

SOCIAL FABRICS

DESIGNING WEARABLE ELECTRONIC TEXTILES
FOR INTERACTION, INTROSPECTION, AND INQUIRY

@jonfroehlich

Assistant Professor, Computer Science
University of Maryland

Under Armour

Aug 10, 2016



COMPUTER SCIENCE
UNIVERSITY OF MARYLAND

makeability lab

UNIVERSITY OF
MARYLAND

A white t-shirt is centered against a solid black background. The t-shirt features a large, bold, black graphic on its chest. The graphic consists of the words 'SOCIAL' and 'FABRICS' in a heavy, blocky, sans-serif font. The letters have a distressed, textured appearance with white speckles and a thin white outline. Below the main title, there is a smaller line of text in a clean, black, sans-serif font.

SOCIAL FABRICS

**DESIGNING WEARABLE ELECTRONIC TEXTILES
FOR INTERACTION, INTROSPECTION, AND INQUIRY**



WHAT ARE? ELECTRONIC TEXTILES

E-textiles are **textiles** with **embedded electronics**/digital components (including small computers)

WRECKING CREW ORCHESTRA



Source: <http://youtu.be/6ydeY0tTtF4>

WRECKING CREW ORCHESTRA



The Printing Dress

Asta Roseway
Microsoft Research



CARRIE UNDERWOOD'S DRESS

2013 GRAMMY AWARDS

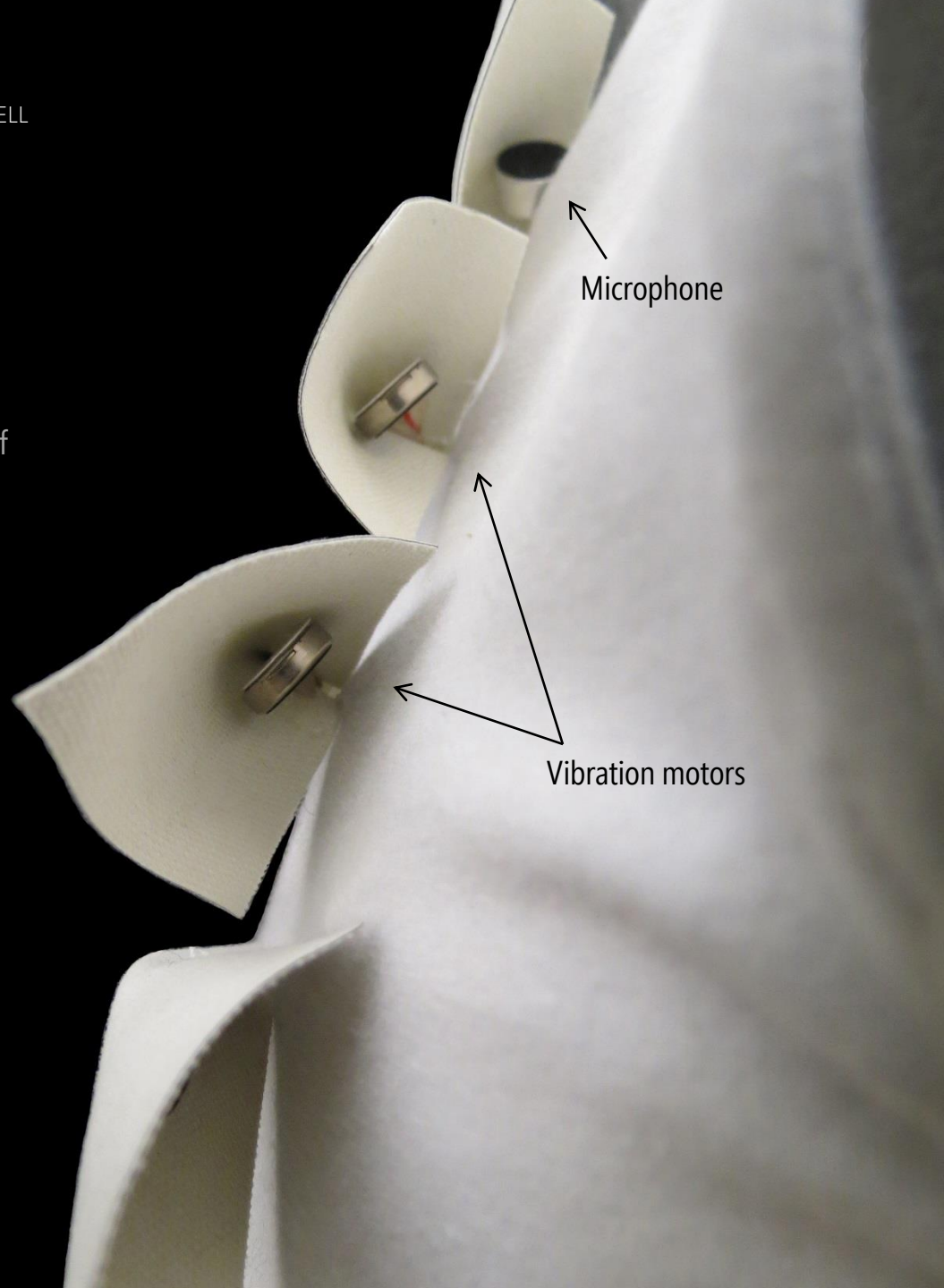


FLUTTER

DESIGNERS: HALLEY PROFITA, NICHOLAS FARROW,, NIKOLAUS CORRELL



Flutters in
direction of
sound



Microphone

Vibration motors

ELECTRO-MECHANICAL DRESS

DESIGNER: HUSSEIN CHALAYAN



Source: <https://youtu.be/wXaONmuCgWE>

INTERACTIVE WALL HANGING

DESIGNERS: JIE QI & JOHN CLIFFORD



HOW CAN E-TEXTILES BE USED TO SUPPORT:

- **LEARNING**
- **SOCIAL INTERACTIONS**
- **HEALTH & WELLNESS**
- **ACTIVITY TRACKING**
- **PLAY**
- **INTROSPECTION**
- **PERSONAL EXPRESSION**

