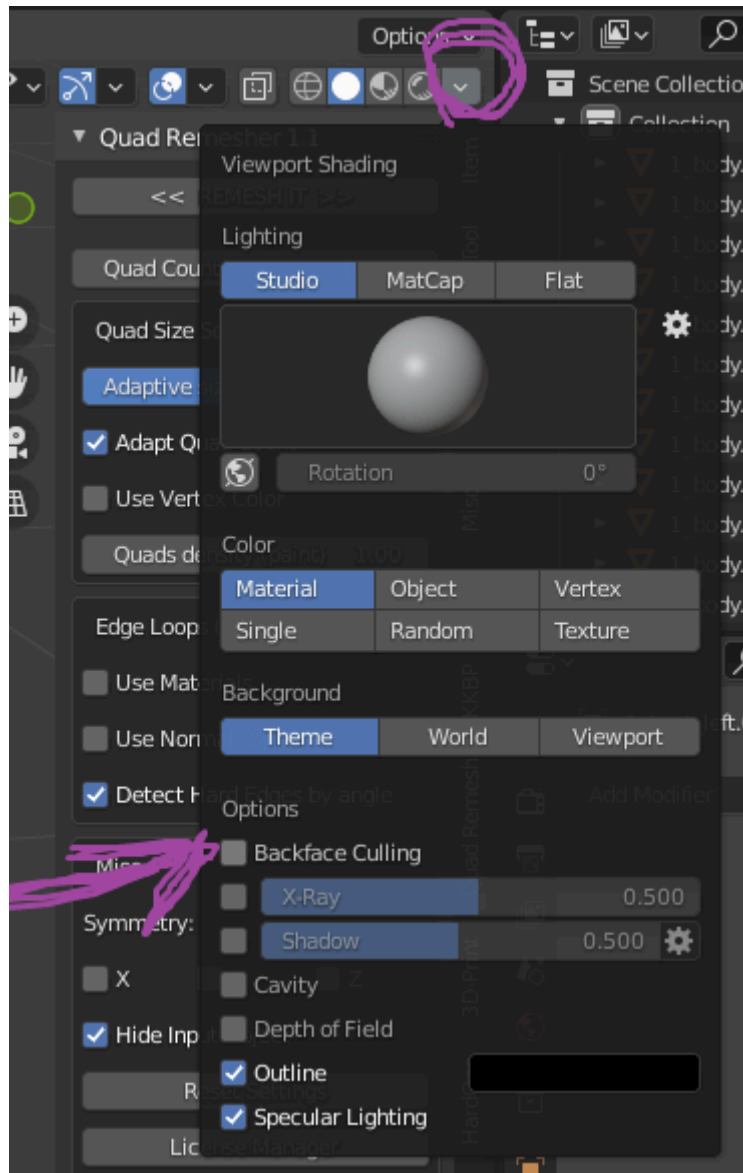


It will automatically be separated into many small parts, fitting the curve neatly.

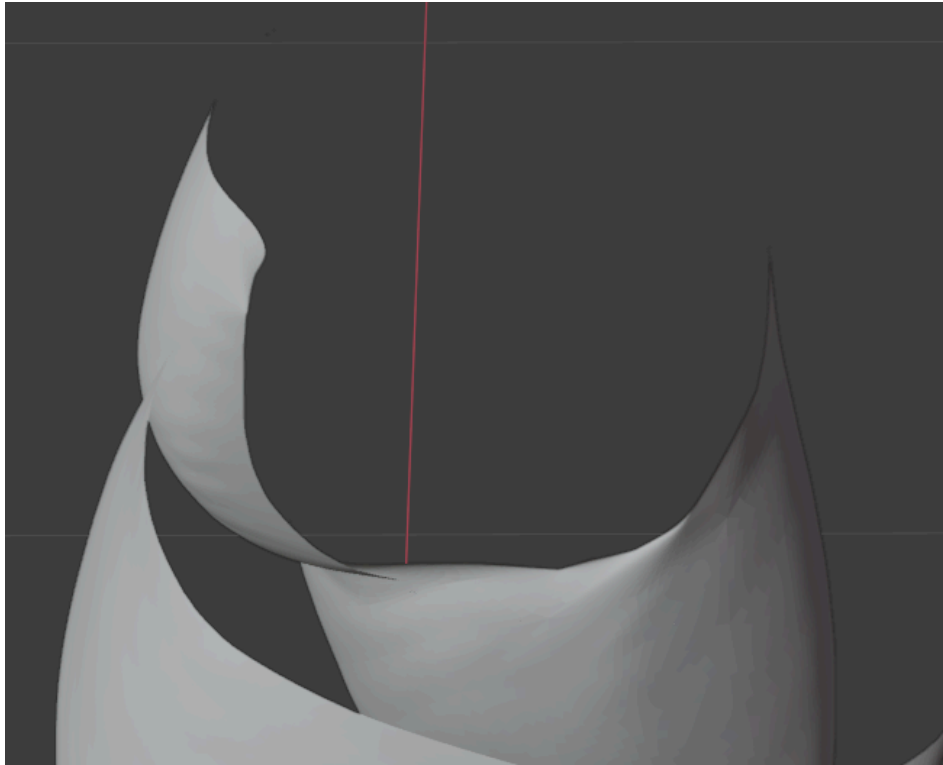
++

Once everything is manifold, you have a final part to do. Check normals. What normal is? Basically it is direction polygon is facing. If the polygon is facing outside, it will be printed. If the polygon is facing inside, it will not be printed. You must have both manifold geometry and correctly placed normals for a model to be printed.

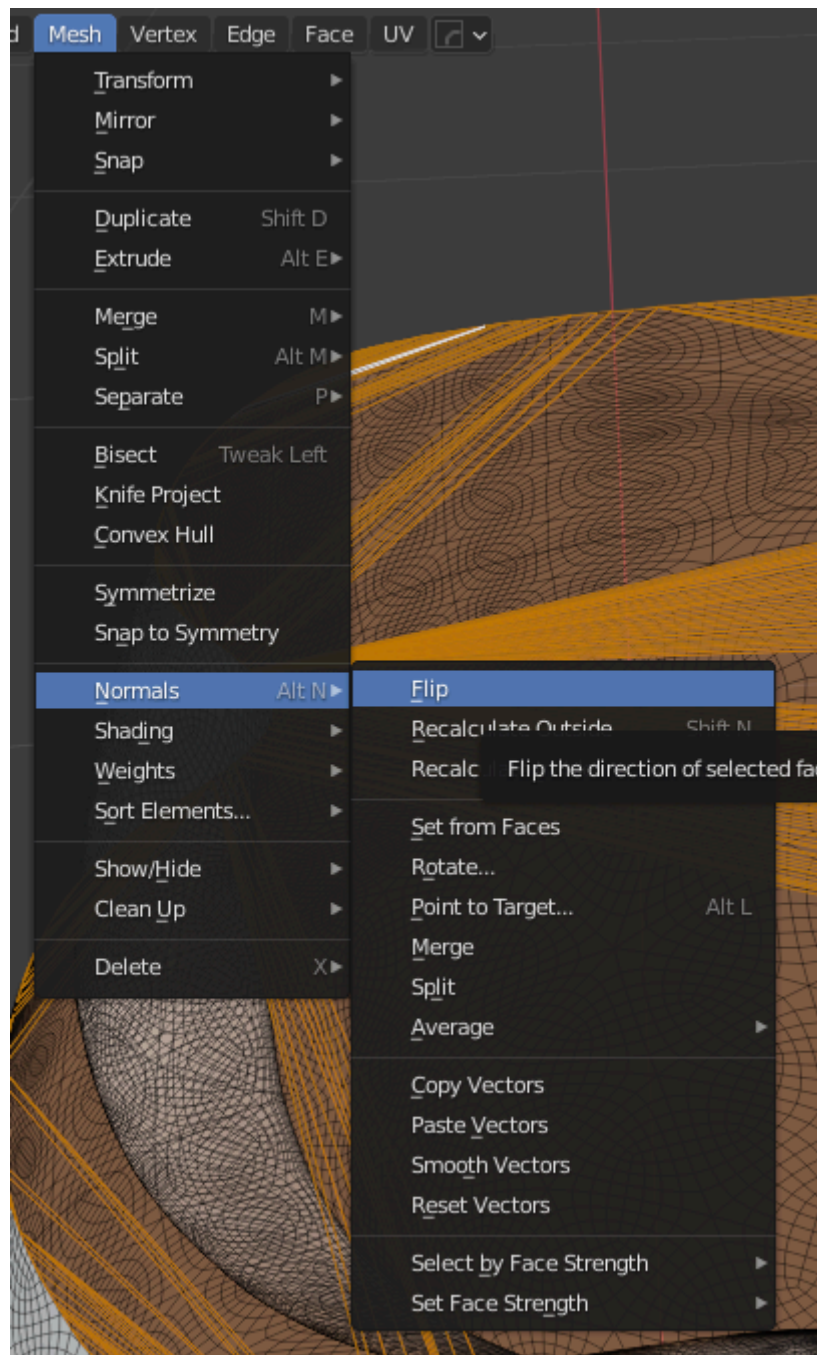
Go to 'Viewport Shading' in the upper-right corner and select 'Backface Culling' mode.



It will not show polygons that are facing you the wrong side. Take a look around the model, checking for holes that suddenly appeared that weren't there before.

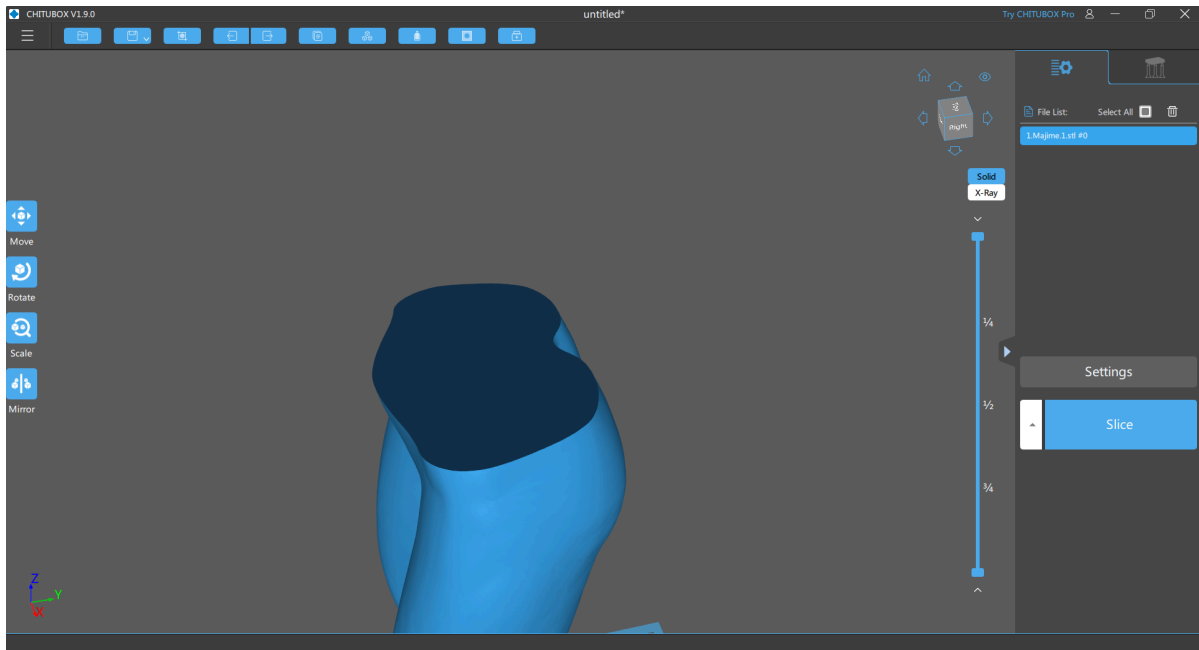


This is an example of bad normal in action. I know I filled this hole before, yet it's still there. To fix this, go into 'Edit Mode', press 3 to enter 'Face Selection' mode, select all the polygons with bad normals and use 'Mesh=>Normals=>Flip' option in the upper-left corner.



