MANUAL

***If you need assistance, please contact the E-NABLE GROUP.**
https://www.facebook.com/#!/enableorganization

http://enablingthefuture.org/our-tree/

https://plus.google.com/u/0/communities/102497715636887179986

Acknowledgements:

Thank you to all members of the E-NABLE group, The Creighton University Group, The University of Wisconsin–Milwaukee Group, and Robohand. This updated version includes modifications from Ivan Owen, Peter Binkley, and Jorge Zuniga. Special thanks you to our beta testers and makers Gregg Dennison, Frankie Flood, and Paul & Leon McCarthy.

Description

The Cyborg Beast is a remix of the snap together Robohand and the original Robohand . Most voluntary closing devices including this design need sufficient wrist movement and strength for proper function. This design doesn't require Orthoplastic. The fingers are designed for better griping and to avoid over extension of the proximal phalange and distal finger segment. It fits a 1 to 2 mm cabling and elastic bands. This design is compatible with any version of the MakerBot MakerWare software and any of the MakerBot Replicator printers. This design was developed using ***Blender 2.69.***

Printing Instructions

Best quality is obtained using ABS plastic with rafts and supports. The proximal phalanges and finger STL files contain one element. Please add or duplicate as needed on the building platform. The thumb phalange and distal finger segment are slightly different that the rest of the fingers. You can replace the thumb parts with the regular finger parts if you need to increase the length of the thumb.

Sizing (adapted from the Snap Together Robohand Instruction Manual
http://www.thingiverse.com/thing:92937**)**

Overview: to get a perfect fit, you will be scaling all the parts of the hand by a percentage, based upon the size of the user's hand.

- Measure the knuckle area of the non-affected hand in centimeters or inches. If you measured inches, multiply your number by 2.54 to obtained centimeters.
- Convert centimeters to millimeters by multiplying your number times 10.

- Add 5mm to your measurement to account for the thickness of the Velcro based gauntlet.
- (Example: if the individual's hand measures 3 inches, then you will take 3 x 2.54 = 7.62 cm, then multiply this number times 10, so you will get 76.2 mm, add 5mm for the Velcro based gauntlet and you will get a total length of 81.2 mm).
- The knuckle with in the files you downloaded is 55 mm. Divide your result by
- 55. (Example: 81.2/55 = 1.48 rounded)
- Multiply the answer times 100 to get a percentage.
- (Example: 1.48 x100 = 148%)
- Scale all the parts of the Cyborg Beast by this percentage before printing. This can be done using the 'Scale' tool in Makerware.
- Print all the components at the same scale.
  **We found that for sizes less than 130% of the original the holes size may compromise the structure of the Cyborg Beast. We are in the process of developing plastic pins to replace the Chicago Screws in the finger joints.*

Assembly Materials

For assembly you will need:

- Chicago screws (www.chicagoscrews.com).
  - Aluminum Chicago Screws – 3'' to 3 1/4"(or larger) for the knuckle. Size will depend on the width of the hand. You need 1 per hand.
  - Stainless Steel Chicago Screws - 3/16" Blind or 1/4" for Velcro based gauntlets (hand and forearm). The specific size would depend of thickness of the Velcro. You need 6 of these.
  - Stainless Steel Chicago Screws 3/8" – for wrist hinge/joint and 1/2'' for the fingers. You need two 3/8'' for the wrist hinge/joint and five 1/2 '' for the fingers. For the wrist Chicago screws, include a plastic washer (see STL files) on each 3/8'' Chicago screw post. The stainless Steel Chicago screws for the finger can be replaced by Aluminum Chicago Screws.
- Genuine Velcro 30' Length x 2" Width. It is sold by the roll, but you need about 24'' inches. (http://www.amazon.com/dp/B006AWFGJ2/ref=pe_385040_30332200_pe_309540_26725410_item)
- Shade Cord (Or Lift Cord) 0.9 mm (http://www.amazon.com/Roll-Yards-Shade-Cord-Lift/dp/B006DDHVM8). It is sold by a roll of 100 yards, but you need about 2 yards.
- 2mm Black Elastic Bead Cord (http://shop.hobbylobby.com/products/2mm-black-elastic-bead-cord-183418/). It is sold by a roll of 5 yards, but you need only 1 yard.
- Firm Foam Padding. Sold by a roll of 25' feet, but you only need 1 foot. (http://www.pattersonmedical.com/app.aspx?cmd=getProductDetail&key=070_921018416)
- Sleeve arm protector (http://www.expressmedicalsupplies.com/derma-sciences-glensleeve-arm-protectors-p-10193.html)

Assembly instructions

Note: *You may need to drill the holes a little bit to increase their size so the Chicago screw fit properly. Due to scaling the size of the holes get distorted.*

1. Place -1/2" Chicago screws in finger (Figure 1) and 3'' to 3 1/4"(or larger) Chicago screw in knuckle joints (Figure 2). It is recommended to place Teflon tape (http://www.amazon.com/Teflon-Tape-1-2-in/dp/B00004TZP8) on the treads to firm the screws so they don't come loose. Ensure fingers move smoothly. If not, clean holes and remove plastic residues from the support plastic structure.

