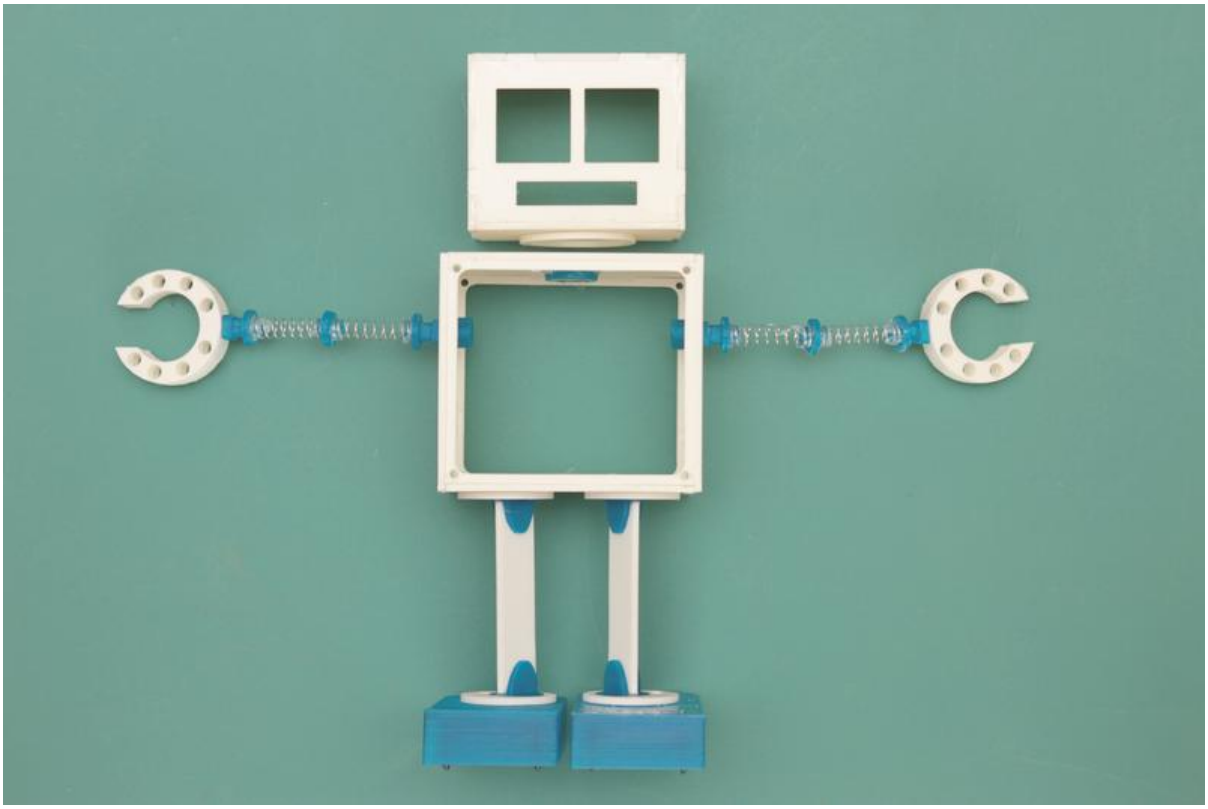
Making Adabot: Part 1

Created by Rick Winscot



https://learn.adafruit.com/making-adabot-part-1

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Overview

The Internets abound with awesome robot creations like DARwIn-OP (), Asimo (), NAO (), and Jimmie (). Speaking of Jimmie... have you heard of the 21st Century Robot Manifesto ()?

Creating your own robot is exactly what this guide is all about!

Before we get started... you should know that you don't need to have a 3D printer to build a robot; that's just one option. We'll cover a wide variety of substitute materials along the way.

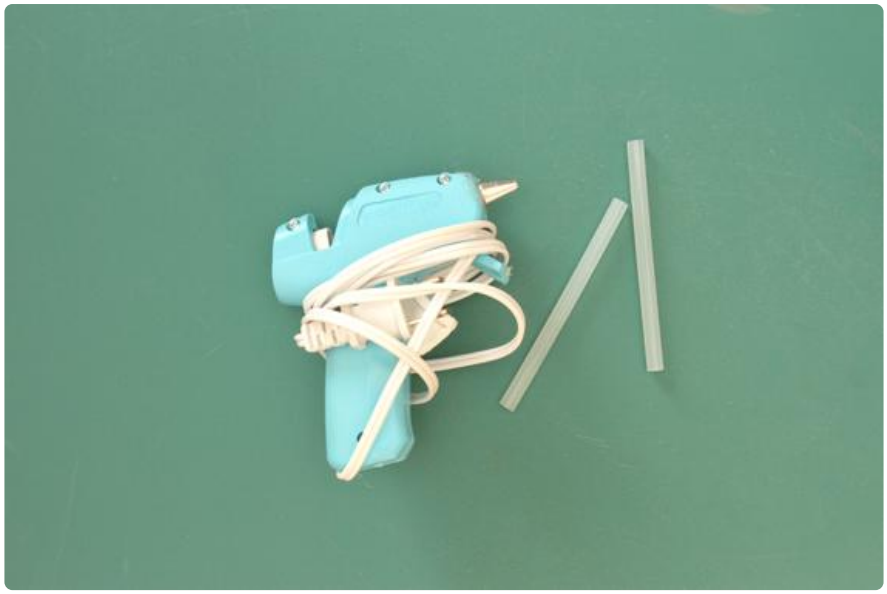
As far as body construction goes, you may have everything you need in the cupboard above your office desk!

Ready?

Let's start with the tools and materials we'll need to build the skeleton for this guy.

Tools / Materials

First on our tool list is the "Magic Wand" of crafting. This little guy, whom I affectionately refer to as Stanley, is a low-temp hot glue gun (recommend for crafters of all ages).



Next, we will need something to measure with; calipers or a good ruler. Metal ones are nice or you could give the shiny Adafruit 6" Ruler a go!

Remember, measure twice - cut once.

Regardless of construction material, making small adjustments here and there is likely. For this, a hobby knife is ideal. A pair of scissors may also be helpful if your primary construction material is paper-based.

When it comes time to assemble some of the mechanical bits, have a pair of pliers and screwdriver nearby.

Let's move-on to the materials we'll need to construct the robot chassis / body.

Chassis Fantastic

I've printed mine out of PLA on a 3D printer... as I mentioned before this is just one approach. Alternatively, you could use foam-core presenter / poster board, 1/8 inch plywood, 3mm acrylic, or cardboard. I constructed my first models using foam dinner plates.

When you're done, you should have a pile of flat parts ready to assemble.

3D Models (.stl files)

Easy Hardware

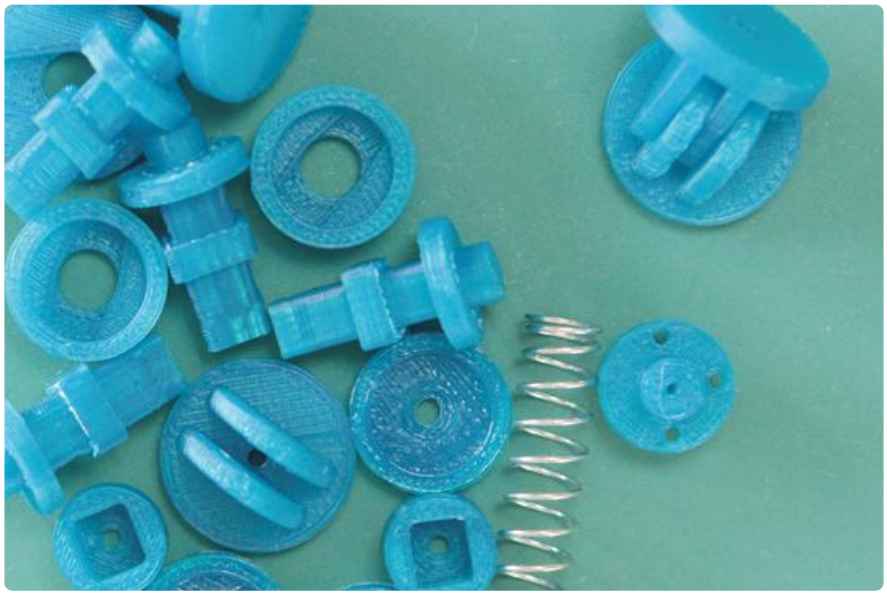
I've kept hardware requirements simple, limiting the list to items that your local home improvement or craft store should have plentiful supply of.

