Fabrication and Do-It-Yourself Assistive Technology

05-499/899 Fall 2024

Celebrating Accessibility

https://cmu-05-499.github.io

Andrew Begel and Patrick Carrington

Administrivia

Project Milestone 2 due tonight

HW4 Celebrating Accessibility Essay due tonight

P6 - Project Final Presentation and Deliverables

20 minutes team check-in

Project Presentations in class December 3rd

Prototyping to Manufacturing

Non-trivial to move from design to product

Fabrication and Prototyping

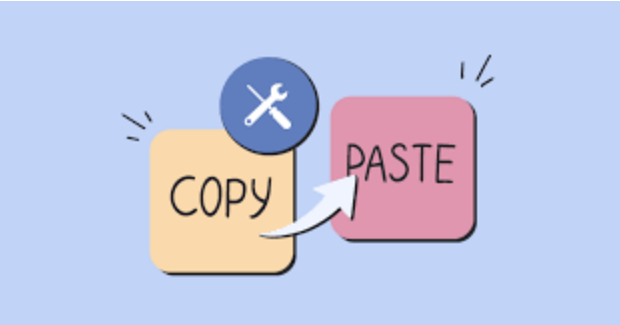
Maker Spaces

Children's Museum

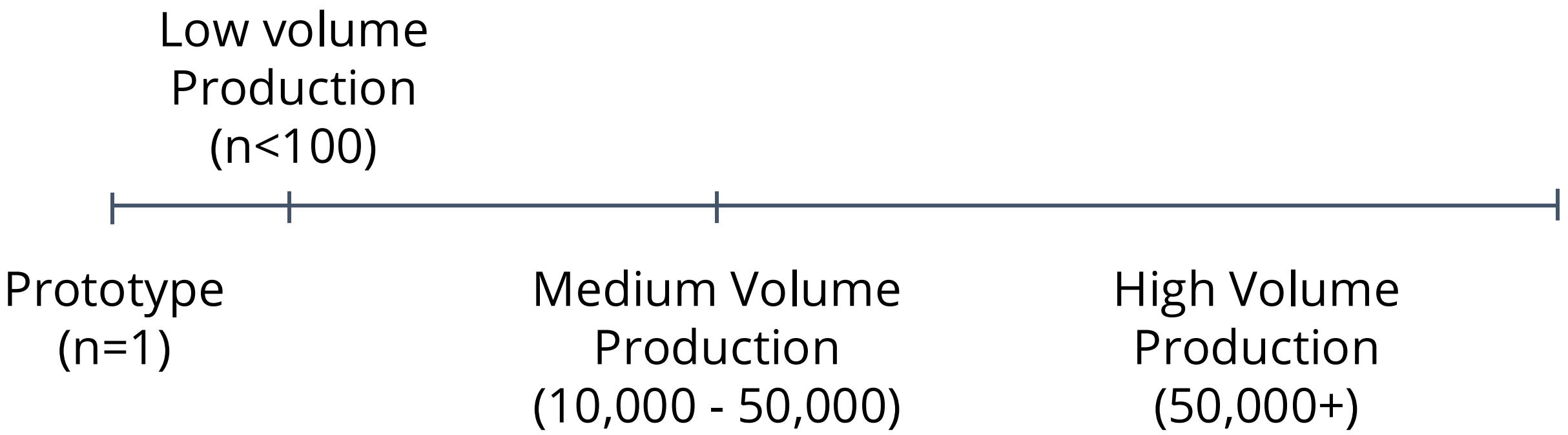
College of Engineering

Aside: Software Replication

An oversimplification but relatively easy to do



Aside: Hardware Replication



Rushil Khurana and Steve Hodges. 2020. Beyond the Prototype: Understanding the Challenge of Scaling Hardware Device Production. In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20).

