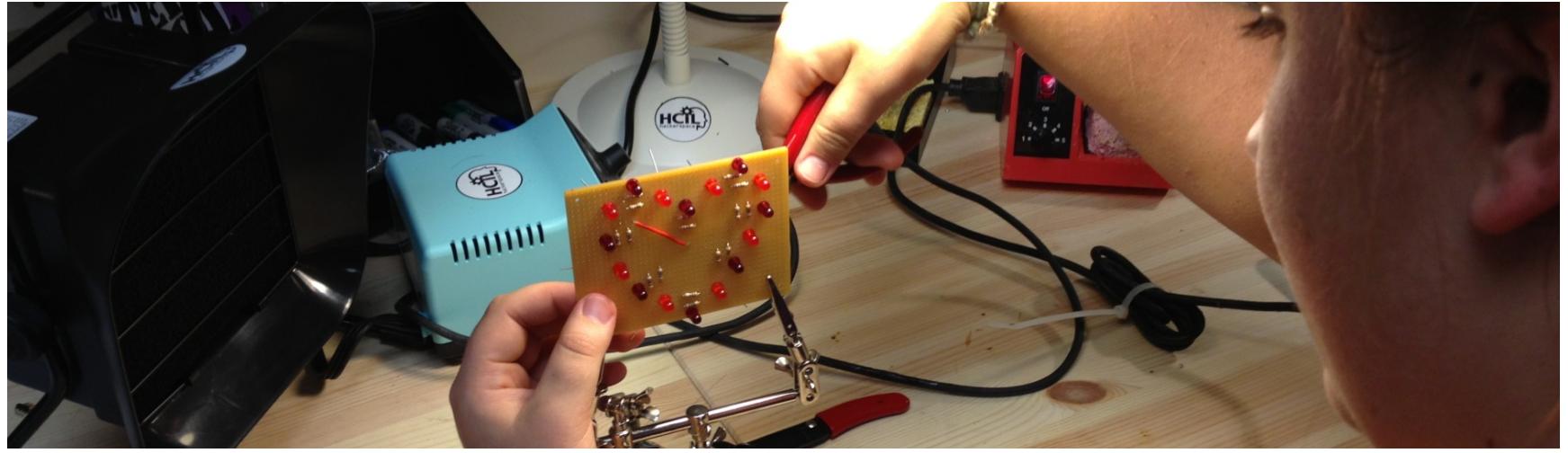


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Supporting Everyday Activities for Persons with Visual Impairments Through Computer Vision-Augmented Touch

Leah Findlater¹, Lee Stearn¹, Ruotie Du¹, Umar Ch², David Ross³, Rama Chellappa³, Jon E. Froehlich¹

¹College of Information Studies, ²Dept. of Computer Science, ³Dept. of Electrical and Computer Engineering

University of Maryland, College Park, MD 20742

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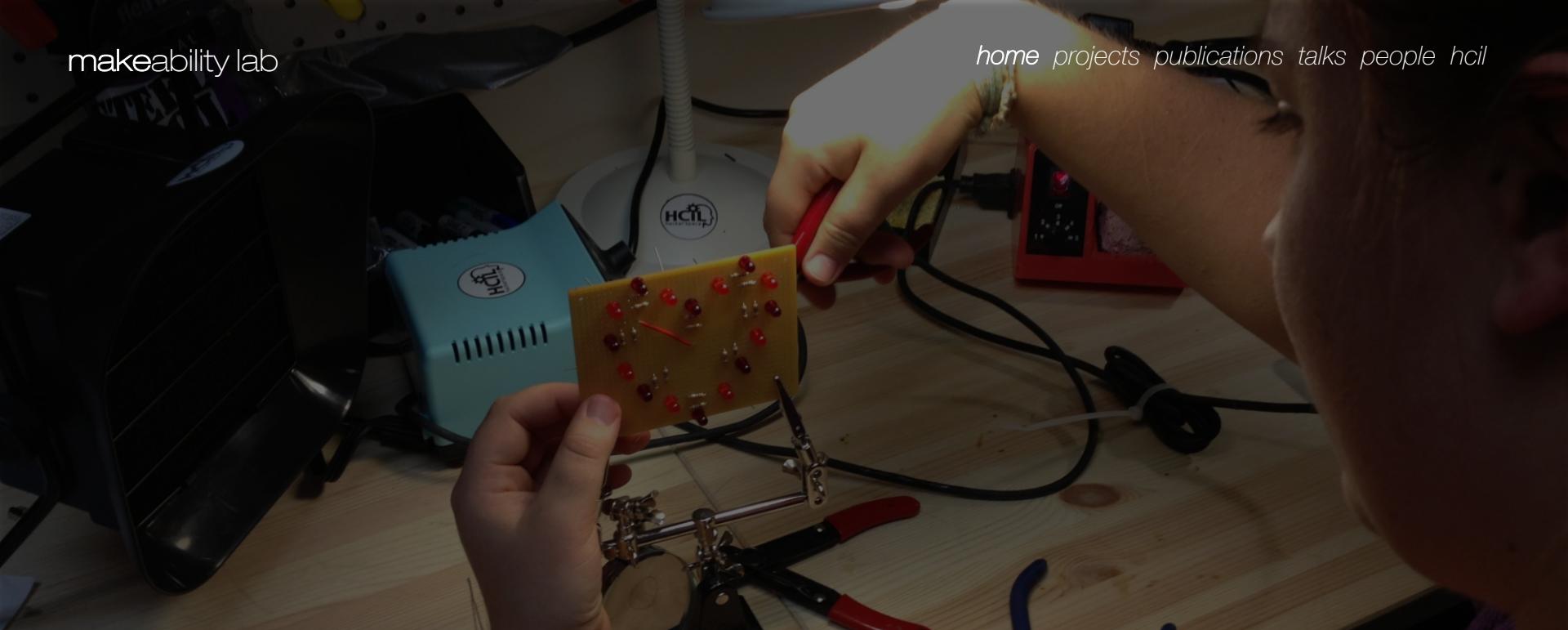
ABSTRACT
This paper presents a novel approach to support visually impaired users in performing everyday activities. We propose a computer vision system that augments touch-based interfaces with visual information (e.g., voice directed text), potentially aiding an effect of it. We present a case study of how this system can support users in navigating their environment. In addition, we present our current proof-of-concept prototype, and a summary of future work. Finally, we conclude with a discussion of challenges in this early stage project, we also encourage current open questions.

CATEGORIES AND SUBJECT HEADINGS I.4.2 [Computer Systems]: Human Factors – Assistive technologies for disabled users with disabilities

Keywords Blind, visually impaired, wearable computing, computer vision, assistive technologies

1. INTRODUCTION
The goal of this paper is to support visually impaired users in performing everyday activities. We propose a computer vision system that augments touch-based interfaces with visual information (e.g., voice directed text), potentially aiding an effect of it. We present a case study of how this system can support users in navigating their environment. In addition, we present our current proof-of-concept prototype, and a summary of future work. Finally, we conclude with a discussion of challenges in this early stage project, we also encourage current open questions.

2. RELATED WORK
There has been significant research in the area of computer vision to support blind and visually impaired users based on an abundance of information available online (e.g., [\[1\]](#), [\[2\]](#), [\[3\]](#), [\[4\]](#), [\[5\]](#), [\[6\]](#), [\[7\]](#), [\[8\]](#), [\[9\]](#), [\[10\]](#), [\[11\]](#), [\[12\]](#), [\[13\]](#), [\[14\]](#), [\[15\]](#), [\[16\]](#), [\[17\]](#), [\[18\]](#), [\[19\]](#), [\[20\]](#), [\[21\]](#), [\[22\]](#), [\[23\]](#), [\[24\]](#), [\[25\]](#), [\[26\]](#), [\[27\]](#), [\[28\]](#), [\[29\]](#), [\[30\]](#), [\[31\]](#), [\[32\]](#), [\[33\]](#), [\[34\]](#), [\[35\]](#), [\[36\]](#), [\[37\]](#), [\[38\]](#), [\[39\]](#), [\[40\]](#), [\[41\]](#), [\[42\]](#), [\[43\]](#), [\[44\]](#), [\[45\]](#), [\[46\]](#), [\[47\]](#), [\[48\]](#), [\[49\]](#), [\[50\]](#), [\[51\]](#), [\[52\]](#), [\[53\]](#), [\[54\]](#), [\[55\]](#), [\[56\]](#), [\[57\]](#), [\[58\]](#), [\[59\]](#), [\[60\]](#), [\[61\]](#), [\[62\]](#), [\[63\]](#), [\[64\]](#), 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Leah Findlater, Lee Stearns, Ruofei Du, Uran Oh, David Lee, Rama Chellappa, Jon E. Froehlich
Poster Proceedings of ASSETS'15
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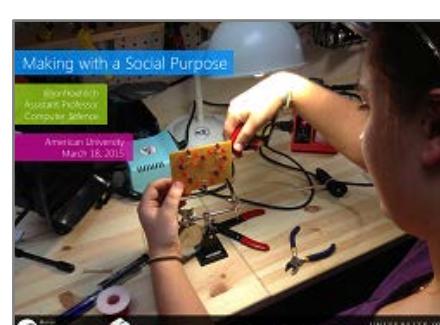


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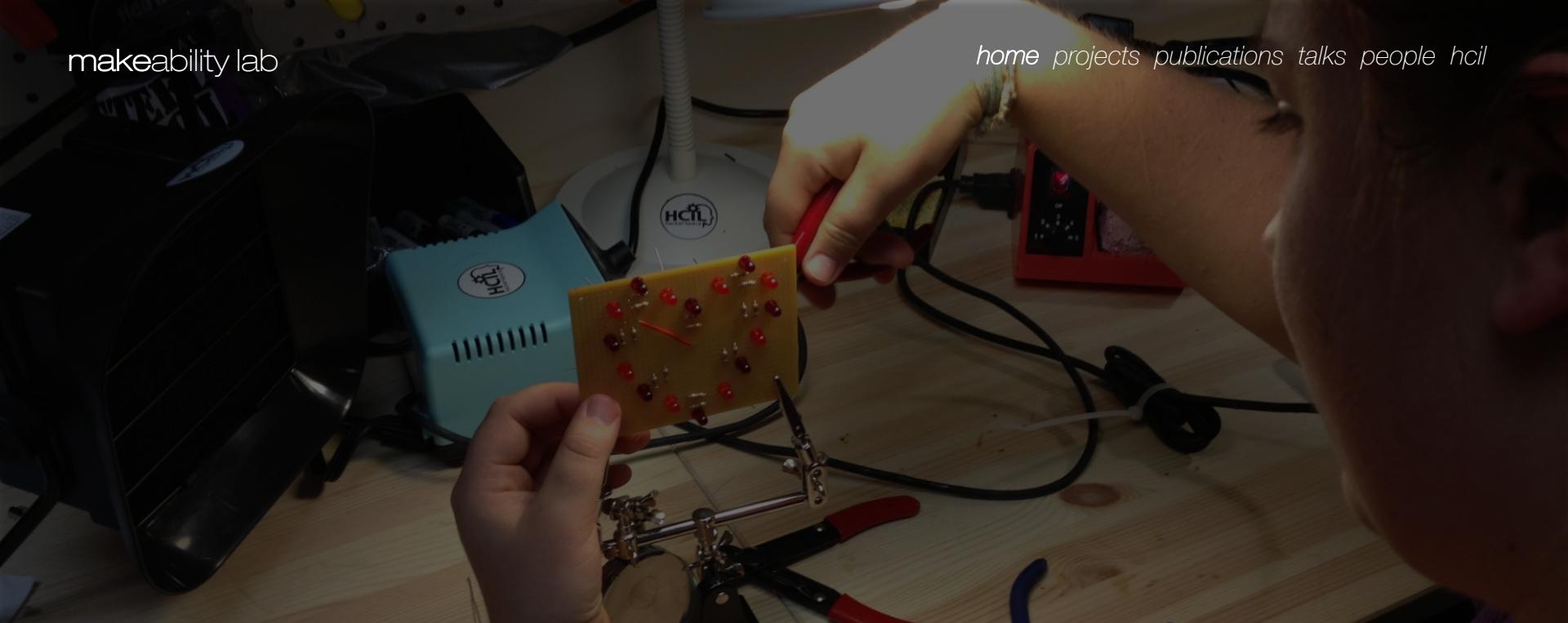
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Supporting Everyday Activities for Persons with Visual Impairments Through Computer Vision-Augmented Tools

Leah Findlater,¹ Lee Stearns,² Ruolei "Uan" Cuih,³ David Rose,³ Ramia Almagh
¹College of Information Studies, ²Dept. of Computer Science, ³University of Maryland Institute for Advanced Computer Studies, University of Maryland, College Park, MD 20742

ABSTRACT
This paper presents a new paradigm for how wearable microcomputers can be used to support everyday activities. It is proposed that a device can be used to collect visual information from the environment and then use computer vision techniques to extract relevant information (e.g., a door is open, address, person in view). This information can then be used to support a user's everyday activities (e.g., opening a door, navigating to a destination, preparing a meal). The paper presents a conceptual design-space analysis, a summary of our work to date, and a discussion of future research directions.

Categories and Subject Descriptors
H.4.2 [Computer Systems]: User interfaces—Assistive technologies; H.4.2 [Computer Systems]: User interfaces—User-centered design

Keywords
wearable computing, sensor computing, computer vision, user-assisted tools

INTRODUCTION
As people age, they are prone to cognitive and physical impairments that have focused on a limited set of abilities. However, there is a growing need to support everyday activities for persons with visual impairments. In particular, as people with visual impairments grow older, they are more likely to experience progressive cognitive decline. This decline can lead to significant challenges in performing everyday tasks, such as navigating through a familiar environment or preparing a meal. To address these challenges, we propose a new paradigm for how wearable microcomputers can be used to support everyday activities. This paradigm involves collecting visual information from the environment and using computer vision techniques to extract relevant information (e.g., a door is open, address, person in view). This information can then be used to support a user's everyday activities (e.g., opening a door, navigating to a destination, preparing a meal).

Figure 1: A photograph of a subject wearing a head-mounted display (HMD) with a camera mounted on top. The HMD displays a video feed from the camera, showing a close-up of a hand holding a small object. The background shows a cluttered desk environment.

Figure 2: A photograph of a subject wearing a head-mounted display (HMD) with a camera mounted on top. The HMD displays a video feed from the camera, showing a close-up of a hand holding a small object. The background shows a cluttered desk environment.

A composite image consisting of four photographs. The top-left photo shows a white t-shirt with a large blue thumbs-up graphic. The top-right photo shows three people standing together, smiling. The bottom-left photo shows a person sitting at a desk, looking at a computer screen. The bottom-right photo shows a person's hands working on a keyboard.

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A close-up photograph of a person's hands working on a small electronic project. They are using a soldering iron to connect components on a printed circuit board (PCB) held in a blue plastic stand. The PCB has several yellow and orange resistors and a few other small components. The background shows a workshop environment with various tools and equipment.

Making with a Social Purpose

A close-up photograph of a person's hands working on a small electronic project. They are using pliers to manipulate a yellow component with red patterns on a wooden workbench. In the background, there are several other electronic components, wires, and tools, including a red screwdriver and a white roll of tape. The scene is well-lit, highlighting the hands and the work area.

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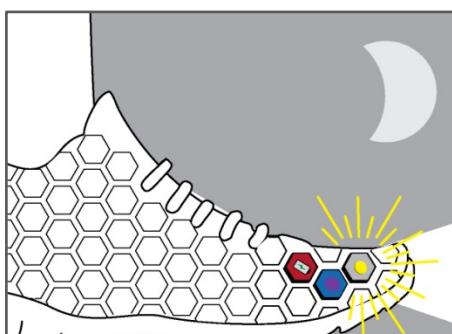
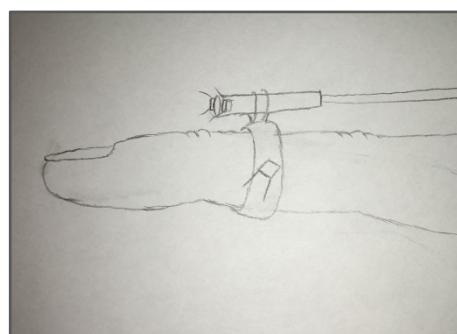
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*Workshop on Empirical Evaluation of Evidence in Vision and
Haptics, UIUC, Urbana-Champaign, IL, USA, 2015

