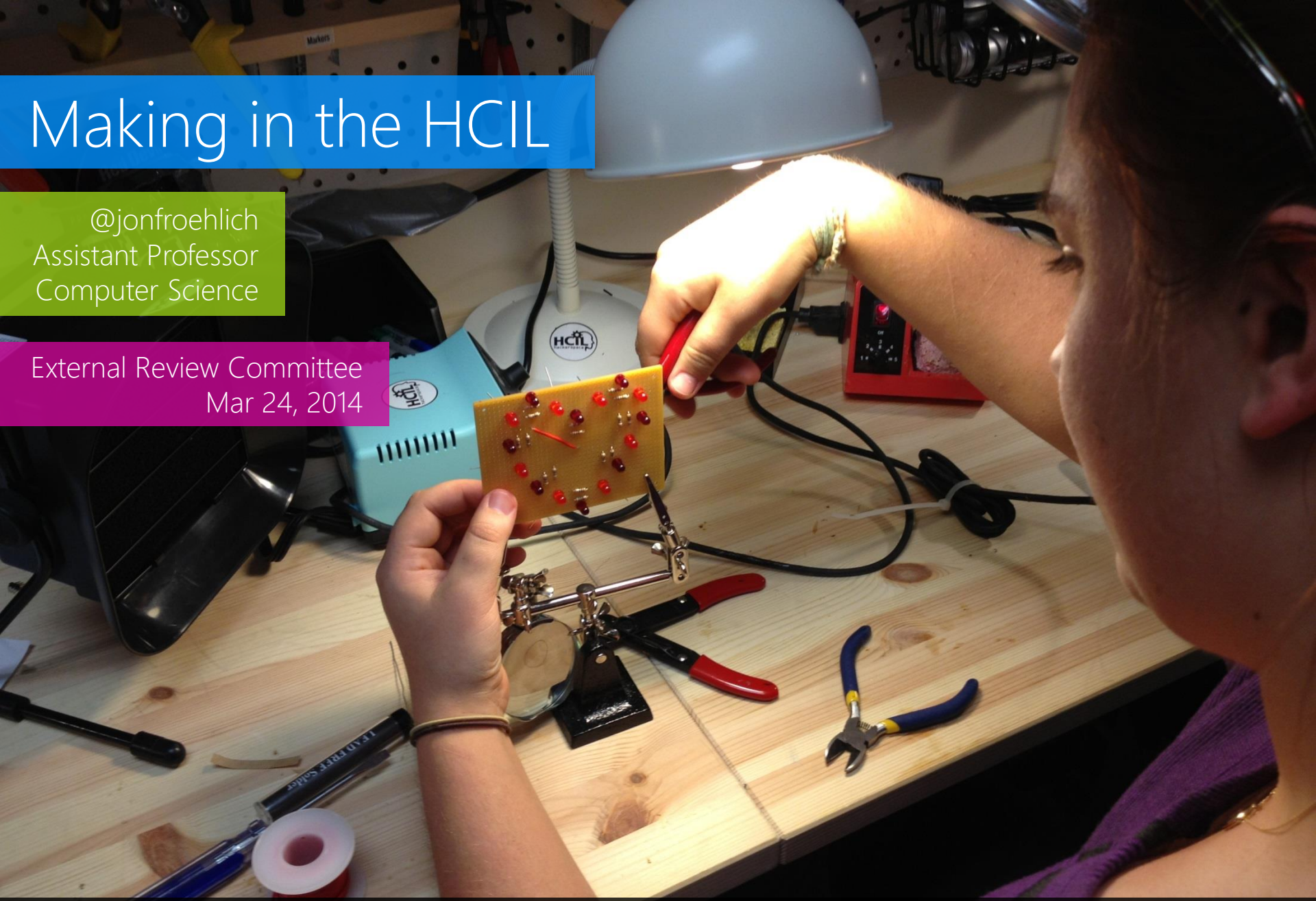
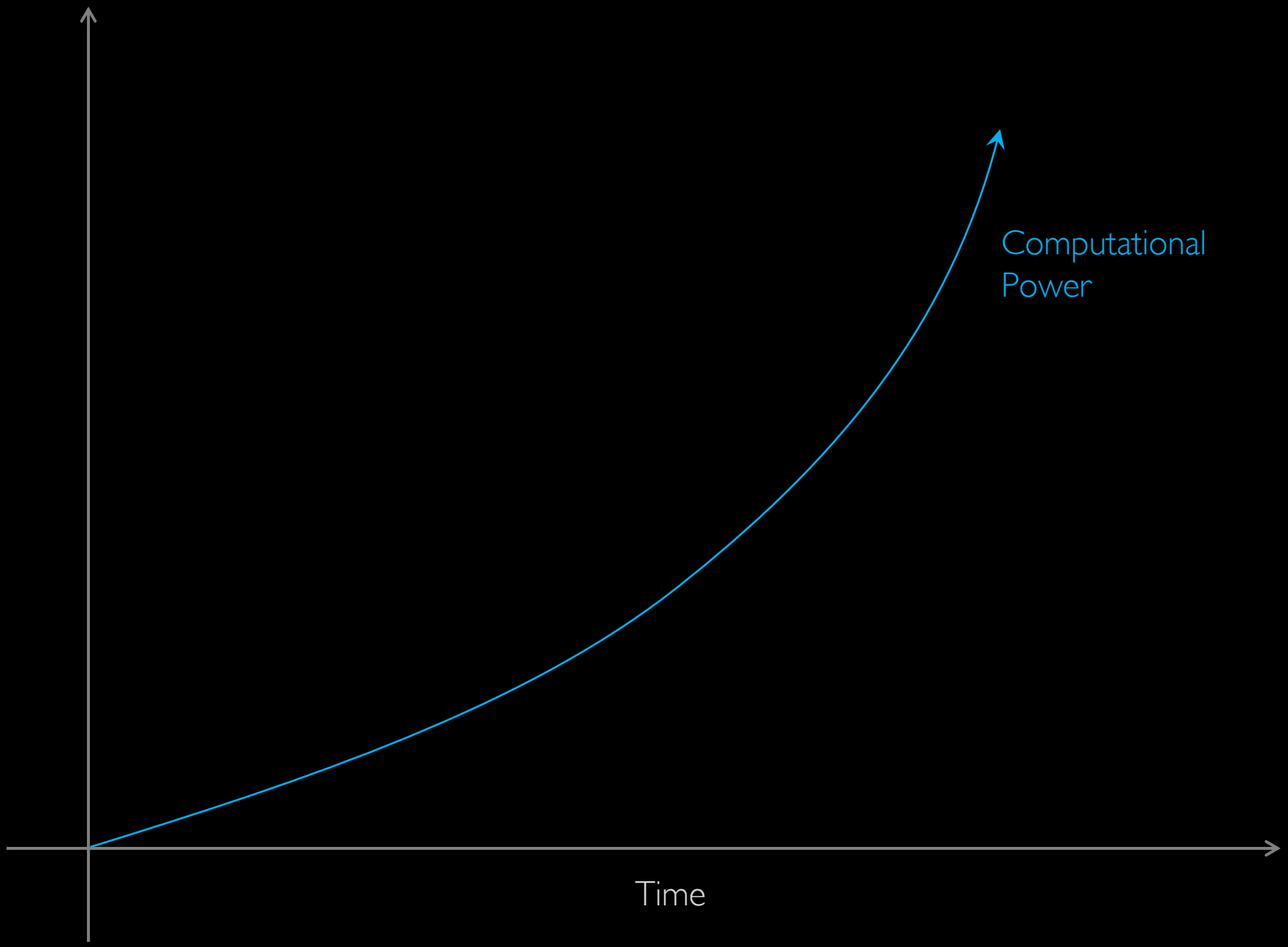
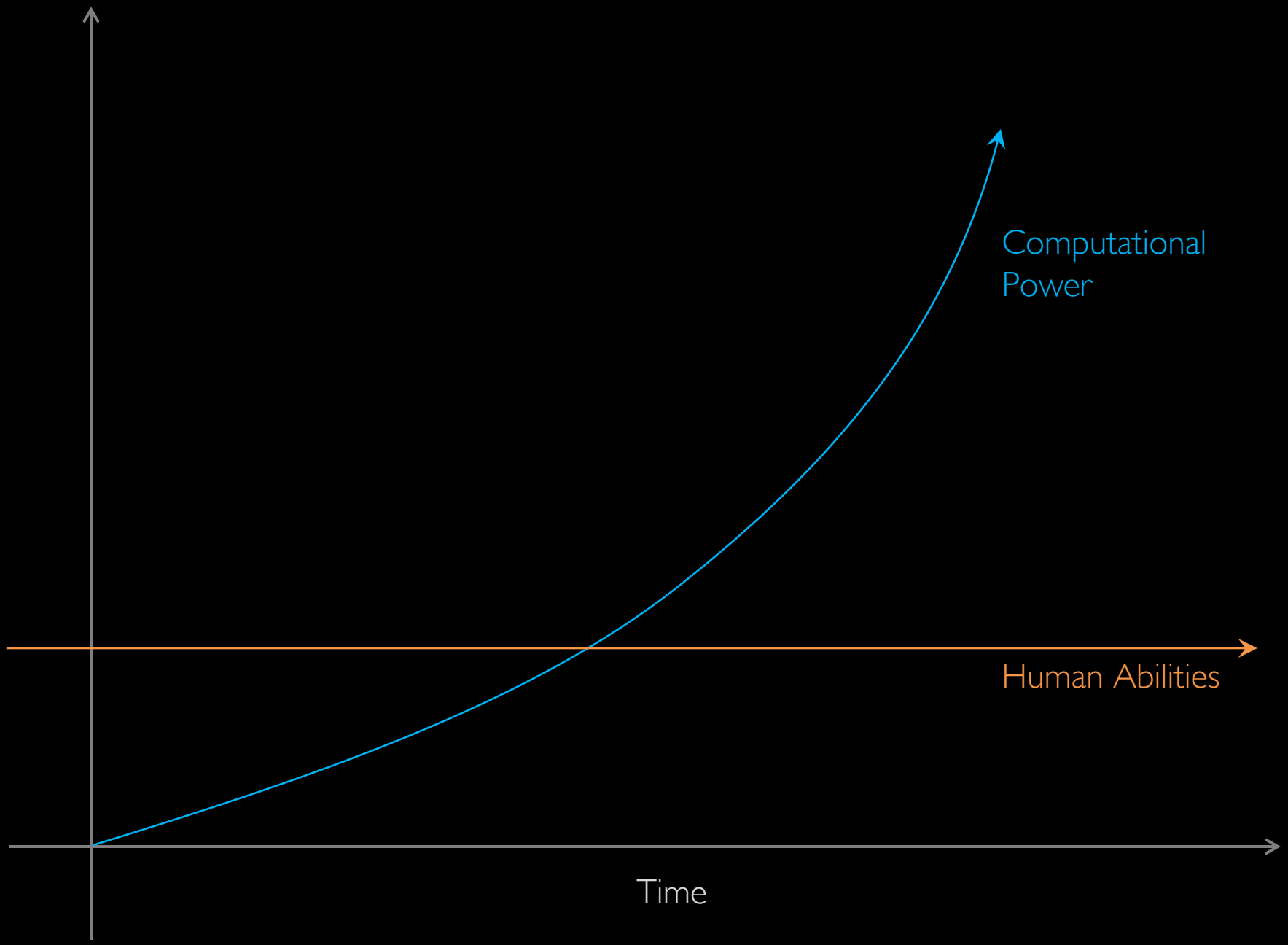
Making in the HCIL

