Using OpenSCAD to Render Kwawu Arm 2.1 Thermoform Version

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This document will walk you though using OpenSCAD to size and make printable STL files for the Kwawu Arm 2.0.

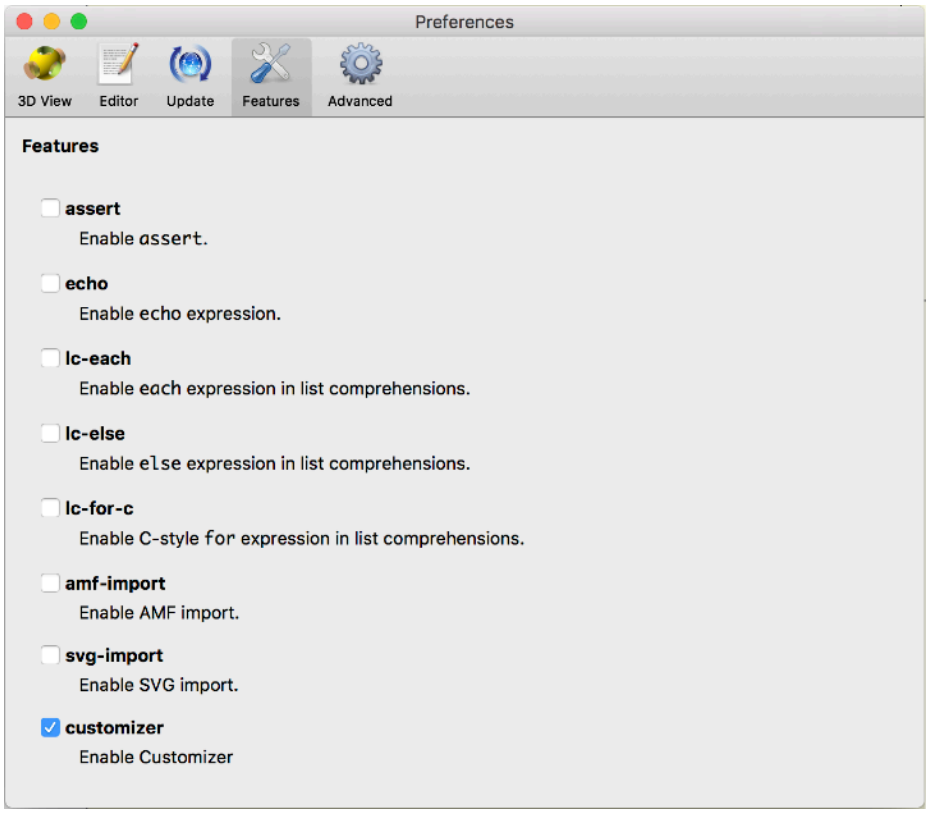
Downloading and Installing OpenSCAD

1 Download and install OpenSCAD. You need the latest development snapshot to be able to use the customizer feature. Unlike the old stable version which has a yellow program icon, the development snapshot has a blue icon. You can find it here:

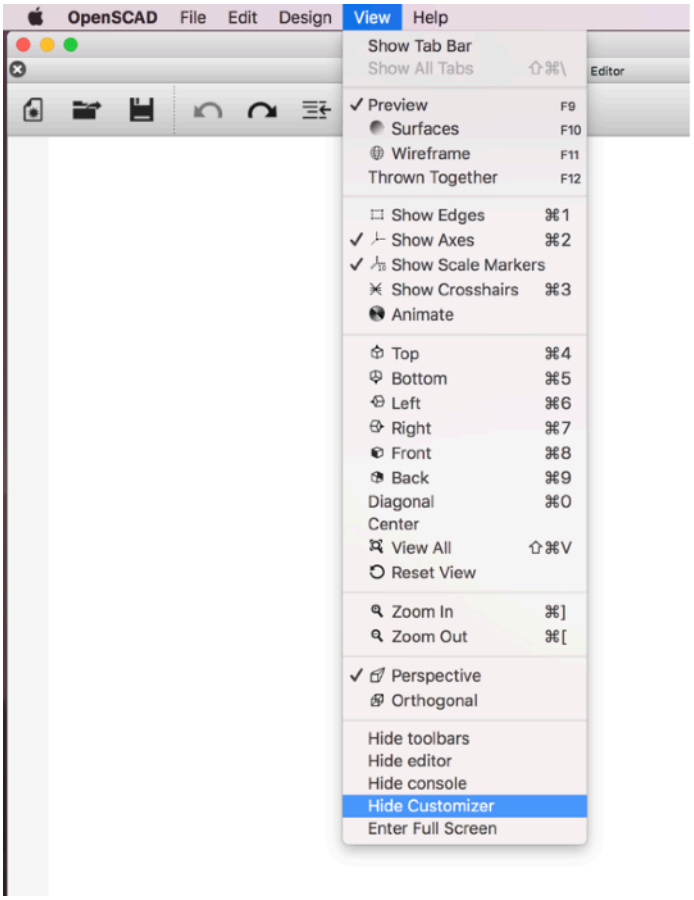
http://www.openscad.org/downloads.html#snapshots