Readings Discussion

Lead: Siyun Wen

- Empowering individuals with do-it-yourself assistive technology
- Occupational Therapy is Making

Do-It-Yourself Assistive Technology

If you want something done right, do it yourself!

or do it yourself for other reasons…

Hurst and Tobias (2011) - DIY Assistive Technology

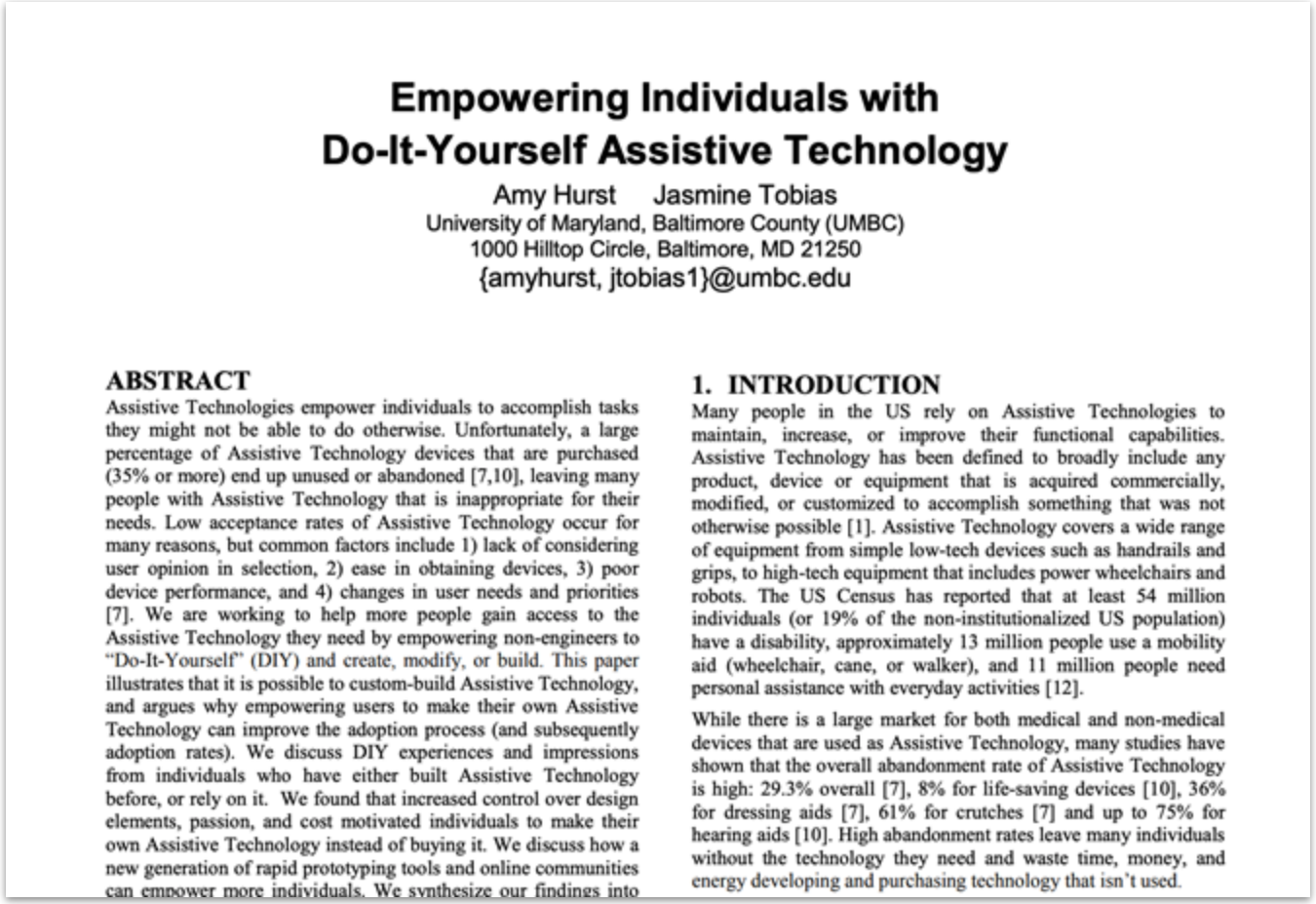
Dr. Amy Hurst

Associate Professor at NYU

a joint appointment in the Occupational Therapy Department in the Steinhardt School of Culture, Education, and Human Development and the Technology, Culture and Society Department in the Tandon School of Engineering.