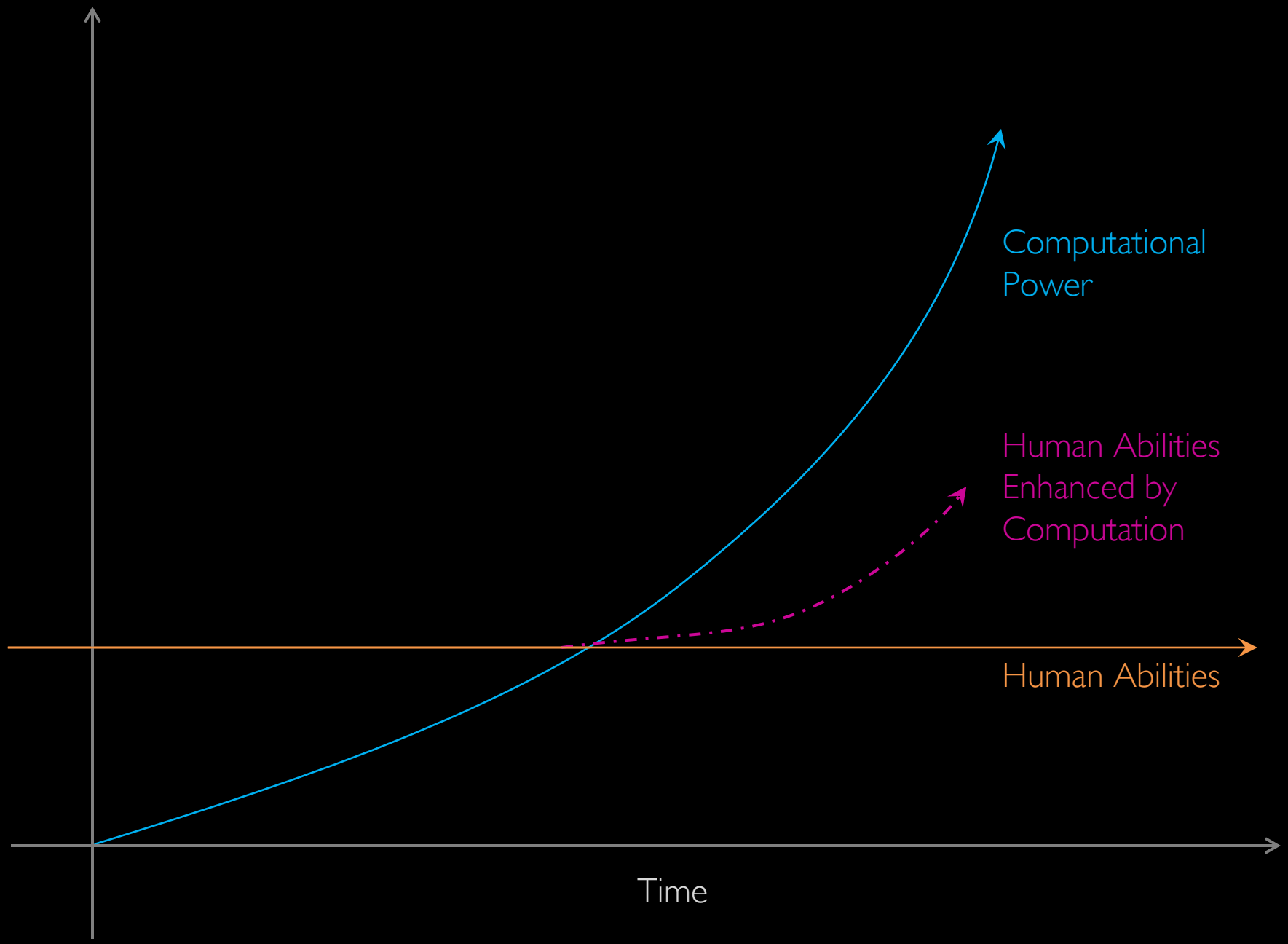
@jonfroehlich
Assistant Professor
Computer Science

External Review Committee
Mar 24, 2014




Computational
Power
Time


Computational
Power
Human Abilities
Time

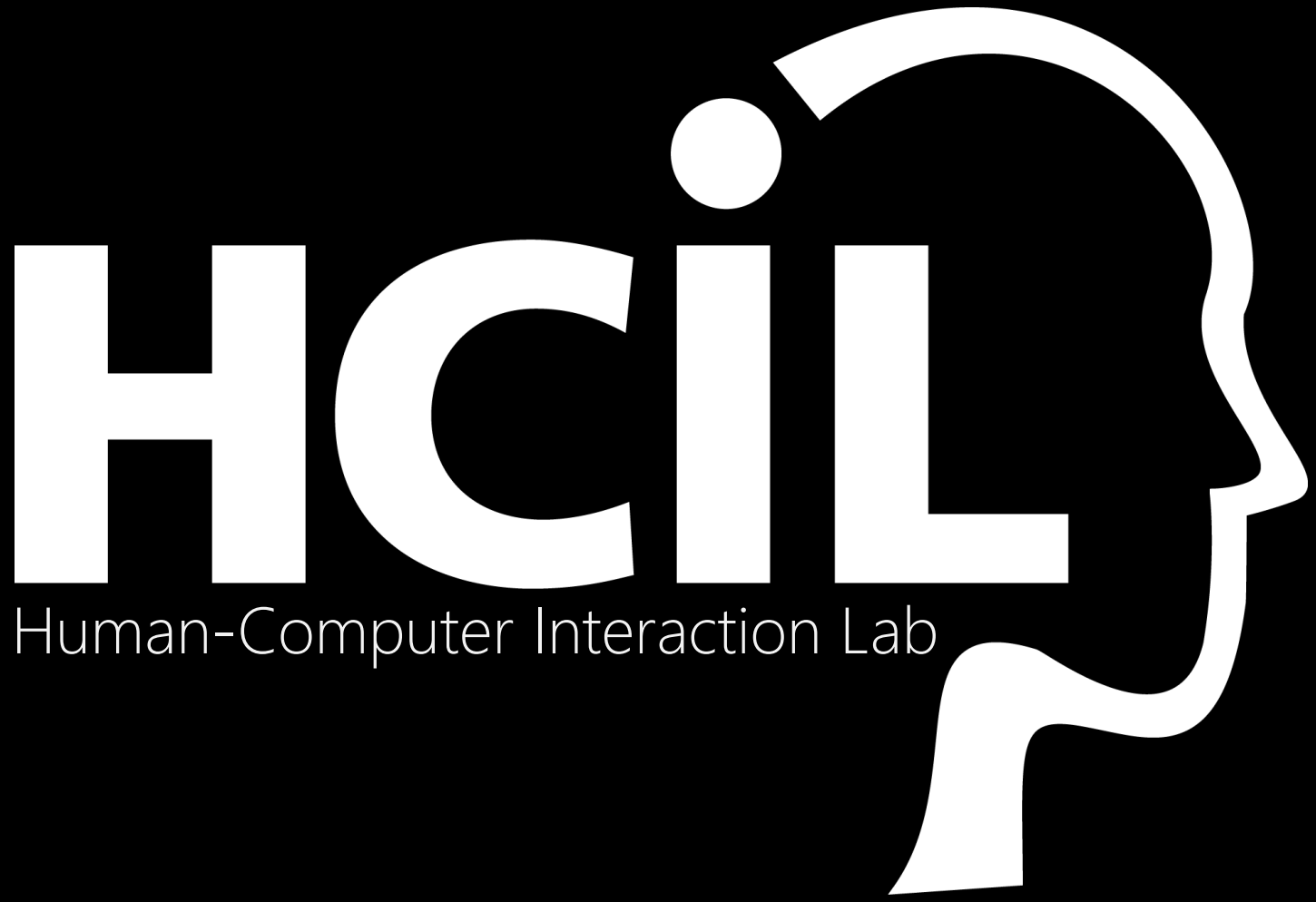

Computational
Power
Human Abilities
Enhanced by
Computation
Human Abilities
Time

My Group

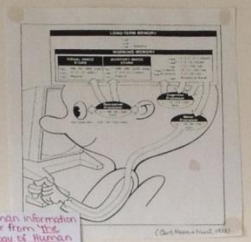
Started in 2012

makeability lab

makeability lab
PhD: 4 (2 are 1st yrs)
MS: 2 (both iSchool)
UGrad: 3-5 per semester
High Sch: 1-2 per summer
A lablet within the HCIL