Figure 1. Finger Chicago Screw (1/2'')

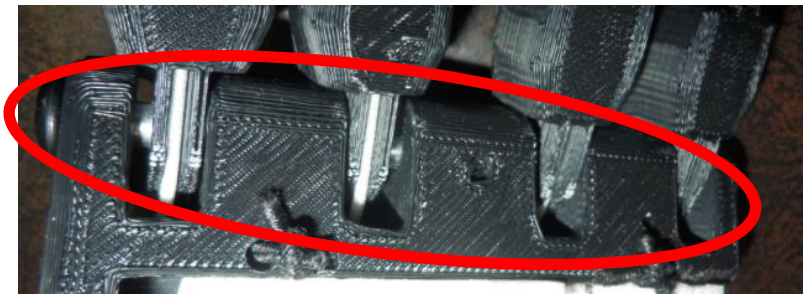


Figure 2. Knuckle Chicago Screw (3'' to 3 1/4"or larger)

2. Cut and apply adhesive firm foam padding on the sides of the forearm gauntlet (Figure 3 and 4), back of the knuckle area (front part of the hand, see Figure 5), and any other are that may be in contact with the skin.

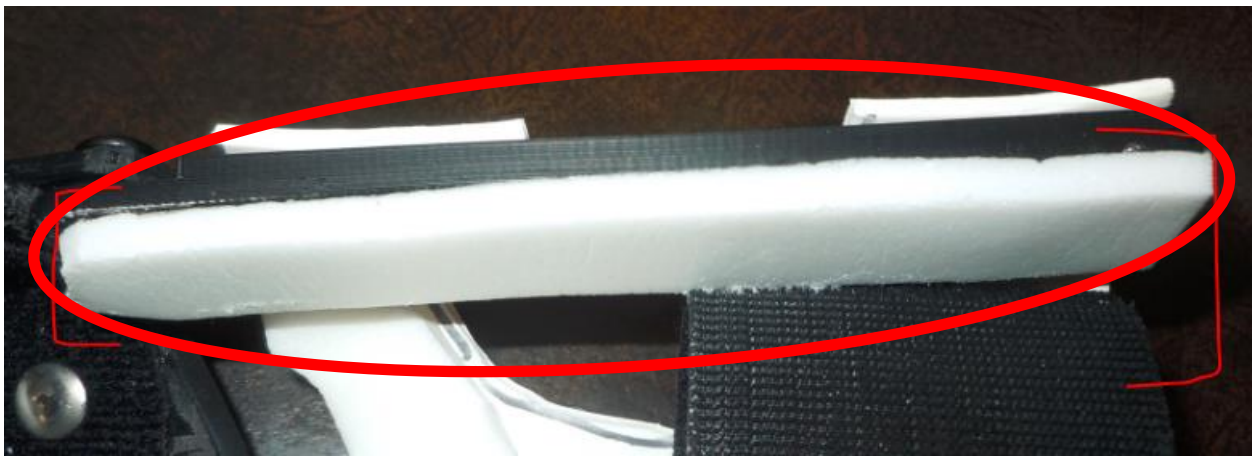


Figure 3. Gauntlet with firm foam padding (one side)

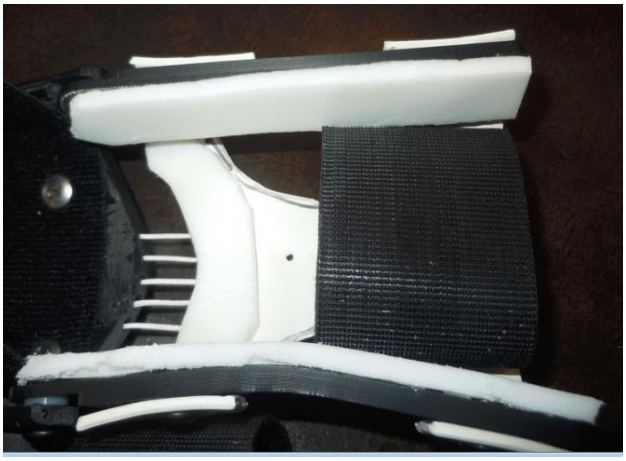


Figure 4. Gauntlet with firm foam padding (both sides and on top)