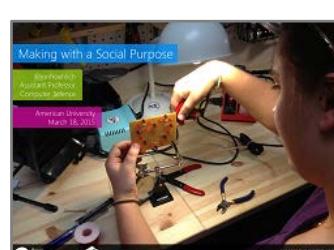
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“College of Information Studies, Dept. of Computer Science, University of Maryland, College Park, MD, USA
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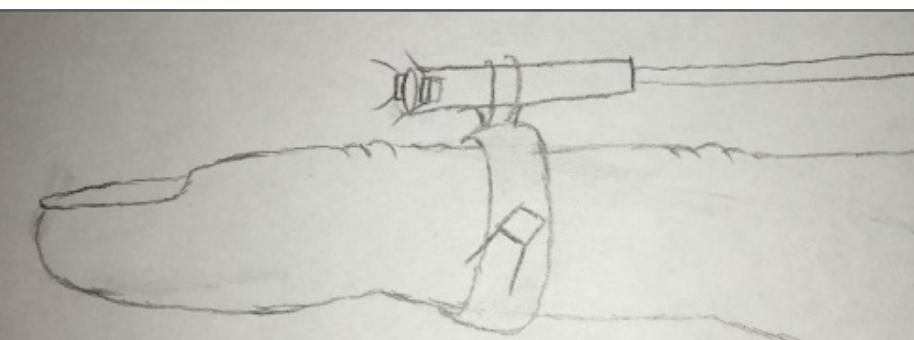
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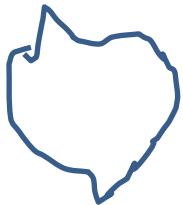
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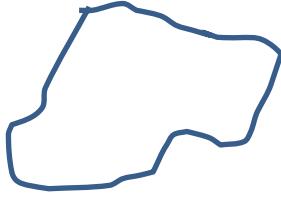
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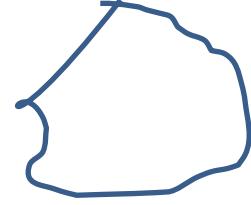
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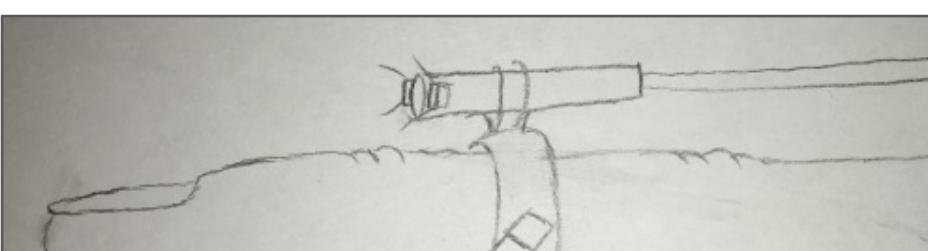
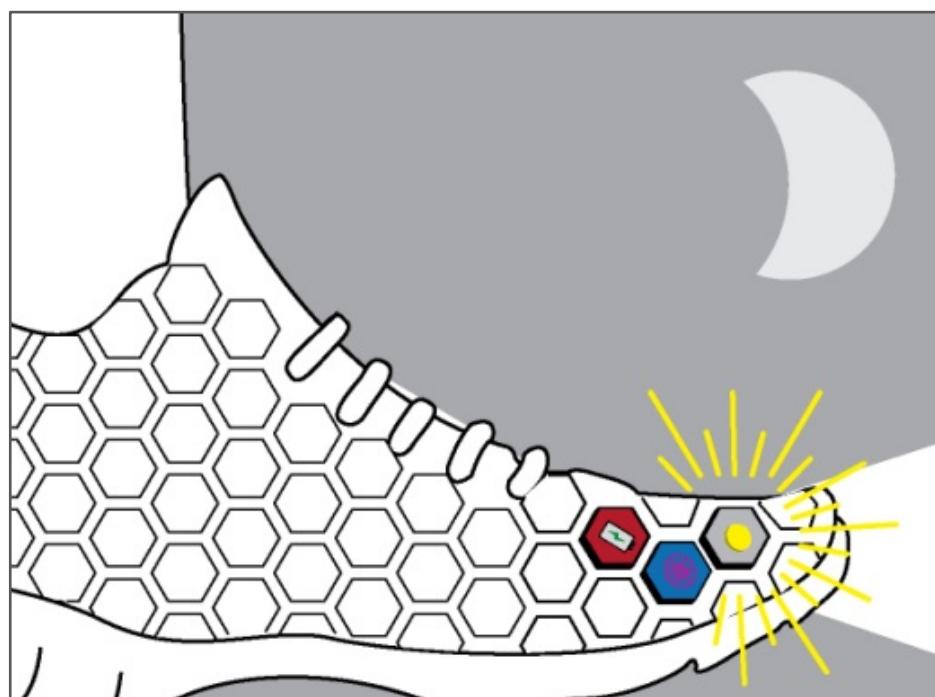
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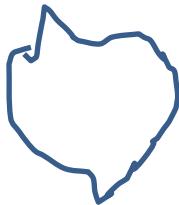
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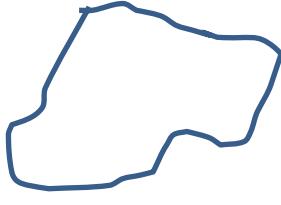
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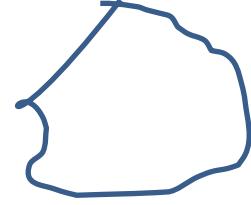
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RECENT TWEETS

Jon Froehlich Retweeted

Hillary Clinton @HillaryClinton

You literally said all those things. hrc.io/22CyaZB
twitter.com/realDonaldTrump...

13 Jun

Matthew Louis Retweeted

Greg Walsh @gxwalsh

I have been working with my 1st grader on HOURS of busy work homework. I feel bad for her if her teacher thinks this is learning.

13 Jun

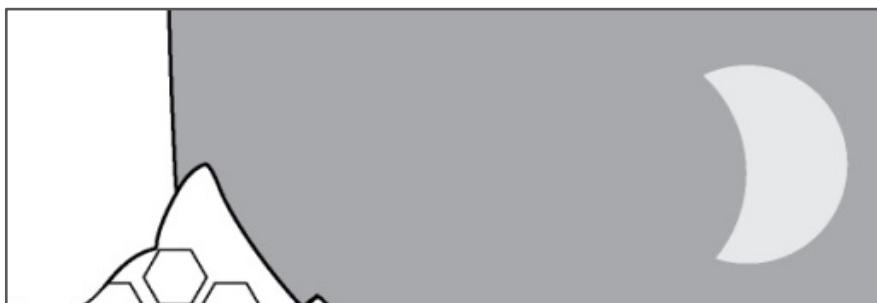
Matthe Louis Retweeted

Dirigiballers @Dirigiballers

Thank you for a successful Steam Launch; have fun riding the rails! store.steampowered.com/app/372350

13 Jun

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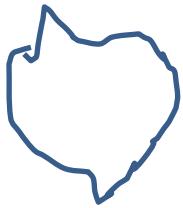
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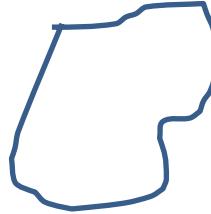
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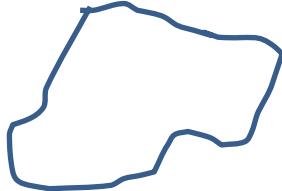
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RECENT PAPERS



Evaluating Haptic and Auditory Directional Guidance to Assist Blind People in Reading Printed Text Using Finger-Mounted Cameras
Lee Stearns, Ruofei Du, Umar Oh, Catherine Jou, Leah Findlater, David A. Ross, Jon E. Froehlich
ACM Transactions on Accessible Computing (TACCESS) 2016 To Appear
keywords: accessibility, wearables, visual impairments, handsight, real-time ocr, blind reading

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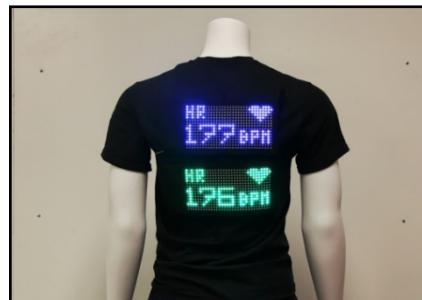
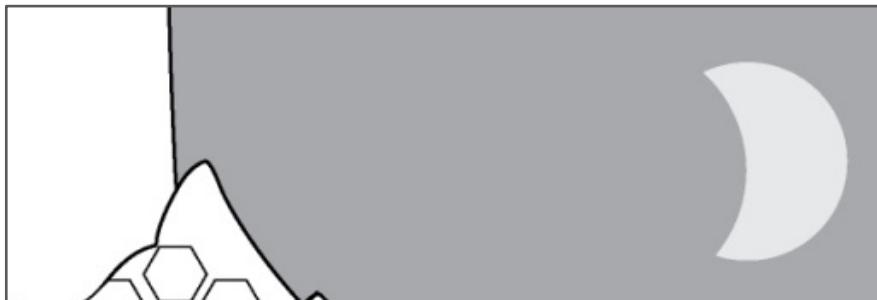
SharedPhys: Live Physiological Sensing, Whole-Body Interaction, and Large-Screen Visualizations to Support Shared Inquiry Experiences
Seokbin Kang, Leyla Norooz, Vanessa Oguamanam, Angelisa Plane, Tamara L. Clegg, Jon E. Froehlich
Proceedings of IDC 2016
keywords: sharedphys, bodyvis, physiological sensing, large-screen displays, mixed-reality, scientific inquiry, collaborative learning, stem, wearables

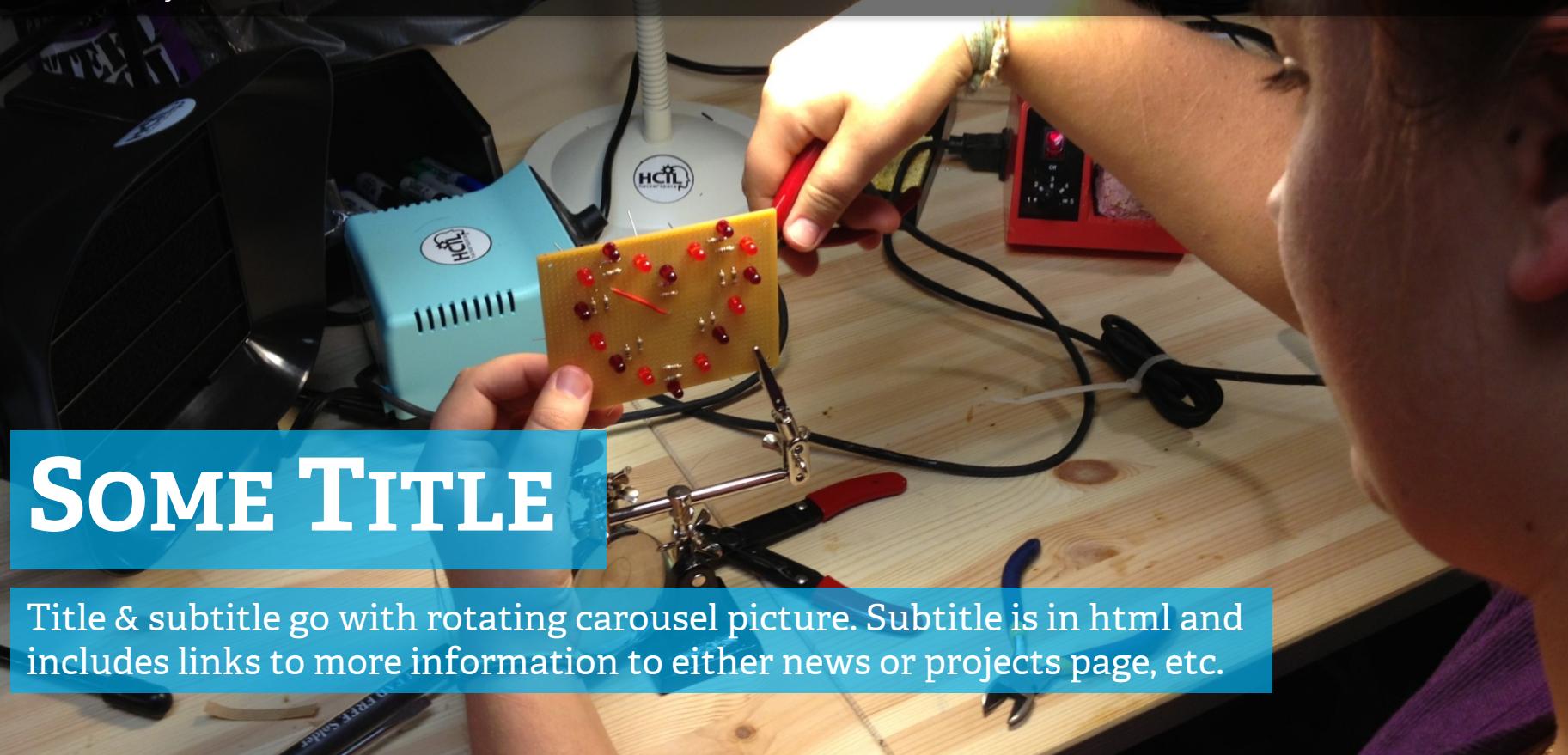
[Download: \[pdf\]](#) [Export: \[Citation\]](#)



"That's Your Heart!": Live Physiological Sensing & Visualization Tools for Life-Relevant & Collaborative STEM Learning
Leyla Norooz, Tamara L. Clegg, Seokbin Kang, Angelisa Plane, Vanessa Oguamanam, Jon E. Froehlich
Proceedings of ICLS 2016
keywords: sharephys, bodyvis, physiological sensing, large-screen displays, mixed-reality, scientific inquiry, collaborative learning, stem, wearables

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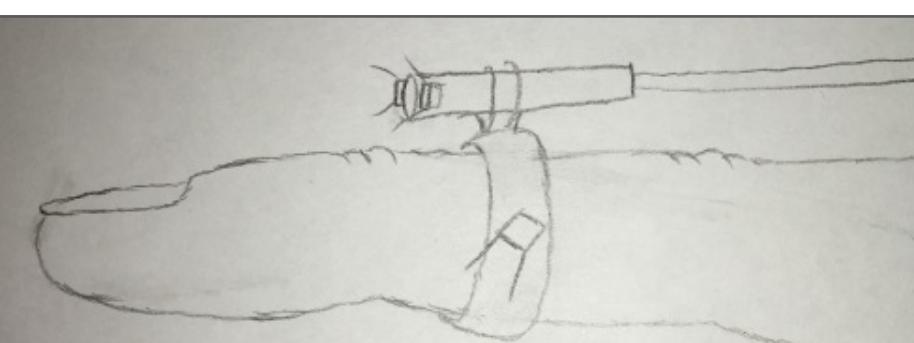
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RECENT PROJECTS

MAKERSHOE

Some subtitle here that sounds super awesome



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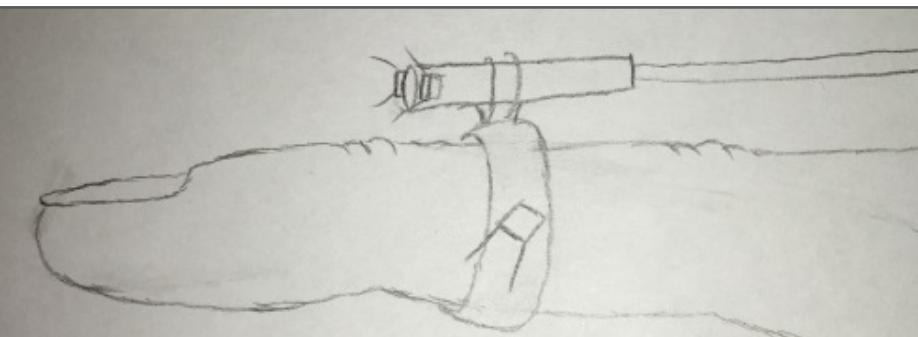
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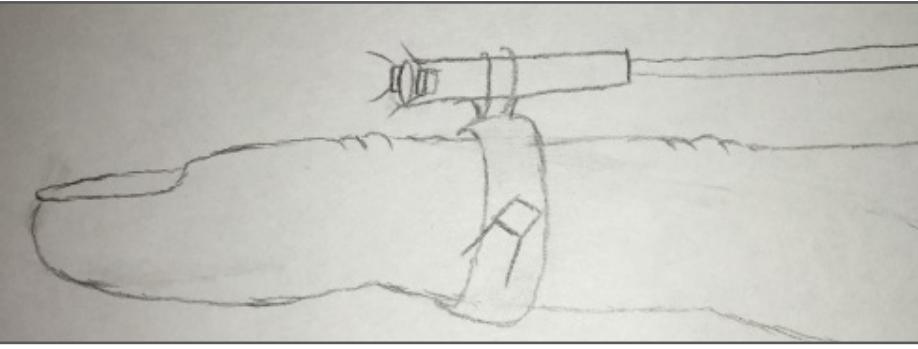
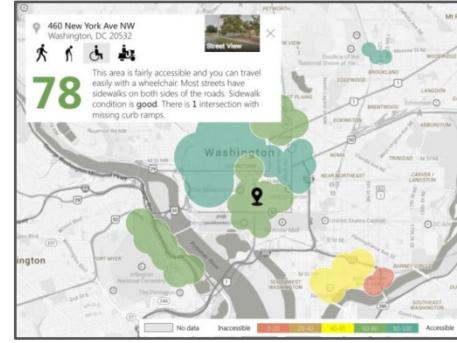
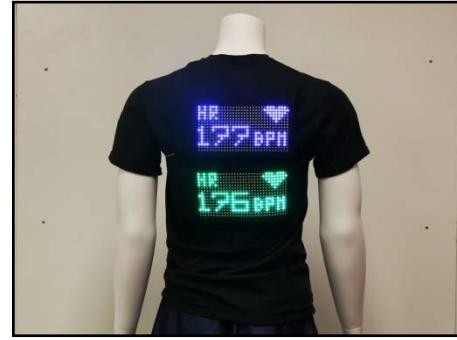
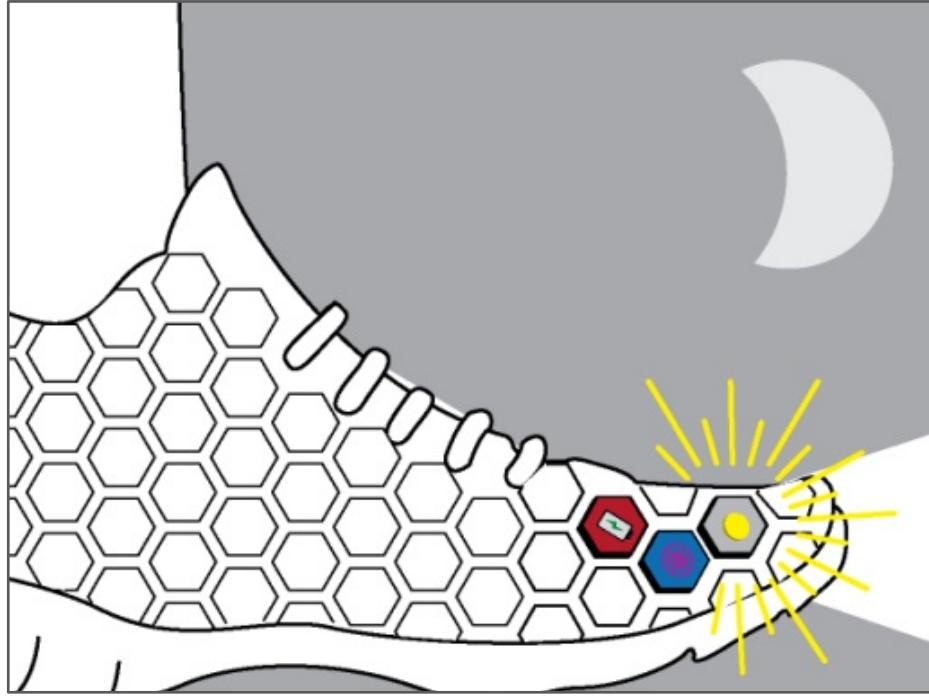
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RECENT PAPERS

SIGACCESS Newsletter
Issue 103
October 2015

CHARACTERIZING AND VISUALIZING PHYSICAL WORLD ACCESSIBILITY AT SCALE USING CROWDSOURCING, COMPUTER VISION, AND MACHINE LEARNING

Kotaro Hara and Jon E. Froehlich
Makeability Lab, University of Maryland, College Park
Baltimore, Maryland, USA

Supporting Everyday Activities for Persons with Visual Impairments Through Computer Vision-Augmented Touch

Leah Findlater*, Lee Stearns*, Rueter Du*, Uyen Ch*, David Ross*, Ramya Chellappa*, Jon E. Froehlich*

*College of Information Studies, Dept. of Computer Science, Dept. of Electrical and Computer Engineering, University of Maryland, College Park, MD 20742

ABSTRACT

The Makeability project investigates how wearable micro-computers can support persons with visual impairments in their everyday activities. One goal is to support an array of users with different types of visual impairments. Another goal is to support users in their daily lives by providing them with informative (e.g., white-printed text) feedback about an object as it is being touched. This paper presents our work on supporting users with visual impairments in their daily lives through computer vision-augmented touch.