HCIL
Human-Computer Interaction Lab

HCIL Begins



The human information processor from the Psychology of Human Computer Interaction

1983

Ben Shneiderman
Founding Director

NOOBIE 1986
(A.DRUIN'S MASTER'S THESIS AT MIT)

Lab in Comp. & Space Sciences Bldg pre-1988

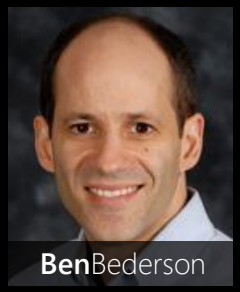
Ben Shneiderman Trading Card

PROF. ARIEL ROSENFELD
(1931-2004)

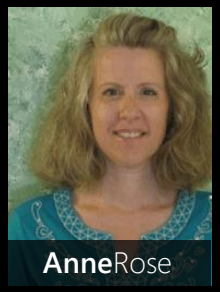
LeahFindlater

JenGolbeck

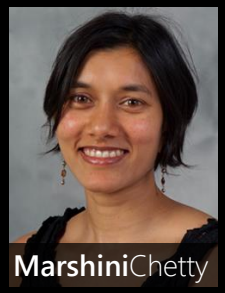
BenShneiderman

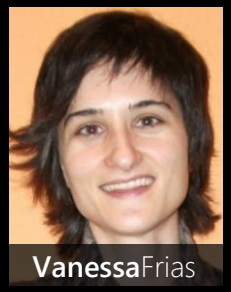

BenBederson

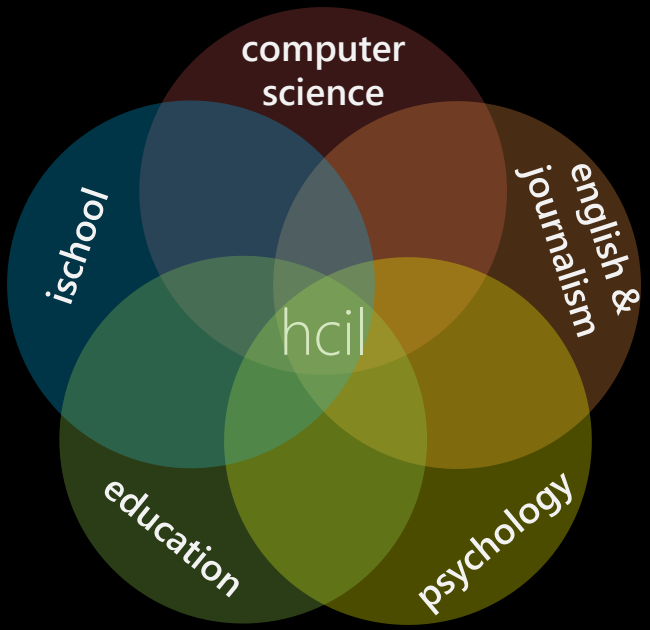
JonFroehlich


AnneRose

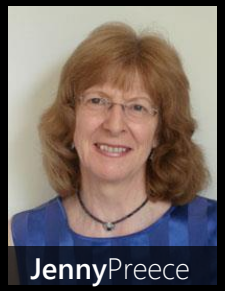
CatherinePlaisant

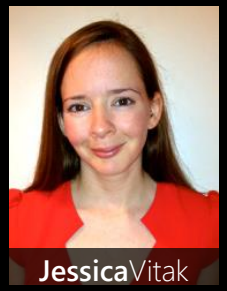

MarshiniChetty

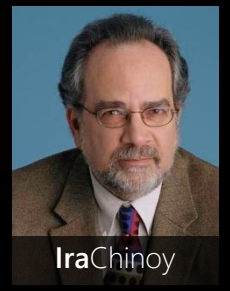

VanessaFrias


computer science
ischool
english & journalism
hcil
education
psychology

KariKraus


JennyPreece

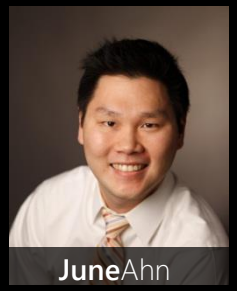

JessicaVitak

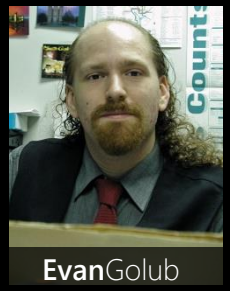

IraChinoy

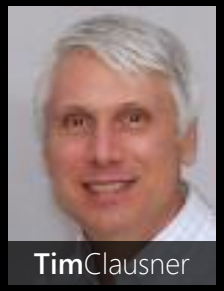
AllisonDruin

MonaLeighGuha

TammyClegg


JuneAhn


EvanGolub


TimClausner

KentNorman

AV Williams
Computer Science Building
Hornbake Library, South
iSchool Building
HCIL
is on the 2nd floor
Cambridge Hall
Farm Dr
Valley Dr
Computer and Space Sciences Bldg
Entrance / Exit
Computer and Space Sciences Building
Institute for Physical Science and Technology
Dept of Animal and Avian Sciences
Nanoscale Imaging, Spectroscopy, and Properties Laboratory
Jeong H. Kim Engineering Bldg
FabLab Micro and Nano Fabrication Laboratory
University of Maryland Institute for Advanced Computer Studies
Paint Branch Trail
Joint Quantum Institute
Stadium Dr
Regents Dr
Dept of Fire Protection Engineering
Dept of Chemical and Biomolecular Engineering
Maryland Technology Enterprise Institute
Glenn L. Martin Wind Tunnel
Computer Science Instructional Center
College Park Church of Christ
Paint Branch Dr
J.Logan and Louise Schutz Football Practice Complex
Chemistry Stores
Office of Advanced Engineering Education
Fieldhouse Dr
Dept of Plant Science and Landscape Architecture
Maryland MEMS and Microfluidics Laboratory
Dept of Aerospace Engineering
Psychotherapy Clinic and Research Lab
Dept of Physics
Campus Dr
Baltimore Ave
Library Media Services
Dept of Mathematics
Dept of Cell Biology and Molecular Genetics
National Trust Library
Hornbake Plaza
Engineering Fields
University of Maryland
Club Sports Field
College of Agriculture and Natural Resources
Dept of Environmental Science and Technology
University of Maryland
Office of International Affairs

HCIL

Offices

Main Lab

From Back

HCIL Usability Lab

With One-Way Transparent Mirror

When I arrived in 2012, I observed a lack of space
for **combining materiality & computation**

MENU
TIME
SMALL BUSINESS
How the 'Mak
Bits
OCTOBER 29
Subscribe: Digital / Home Delivery | Log In | Register Now | Help
HOME PAGE | TODAY'S PAPER | VIDEO | MOST POPULAR | U.S. Edition
Search All NYTimes.com
Go
ING DIRECT
The New York Times
Business Day
Technology
WORLD | U.S. | N.Y. / REGION | BUSINESS | TECHNOLOGY | SCIENCE | HEALTH | SPORTS | OPINION | ARTS | STYLE | TRAVEL | JOBS | REAL ESTATE | AUTOS
nexus 7
The new $199 tablet from Google.
Buy now
Advertise on NYTimes.com
A Hardware Renaissance in Silicon Valley
Log in to see what your friends are sharing on nytimes.com.
Privacy Policy | What's This?
Log In With Facebook
What's Popular Now
The Real Romney
Philippine Economy Set to Become Asia's Newest Bright Spot
New Program:

