DIY Custom American Girl Doll Prosthetics

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https://learn.adafruit.com/diy-custom-american-girl-doll-prosthetics

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Overview

Bring joy to a child's heart by customizing thier doll to look just like them.

For this project, we wanted to avoid cutting any actual limbs and instead, completely replace them with entirely 3D printed ones. We 3D modeled the limbs inside of Autodesk Fusion 360, so it's easy to modify the design based on the type of amputee. We then 3D printed the design on our desktop 3D printers, but these could easily be sent to a 3d printing service.

The tolerances for the sockets closely match the original limbs to the can hold poses to allow the doll to stand up or hold accessories.

Allowing a child to model and design their own doll can also help them realizing they can shape their own future.
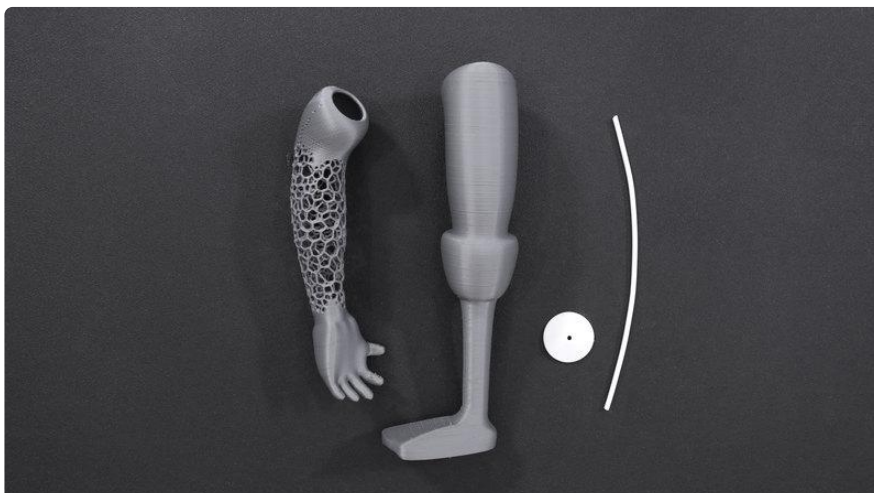
Parts

You can send the files to a 3D Printing service, but owning a 3D printer will make this project much more easier.

- 3D Printing Filament (http://adafru.it/2080)
- Elastic String or a piece of NinjaFlex (http://adafru.it/3186)

Tools and Supplies

- 3D Printer (https://adafru.it/doT)
- Flat Pliers (http://adafru.it/1368)
- Tweezers (http://adafru.it/421)

3D Printing

3D Printed Parts

The limb sockets are held in place using a 17.5cm (7in.) piece of NinjaFlex, but you could also use elastic string.

Download STLs

https://adafru.it/oLB

Slicer Settings

To slice the strip part, we used Simplify3D. We recommend using the settings below or use them as reference. We 3D printed the part on a Ultimaker 2+ with a 6.mm nozzle. If you have Simplify3D, you can download our profiles below.

Printer Profiles

https://adafru.it/oHD

Customize The Design

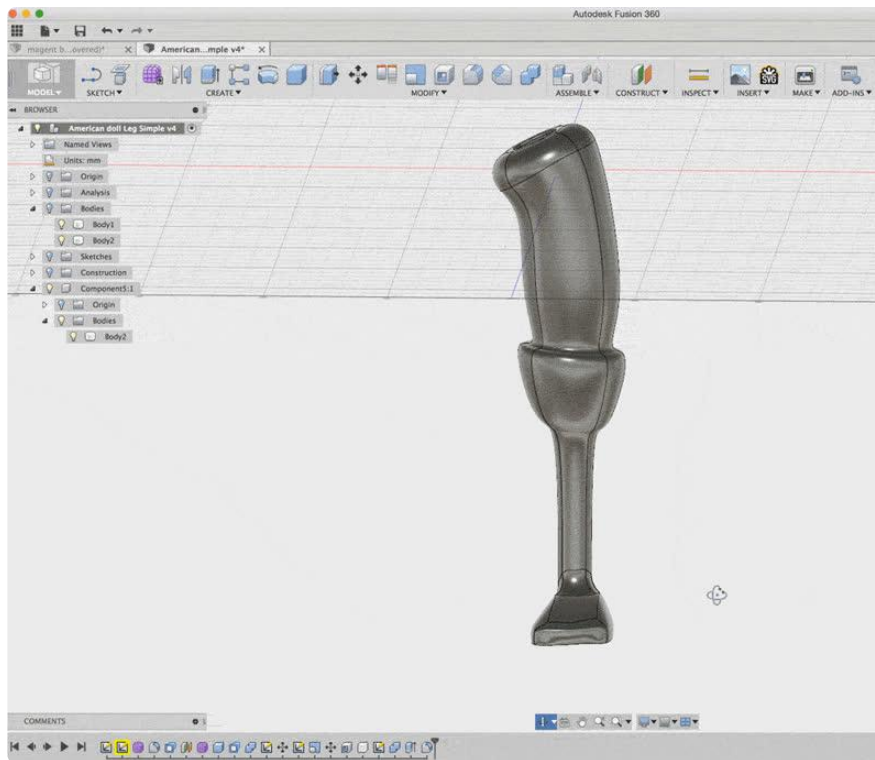It's easy to modify design based on the type of amputee.

