# Collaboration &
# DIY Accessibility

# Today

- Collaboration
- DIY Accessibility

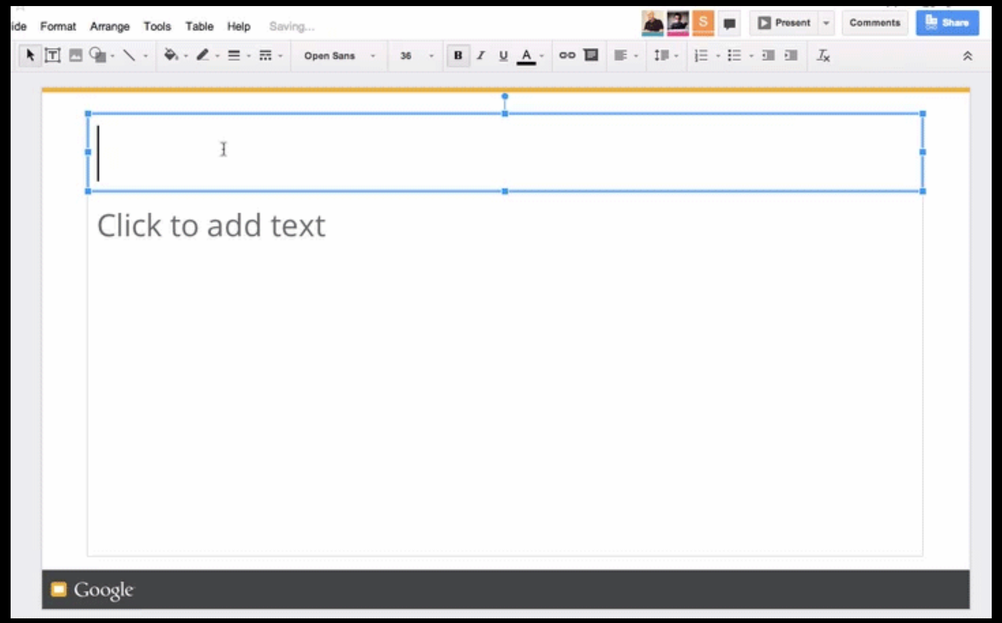
# Collaboration & DIY

- Two emerging trends in assistive technology
- **Cross-Ability Collaboration:** How can we link together different types of AT (and traditional technologies)
- **DIY AT:** How do we make and distribute assistive technology? And who does it?

# Why these topics are important

- New areas of research – not much work done so far
- Lots of opportunity for research and design contributions
- Can affect the future of accessibility

# Cross-Ability Collaboration




How to describe what's going on in this screencast?

What's happening in this screen reader session?

# What happens when collaboration is no good?

- Can reduce access to education, work, other activities
- Can cause AT users to work alone and stay away from collaborative situations
- Left out of informal social activities and culture
- Can make it more difficult for the AT user than normal; reinforce idea that AT user is not as good at the task

# Supporting collaboration

- How can we tell if our technology supports cross-ability collaboration well?
- How should we measure this?
  - Proportion of contributions (equal vs. not)
  - Single-user measures (clicks, typing, speed)
  - Subjective measures