HCIL Hackerspace

Front Entrance

Building the Hackerspace

Making the Whiteboard Wall

Building the Hackerspace

Making the Workbench

Building the Hackerspace

Making the Workbench

Building the Hackerspace

Making the Workbench

Workspace

HCIL Hackerspace

Workspace

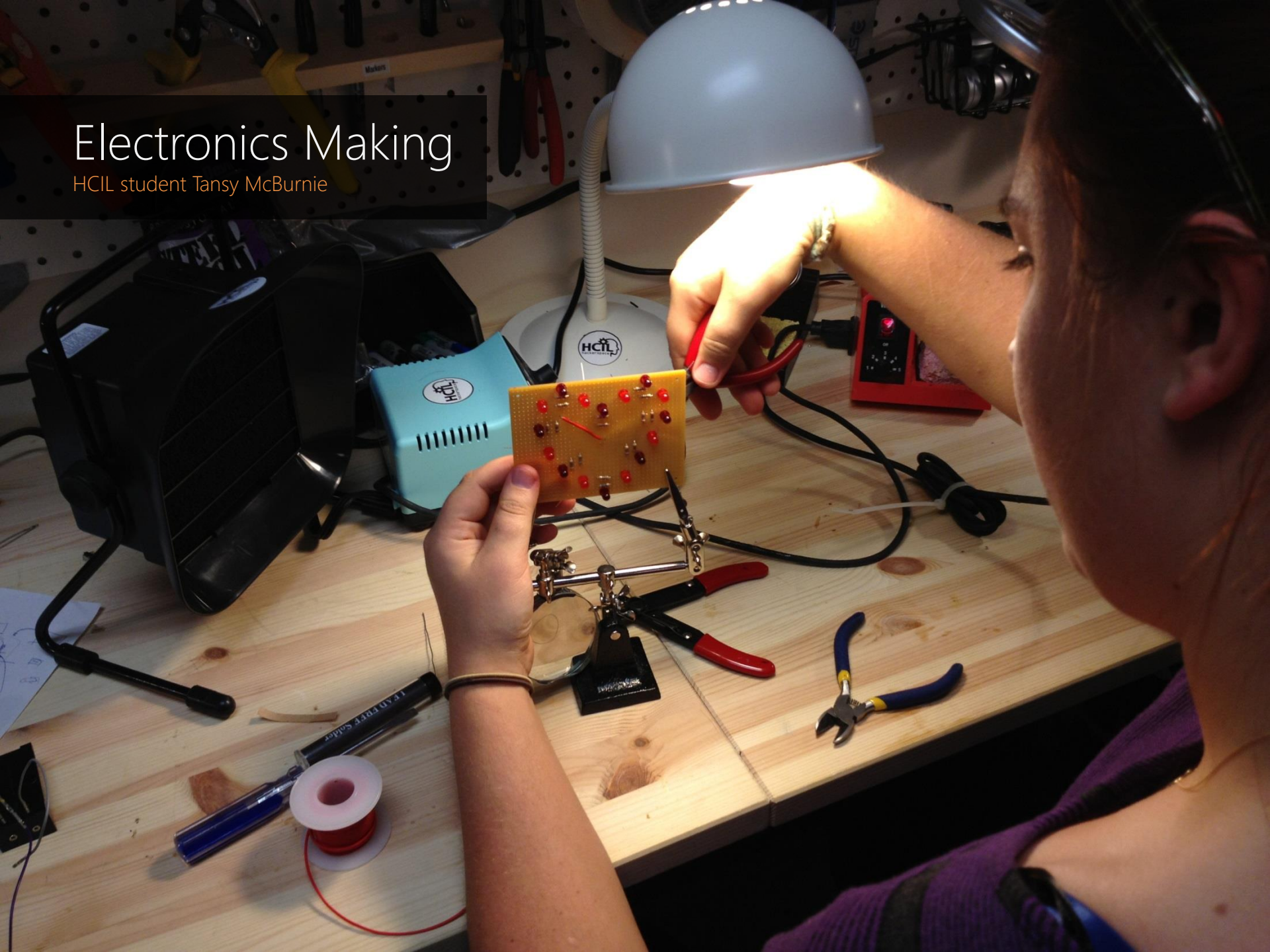
HCIL Hackerspace

Physical Making

HCIL Student Leyla Norooz

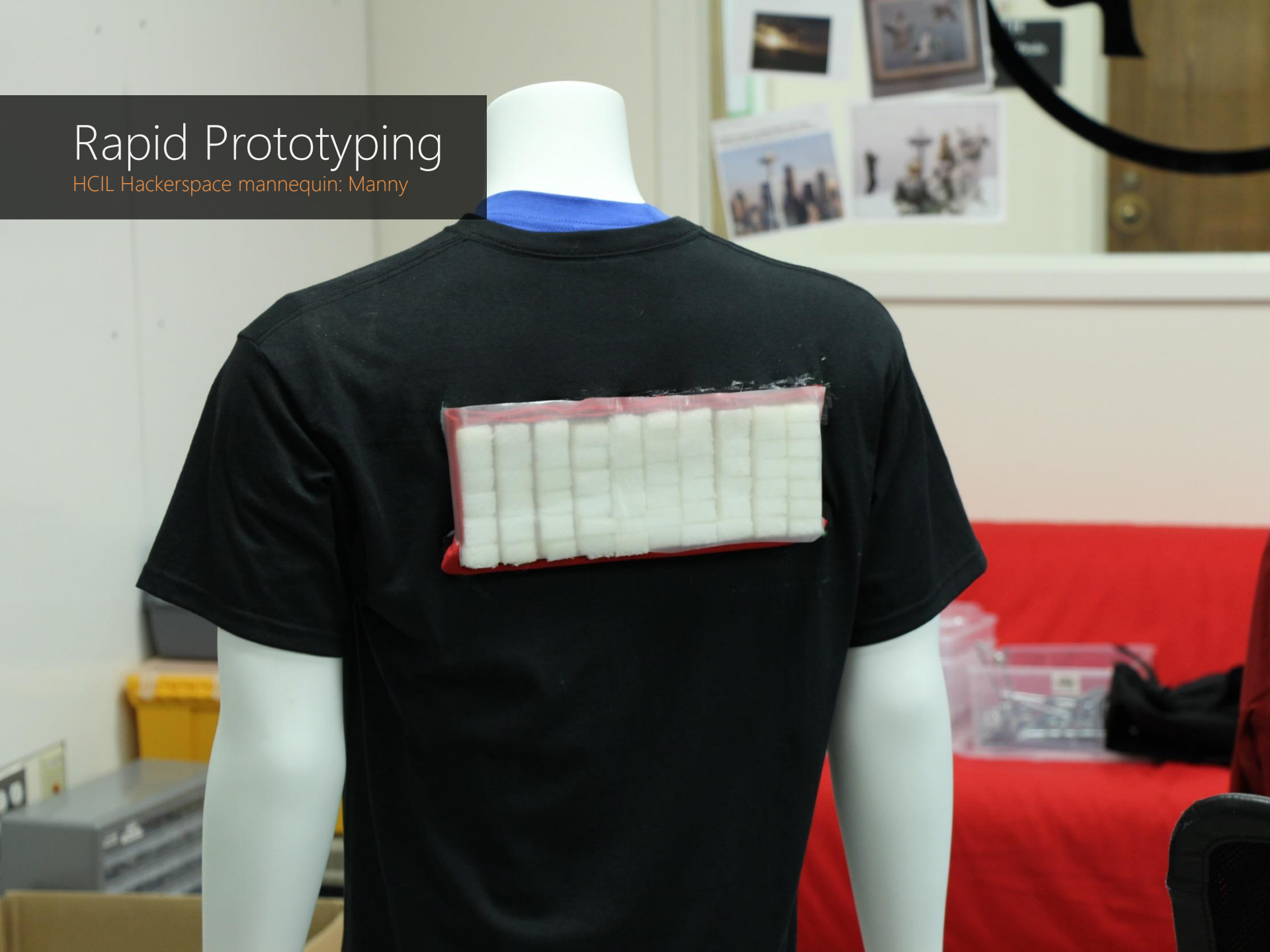
Craft/Fabric Making

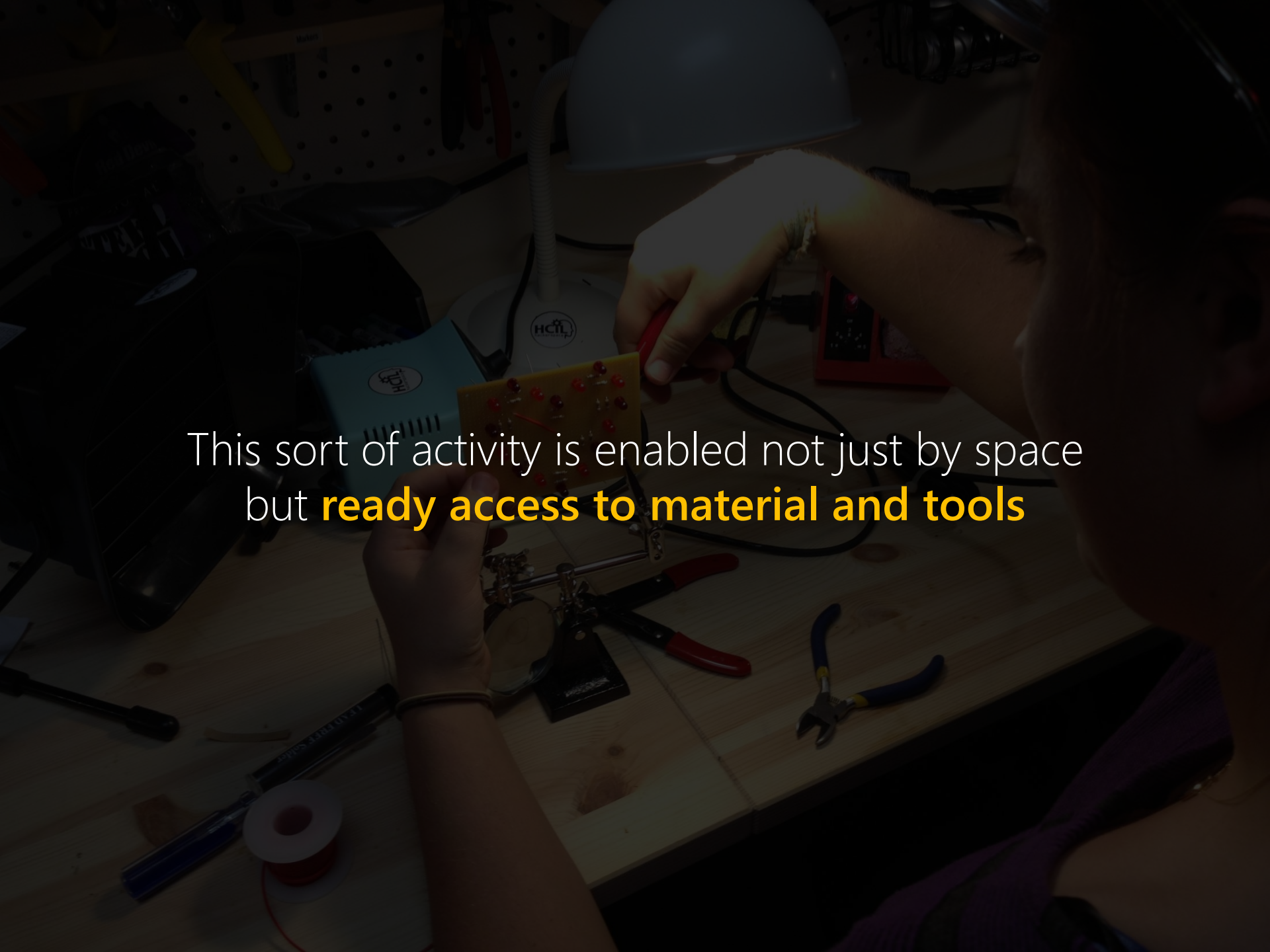
HCIL student Matt sewing


Electronics Making
HCIL student Tansy McBurnie

Rapid Prototyping

HCIL Hackerspace mannequin: Manny




This sort of activity is enabled not just by space
but **ready access to material and tools**