The parts where modeled in Autodesk Fusion 360. The design is public and available to download in different formats. If you'd like to use a different CAD software package, you are free to import the files and remix them.
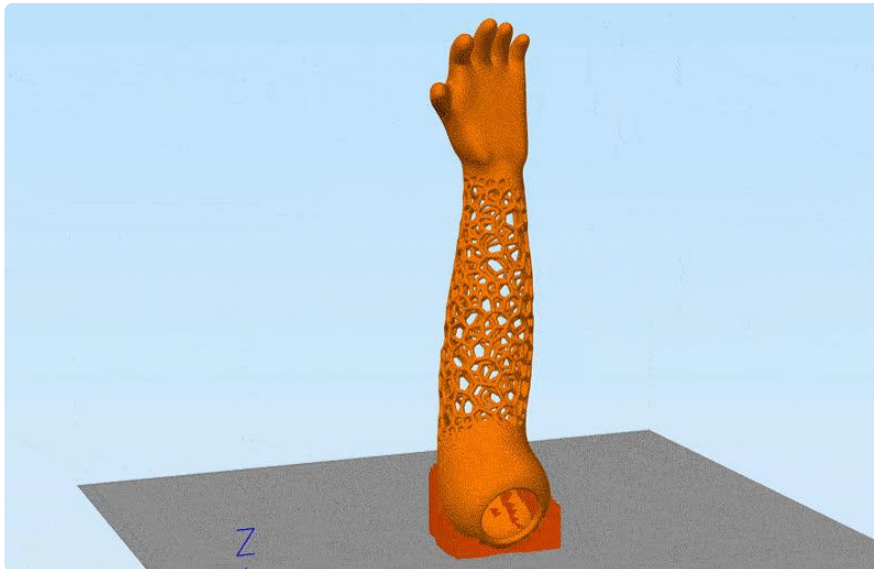
Edit Leg Design

https://adafru.it/oLf

Edit Arm Design

https://adafru.it/oLA

Doll-Arm.stl Doll-Leg.stl Doll-Disc.stl	245c extruder 50mm/s print speed 120mm/s travel speed 0.6mm Nozzle .72mm Extrusion width Arm Brim + supports Skirt Offset from part: 0mm Skirt Outlines: 6 Skirt Layers: 1 Support Pillar Resolution: 8mm	To speed up printing we used a . 6mm nozzle. The arm requires custom supports added to the bottom of the arm's stocket. Follow the picture below for reference. The leg doesn't need any supports

Filament Materials

We recommend using PLA material to reduce wrapping while 3D printing. The parts can be printed in different types of filament, such as ABS, PET or Nylon.
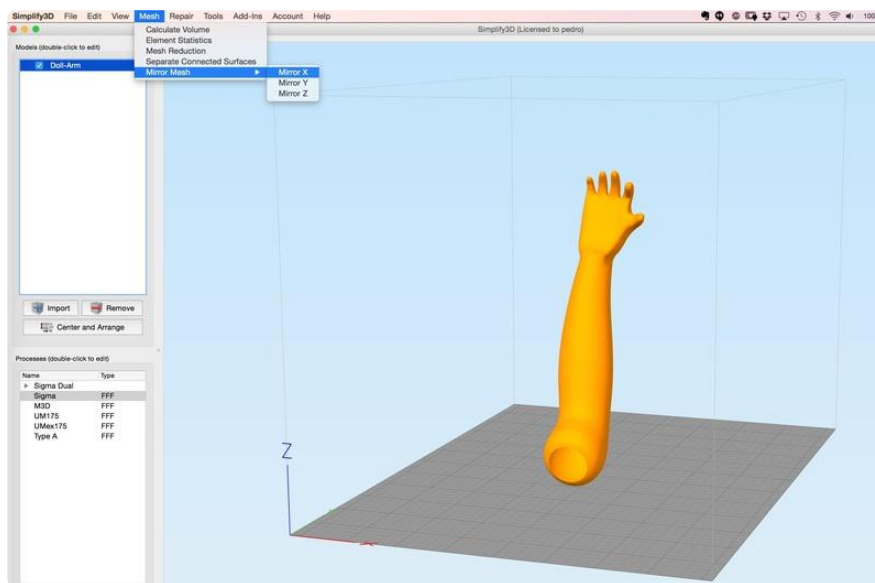
Left and Right limbs

You can easily adjust the arms and legs for left or right by mirroring the mesh on the X axis.

Assemble

Before Disassembly

If you are working with a brand new doll, make sure not to remove the hair net that it comes with.
This will make working with the head alot easier. The hair can easily get caught on the cloths velcro strips, so be careful not to get it tangled.

Removing the head

The head is held in place by a piece of string tied around the neck. You can loosen the string by wedging a tweezer between the knot and carfully pushing the tweezer through until the knot becomes loose.