You will instantly notice that all these polygons are no longer see-through. This fixed them.

In slicer software for 3D printers, polygons with wrong-sided normals are usually highlighted in black.



If you missed a few bad normals, this will be a clear and final warning. Do not forget to fix normals, or they **WILL** mess up the print big-time.

++

Finally, all the work with the model in Blender is done. You've finished the model. It's ready to be printed. Simply export as .stl and you're almost ready to print.

+++

V. Extra Actions

This chapter will deal with optional steps. They're not required to 3D print a figure, they're just optional actions that will either add more details or make it easier to paint later.

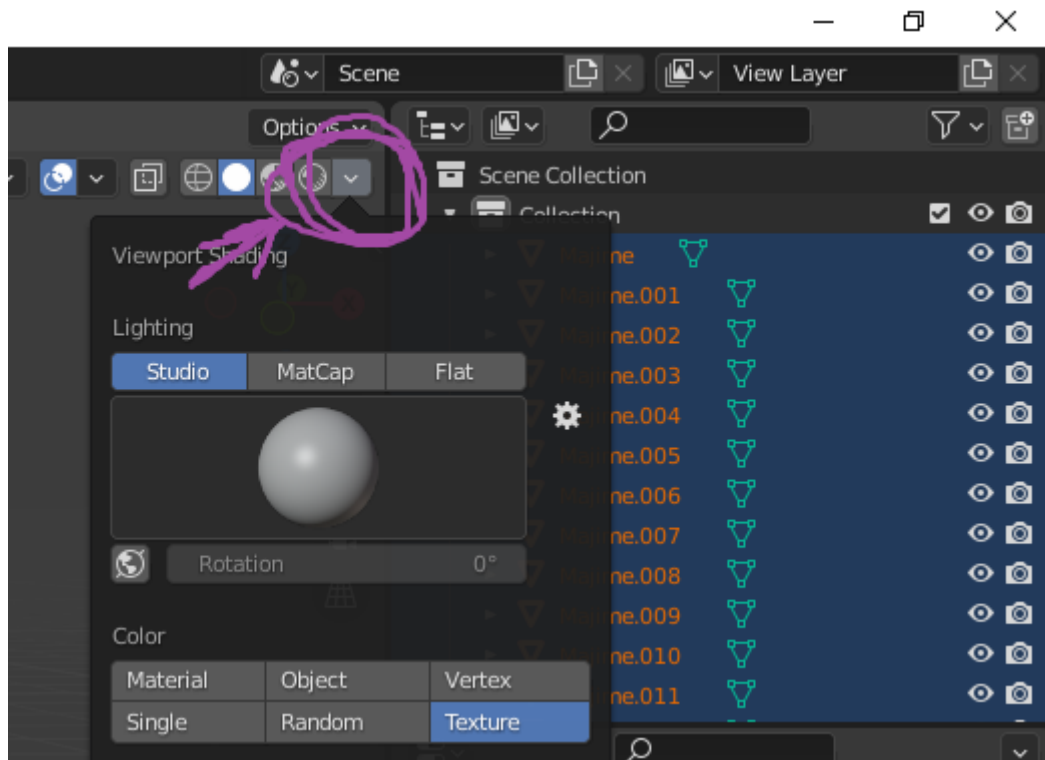
Take a look at the workflow to see where these steps are to be done. Some actions can be done only during specific stages of editing.

++

Textures are basically flat images projected on top of geometry, to give it colour. Think of them as paint. Textures are completely unnecessary if you don't plan on manually adding extra details or sculpting extra parts. Take a good look at the model, see if it's fine as it is, and consider what you want to do with it.

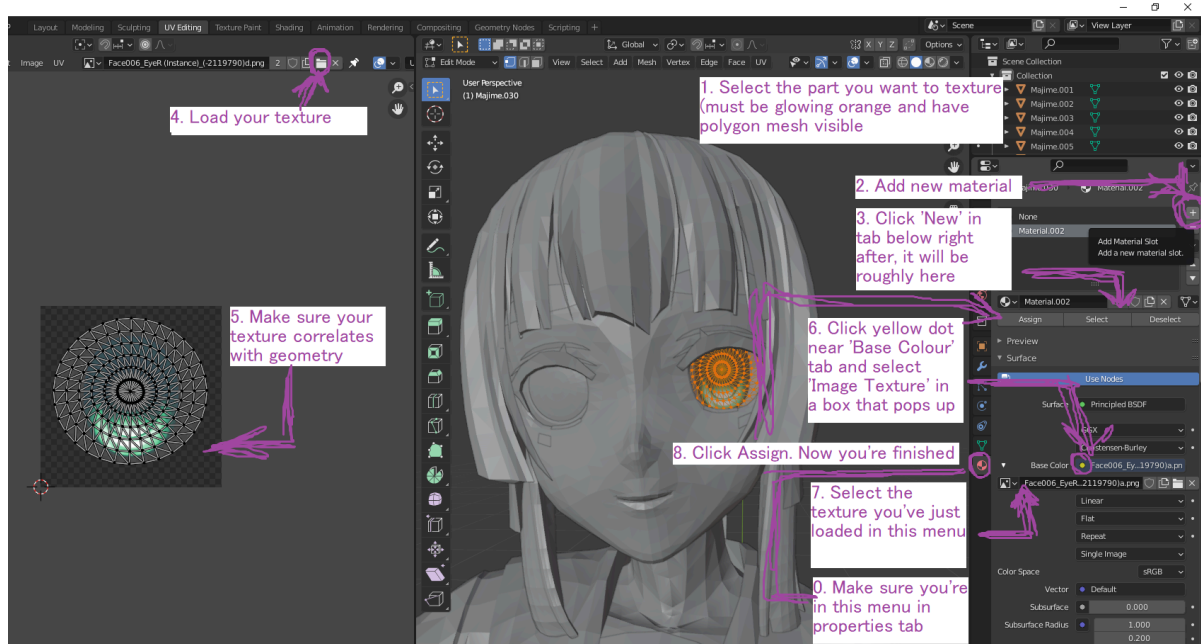
In case you DO want to add or sculpt details, textures serve as an immaculate guideline. They can only be easily loaded right after you imported the model and separated it into loose parts but before you started combining them, loading textures later down the track would prove to be extremely time consuming and hard.

First, check if textures were loaded automatically. In 95% of cases it will naturally happen. Press 'Viewport Shading' context menu in the upper right and select 'Textures'



If everything's alright, the model will instantly be painted with textures. Switch back to 'Material' and continue progressing down the workflow. Working with a grey blob is much easier than with a painted one, do not turn textures on unless you're specifically adding or sculpting new details and using them as reference.

In case textures haven't loaded automatically, you will have to do it manually. Check the folder with the model for textures, there should be a fuckton of image files. Those are the textures we need. Usually you can easily recognize what image correlates to what part of the model just with visual and a name. Select body part that you want textured (even if it's just a small chunk of something bigger, go one by one) and go to 'UV Editing' tab in the upper-centre bar. Now follow the procedure on the image below.



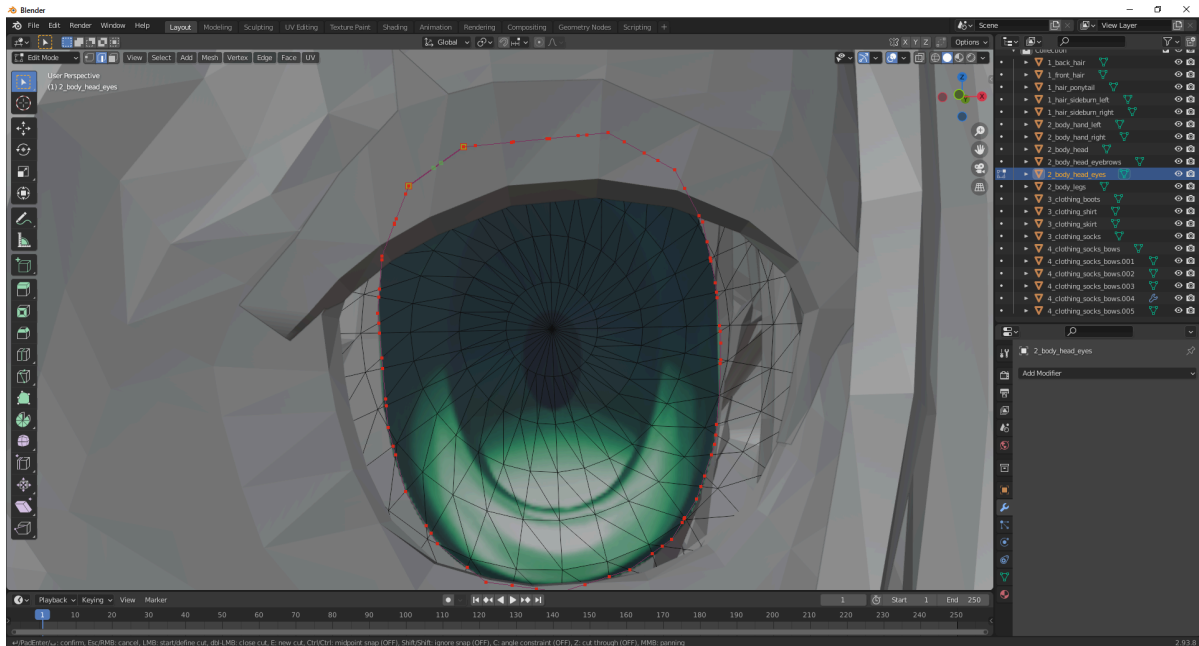
++

Next step would be adding details. This is why textures were loaded before.