Three Soldering Stations

HCIL Hackerspace

One Oscilloscope

HCIL Hackerspace

Craft/Textile Station

HCIL Hackerspace

Two Mannequins

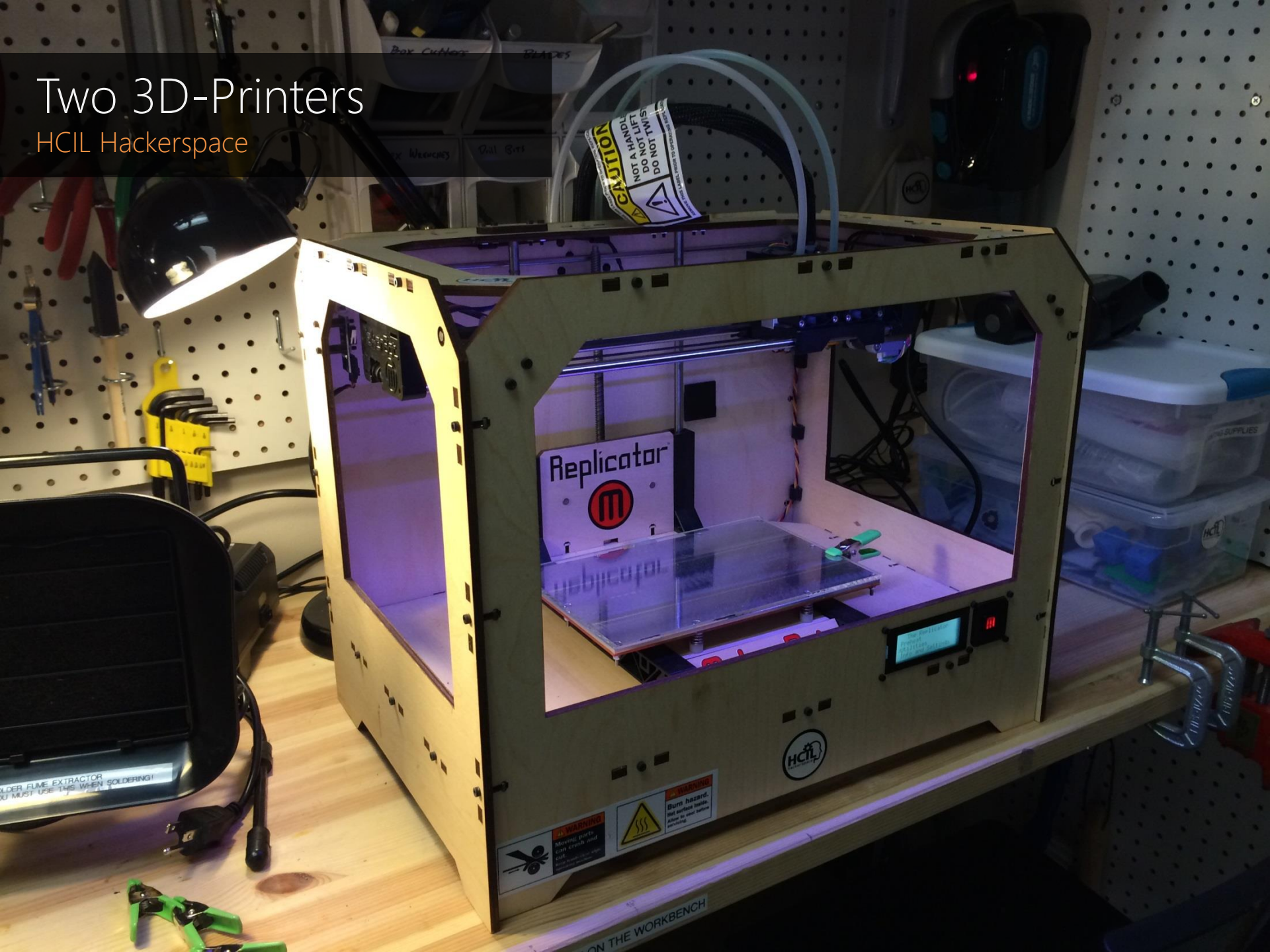
HCIL Hackerspace

Wall of Electronic Components

HCIL Hackerspace

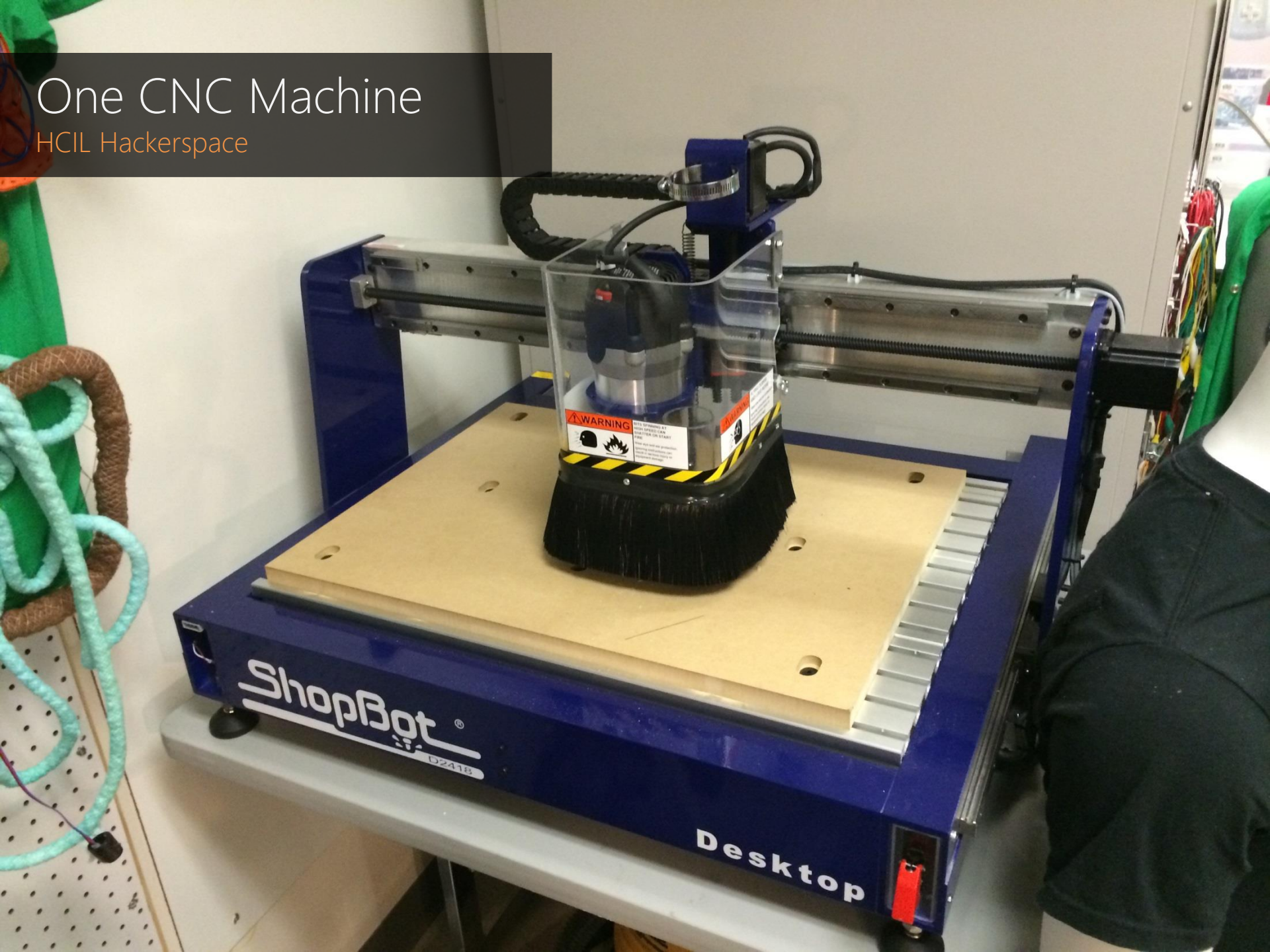
Two 3D-Printers

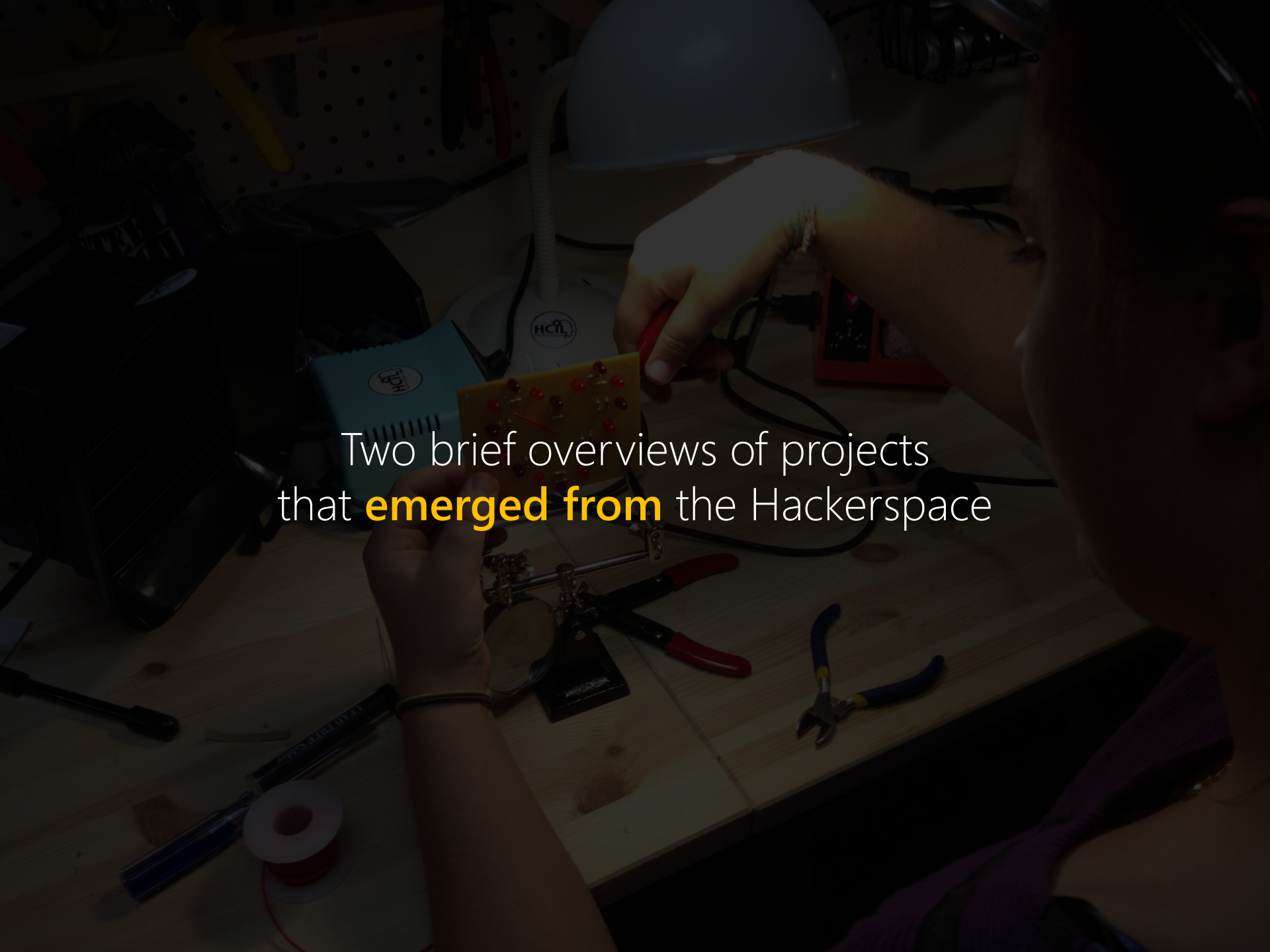
HCIL Hackerspace



One CNC Machine

HCIL Hackerspace




Two brief overviews of projects
that emerged from the Hackerspace

BodyVis
Led by Leyla Nooroz
Silver Spring Mini
Maker Faire
Leyla
MAKER
Motivation

What if we could build clothes that revealed the inner-workings of the human body?

Research Questions

1. How can wearable sensing and visualization be used to support new types of body learning?
2. How do the on-body visual representations and animations affect engagement, exploration, and learning?
3. How can we draw links between learners' body systems and their everyday practices (*e.g.*, "how is my heart affected by soccer practice?")?

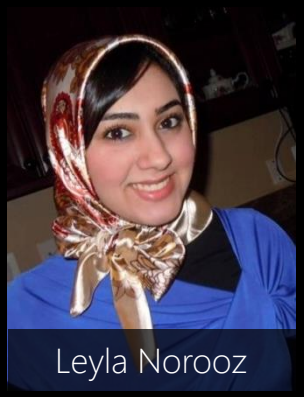
Initial
Prototype

Prototype
#2
Esophagu
Heart
Lung
Lung
Liver
Small Intestine

Esophagus
Heart
Lung
Liver
Large Intestine
Small Intestine

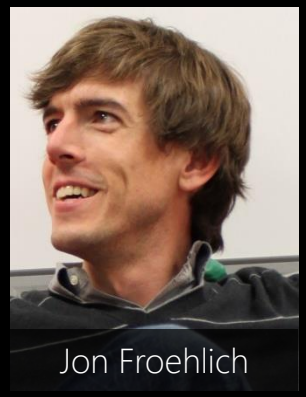
Esophagus
Heart
Liver
Large Intestine
Small Intestine

The **BodyVis** Team!


Leyla Norooz

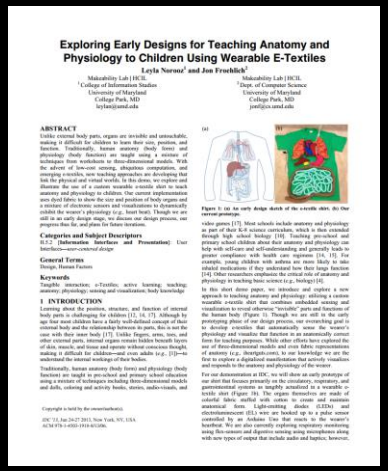
Anita Jorgensen

Tamara Clegg


Jon Froehlich

Just joined the team: College of Education professor

Follow-up Sources:



Exploring Early Designs for Teaching Anatomy and Physiology to Children Using Wearable E-Textiles

Leyla Norooz[1] and Jon Froehlich[2]

[1]College of Information Studies, University of Maryland, College Park, MD, leylan@umd.edu

[2]Dept. of Computer Science, University of Maryland, College Park, MD, jonf@cs.umd.edu

ABSTRACT

Unlike external body parts, organs are invisible and untouchable, making it difficult for children to learn their size, position, and function. Traditionally, human anatomy (body form) and physiology (body function) are taught using a mixture of techniques from worksheets to three-dimensional models. With the advent of low-cost sensing, ubiquitous computation, and emerging e-textiles, new teaching approaches are developing that have the potential to support learning in more engaging and lifelong ways. We present a custom wearable e-textile shirt to teach anatomy and physiology to children. Our current implementation uses dyed fabric to show the size and position of body organs and a mixture of electronic sensors and visualizations to dynamically exhibit the wearer's physiology (e.g., heart beat). Though we are still in an early design stage, we discuss our design process, our progress thus far, and plans for future iterations.

Categories and Subject Descriptors

H.5.2. [Information Interfaces and Presentation]: User Interfaces—*user-centered design*

General Terms

Design, Human Factors

Keywords

Tangible interaction; e-Textiles; active learning; teaching; anatomy; physiology; sensing and visualization; body knowledge

1 INTRODUCTION