Director of The Ability Project

30% of Assistive Technology Devices Abandoned



Empowering Individuals with Do-It-Yourself Assistive Technology

Amy Hurst Jasmine Tobias
University of Maryland, Baltimore County (UMBC)
1000 Hilltop Circle, Baltimore, MD 21250
{amyhurst, jtobias1}@umbc.edu

ABSTRACT

Assistive Technologies empower individuals to accomplish tasks they might not be able to do otherwise. Unfortunately, a large percentage of Assistive Technology devices that are purchased (35% or more) end up unused or abandoned [7,10], leaving many people with Assistive Technology that is inappropriate for their needs. Low acceptance rates of Assistive Technology occur for many reasons, but common factors include 1) lack of considering user opinion in selection, 2) ease in obtaining devices, 3) poor device performance, and 4) changes in user needs and priorities [7]. We are working to help more people gain access to the Assistive Technology they need by empowering non-engineers to "Do-It-Yourself" (DIY) and create, modify, or build. This paper illustrates that it is possible to custom-build Assistive Technology, and argues why empowering users to make their own Assistive Technology can improve the adoption process (and subsequently adoption rates). We discuss DIY experiences and impressions from individuals who have either built Assistive Technology before, or rely on it. We found that increased control over design elements, passion, and cost motivated individuals to make their own Assistive Technology instead of buying it. We discuss how a new generation of rapid prototyping tools and online communities can empower more individuals. We synthesize our findings into

1. INTRODUCTION

Many people in the US rely on Assistive Technologies to maintain, increase, or improve their functional capabilities. Assistive Technology has been defined to broadly include any product, device or equipment that is acquired commercially, modified, or customized to accomplish something that was not otherwise possible [1]. Assistive Technology covers a wide range of equipment from simple low-tech devices such as handrails and grips, to high-tech equipment that includes power wheelchairs and robots. The US Census has reported that at least 54 million individuals (or 19% of the non-institutionalized US population) have a disability, approximately 13 million people use a mobility aid (wheelchair, cane, or walker), and 11 million people need personal assistance with everyday activities [12].

While there is a large market for both medical and non-medical devices that are used as Assistive Technology, many studies have shown that the overall abandonment rate of Assistive Technology is high: 29.3% overall [7], 8% for life-saving devices [10], 36% for dressing aids [7], 61% for crutches [7] and up to 75% for hearing aids [10]. High abandonment rates leave many individuals without the technology they need and waste time, money, and energy developing and purchasing technology that isn't used.

DIY-AT as a Novel Concept

Rather than develop AT and deliver them, empower users with:

- Tools
- Knowledge
- Resources

To create and modify their AT as their needs change

Head Pointers and Miniature Wheelchairs

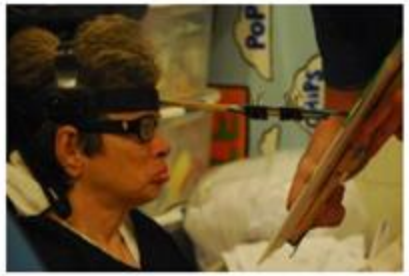


Figure 2. Homemade miniature wheelchairs – the "founding project, 1972".

Takeaways

Supporting adoption and buy in

Considering all the stakeholders

Reducing the Time to adoption

Need to empower Novices

Online Communities for sharing knowledge and designs!

Anyone know any good online maker communities or websites?