- 35mm x 10mm round compression springs
- 10mm M3 screws
- 12mm small wood screws
- #10 O-Rings

Compression springs can be expensive. Consider coiling a large paperclip around a pencil to create your own for just a few pennies each.

Classic Connectors

There are a few 'connectors' you'll have to make for the arms, legs, and servos. You can 3D print them or make them out of Sugru, FIMO, Sculpey, or Apoxie Sculpt.



Magnificent Magnets

If you plan on putting electronics into your robot, now is the time to think about access panels.

You can go the fancy route and use neodymium magnets in the corners of the front

and back of the body... I purchased a package of 100 1/8 x 1/16 inch rare earth magnets from Amazon for a few dollars.

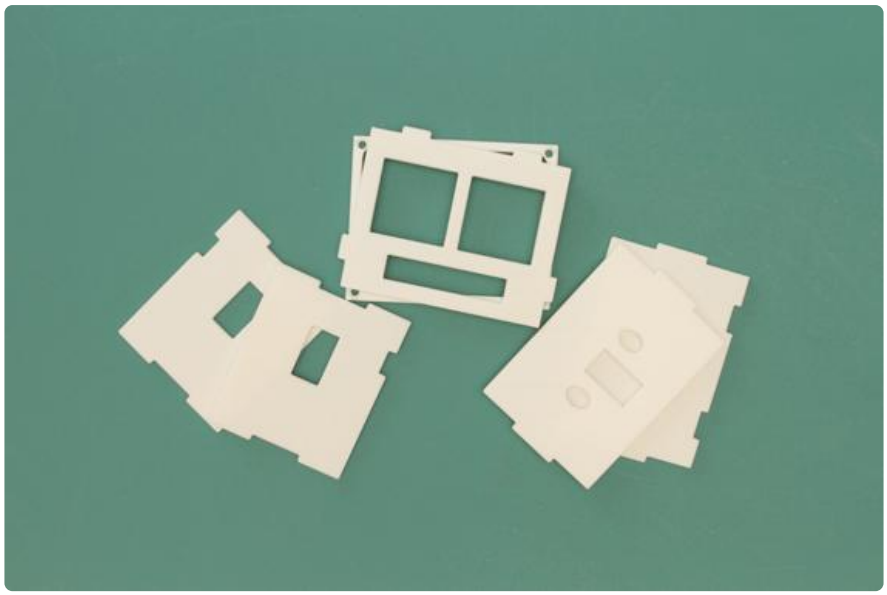
Or, you could go the craft rivet / paper fastener route.

Neodymium magnets can damage magnetic media and electronics that are sensitive to strong magnetic fields. Also, small magnets pose a choking hazard and should never be swallowed or inserted into any part of the body.

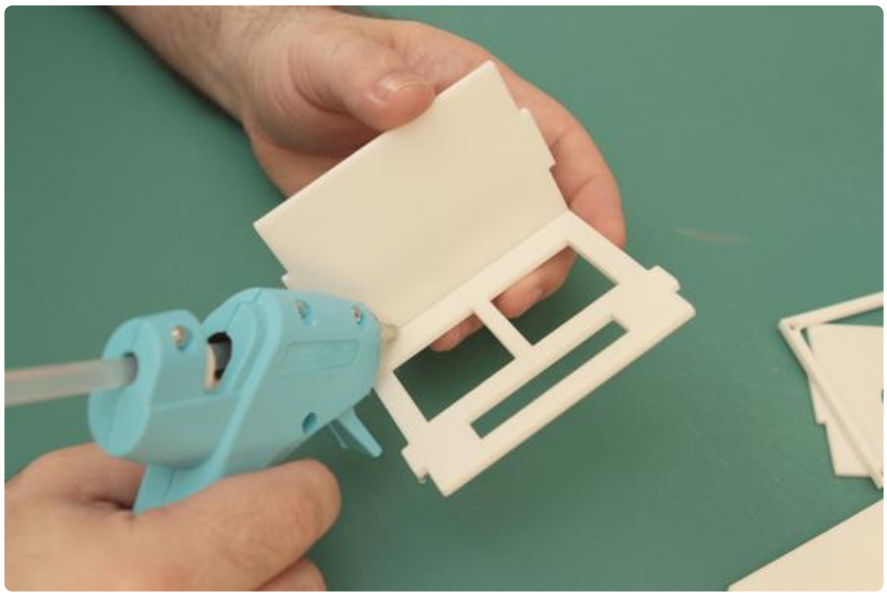
Time to roll up your sleeves... and fire-up Stanley (the low-temp hot glue gun).

Head

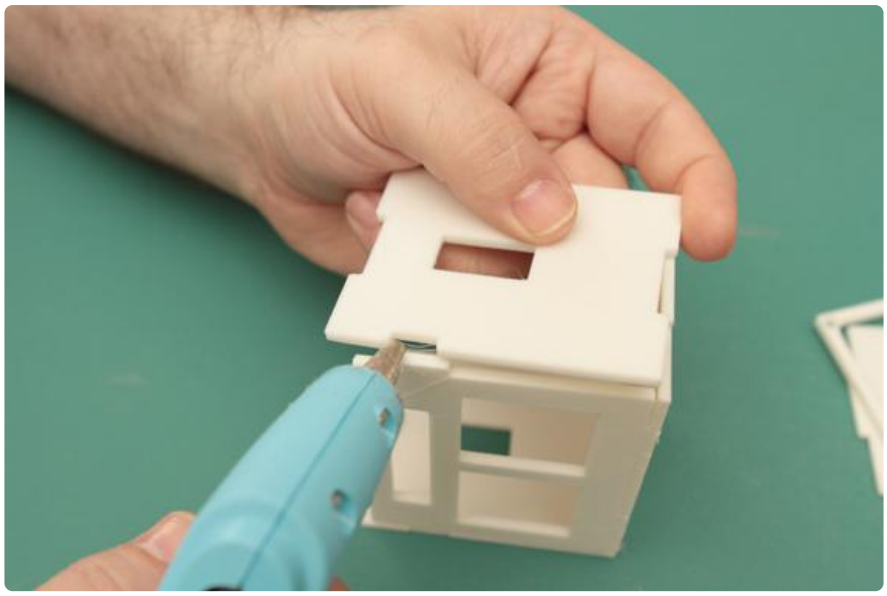
Grab your six head panels: face-plate, top, sides, back, and bottom. We'll be assembling them in that order.



Apply hot-glue on the edge where the panels make contact, and on the inside corner for added stability.

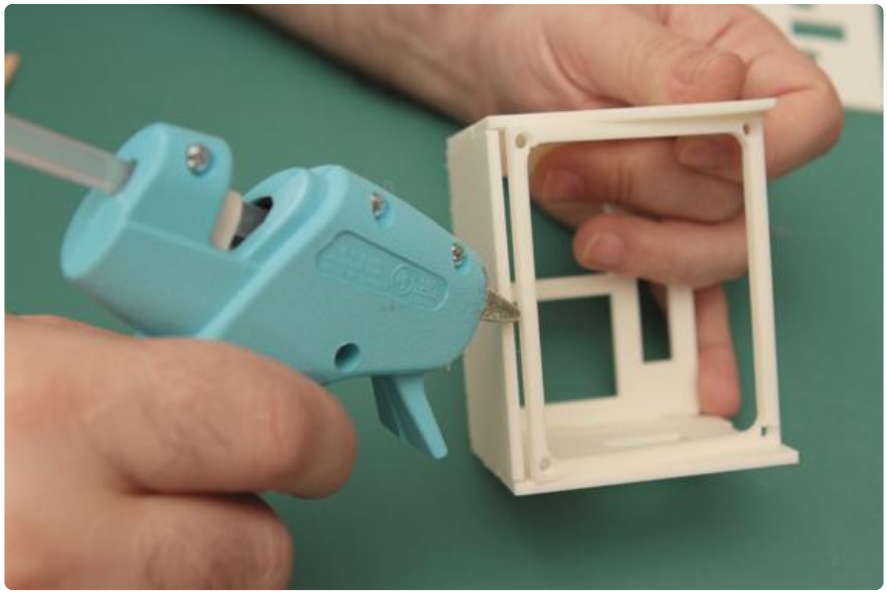


Add the sides next.