Learning about the position, structure, and function of internal body parts is challenging for children [12, 16, 37]. Although by age four most children have a fairly well-defined concept of their external body and the relationship between its parts, this is not the case for internal body parts [16]. Unlike our hands, feet, and other external parts, internal organs remain hidden beneath layers of skin, muscle, and tissue and operate without conscious thought, making it difficult for children—and even adults (e.g., [1])—to understand the internal workings of their bodies.

Traditionally, human anatomy (body form) and physiology (body function) are taught in pre-school and primary school education using a mixture of techniques including three-dimensional models and dolls, coloring and activity books, stories, audio-visuals, and

Copyright is held by the owner/author(s).

IDC '13, Jun 24-27 2013, New York, NY, USA
ACM 978-1-4503-1918-8/13/06.

Figure 1: (a) An early design sketch of the e-textile shirt. (b) Our current prototype.

video games [17]. Most schools include anatomy and physiology as part of their K-8 science curriculum, which is then extended in high school and college [18, 19]. Thus, by teaching children in primary school children about their anatomy and physiology can help with self-care and self-understanding and generally leads to greater compliance with health care regimens [14, 15]. For example, young children with asthma are more likely to take inhaled medications if they understand how their lungs function [14]. Other researchers emphasize the critical role of anatomy and physiology in teaching basic science (e.g., biology) [4].

In this short demo paper, we introduce and explore a new approach to teaching anatomy and physiology: utilizing a custom wearable e-textile shirt that combines embedded sensing and visualization to reveal otherwise "invisible" parts and functions of the human body (Figure 1). Though we are still in the early prototyping phase of our design process, our overarching goal is to develop e-textiles that automatically sense the wearer's physiology and display it using visual and tactile representations of form for teaching purposes. While other efforts have explored the use of three-dimensional models and even fabric representations of anatomy (e.g., fleshgeek.com), to our knowledge we are the first to explore a digitalized manifestation that actively visualizes and responds to the anatomy and physiology of the wearer.

For our demonstration at IDC, we will show an early prototype of our shirt that focuses primarily on the circulatory, respiratory, and gastrointestinal systems as tangibly actualized in a wearable e-textile shirt (Figure 1b). The organs themselves are made of colorful fabric stuffed with cotton to create and maintain anatomical form. Light-emitting diodes (LEDs) and electroluminescent (EL) wire are hooked up to a pulse sensor controlled by an Arduino Uno that reacts to the wearer's heartbeat. We are also currently exploring respiratory monitoring using flex-sensors and digestive sensing using microphones along with new types of output that include audio and haptics; however,

Interaction Design and Children '13

Social Fabric Fitness

Led by Matt Mauriello

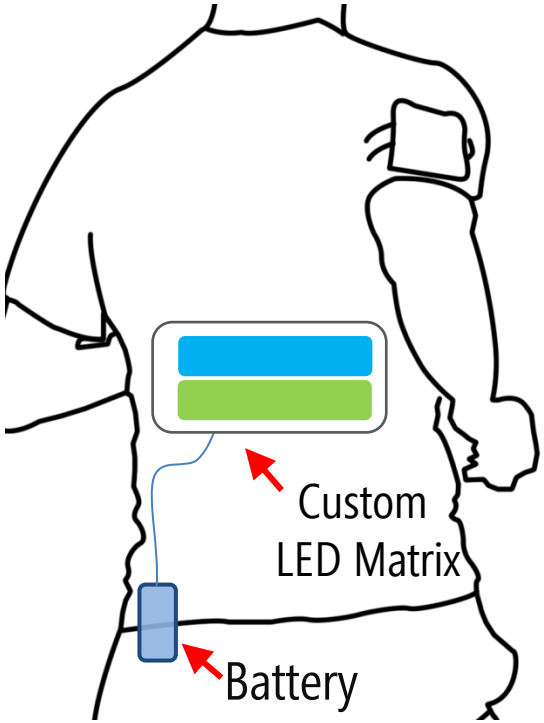
What if Our Clothes Could Show How Fast We Run?