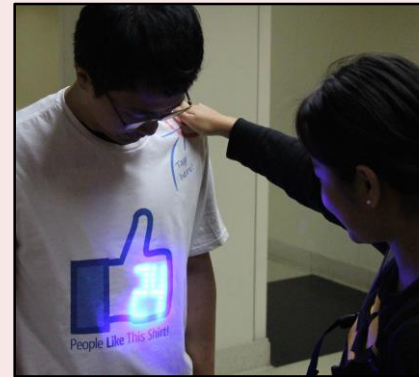
3 BRIEF EXAMPLES



**SOCIAL FABRIC
FITNESS**



BODYVIS



ILIKETHISSHIRT

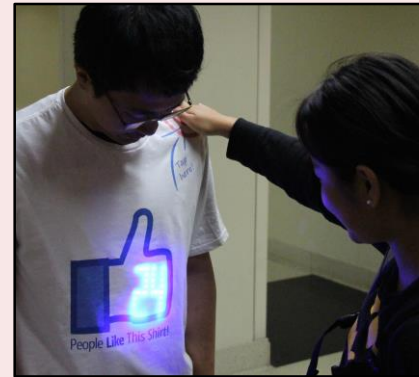
3 BRIEF EXAMPLES



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ORIGINAL FITBIT



SPORTS WATCH

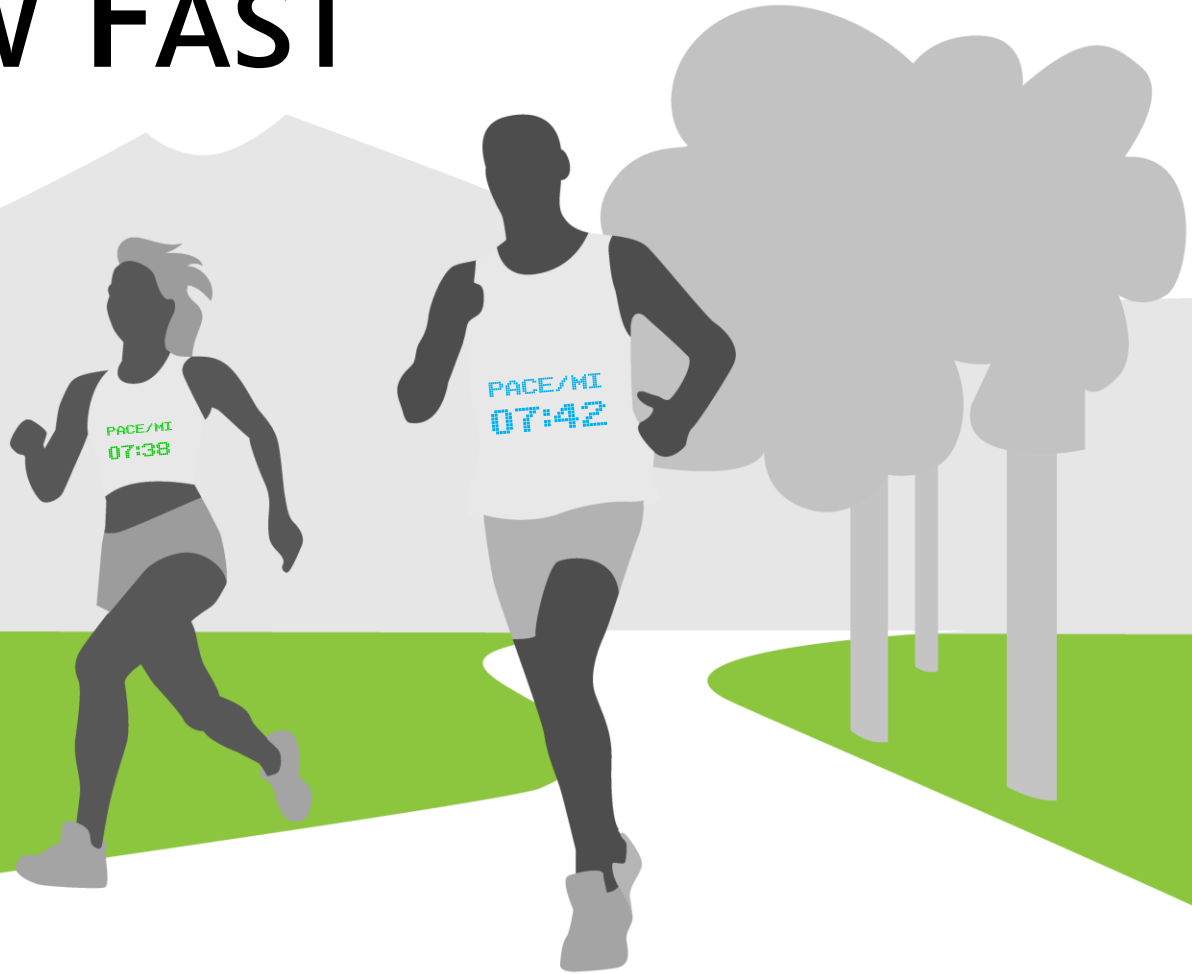


SMARTPHONE APP

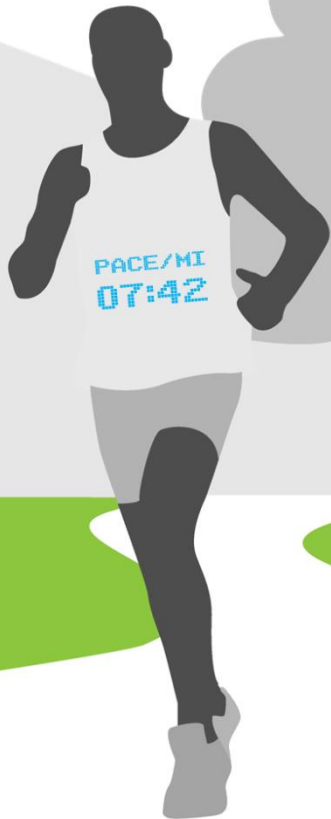


We wanted to **flip** this on its **head**...

WHAT IF OUR CLOTHES COULD SHOW HOW FAST WE RUN?



