E-NABLE: Prosthetists Meet 3D Printers

Mainstreaming Open Source 3D Printed Prosthetics for Underserved Populations
September 28, 2014
Johns Hopkins Hospital, Baltimore MD

Theresa Funk, Resident Prosthetist Orthotist, Dankmeyer, Inc.

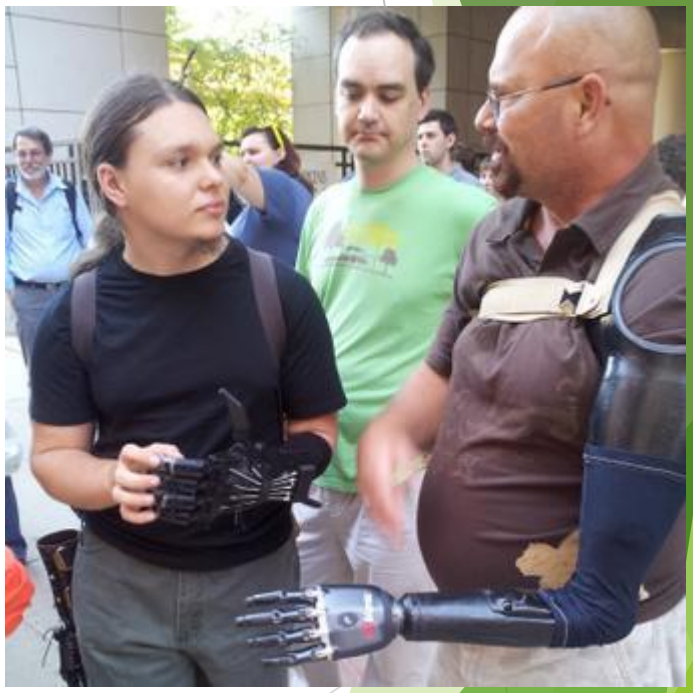
Dr. Albert Chi – Opening Welcome

Modular Prosthetic Limb (APL)

- Strength and dexterity close to anatomical
- Tactile and position sensing
- Neural interface – closed loop control

3D printed hands

- Affordable and accessible
- Mechanical
- “Backpack straps” for harnessing?



“$50 hand meets $85k hand”

Jon Schull – Enabling the Future: A Vision and a Movement

- “Electronic communications, 3D printing, and good will”
- Superhero hands
- Wrist driven design
- Partnership with medical professionals
- Raptor hand