Research Questions

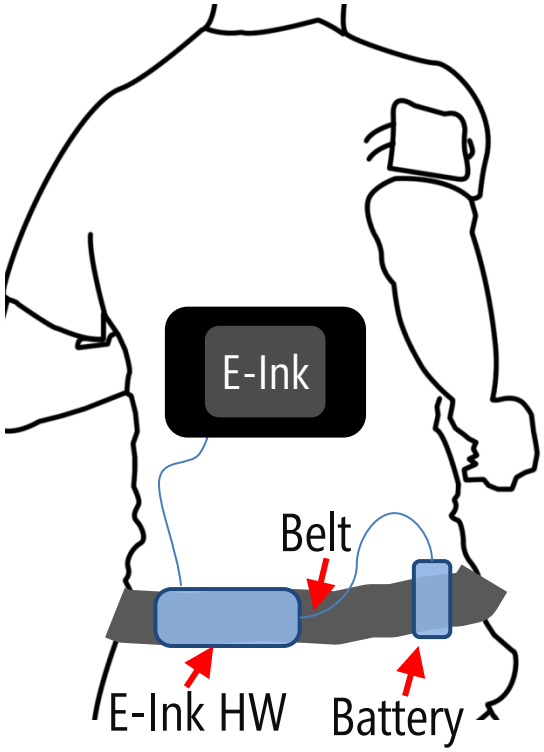
1. Can we create a lightweight, flexible display that doesn't physically interfere with running?
2. How does visualizing otherwise invisible performance data change the run experience?
3. What to display?
4. Could these displays be useful in group running or race contexts?

SFF: Three Prototypes

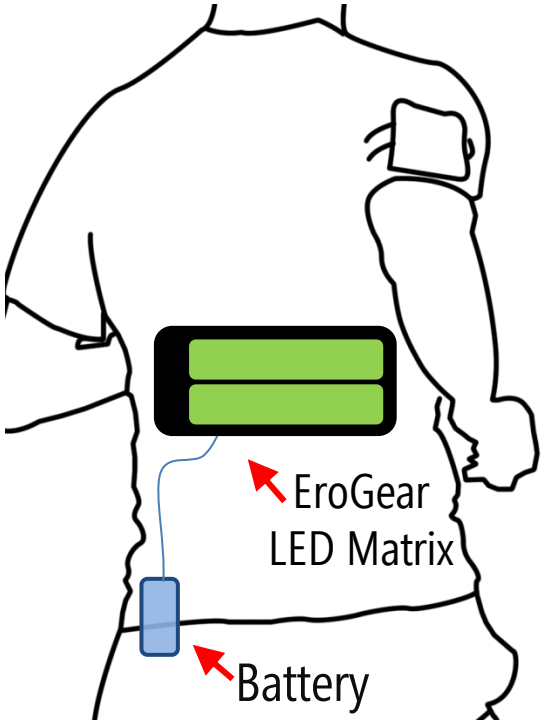
Prototype #1



Prototype #2

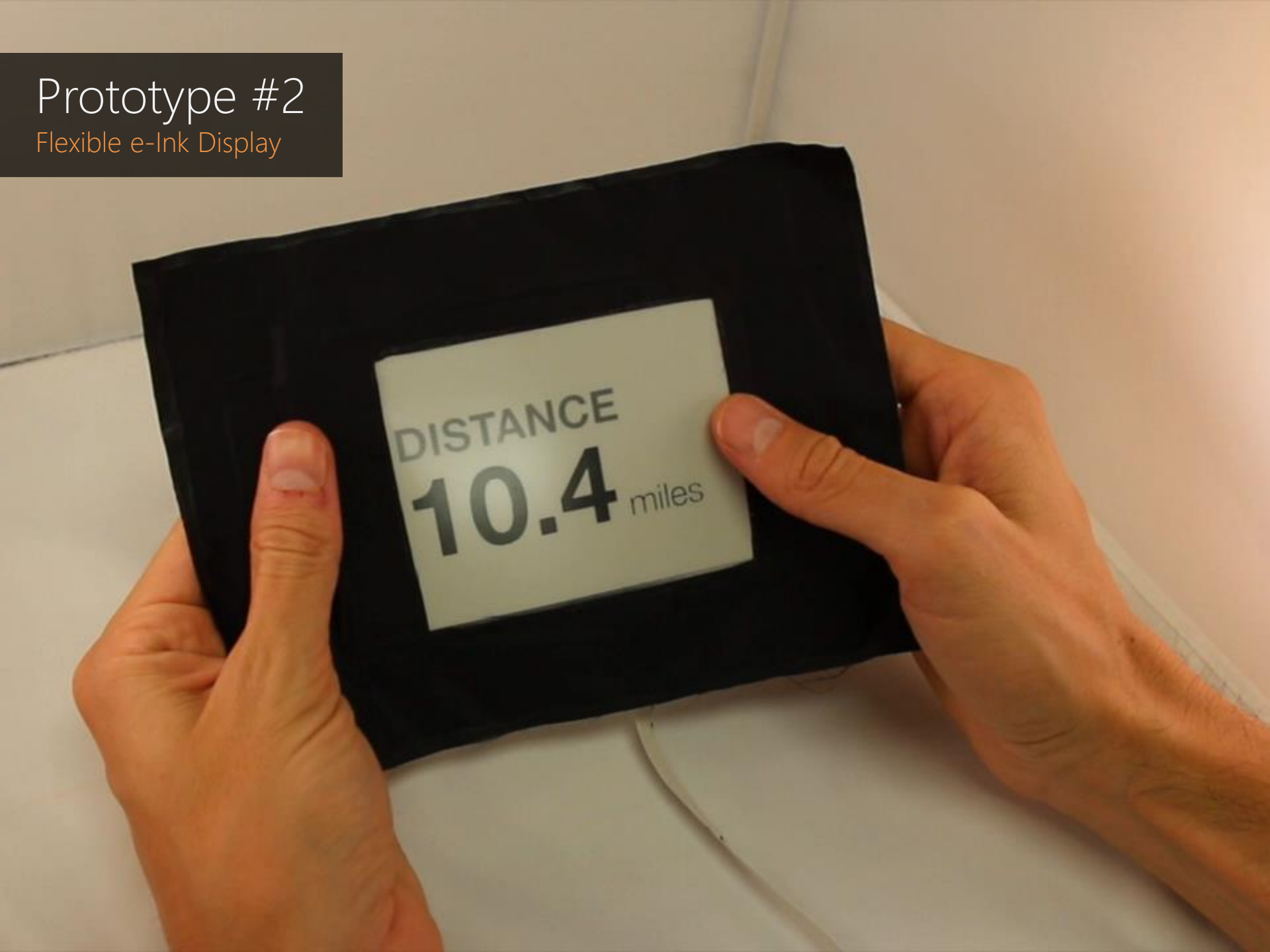


Prototype #3



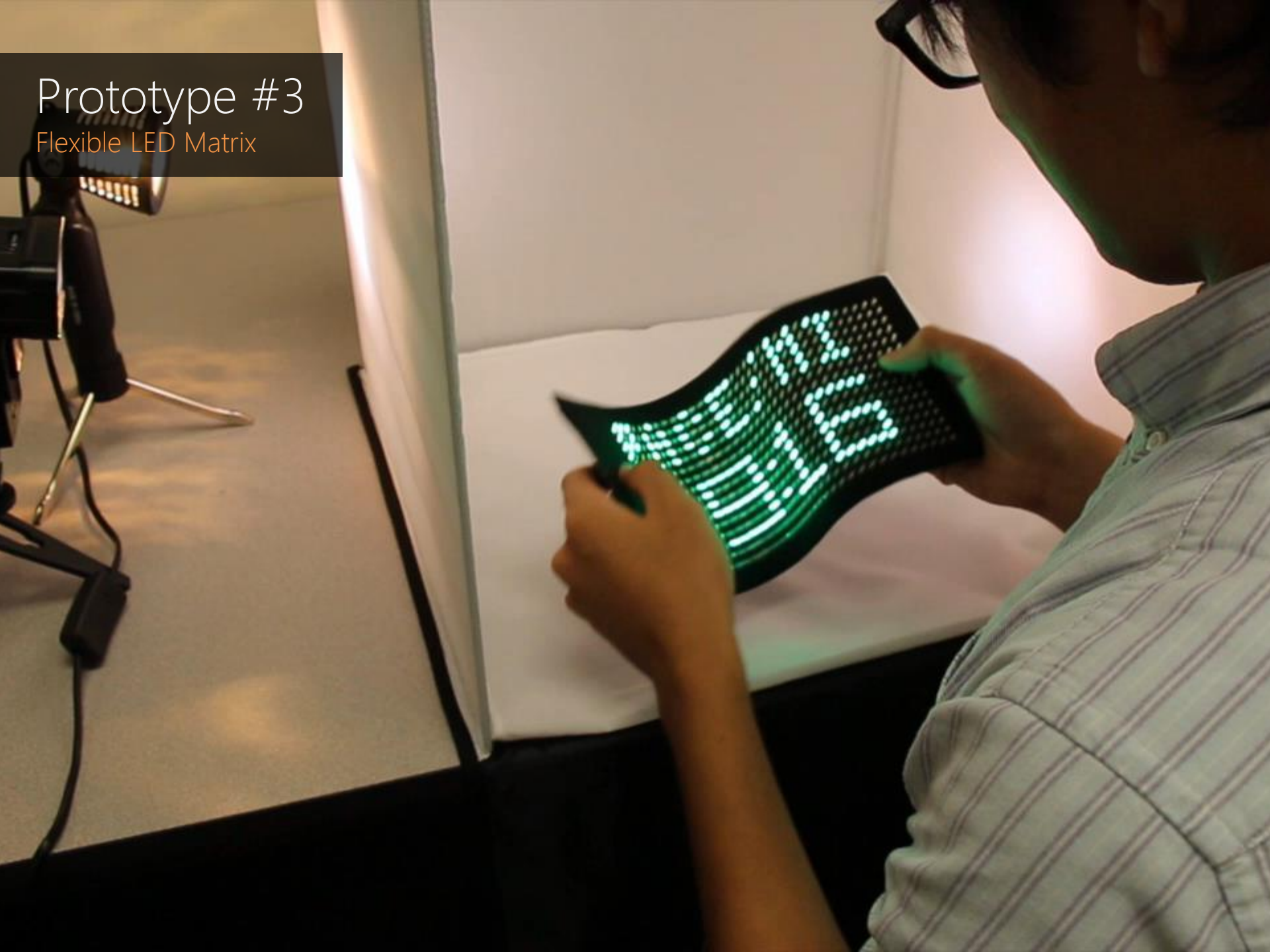
Prototype #2

Flexible e-Ink Display



Prototype #3

Flexible LED Matrix



I GOT THIS

It made me run faster because **my performance was on display**.