Social Fabric Fitness

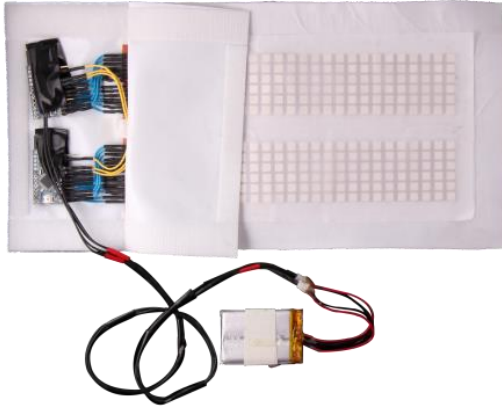


HOW WOULD A SEMI-PUBLIC DISPLAY CHANGE THE **EXPERIENCE OF RUNNING?**

WOULD RUNNERS FEEL **STRESS OR ADDITIONAL **MOTIVATION**?**

COULD THE DISPLAYS BE USED TO SUPPORT **RACES OR IN **RUNNING GROUPS**?**

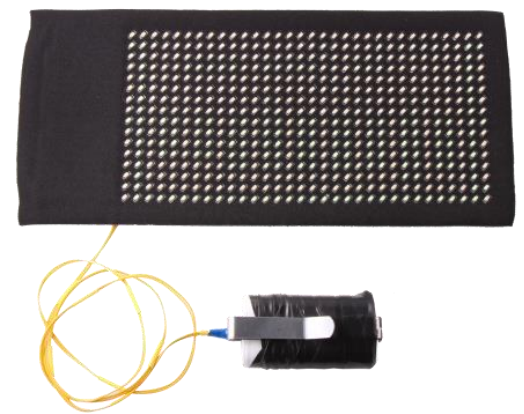
SFF: THREE PROTOTYPES



Prototype#1



Prototype#2

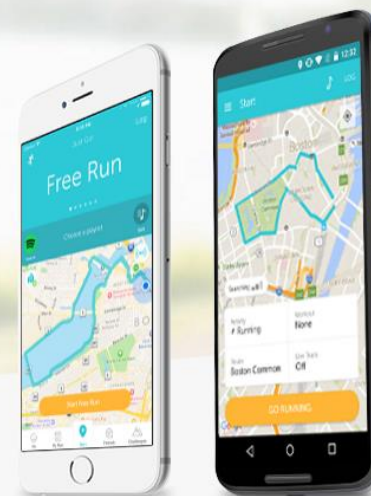


Prototype#3

We created **three flexible prototypes**, which differed in display technology, resolution, viewability, weight

Everyone. Every run.

Join the running community that helps people get out the door and stick with running forever.

[Sign Up for Free](#)[Learn More](#)

45 million runners strong

Welcome to the community!



Jordan, 24
Waterlooville, U.K.

"I love that I can look through my Runkeeper app to see the progress I have made."



Kaylyn, 26
Cambridge, MA

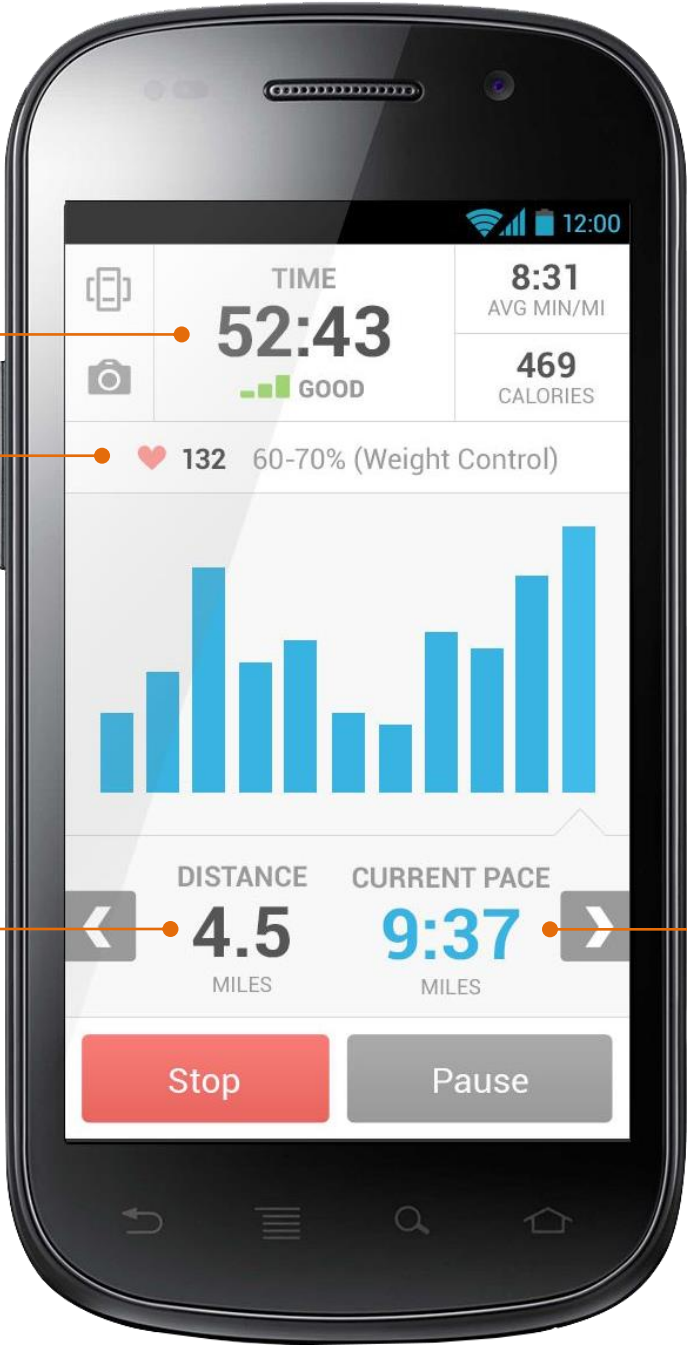
"I love how user friendly Runkeeper is. From training plans to workouts, it makes organizing my runs a breeze."



Derek, 45
Lexington, VA

"Runkeeper helps me set and reach my goals, motivating me to stay ahead of my family history of poor health."