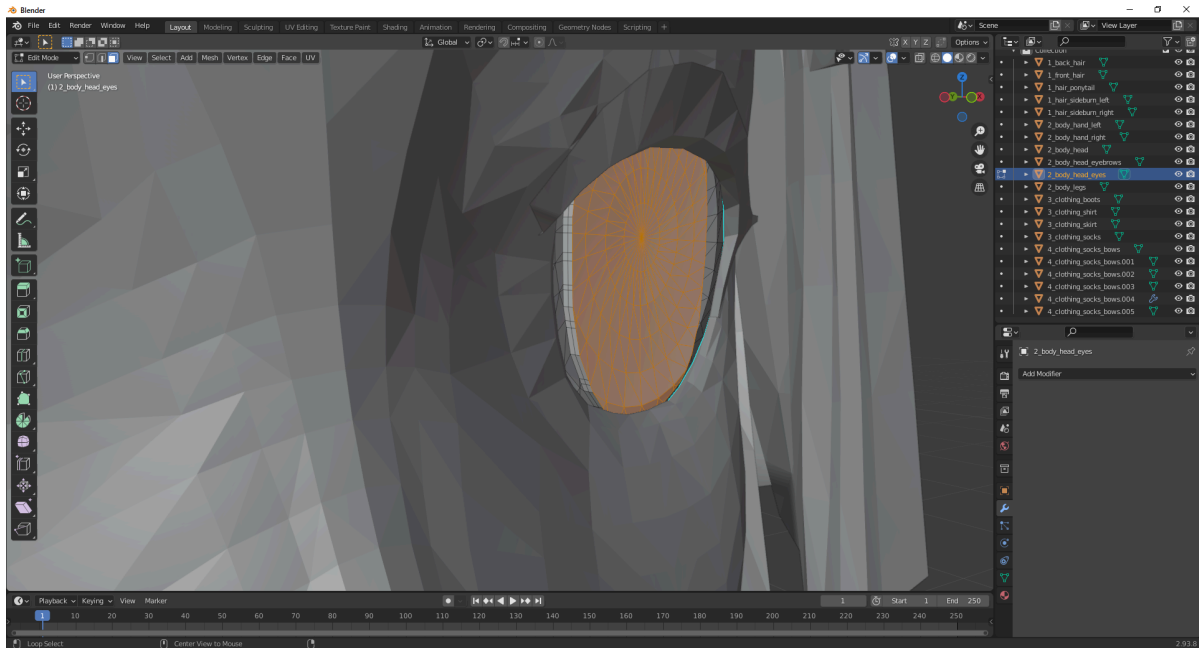


As an example, usually there is no iris geometry in the eyes. They're just flat surfaces. Creating iris geometry would significantly improve the looks of the model if you're not planning to paint it. It will also make painting iris later easier too.

Enable textures to be visible, select the eye part, go to the Edit Mode and press K to use 'Knife' tool. It places a series of connected dots, as a pencil of sorts. Use it to outline the geometry of the eye by tracing the dots around the texture of the iris.



When you're done, press Enter to confirm the placement of the outline, press 3 to enable face selection, and use Select tool(hotkey C) to select the faces inside the eye. Then, extrude it a bit(hotkey E), just to give a hint of volume.



Do not worry if it looks very blocky and edgy, smoothing will fix it later.

It is exactly the same process for any other detail you might want to add. Cloth patterns, engravings on the armour or weapons, etc. Enable textures, trace the outline with Knife tool, use Extrude tool to modify geometry. Rinse, repeat.

There is no way to automatically translate texture into geometry

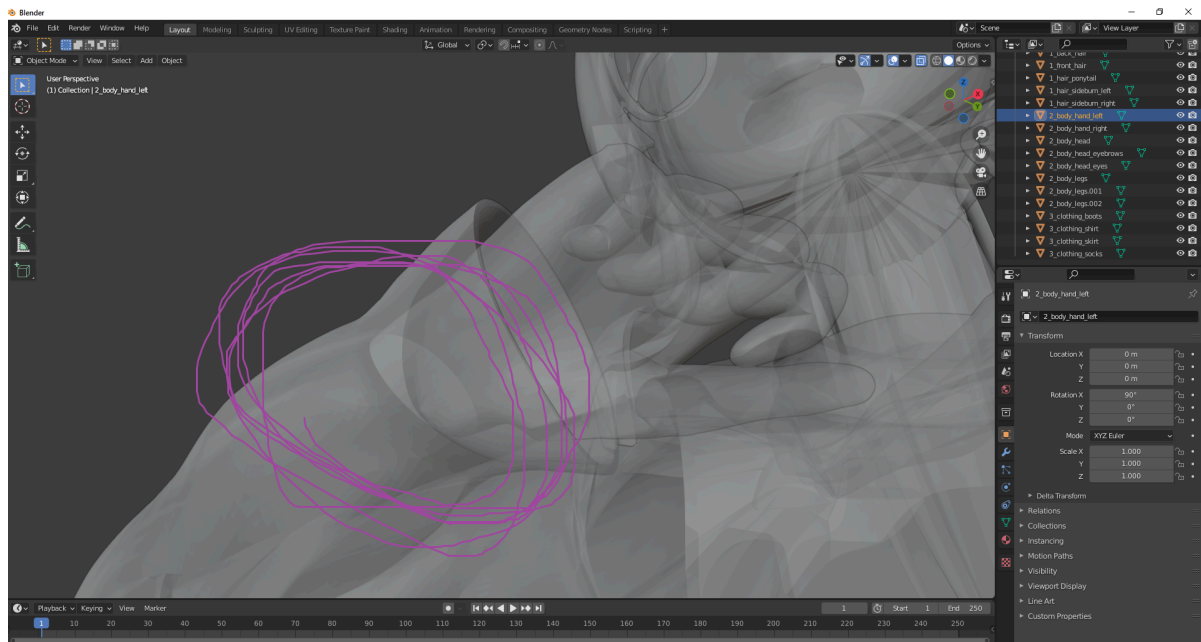
Well, there is one, but it's an extremely convoluted process that produces very questionable results. I strongly recommend using a trusty Knife tool to trace textures for details and patterns. Faster, simpler, easier to control and requires magnitudes less computer power.

+++

If you want to make it easier to paint the figure later and not just increase the size in a brute way, you might want to go even further and separate it to even more parts.

For example, the right hand in the example figure I've been working with this whole time will be a nightmare to paint since it is placed very awkwardly and blocks access to many other parts. It must be separated.

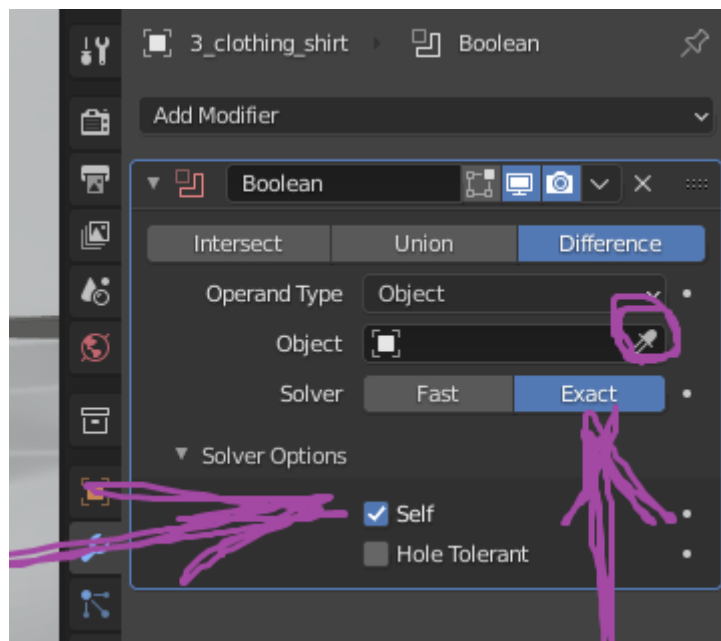
But it's not a simple matter of just printing this part separately. As you can see, it intersects part of the sleeve (purple circle). A socket must be prepared for it to fit in later when you'll be assembling the model.



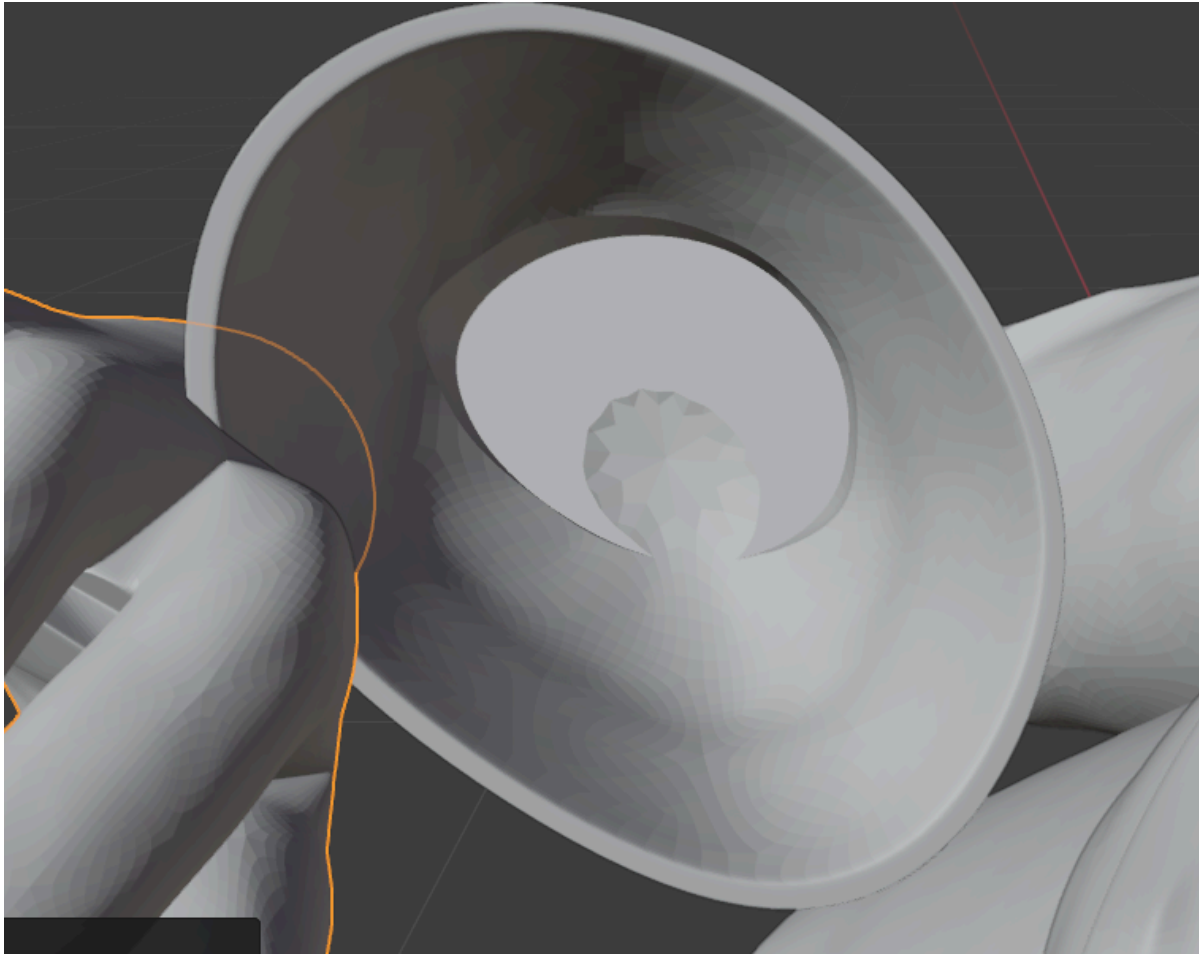
This socket can be created with a 'Boolean' modifier. It basically cuts the primary object to fit the form of the second object. Just the tool we need.