2 Once you have installed OpenSCAD, open the file "Kwawu 2.0 Prosthetic Arm-Thermoform Version.scad"

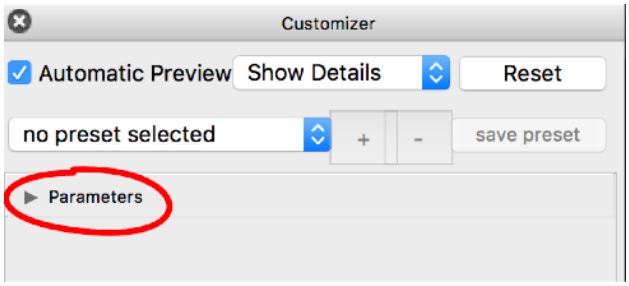
3 Go to the Preferences menu, and in the **'Features'** section, ensure Customizer is enabled (you only need to do this once).



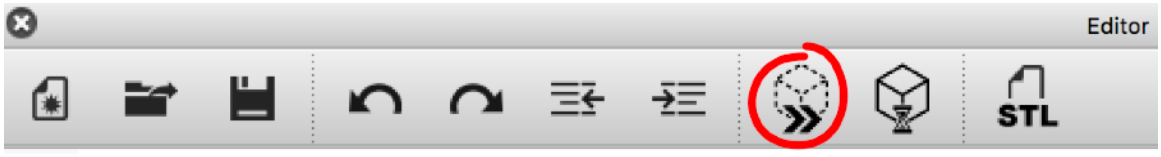
4 Uncheck 'Hide Customizer' in the View menu to show the Customizer UI at the right.



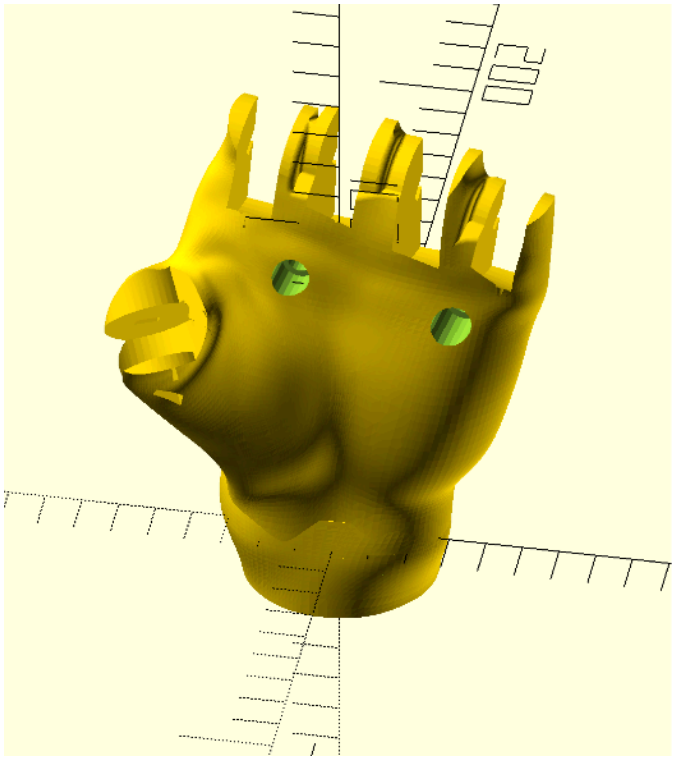
5 In the Customizer menu on the Right Hand side, click the little black arrow to display the parameters. Make sure “Automatic Preview” and “Show Details” are both checked.