SFF: DATA



Total Run Time

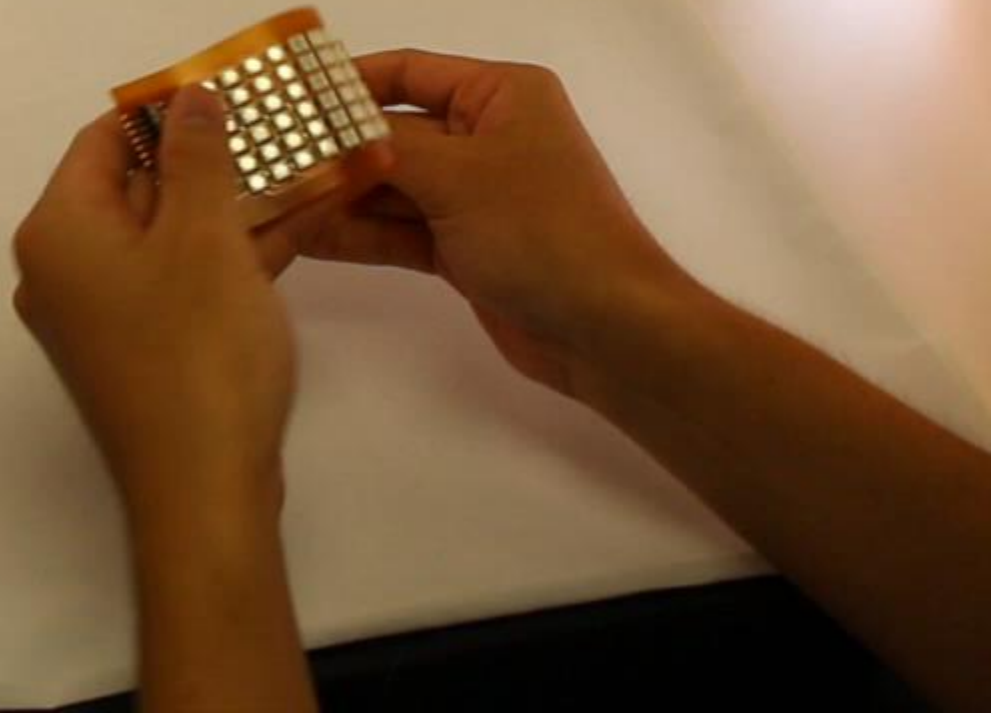
Heart Rate

Total Run Distance

Current Running Pace

Prototype #1

Flexible PCB



Prototype #2

e-Ink Display



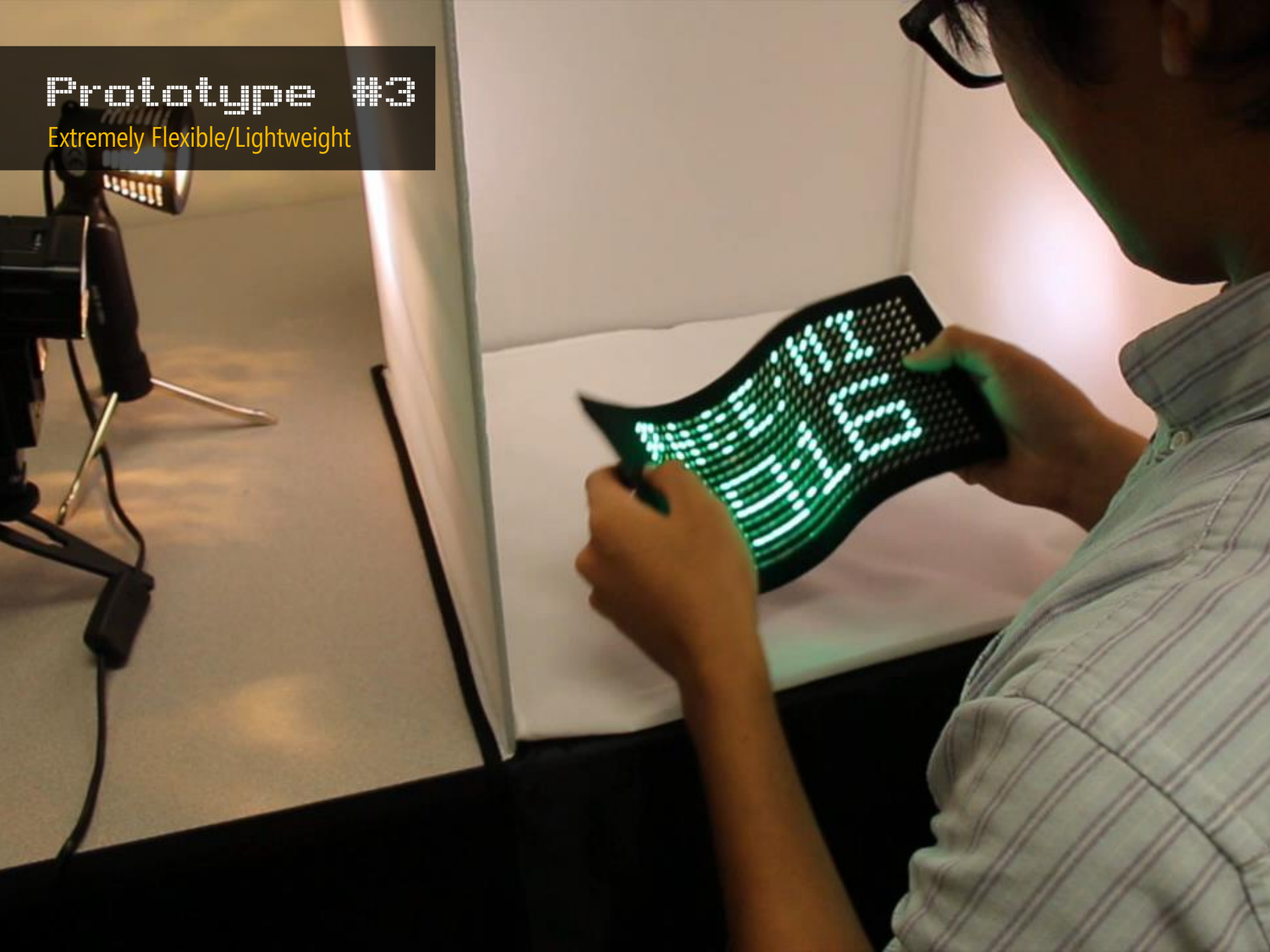
Prototype #3

Worked with Alpha Hardware from Erogear



Prototype #3

Extremely Flexible/Lightweight



Pilot Studies

Ran ~10 pilots with displays



Pilot Studies

Prototypes 1 & 2



Prototype #1

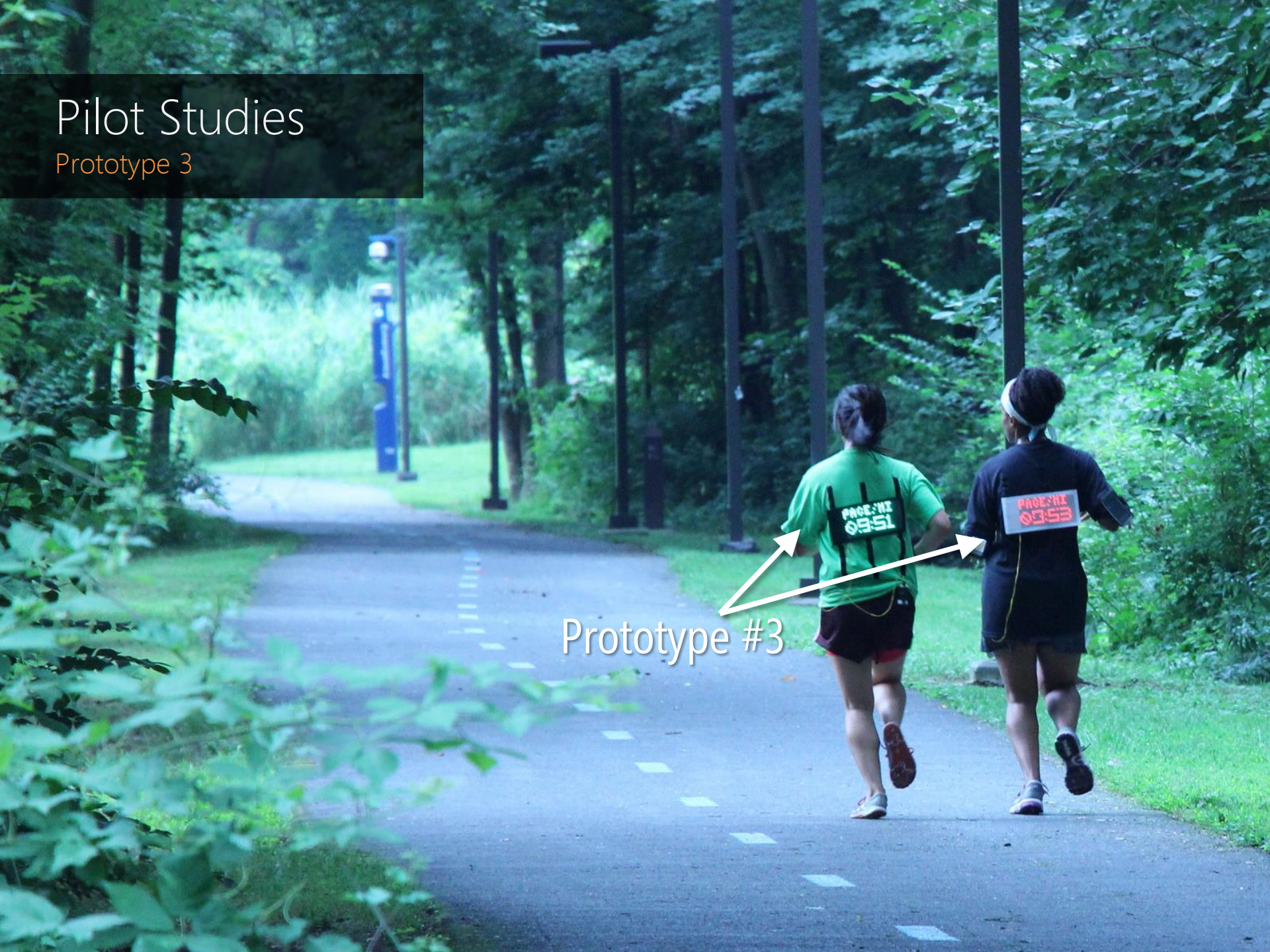


Prototype #2

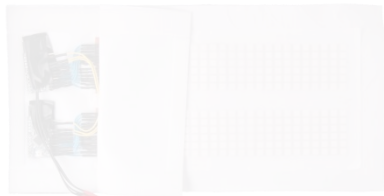
Pilot Studies

Prototype 3

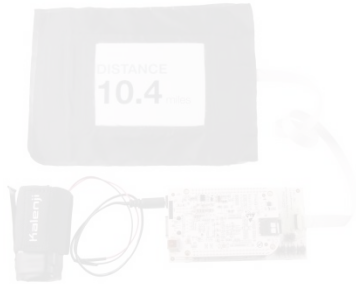
Prototype #3



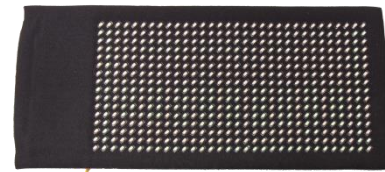
SFF: PROTOTYPE #3 PERFORMED BEST IN PILOTS



Prototype#1

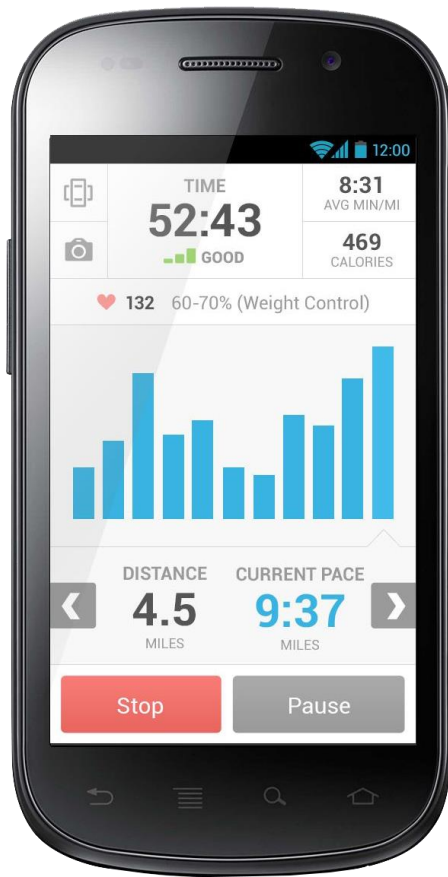


Prototype#2



Prototype#3

SFF: FINAL VISUALIZATIONS



Social Goal

Goal-based Visualization for Group



STUDY I: EXISTING RUNNING GROUPS

10 GROUPS; 52 INDIVIDUALS (35 FEMALE)



Avg Group Size:

5

Avg Age:

40.7

Avg Target Pace:

10:14

Avg Distance:

3.5 mi

STUDY II: RACE DEPLOYMENTS

4 INDIVIDUALS (1 FEMALE)



Male, 34

Target Pace: 6:10

County 8K



Female, 33

Target Pace: 8:20

County 8K



Male, 26

Target Pace: 7:45

Labor Day 10K



Male, 18

Target Pace: 8:30

Labor Day 10K

Race Deployment

Competitive Interactions





FIELD STUDY RESULTS

DATA AWARENESS; ALL (N=52)

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

-G2P2-W





FIELD STUDY RESULTS

MOTIVATION; ALL (N=52)

"Made me feel like I was pushing my efforts, which is good."

-G7P8

"Motivated me to go faster than the pace displayed."