But before happily using it, we must check if the hand is manifold or not. There must be a completed, manifold surface that can leave a footprint in the parent object or 'Boolean' modifier will not work. Once you've made it manifold, you can go forward with the process.

To cut one object with another using 'Boolean' modifier, first select the object to be cut. In our case, the sleeve of a shirt. Then, add 'Boolean' modifier. Make sure 'Exact' option is selected, and in 'Solver Options' check 'Self' box. Finally, click on the pipette icon and select the object you want to cut with(in our case, hand).



Once Blender finishes calculating the cut, press apply and wait for the chug. I wasn't kidding when I said it takes shit ton of computer power to calculate stuff at high geometry levels.

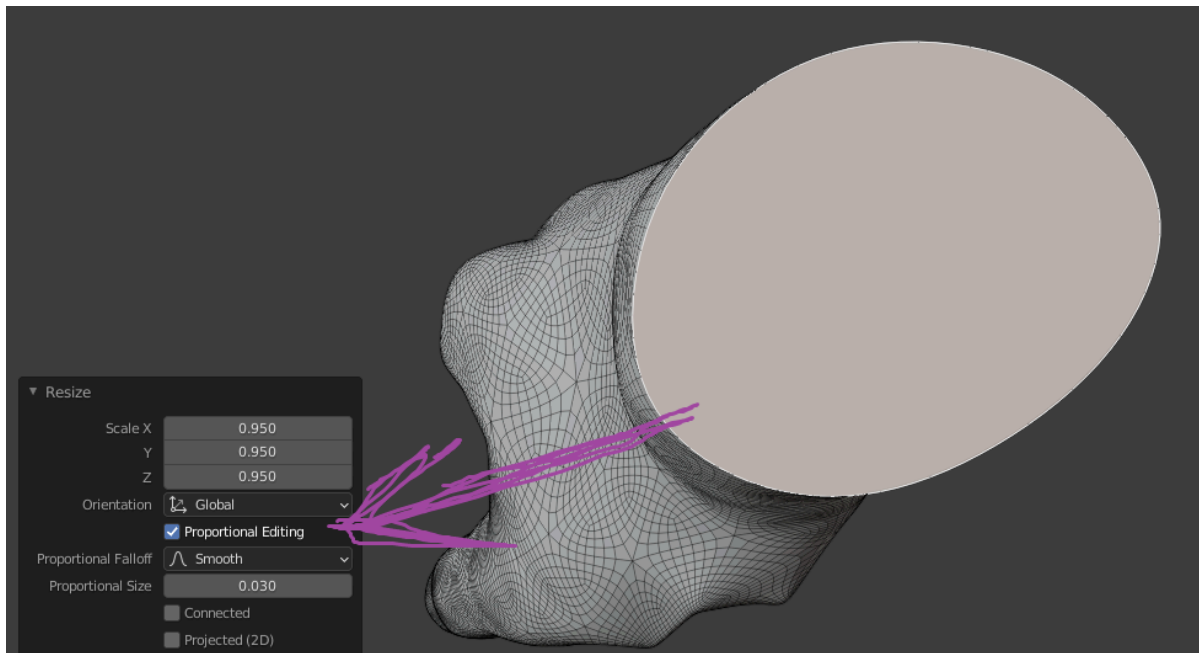


Now you have a socket exactly fitting the hand. But, as I've said before, resin printing is imperfect. If you went on to print it like that, the hand will never fit inside it without heavy sanding. You must adjust the hand's size to be a little smaller to fit inside the socket.

Select the hand, go into Edit Mode, press 3 to go into Face editing mode, and select the back end, the one that directly goes into the socket.

Press S to scale it, and reduce the size by about 10%. Make sure that 'Proportional Editing' box is ticked in the lower left corner. Edit 'Proportion Size' value so it only affects the part that's going into the socket.

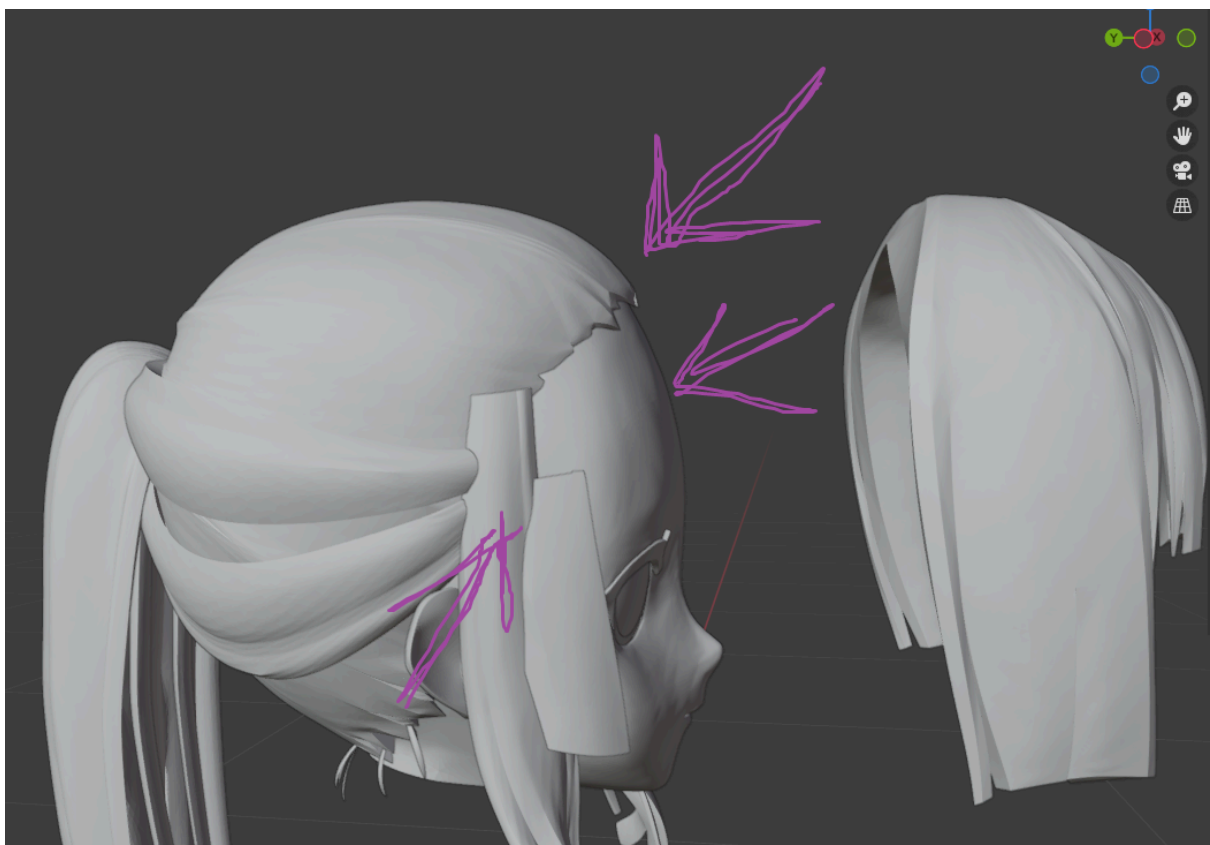
With this method, only the back end of the arm would be scaled while keeping the important front end fully intact. Now when printed the hand would absolutely fit in the socket.



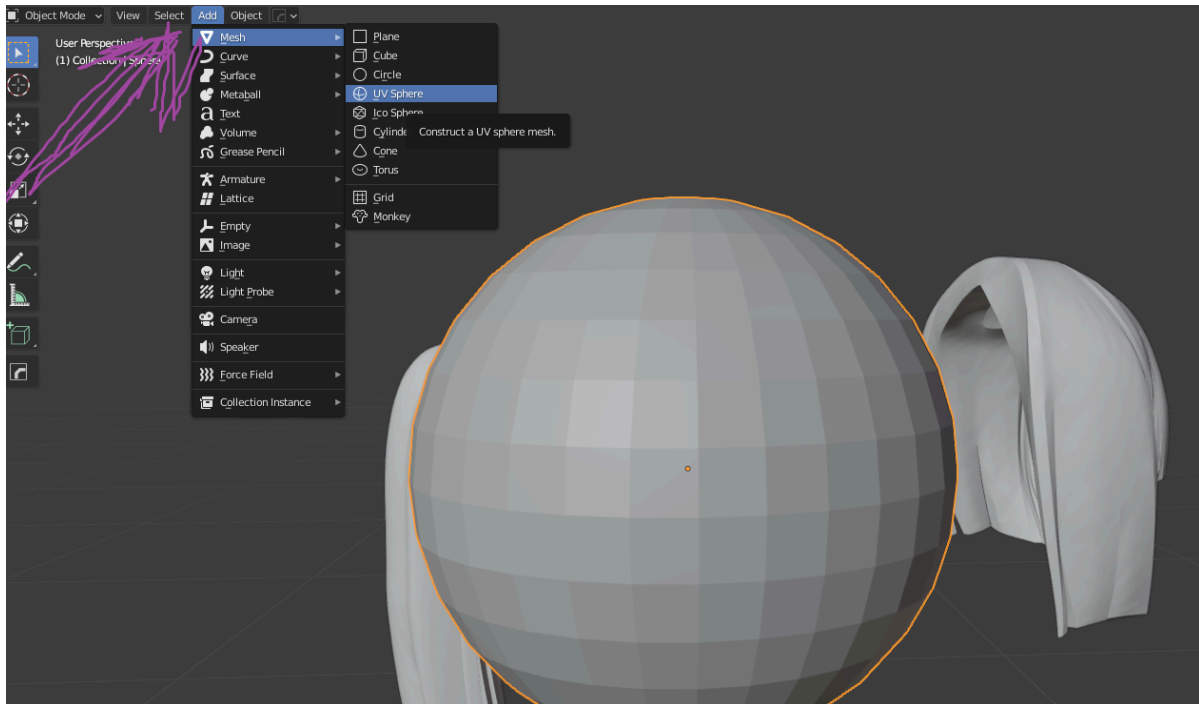
'Boolean' modifier is a temperamental bitch that barely works. There are Blender plugins that do the same job, but better. Find what works for you.