6 Hit the Preview button (F5) to get a quick preview (should not be necessary if ‘Automatic preview’ is enabled).



You should see a preview of the palm in the main window it looks something like this.

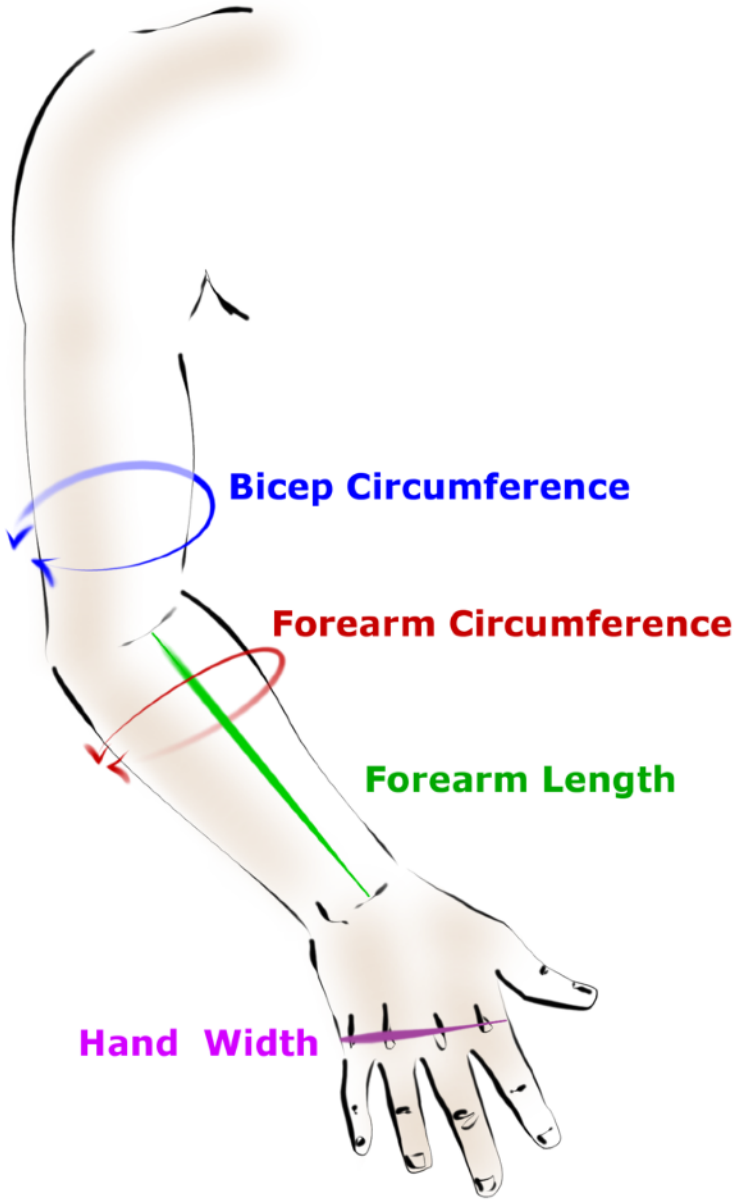


If the object is too large or small press the “View all” button

Now you are ready to set all the sizing parameters. Once you have set all the parameters you will need to render each part and save to an STL file.

Measuring Your Recipient

There are several measurements you will need from the recipient. The circumference measurements you will want to make on the residual arm. The Forearm Length and Hand Width you will make on the intact arm. All measurements are in millimeters.



Bicep Circumference: Measured around the upper arm at is thickest point. Measured on the residual arm being fitted with the prosthesis.

Forearm Circumference: Measured around the forearm at its thickest point. Measured on the residual arm being fitted with the prosthesis.