MakerShoe: Towards a Wearable E-Textile Construction Kit to Support Creativity, Playful Making, and Self-Expression

Maged Kazemzababae*, Leyla Norouzi*, Morteza Gharib*, Jon E. Froehlich*

*College of Computer Science, Dept. of Computer Science, Dept. of Electrical and Computer Engineering, University of Maryland, College Park, MD 20742

ABSTRACT

This paper presents the MakerShoe, a wearable e-textile construction kit that has been successful in broadening participation in STEM-related design activities. In response to the lack of resources for making creative, expressive, and meaningful playful-physical designs, we have developed a low-cost, open-source, and accessible construction kit for playful making.

"I Like This Shirt": Exploring the Translation of Social Mechanisms in the Virtual World into Physical Experiences

Laura Neff*, Leah Findlater*, Jon E. Froehlich*

*College of Computer Science, Dept. of Computer Science, Dept. of Electrical and Computer Engineering, University of Maryland, College Park, MD 20742

ABSTRACT

Translating social mechanisms from the virtual world into the physical world is often considered as a challenge in HCI. The goal of this paper is to explore the translation of social mechanisms from the virtual world to the physical world as design mechanisms. In this paper, we present our work on "I Like This Shirt", a system that translates social mechanisms from the virtual world to the physical world as design mechanisms. The goal of this paper is to explore the translation of social mechanisms from the virtual world to the physical world as design mechanisms. The goal of this paper is to explore the translation of social mechanisms from the virtual world to the physical world as design mechanisms.

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Sustainability



Accessibility



Health

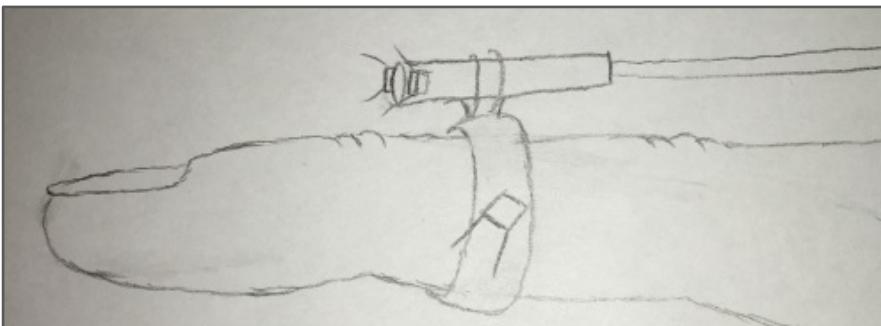


Learning Tools



Maker Tools

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Sustainability



Accessibility



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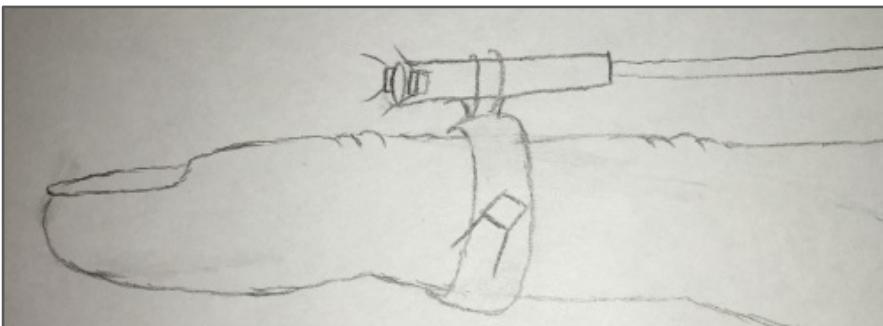


Learning Tools



Maker Tools

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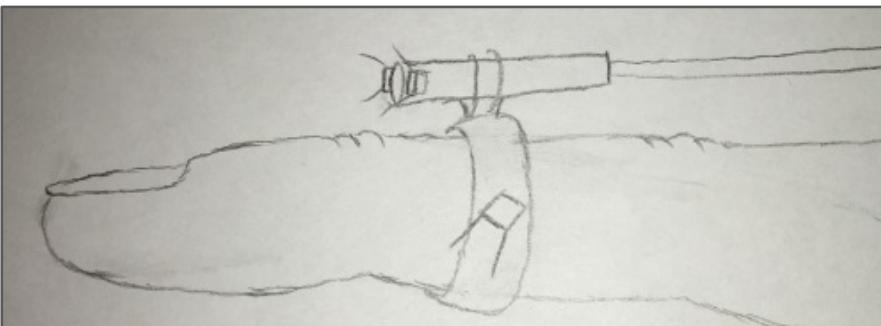


Learning Tools



Maker Tools

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OUR MISSION

Our Mission is to build and create technologies with a high social value and impact in accessibility, education, health and sustainability.



Sustainability



Accessibility



Health



Learning Tools



Maker Tools

RECENT PAPERS

Supporting Everyday Activities for Persons with Visual Impairments Through Computer Vision-Augmented Touch

Lynn Foulkes¹, Lee Gammie², Ruthie L. Lewis³, Ute Czerw⁴, Rosemarie Roselli⁵, Jamie Cheek⁶, Joni Eareckson Apter⁷

¹College of Information Studies, Dept. of Computer Science, ²Dept. of Electrical and Computer Engineering, University of Maryland, College Park, MD 20742

ABSTRACT
The hands-free project investigate how wearable technologies can support everyday activities for persons with visual impairments. The goal of this study is to determine if touch-based methods for daily living are feasible and benefit individuals with visual impairments. In this paper, we provide an overview of the hands-free project and describe the first two studies of hands-free finger-tap text reading. This is an initial step toward developing a hands-free computer system.

Categories and Subject Descriptors H.5.1. Information interfaces and presentation (e.g., HCI) → Assistive technologies with people with disabilities

Keywords assistive technologies, touch computing, computer vision, haptic feedback, sensorimotor integration

1. INTRODUCTION

The majority of work on computer vision is targeted toward and focused on the needs of able-bodied users. However, there is a large population of individuals with visual impairments who have difficulty using standard computer systems. One way to support these users is through the use of assistive technologies such as screen readers, speech recognition, and braille displays, along with touch-based interaction techniques. These technologies, though, have significant limitations. For example, screen readers are limited by the amount of text displayed on a screen at one time, and speech recognition is often unreliable in noisy environments. Braille displays are also limited by the amount of text that can be displayed simultaneously. In addition, these technologies require users to use their hands to interact with the computer, which can be problematic for individuals with visual impairments who may have difficulty using their hands due to physical disabilities or cognitive impairments.

Figure 1: Handheld device with a 10W AMR-HDR 3D camera mounted on top. The device is being held by a person's hand. The camera is facing towards the right side of the image. The background shows a blurry view of a room with some furniture and objects.

Figure 2: Handheld device with a 10W AMR-HDR 3D camera mounted on top. The device is being held by a person's hand. The camera is facing towards the left side of the image. The background shows a blurry view of a room with some furniture and objects.

Figure 3: Handheld device with a 10W AMR-HDR 3D camera mounted on top. The device is being held by a person's hand. The camera is facing towards the bottom-left side of the image. The background shows a blurry view of a room with some furniture and objects.

Figure 4: Handheld device with a 10W AMR-HDR 3D camera mounted on top. The device is being held by a person's hand. The camera is facing towards the bottom-right side of the image. The background shows a blurry view of a room with some furniture and objects.

The poster features a central image of a person wearing a colorful, glowing blue and red light-up shoe. To the left is a photograph of a child's hands working on a project. Below the main image are two circular diagrams labeled 'Figure 1: Illustration of a creative construction kit' and 'Figure 2: Illustration of a creative construction kit'. The top half of the poster contains text about the project's goals and its impact on children's learning.

"I Like This Shirt": Exploring the Translation of Social Mechanics in the Virtual World into Physical Experiences

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University of Hagen
Chair of Computer Graphics
and Media Informatics
Hagen, Germany
http://www.cs.uni-hagen.de/~lfd/

Jan Pohlmann
Laboratory for Social Design
University of Hagen
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Ulrich Gähde
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University of Hagen
Chair of Computer Graphics
and Media Informatics
Hagen, Germany
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Abstract
In this paper we present a study that explores how social mechanics from the virtual world can be translated into physical experiences. We introduce the concept of "social mechanics" and show how they can be used to design social interactions in the physical world. We also discuss the challenges of translating social mechanics from the virtual world into the physical world, and how they can be overcome. Finally, we present a case study where we applied our findings to a real-world scenario.

Keywords
Social mechanics, social interaction, physical experiences, user-centered design, user research.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI)

Introduction
Social mechanics are characterized by the breadth of ways people interact with one another. In this paper, we focus on the translation of social mechanics from the virtual world into the physical world.

RECENT TALKS

A close-up photograph of a person's hands working on a small electronic project on a wooden desk. The person is using a multimeter probe to test a component. A laptop is open in front of them, displaying a presentation slide with the title "Making with a Social Purpose". The slide also includes the names of the presenters: "Brett Hettler, Assistant Professor, Computer Science" and "American University, March 18, 2015". The slide has a purple header and footer.

A close-up photograph of a person's hands working on a small electronic project. They are holding a rectangular circuit board with a yellow and red patterned top layer. Several wires are attached to the board, some with alligator clips. The person is using a pair of pliers to manipulate one of the wires. The background shows a wooden workbench with other tools and components scattered around.

A photograph showing a man in a wheelchair sitting at a crosswalk, looking down at his smartphone. The background is a blurred city street with buildings and other people, suggesting a public space. The image serves as the main visual for the presentation.

Social Fabrics: Designing Wearable Electronic Textiles for Interaction, Introspection, & Inquiry

Jon Froehlich | May 28, 2015 | HCIL Symposium

Making with a Social Purpose

Making with a Social Purpose

Characterizing Physical World Accessibility at Scale Using Crowdsourcing, Computer Vision, and Machine Learning

Jon Froehlich | Oct 29, 2014 | CMU | HCII

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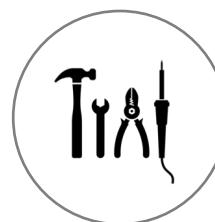
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MakerShoe in the dark

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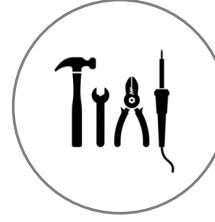
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SIGACCESS Newsletter Issue 113 October 2015

CHARACTERIZING AND VISUALIZING PHYSICAL WORLD ACCESSIBILITY AT SCALE USING CROWDSOURCING, COMPUTER VISION, AND MACHINE LEARNING

Kotaro Hara | Jon E. Froehlich
Makeability Lab | University of Maryland, College Park
(notoro, jefro)@cs.umd.edu



Supporting Everyday Activities for Persons with Visual Impairments Through Computer Vision-Augmented Touch

Leah Findlater¹, Lee Stemmer², Ruiping Du², Linda Oh², David Ross³, Rama Chellappa⁴, Jon E. Froehlich²
¹College of Information Studies, Dept. of Computer Science, ²Dept. of Electrical and Computer Engineering,
University of Maryland, College Park, MD 20742
³National VA R&D Center of Excellence in Neurocognitive Rehabilitation (CNRS)
16570 Clarmont Road, Decatur, GA 30033

ABSTRACT

The Makeability project investigates how wearable micro-camera systems can support persons with visual impairments through the expansion of touch with computer vision. Our goal is to support an array of everyday activities for persons with visual impairments by providing information (e.g., color, printed text, patterns) about an object as it is being touched. In this paper, we present the design of the Makeability project, our current proof-of-concept prototype, and a summary of our initial user evaluations. This work is preliminary. As this is an early-stage project, we also enumerate current open questions.

Categories and Subject Descriptors



MakerShoe: Towards a Wearable E-Textile Construction Kit to Support Creativity, Playful Making, and Self-Expression

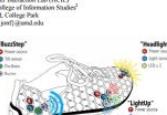
Majeed Kazemzadeh¹, Leyla Norsad¹, Mona Leigh Culpe², Jon E. Froehlich¹
¹Makeability Lab | Human Computer Interaction Lab (HCIL), Department of Computer Sciences, College of Information Studies,
University of Maryland, College Park, MD 20742, USA
(majeed.kazemzadeh, leyla.norsad, jefro)@cs.umd.edu

ABSTRACT

Electronic textile (e-textile) sodicks have been successful in expanding perception of computing, and in engaging users in creative, expressive, and meaningful digital-physical design.

Unfortunately, they often require specialized skills and knowledge to use.

In this paper, we introduce the Makeability project, a new approach to support younger children (4-8) in the creative design and making of e-textiles. We present the Makeability kit without requiring the creation of code. This allows children to learn how to make e-textiles without the need for a computer or a computer program.



"I Like This Shirt": Exploring the Translation of Social Mechanisms into Physical Experiences

Laura Nagelkirk¹, Makeability Lab | HCIL, Department of Computer Sciences, College of Information Studies, University of Maryland, College Park, MD 20742, USA
(laura.nagelkirk)@cs.umd.edu

ABSTRACT

Translating social mechanisms from the digital world into the physical world can be challenging. In this paper, we introduce one example called "I Like This Shirt". This shirt features a screen that displays a thumbs-up icon and text that changes based on the number of likes received. The shirt is embedded in an interactive coat-tail. The coat tail allows users to receive likes from other people and translate the "like count" in real time on the shirt's screen. This paper presents the design and the results of a preliminary deployment.

Categories and Subject Descriptors



Keywords

social media, social interaction, social network, social elements, social media, social interaction, social network, social elements

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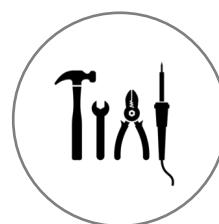
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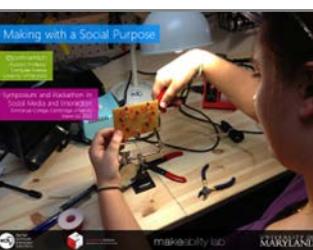
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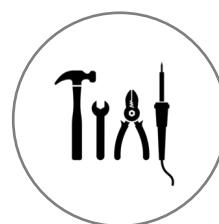
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Poster Proceedings of ASSETS'15



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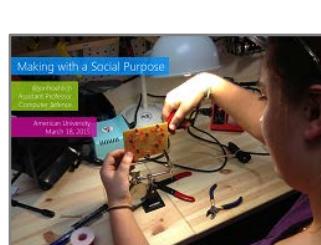
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Social Fabrics: Designing



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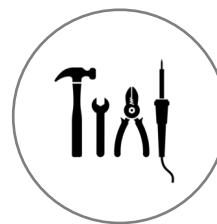
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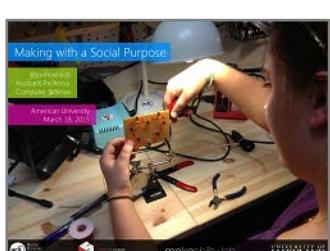
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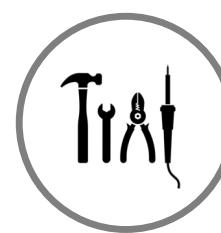
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Supporting Everyday Activities for Persons with Visual Impairments Through Computer Vision-Augmented Touch

Leah Findlater¹, Lee Stearns², Ruote Liu³, Umar Chishti⁴, David Rossi⁵, Rana Chittappa⁶, Jon A. Freeman⁷,
¹College of Information Studies, ²Dept. of Computer Science, ³Dept. of Electrical and Computer Engineering, University of Maryland, College Park, MD, USA
⁴University of Texas at Dallas, Dallas, TX, USA
⁵Georgia Institute of Technology, Atlanta, GA, USA
⁶Georgia Institute of Technology, Atlanta, GA, USA
⁷Georgia Institute of Technology, Atlanta, GA, USA

ABSTRACT
The blindfold project introduces a highly valuable technique to help users with visual impairments learn to identify objects by touch. Our goal is to support an area of assistive technology that has been largely overlooked: how to use computer vision to support this type of information (e.g., color, printed text, patterns) without object as it is being touched. In this paper, we introduce the blindfold project, our current proof-of-concept prototype, and a summary of findings from our initial user study. Finally, we argue that early-stage work, like this one, can be extremely useful for the blindfold project, we also share current open questions.

Categories and Subject Descriptors
D.2.3 [Information Storage and Retrieval]: Image Indexing – Assistive technologies for persons with disabilities

Keywords
computer vision, visually impaired, sensory computing, computer vision, touch-based interfaces

1. INTRODUCTION
For people with visual impairment, touch is an important way to explore the world around them. To support blind users in their everyday activities, we have developed a system that uses computer vision to support touch. Specifically, our system uses a camera to capture images of objects and then processes those images to extract features such as color, shape, and texture. These features are then used to identify the object and provide feedback to the user. For example, if a user touches a red apple, the system will tell them that they are touching a red apple. This allows users to explore the world around them and perform everyday tasks even if they are visually impaired.