Making Making Easier

"Like This, But Better": Supporting Novices' Design and Fabrication of 3D Models Using Existing Objects

Patrick A. Carrington, University of Maryland Baltimore County
Shannon Hosmer, University of Maryland Baltimore County
Tom Yeh, University of Colorado Boulder
Amy Hurst, University of Maryland Baltimore County
Shaun K. Kane, University of Colorado Boulder

Abstract
Despite the prevalence of affordable "maker" tools such as 3D printers and laser cutters, actually creating digital models remains out of the reach of most everyday users. Even when users are able to design or fabricate items, some everyday users may be more interested in modifying or replacing objects that they already own rather than inventing new items. Addressing the needs of these users requires taking a different approach than that taken by most computer-aided design tools. To address this need, we introduce the notion of *design from imperfect examples*, in which existing objects are scanned and modified to create new objects. We present examples of this design approach and describe the development and formative evaluation of the Easy Make Oven, a prototyping tool that enables novice users to create simple 3D designs based on their existing possessions.

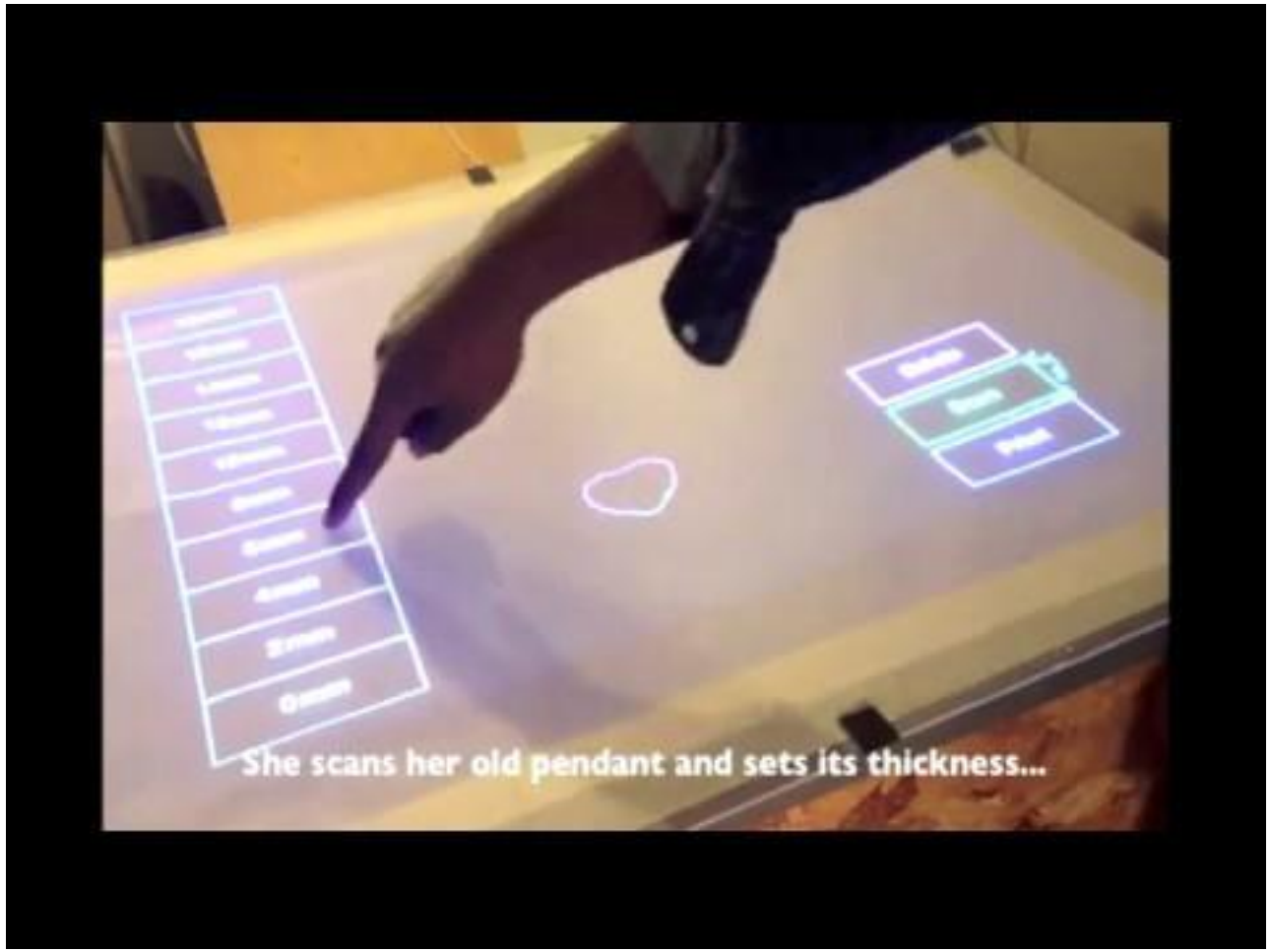
Keywords: Creativity; Rapid Prototyping; 3D Modeling; Making

