

Flexy Beast Documentation

ThingDoc

August 7, 2014



The Flexy Beast is a wrist-powered prosthetic hand for the e-NABLE Project. This is a mashup of the Parametric Cyborg Beast by MakerBlock and the Flexy Hand by Steve Wood/Gyrobot. Like the Flexy-Hand, the Flexy Beast uses flexible joints to replace the Chicago screws and elastics used on previous e-NABLE designs. This makes the hand lightweight, less expensive, better looking, more adaptable for smaller sizes, and easier to assemble and use.

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1 Bill of Materials

List of things you need to build the machine divided by categories.

1.1 Prerequisites!

- 1x [Configuration File](#)

1.2 Flexible

- 10x [Flexy Joint](#)

1.3 Other

- 5x [String](#)

1.4 Printed

- 4x [Finger Tip](#)
- 5x [Finger Tip Mold](#)
- 1x [Palm](#)
- 5x [Finger Base](#)
- 1x [Thumb Tip](#)

2 Things Overview

List of things and their descriptions.

2.1 Grippy Thumb Tip

Molded silicone grippy thumb tip

2.2 Configuration File

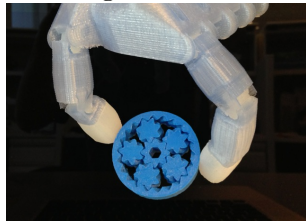
Configuration settings for Flexy Beast, required to generate correctly sized STLs of the printed parts. See the Configuration File Assembly instructions to set this up.

2.3 String

Just some string

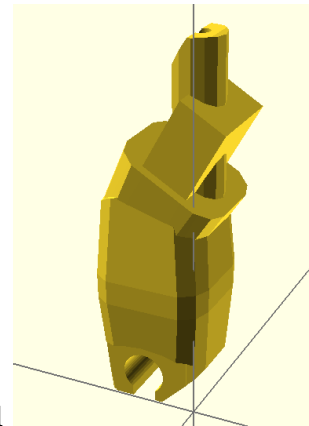
2.4 Grippy Finger Tip

The Flexy Beast fingers can be made with silicone finger pads for improved grip. These finger pads are designed to be easily removeable and replaceable by hand, but attach firmly enough to stay on during use. Dragon Skin 10 silicone produces very soft and grippy pads; Dragon



Skin 30 is tougher.

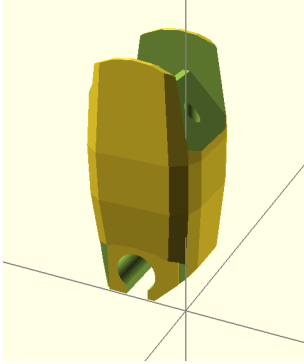
2.5 Finger Tip



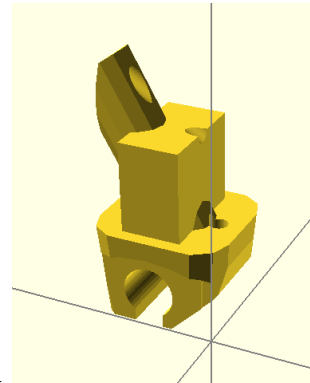
Distal phalanx of fingers - rendered from parts/finger.tip.scad

2.6 Finger Base

Proximal phalanx for all digits (fingers and thumb) - rendered from parts/finger_base.scad



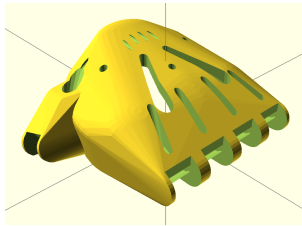
2.7 Thumb Tip



Distal phalanx of thumb - rendered from parts/thumb_tip.scad

2.8 Assembled Thumb

2.9 Palm



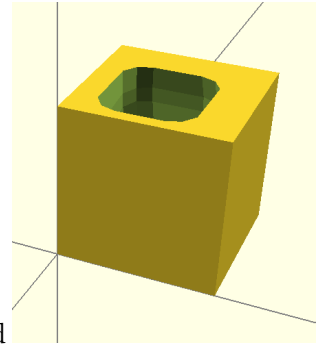
Palm - rendered from parts/palm.scad

2.10 Flexy Joint

Flex joint - can be molded in silicone or printed in Filaflex. The Configuration File instructions will help you find a good size for these.

2.11 Assembled Finger

2.12 Finger Tip Mold



Mold for casting silicone finger tip grip - rendered from parts/finger_tip_mold.scad

3 Assembly Instructions

3.1 Assemble Configuration File

Steps:

1. Open config.scad in your favorite text editor.
2. As per the normal Cyborg Beast instructions, measure the width of the knuckles in the non-affected hand and convert to millimeters.
3. Add 5 to that result and then divide by 55.
4. Replace the x-, y-, and zScaleFactor variables in config.scad with that number.
5. If desired, adjust the proportions of the hand by changing those variables individually. xScaleFactor controls the width of the hand, yScaleFactor controls the length, and zScaleFactor controls the height.
6. Open assembly.scad in OpenSCAD to check that the flexy joint holes are not too large for the hand (should only be necessary for small children). If necessary, reduce the jointDia and jointThick variables. jointDia=5 and jointThick=2 is a good amount for smaller hands.
7. Set the fingerPads variable to true or false depending on whether you want to cast silicone finger pads for improved grip.
8. In palm.scad, finger_base.scad, finger_tip.scad, and thumb_tip.scad, uncomment the first line that renders the part.
9. Render each part (F6) and export as STL, then print.