2. RELATED WORK
There is a growing body of research on using computer vision to support touch. One approach is to use depth cameras to capture 3D point clouds of objects. These point clouds can then be processed to extract features such as depth, surface normals, and curvature. Another approach is to use cameras to capture 2D images of objects. These images can then be processed to extract features such as color, shape, and texture. Both approaches have their own strengths and weaknesses. For example, depth cameras are good for capturing 3D point clouds of objects, but they are expensive and require a lot of processing power. Cameras, on the other hand, are less expensive and require less processing power, but they are limited in their ability to capture 3D point clouds. Despite these differences, both approaches have been used to support touch in various applications, such as robotics, haptics, and assistive technologies.

3. SYSTEM DESIGN
Our system consists of three main components: a camera, a computer, and a haptic device. The camera captures images of objects and sends them to the computer. The computer processes the images to extract features and then sends feedback to the haptic device. The haptic device provides tactile feedback to the user. We have implemented our system using Python and OpenCV, and we have tested it on a variety of objects, including fruits, vegetables, and household items.

4. EVALUATION
We conducted a user study to evaluate our system. In the study, participants were asked to identify objects using touch and our system. They were given a set of objects and asked to identify them by touch. They were then asked to identify them again using our system. The results showed that our system was able to correctly identify most of the objects, even for objects that were difficult to identify by touch alone. This suggests that our system is effective at supporting touch in everyday activities.

5. CONCLUSION
In conclusion, our system provides a new way to support touch for people with visual impairment. By using computer vision to extract features from objects, our system can provide more accurate and reliable feedback than traditional touch-based interfaces. This can help users with visual impairment to explore the world around them and perform everyday tasks more easily.

MakerShoe: Towards a Wearable E-Textile Construction Kit to Support Creativity, Playfulness, and Self-Expression

Jameed Kazemtabrizi^a, Leyla Norouzi^b, Mona Leigh Guha^c, Jon E. Froehlich^a

^a MobiLab at Human-Computer Interaction Lab (HCIL), Department of Computer Science, University of Maryland, College Park
^b Department of Early Childhood Education, University of Maryland, College Park
^c Dept. of Kinesiology, University of Maryland, College Park

ABSTRACT
Electronic textile (e-textile) toolkit have been successful in encouraging participation in STEAM-related activities, in supporting children's learning through play, and in creating, expressive, and meaningful digital-augmented design. In this paper, we introduce MakerShoe, a new e-textile toolkit (LiDarl) that cater primarily to adults and older children and how it can support creative play and self-expression. We also present our initial findings from two studies that explore new approaches to support younger children (4-8) as they create their own designs using the MakerShoe toolkit. The results show that children can learn how to use the LiDarl platform and make their own designs using the provided paper template and such everyday objects as wool, Maracas, and beads. Children also enjoyed the process of creating their own designs and playing with them. We discuss the two participatory design sessions as well as the challenges and opportunities for future research on how to meaningfully engage children in creating their own designs using the LiDarl platform.

Categories and Subject Descriptions
H.5.2 [Information Integration and Presentation]: User Interfaces—Design and Evaluation

Keywords


Figure 1. A photograph of a child wearing a white sneaker with colorful, glowing electronic components attached to the toe and side, demonstrating the MakerShoe prototype.


Figure 2. A photograph of a child's hand holding a small, colorful electronic device with glowing components, likely a component of the MakerShoe toolkit.


Figure 3. A photograph of a child's hand holding a small, colorful electronic device with glowing components, likely a component of the MakerShoe toolkit.

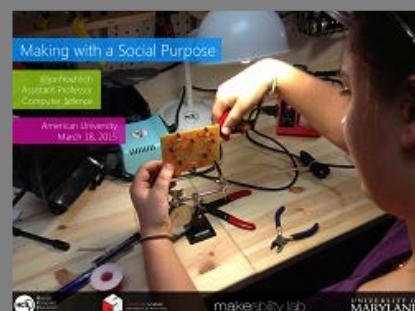
A composite image consisting of three separate photographs. The top left shows a white t-shirt with a large, stylized blue thumbs-up icon in the center. The bottom left shows two people in athletic gear playing basketball on an indoor court. The right side shows a person sitting at a desk, facing a computer monitor, with their hands resting on the keyboard.

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DESIGNING WEARABLE ELECTRONIC TEXTILES
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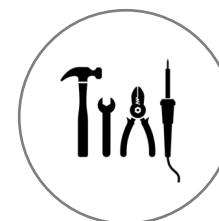
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Supporting Everyday Activities for Persons with Visual Impairments Through Computer Vision-Augmented Touch

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⁴Georgia Institute of Technology, Atlanta, GA, USA
⁵Georgia Tech Research Institute, Atlanta, GA, USA
⁶Georgia Institute of Technology, Atlanta, GA, USA
⁷Georgia Institute of Technology, Atlanta, GA, USA

ABSTRACT
The blindfolded project introduces how visual information can be used in a touch-based activity to visually support one's sense of touch with computer vision. Our goal is to support an area of assistive technology research that has been largely overlooked: how to support touch-based activities with visual information (e.g., color, printed text, patterns) without object as a visual cue. This paper presents our initial work on this topic, our current proof-of-concept prototype, and a summary of findings from our first user study. In addition, we present an early-stage project, we also describe current open questions.

Categories and Subject Descriptors
D.2.3 [Information Storage and Retrieval]: Image Indexing – Assistive technologies for persons with disabilities.

Keywords
computer vision, sensory computing, computer vision-augmented touch

1. INTRODUCTION
In today's world of work-to-sense activity to support blind and visually impaired users has been a relatively infrequent task made possible by the development of assistive technologies such as screen readers and Braille displays.

Figure 1. Headlight uses a 1×1mm AWABA Noddy 2 camera to capture 2D images of a headlight. The camera is able to capture 250-280 images/s at 640x480. Early results for face detection, gender classification, and age estimation are promising. In contrast, a contact-lens imager detects faces with vibrations generated by the device moving away with the finger [4].

2. RELATED WORK
The field of computer vision-augmented touch has been explored in a variety of ways. One approach is to use a camera to detect the user's hand and then provide feedback to the user through haptic actuators [1]. Another approach is to use a camera to detect the user's hand and then provide feedback to the user through haptic actuators [1].

3. HEADLIGHT
Headlight is a system that uses a camera to detect the user's hand and then provide feedback to the user through haptic actuators [1].

4. CONCLUSION
Headlight is a system that uses a camera to detect the user's hand and then provide feedback to the user through haptic actuators [1].

ACKNOWLEDGMENTS
This work was partially funded by grants from the National Science Foundation (NSF) and the National Institute of Child Health and Human Development (NICHD). We would like to thank the anonymous reviewers for their valuable feedback.

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[1] Findlater, L., Stearns, L., Liu, R., Chishti, U., Rossi, D., Chittappa, R., Freeman, J.A., and Findlater, L. Headlight: Supporting everyday activities for persons with visual impairments through computer vision-augmented touch. In *Proceedings of the 2013 ACM SIGART Conference on Assistive Technologies* (Atlanta, GA, USA, April 2013).

MakerShoe: Towards a Wearable E-Textile Construction Kit to Support Creativity, Playfulness, and Self-Expression

Jameed Kazemtabrizi^a, Leyla Norouzi^b, Mona Leigh Guha^c, Jon E. Froehlich^a

^a MobiLab at Human-Computer Interaction Lab (HCIL), Department of Computer Science, University of Maryland, College Park
^b Department of Early Childhood Education, University of Maryland, College Park
^c Dept. of Kinesiology, University of Maryland, College Park

ABSTRACT
Electronic textile (e-textile) toolkit have been successful in encouraging participation in STEAM-related activities, in supporting children's learning through play, and in creating, expressive, and meaningful digital-augmented design. In this paper, we introduce MakerShoe, a new e-textile toolkit (LiDarl) that cater primarily to adults and older children and how it can support creative play and self-expression. We also present our initial findings from two studies that explore new approaches to support younger children (4-8) as they create their own designs using the MakerShoe toolkit. The results show that children can learn how to use the LiDarl platform and make their own designs using the provided paper template and such everyday objects as wool, Maracas, and beads. Children also enjoyed the process of creating their own designs and playing with them. We discuss the two participatory design sessions as well as the challenges and opportunities for future research on how to meaningfully engage children in creating their own designs using the LiDarl platform.

Categories and Subject Descriptions
H.5.2 [Information Interfaces and Presentation]: User Interaction; H.5.1 [Information/Computer Systems]

Keywords



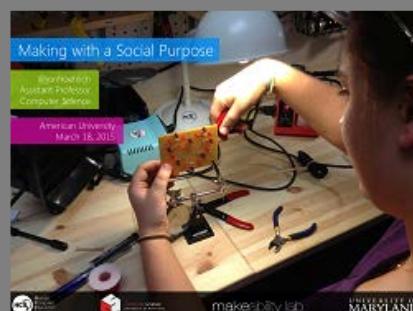
A composite image consisting of three separate photographs. The top left shows a white t-shirt with a large, stylized blue thumbs-up icon in the center. The bottom left shows two people in athletic gear playing basketball on an indoor court. The right side shows a person sitting at a desk, facing a computer monitor, with their hands resting on the keyboard.

RECENT TALKS

SOCIAL FABRICS

DESIGNING WEARABLE ELECTRONIC TEXTILES
FOR INTERACTION, INTROSPECTION, AND INQUIRY

Social Fabrics: Designing Wearable Electronic Textiles for Interaction, Introspection, & Inquiry



Making with a Social Purpose
Jon Froehlich | March 16, 2015 | American University



Making with a Social Purpose
Jon Froehlich | March 16, 2015 | American University



Characterizing Physical World Accessibility at Scale Using Crowdsourcing, Computer Vision, and Machine Learning

Jon Froehlich | Oct 29, 2014 | CMU HCII

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Sustainability



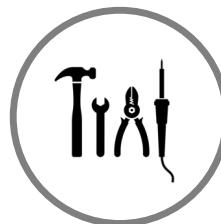
Accessibility



Health



Learning Tools



Maker Tools

RECENT PAPERS



Evaluating Haptic and Auditory Directional Guidance to Assist Blind People in Reading Printed Text Using Finger-Mounted Cameras
Lee Stearns, Ruofei Du, Uran Oh, Catherine Jou, Leah Findlater, David A. Ross, Jon E. Froehlich



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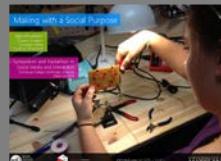
RECENT TALKS



MakerWear: Early Explorations of Wearable Construction Kits for Children
Jon E. Froehlich, Majeed Kazemitaabari
33rd Annual HCIL Symposium

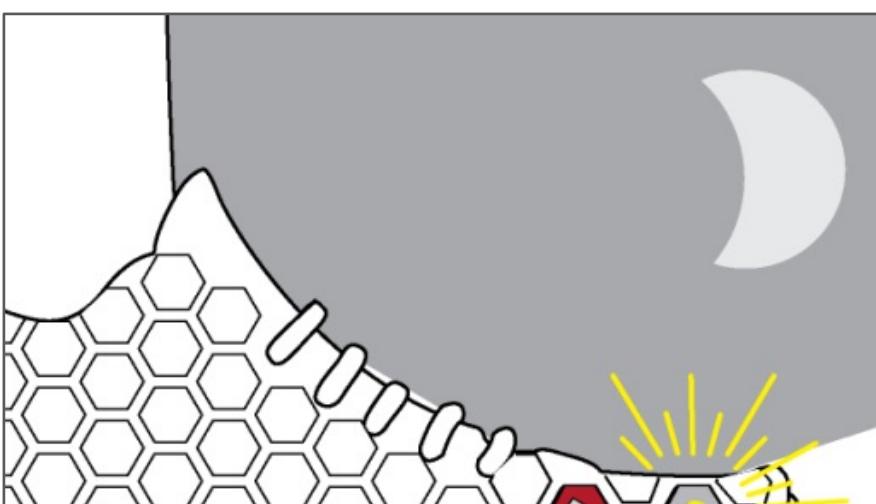


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RECENT PROJECTS



CHARACTERIZING PHYSICAL WORLD ACCESSIBILITY AT SCALE
USING CROWDSOURCING, COMPUTER VISION, AND MACHINE LEARNING

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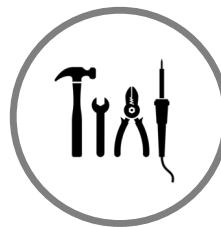
Accessibility



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RECENT PROJECTS



Sidewalk Accessibility



Glassear

RECENT PAPERS



Characterizing and Visualizing Physical World Accessibility at Scale Using Crowdsourcing, Computer Vision, and Machine Learning
Kotaro Hara and Jon E. Froehlich
SIGACCESS Newsletter '15



Supporting Everyday Activities for Persons With Visual Impairments Through Computer Vision-Augmented Touch
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Poster Proceedings of ASSETS '15



MakerShoe: Towards an E-Textile Construction Kit to Support Creativity, Playful Making, and Self-Expression
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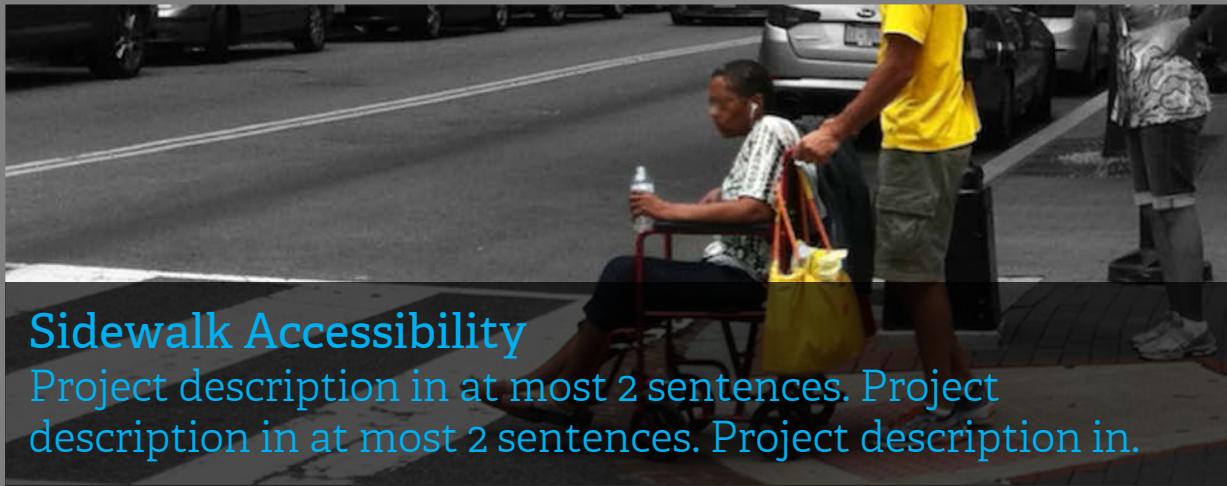


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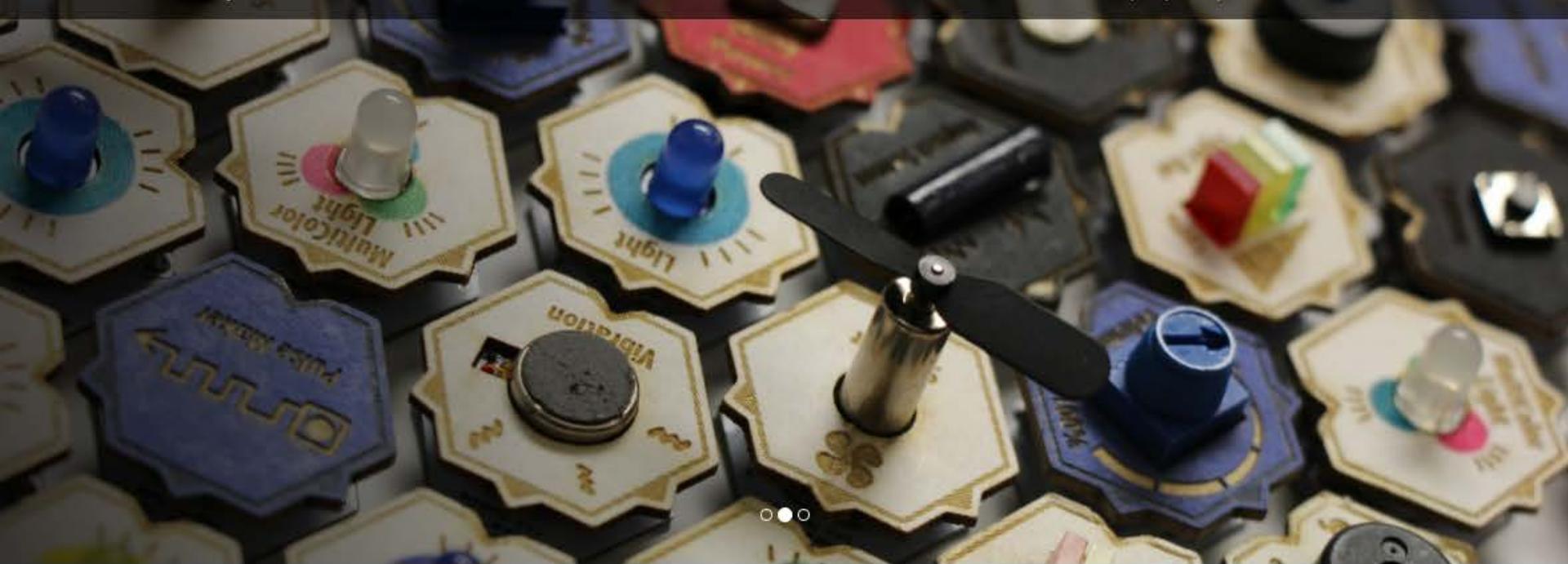
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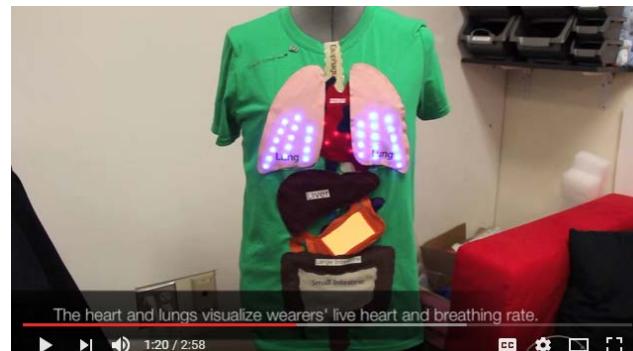
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Recent Videos



Head-Mounted Display Visualizations to Support Sound Awareness for the Deaf and Hard of...