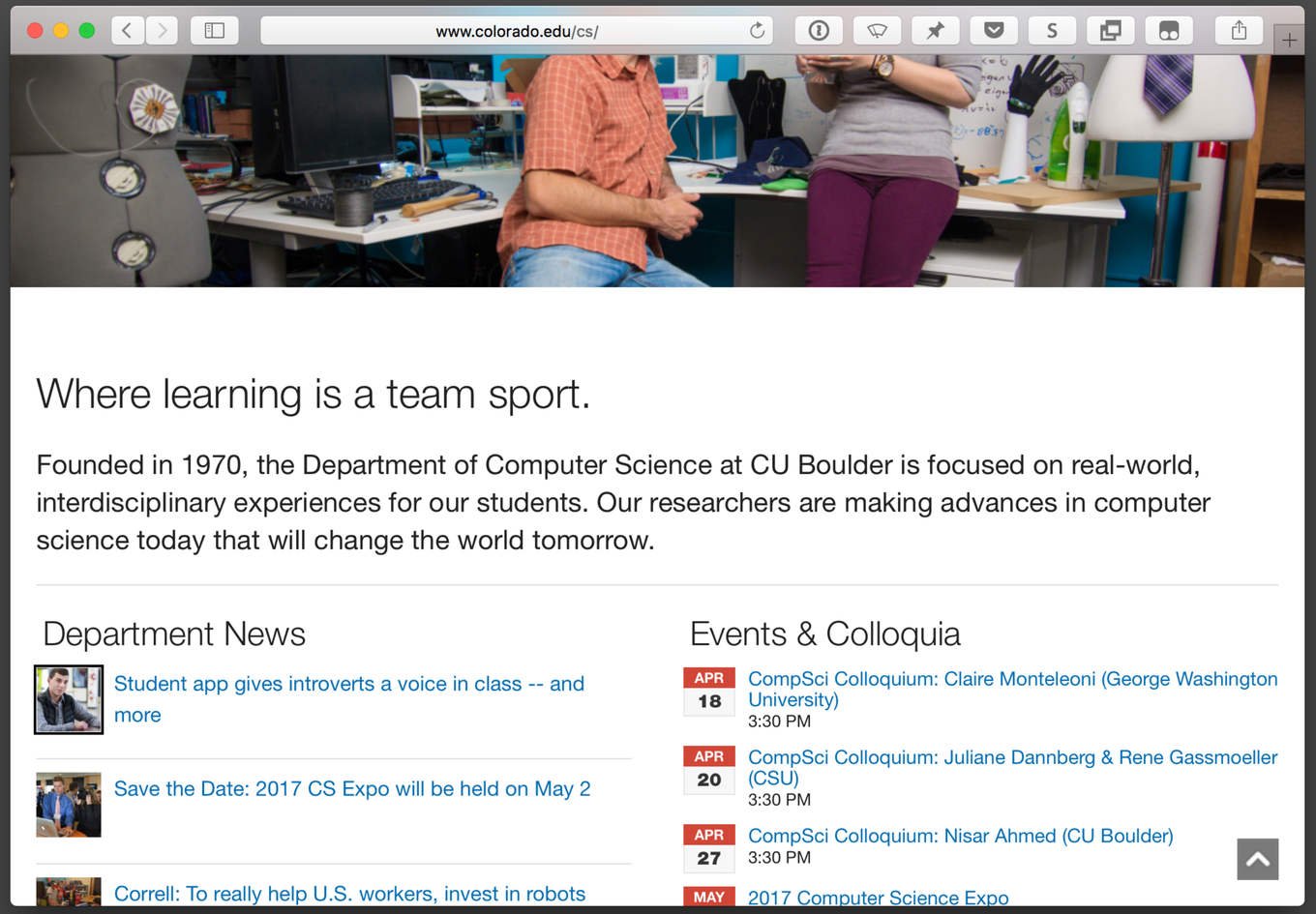
# Collaboration metrics

- Output
  - Sprint velocity
- Amount of activity
- Equal participation
- Understanding strengths / people do what they’re good at
- Distraction / anti-collaboration
- Wasted effort
- People like it

# Collaboration challenges

- **Awareness:** what is my partner doing? am I missing out on nonverbal communication?
- **Info overload:** what info to share about collaborative partner? when to share it?
- **Interface mismatch:** how do I do task X on interface Y?
- **Interface equality:** can my interface do everything my partner's can? Is it easier/more difficult?