++

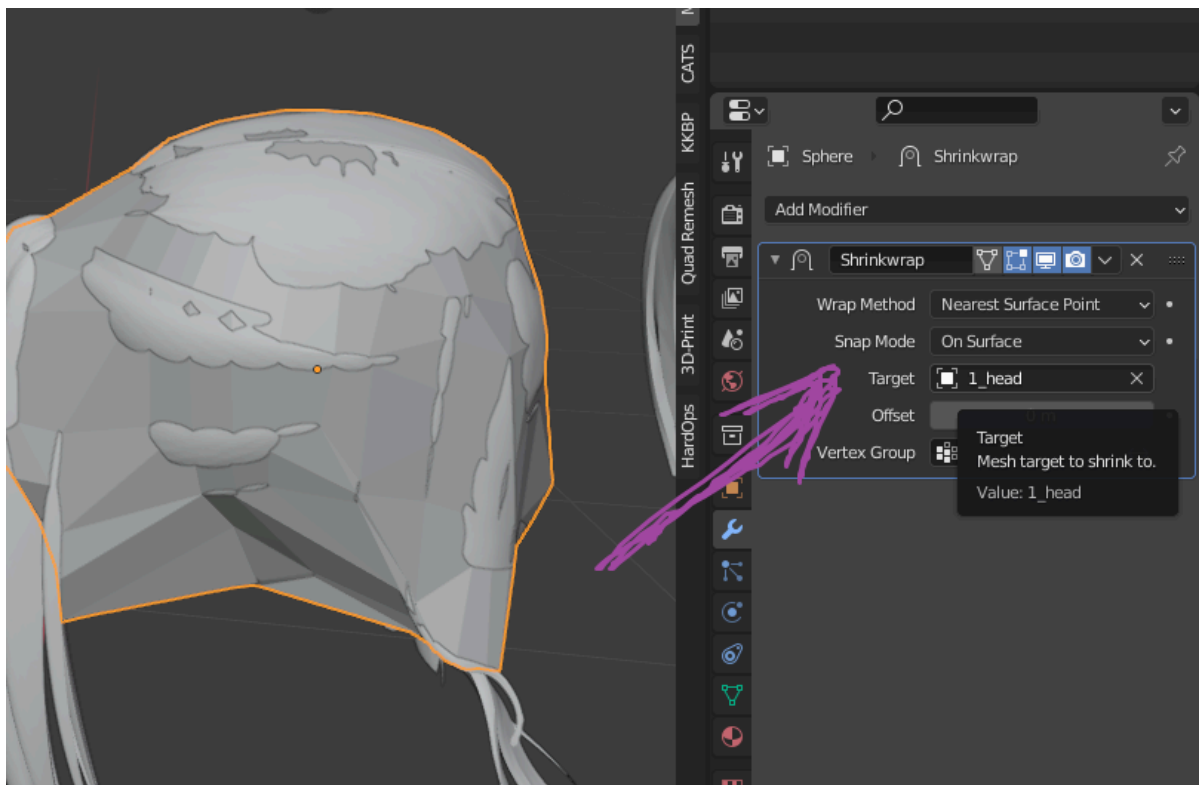
If you're having problems with Boolean not working at all, there is a hack solution. If there is a lot of intersecting geometry (meaning, it was combined from different parts), Boolean will ever if rarely work. This is especially common in case of front hair bangs and the head.



Many different parts combined into one, as you see. To fix this, you need to create a simplified copy of the head. This is where the 'Shrinkwrap' modifier comes to help.



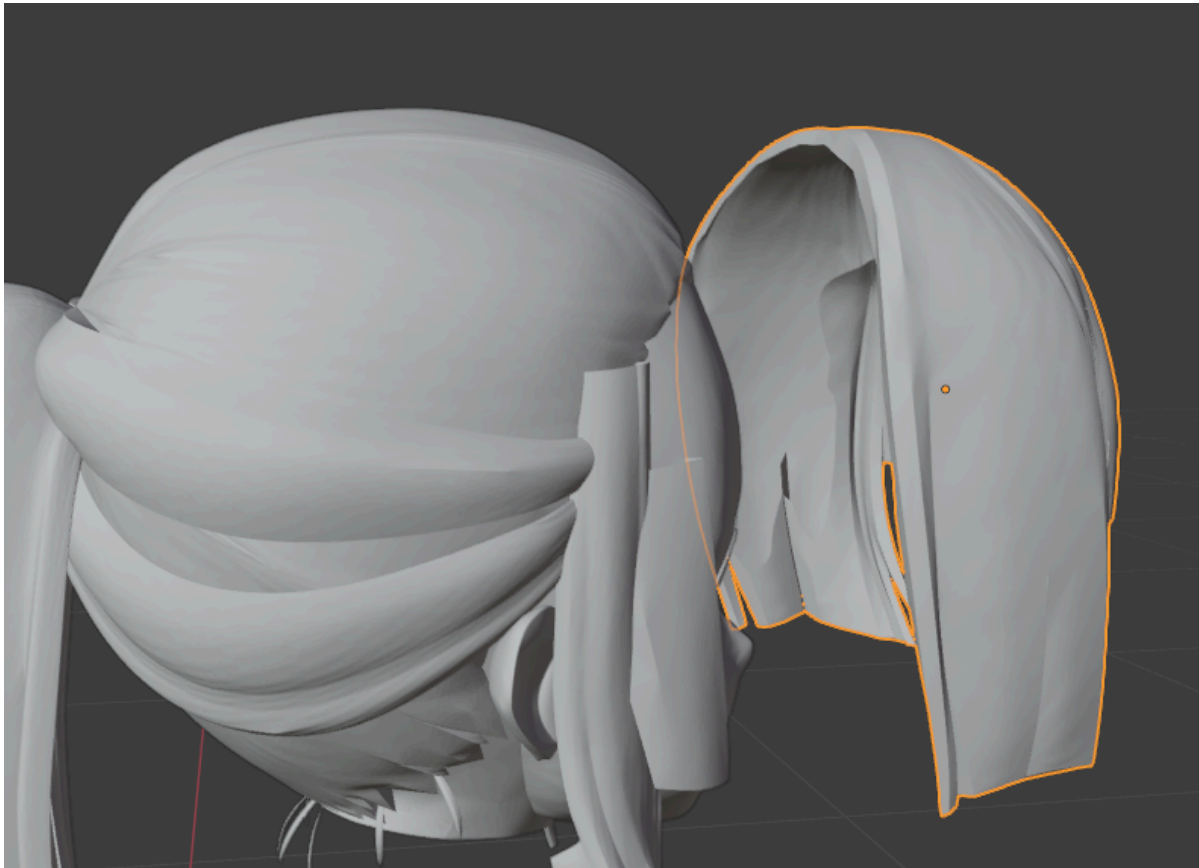
Go to the top left corner, and use 'Add=>Mesh=>UV Sphere' option. It will create a sphere. Move it to enclosure the head and apply the 'Shrinkwrap' modifier to it, using head as a target.



This will create an extremely rough approximation of the head that will be used to cut later.

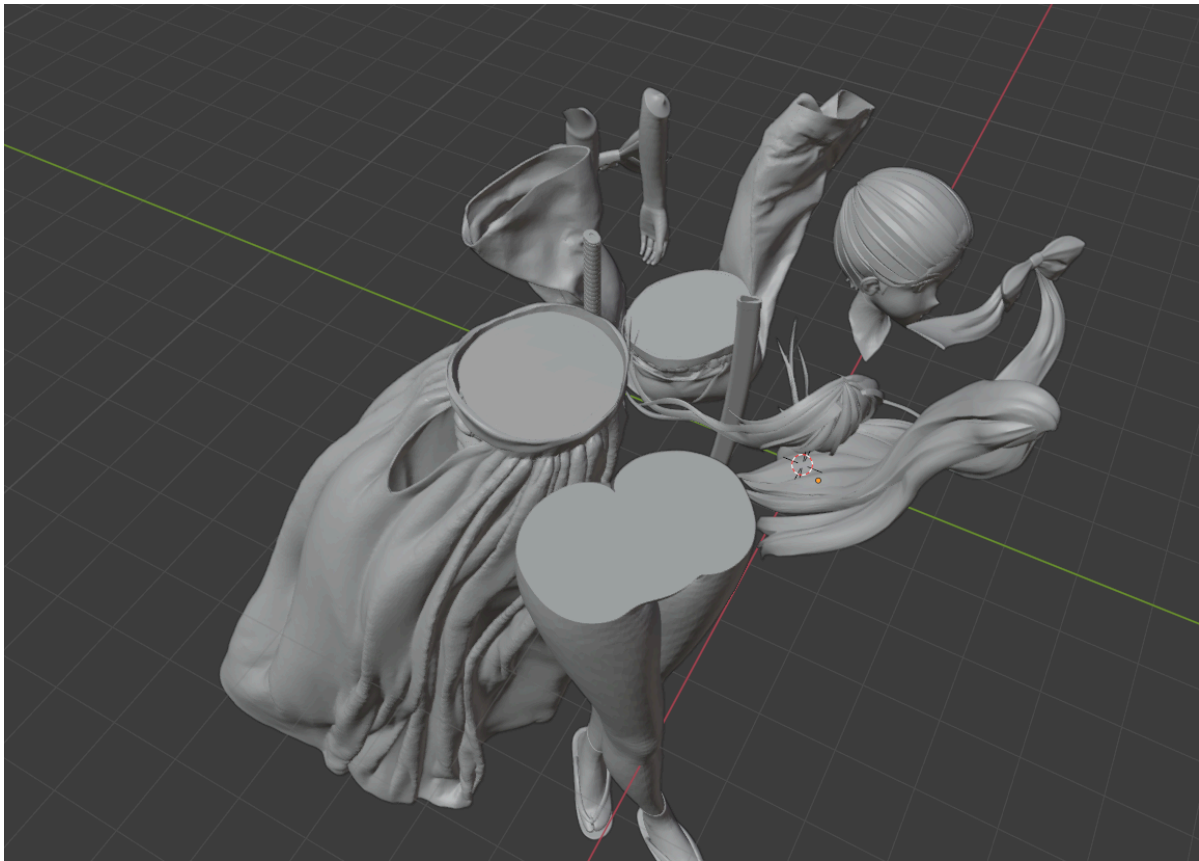
Now apply the `Boolean` modifier to cut the front hair bangs with this rough approximation.

And viola! Now you have created a socket in bangs where the head will fit in later when you assemble printed parts.