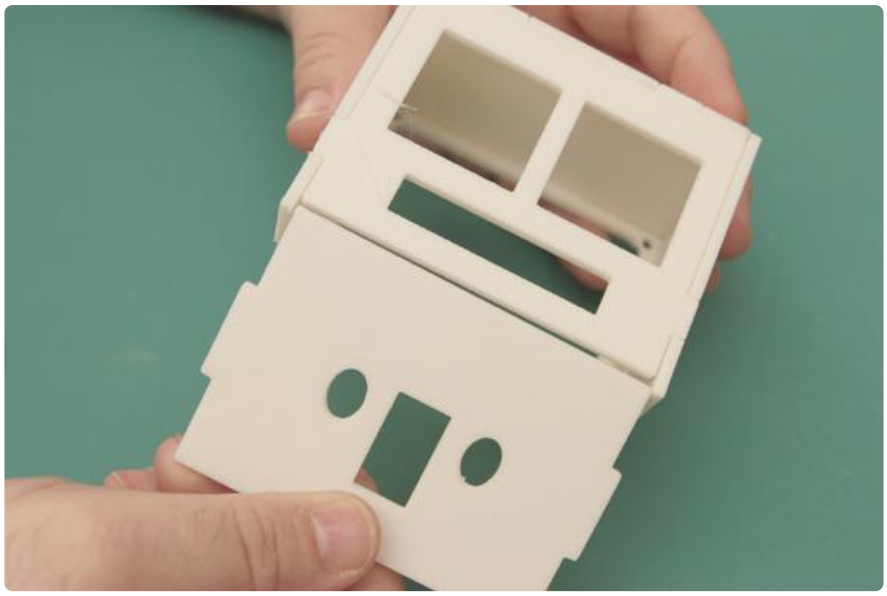


Back.

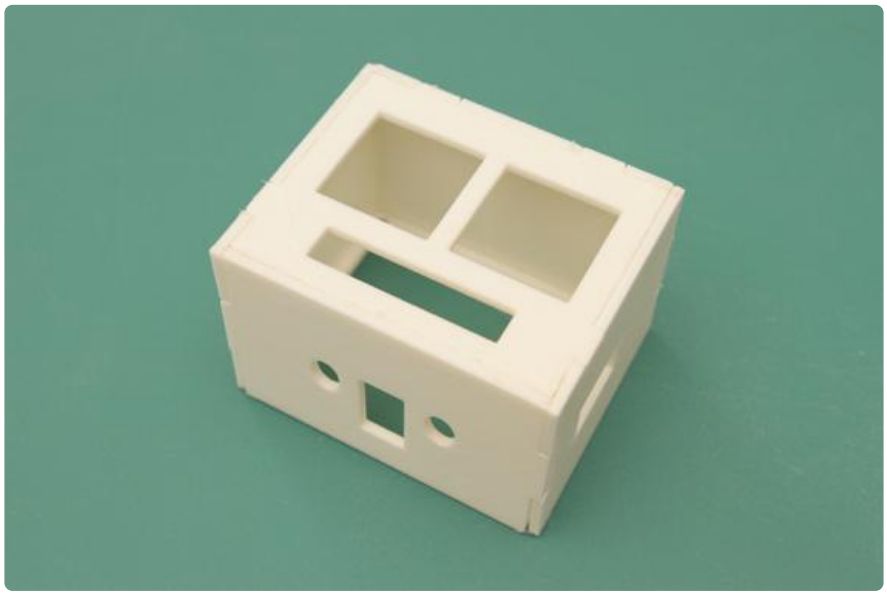
(we'll be putting magnets in the holes in the corners of the panel later)



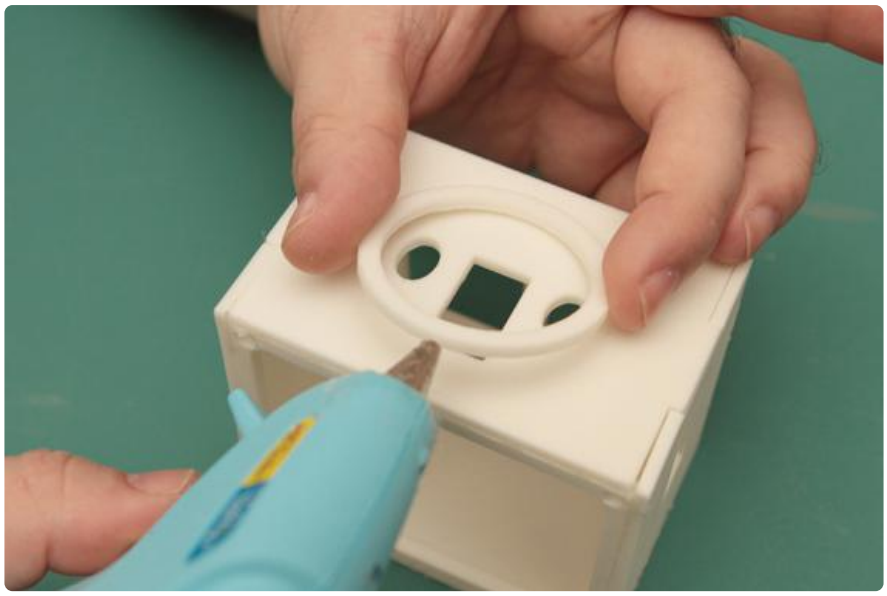
Orient the bottom panel with the mounting holes closest to the back of the head.



One more step!



This spacer will help stabilize and strengthen the neck.



Don't be too picky if you drop a glob of glue here and there on the parts... just use your fingernail to scrape it off.

Not enough detail?

Each step includes an archive (blue button below) that contains additional photos that might help fill-in any gaps.

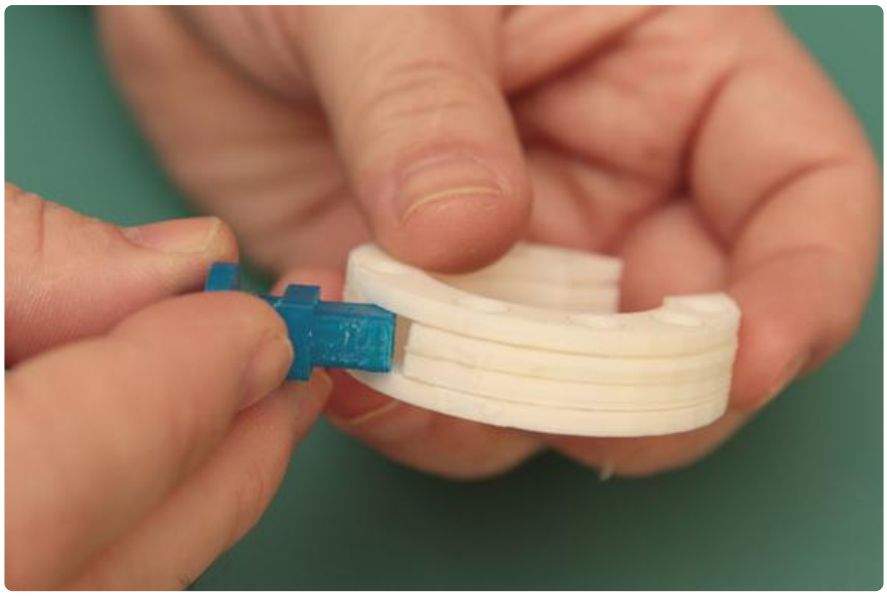
Head Assembly Photostream

Shoulders

More like claw, shoulder, wrist, and elbow...