S3

Carnegie Mellon University

Anyone know what this is?

The Easy “Make” Oven



The EMO v2 (circa 2013)

Replicate and Combine

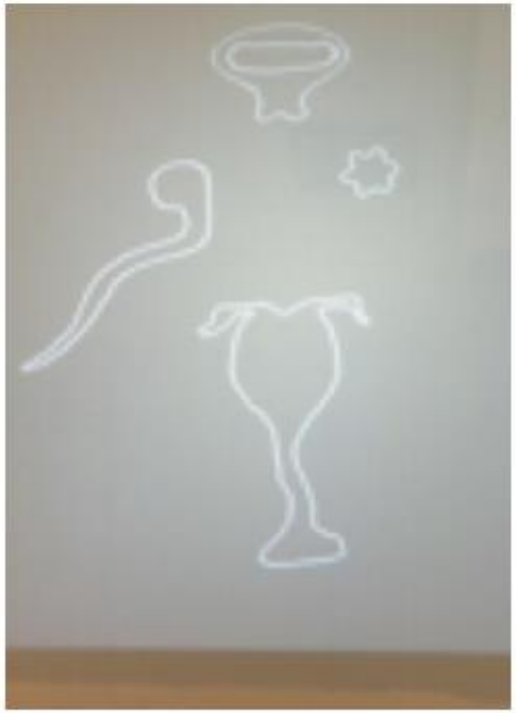
A. 

B. 

Work Together

A.

B.



C.

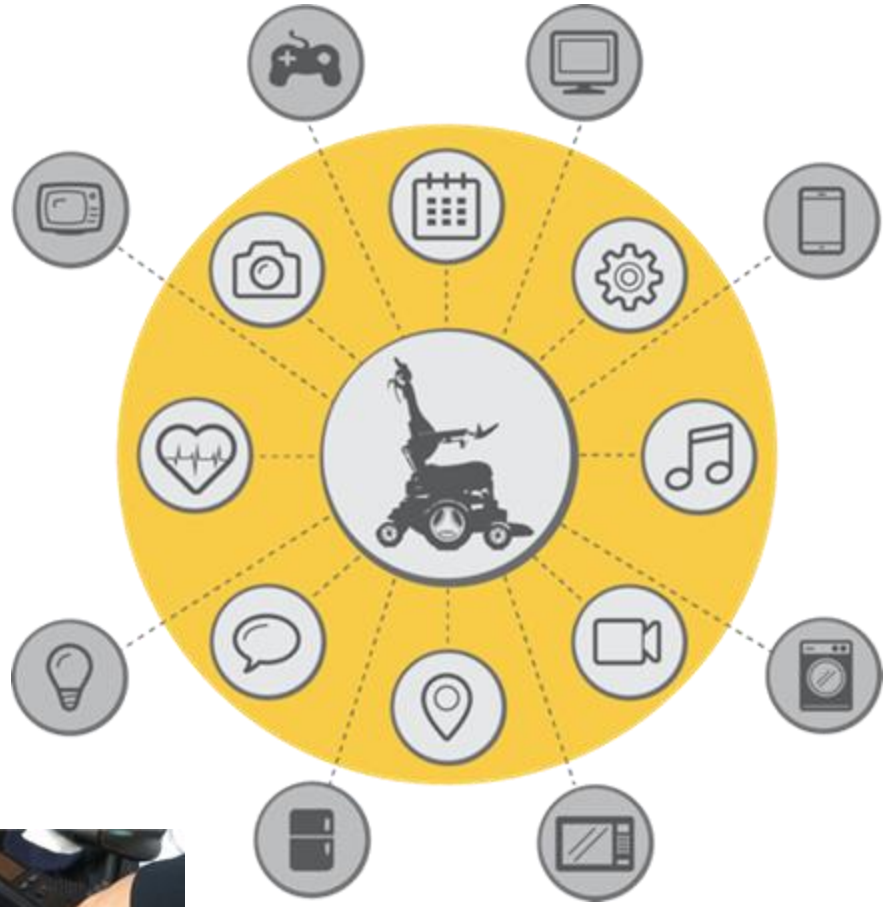
Like this but…”different”