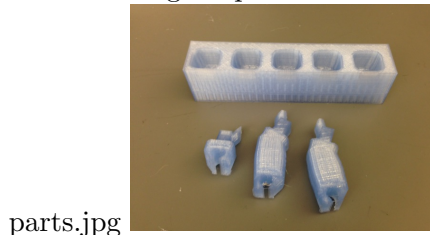
3.2 Assemble Grippy Finger Tip

Things needed:

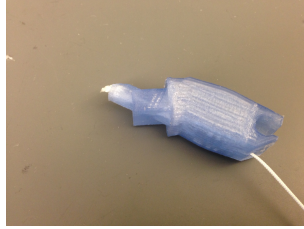
- 1x [Finger Tip](#)
- 1x [Finger Tip Mold](#)

Steps:

1. Print the finger tip and mold.



2. Insert the string through the fingertip and tie off the end prior to molding (not shown in all photos here).



with string.jpg

3. Mix silicone according to the instructions from the supplier. Wear gloves and follow the supplier's safety instructions while working with liquid silicone.



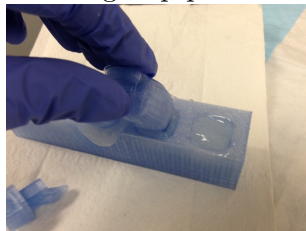
part A.jpg

4. Pour the liquid silicone to mostly fill the fingertip mold.



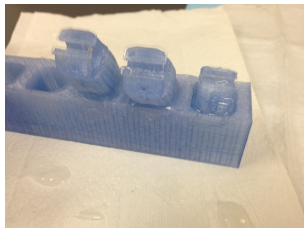
into mold.jpg

5. Insert the printed fingertip piece into the filled mold.



phalange.jpg

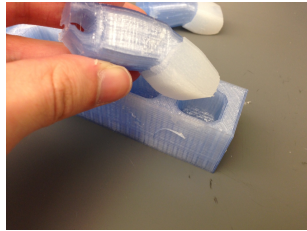
6. Remove any excess silicone. If necessary, use tape to hold the phalange in place.



in mold.jpg

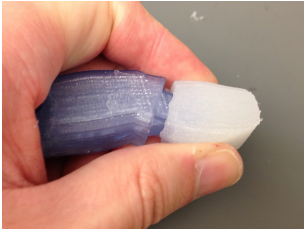
7. When the silicone is cured, remove the fingertip and silicone pad from the mold. The pad may stay on the fingertip or it may need to be removed separately.

from mold.jpg



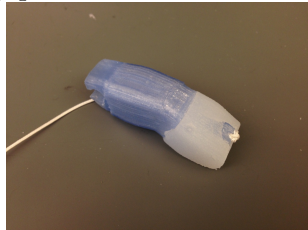
8. If the pad came off the fingertip during demolding, it can be reattached by pushing it over the end of the fingertip.

finger pad.jpg



9. If necessary, use an x-acto knife to trim off excess silicone so that the edges of the pad are flush with the edges of the fingertip.
10. The fingertip pads are finished. Continue installing them onto the hand.

fingertip.jpg



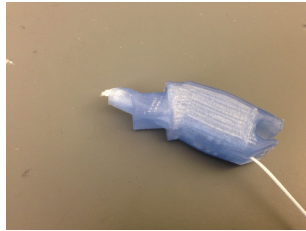
3.3 Assemble Flexy Beast

Things needed:

- 1x [Palm](#)
- 1x [Assembled Thumb](#)
- 1x [Configuration File](#)
- 4x [Assembled Finger](#)

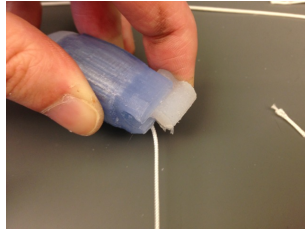
Steps:

1. Print the palm, thumb base, thumb tip, and four each of the finger base and tip. These can be scaled as needed in each dimension using the x-, y-, and zScaleFactor variables in the OpenSCAD code.
2. Insert a string through each fingertip (the hole may need to be drilled slightly to deburr) and tie it off on the end.



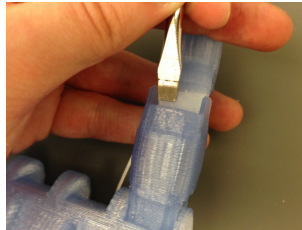
with string.jpg

3. After making the 3D printed parts and flexible joints, slide a flex joint into the proximal end of each finger.



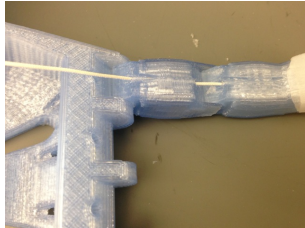
joint.jpg

4. Use a flat screwdriver or other thin, flat tool to insert the other end of the joint into the corresponding slot on the next inner segment.



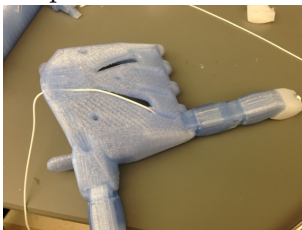
joint with screwdriver.jpg

5. Route the string through all the finger segments.



routing.jpg

6. Route the string through the palm.



routing through palm.jpg