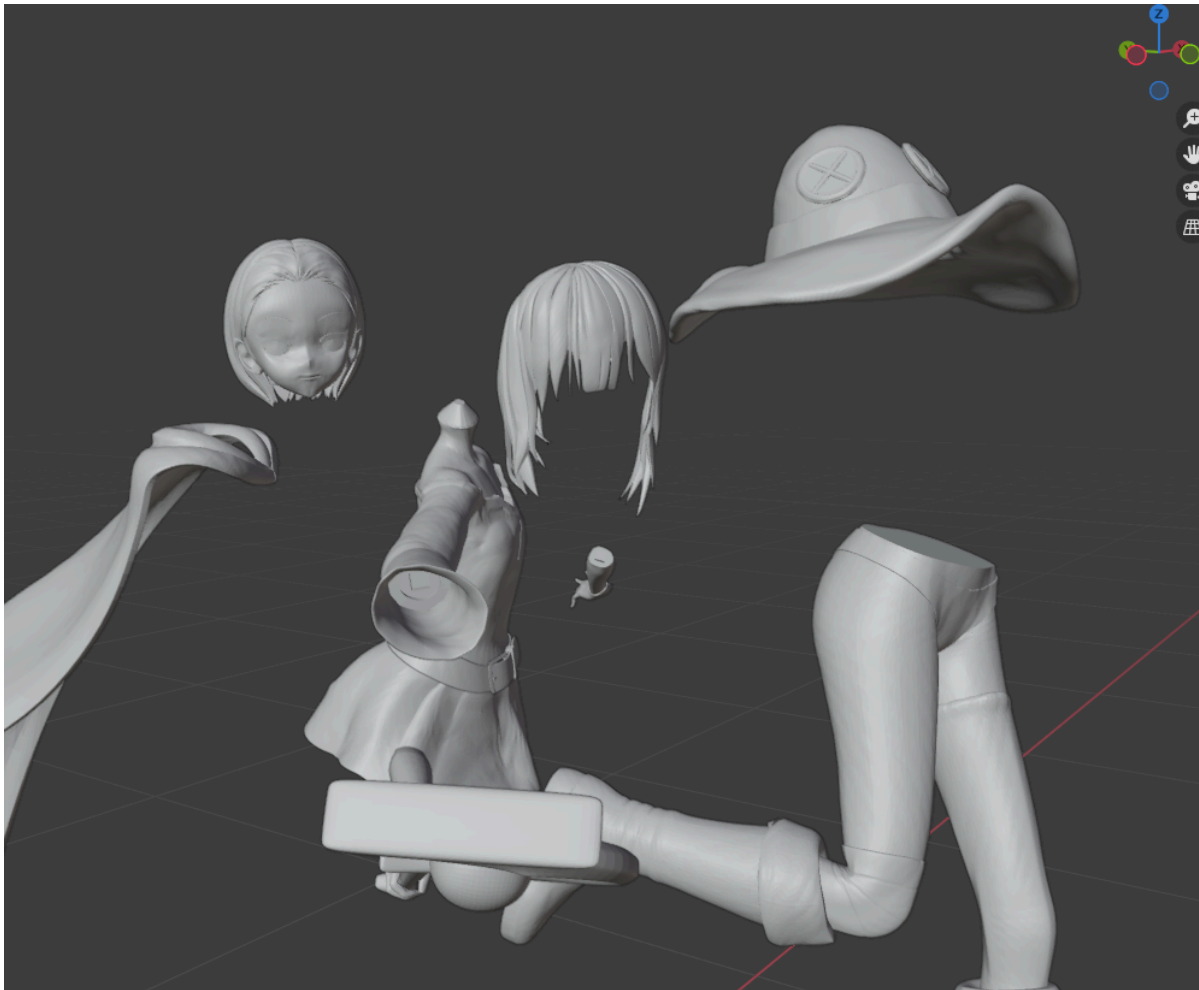


—

Exactly the same process (using `Bisect` to cut into parts and using `Boolean` to create sockets) is used to completely chop the figure into parts that you can easily paint and assemble later.



This is what I did here. Notice how the seam line on the dress will be hidden by the belt extending above it. Also notice how to make painting the head easier later, I've separated it away from the main body and created a socket in the dress where the neck part would be plugged in. Collar will be hiding the seam line in this case.



Another option to separating the head from the body is to create a socket right at the point where the skull connects to the neck. While it will leave a definitive seam line, it will be hidden by hair bangs and chin unless you look at the model from very specific angles.

To get some insight into what parts should be cut, I advise you to look at professional resin garage kits. They'll give you a rough idea what to chop away and how to hide seam lines.

+++++

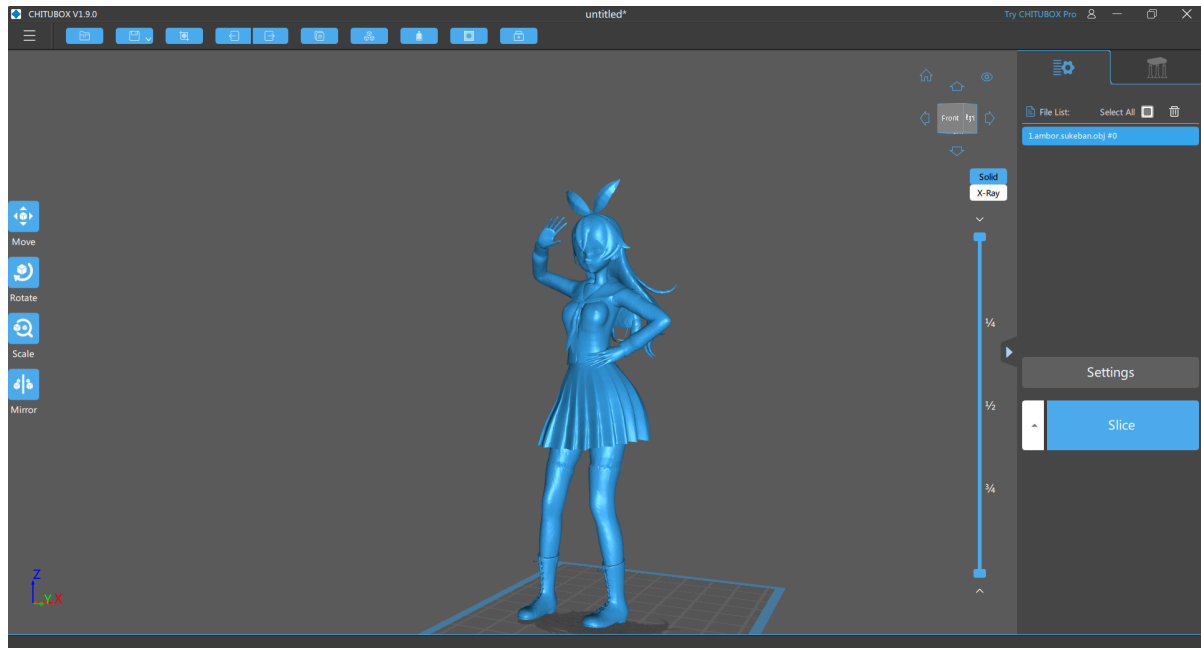
Chapter 4. Slicing and Printing

Notes about using 3D printer itself and associated software

To 3d print a model, you must slice it in a special software that comes bundled with a printer or use one of many other options available. I use CHITUBOX because it's simple and free. It has built-in support for most popular 3D printers, so select the one you have in options on the first launch of the software.

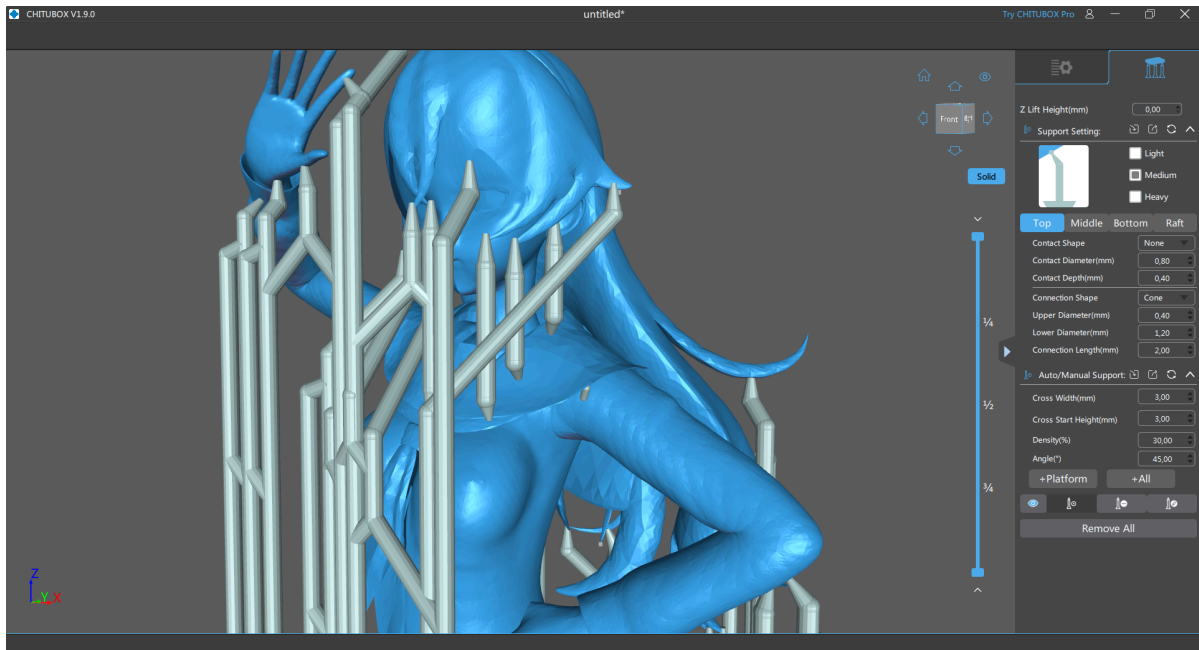
++

Now that your slicer is ready to make files for you printer, import the model, scale rotate and move it around the build plate til you're satisfied with the result.



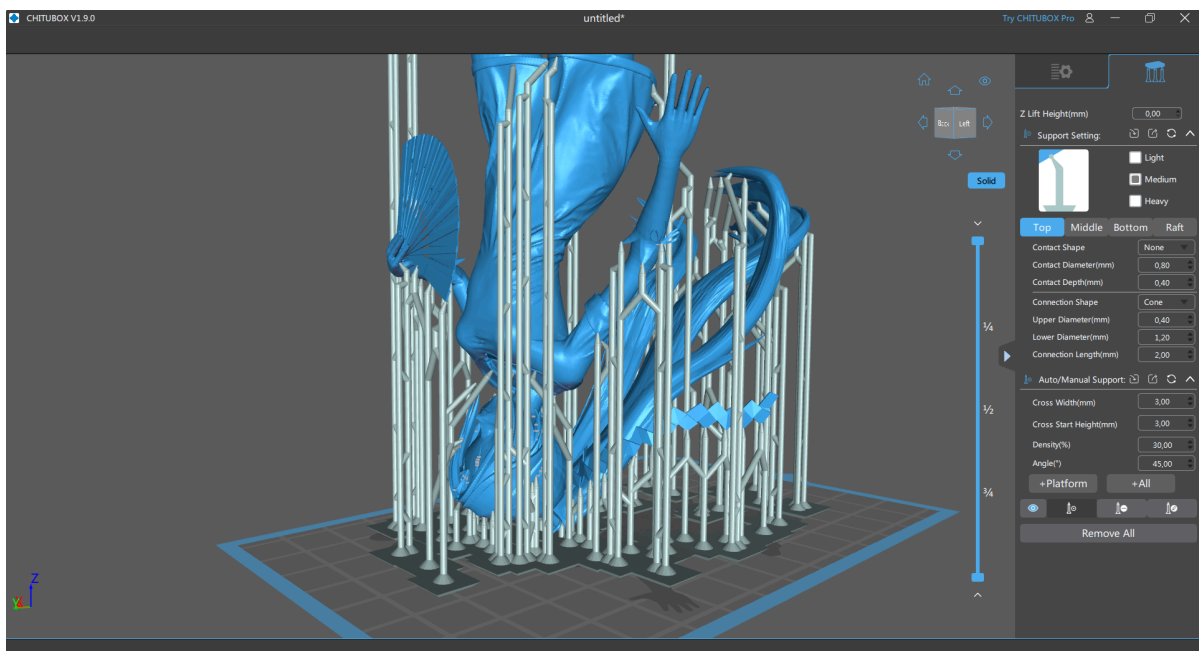
Then, add printing supports. Every single slicer has a function of automatically adding supports, and it will generate them quite well. But you still have to manually make sure everything will be printed right.