# Visualizing AT use




David Meyer holds a phone displaying the intro screen for Flatiron Chat., link, image

**Asakawa et al, Accessibility Designer (ASSETS '04)**

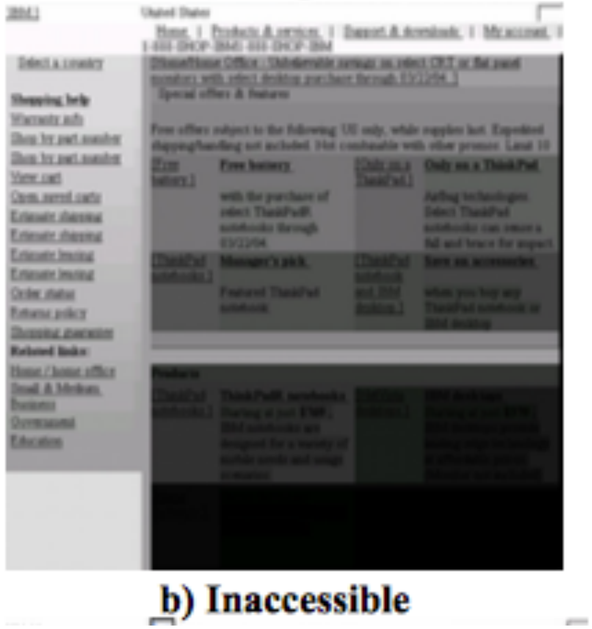






**Figure 1. Effectiveness of reaching-time visualization**
(white for 0 seconds and black for 120 seconds or longer from the top of a page)

# Collaborative accessibility: what to do

- Consider whether this technology will be used collaboratively (collocated or remote, synchronous or asynchronous)
- Address issues of awareness, info overload, interface mismatch
- Develop accessibility features along with “main” technology, not separately
- Test collaborative tools in collaborative scenarios

# Do-It-Yourself AT

- Accessibility has always been a do-it-yourself activity
- New technologies may better support customization, sharing

# Assistive Technology Dissemination through History

- 19th—early 20th Century:  Medical era. Assistive technology delivered via medical industry
- Late 20th Century: Private industry. Medical technology supplemented by affordable commercial AT by private business. Hardware and simple software.
- Late 2000s—early 2010s: App era. People with disabilities adopt mainstream devices. Assistance provided through apps.
- Present: DIY AT, crowdfunding. How to disseminate hardware and combined systems?

# Opportunities in DIY AT

- **Crowdfunding:** support AT design and development; support projects that might not work as a traditional business
- **3D Printing:** Support affordable production and of physical objects
- **Online communities:** Share models, resources, and tips
- **Computer-Aided Design:** Allow creation of objects without physical skills; easy sharing of objects; customization possible. Create **add-ons** for things

# The promise of DIY AT

TREATMENTS

## 3-D Printer Brings Dexterity To Children With No Fingers

7:46

+ Queue

Download

Embed

Transcript

June 18, 2013 · 4:11 AM ET

Heard on Morning Edition

STEVE HENN | CINDY CARPIEN

1 OF 6

Courtesy of Makerbot

EDITION US

THE HUFFINGTON POST

NEWS | POLITICS | ENTERTAINMENT | LIFESTYLE | IMPACT | VOICES | VIDEO | ALL SE

PARENTS 11/04/2013 07:05 pm ET

## Dad Uses 3D Printer To Make His Son A Prosthetic Hand (VIDEO)


Leon McCarthy was born without fingers on his left hand, but with some help from his dad, he can now draw, pick up food and hold a water bottle using a homemade prosthetic.

# DIY AT Challenges

- What’s difficult about DIY AT?
  - Do it yourself is not always DIY
  - Custom tailoring
  - Dangerous! Is this tested? Liability!

# DIY AT Challenges

# DIY AT Projects

- AT on Thingiverse
- Instructables
- DIY hearing aid decoration
- e-NABLE
- GripFab

MakerBot Thingiverse DASHBOARD EXPLORE CREATE Enter a search term SIGN IN / JOIN

# 3D printed Wheelchair-Ramp for one step

by nanonan, published Dec 26, 2013





Like 376
Collect 119
Comment 38
I Made One 0
Remix It 0
Share

Download This Thing!

| Thing Info | Instructions | Thing Files | 38 Comments | 0 Made | 119 Collections | 0 Remixes |
|---|---|---|---|---|---|---|