Untying arm cords

You can skip this step if only need to modify the legs.

The arms are held in place by a knot on an elastic cord. Use a pair of flat pliers to grip and pull the string until you can see the knot. Use the same technique with the tweezers and wedge them between the knot until you can unfasten the cord.

Prepping for leg removal

Modifying the legs requires making room in the body cavity so we can get to the legs elastic cords.
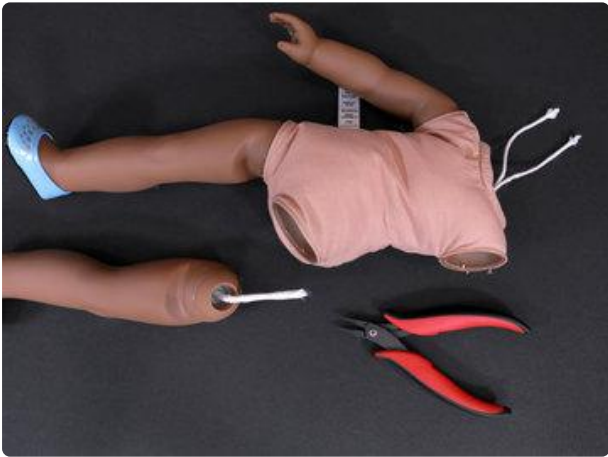
Stuffing

We recommend using a bag to store the stuffing while working as it will puff up quite a bit once you remove it from the doll. Remove a enough stuffing until you can easily reach the legs elastic cord.
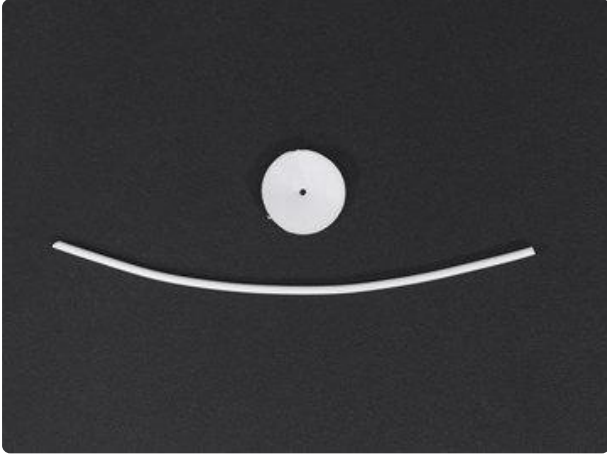
Untie leg cords

Use the flat pliers to grip the elastic cord and tweezers to unwedge the knot.
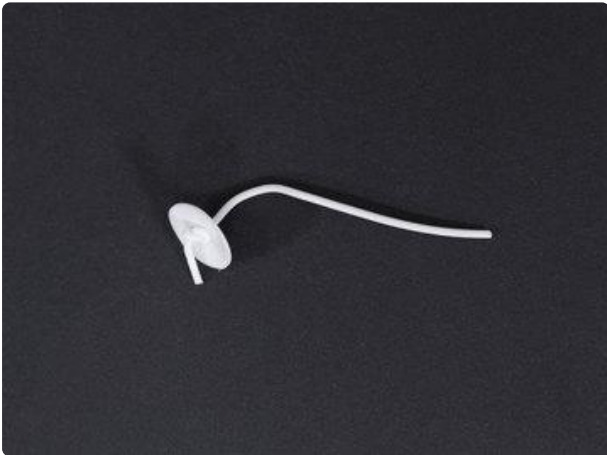
Socket parts

We'll need longer elastic cords to hold the printed prosthetics to the body. You can cut a new piece of cord or you can use a piece of NinjaFlex.

The new cord length needs to be at least 17.5cm long.

The inner sockets that hold the limbs together can't be removed from the original arms and legs.

Use NinjaFlex or any TPU material to print the socket.stl part. Assemble the cord and inner socket part as shown.

You can actually use brass ferrules to secure the elastic string in place. A number of collectors swear by that, and it's what AG used prior to just knotting them as a cost-cutting measure.

Make sure the knot on the new cord is as close to the end as it can be.

Thread the cord through the inner socket.

If the hole on the socket is tight, use flat pliers to poke through one end of the socket hole, grab the cord from the other side and pull the cord through the hole.

Insert inner socket

Bend the assembled socket and insert it into the limb as shown.

Align socket

The inner socket inside the body needs to be aligned so the cord can thread through the two holes.

Thread string

Push the cord through the socket and inner socket.

Attach leg

Make a loose knot so it can be pushed down towards the inner socket.

Tie string

Push the knot toward the inner socket and move the limb around until the knot is taut enough to allow the limb's position to stay in place.

If you leave the knots loose the doll won't be able to keep a pose.

Don't re stuff the doll until the knots can completely hold the limbs in a pose. Limbs should be able to hold a pose without flopping over.

Re stuffing

Once the limbs can hold a pose without flopping over, your ready to add the suffing back.
Make sure to evenly add the stuffing by packing it all around the body.

And that's it! You are ready to repackage and gift a uniquine, one of a kind doll!