Take a good look at the model after its supports were generated. Some parts are likely to miss supports and it would be impossible to print them. In particular take a good look at the chin, fingers, hair and skirt ends, bows and ribbons, basically all overhanging objects. They typically suffer the most.



Sure enough, chin had no supports generated for it automatically. Manually place supports to such places if you don't want to find the print missing half the face.

If the character has especially voluminous hair with a lot of long, curvy parts it is better to to print the model upside down.



This will significantly reduce the amount of supports needed and make it much easier for the machine to print it, but you will be running the risk of the model simply falling off mid-print under its own weight.

After triple checking that everything is supported, you're ready to slice.

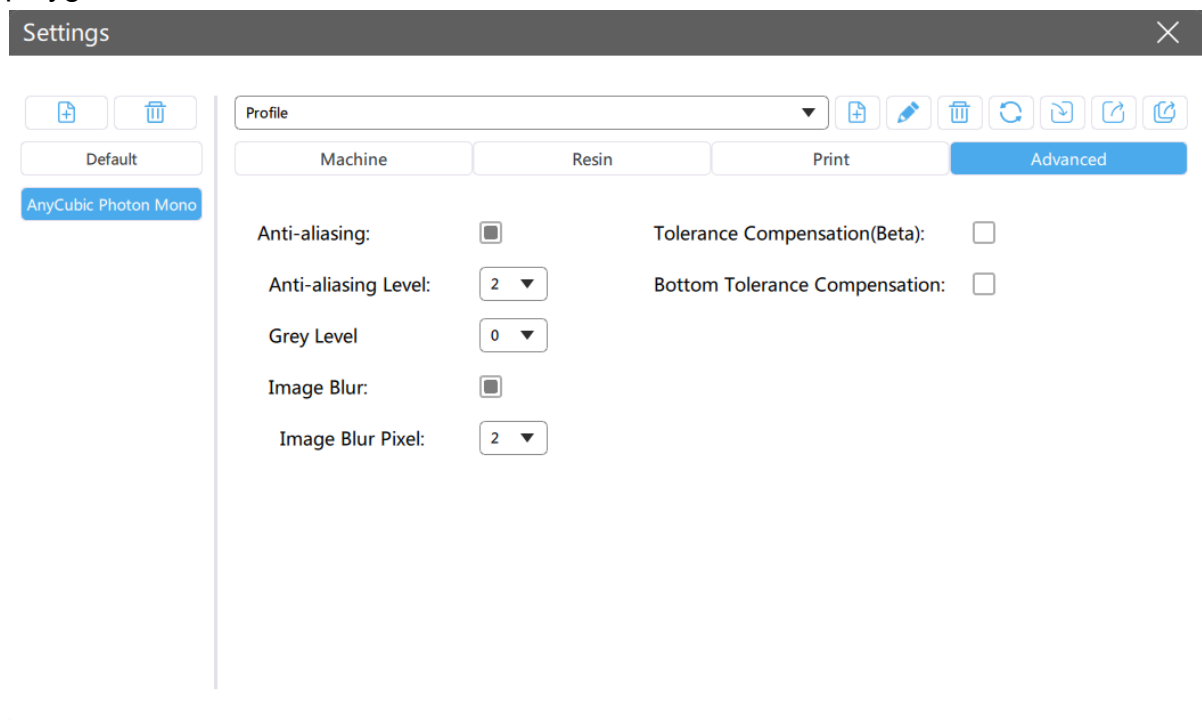
++

Another option slicer provides is to hollow out the model. I STRONGLY DO NOT RECOMMEND DOING THAT. It significantly increases the risk of print misprinting, cracking and deforming, all for the sake of saving odd 30-40ml of resin. The risks are just not worth it, especially with resin being as cheap as it is.

If you DO want to hollow the model out because it is in very large scale(1/4 for example and above) and savings in resin are big enough, make sure to set thickness of outer shell to at least 2,5mm and inner filling to at least 33%. This should dramatically reduce the chance of bad stuff happening.

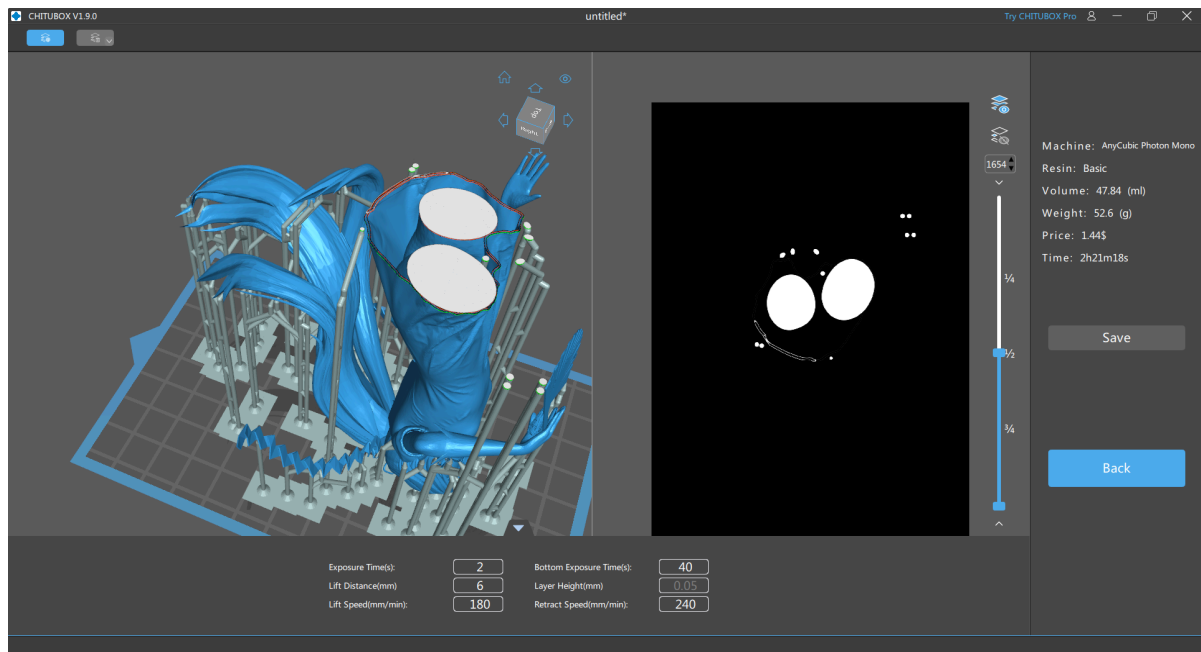
++

Before finally pushing that big 'Slice' button, you can enable some extra options. They will additionally smooth the surface a bit, completely removing any traces of polygons left.



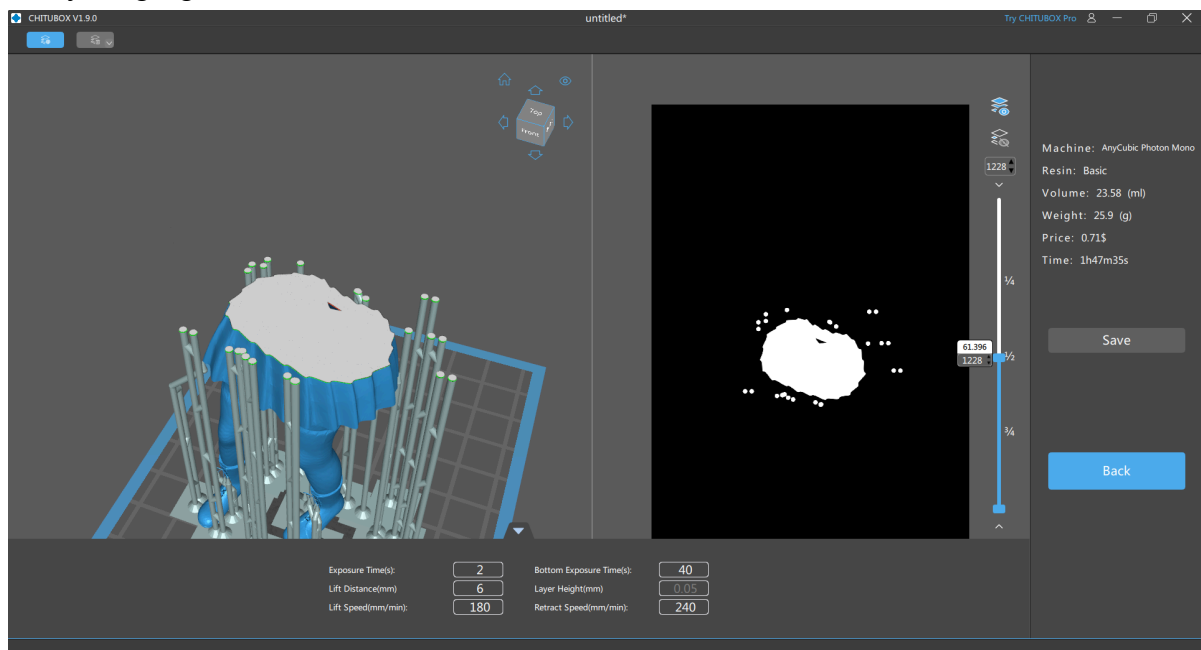
If you go too trigger-happy with them, some finer parts of the model will be removed, so don't go full retard. Heavy anti-aliasing or image blurring will damage the quality of the model you painstakingly created.

After you've sliced the model(just press the 'Slice' button) you will be able to check how the printer will be printing the model.



This black and white picture is what actually will be printed in this specific layer. Check that everything looks right.

It is very important to check, as you can get stuff like this if you haven't done everything right in Blender.



See how the printer will ignore the skirt and just create a solid volume underneath? This is my own fault, as I forgot to solidify the skirt and add extra thickness. You'll have to go back to Blender to fix this.

At the bottom you see 'Exposure Time'. This is how long the printer will cook liquid resin to make it solid. The less time resin is cooked, the finer details will be, but the risk of misprint rises sharply. The longer resin is cooked, the less miniature details

you get, but the model is all but guaranteed to be printed intact. These values very much depend on resin you use and in a perfect world should be calibrated with test prints, but as a ballpark figure:

- 1,7 to 2,2 seconds — very sharp details, high risk of misprint;
- 2,5 to 3,0 seconds — good details, medium risk;
- 3,2 and above — small details are noticeably less sharp, minimal risk.