Andreas Baston – 3D-Printing: Now and Soon

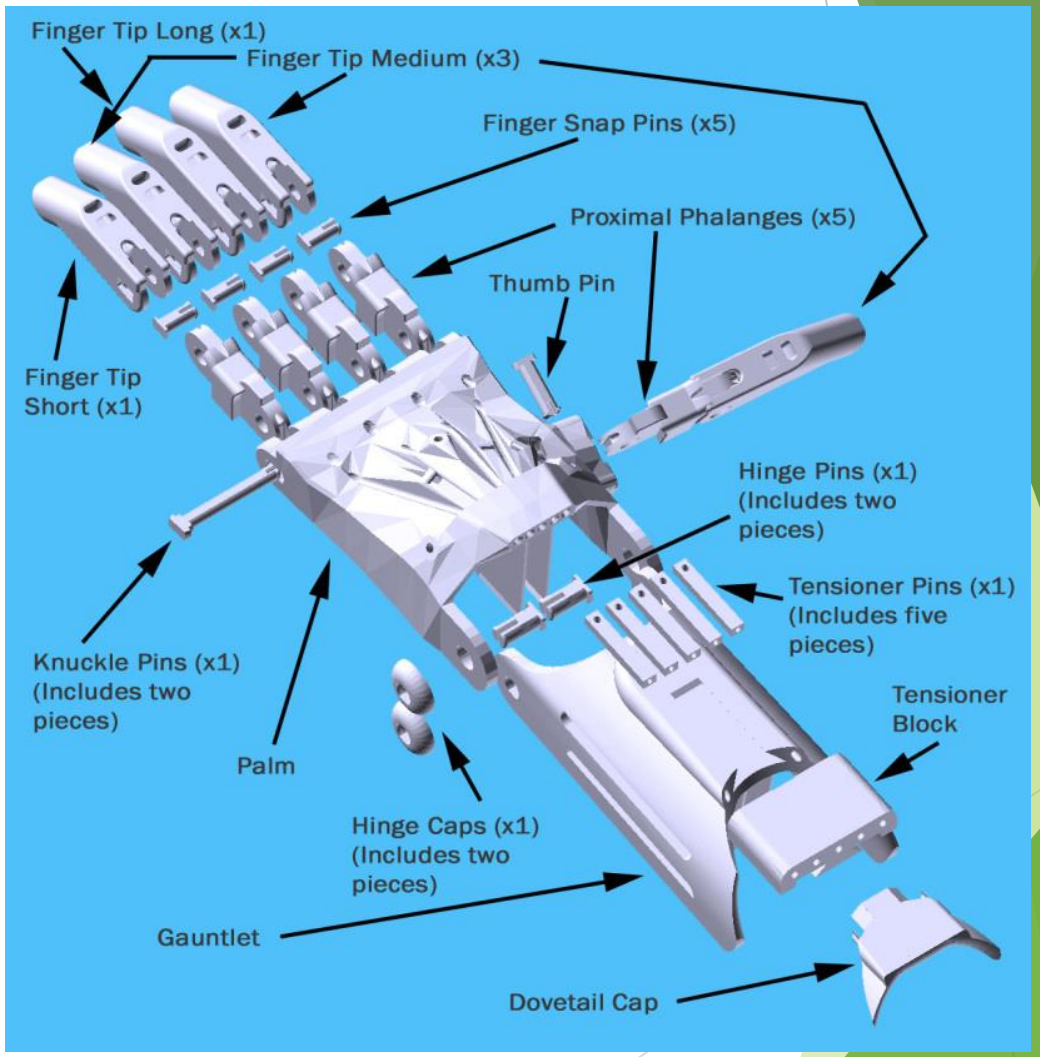
- ENABLE 3D Printing Uses FDM/FFF (Fused Deposition Technology and Fused Filament Fabrication)
- Strong parts, affordable, fast printing
- Hot glue guns
- Can control the internal structure, density, of the object printed
- Sharing printers
- Tissue grafts? Parts of organs?

Jorge Zuniga – It Seems to Work: Preliminary Data & Future Research Directions

- Cyborg Beast Prosthetic Hand
  - Increase in extensor (extensor digitorum longus) and flexor (flexor carpi ulnaris) strength
  - Can prepare a patient for use of a myoelectric device
- Cyborg Arm
  - Elbow driven
  - Adjustable thumb
  - Radial/Ulnar deviation control
  - Sports line

Raptor Hand

- ✓ Easy to print and assemble
- ✓ 3D printed snap pins
- ✓ Modular tensioning system



The Cyborg Beast

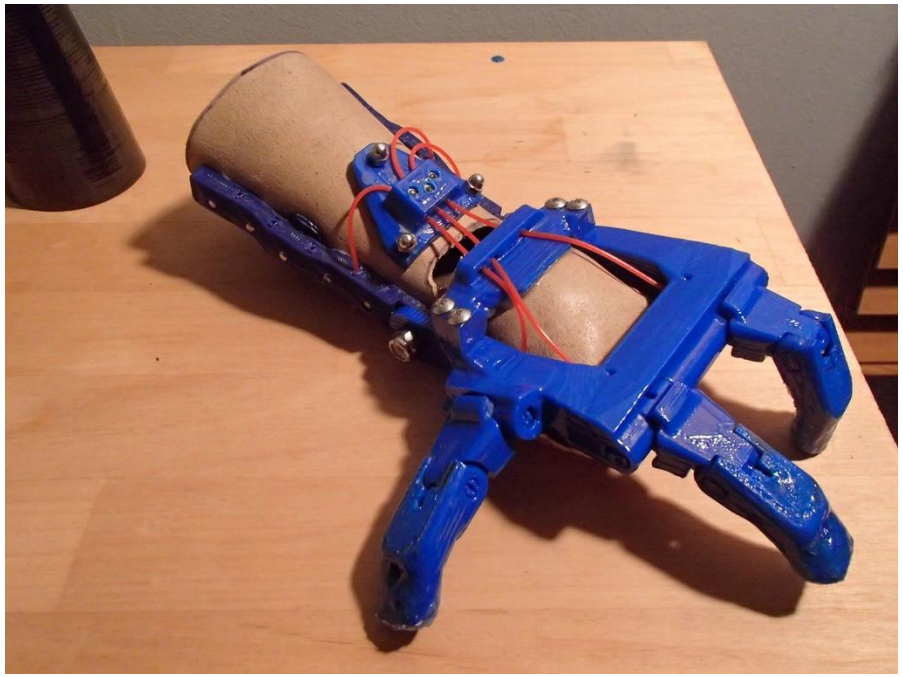
- ✓ Developed by Jorge Zuniga (Creighton University)
- ✓ Textured finger tips to improve grip
- ✓ Chicago screw joints
- ✓ Cable routed through body of the palm