What would you make?

What is a Chairable?

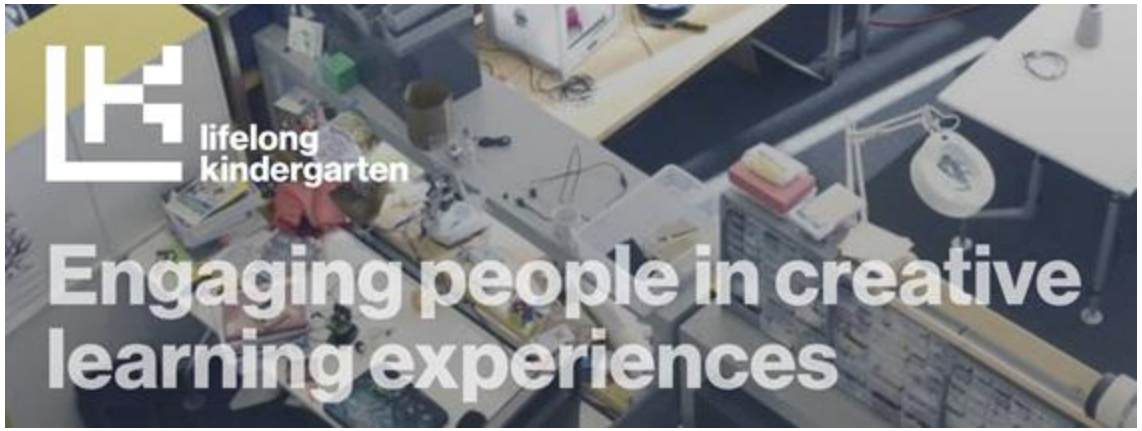
Chairable
(/CHe(ə)r-əbEəl/) noun.

Devices designed to fit a wheelchair form factor, maintaining its shape, and considering the abilities of the user.