Another value that can be tweaked is 'Lift speed'. Reducing lift speed significantly increases printing time, but reduces the odds of misprint. And when I'm talking significantly, I mean it. Model that will take 6 hours to print normally will take about 15 hours, basically double the time. It is absolutely worth it though. There is no need to rush and pump as many figures as you can. Slow and steady approach with minimal risks is the best way to move forward.

I've tried many types of different resin brands and types, and honestly they're all the same for our purposes. Basic bitch grey resin gives as much details on a print as expensive ultra-high detail brown ones. The only real difference was water solubility. It is just much more pleasant to work with water-soluble resin rather than other types. Also, stuff like eco-resin is just marketing. Inside the bottle is exactly the same resin as in basic bitch one, just with a different label and a heftier price. Don't be a fool following the eco hype train.

If everything looks alright, all that's left is just to print it. Save the output file from the slicer, transfer it to your printer via usb stick or wireless, and print it.

Do note that resin is temperature sensitive. Printing above +40 degree Celsius or less than +10 degree Celsius will result in largely failed prints. Accommodate for your surroundings.

++

After you've printed your model and the feeling of absolute euphoria died down a bit, there are 2 very important steps that must be taken. Washing and curing. **Do not skip them.**

First, you wash your figurine in a small bucket of isopropyl alcohol. It is dirt cheap and readily available in most chem stores. You can use pretty much any organic solvent, but isopropyl alcohol is just the cheapest choice. Why you need to wash it? To clear away all left-over resin so it would not hinder you later. Just put your printed figurine in a small bucket, fill it to the top with isopropyl alcohol, and use a large soft brush to give the figurine a good washing. Don't throw away the alcohol, you can re-use the same one it for washing for a long time. This is where water-washable resins truly shine. It's just so much more handier to use water.

After a good bath in iso-alcohol, fill the same bucket with hot(80+ degree Celcius) water and submerge the figure for a few minutes, so it warms up. Warm resin is very soft, so supports can be removed without almost any force applied at all. Just gently peel them off. On super thin parts like hair ends, use hobby pliers to cut them off or you will peel off the support together with part of hair. There is nothing worse than looking at the figurine with half the hair missing because of your incompetence.

With supports removed, it's time to cure the print. It is absolutely necessary to let the resin completely solidify. If you live in a sunny place, just leave it outside under direct sunlight for an hour. If direct sunlight is a rare commodity, you can either buy anti-bacterial UV lamp and use it instead of sunlight, or buy a dedicated wash&cure station that does both washing and curing for you. Both work just fine, though former costs 5 quid and the later one hundred. To be fair, wash&cure station is very handy and relatively cheap tool, if you're going to make 3D printing your hobby it's better to get one sooner or later. That being said, it's not necessary, just a quality of life thing.

+++++

Chapter 5. Sanding and Painting

This is the final leg of the journey. But you still must pay due diligence and not rush ahead. Sanding and especially painting will consume by far the largest amount of time. Keep a steady pace and go forward.

++

After curing the resin, you have to sand over any support remains, so they're flush with the whole model. I use needle files and 800 grit sandpaper for this. The task is rather self-explanatory and simple. You will have to sand if you want your character to look good.

What is not obvious though, is how to deal with holes left by supports as in the image below.

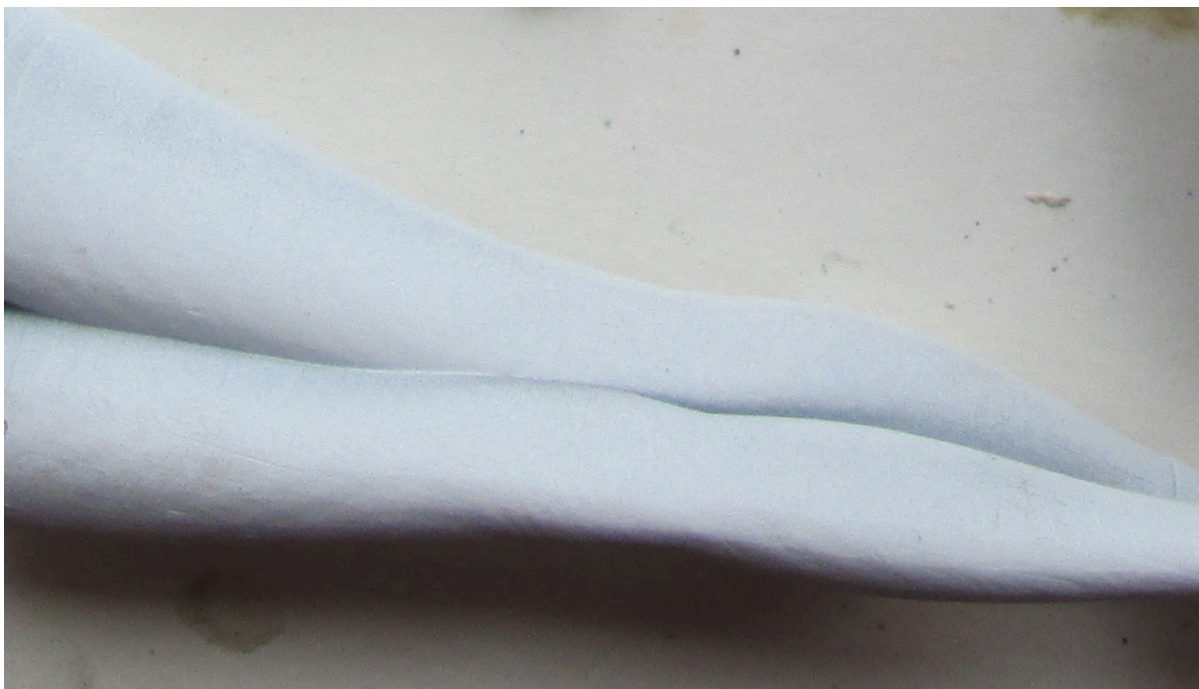


There are two main ways to fill them. Either use a very thick coat of primer (but this will eat all other details) or manually fill them and sand stuff down later.

The easiest solution to fill those is a humble super glue. It's robust enough to handle sanding it flush with surface and can be applied very easily.



Find a hole left by support, place a small dot of superglue on top of it, wait for it to dry, and sand it flush with the surface. Note that I specifically made a huge lump to make it easily visible on the photo. You need much less than that. With some practice filling holes with super glue with barely require sanding, as it will be already mostly flush.



After priming, any marks you could of left will be completely hidden, giving a smooth surface.

++

Speaking about priming, it is an absolutely mandatory step. 3d printed resin has very poor adhesion, you need the bonding power provided by the primer. Acrylic primer in a spray can works just fine. Given the choice, pick white-coloured primer. It takes less effort to paint very vibrant colours that anime is famous for on white primer. With grey or black primer, colours will be noticeably muted, requiring more work to bring them in line.

When spraying parts with primer, make absolutely sure to apply the primer from the can in small doses from a large distance(30-50cm) away. Figure, or parts of it, must be visually almost dry when the primer lands on them. Thick globs of liquid primer will kill all details and make painting harder.

Fully printed figure can be primed and painted as it is, but if it was separated into parts it would be handy to attach them to toothpick or bent paper clips in places that would not be visible.



Affix the stick/wire with a drop of super glue in a place that would be hidden later. Now you can easily paint the part hanging mid-air on a stick from all sides without hassle. Wooden toothpicks break easily leaving parts of them glued to the part, so I'd advise to go with metal paper clips. Another option is to buy a set of miniature

alligator clips specifically designed for holding and painting small parts, that's what I've settled on personally.

++

To paint you will need an airbrush. It makes painting the figure so much more easier. You don't need a fancy one, even a JAS double action airbrush for 15 quid with a compressor for another 40 will do the work admirably. While you can paint everything with brushes, typically 1/8 scale anime figures(15+cm) and above are just too big to evenly apply paint on large flat surfaces.

Also, a set of brushes, size 0 and 000 in particular, are also required to paint smaller details like eyes. Shitty brushes will drive you insane. Do not buy the cheapest one you can find, get good quality, it really **REALLY** matters here.

And now for the paints. There are 3 options. Acrylics, enamels and oils.

- ❖ Acrylics are quite finicky and dry fast, but cheap, very common and use water as a thinner. Industry standard.
- ❖ Enamels are heavy duty paints with very good coverage and stable colour, but require noxious chemicals to thin them.
- ❖ Oils are a mixed bag. They are both finicky, dry super slowly and require oil as thinner, but they offer the best way to make extremely smooth transitions for shading that nothing else can quite match.

You don't need every single colour imaginable to paint accurate colours. All those myriads of paints with crazy names are for wargamers to paint many miniatures in the same hues. As every figure you make is a one-off thing, you only need basic 6 colours — Titanium White, Cadmium Yellow, Cadmium Red, Cobalt Blue, Ivory Black and Burnt Sienna. They're enough to paint anything, really. Additionally, mixing your own colours would make the figurine look more uniform and life-like, as you naturally will mix colours with similar hues from the same basic palette.

Once again, I strongly advise you to start with acrylic paints and an airbrush. It is the most simple and easy way to paint your figures.

Most anime figures are painted in flat colour with little to no colour modulation. What I mean by that, everything is sprayed with one smooth colour coat(the so called base coat), and no other work is done beyond that. This will look good and professional.

When airbrushing, just like when priming, under no circumstances allow the paint to visibly glob around and be very wet when spraying. Paint must be almost dry on the figure when it lands on the figure.

If you're just starting out, making a solid base coat is what you should aim for. Do not try any of the fancy shmancy shading techniques and the like.

Here's the titular character, the one that was used in almost all Blender editing showcase, painted completely flat without any extra special effects.



Looks passable enough, isn't she?

If you want to give your model extra oomph, I suggest looking for pre-shading and pre-highlighting tutorials on youtube. That's exactly techniques japanese use to paint figures. They also further refine their figures with a bit of highlights done with soft pastel paints, and once again you can find tutorials on highlighting with pastels on youtube if you dig deep enough. These two techniques will give you that distinctively japanese painting look on your figures.

++

When you're painting small details like eyes, before you start doing anything grab a piece of paper and draw your character's eyes a few times with paints. Start big to really get a feel for the form and colour of the iris, going smaller and smaller. This immensely helps to get the eyes right.

If you don't trust yourself to paint eyes or intricate cloth patterns, there is very viable alternative. Custom made decals. Waterslide paper costs practically nothing and can be used by many different printers. All you have to do is ensure that the scale is correct between your figure and the decals. Blender has built-in ruler to measure things, use it to scale decals correctly. As for the source of the image to base the decal on, use textures. If you don't have a printer yourself, any local photocopy center will be happy to print them on your waterslide paper for you, at a small fee.

+++++

FIN

If you have any questions, feel free to contact me in Discord. My tag is Hatsuharufag#4291.