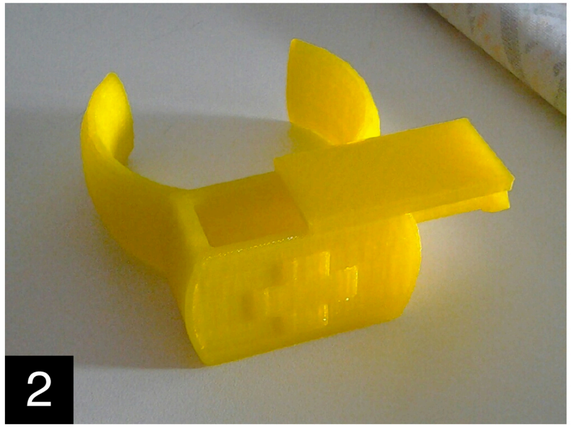
## Description

As a wheelchair-user i often need to overcome a step in front of a building, a shop, cafe or bar. Therefor i had the idea of printing me my own small ramp. It has to be as small as possible to carry it in my bag, when i'm on my way through Berlin.

This is my first prototype. Please feel free to print and to develop it... Any feedback is apreciated!

# AT on Thingiverse


thing: 16174



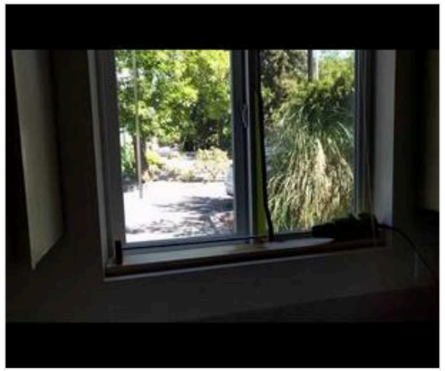

thing: 34784


thing: 3666

instructables let's make accessibility Explore Contests Classes Publish Login | Sign Up

Featured: Easter 3D Printing Class Arduino For Teachers AUTODESK. Make anything.

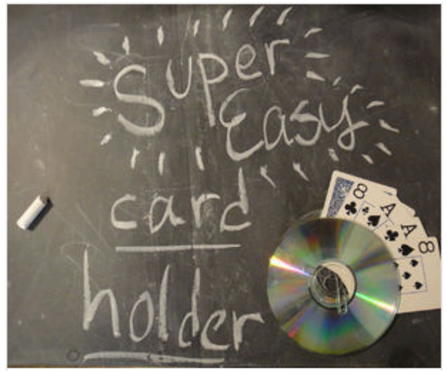
everything Featured | Recent | More All Types