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BodyVis: A New Approach to Body Learning Through Wearable Sensing and Visualization

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Recent Publications



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 Proceedings of IDC 2016



Evaluating Angular Accuracy of Wrist-based Haptic Directional Guidance for Hand Movement

Jonggi Hong Lee Stearns Tony Cheng Jon E. Froehlich David Ross Leah Findlater
 Proceedings of GI 2016

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[YouTube](#) | [Paper](#)



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A video supplement to our TEI 2017 paper "SqueezePulse: Adding Interactive Input to Fabricated Objects Using Corrugated Tubes and Air Pulses"

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Characterizing Street-level Accessibility at Scale

Kotaro Hara's talk on Project Sidewalk at Microsoft Research

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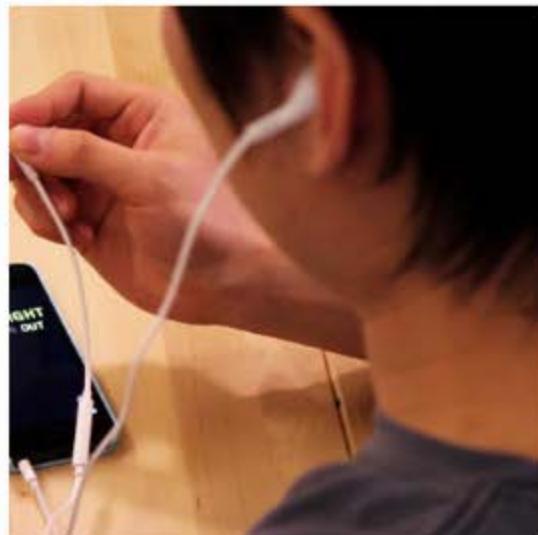


Maker Tools

Recent Projects



SKINTRACK (2016)



SWEEPSENSE (2016)



FINGERPOSE (2015)



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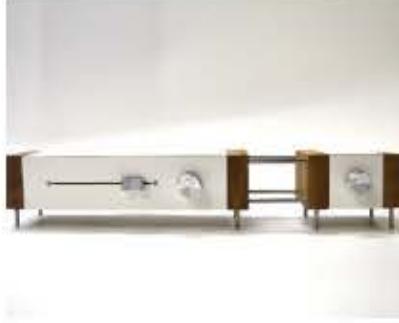


Learning Tools



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Recent Projects



olo (ongoing)
Design



Olly (ongoing)
Design & Field Study



Slow Game (ongoing)
Open Source DIY Kit & Field Study



Photobox
Design & Field Study



Unaware Objects
Design & Field Study



Fenestra
Design & Field Study



Digital Artifacts as Legacy
Design & Field Study



Technology Heirlooms
Design & Field Study



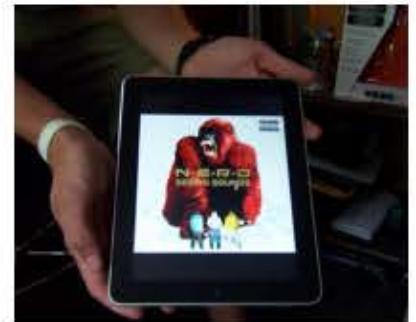
User Enactments



Email Postcards



Long-Term Use of Slow Technology



Qualities of Virtual Possessions

Working in the HCIL Hackerspace

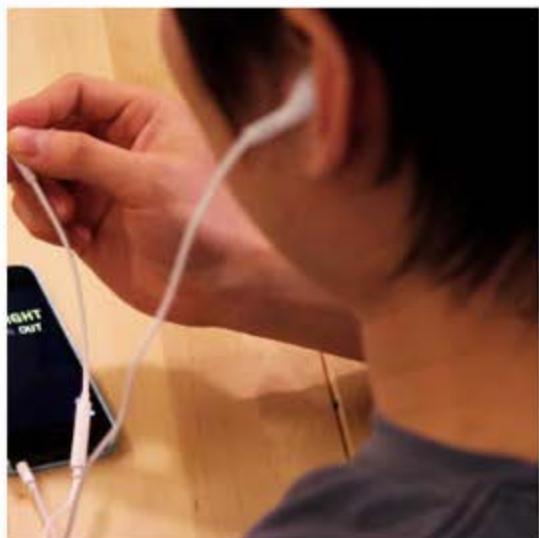
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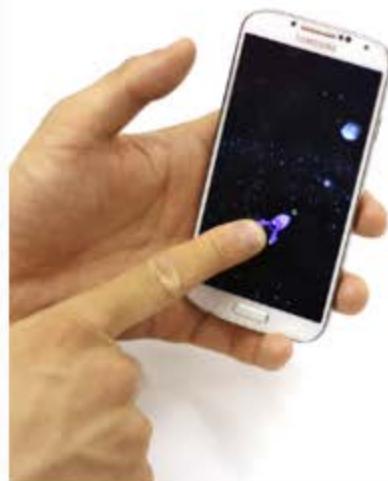
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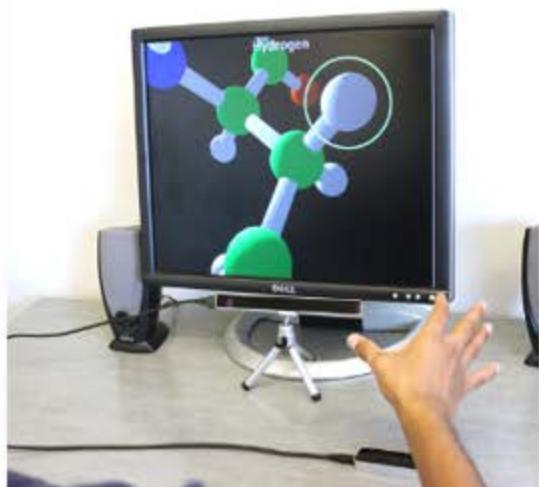
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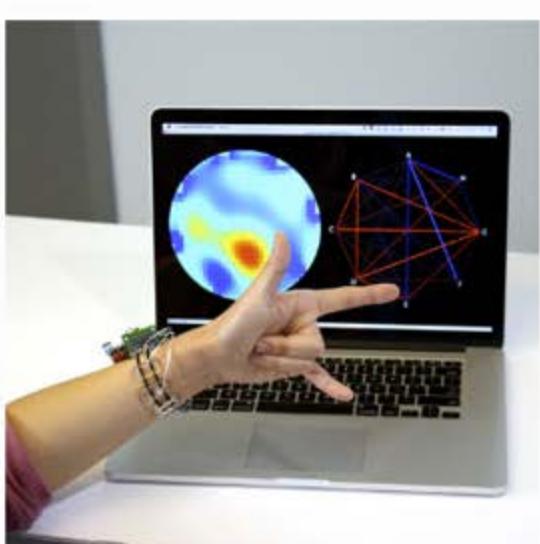
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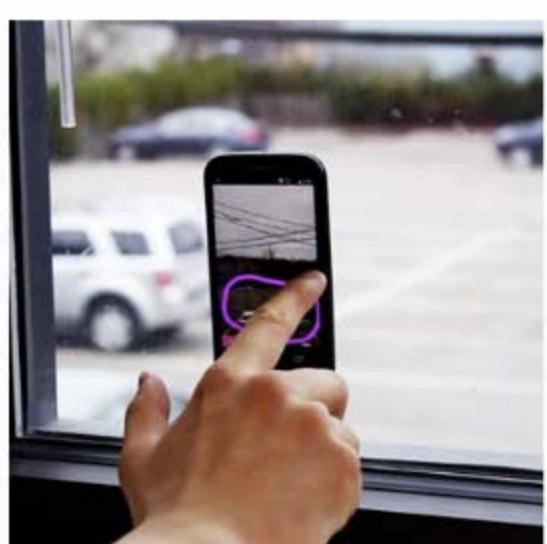
EM-SENSE (2015)



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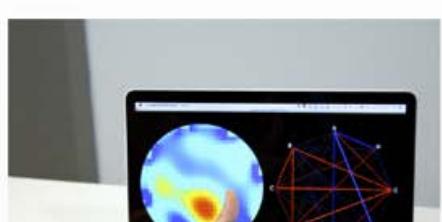
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Recent Projects



olo (ongoing)
Design



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Design & Field Study



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Open Source DIY Kit & Field Study



Photobox
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Fenestra
Design & Field Study



Digital Artifacts as Legacy
Design & Field Study



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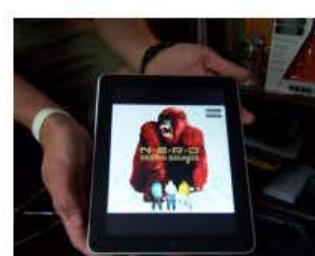
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Email Postcards
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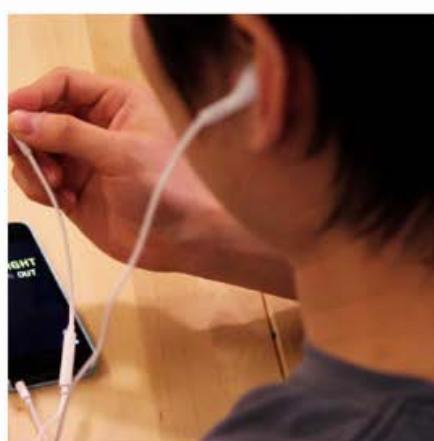
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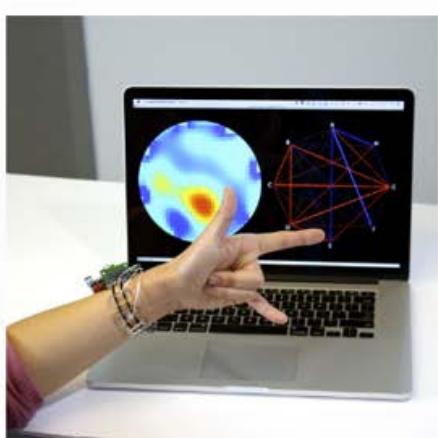
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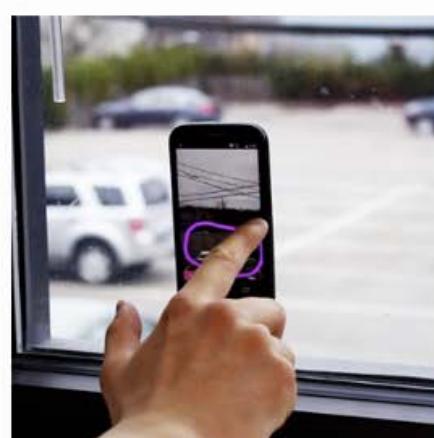
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Exploring Novice Approaches to Smartphone-based Thermographic Energy Auditing: A Field Study

Matthew L Mauriello Manaswi Saha Erica Brown Jon E. Froehlich

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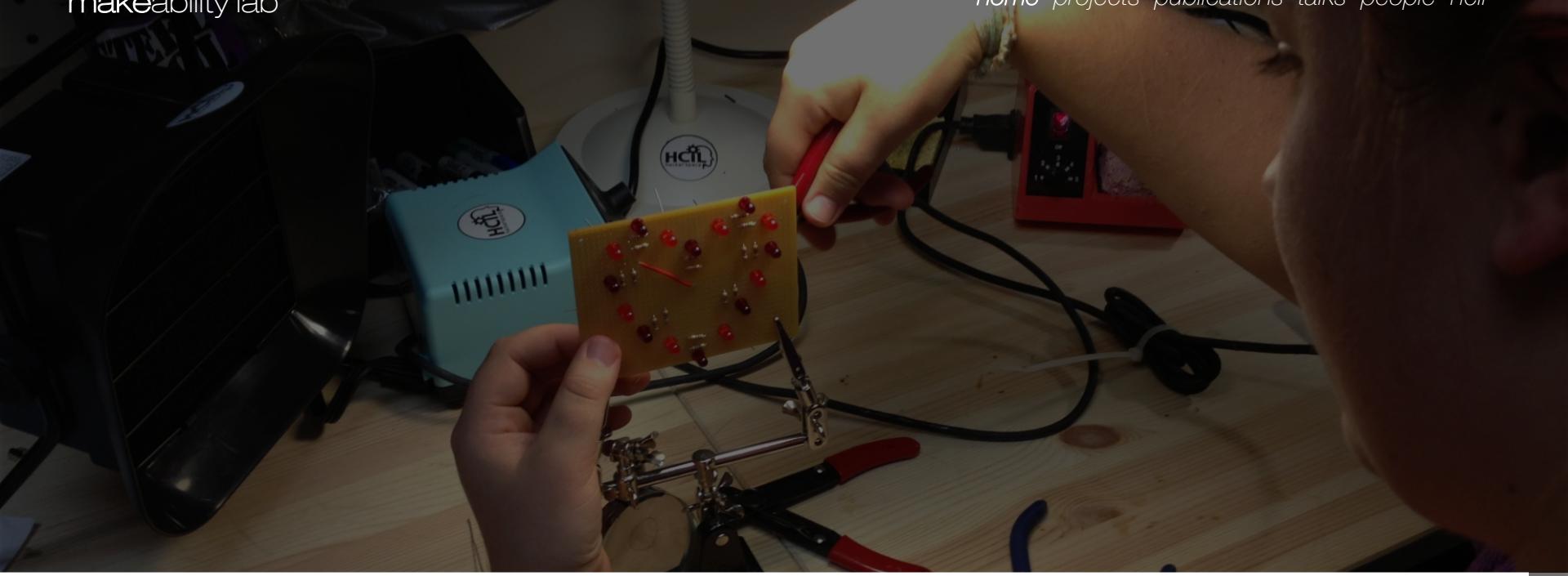
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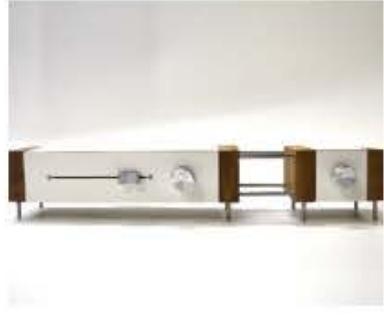


Learning Tools



Maker Tools

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. @person_1123 presenting our latest temporal thermography data collection and analysis poster at #HCIL @makeabilitylab

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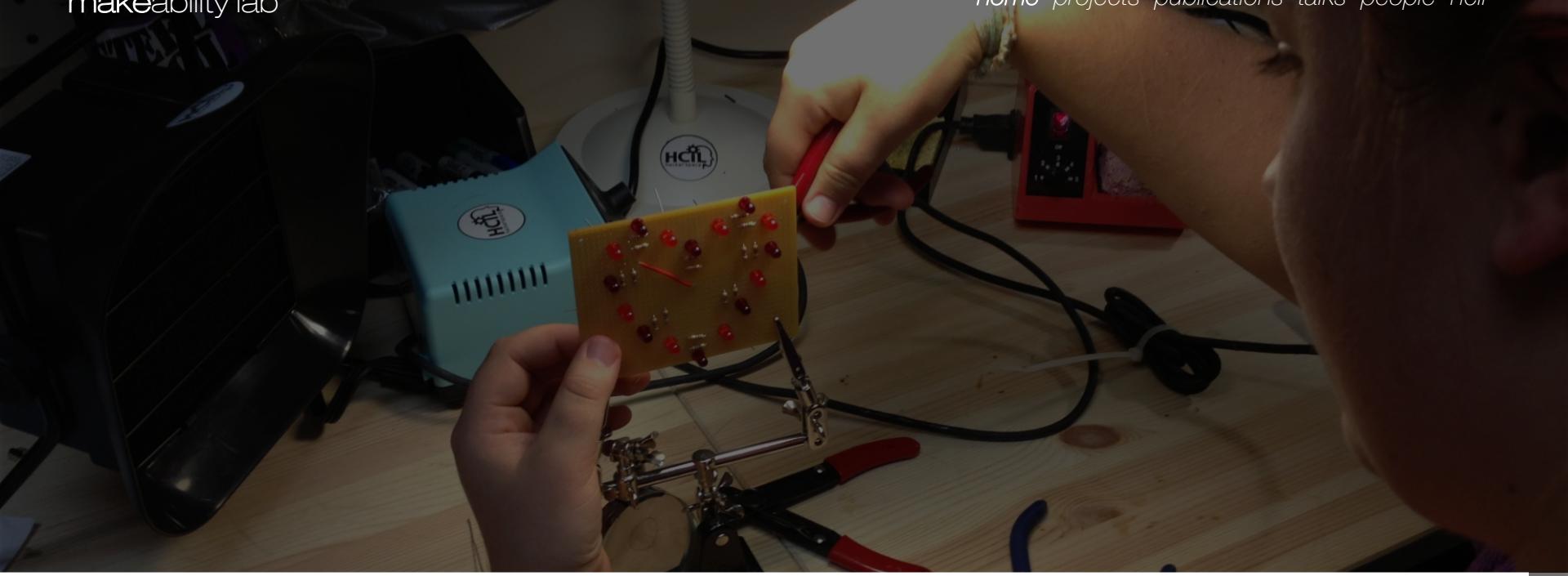
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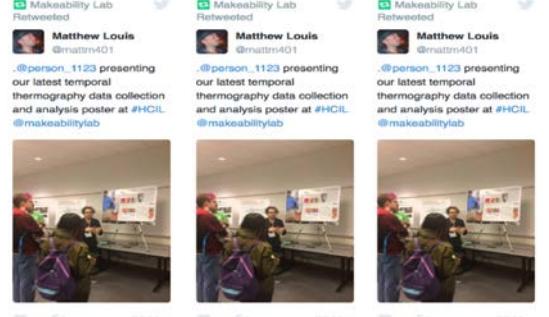
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Apr 12, 2017 | Jon