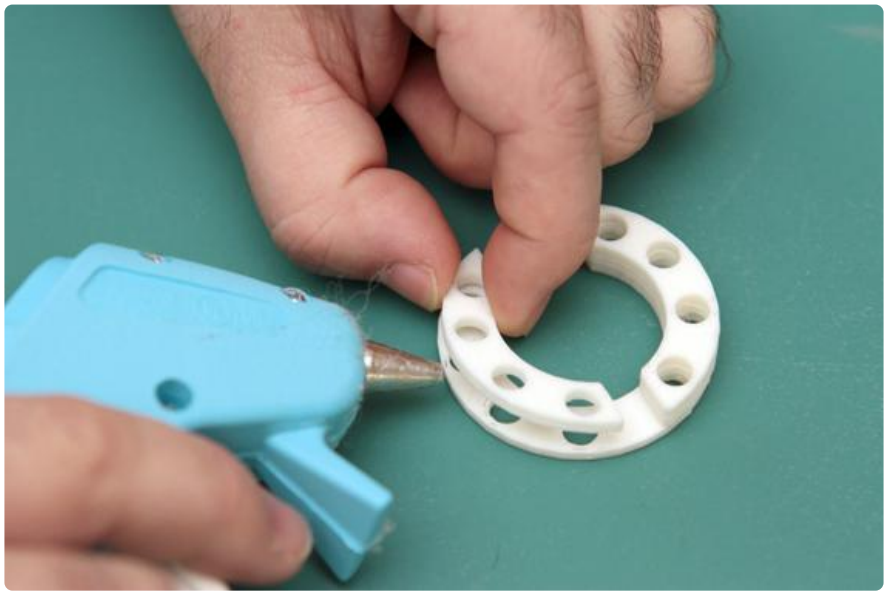
"The Claw"

If you have a 3D printer, you can print the claw in one piece and skip this step. Else, you could assemble the claw as slices.

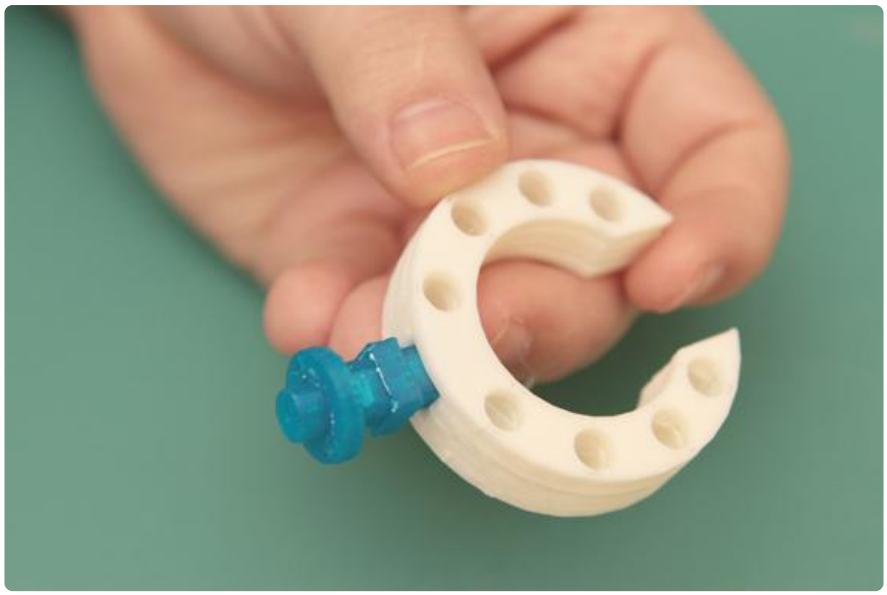


Hold all the slices together and insert an arm post into the socket to get an idea of how much room you have for adhesive.

Apply hot-glue between each one of the slices.



Test fit looks good!



Repeat these steps for the other claw.

Shoulder / Wrist

An arm is comprised of two arm posts, two compression springs, and an elbow. As mentioned previously, you can do some substitutions here with DIY paperclip springs or stiff wire.

Use a good coating of hot-glue to hold the spring to the post. Grab another spring and post - repeat.

Elbow

If you're using 3D printed parts and plan to hook-up servos to the arms... you'll need to make sure that you align the tiny guide-wire holes.

Then, glue-up the elbow to the springs just like you did with the arm posts.

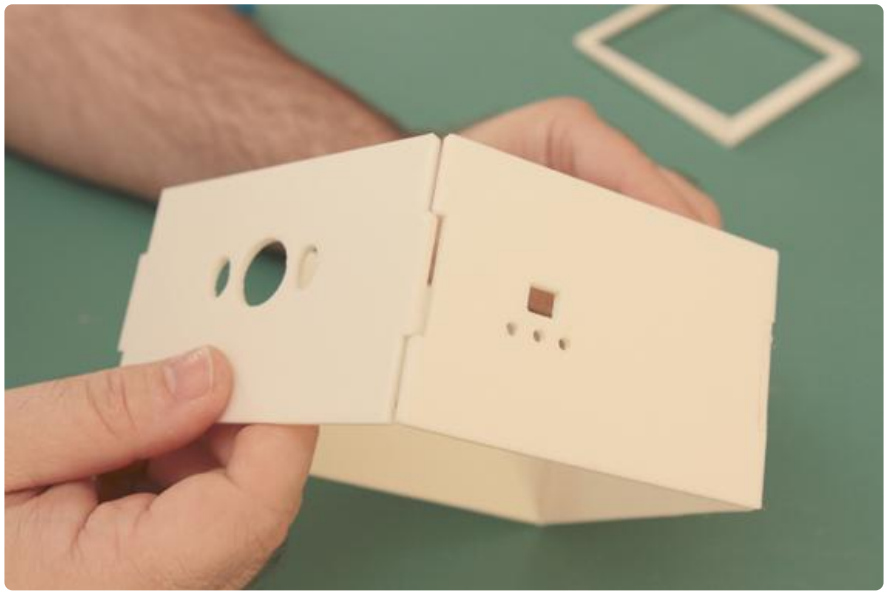
Which, will look something like this when you're done.

On to the body!

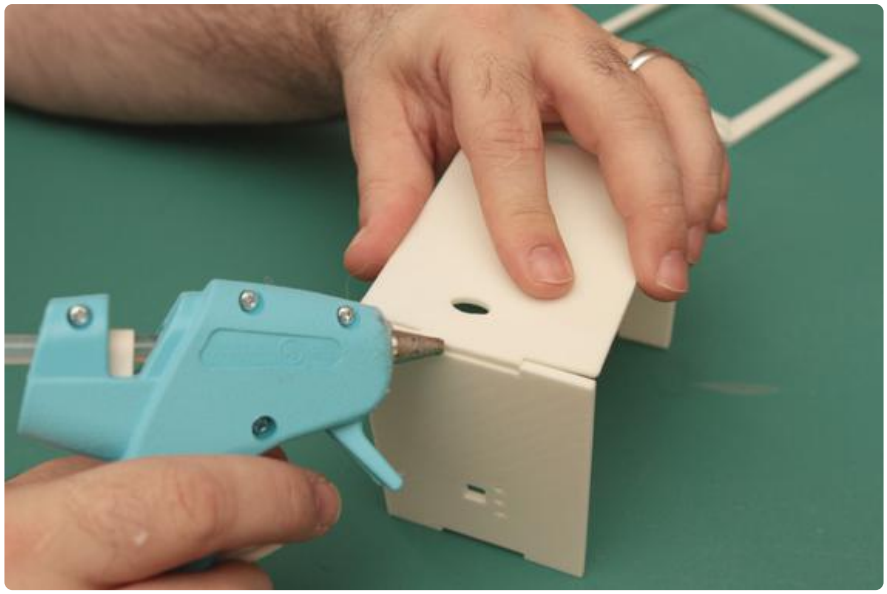
Shoulder Assembly Photostream

Body

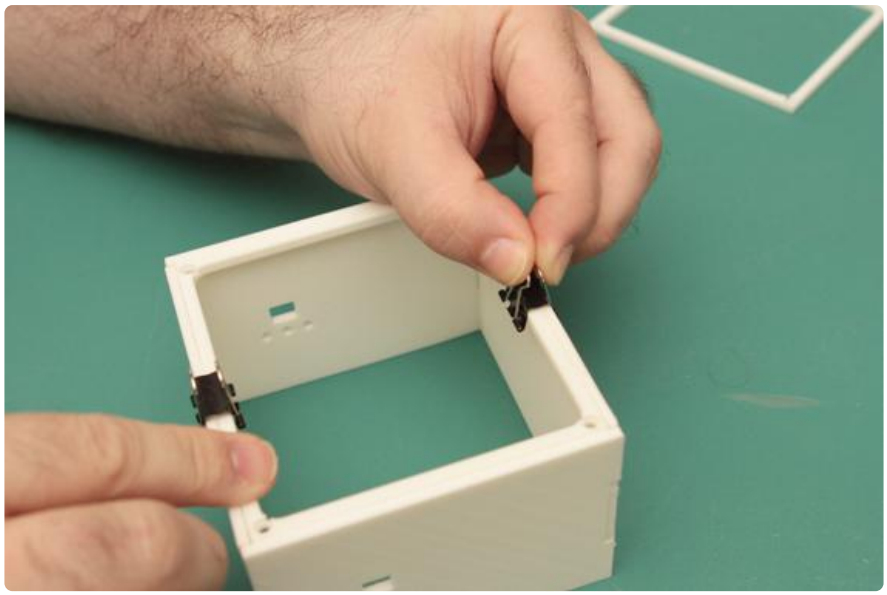
Assembly of the body is very similar to the head... panels should be oriented as pictured!



