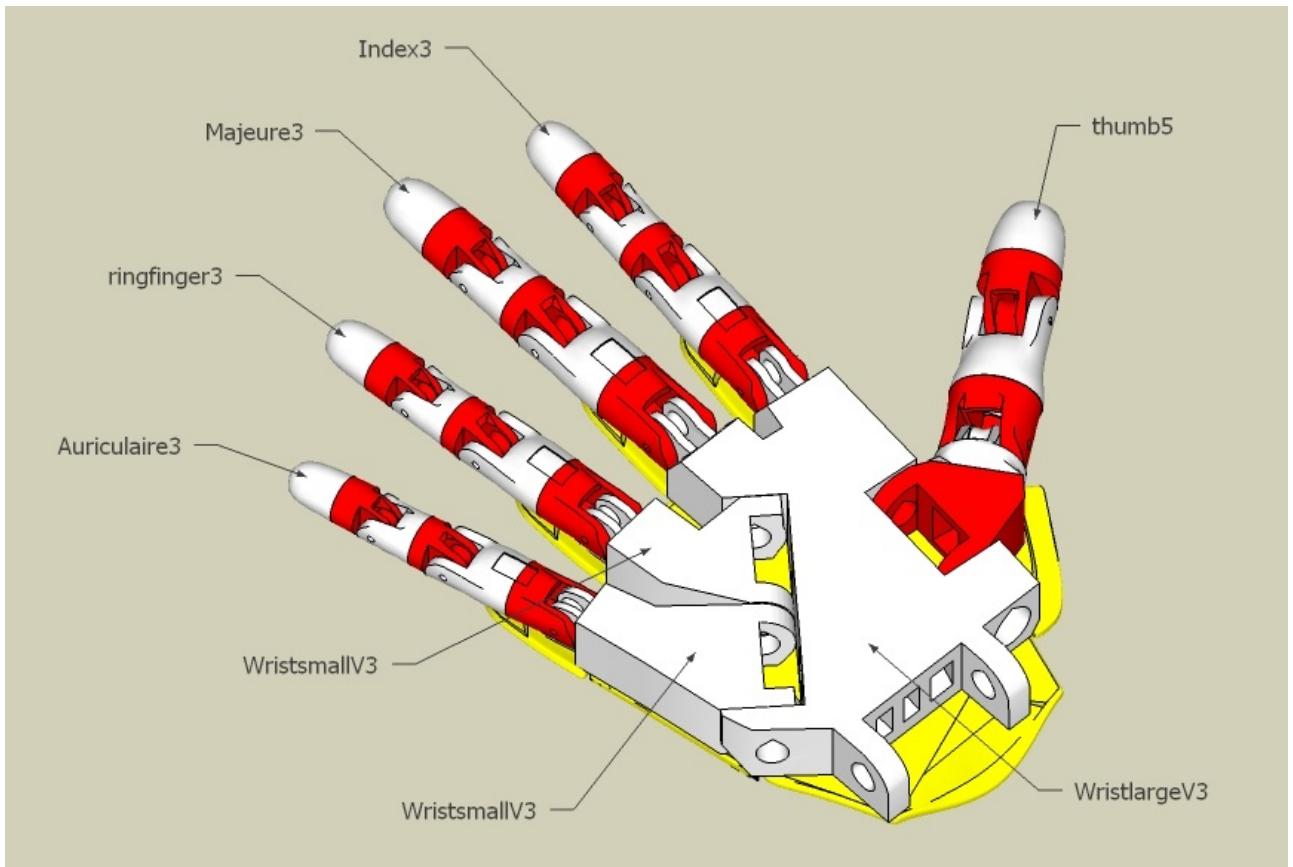


# PART: RIGHT HAND



## Assembly

*These instructions are for the right hand. The left hand is similar but some parts are mirrored. If you want to see more detailed instructions on how to build the fingers, you can have a look at the "Finger Starter" node*

- Print with an infill of 30%, 3 shells, best with no support, no raft:
  - Wristlarge
  - Wristsmall
  - Thumb
- Print Index3, Majeure3, ringfinger3 and Auriculaire3, with an infill of 30%, 1 shell, best with no support, no raft:
  - Index3
  - Majeure3
  - ringfinger3
  - Auriculaire3
- Print coverfinger with an infill of 30%, 3 shells, with support. To get the best printing result on the covers is to print them standing up, instead laying them flat.

# PART: RIGHT HAND



Time to redrill the finger hinges. I keep the fingers in separate bags to avoid mixing them.



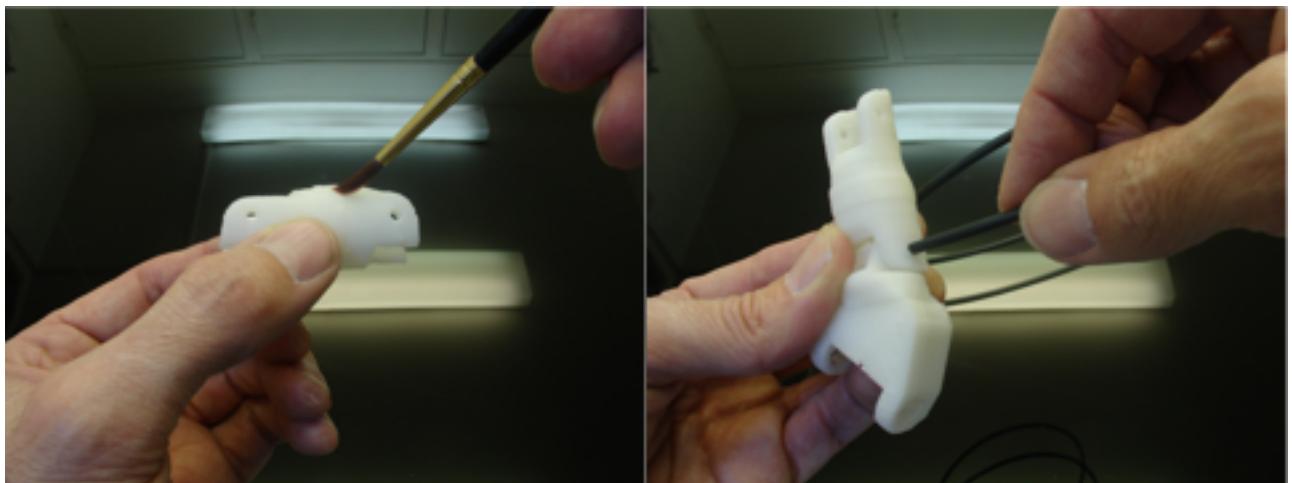
The outside hinge is redrilled with a 3mm drill.

The inside hinge is redrilled with a 3.2 or 3.5mm drill.

# PART: RIGHT HAND

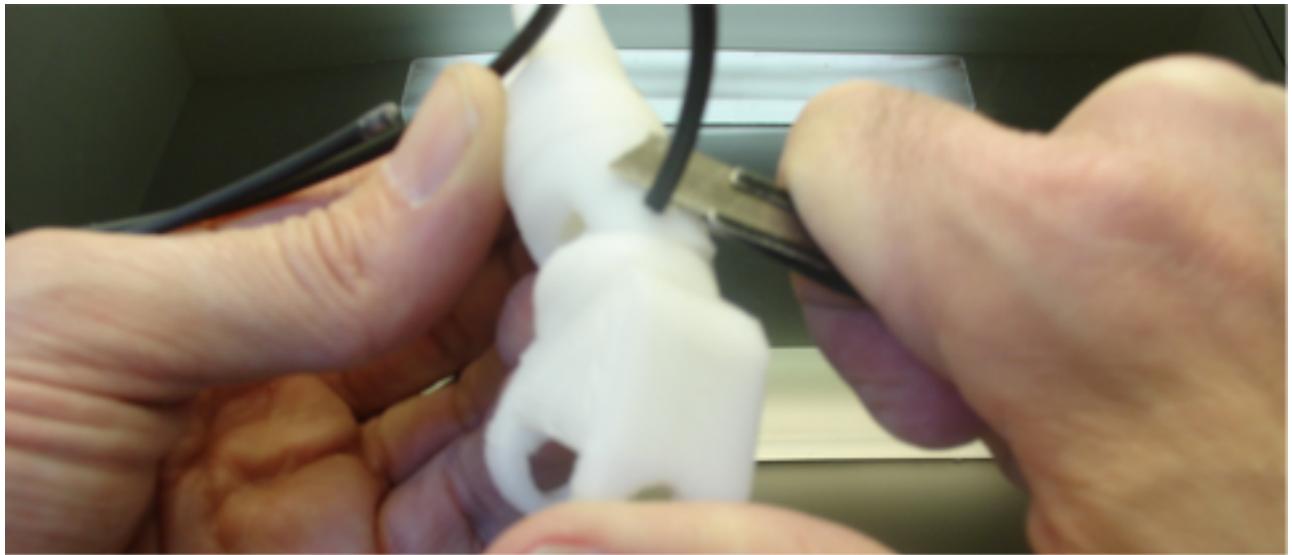


File the hinges to really adapt them the best.

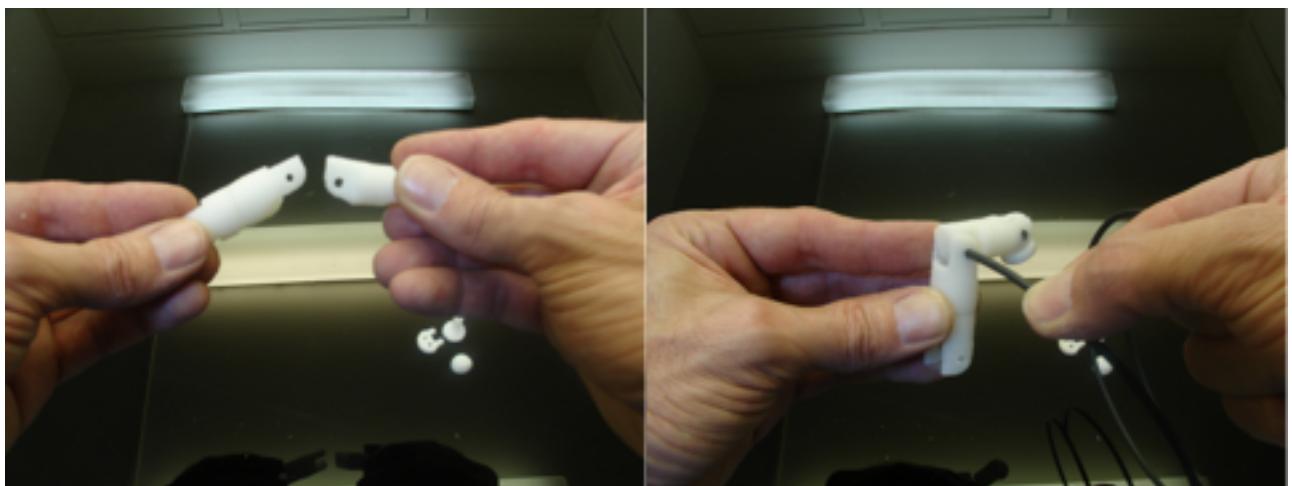


Glue the parts together with Acetone(ABS). Then use your 3mm filament to make pegs.