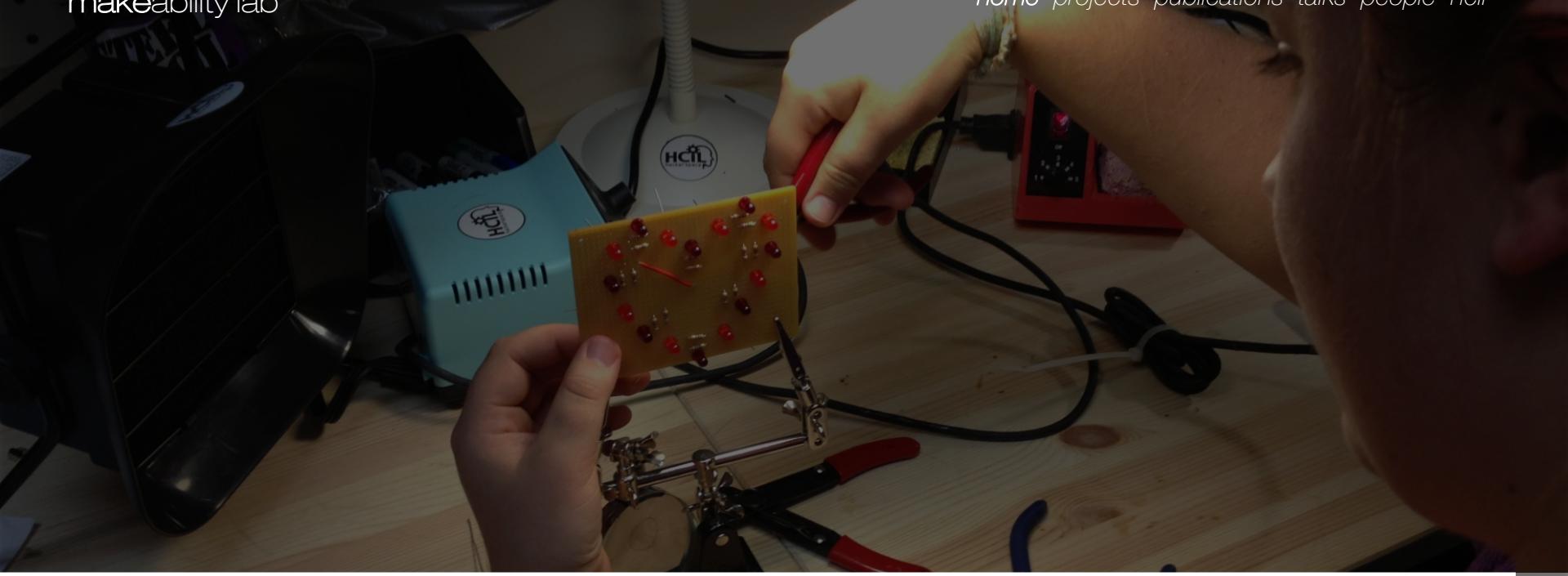
 Matt Mauriello
Selected as All-...
Apr 25, 2017 | Jon

Congratulations to Matt Mauriello who was just selected as an All-S.T.A.R Fellow for his work on scalable thermography—one of sixteen across the entire...

 Froehlich Named Sloan Fellow
Feb 21, 2017 | Jon

Recent Tweets





We are the **Makeability Lab**, dedicated to building and studying interaction technology for a social purpose



Sustainability



Accessibility



Health



Learning Tools



Maker Tools

RECENT PROJECTS

**olo** (ongoing)

Design

**Olly** (ongoing)

Design & Field Study

**Slow Game** (ongoing)

Open Source DIY Kit & Field Study

**Photobox**

Design & Field Study

**Unaware Objects**

Design & Field Study

**Fenestra**

Design & Field Study

**Digital Artifacts as Legacy**

Design & Field Study

**Technology Heirlooms**

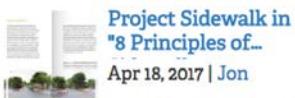
Design & Field Study

Recent News

HandSight
Covered in Terp...

May 16, 2017 | Jon

There is a nice writeup on Lee Stearns' PhD dissertation topic, HandSight, in Terp Magazine this month ([link](#)). The article is entitled *A New...*

Project Sidewalk in
"8 Principles of..."

Apr 18, 2017 | Jon

Project Sidewalk is featured

Makeability Lab at
CHI2017

May 10, 2017 | Jon

The Makeability Lab had five full papers at CHI2017, including MakerWear which received a best paper award and is the first longform paper on my [NSF CAREER...](#)

Join Project
Sidewalk for...

Apr 12, 2017 | Jon

Our research group is

Matt Mauriello
Selected as All...

Apr 25, 2017 | Jon

Congratulations to Matt Mauriello who was just selected as an All-ST.A.R Fellow for his work on scalable thermography—one of sixteen across the entire...



Froehlich Named

Sloan Fellow

Feb 21, 2017 | Jon

I am deeply honored to be

Recent Tweets



William Northcote @WNorthcote

@Support If it was real lolcat speak, the me at the top would say Kitteh instead of me.



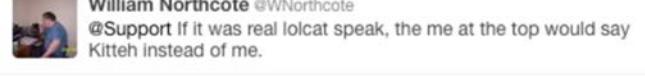
Sandy Guerriere @SandyGuerriere

@Support Thank you for your support. #Twitter #Support is awesome. :-)



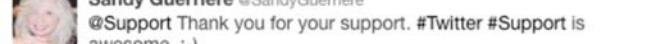
Ayuda y Soporte @ayuda

#ProTip Las Tendencias en Twitter para iPhone y Android dependen de las Tendencias que configures en twitter.com via web.



William Northcote @WNorthcote

@Support If it was real lolcat speak, the me at the top would say Kitteh instead of me.



Sandy Guerriere @SandyGuerriere

@Support Thank you for your support. #Twitter #Support is awesome. :-)

RECENT PROJECTS



HandSight



Touchscreen Accessibility



MakerWear



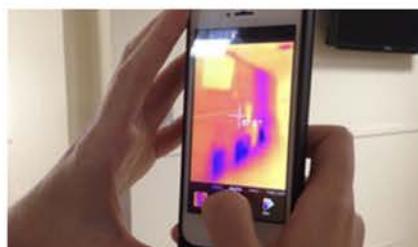
Squeezapulse



Project Sidewalk



BodyVis



Scalable Thermography



GlassEar

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RECENT VIDEOS



MakerWear: A Tangible Approach to Interactive Wearable Creation for Children
YouTube | Paper



Squeezapulse: Adding Interactive Input to Fabricated Objects Using Corrugated Tubes and Air Pulses
YouTube | Paper



BodyVis: A New Approach to Body Learning Through Wearable Sensing and Visualization
YouTube | Paper

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PEOPLE GALLERY MOCKS

PEOPLE

CURRENT MEMBERS

5 PhD, 2 MS, 4 Undergrad



Jon Froehlich
Assistant Professor, CS
University of Maryland



Kotaro Hara
PhD Student, CS
[Sidewalk](#)



Zachary Lawrence
Undergrad, CprE
[Sidewalk](#)



Matt Mauriello
PhD Student, CS
[SFF](#), [Thermography](#)



Ladan Najafizadeh
MS Student, CS
[E-Textiles](#), [Sidewalk](#)



Majeed Kazemitaab
MS Student, CS
[MakerWear](#)



Manaswi Saha
PhD Student, CS
University of Maryland



Lee Stearns
PhD Student, CS
University of Maryland



Liang He
PhD Student, CS
University of Maryland



Seokbin Kang
PhD Student, CS
University of Maryland



Leyla Norooz
PhD Student, iSchool
University of Maryland

ALUMNI



Dhruv Jain
Summer Intern, 2014
[GlassEar](#)



Michael Gubbels
iSchool, MS, 2013-2015
[SFF](#), [Pixel](#)



Victoria Le
Undergrad, CS, 2012-2013
[Sidewalk](#)



Robert Moore
Undergrad, CS, 2012-2013
[Sidewalk](#)



Sean Panella
Undergrad, CS, 2013
[Sidewalk](#)



Sean Panella
High School Intern, 2013
[Sidewalk](#)

COLLABORATORS



David Jacobs
Professor, CS
University of Maryland
[Sidewalk](#)



Leah Findlater
Assistant Prof, iSchool
University of Maryland
[HandSight](#), [Touchscreen Accessibility](#)



Rama Chellappa
Professor, CSE
University of Maryland
[HandSight](#)



Ramani Duraiswami
Professor, CS
University of Maryland
[GlassEar](#)



Christian Volger
Associate Prof, Com Studies
Gallaudet University
[GlassEar](#)



Shiri Azenkot
Assistant Prof, CS
Cornell Tech
[BusStop](#)

PAST COLLABORATORS

Collaborators from > 1 year ago; titles and affiliations are from time of collaboration



Eric Hekler
Assistant Prof, Nutrition & Health
Arizona State University



Pedja Klasnja
Assistant Prof, iSchool
University of Michigan

PEOPLE

CURRENT MEMBERS

5 PhD, 2 MS, 4 Undergrad



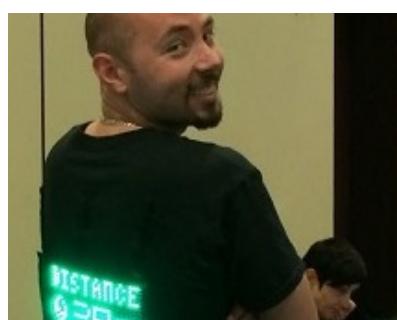
Jon Froehlich
Assistant Professor, CS
University of Maryland



Kotaro Hara
PhD Student, CS
[Sidewalk](#)



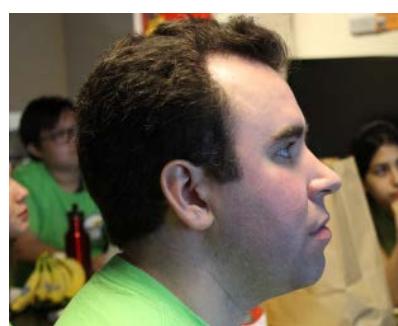
Zachary Lawrence
Undergrad, CprE
[Sidewalk](#)



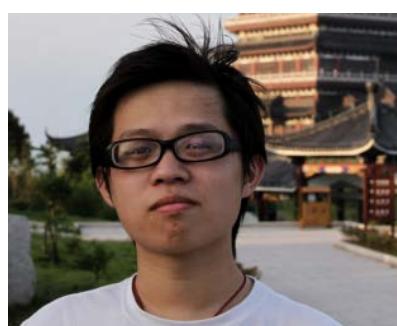
Matt Mauriello
PhD Student, CS
[SFF](#), [Thermography](#)



Manaswi Saha
PhD Student, CS
University of Maryland



Lee Stearns
PhD Student, CS
University of Maryland



Liang He
PhD Student, CS
University of Maryland



Seokbin Kang
PhD Student, CS
University of Maryland



Ladan Najafizadeh
MS Student, CS
[E-Textiles](#), [Sidewalk](#)



Majeed Kazemitaabari
MS Student, CS
[MakerWear](#)



Leyla Norooz
PhD Student, iSchool
University of Maryland

ALUMNI



Dhruv Jain
Summer Intern, 2014
[GlassEar](#)



Michael Gubbel
iSchool, MS, 2013-2015
[SFF](#), [Pixel](#)

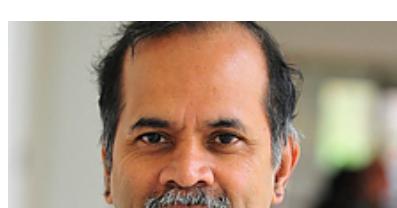


Victoria Le
Undergrad, CS, 2012-2013
[Sidewalk](#)



Robert Moore
Undergrad, CS, 2012-2013
[Sidewalk](#)

COLLABORATORS



PEOPLE

Faculty and Grad Students | Alumni | Collaborators | Past Collaborators

FACULTY AND GRAD STUDENTS

5 PhD, 2 MS, 4 Undergrad



Jon Froehlich

Assistant Professor, CS
University of Maryland



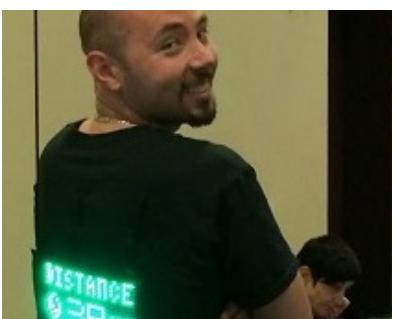
Kotaro Hara

PhD Student, CS
[Sidewalk](#)



Zachary Lawrence

Undergrad, CprE
[Sidewalk](#)



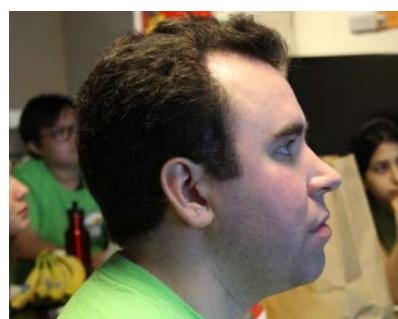
Matt Mauriello

PhD Student, CS
[SFF](#), [Thermography](#)



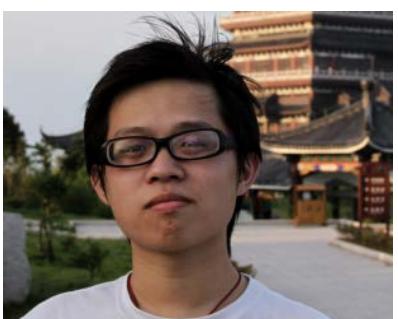
Manaswi Saha

PhD Student, CS
University of Maryland



Lee Stearns

PhD Student, CS
University of Maryland



Liang He

PhD Student, CS
University of Maryland



Seokbin Kang

PhD Student, CS
University of Maryland



Ladan Najafizadeh

MS Student, CS
[E-Textiles](#), [Sidewalk](#)



Majeed Kazemitabaar

MS Student, CS
[MakerWear](#)



Leyla Norooz

PhD Student, iSchool
University of Maryland

ALUMNI



Dhruv Jain

Summer Intern, 2014
[GlassEar](#)



Michael Gubbels

iSchool, MS, 2013-2015
[SFF](#), [Pixel](#)



Victoria Le

Undergrad, CS, 2012-2013
[Sidewalk](#)



Robert Moore

Undergrad, CS, 2012-2013
[Sidewalk](#)

COLLABORATORS



NEWS LISTING

NEWS



[How to Eat If You're Trying to Lose Weight, According to a Dietitian](#)

POPSUGAR - 14 hours ago

Like most people trying to lose weight, I listened to the experts. Instead of eating breakfast, ...



[How to Eat If You're Trying to Lose Weight, According to a Dietitian](#)

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NEWS

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MONTH
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Feb. 2018 (10)
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... (etc)

AUTHOR
Jon Froehlich
Johnsn Kuang
Aileen Zeng
... (etc)

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Displays news
posted within
certain
timeframe (e.g.
24 hours)

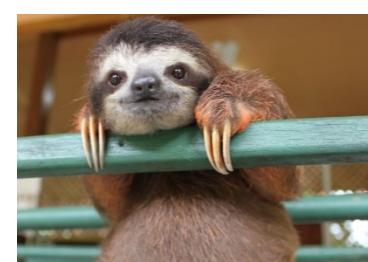
PROJECT
Glass Ear
Sidewalk
Handsight



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Jon Froehlich – 14 hours ago

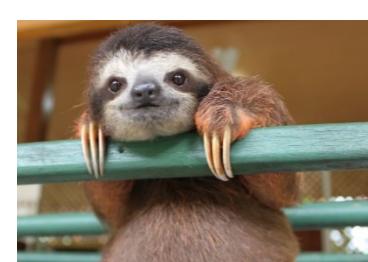
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Jon Froehlich – 14 hours ago

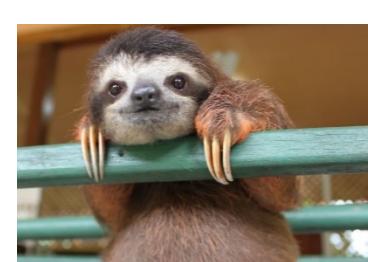
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Jon Froehlich – 14 hours ago

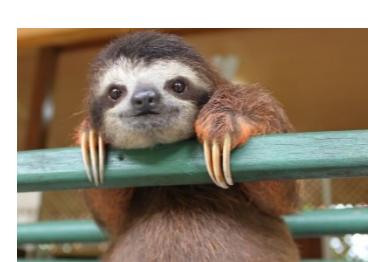
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Jon Froehlich – 14 hours ago

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Year

Pub Type

None

YEAR

2016 (1)

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2013 (10)

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Jon Froehlich – 14 hours ago

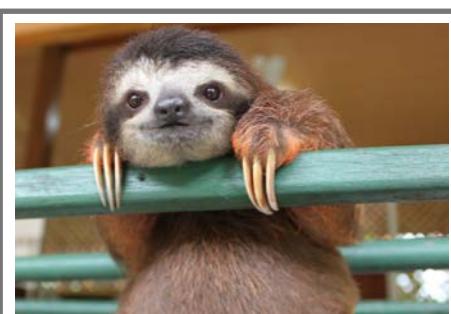
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Jon Froehlich – 14 hours ago

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Jon Froehlich – 14 hours ago