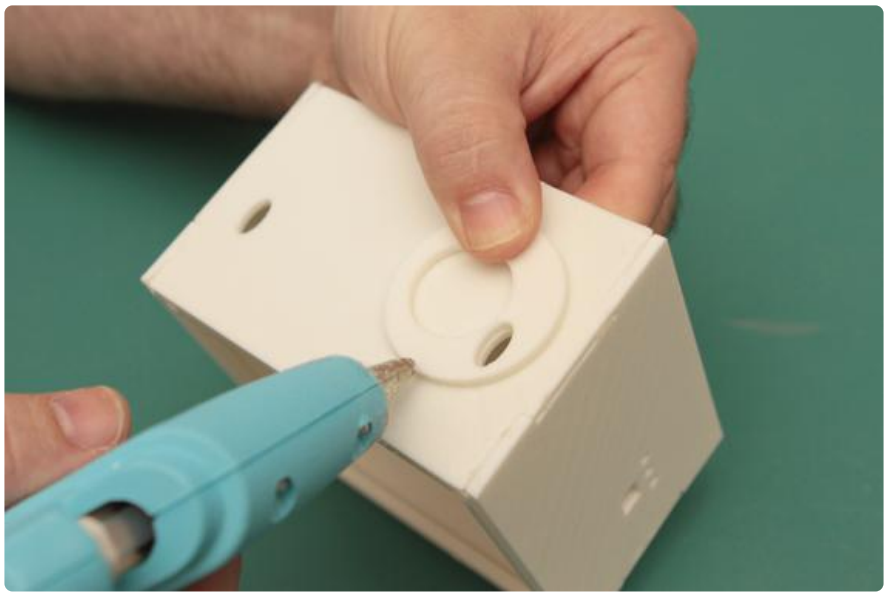
Add hot-glue to the edges of the panels where they meet and on the inside corner.



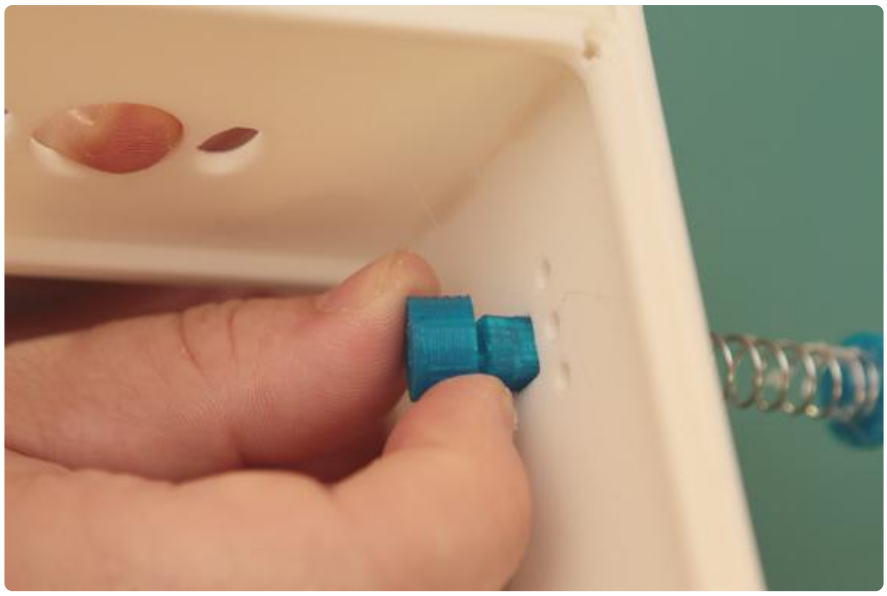
You can use binder clips to prevent panels from separating while adhesive dries / cools.



These strange looking round parts provide a socket for the leg and a ridge for us to wrap paper around. Align the holes before you make placement permanent.



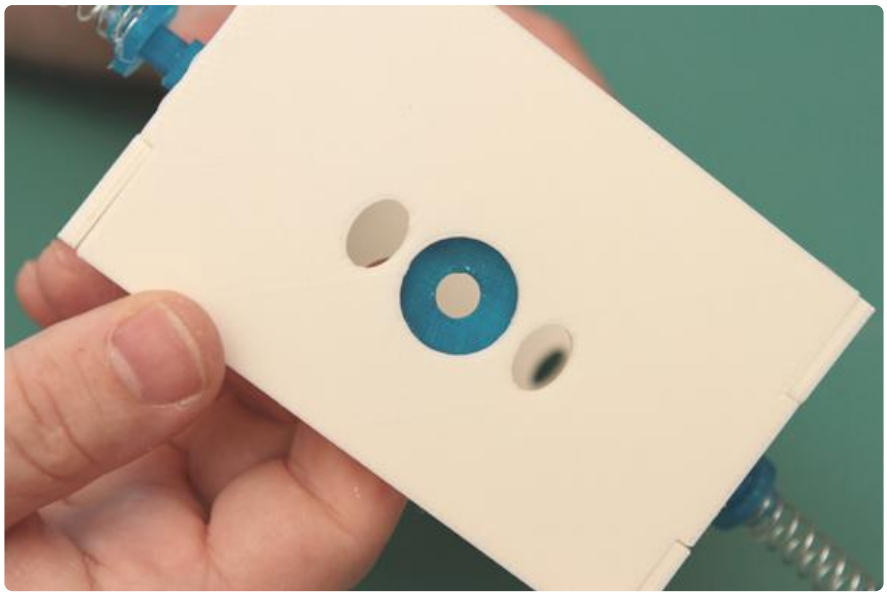
The arm is mounted to the body with a press-fit connector. Some of these parts might require a little trimming or sanding to get them to fit just-right.



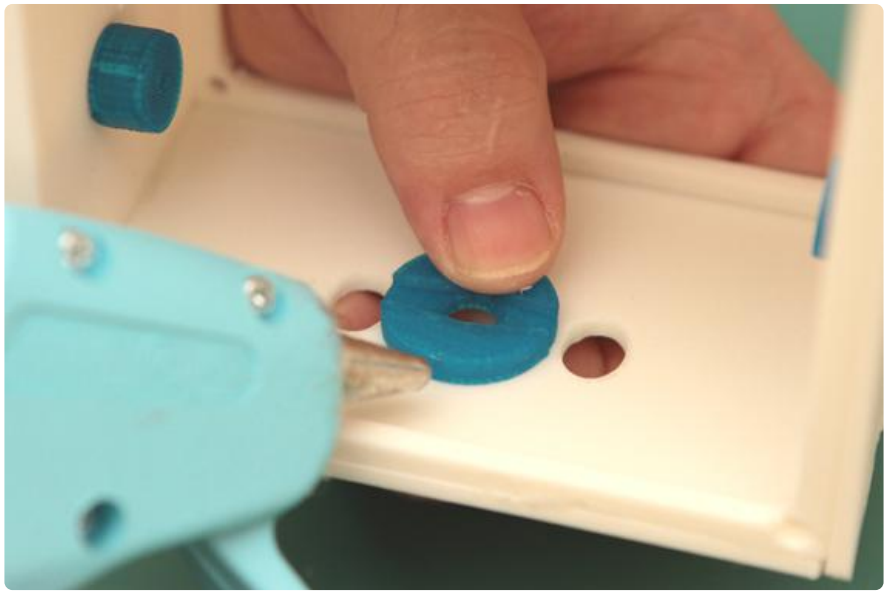
Note the tiny guide-wire holes on the body? They should be on the same side as the holes in the arm if you want to animate the arms with servos.

Servos have a tendency of wiggling loose... which is what this servo horn adapter in the neck is all about.