# PART: RIGHT HAND



Cut the filament with a knife. If you don't have 3mm filament you will need to do this with bolts of 3mm. I recommend the filament, it's perfect, cheap and fast.

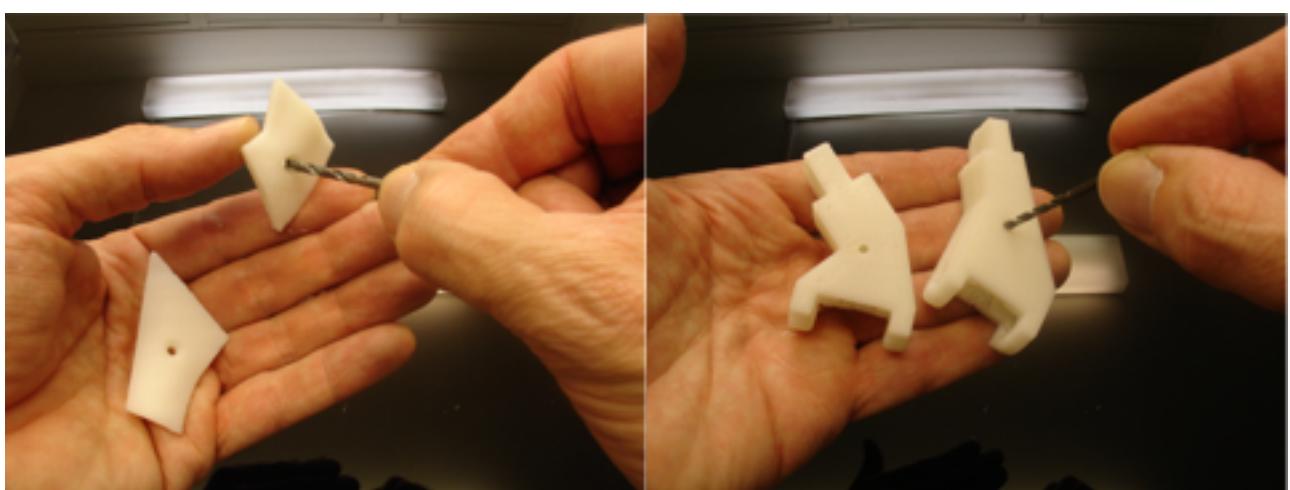


We will leave the fingers for now and get back to making the sensors and attaching them to the hand later on.

# PART: RIGHT HAND

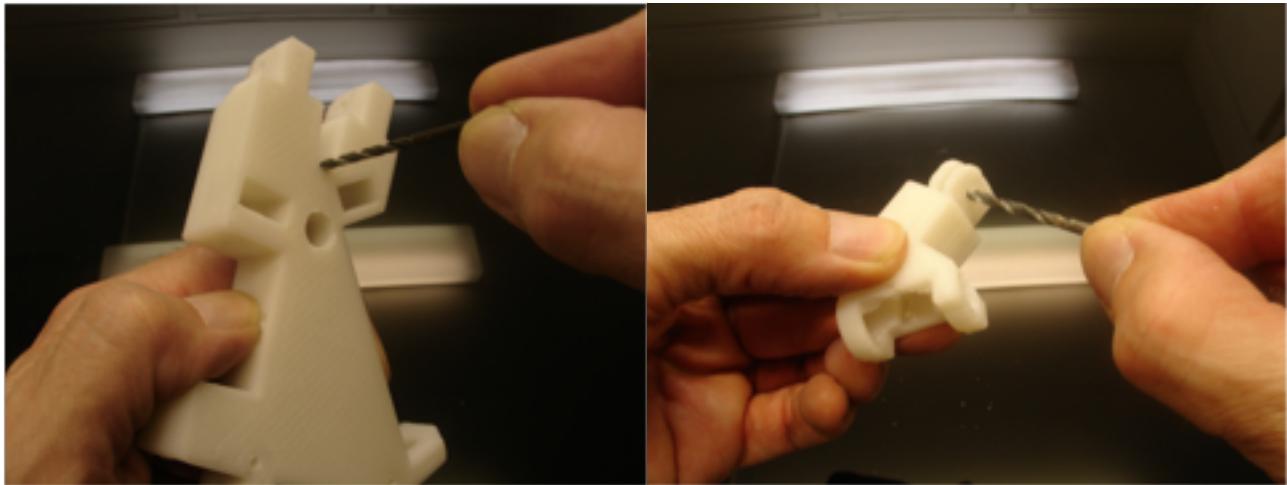


Redrill all holes of the covers with a 3mm drill.

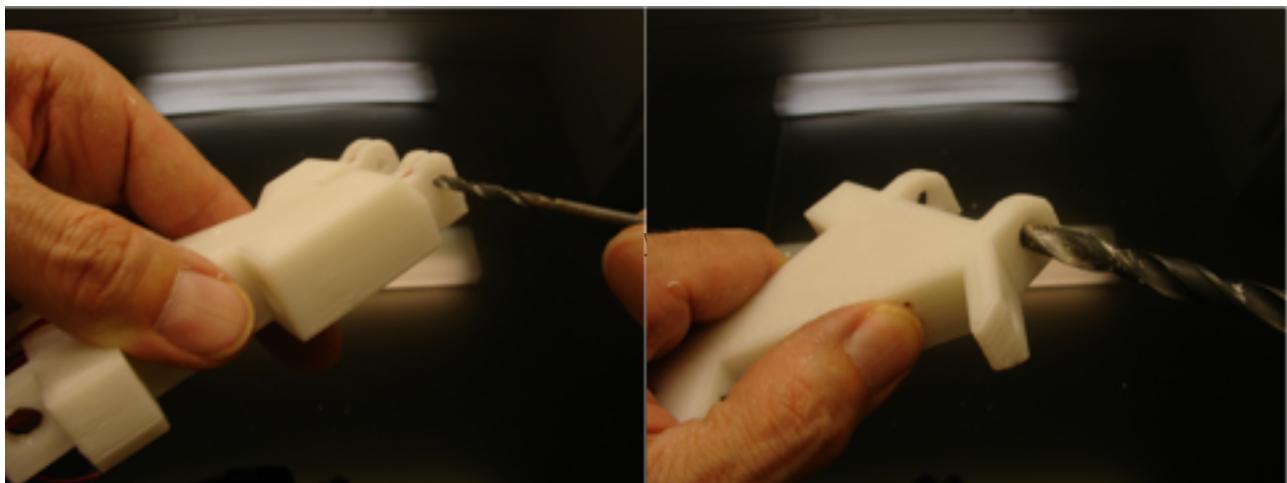


Redrill Wristmall and Wristlarge with a 2.5mm drill for to adapt the covers. If you don't have exactly these size of screws, it doesn't really matter. Use whatever you find at you hardware shop. Remember that the covers have a purpose and are necessary to have a correctly functional hand. They restrain Wristmall from going to the back of the hand. Redrill the hinges of Wristmall and Wristlarge with a 3.2 or 3.5mm drill. Ensure Bolts or printed Bolts run smoothly with no resistance but without wobbling.

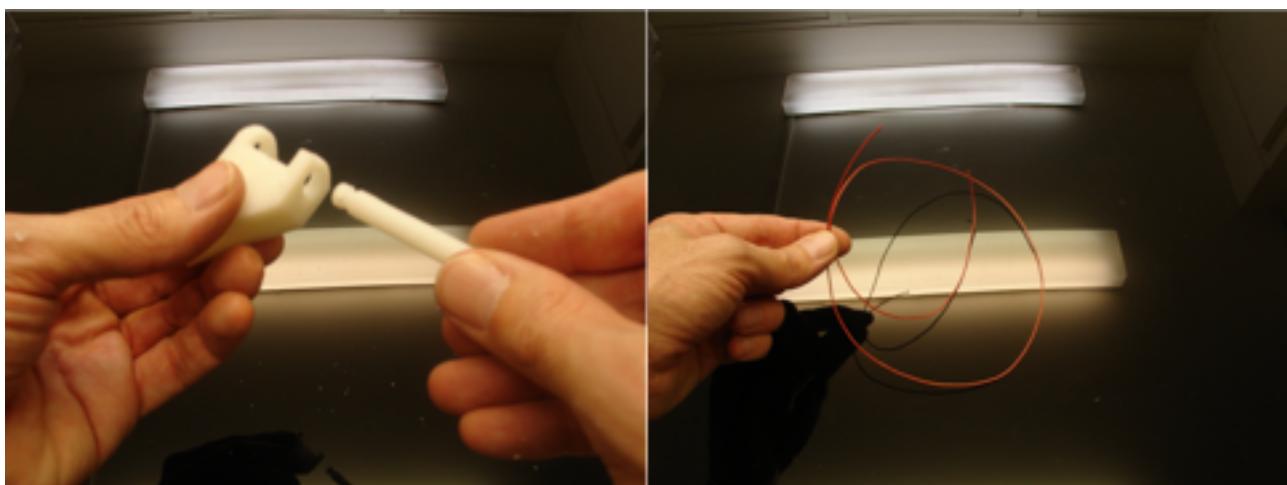
# PART: RIGHT HAND



Redrill the small hinges of Wristmall and Wristlarge with a 3.2 or 3.5mm drill



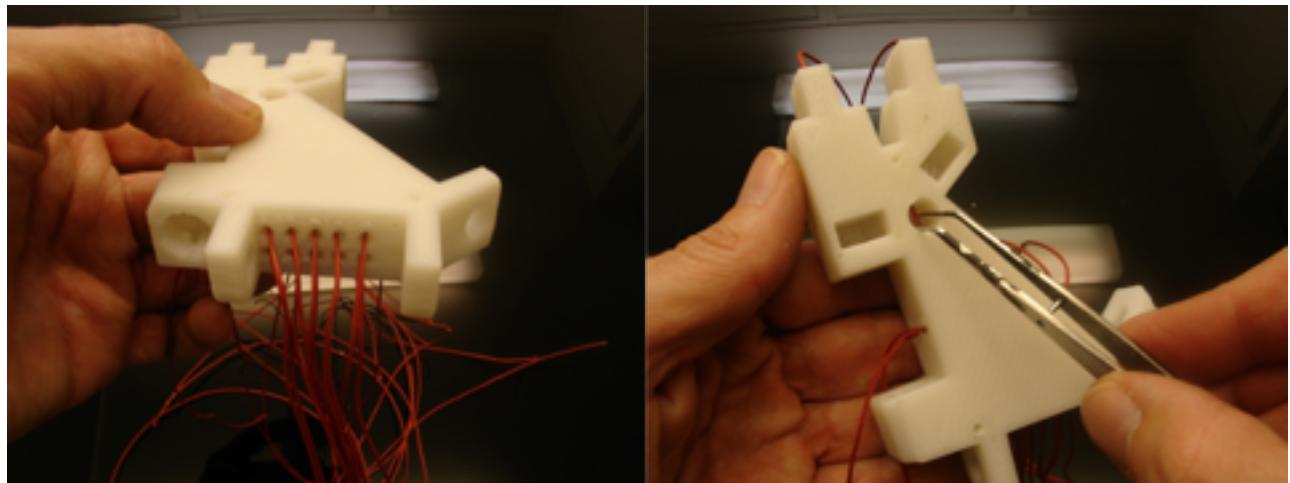
Redrill the big hinges with a 8mm drill.