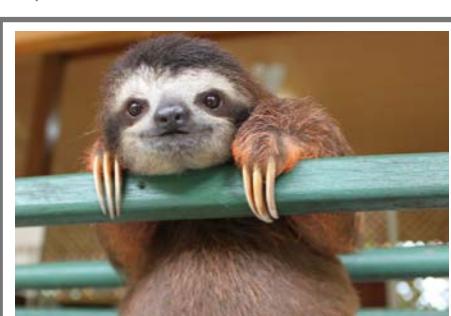
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Jon Froehlich – 14 hours ago

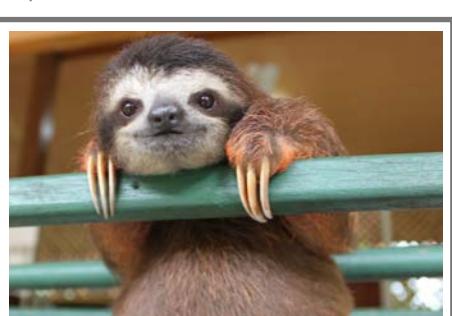
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Jon Froehlich – 14 hours ago

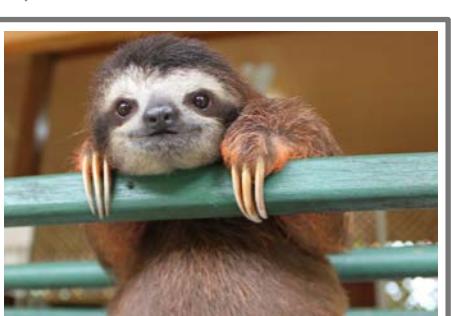
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Jon Froehlich – 14 hours ago

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Filter elements



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14 hours ago **Jon Froehlich**

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14 hours ago **Jon Froehlich**

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14 hours ago **Jon Froehlich**

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14 hours ago **Jon Froehlich**

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JON FROEHLICH



Publications

2016



SharedPhys: Live Physiological Sensing, Whole-Body Interaction, and Large-Screen Visualizations to Support Shared Inquiry Experiences

Seokbin Kang, Leyla Norooz, Vanessa Oguamanam, Angelisa Plane, Tamara L. Clegg, Jon E. Froehlich

Proceedings of IDC 2016

sharedphys, bodyvis, physiological sensing, large-screen displays, mixed-reality, scientific inquiry, collaborative learning, stem, wearables

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The Future Role of Thermography in Human-Building Interaction

Matthew Mauriello, M. Dahlhausen, E. Brown, Manaswi Saha, Jon E. Froehlich

CHI 2016 Workshop: Future of Human-Building Interaction

thermography, human-building interaction, thermal cameras

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Year

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Project

None

YEAR

2016 (5)

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2014 (7)

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Evaluating Angular Accuracy of Wrist-based Haptic Directional Guidance for Hand Movement

Jonggi Hong, Lee Stearns, Tony Cheng, Jon E. Froehlich, David Ross, Leah Findlater

Proceedings of GI 2016

wearables, haptics, non-visual directional guidance, handsight

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ReWear: Early Explorations of a Modular Wearable Construction Kit for Young Children

Majeed Kazemitaabari, Liang He, Katie Wang, Chloe Aloimonos, Tony Cheng, Jon E. Froehlich

CHI '16 Extended Abstracts

construction kits, electronic textiles, e-textiles, wearables, children, making

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The Design of Assistive Location-based Technologies for People with Ambulatory Disabilities: A Formative Study

Kotaro Hara, Christine Chan, Jon E. Froehlich

Proceedings of CHI 2016

accessibility, mobility impairments, formative study, gis, navigation, trip planning

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2015



Characterizing and Visualizing Physical World Accessibility at Scale Using Crowdsourcing, Computer Vision, and Machine Learning

Kotaro Hara, Jon E. Froehlich

SIGACCESS Newsletter '15

crowdsourcing accessibility, computer vision, google street view, amazon mechanical turk, personalized routing, accessibility map visualizations

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Talks

2015



Social Fabrics: Designing Wearable Electronics Textiles for Interaction.
Jon E. Froehlich
May 27, 2015 | College Park, Maryland
[PDF](#) | [PPTX](#)



Making with a Social Purpose
Jon E. Froehlich
March 23, 2015 | Emmanuel College, Cam...
[PDF](#) | [PPTX](#)



Making with a Social Purpose
Jon E. Froehlich
March 17, 2015 | Washington DC
[PDF](#) | [PPTX](#)

JON FROEHLICH

**Jon Froehlich**

Assistant Professor, CS
University of Maryland
Email: jonf@cs.umd.edu
Twitter: [@jonfroehlich](https://twitter.com/jonfroehlich)
<http://www.cs.umd.edu/~jonf>

Publications

2016

[C.13]



SharedPhys: Live Physiological Sensing, Whole-Body Interaction, and Large-Screen Visualizations to Support Shared Inquiry Experiences

Seokbin Kang, Leyla Norooz, Vanessa Oguamanam, Angelisa Plane, Tamara L. Clegg, Jon E. Froehlich

Proceedings of IDC 2016

sharedphys, bodyvis, physiological sensing, large-screen displays, mixed-reality, scientific inquiry, collaborative learning, stem, wearables

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[W.6]



The Future Role of Thermography in Human-Building Interaction

Matthew Mauriello, M. Dahlhausen, E. Brown, Manaswi Saha, Jon E. Froehlich

CHI 2016 Workshop: Future of Human-Building Interaction

thermography, human-building interaction, thermal cameras

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Year
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Project
None

YEAR
2016 (5)
2015 (9)
2014 (7)
2013 (10)
2012 (4)

[C.12]



Evaluating Angular Accuracy of Wrist-based Haptic Directional Guidance for Hand Movement

Jonggi Hong, Lee Stearns, Tony Cheng, Jon E. Froehlich, David Ross, Leah Findlater

Proceedings of GI 2016

wearables, haptics, non-visual directional guidance, handsight

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[O.7]



ReWear: Early Explorations of a Modular Wearable Construction Kit for Young Children

Majeed Kazemtabaari, Liang He, Katie Wang, Chloe Aloimonos, Tony Cheng, Jon E. Froehlich

CHI '16 Extended Abstracts

construction kits, electronic textiles, e-textiles, wearables, children, making

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[C.11]



The Design of Assistive Location-based Technologies for People with Ambulatory Disabilities: A Formative Study

Kotaro Hara, Christine Chan, Jon E. Froehlich

Proceedings of CHI 2016

accessibility, mobility impairments, formative study, gis, navigation, trip planning

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2015

[A.1]



Characterizing and Visualizing Physical World Accessibility at Scale Using Crowdsourcing, Computer Vision, and Machine Learning

Kotaro Hara, Jon E. Froehlich

SIGACCESS Newsletter '15

crowdsourcing accessibility, computer vision, google street view, amazon mechanical turk, personalized routing, accessibility map visualizations

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Talks

2015



Social Fabrics: Designing Wearable Electronics Textiles for Interaction.
Jon E. Froehlich
May 27, 2015 | College Park, Maryland
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Making with a Social Purpose
Jon E. Froehlich
March 23, 2015 | Emmanuel College, Cam...
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Making with a Social Purpose
Jon E. Froehlich
March 17, 2015 | Washington DC
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JON FROEHLICH



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Jon Froehlich

Assistant Professor, CS
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[email](#) [website](#) [github](#) [twitter](#)

Publications

2016

[C.13]

SharedPhys: Live Physiological Sensing, Whole-Body Interaction, and Large-Screen Visualizations to Support Shared Inquiry Experiences

Seokbin Kang, Leyla Norooz, Vanessa Oguamanam, Angelisa Plane, Tamara L. Clegg, Jon E. Froehlich

Proceedings of IDC 2016

sharedphys, bodyvis, physiological sensing, large-screen displays, mixed-reality, scientific inquiry, collaborative learning, stem, wearables

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[W.6]

The Future Role of Thermography in Human-Building Interaction

Matthew Mauriello, M. Dahlhausen, E. Brown, Manaswi Saha, Jon E. Froehlich

CHI 2016 Workshop: Future of Human-Building Interaction

thermography, human-building interaction, thermal cameras

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[C.12]

Evaluating Angular Accuracy of Wrist-based Haptic Directional Guidance for Hand Movement

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wearables, haptics, non-visual directional guidance, handsight

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ReWear: Early Explorations of a Modular Wearable Construction Kit for Young Children

Majeed Kazemitabaar, Liang He, Katie Wang, Chloe Aloimonos, Tony Cheng, Jon E. Froehlich

CHI '16 Extended Abstracts

construction kits, electronic textiles, e-textiles, wearables, children, making

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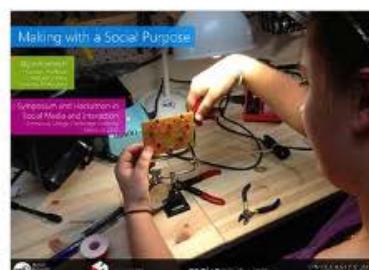
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Social Fabrics: Designing Wearable

Making with a Social Purpose

Making with a Social Purpose

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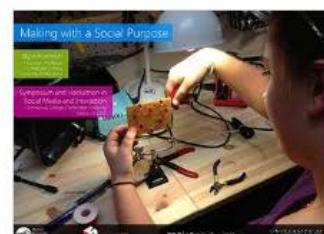
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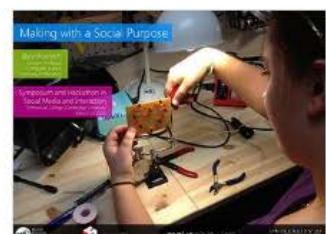
2015



- Social Fabrics: Designing Wearable Electronics Textiles for Interaction.**
Jon E. Froehlich
May 27, 2015 | College Park, Maryland
[PDF](#) | [PPTX](#)



- Making with a Social Purpose**
Jon E. Froehlich
March 23, 2015 | Emmanuel College, Cam...
[PDF](#) | [PPTX](#)



- Making with a Social Purpose**
Jon E. Froehlich
March 17, 2015 | Washington DC
[PDF](#) | [PPTX](#)

2014



Recent News



Kotaro Hara Successfully...
Aug 15, 2016 | Jon E. Froehlich

I am pleased to announce that Kotaro Hara passed his PhD defense this afternoon on "Scalable Methods to Collect and Visualize Sidewalk Accessibility Data for People with Mobility...



BodyVis in 2016 NSF STEM for AL...
May 24, 2016 | Seokbin Kang

We are excited to announce that our research video BodyVis: Advancing New Science Learning and Inquiry Experiences received special recognition as Facilitator's Choice in 2016 NSF Video...



Summer Internship at Adobe Research!
Apr 07, 2016 | Manaswi Saha

I am excited to announce that I will be spending my summer at Adobe Research in San Jose, CA. I will be working in the area of Internet of Things (IoT) in the BigData Experience Lab. Broadly...



Best Late Breaking Work for ReWear
Apr 07, 2016 | Majeed Kaze...

I'm happy to announce that our CHI'16 Late Breaking Work entitled ReWear: Early Explorations of a Modular Wearable Construction Kit for Young Children was just honored...



ACM-W Scholarship to...
Mar 01, 2016 | Manaswi Sa...

I have been awarded ACM-W Scholarship for attending ACM CHI 2016 in May! It's a brilliant scholarship for women in CS when they are starting out in their research career. It gives an...

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TALKS

2015



Social Fabrics: Designing Wearable Electronic Textiles for Interaction, Introspection, & Inquiry
Jon Froehlich, May 28, 2015, HCIL Symposium



Making with a Social Purpose
Jon Froehlich | March 16, 2015 | American University



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Characterizing Physical World Accessibility at Scale Using Crowdsourcing, Computer Vision, and Machine Learning
Jon Froehlich | Oct 29, 2014 | CMU HCII



Making in the HCIL
Jon Froehlich | May 28, 2015 | HCIL Symposium



Making + Health: Social Fabric Fitness
Jon Froehlich | March 16, 2015 | American University



Go Mobile! Designing Accessible Mobile Experiences
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**If you Built It, They Will Come:
Reflecting on the Successes (and
Failures) of Building the HCIL
Hackerspace**
Jon Froehlich | Oct 29, 2014 | CMU HCII

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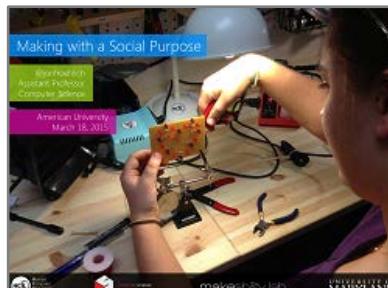
2015

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Talk Type
None

YEAR
2015 (3)
2014 (9)
2013 (11)
2012 (11)
2011 (18)
2010 (13)
2009 (11)
2008 (5)
2007 (5)
2006 (2)
2005 (1)
2004 (1)



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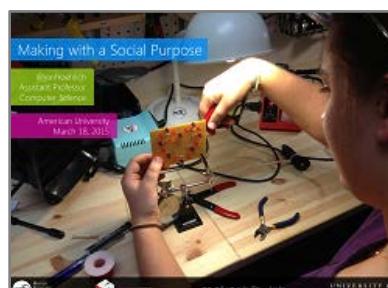


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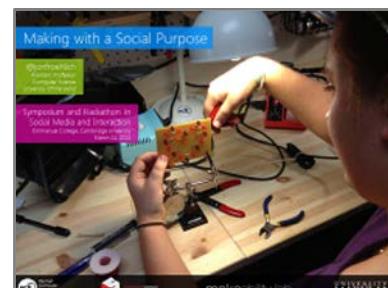
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2016 (1)
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2004 (2)**The Design of Assistive Location-Based Technologies for People With Ambulatory Disabilities: A Formative Study****Kotaro Hara, Christine Chan, Jon E. Froehlich**

Proceedings of CHI 2016 To Appear | Acceptance Rate: 23% (538/2300)

keywords: accessibility, mobility impairments, formative study, gis, navigation, trip planning

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SIGACCESS Newsletter '15

keywords: crowdsourcing accessibility, computer vision, google street view, amazon mechanical turk, personalized routing, accessibility map visualizations

[Download: \[pdf\]](#) [Talk Slides: \[pdf, pptx, slideshare\]](#) [Export: \[Citation\]](#)**Supporting Everyday Activities for Persons With Visual Impairments Through Computer Vision-Augmented Touch****Leah Findlater, Lee Stearns, Ruofei Du, Uran Oh, David Lee, Rama Chellappa, Jon E. Froehlich**

Poster Proceedings of ASSETS 2015

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[Download: \[pdf\]](#) [Export: \[Citation\]](#)**MakerShoe: Towards an E-Textile Construction Kit to Support Creativity, Playful Making, and Self-Expression****Majeed Kazemitaabar, Leyla Norooz, Mona Leigh Guha, Jon E. Froehlich**

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[Download: \[pdf\]](#) [Export: \[Citation\]](#)**"I Like This Shirt": Exploring the Translation of Social Mechanisms in the Virtual World Into Physical Experiences****Ladan Najafizadeh, Seokbin Kang, Jon E. Froehlich**

CHI '15 Extended Abstracts | Acceptance Rate: 45% (240/529)

keywords: tangible social interaction, social fabric, social objects, e-textiles, wearables

[Download: \[pdf\]](#) [Export: \[Citation\]](#)**AtmoSPHERE: Representing Space and Movement Using Sand Traces in an Interactive Zen Garden****Ruofei Du, Kent Wills, Max Potasznik, Jon E. Froehlich**

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IDC '15 Extended Abstracts

keywords: construction kits, electronic textiles, e-textiles, wearables, children, making

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"I Like This Shirt": Exploring the Translation of Social Mechanisms in the Virtual World Into Physical Experiences

Ladan Najafizadeh, Seokbin Kang, **Jon E. Froehlich**

CHI '15 Extended Abstracts | Acceptance Rate: 45% (240/529)

keywords: tangible social interaction, social fabric, social objects, e-textiles, wearables

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Ruofei Du, Kent Wills, Max Potasznik, **Jon E. Froehlich**

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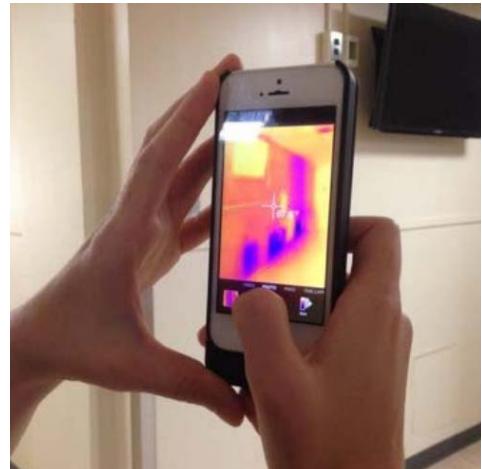
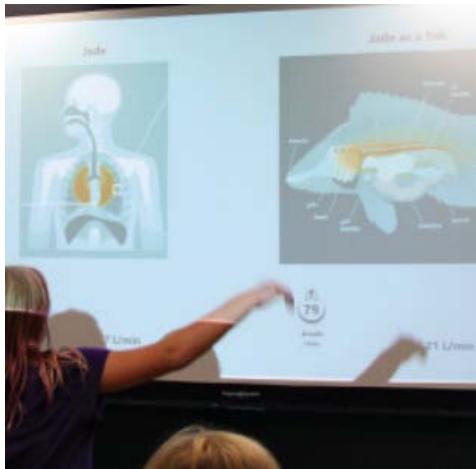
keywords: tangible interactive art, xy servo table, sand drawings, zen gardens, calm technology, physical computing