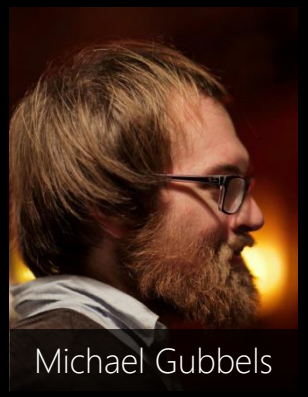
- Race Participant

It made **me more aware** of our pacing and **kept me more focused** on the run itself.

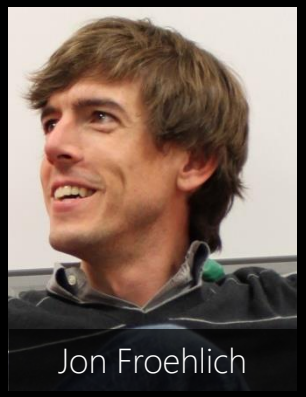
- Field Study Participant

The **Social Fabric Fitness** Team!

Matt Mauriello

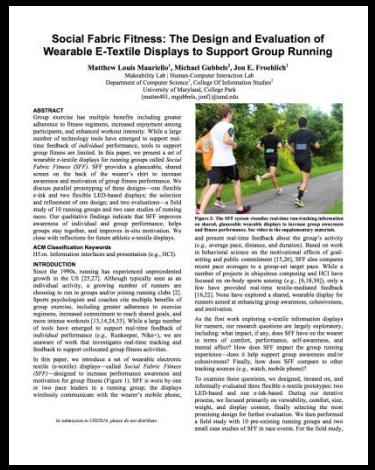


Michael Gubbels



Jon Froehlich

Follow-up Sources:



Social Fabric Fitness: The Design and Evaluation of Wearable E-Textile Displays to Support Group Running

Matthew Louis Mauriello[1], Michael Gubbels[2], Jon E. Froehlich[1]
Makeability Lab | Human-Computer Interaction Lab
Department of Computer Science[1], College Of Information Studies[2]
University of Maryland, College Park
{mattm481, mgubbels, jonf}@umd.edu

ABSTRACT
Group exercise has multiple benefits including greater adherence to fitness regimens, increased enjoyment among participants, and enhanced workout intensity. While a large number of technology tools have emerged to support real-time feedback of *individual* performance, tools to support group fitness are limited. In this paper, we present a set of wearable e-textile displays for running groups called *Social Fabric Fitness (SFF)*. SFF provides a glanceable, shared screen on the back of the wearer's shirt to increase awareness and motivation of group fitness performance. We discuss parallel prototyping of three designs—one flexible e-ink and two flexible LED-based displays; the selection and refinement of one design; and two evaluations—a field study of 10 running groups and two case studies of running races. Our qualitative findings indicate that SFF improves awareness of individual and group performance, helps groups stay together, and improves in-situ motivation. We close with reflections for future athletic e-textile displays.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI).

INTRODUCTION
Since the 1990s, running has experienced unprecedented growth in the US [25,27]. Although typically seen as an individual activity, a growing number of runners are choosing to run in groups and/or joining running clubs [2]. Sports psychologists and coaches cite multiple benefits of group exercise, including greater adherence to exercise regimens, increased commitment to reach shared goals, and more intense workouts [13,14,24,33]. While a large number of tools have emerged to support real-time feedback of *individual* performance (e.g., Runkeeper, Nike+), we are unaware of work that investigates real-time tracking and feedback to support *collocated group* fitness activities.

In this paper, we introduce a set of wearable electronic textile (e-textile) displays—called *Social Fabric Fitness (SFF)*—designed to increase performance awareness and motivation for group fitness (Figure 1). SFF is worn by one or two pace leaders in a running group; the displays wirelessly communicate with the wearer's mobile phone,

In submission to CHI2014, please do not distribute

Figure 1: The SFF system visualizes real-time run-tracking information on shared, glanceable wearable displays to increase group awareness and fitness performance. See video in the supplementary materials.

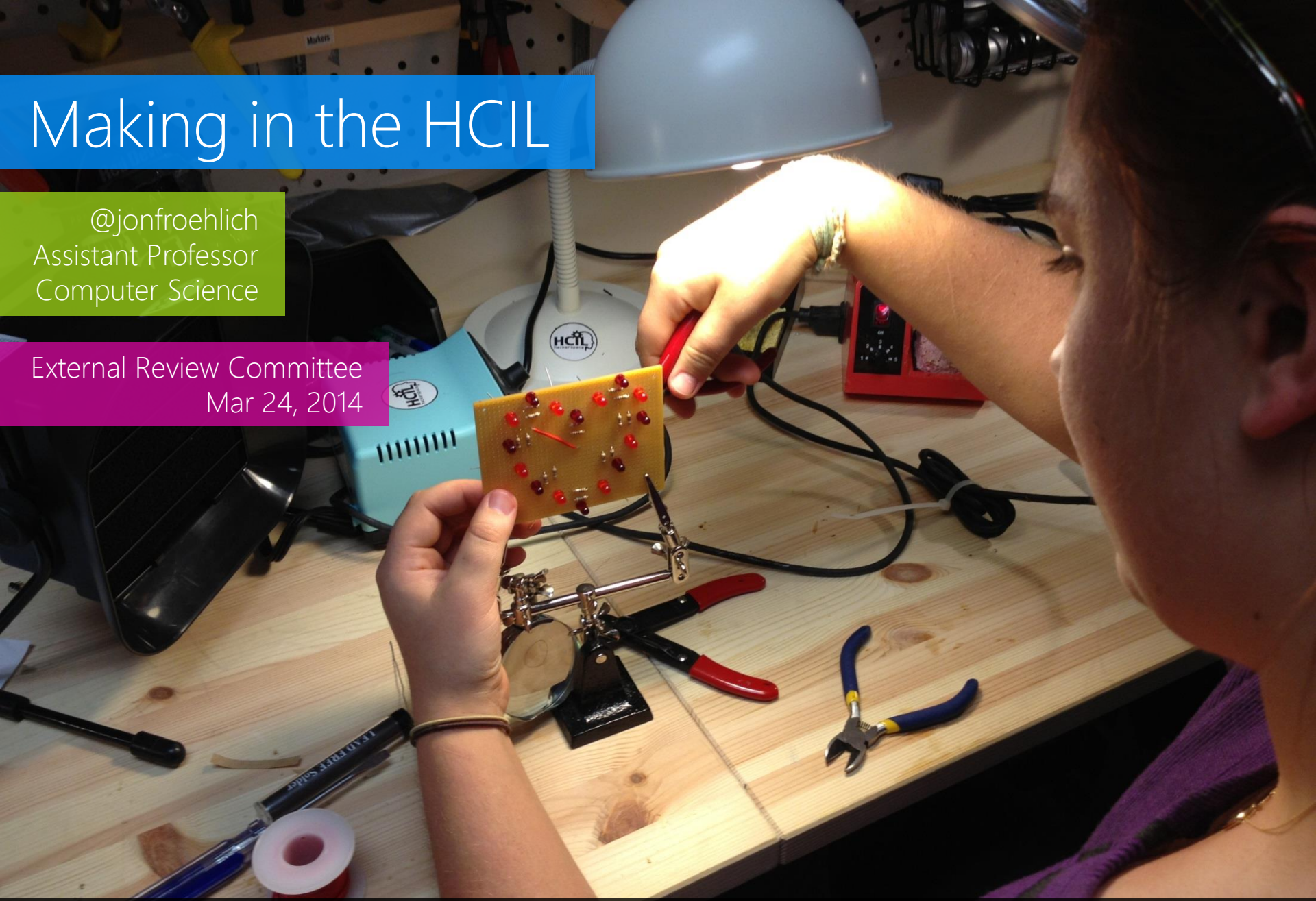
and present real-time feedback about the group's activity (e.g., average pace, distance, and duration). Based on work in behavioral science on the motivational effects of goal-setting and public commitment [15,26], SFF also compares recent pace averages to a group-set target pace. While a number of projects in ubiquitous computing and HCI have focused on on-body sports sensing (e.g., [6,18,30]), only a few have provided real-time textile-mediated feedback [16,22]. None have explored a shared, wearable display for runners aimed at enhancing group awareness, cohesiveness, and motivation.

As the first work exploring e-textile information displays for runners, our research questions are largely exploratory, including: what impact, if any, does SFF have on the wearer in terms of comfort, performance, self-awareness, and mental affect? How does SFF impact the group running experience—does it help support group awareness and/or cohesiveness? Finally, how does SFF compare to other tracking sources (e.g., watch, mobile phone)?

To examine these questions, we designed, iterated on, and informally evaluated three flexible e-textile prototypes: two LED-based and one e-ink-based. During our iterative process, we focused primarily on viewability, comfort, size, weight, and display content, finally selecting the most promising design for further evaluation. We then performed a field study with 10 pre-existing running groups and two small case studies of SFF in race events. For the field study,

CHI'14 (to appear)

Making in the HCIL

@jonfroehlich
Assistant Professor
Computer Science

External Review Committee
Mar 24, 2014