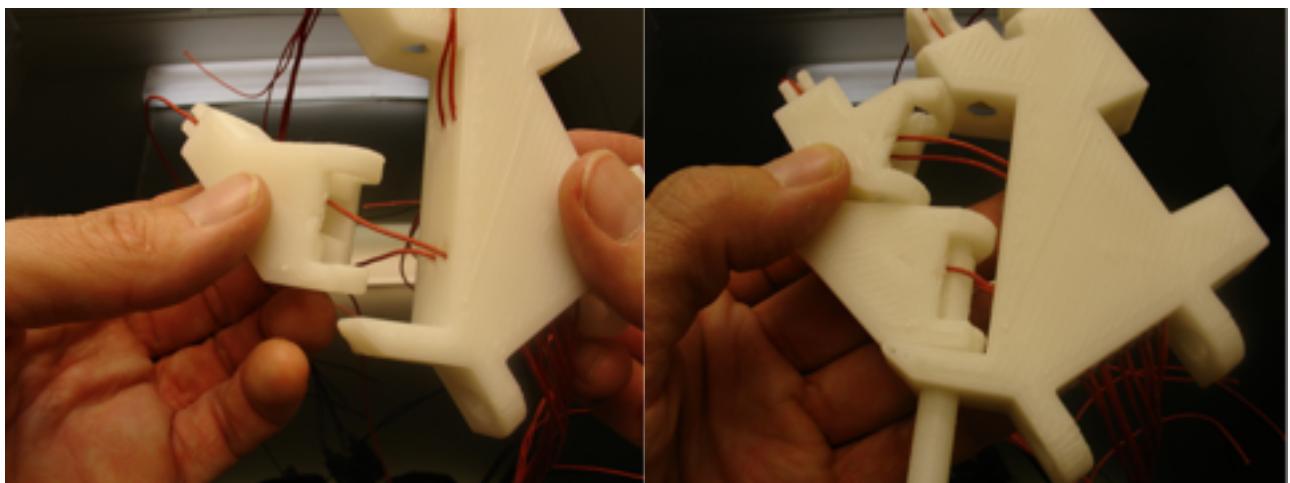
Ensure Bolts or printed Bolts run smoothly with no resistance but without wobbling.  
Cut 10 pieces of 75cm long of your braided fish line 200LB. Don't use standard nylon because it stretches.

# PART: RIGHT HAND

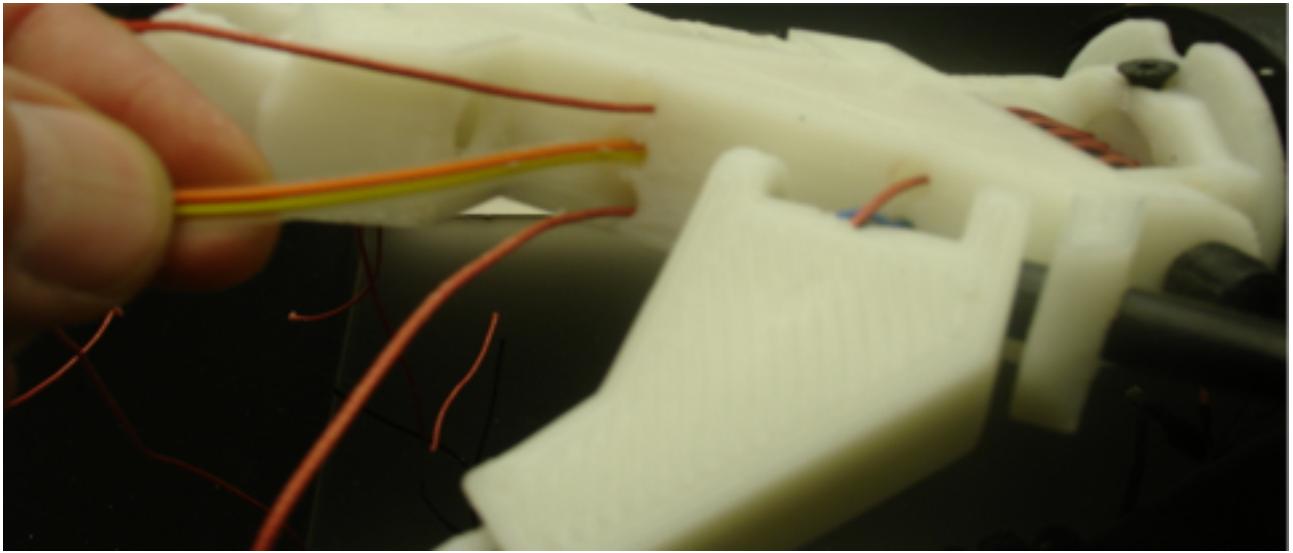
At this point it is good to decide if you want to have sensors on the tip of the fingers or not. You must have seen three holes above each other for the linings in WristLarge. The third hole (middle one) is for running electrical cables to wire up the sensors.



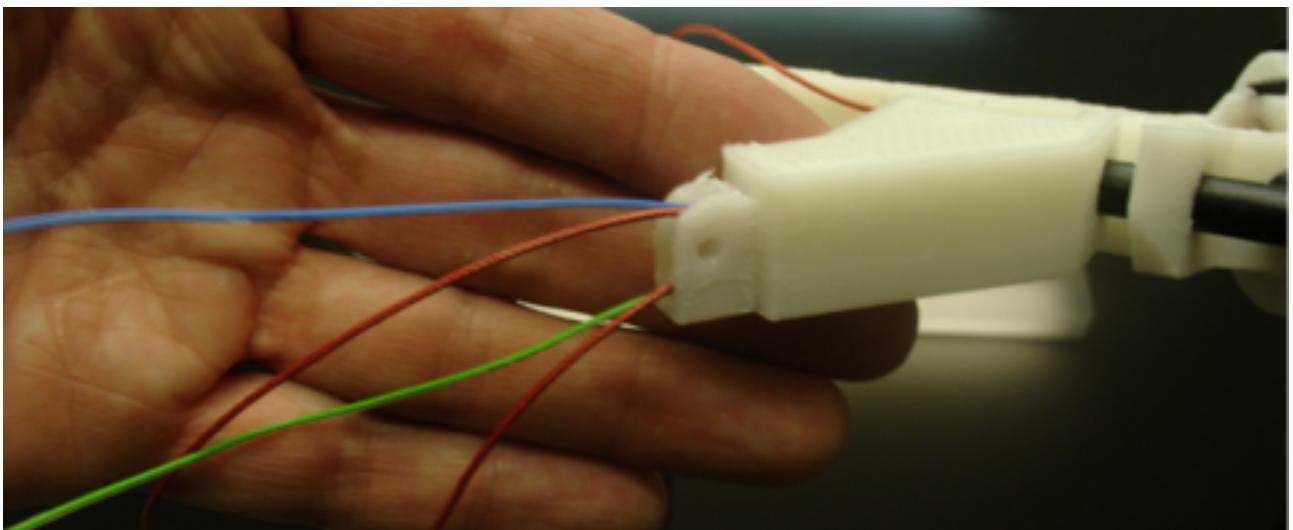
Insert the braided fish lines in the holes of Wristlarge. In this picture, I don't have electrical wires for the finger sensors yet because it was a previous version. I designed a little hole which can help you to guide the linings.



## PART: RIGHT HAND

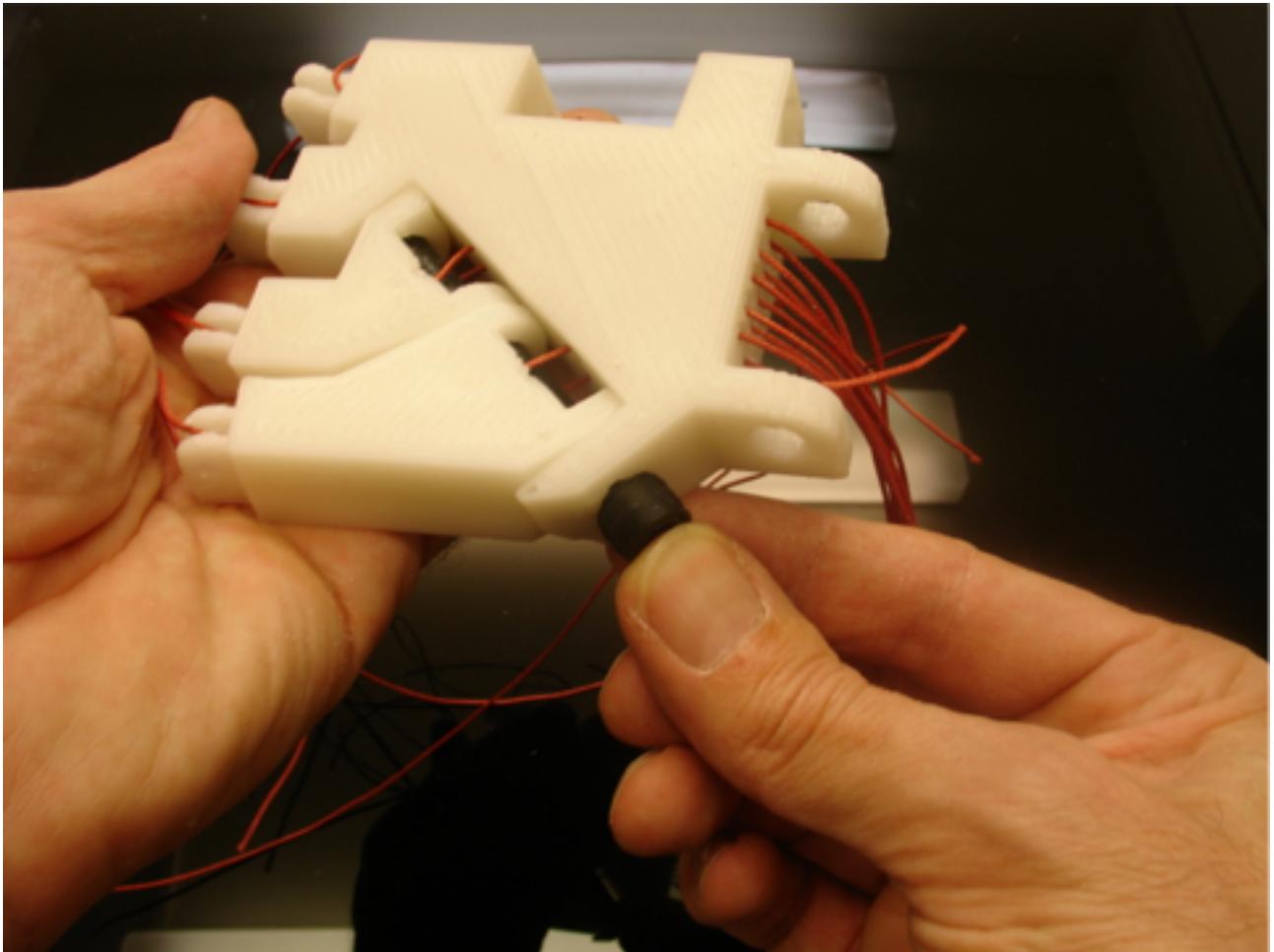


The electrical cables should run through the middle holes.