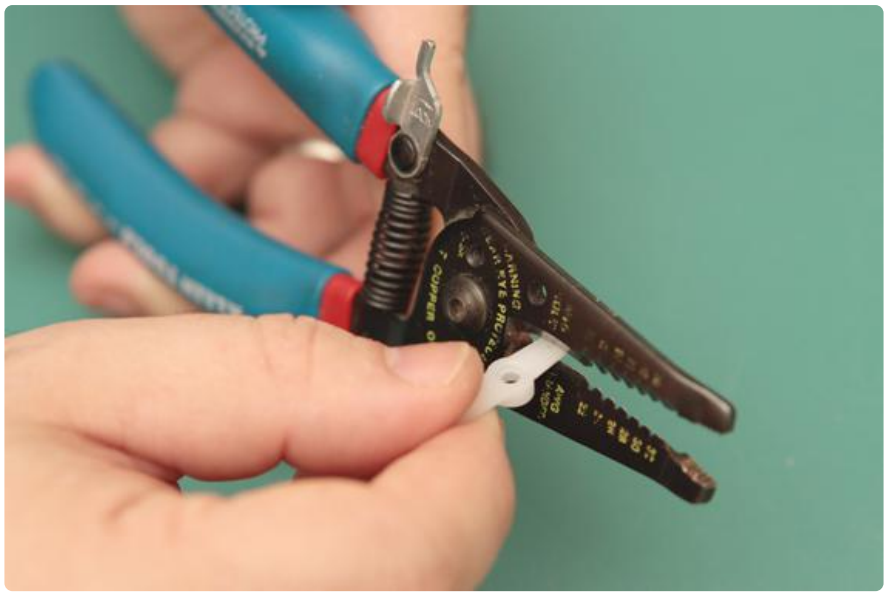
Align it in the neck hole.



And make it permanent with a healthy helping of hot-glue on the interior of the body. Don't put any hot-glue in the hole on the side that attaches to the head. A servo is going to occupy that space.

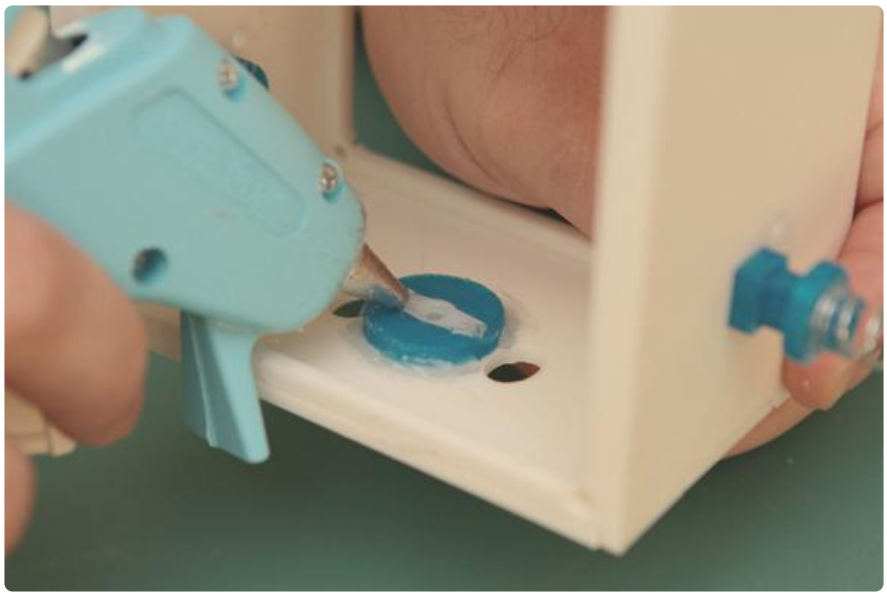


We'll need to trim the servo horn down a bit.



Eye protection is always a good idea when trimming small nylon / plastic parts.

And... make it permanent.



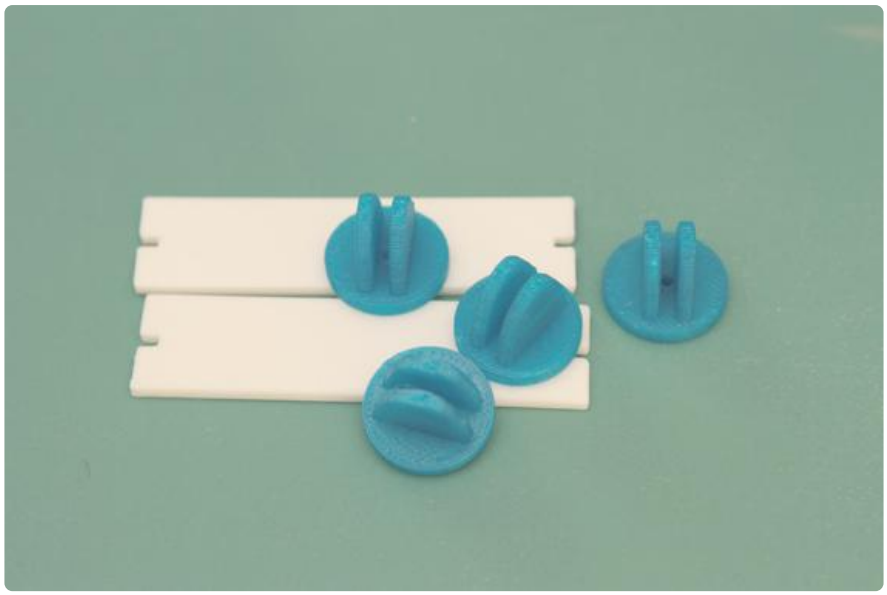
Next stop... knees-ville.

Body Assembly Photostream

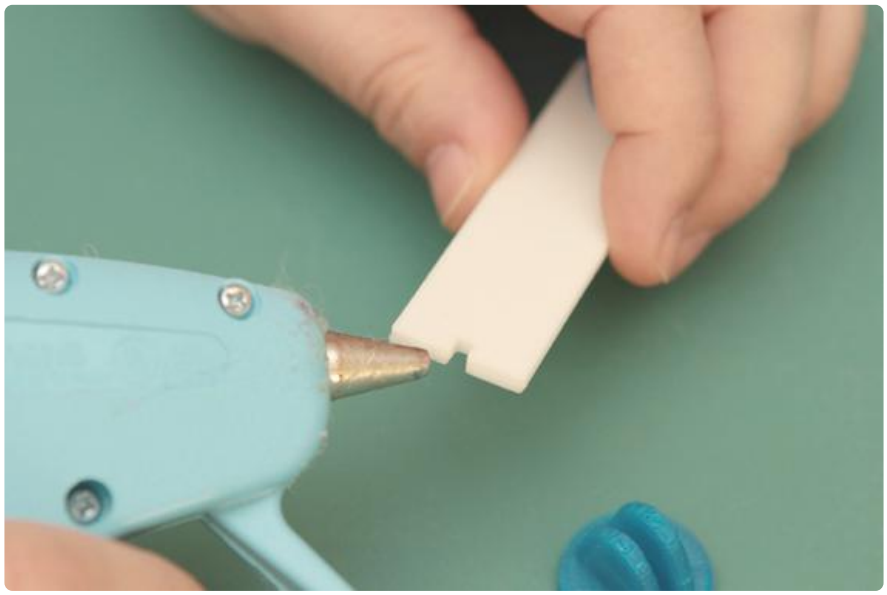
Knees

This is a knee-sy step.

If you aren't into printed parts, you can use a dowel instead. Actually... that might be faster!