**Motorize your window with a cordless drill**

by pefferie in Life Hacks

55 4.3K




**Free Accessible Playing Card Holder**

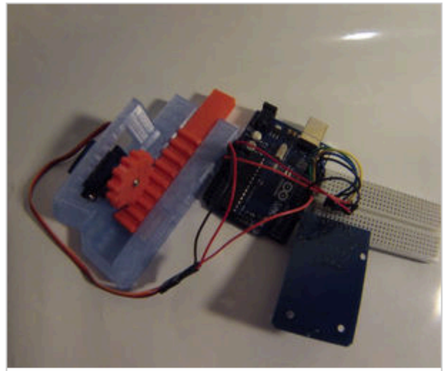
by neddy1 in Card Games

15 1.2K


**Motorized System for Raising and Lowering Hanging Plants**

by DIY Hacks and How Tos in Gardening

69 4.5K



**RFID Controlled Door**

by Swellsandstorms in Arduino

645 43K


**Create External Buttons For Your Keyboard**

by DIY Hacks and How Tos in Computers

437 95K

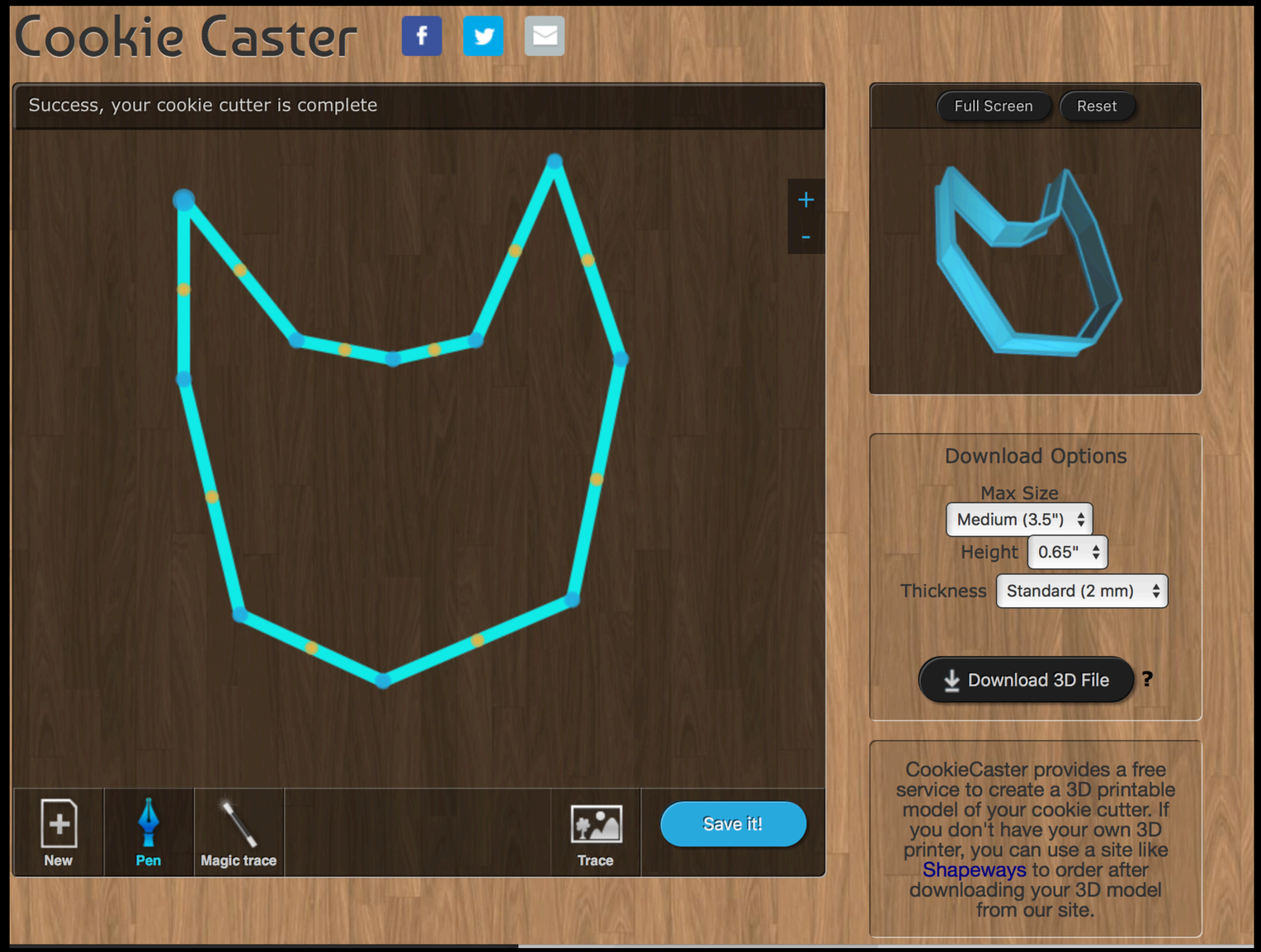
**Aesthetic customization**
([Profita et al. ASSETS 16])

This online community has over 4,000 members!