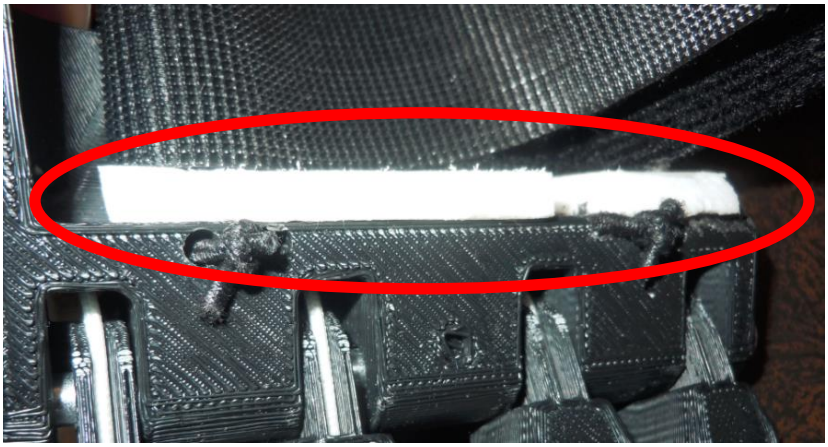


Figure 5. Knuckle with firm foam padding

3. Cut 2 pieces of about 8'' inches long of Velcro (smaller or larger depending on the forearm and hand circumference of the individual, see Figure 6). Cut another two Velcro pieces of about 6'' and 2'' inches long.
4. Cut 3 holes to fit the3/16" (or 1/4'') Chicago screws posts on the two pieces of Velcro that are 8'' inches long (Figure 6 and 7). Make sure that one piece is aligned with the holes in the hand and the other is aligned with the holes in the forearm gauntlet. Place the Chicago screws posts **to ensure that the soft side of the Velcro will be in contact with the skin** (Figure 8). Place these two pieces on the hand and forearm gauntlet.

Figure 6. Velcro 8'' long piece (hand gauntlet)

Figure 7. Velcro 8'' long piece (forearm gauntlet)

Figure 8. Velcro 8'' long piece (soft side)

5. Use the 6'' and 2'' inches long pieces of Velcro to cover the smooth side of the Chicago screw posts on the hand and forearm gauntlet, respectively (Figure 9).

Figure 9. Velcro 8'' long piece (hand gauntlet) and 6'' long (cover for the blind posts).

6. On the wrist hinge/joint place the 3/8" Chicago screw posts and add a plastic washer (included on the STL files) between the hand and forearm gauntlet hinges.