-G7P7

Gold Medal





RACE STUDY RESULTS

MOTIVATION; WEARERS (N=4)

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

-R2P1-W

Potential Dichotomy

Increased motivation
vs. increased anxiety

SFF Externalizes
Performance



NEW EROGEAR FOS DISPLAY



Source: <http://www.erogear.com/>

3 BRIEF EXAMPLES



**SOCIAL FABRIC
FITNESS**



BODYVIS



ILIKETHISSHIRT

3 BRIEF EXAMPLES



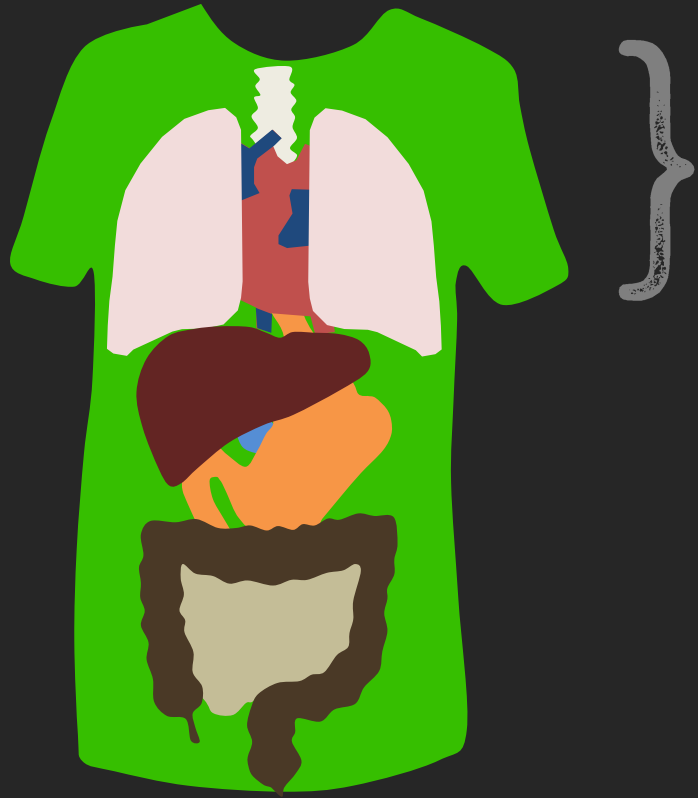
**SOCIAL FABRIC
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BODYVIS



ILIKETHISSHIRT



**WHAT IF OUR CLOTHES
REVEALED HOW OUR
BODY'S FUNCTIONED?**

**HOW COULD THIS CHANGE
THE WAY CHILDREN LEARN
ABOUT AND UNDERSTAND
THEIR BODIES?**

**COULD A T-SHIRT BE A
PLATFORM FOR
EXPERIMENTATION AND
INQUIRY**

"Does my heart beat faster when running *vs.* reading a book? Why?"

"How does my breathing rate compare to my classmate's and why may this be?"

"How does food travel through my body?"



The heart and lungs visualize wearers' live heart and breathing rate.

3 BRIEF EXAMPLES



**SOCIAL FABRIC
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BODYVIS



ILIKETHISSHIRT

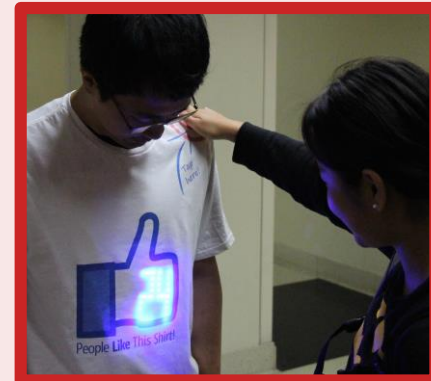
3 BRIEF EXAMPLES



**SOCIAL FABRIC
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BODYVIS



ILIKETHISSHIRT



Jon Froehlich
Edit Profile

- News Feed
- Messages 20+
- Events 1

GROUPS

- Arts District Hyatts... 20+
- REU-Combinatorial ... 4
- Workshop on Incon... 6
- CHI2015 in Seoul 20+
- Personal Informatics 13
- NSF CISE 2012 C... 14
- dorkbot seattle 20+
- Mobile Living Labs'...
- Manage Your Groups
- Create Group
- Find New Groups

FRIENDS

- Washington, Distric... 16
- University of Washi...
- University of Califo...
- HCIL, UMCP
- Microsoft Research
- Intel Research
- Intel Research

Update Status

Add Photos/Video

What's on your mind?



Sarita Yardi Schoenebeck

1 hr · 🌐

Reposted my anonymous prof yaks on the UW campus and they were all immediately downvoted. I guess UW students don't want faculty in their Yik Yak. I blame [James Fogarty](#)

Like · Comment

James Fogarty, Julie Kientz, Meredith Ringel Morris and 9 others like this.



James Fogarty Maybe they just don't like reposts?

1 hr · Like · 2



Sarita Yardi Schoenebeck Well one of them called me a liar before it was downvoted. A skeptical bunch!

1 hr · Like · 2



Julie Kientz Well, if you were claiming to be a UW prof they weren't wrong... Maybe they could smell the wolverine blood in your post 😊

1 hr · Like · 4



June Ahn

3 hrs · Twitter · 👤

Excited to give my featured talk at [#NSTA14](#) about [@I_UMD](#) work in informal science learning. Come by at 12:30: <http://t.co/soE5VsLDff>



National Science Teachers Association

1 event invite

[Amanda Marisa Williams](#) and 1 other

TRENDING

- Michael Dukakis:** Former presidential candidate testifies for defendant in trial linked to Boston Marathon bombing
- Selena Gomez:** Boom! Selena Gomez Puts Her Grown-Up Haters In Their Place
- Apple Inc.:** Company unveils thinner iPads, new Mac operating system and 'Retina 5K' high-res display at live event