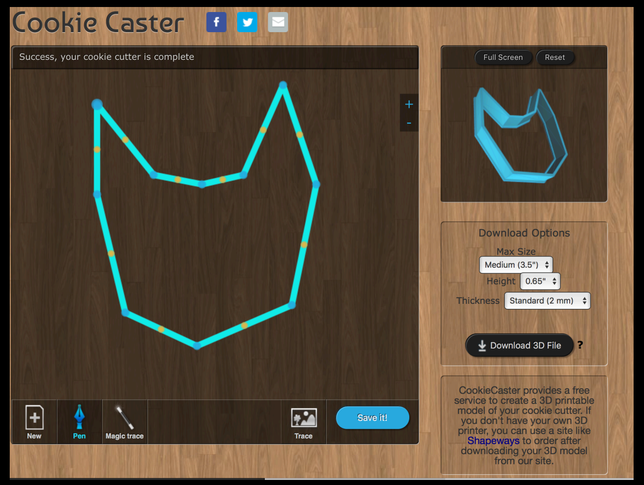

**Figure 2. DIY customization of HA and CIs. A) Blue and silver glitter-decorated HAs with matching nails; B) HAs with My Little Pony character stickers and tube riders; C) HAs with silver dots, "POW" stickers, and a sparkly ear mold. D) HA with purple ear base and shimmering emerald ear mold; E) Cochlear Implant with ankle bracelet repurposed as a bangle.**

# e-NABLE foundation

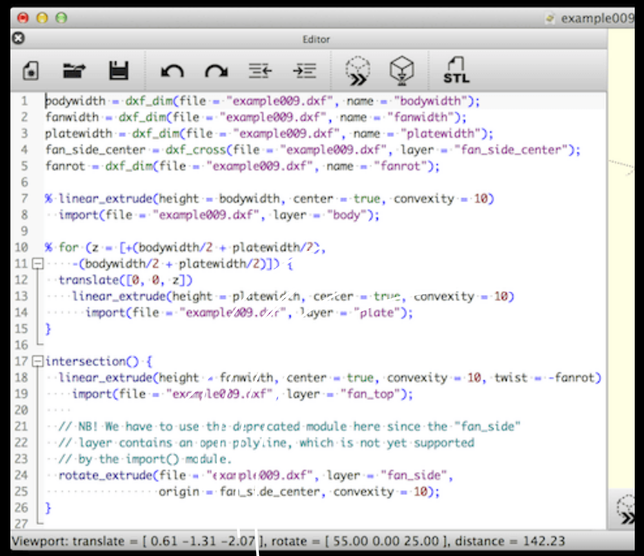
# 3D design without CAD (cookiecaster.com)