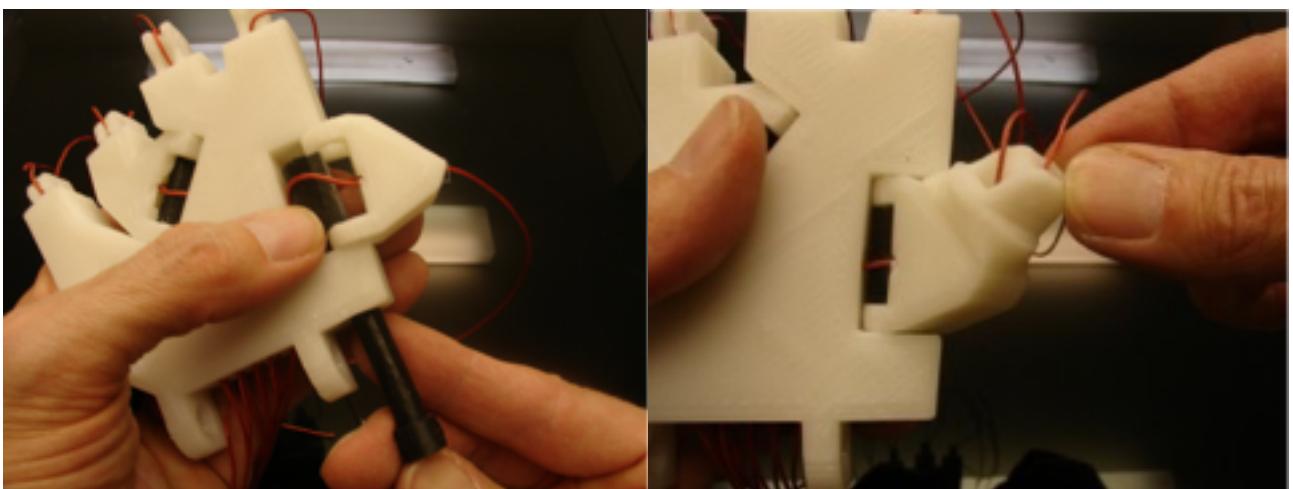


Run the linings into Wristmall. Make sure not to twist them on the way through. If you mix them up, the servos won't be able actuate the fingers correctly.

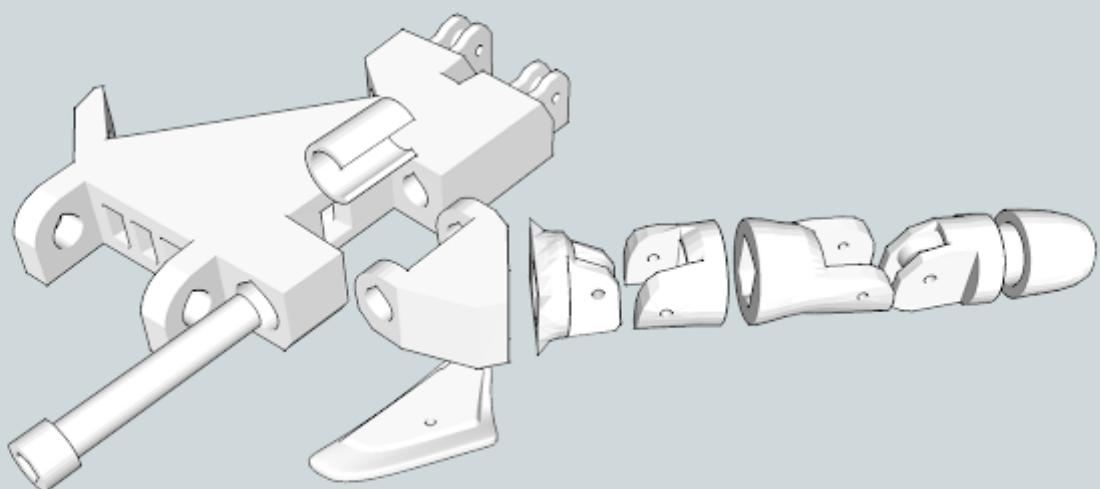
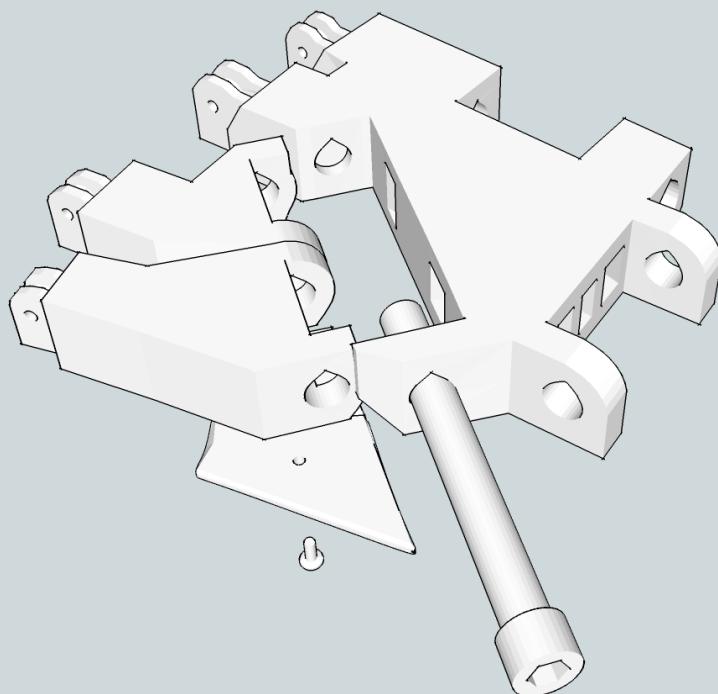
## PART: RIGHT HAND



Repeat the wiring with the thumb. If you are using electrical cables don't use the "Entretoise", as shown above, otherwise you won't be able to run the electric cables.



# PART: RIGHT HAND



# PART: RIGHT HAND

In the next steps we will be making the sensors at the ends of the fingers. These sensors are optional. If you don't want sensors just skip this part.



Your finger sensor prints should look something like this.

Glue the tip of the finger to the hinge tip. Make sure to align the nail lines, it will look better.  
Sorry for the blurry picture.

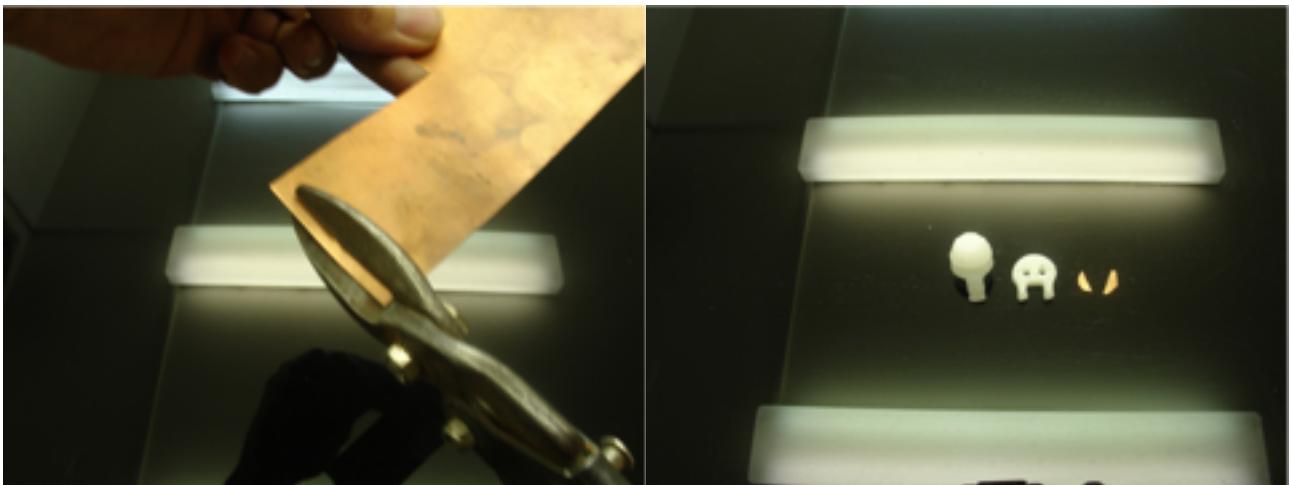


# PART: RIGHT HAND



Redrill the holes of the hinge and the top hinge with a 2mm drill. Now add the hinge to the tip hinge and redrill them together to make sure they fit nicely.

I used non flat metal nails instead of filament here, because the size of these parts are small. I just cut them at the size needed.



Cut some strips of copper of about 3 to 4mm large. Recut those strips in tiny triangles. These are going to be contactors for the antistatic foam.