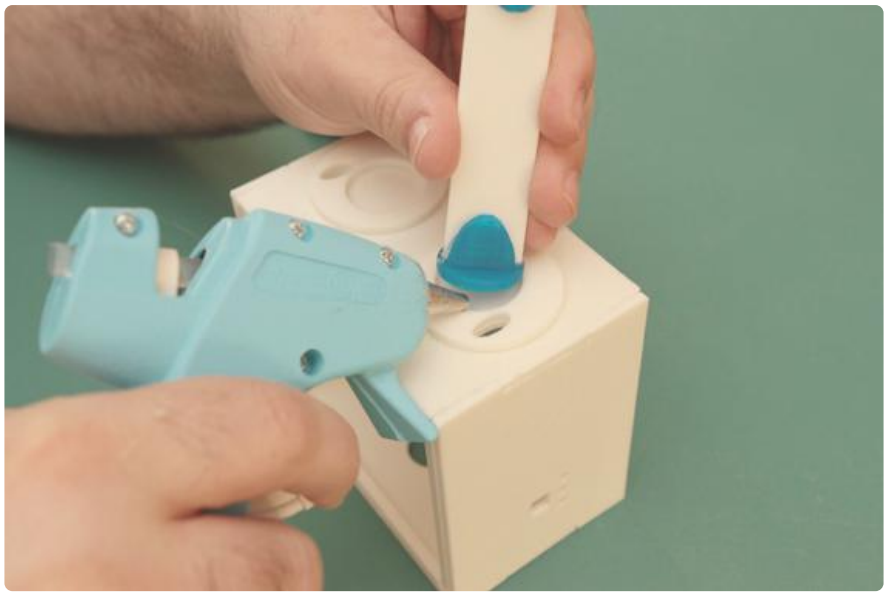


Apply hot-glue to the end of the leg.

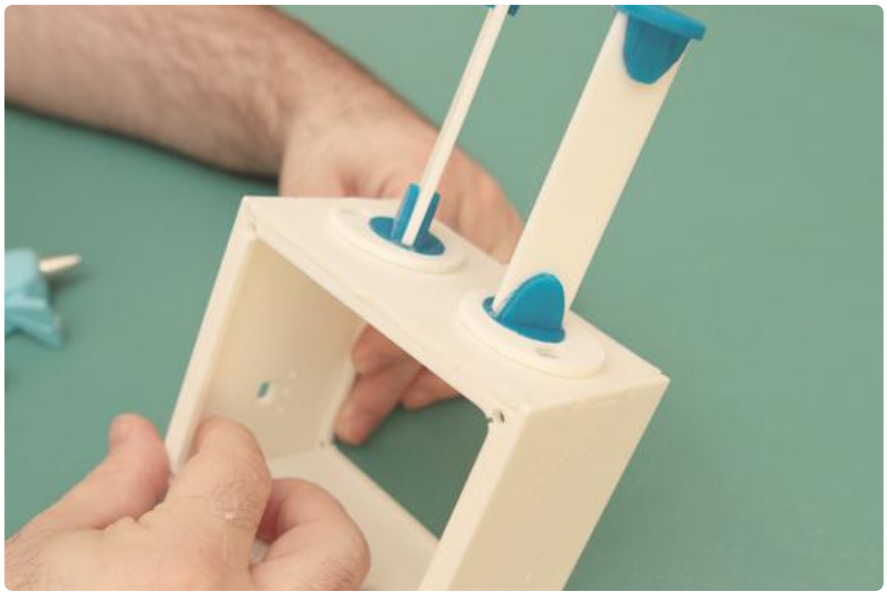


(the notch in the leg is an allowance for a screw... which will make sense in a bit)

I turn the leg slightly here to prevent flexing in the legs as the body moves forward / backward.



Twice as nice.



No screws?

Nope... we'll be adding electronics to the inside later and don't want anything inside the body that might cause shorts, sparks, or magic smoke to escape.

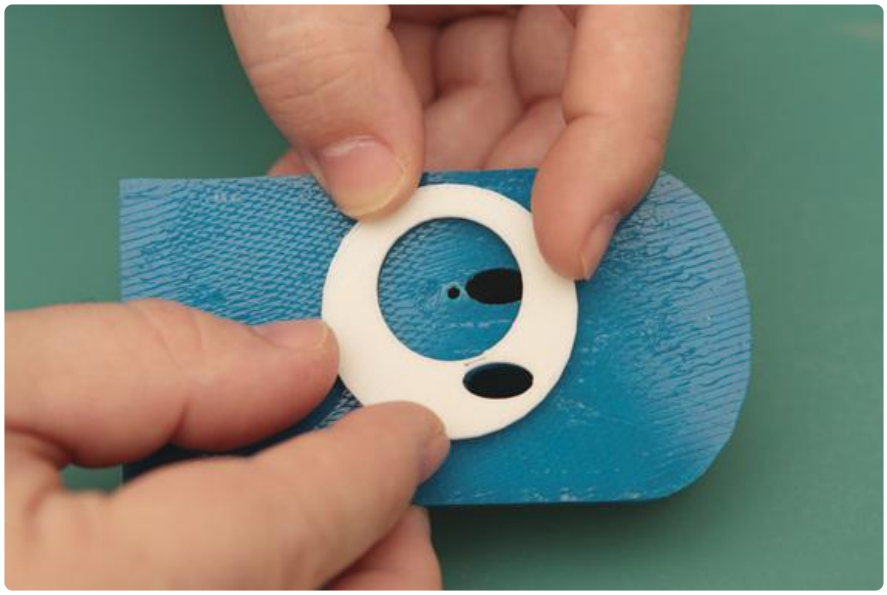
Time for toes.

Knees Assembly Photostream

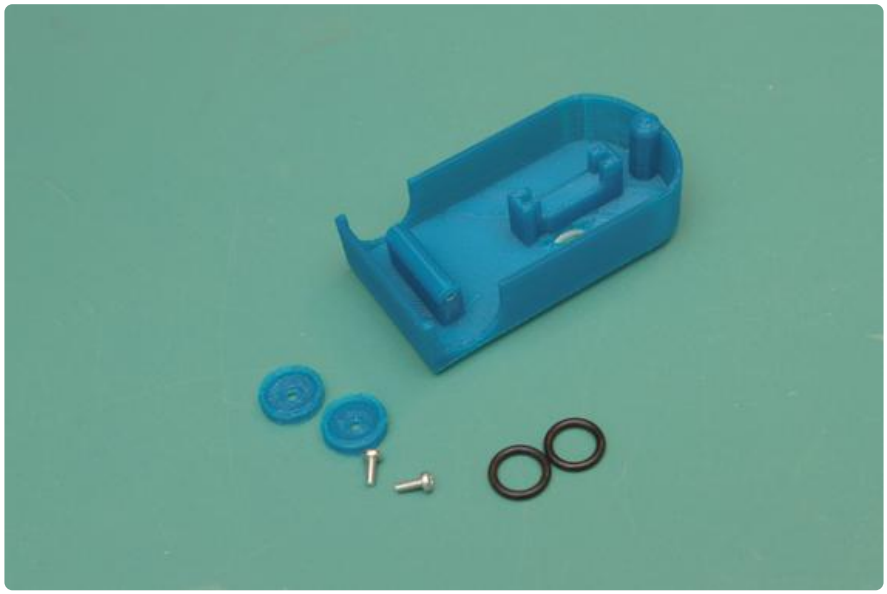
Toes

The feet are symmetrical. Align the small hole in the ankle plate with a hole in the foot and give it some hot-glue. Flip your other ankle plate over, align, and glue.

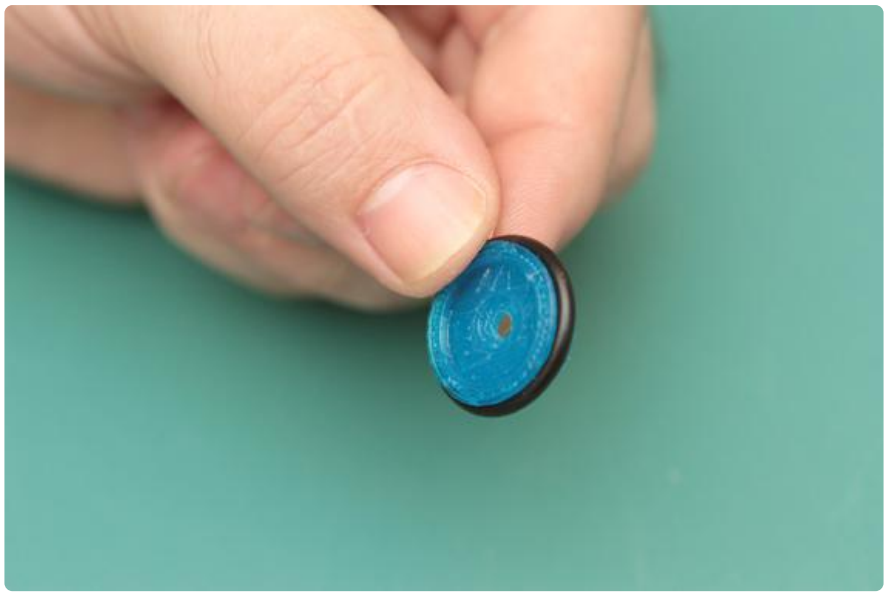
Hmm... you could swap out the fancy 3D printed foot with a block of wood!