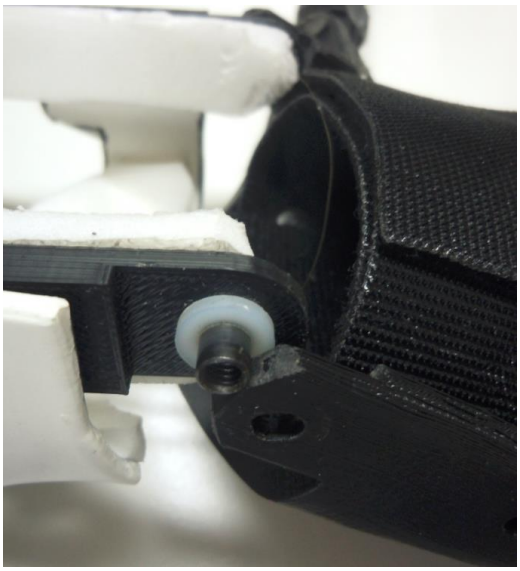


Figure 10. wrist hinge/joint plastic washer placement

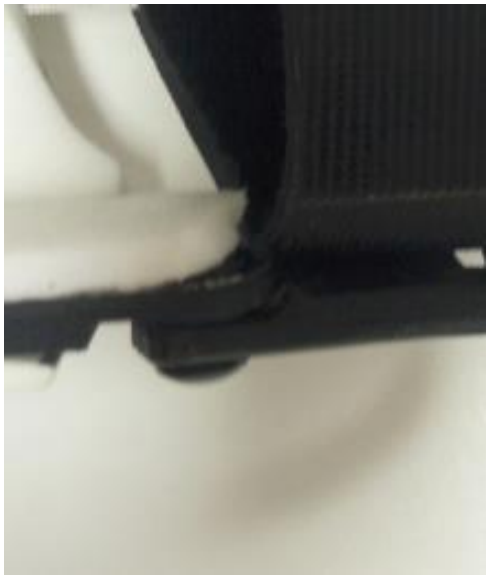


Figure 11. wrist hinge/joint completed

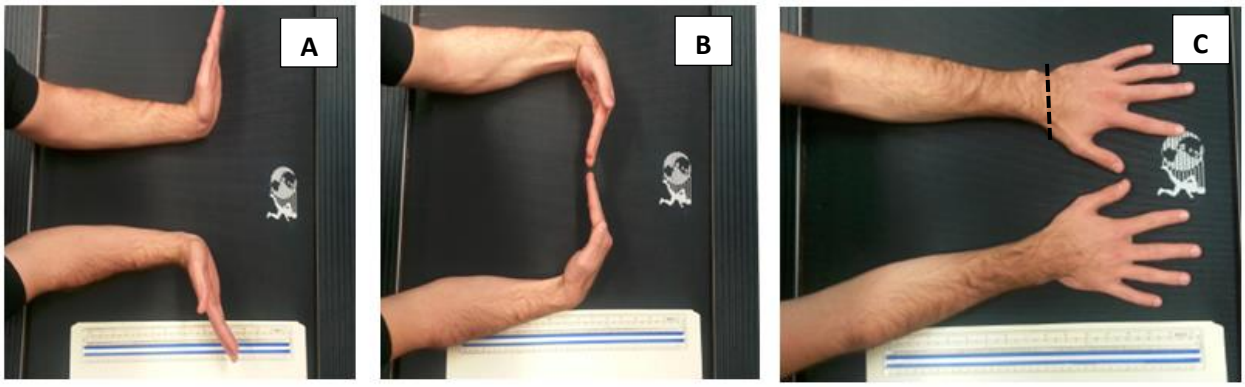
Elastic and Strings

For these steps refer to the Snap Together Robohand instruction manuals from page 41 to 61 (Click the link below, then click download this thing and the manual is the last file "Snap_Togeather_Robohand_Instructions").

(http://www.thingiverse.com/thing:92937).

If you need a device made at a distance, take three pictures of your hands following these instructions.

Template for pictures for range of motion and sizing assessment



1. All pictures should include the entire forearm up to the elbow.
2. All pictures should be taken from directly above the arms and not at any angle.
3. Place a ruler that measures either inches or centimeters (or both) somewhere in the picture so that lines on the ruler are visible.
4. Bend the wrists as far as possible for picture A and B.
5. Draw a line in pen on the top of the wrist of the affected hand for picture C.
6. Post these pictures on the E-NABLE site, so members of the E-NABLE group can take the needed measurements to construct the device at no cost.

Owen's Tensioner System

Ivan Owen took the time to make a quick video to explain the assembly and function of the tensioner system included in the forearm gauntlet of the Cyborg Beast:

http://www.youtube.com/watch?v=vimeVMZjS6E&feature=youtu.be

General Recommendations for E-NABLE Prosthetic Devices

1. As a general rule we recommend the users of these Mechanical Hands not to expose these devices to extremely hot conditions (over 250° F) or fire since they are made out of plastic.

2. Make sure there are no areas that may cause pressure or skin irritation as it may cause skin breakdown

3. Allow the mechanical hand breathing room as excessive sweat and other components may cause poor hygiene

4. Check every 30 minutes for redness or skin irritation when first wearing the mechanical hand. If you find redness or skin irritation please stop using the Mechanical Hand.

5. Make sure you have no allergic reactions to the material use to print the mechanical hand or any other component. If you do experience allergic reactions stop using the Mechanical Hand.

6. Make sure the mechanical hand is comfortable

7. Ensure the mechanical hand is functioning for the correct purpose

8. If a child will be using it. The child needs to be supervised at all time.

9. Start using the hand in a progressive manner. If the muscles of your wrist joint are tired, it would be a good idea to take a break and continue using the mechanical hand the next day.

10. If any component of the Mechanical Hand brakes please stop using the Mechanical Hand.

11. Ensure that the screws are not loose.

Acceptance

By accepting and downloading any files, design, plan, component or assembly instructions related to the this artificial/mechanical hand "Cyborg Beast", I understand and agree that any such information or material furnished by any individual associated with the design team is furnished as a gift for the sole purpose of evaluating various design iterations, ideas and modifications. I understand that such improvements are intended to benefit individuals having specific disabilities and are not intended for commercial use. I further understand and agree that there are no warranties expressed or implied associated with the provision of any such information or material.