# PART: RIGHT HAND

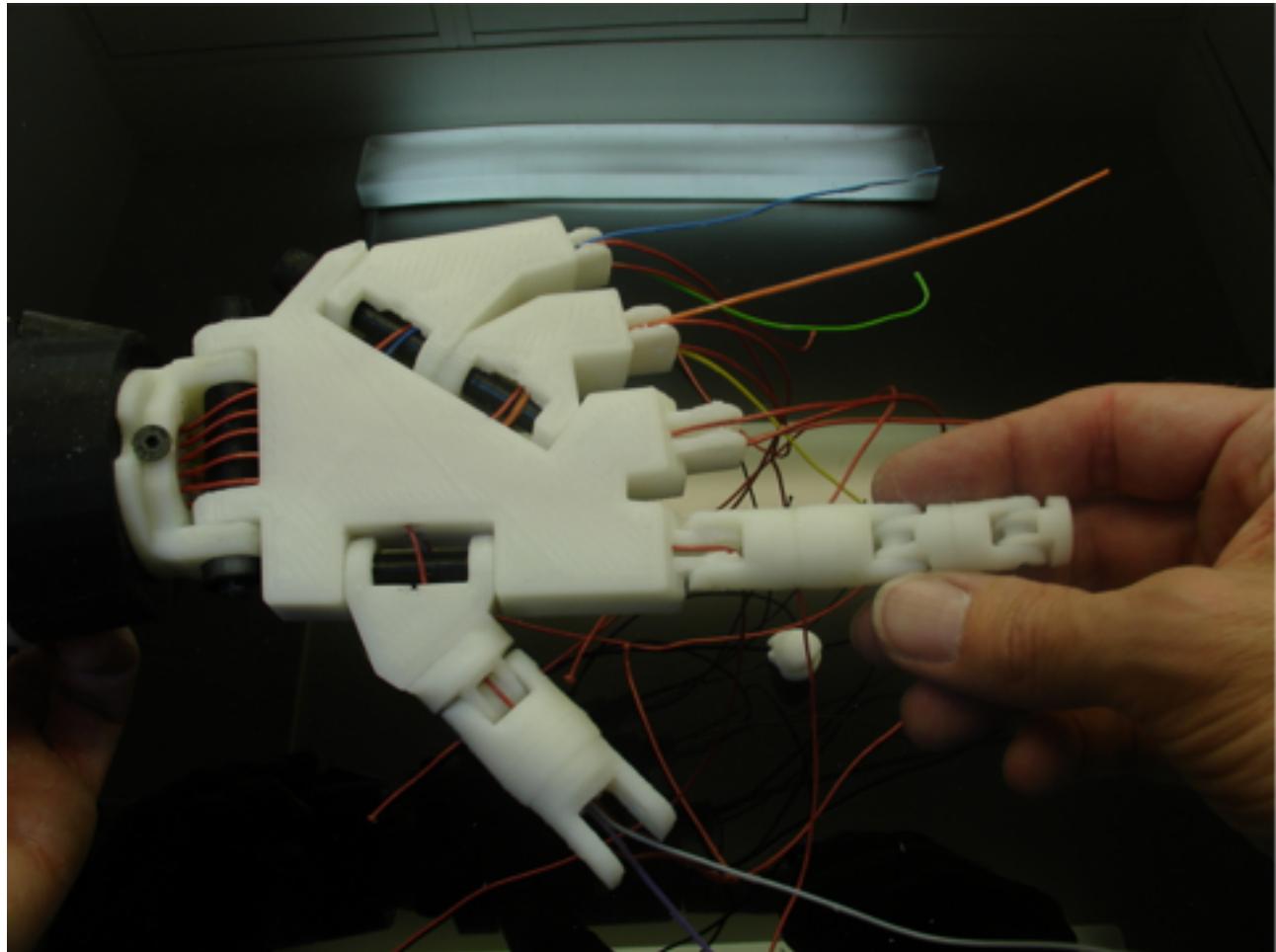


Cut with scissors some nice little rounds in your 4/5mm thick antistatic foam. This foam is sold with electronic components to avoid electric shocks. Most of the time we just throw it away when we buy components, you can also buy it in many electronic shops. It contains carbon which is an electrical conductor. When the foam is pressed against the 2 contactors, the carbon lets the current flow between them. More the foam is pressed and more current goes through. This is the info we will send to the Arduino Analog pins.

Glue with 2 components epoxy the foam to tip hinge part as shown on the picture.  
Try to assemble the two parts and see if it move. The hinge design is supposed to stop the hinge from opening further than the 5mm thickness of the foam.

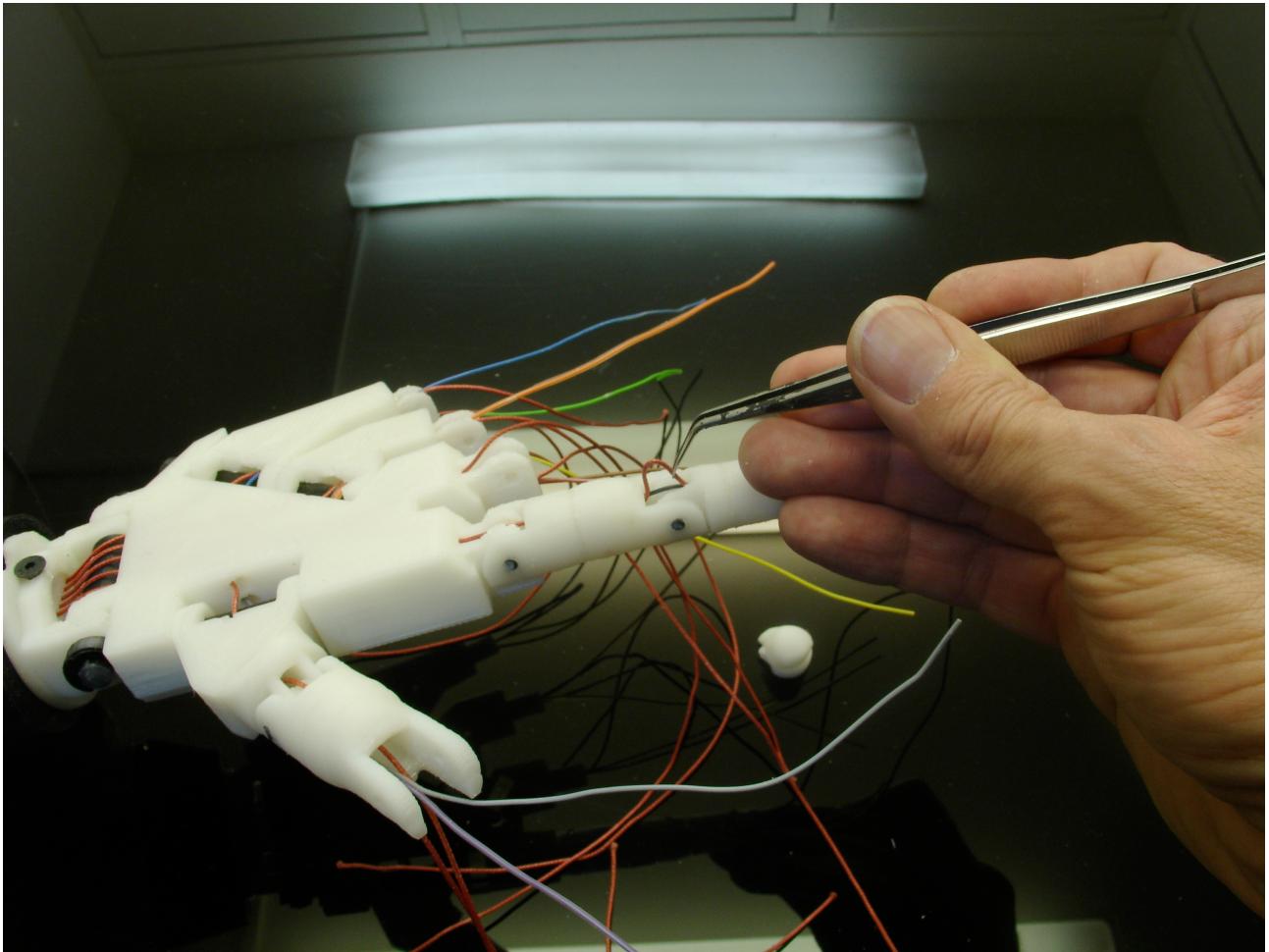


## PART: RIGHT HAND

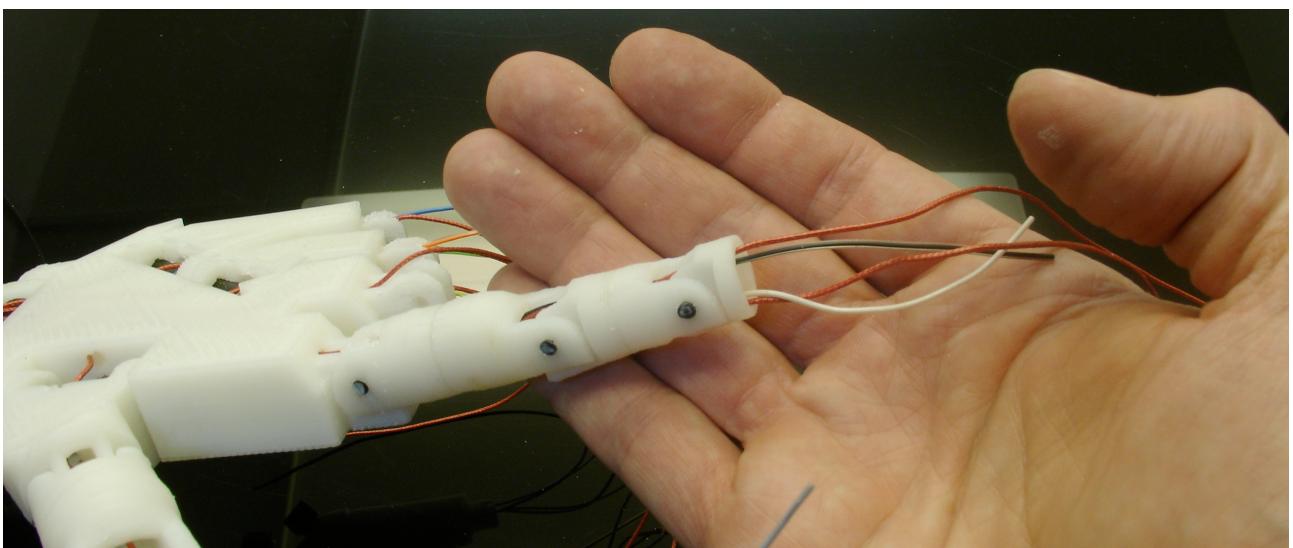


Time to mount the finger to Wristlarge. Notice the last hinge of the finger, this will receive the finger tip sensor assembly. All the holes in those finger parts should be cleared and large enough to have the 2 tension cables and the 2 electrical cables.

## PART: RIGHT HAND

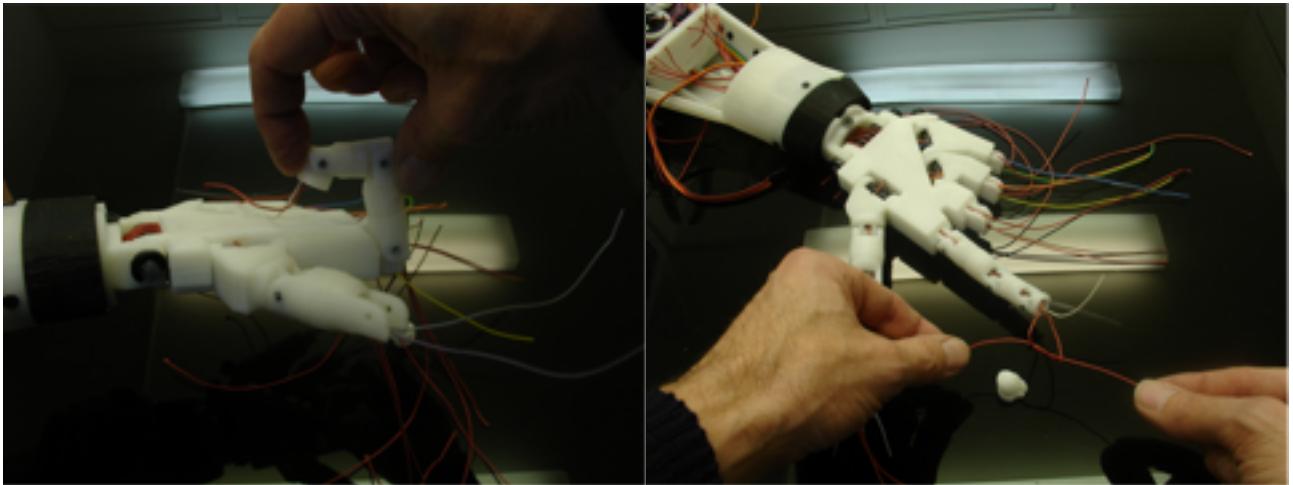


Run the tension cables and the electrical cables. One of each on the up side and one of each on the down side. Make sure to avoid any twisting of cables, this would cause to get unfunctional fingers.