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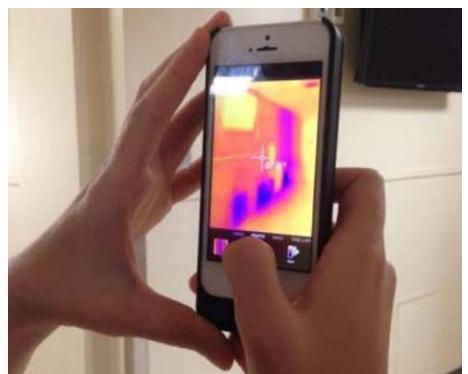
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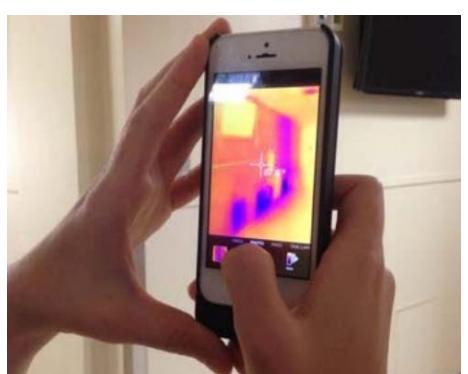
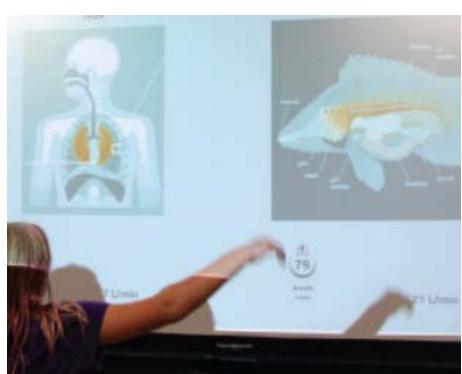
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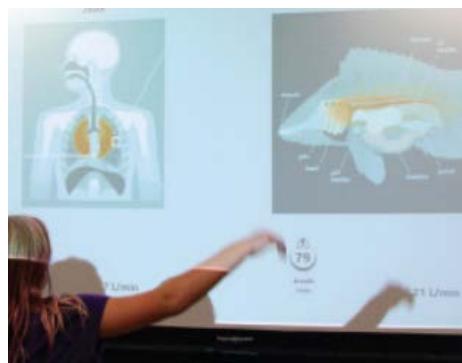
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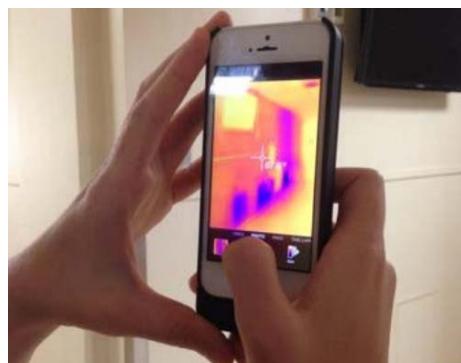
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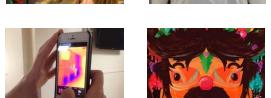
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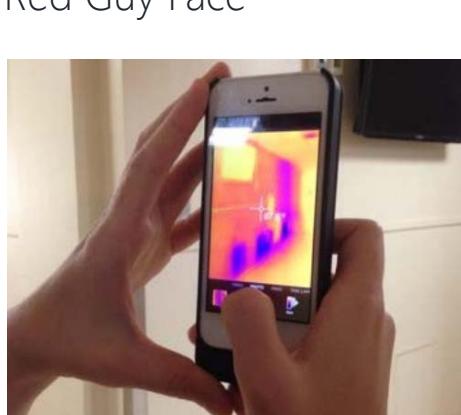
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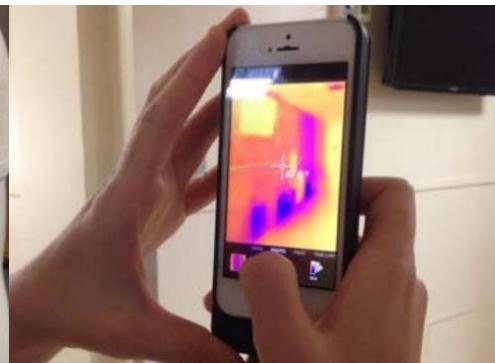
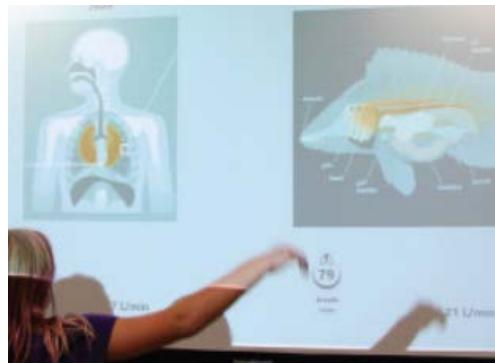
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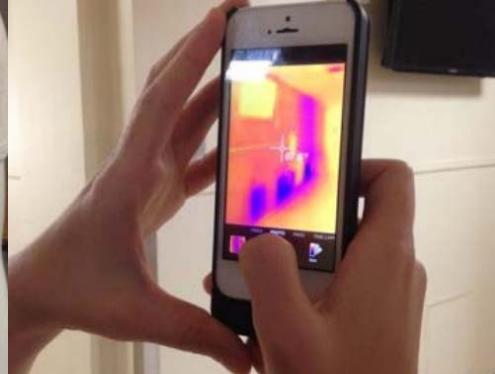
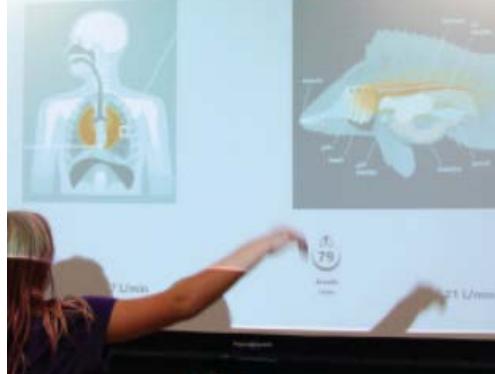
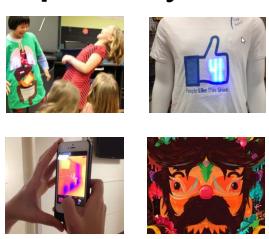
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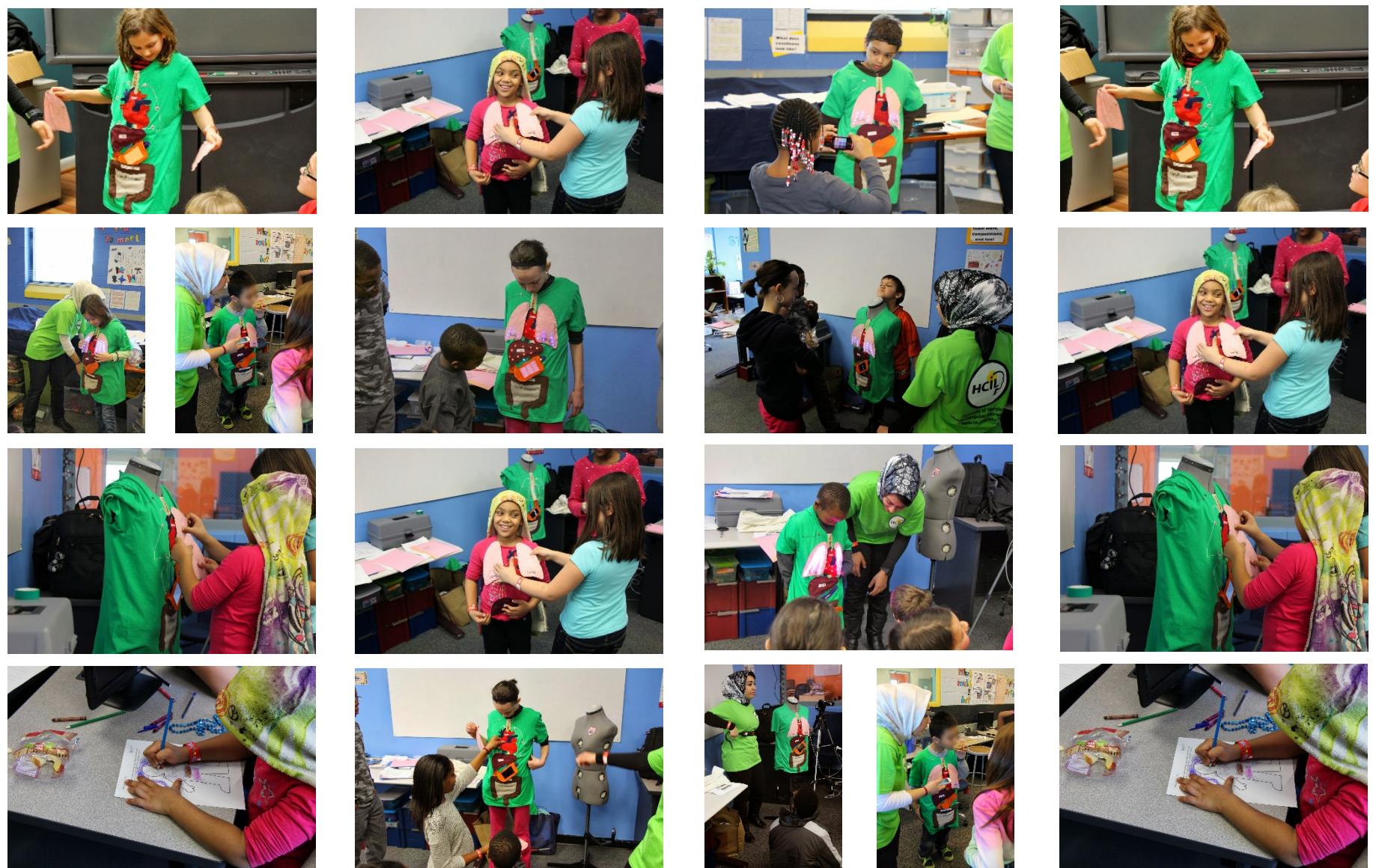
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BODYVIS

Some statement about [BodyVis](#) that is awesome and fun to read and makes me excited! Yah! This is fun!

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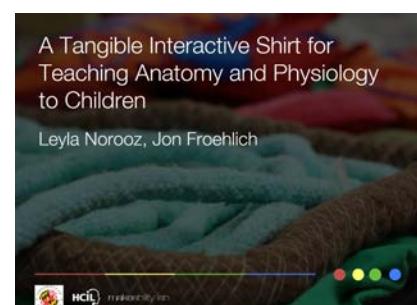
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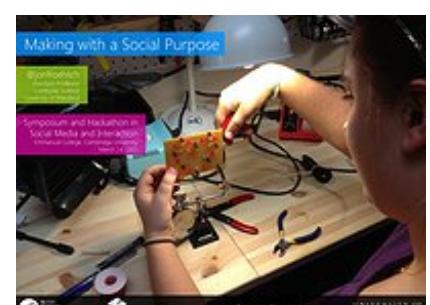
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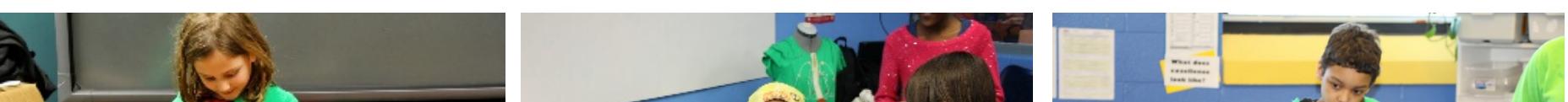


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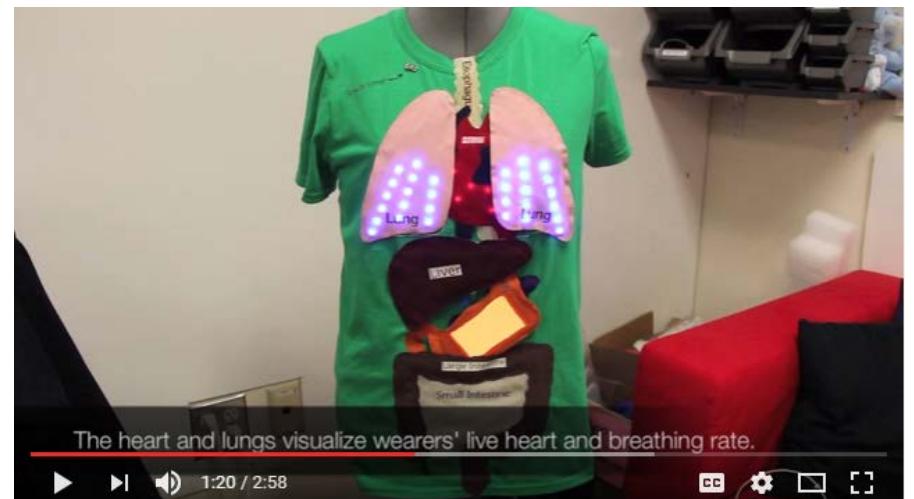
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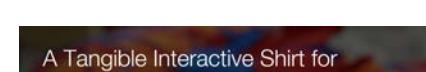


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PIs: Dr. Froehlich (PI) and Tamara Clegg (co-PI)

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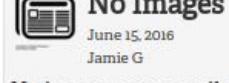


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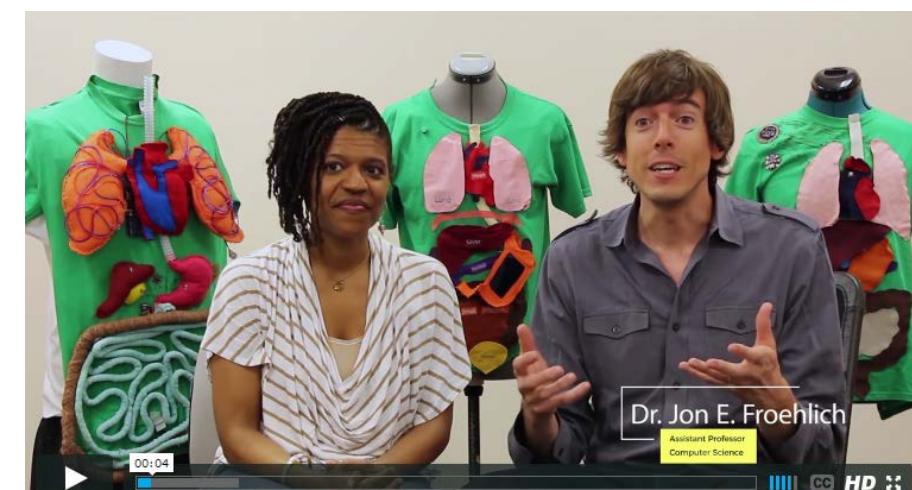


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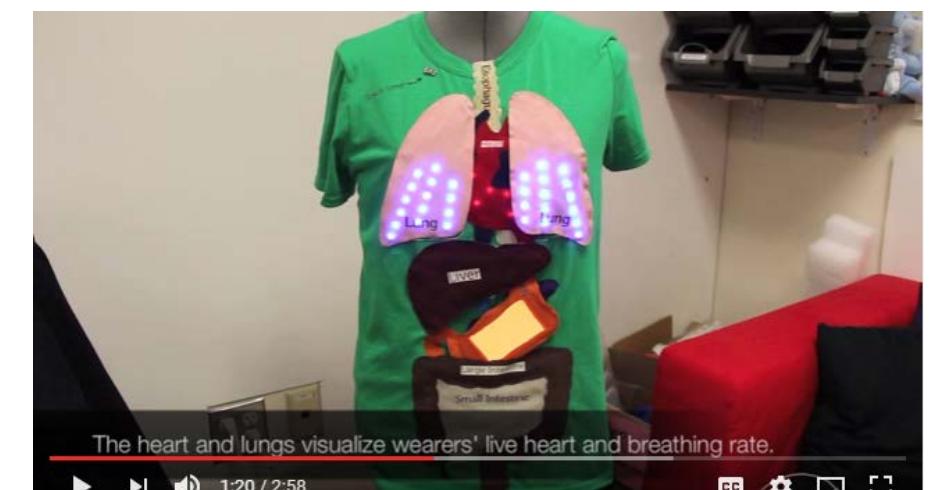


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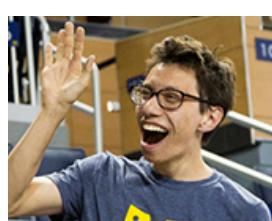
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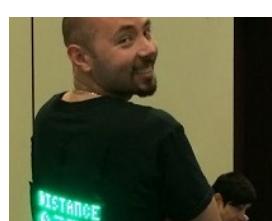
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PIs: Dr. Froehlich (PI) and Tamara Clegg (co-PI)

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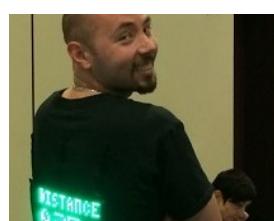
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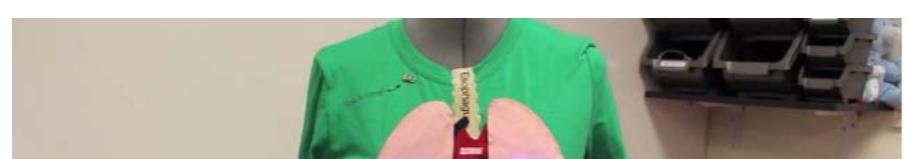
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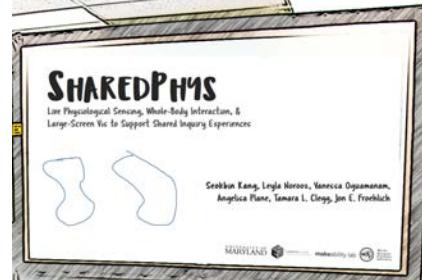
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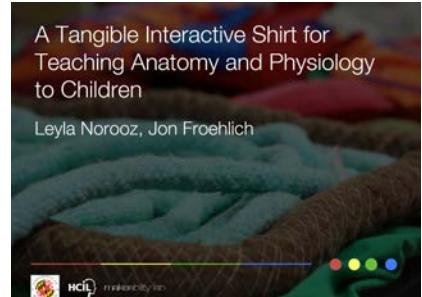
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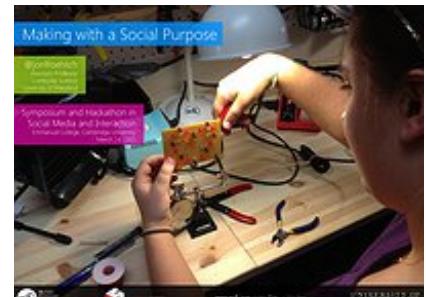


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Leyla Norooz, Jon Froehlich



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