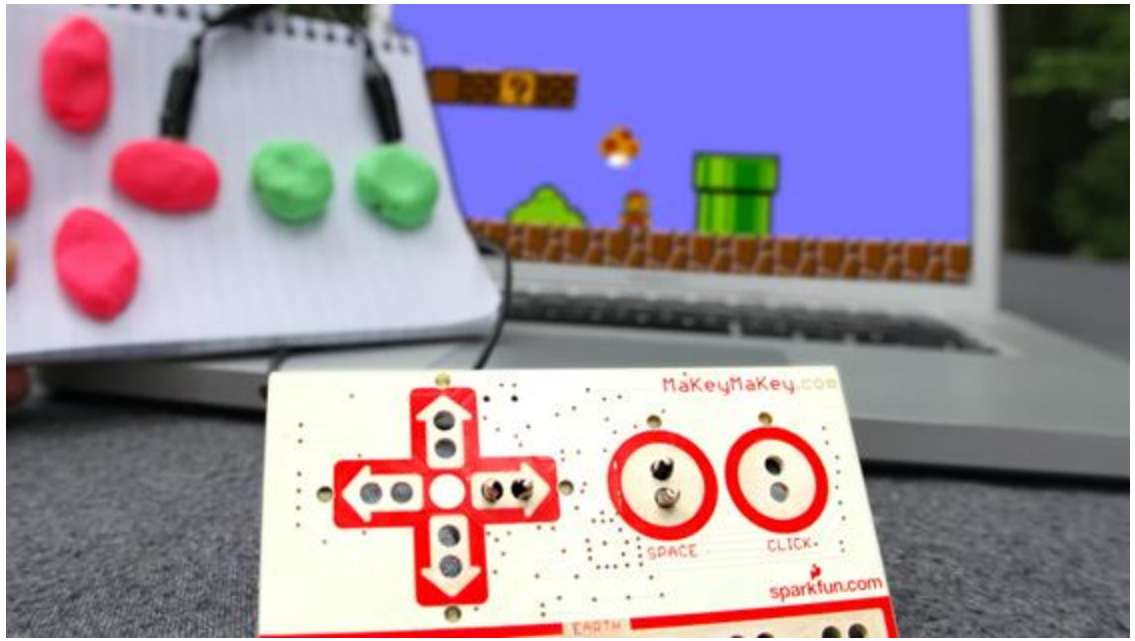
Carrington *et al.*
"Wearables and Chairables" (CHI 2014)