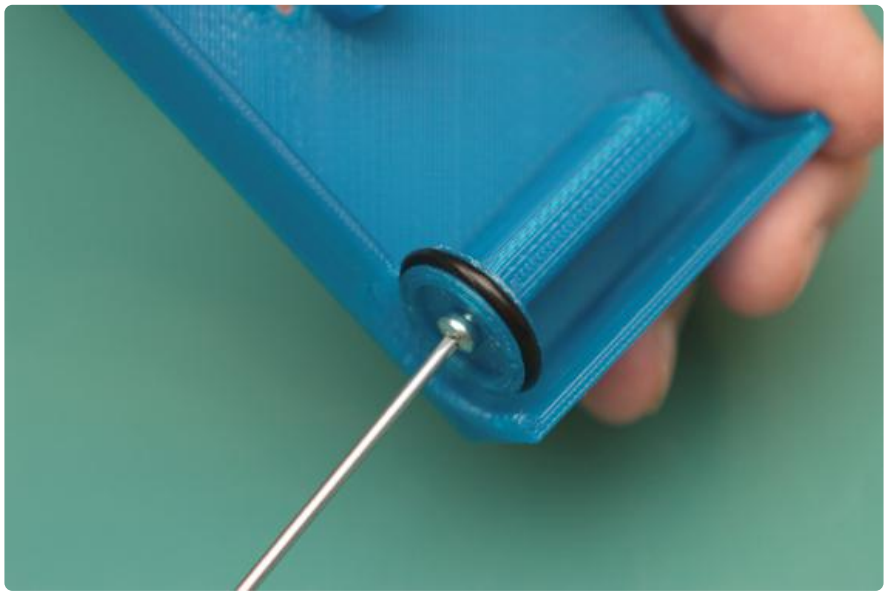
Yep, that's a servo mount in the foot. We'll cover adding that in a later guide.



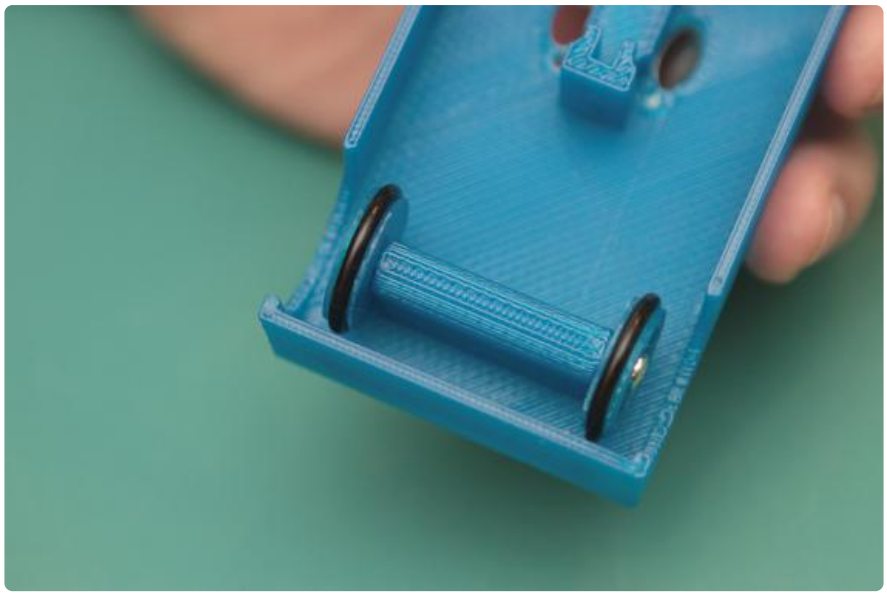
Wrap o-rings around the tiny wheels.



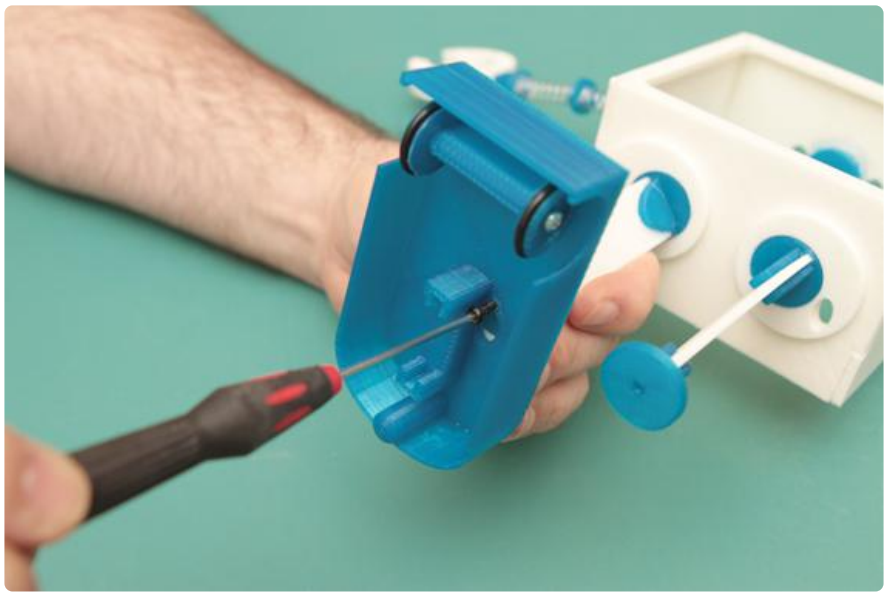
And screw the wheels to the foot... taking care to drive slowly.



Give the wheels a friction test - they should float freely on the axle.



Remember the notches in the legs from earlier? As you screw the foot to the leg, it will prevent the screw from pushing the leg out of the socket.

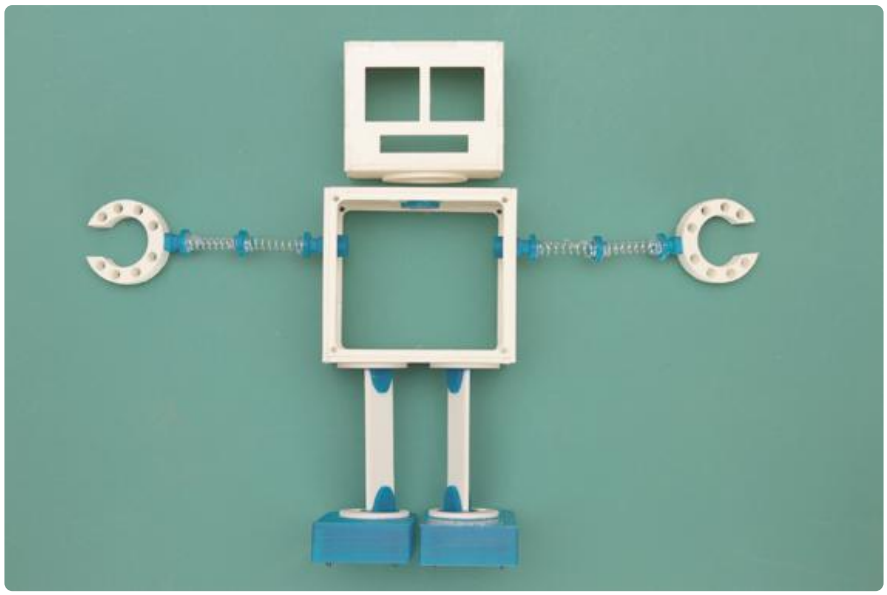


Take it slow when screwing the foot to the leg. You may want to tap the hole or gently warm the plastic to prevent cracking from stress.

Toes Assembly Photostream

Eyes, Ears, yadda yadda

Congratulations! You can un-plug Stanley now... and relax!



Part 2 will cover all the electronics needed to give your robot a little personality:

- Arduino UNO R3
- 16-Channel PWM/Servo Shield
- 9g Servos (qty 3)
- 1.2" 8x8 LED Matrix (qty 2)
- NeoPixel Stick
- 315MHz Receiver (momentary), and a 4-Button Keyfob
- 5v 2A Switching Power Supply
- 2.1mm Jack to Screw Terminal Adapter

So... have you picked a name for your robot yet?