See More

English (US) · Privacy · Terms · Cookies

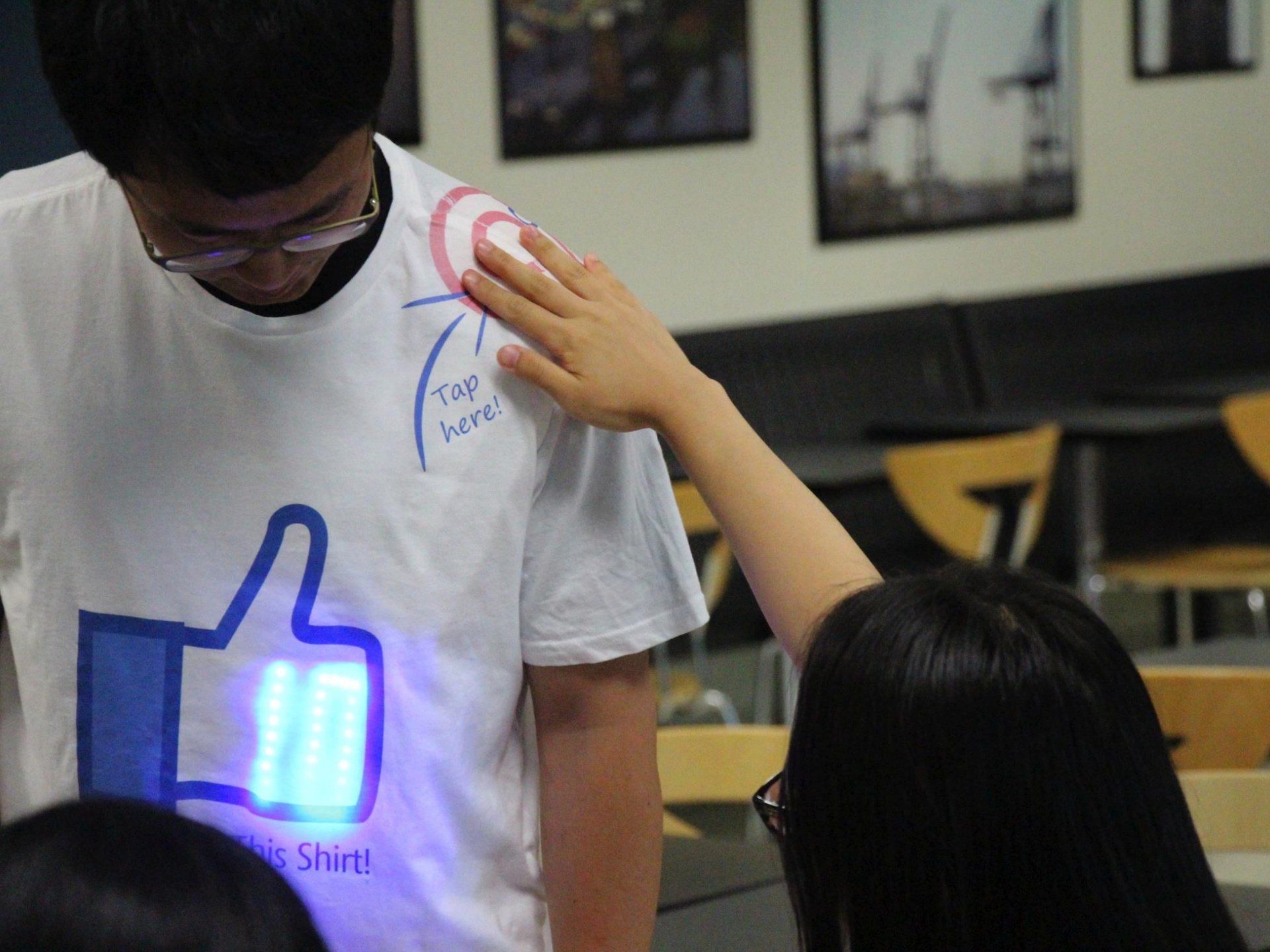
Facebook © 2014



HOW CAN WE
TRANSLATE THESE
LIGHTWEIGHT SOCIAL
INTERACTIONS INTO
THE **PHYSICAL**
WORLD?

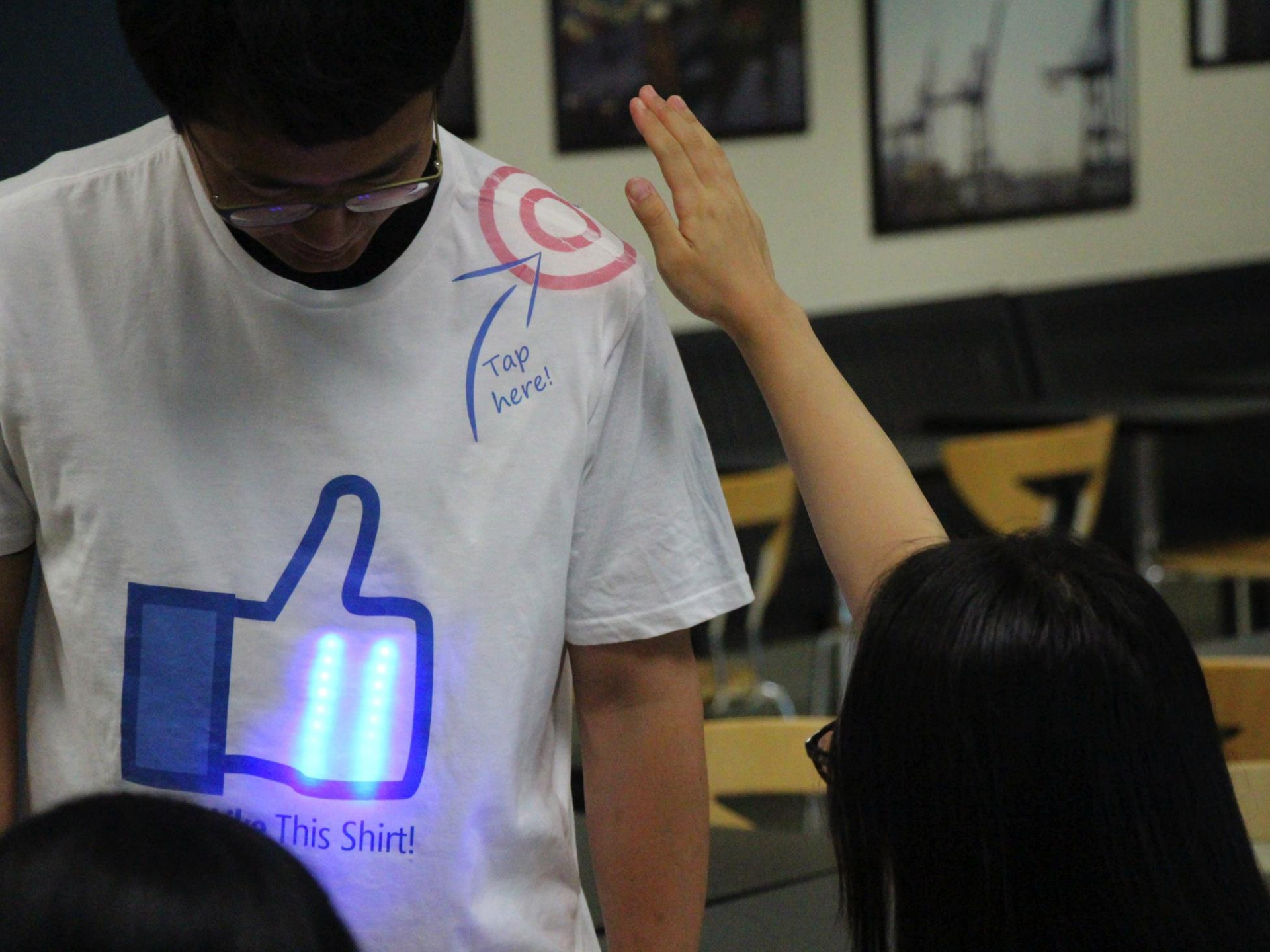
WHAT DOES IT MEAN
TO **IMBUE** EVERYDAY
OBJECTS WITH
SOCIAL HISTORIES?

HOW DOES IT AFFECT
HOW WE INTERACT?



Tap
here!

his Shirt!