# 3D design without CAD workflow




user input



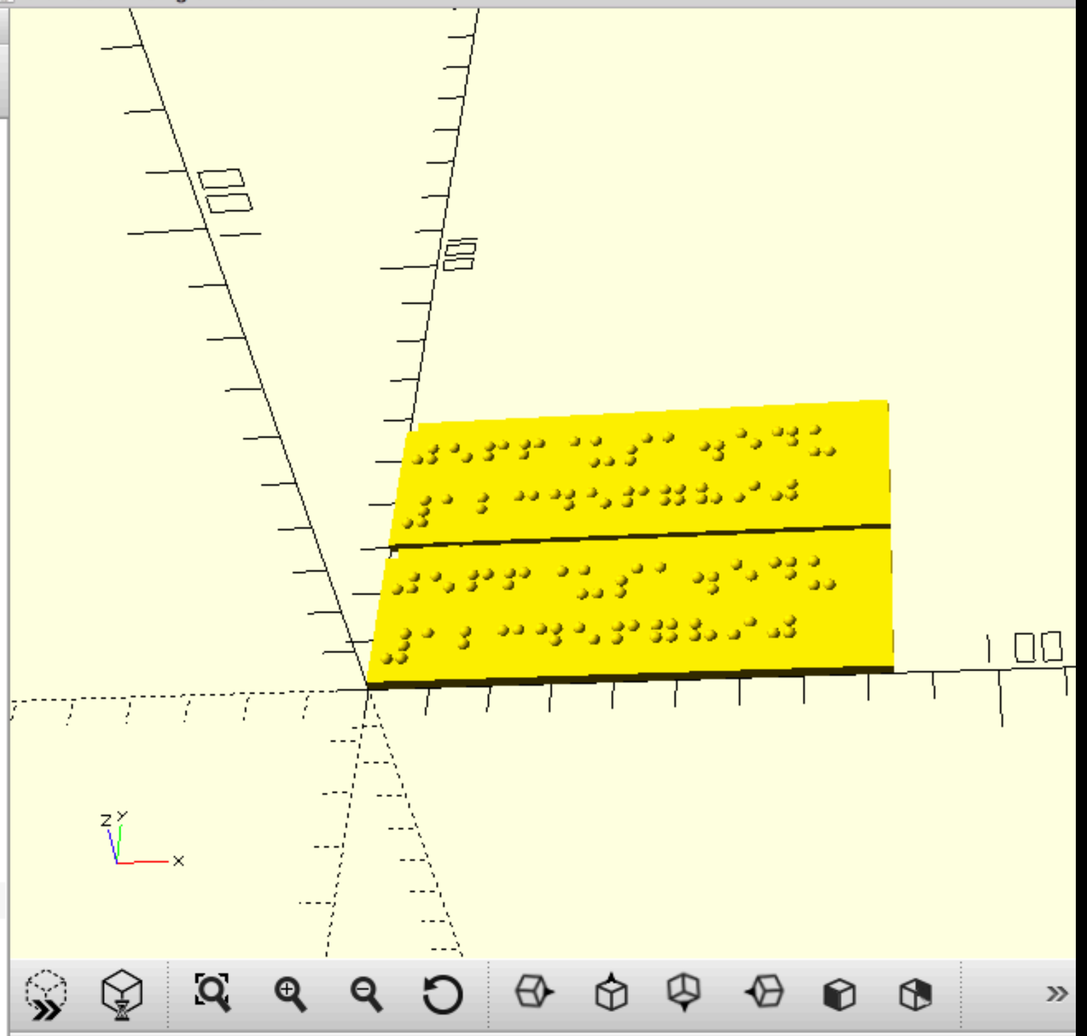

openSCAD code

3d printable .stl file

braillecard-for-grant.scad

Editor

```
1  // full cards 84mm x 55mm
2  // mini cards 70 x 28
3  use<write.scad>
4  use<braille_font.scad>
5
6  name="Jeff Smith";
7  email="jeff@usa.edu";
8  //email="skane@umbc.edu";
9  phone="1234567890";
10
11 for(y = [0, 29]) {
12
13 translate([0,y,0]) {
14 difference() {
15 cube([84,28,2]);
16 translate([-1,26,-1]) cube([3,3,4]);
17 //translate([82,26,-1]) cube([3,3,4]);
18 }
19 translate ([1,24,0]) braille_str(email);
20 translate ([1,12,0]) braille_str(str("#",phone));
21     }
22 }
23
24 // connective bits
25 translate([10,0,0]) cube([2,56,1]);
26 translate([72,0,0]) cube([2,56,1]);
```



Console

```
ECHO: "Total Width: 68.75mm"
ECHO: "Total Width: 75mm"
ECHO: "Total Width: 68.75mm"
Compiling design (CSG Products generation)...
Geometries in cache: 4
Geometry cache size in bytes: 89696
CGAL Polyhedrons in cache: 0
CGAL cache size in bytes: 0
Compiling design (CSG Products normalization)...
Normalized CSG tree has 124 elements
Compile and preview finished.
Total rendering time: 0 hours, 0 minutes, 0 seconds
```

Viewport: translate = [ 38.82 -10.07 58.59 ], rotate = [ 42.40 9.10 4.70 ], distance = 329.25

OpenSCAD 2015.03

# Prototype upper-limb prosthetics (Hofmann et al. CHI 16)

Figure 4.a. Kevin playing the cello with his prosthetic cello-bow holder.