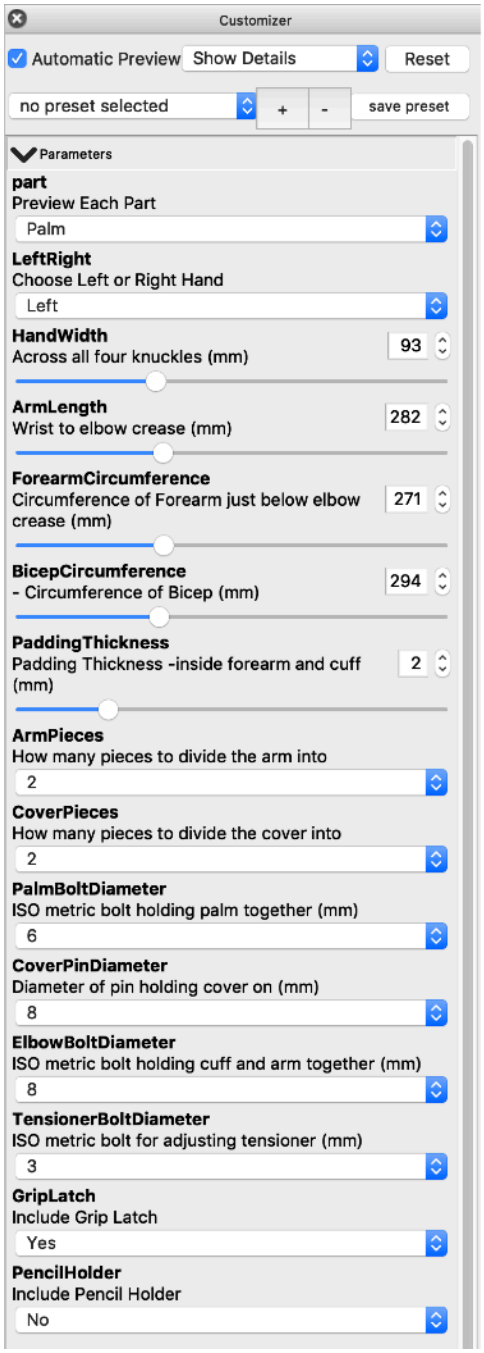
Forearm Length : Measured from the elbow crease the the wrist crease. Measured on the intact arm. I recommend you use a measurement **5% to 10% shorter than the intact arm**. The smaller

size gives better mechanical advantage and does not generally appear to be shorter than the intact arm.

Hand Width: Measured across the knuckles. Measured on the intact arm.

Sizing Parameters

Once you have measurements from the recipient you will enter various parameters into the Customizer Parameters side bar.



Part : Only one part can be previewed, and/or render at a time.

Left Right: Choose which arm you will be making left or right.

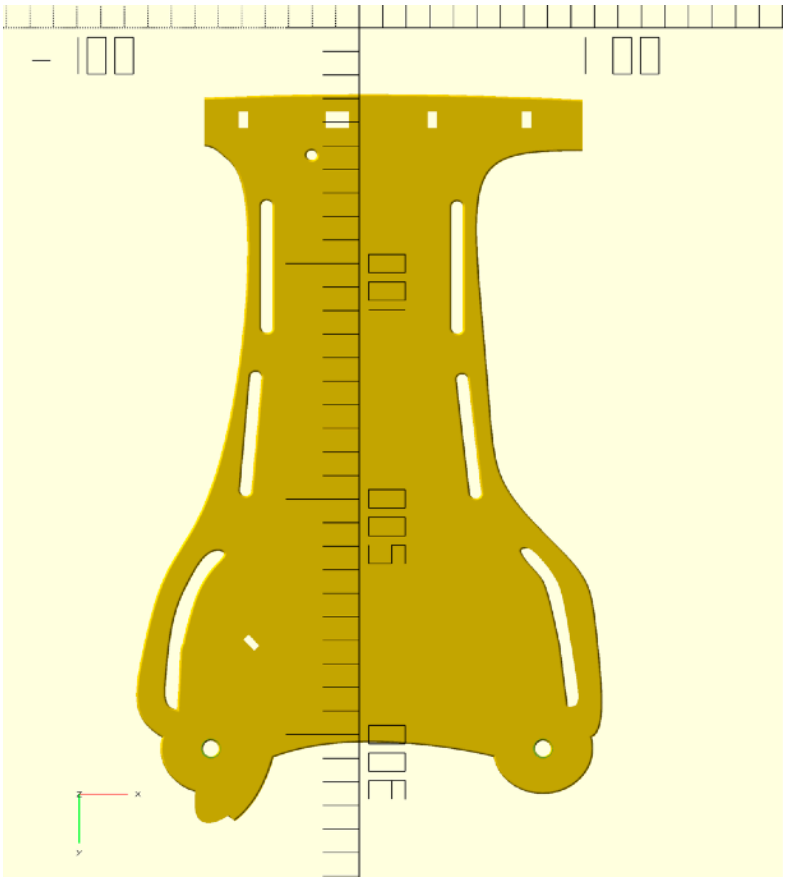
Hand Width, Arm Length, Forearm Circumference, and BicepCircumference: All are from the direct measurements take in the previous section. While these can be any numbers allow by the sliders, you will want all four sliders to be roughly aligned vertically. If the sliders do not roughly line up vertically together then the arm will likely have an unnatural look to it. Meaning you will have a child's hand on an adult's arm or vice versa.