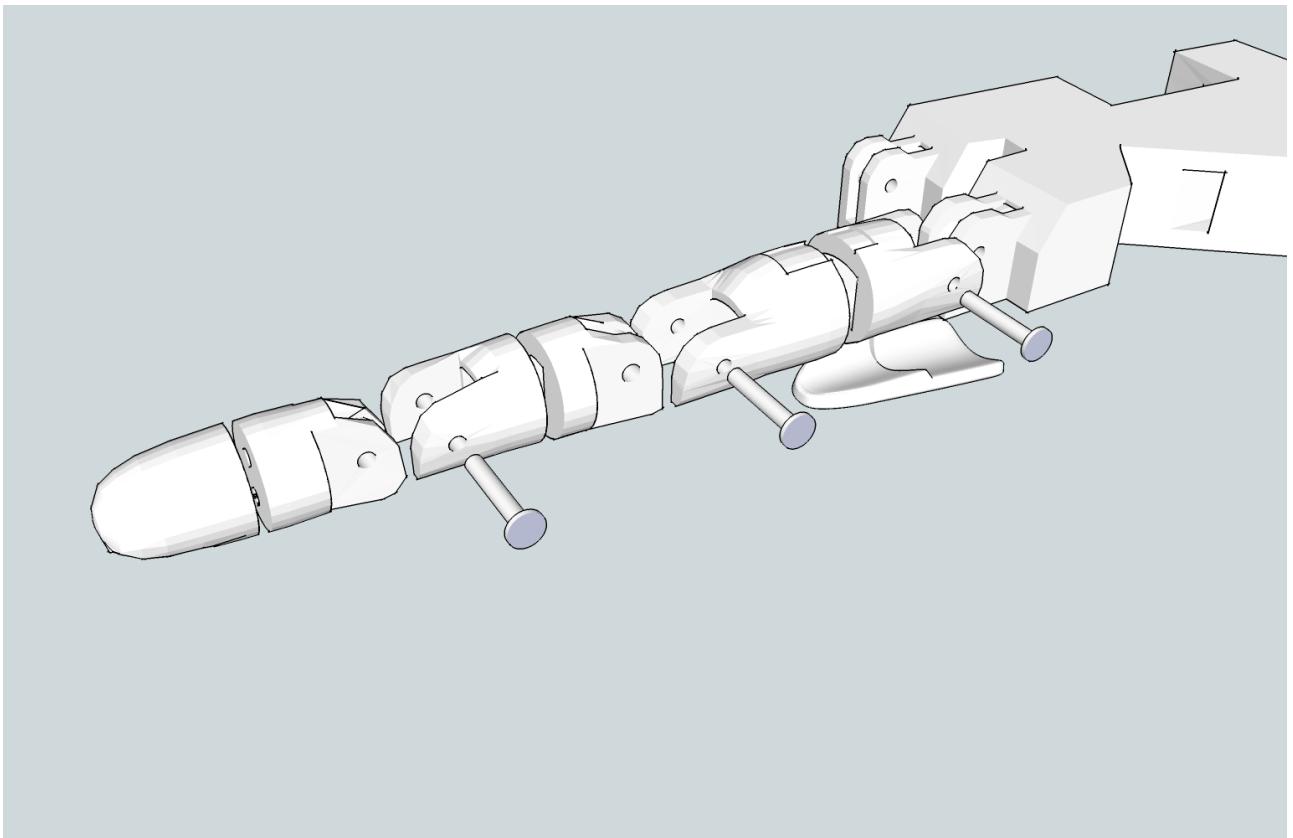
The color ribbon again is handy in this task.

# PART: RIGHT HAND

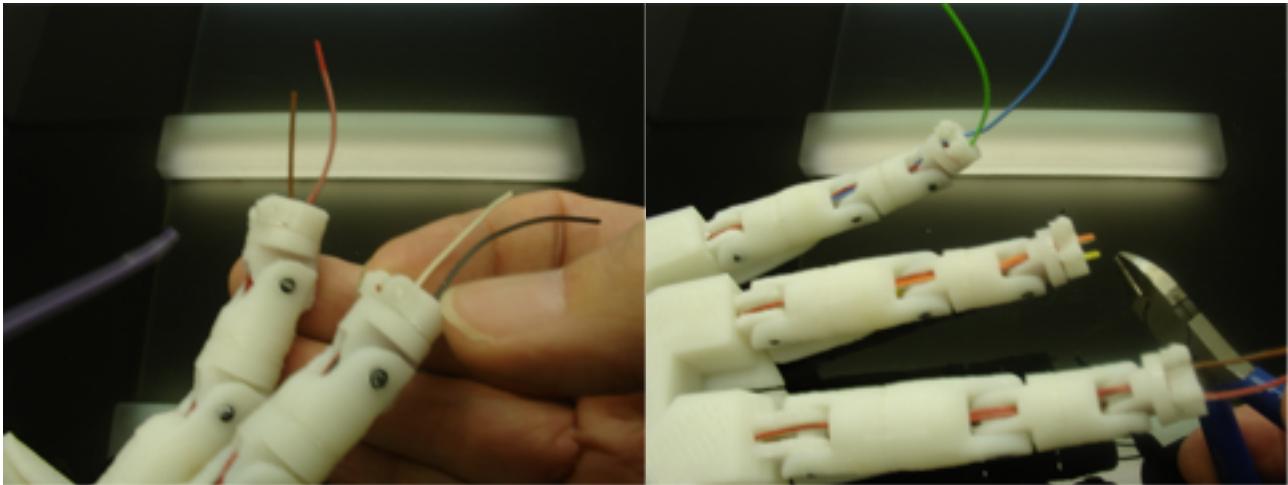


Fold the fingers to smooth up a bit the cables in their path. Make knots with the tension cables. A bunch of them is necessary because we don't want them to go through the holes when the servos are pulling hard on them.

What I do is even add glue to ensure any bad surprise. I also glue the electrical cables at the same time. When doing so, it is good to have the finger folded otherwise the electrical cables could later restrain the full motion of the finger.

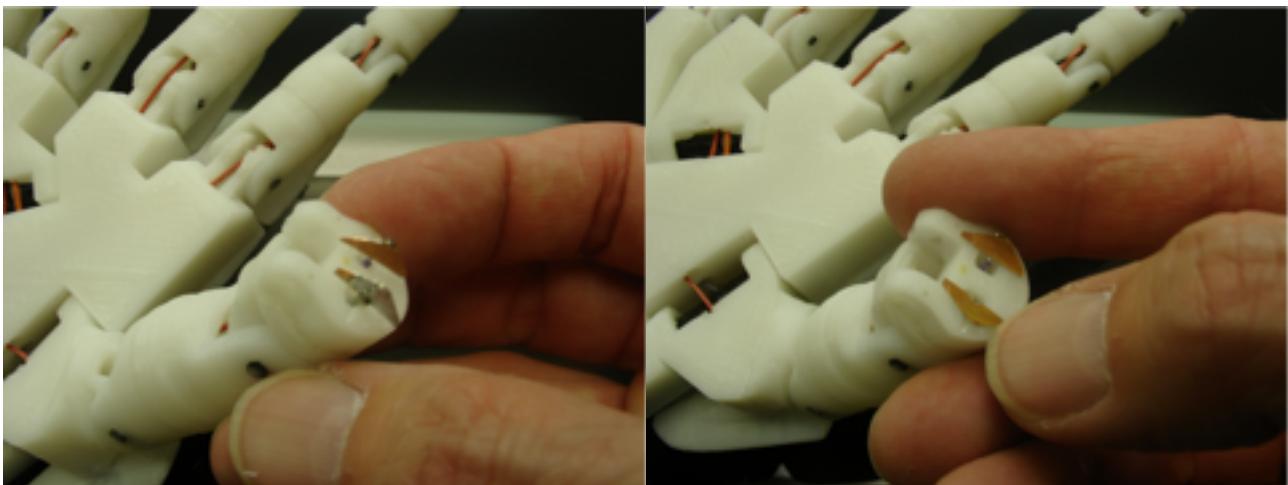


# PART: RIGHT HAND



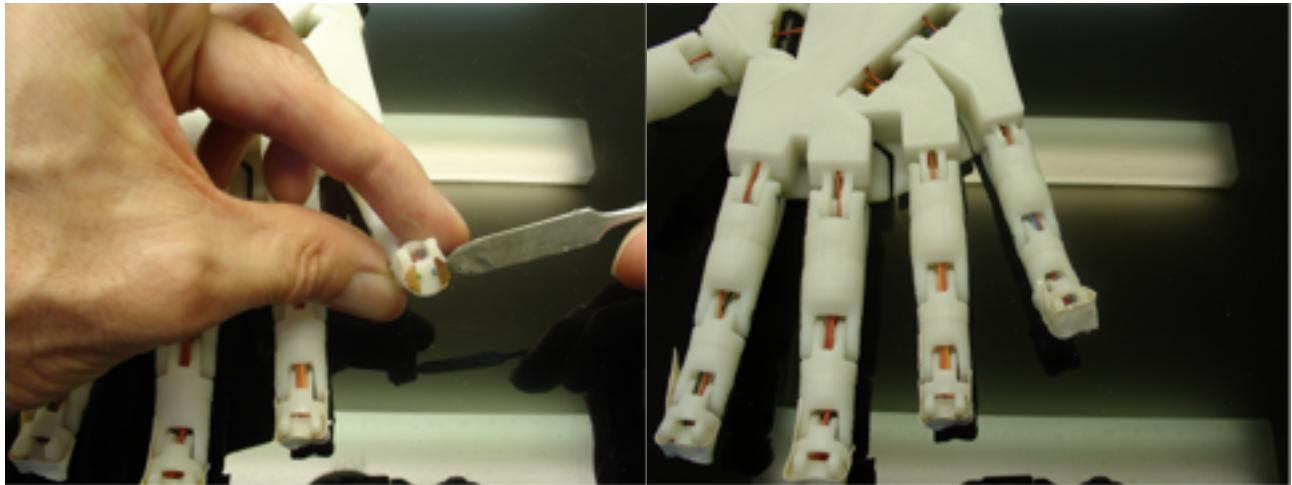
Cut the remains of the tension cables. Now glue the hinge of the finger tip to the last hinge of the finger. Notice the position, don't glue them upside down. Remember I mentioned the tip hinge was designed to avoid opening further than the thickness of the foam.