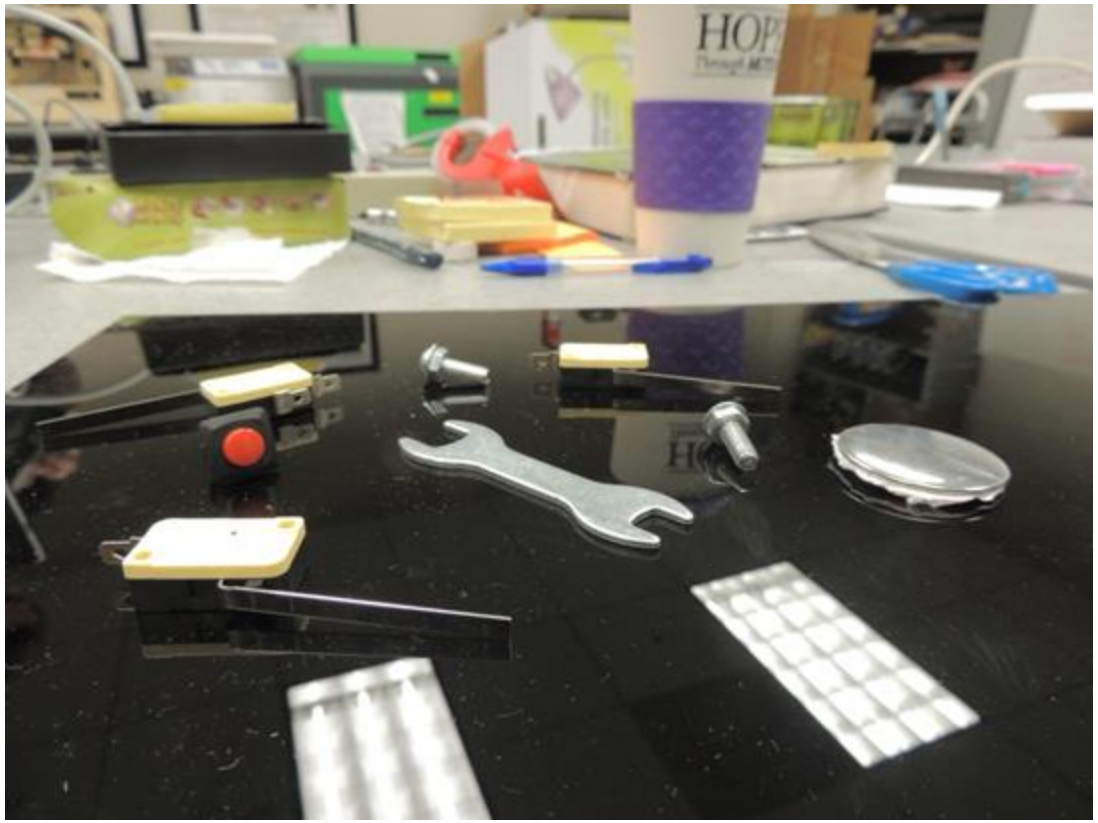
Early Chairables - the MaKey MaKey



https://makeymakey.com/

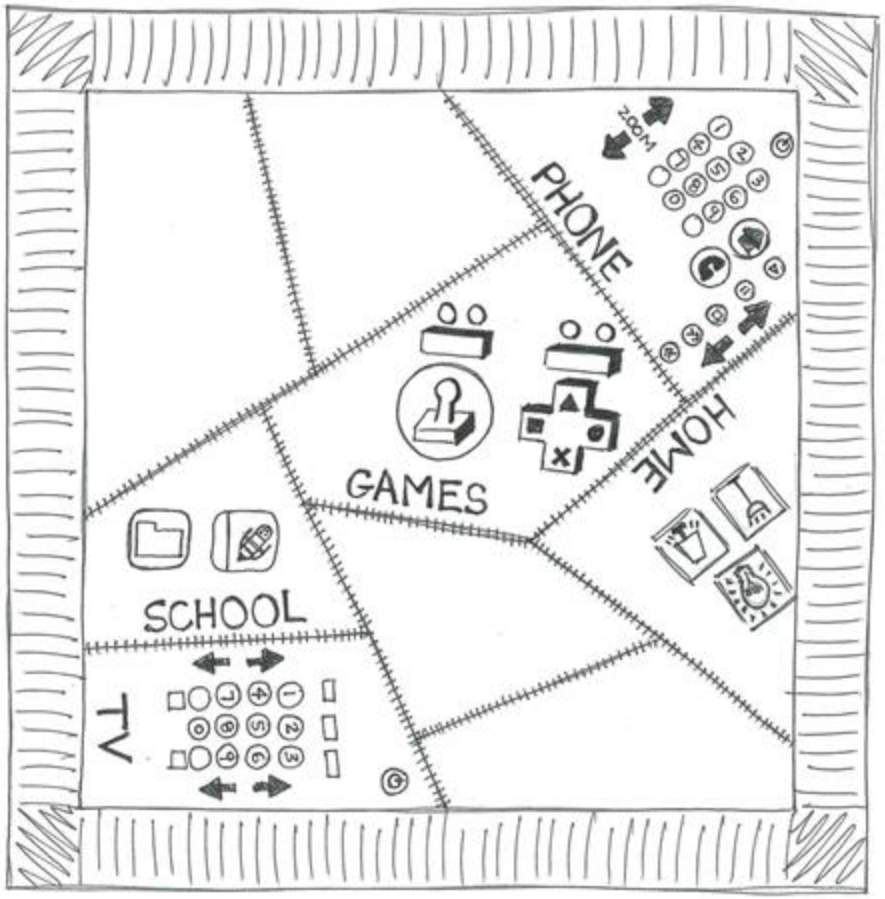
The cool thing about “toys” is that you don’t expect much






TODAY

We can also make soft electronics!



Participation: DIY Add a Handle

Working in groups of 2-3

- Choose a small object that you have with you or near you
- Using only the tools available to you in this room
  - Add a handle to that object that makes it easier to hold for someone who has difficulty gripping objects

On a piece of paper write down:

- Who did you design this device for?
- What functional needs or access barrier does this device address?
- What are the physical requirements to use this device?
- What group(s) would not be able to use this device?