Padding Thickness: Choose the thickness of the padding that will be used to line the cuff and forearm. This thickness will contribute to the overall circumference of the forearm and the cuff.

Arm Pieces: The forearm can be printed as one, two or four pieces. If it is printed as more than one piece you will glue the pieces together with 2-part epoxy or super glue. The only reason to use more than one piece is so it will fit on your printer bed. To get a rough idea to know if the part will fit on your printer, you can preview it specifically.

If you choose orthogonal view  and view from the bottom,  you can see the measurement markings under the arm.

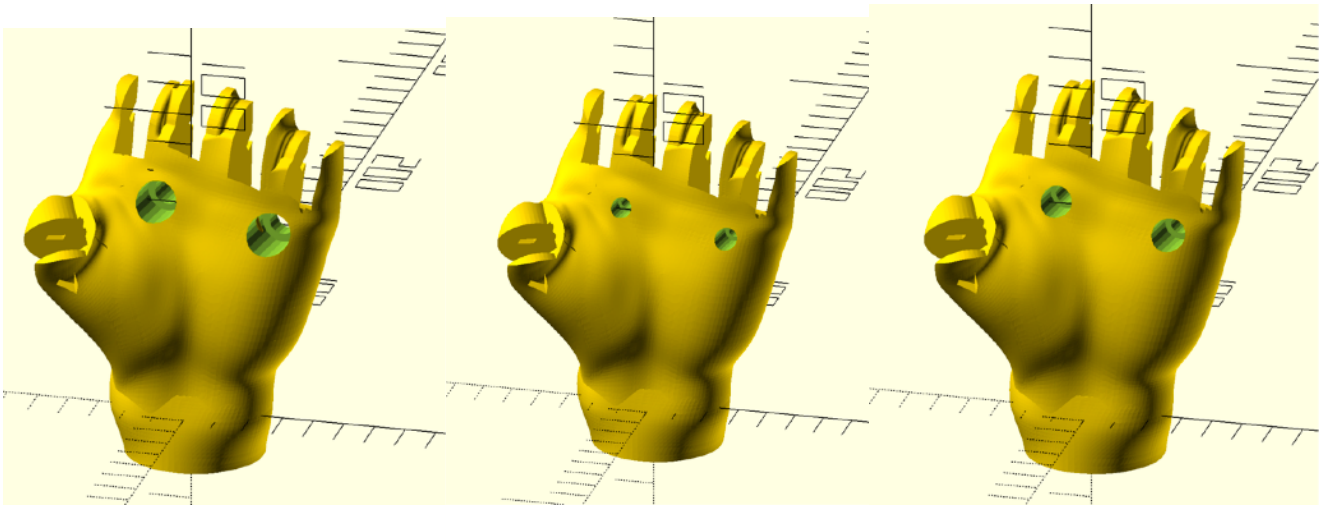
If you select Arm Pieces "1" and Preview Part "Arm1", you get a view where you can estimate this arm would require a 33 centimeter long bed to print.