Cut each electrical wire at a 4/5mm length. Scary moment because too short would mean to redo all the wiring.

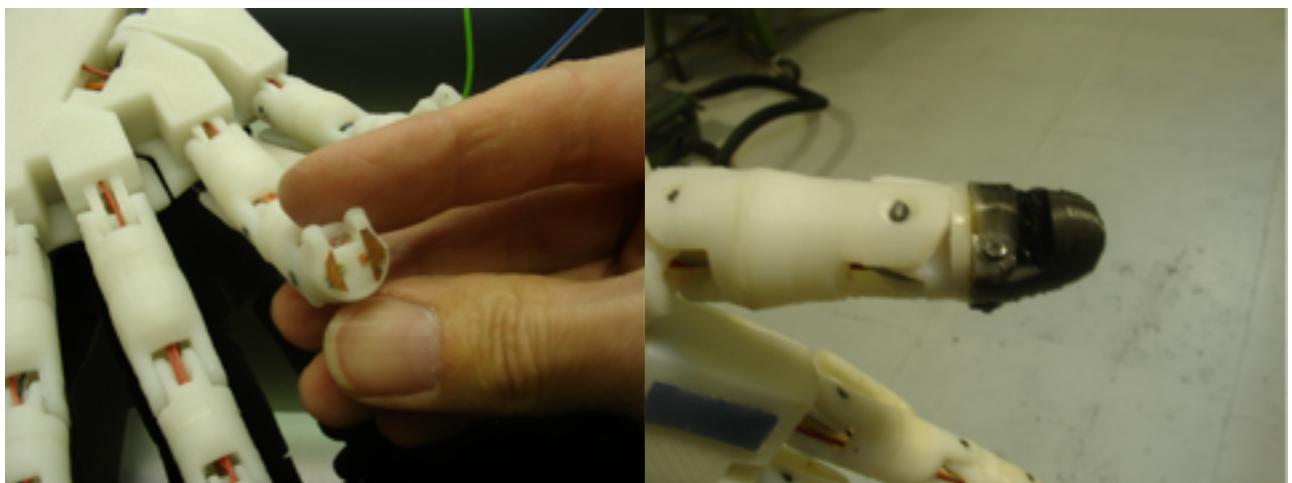


Cut and clear up the plastic on the electrical cable and solder the copper triangles. Once done, fold the cable and lay the copper triangles in a flat position.

# PART: RIGHT HAND



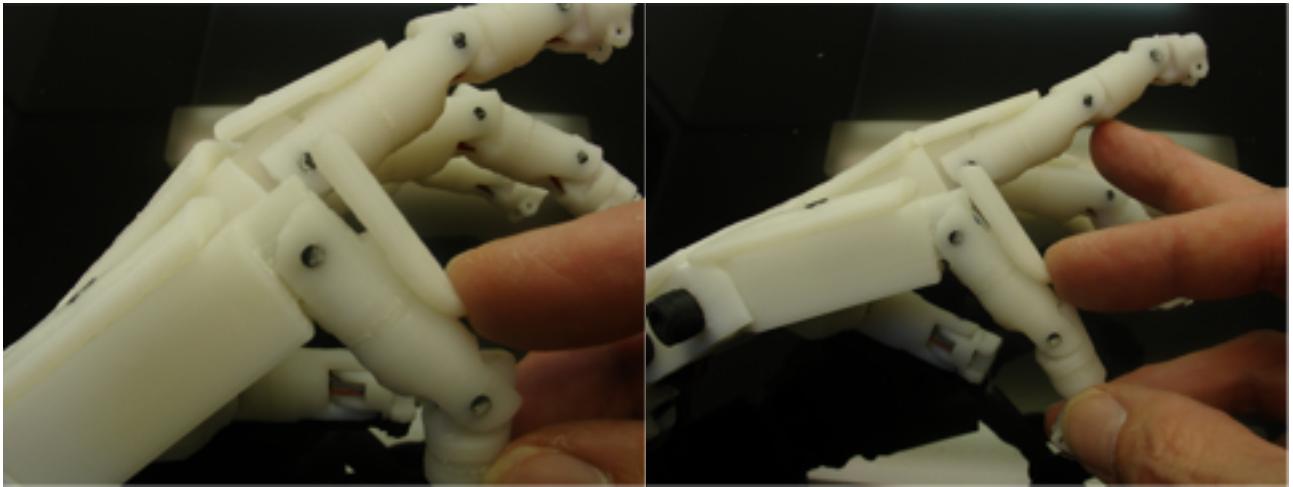
To maintain them flat during the time the glue gets hard, I used some tape. Look out for the tape you use as it maybe glued as well to the finger tips.



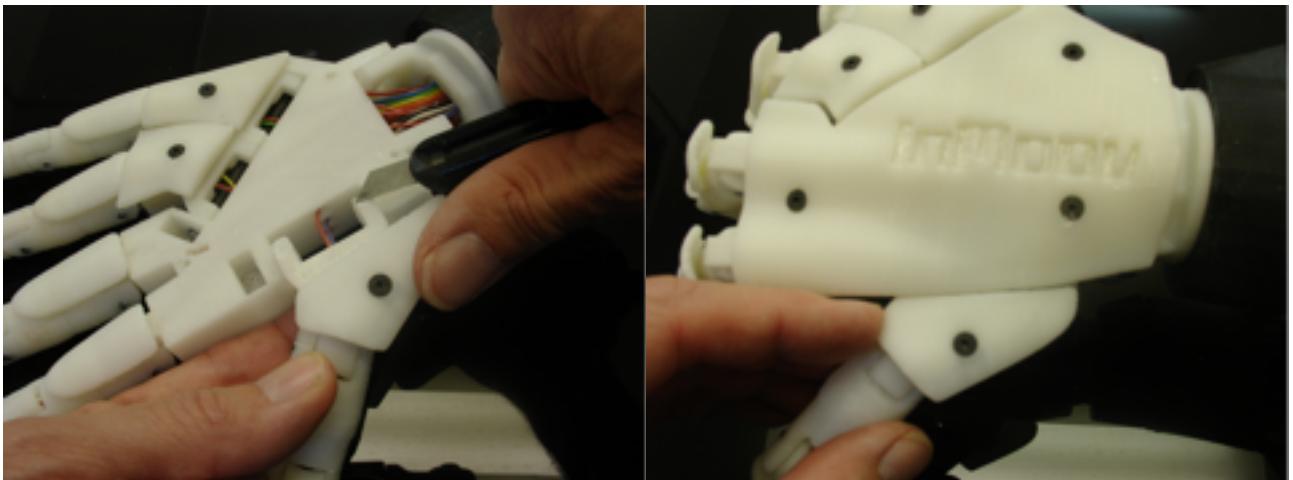
This is the result. Now you can add the finger tip with the nail and you should have a sensor ready to be pressed and give feedback. Also add the finger tip covers for extra protection and some nice grip.

*If you haven't made the finger tip covers yet, have a look at the "Finger Tip Cover" node. Sugru will do as well.*