The Talon Hand 2.0

- ✓ Rugged/durable design
- ✓ Riveted leather gauntlet and palm
- ✓ Integrated tensioning system

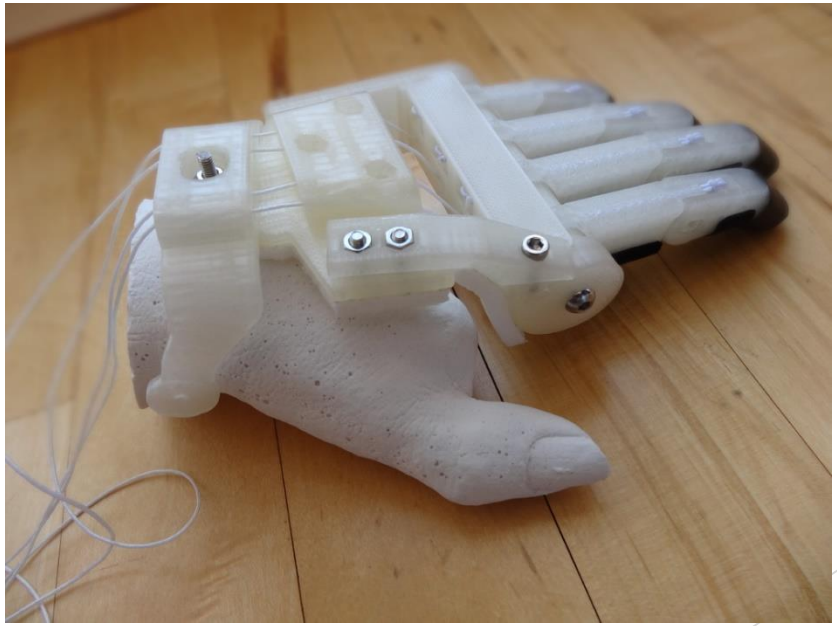
The Odysseus Hand

- ✓ Three finger design requires less force
- ✓ Same leather gauntlet and tensioning system as the Talon Hand



The Second Degree Hand

- ✓ For patients with a thumb
- ✓ Allow radioulnar deviation and flexion/extension of the wrist
- ✓ Some control in closing sequence of the fingers



Feedback from E-NABLE

“Many parents get very excited about e-NABLE and the stories they read on the internet and sometimes come to us with unrealistic expectations as to what these “helper hands” can actually do for their children. These e-NABLE hands are no where near the same as a real prosthetic hand device. They are only as strong as your child makes them and that all depends on their wrist function and how much force they can generate to close the device. Your child may actually prefer to go without their new hand more often than not because they have learned how to get along without fingers for many daily activities and will generally be faster and more efficient at the task without those “pesky fingers” getting in the way!

These hands should be seen simply as “Helper tools” and not actual prosthetic devices. While they will be useful in some activities - they are less effective in others. Much like you would use a hammer to drive a nail so you can hang a picture on the wall…you would not use that same tool to eat your cereal in the morning! (Well…you could…wouldn’t that be an adventure?!)

We encourage ALL who use one of these hands - to work with an occupational therapist, physical therapist or some kind of medical professional that can make sure the fit is correct, that no harm is being done to the skin or muscles and that the user is not using the device too much, too quickly.”

References

Mainstreaming Open Source 3D Printed Prosthetics for Underserved Populations. September 28, 2014. Johns Hopkins Hospital, Baltimore MD

http://enablingthefuture.org/