Cover Pieces: The cover can be printed as one, two or four pieces. If it is printed as more than one piece you will glue the pieces together with 2-part epoxy or super glue. The only reason to use more than one piece is so it will fit on your printer bed.

Palm Bolt Diameter: Choose a threading size for the bolts holding the palm together. All threads are rendered as standard ISO metric threading, so you can use manufactured bolts rather than the printed ones.

To Choose the palm bolt size, select “Palm” as the part to preview. If the hole looks too larger adjust to a different size bolt.

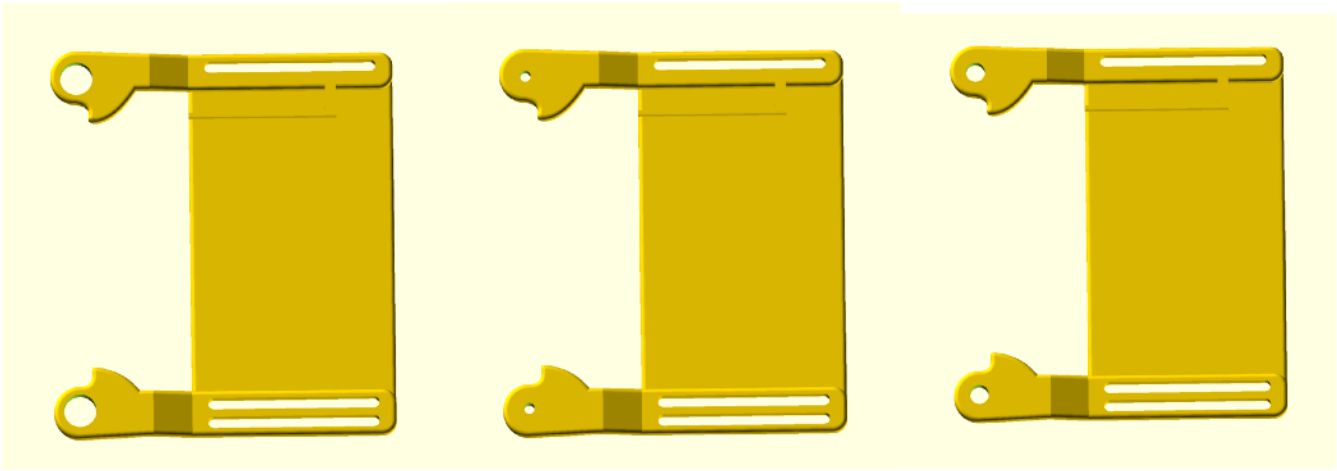


Preview of Palm Bolt sizes; too large, too small, and just right.

Cover Pin Diameter: Choose the diameter of the pin holding the cover on the arm. This pin is part of the arm, and allows the cover to attach to the arm. Choose a **zero diameter** if you don't plan to use a cover.

To choose the cover pin size, select "cover1" as the part to preview. If the hole looks too larger or small adjust to a different size pin.

Elbow Bolt Diameter: Choose the threading size for the bolts holding the arm to the cuff. This is best decided while viewing the cuff from the top or bottom.