# PART: RIGHT HAND

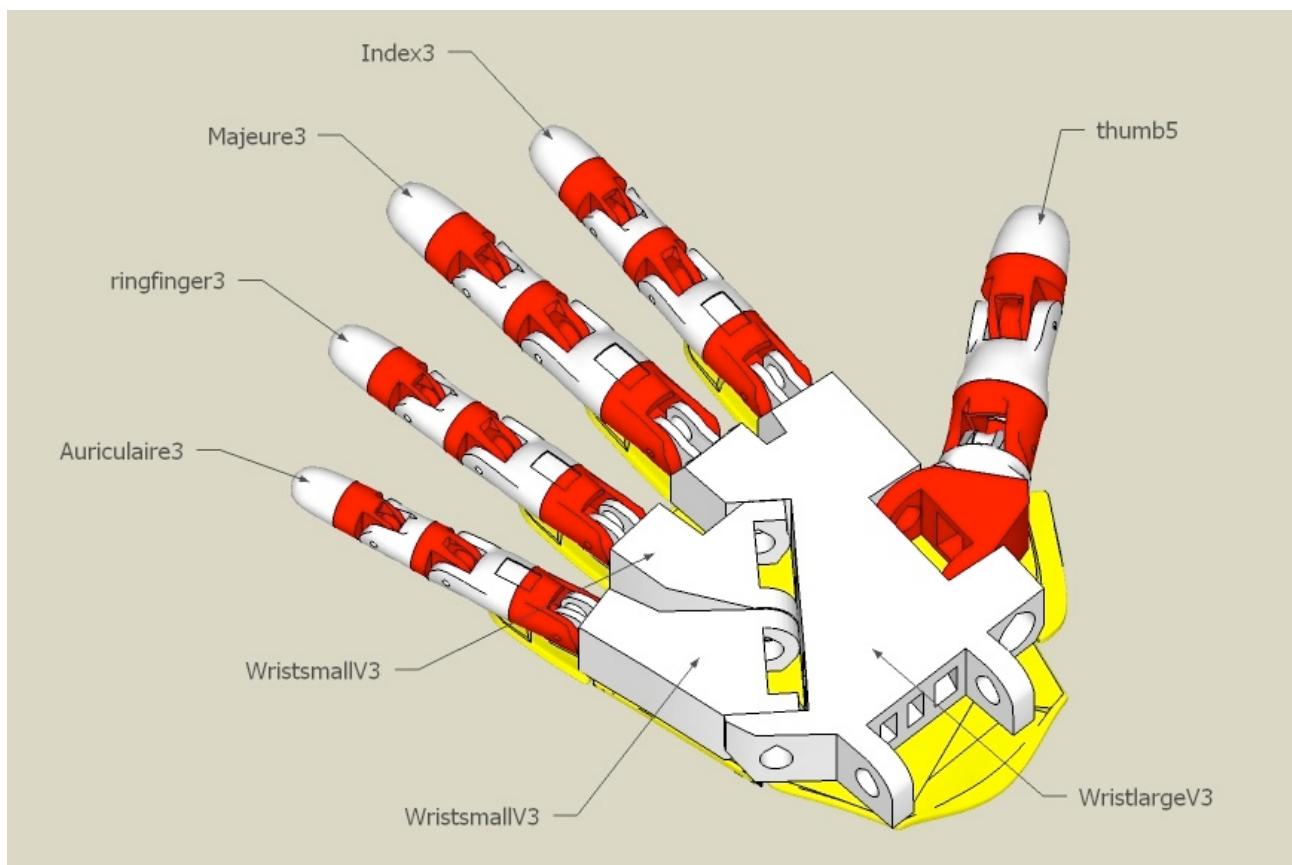
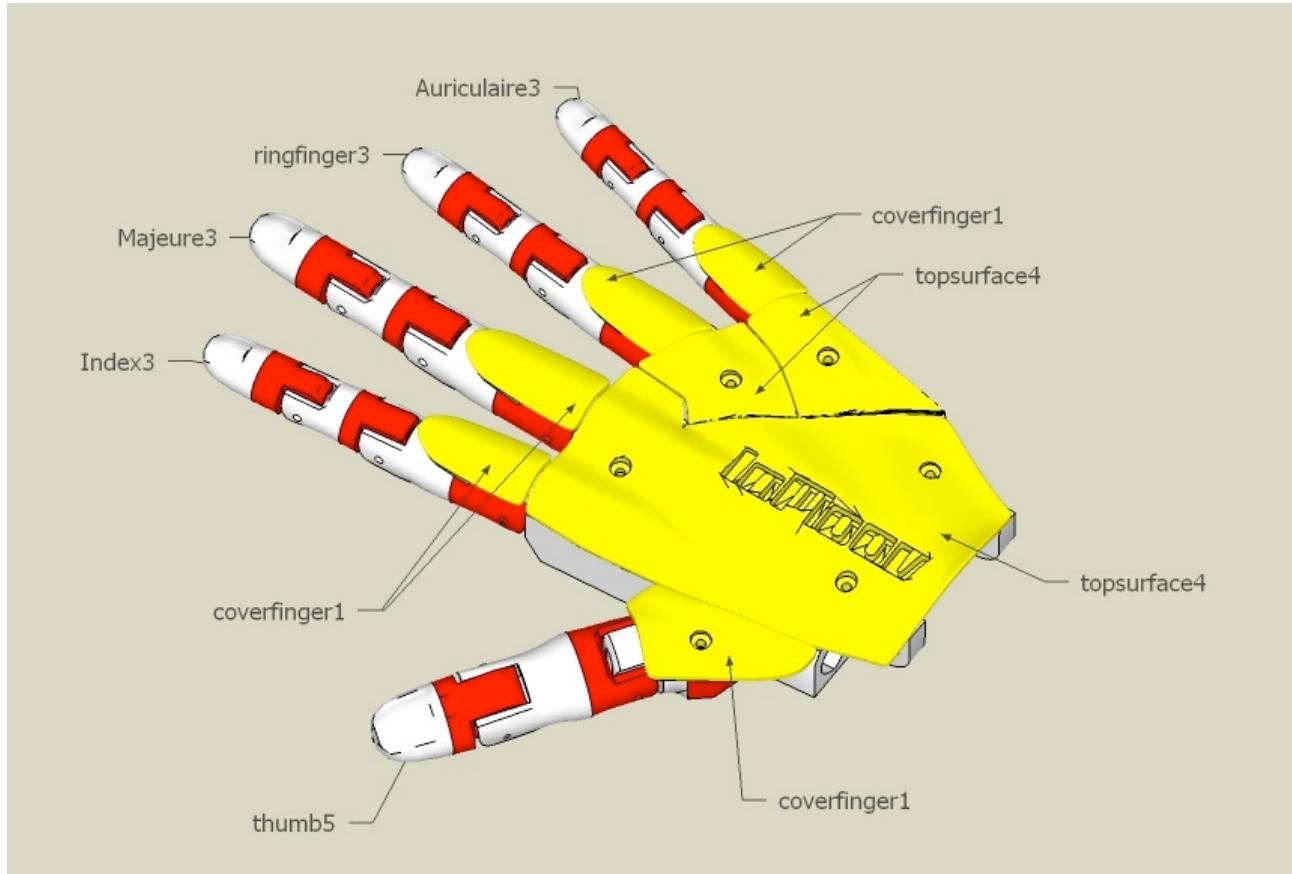


Glue the finger covers onto the fingers. These are used to avoid the finger going to much in a backward position and they also add a nice finish to the design.

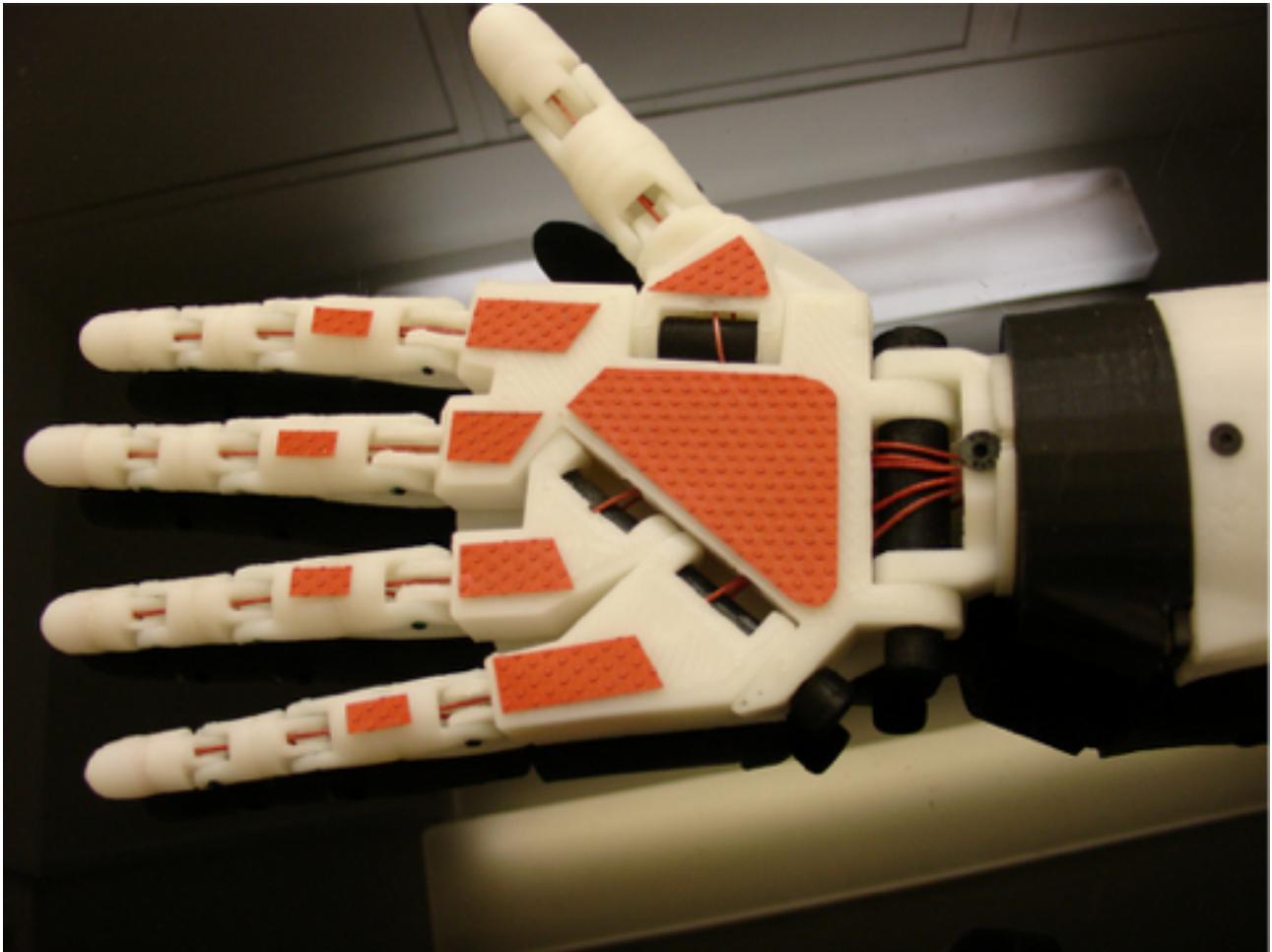


Do the same with the Thumb cover and Wristsmall. I actually glue them first and then I add the screw, that keeps them well in place. Recut with a knife the two corners on the thumb hinge. If you don't the hinge will be forcing against the hand cover. Add the hand cover and check if the fingers are moving nicely.

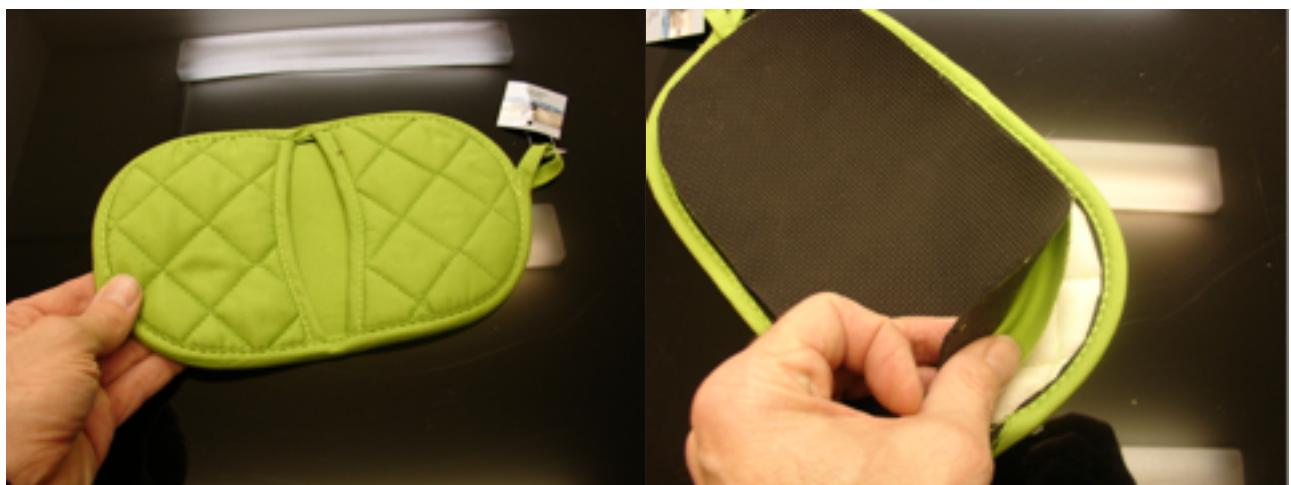
# PART: RIGHT HAND



## PART: RIGHT HAND



You can add ping pong surface in the palm of the hand for a better gripping. I also found some kitchen heat protectors for 1,50 euros with silicone surface. It is even better.



# PART: RIGHT HAND

## Parts

1 x Wristsmall  
1 x Wristlarge  
1 x topsurface  
1 x thumb  
1 x robcap  
1 x ringfinger  
1 x Majeure  
1 x Index  
1 x coverfinger  
1 x Auriculaire  
1 x Bolt\_entretoise  
Some 3mm 3d print filament  
800 cm 200 lb. fish line

*Optional:*

5 x Electrical wire one colour (length from fingertip to arduino)  
5 x Electrical wire another colour (length fro fingertip to arduino)  
1 x Finger tip cover set or some sugru  
1 x Ping Pong pad surface or silicon kitchen heat protector  
4/5mm thick antistatic foam  
A sheet of copper