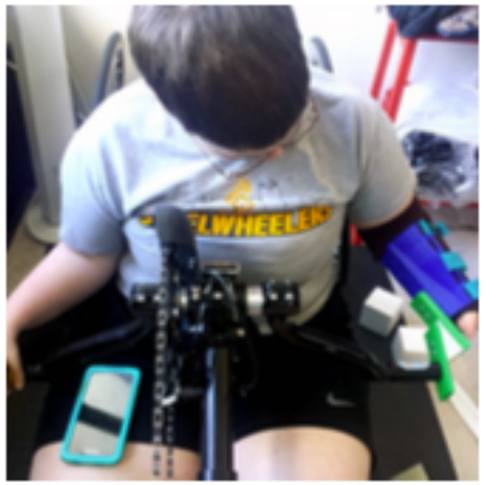


Figure 4.b. Ellen riding a stationary hand-cycle with her final prosthetic hand-cycle attachment.

Figure 4.c. Brett slicing bread with his myoelectric arm and 3D printed knife holder.

Figure 5.a. Legos are used to iteratively adjust the length between the socket and cello bow holder

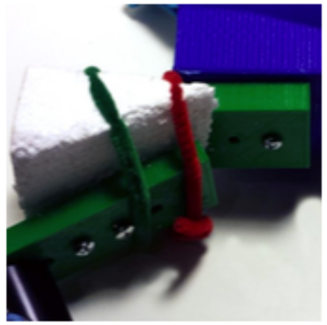


Figure 5.b. Pipe cleaners are used to fasten carved Styrofoam angle blocks for iterative testing.

Figure 5.c. Clay is used to mold grip of a myoelectric hand. Clay is 3D scanned and reproducible.

# GripFab (Buehler et al. ASSETS 14)

**Figure 1. A custom 3D-printed grip designed to hold a stylus.**

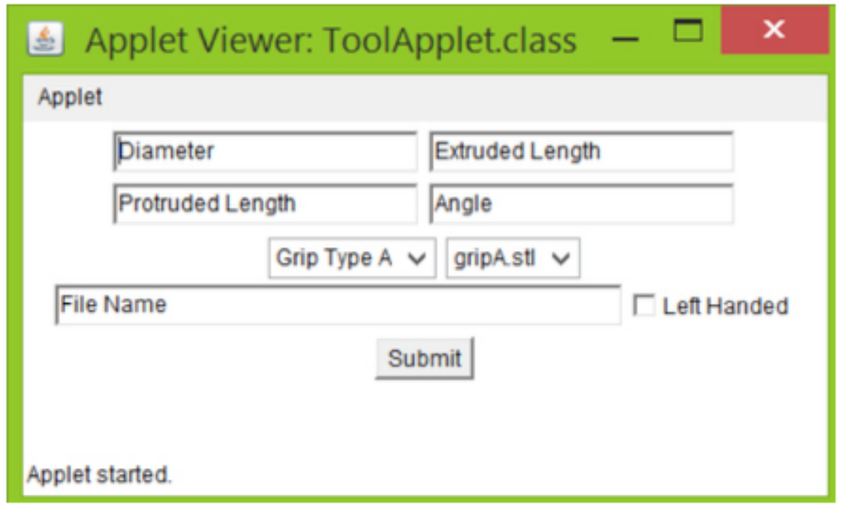



**Figure 2. Screenshot of a prototype interface for GripFab.**

# Tactile graphics 💰 💰 💰 💰


http://
www.matterhackers.com/
envisionthefuture?
rcode=enable

# Activity

- Sketch out a tool (or multiple tools) that could enable a person with a disability to create a 3D-printed AT device
- Be creative! This is a difficult (and unsolved) problem
- Some starting points:
  - Create tactile graphics or maps for blind/VI
  - Create adapters for mobility impairments & household objects
  - Simple 3D modeling for cognitive accessibility

# Activities we’re not doing

- **DIY accessibility:** test an existing DIY AT project or instructable (not enough time)
- **Captioning:** Create captions for an image or video of user interaction
- **Designing collaborative tools:** design a collaborative game for blind and sighted players