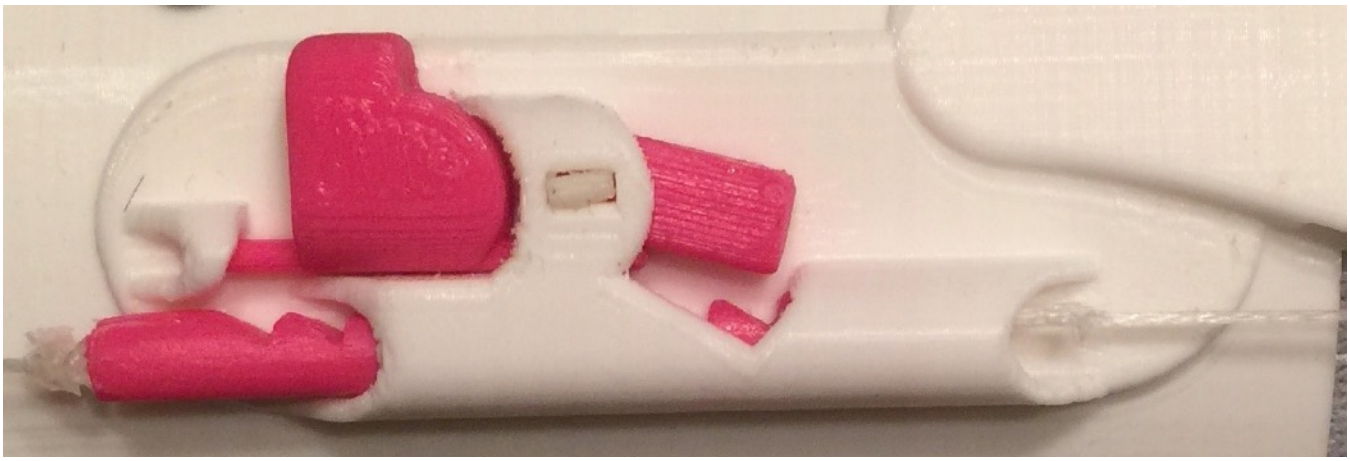


Preview of Elbow Bolt sizes; too large, too small, and just right.

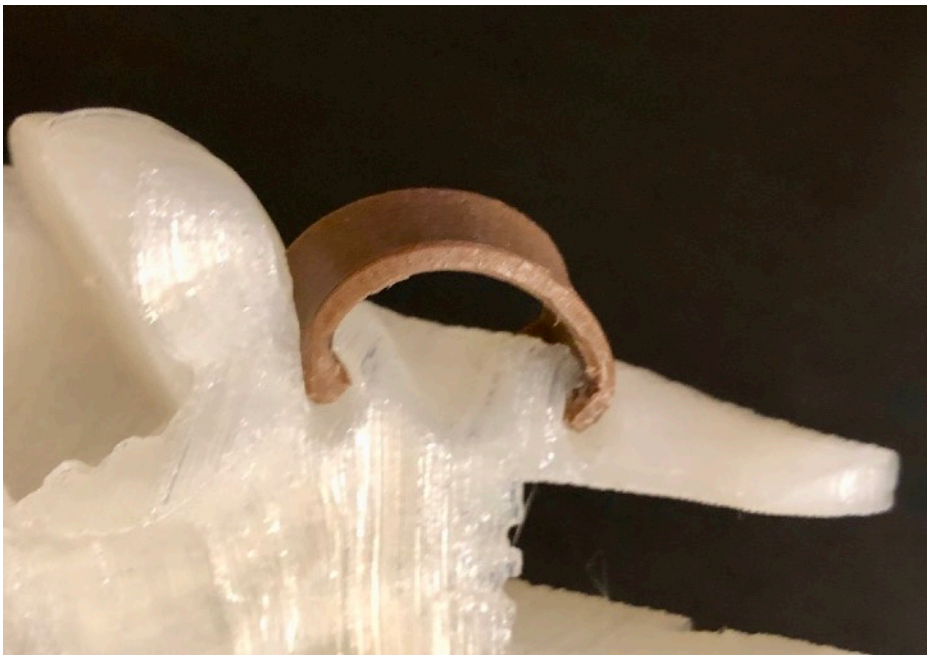
Tension Bolt Diameter: Choose the threading size for the bolt holding the string tensioner in place This is best decided while viewing the tensioner from the top. Choose a size where the slot to retain the nut has plenty of wall thickness around it.

Preview of Tensioner Bolt sizes; too large, too small, and just right.

Grip Latch: Decide whether to include the Grip Latch or not. The grip latch mechanism is useful to hold a grip and retain usage of the elbow.



Pencil Holder : If chosen a cut out is made in the palm to slide a soft pencil holder.



Render and Save STL files

You will have to select each part to preview then press Render, and then Save STL button.

NOTE: The render button can take a long time for some parts **(20 minutes or more).**

Some of the parts render as empty and are **not necessary** depending on your parameters. For example, if you choose the arm as one piece then Arm2, Arm3, and Arm4 are not necessary and will be rendered empty. Likewise with the cover if you chose to the Cover as one piece then Cover2, Cover,3 and Cover4 are not necessary and will render blank. If you choose not to include the

GripLatch, then LatchHinge, LatchSlider, LatchPin, and Latch Teeth are not necessary and will render blank.

Have Fun