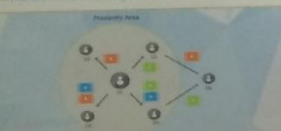
es: a Playful Concept of
ction

ervices using Wi-Fi Direct
d friends and strangers
ollaborative Video Challenges

Pass it forward



Interact with nearby users



Future work

Implementation of the prototype is in progress
A large-scale user study will be organized with it
in order to understand its user experience and
social impact
More concepts for proximity-based playful social
interaction will be researched

nikova, Thomas Olsson
land

"I LIKE THIS SHIRT"

EXPLORING THE TRANSLATION OF SOCIAL MECHANISMS IN THE VIRTUAL WORLD INTO
PHYSICAL EXPERIENCES



GOAL

What if you could instead of clicking
the 'Like' button in the virtual world

EMPLOYMENT
RESULTS





Welcome to CHI 2015 20 - 23 April 2015

HEALTH & BEAUTY WEEK

2015

Ladan
Hajjizadeh
University of Maryland
CHI 2015
STUDENT VOLUNTEER

Jiawei
Ou
Baidu Research
CHI 2015
STUDENT VOLUNTEER





Selamat Datang! مرحبا! ¡Bienvenidos! 歓迎 Willkommen! 환영합니다! Bem-vindo
ようこそ Welcome to **CHI 2015** 20 - 23 April 2015 स्वागत





People Like This Shirt!

Tap here!



BONUS: MAKERWEAR



RESEARCH VISION

MakerWear

A new construction kit aimed at **enabling children** to **design** and build their own **interactive wearables**.



RESEARCH VISION

MakerWear

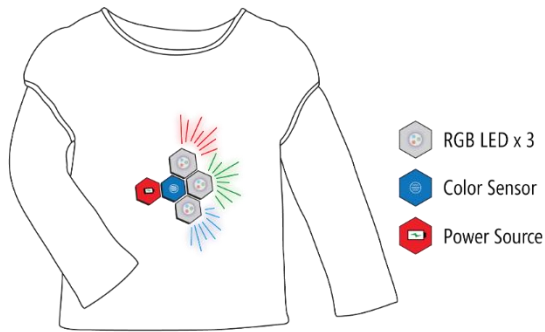
A new construction kit aimed at **enabling children** to **design** and build their own **interactive wearables**.

With only a **few components**, children can build a **wide range of designs**...



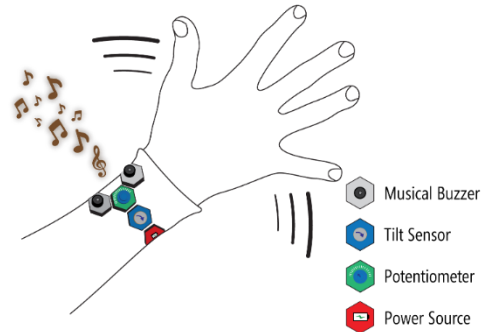
3 Simple MakerWear Examples

All built without the creation of code



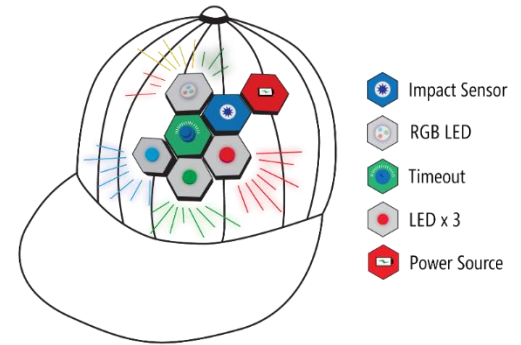
"Chameleon" Shirt

Shirt changes color based on color in environment



Musical Bracelet

Bracelet plays different tones based on arm movement



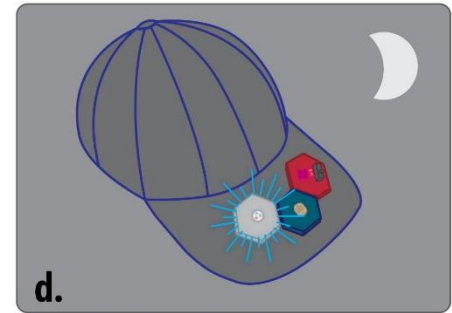
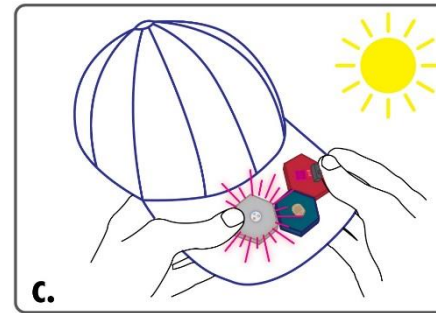
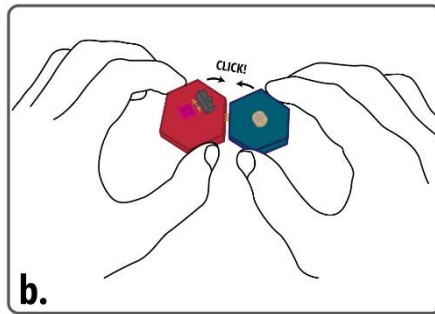
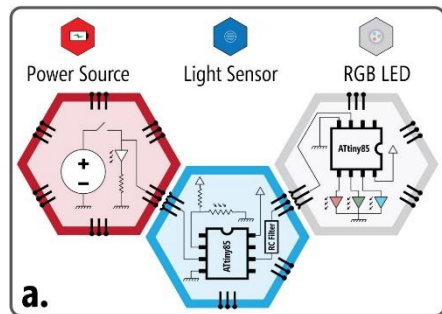
Light-Up Hat

Hat flashes various lights when wearer moves

MAKERWEAR EXAMPLE

Light Up Hat

Plug-and-play wearable construction



DESIGN OVERVIEW

Module Library



MOVEMENT-BASED INSTRUMENT W/LIGHTS

8 and 10 year old makers



MOVEMENT-BASED INSTRUMENT W/LIGHTS

8 and 10 year old makers



MAKERWEAR: INTERACTIVE WEARABLES

August 14 @ 11:00 am - 12:30 pm



Customize clothing with lights and sounds that react to your movements. Be a part of the University of Maryland's [Human-Computer Interaction Lab](#) prototyping project on MakerWear. Take part in mini-challenges, learn to design, build and test electronics-powered reactions on your clothes. (Please note: you cannot bring MakerWear equipment home with you). Administrative fee required; UMD's research-based workshop is free.

[+ GOOGLE CALENDAR](#)
[+ ICal EXPORT](#)

Details

Date:
August 14

Venue

[KID Museum](#)

6400 Democracy Blvd

Other

Registration Link

<https://kidmuseum.nonprofiteasy.net/PublicPages/Event/Details.aspx?>



**BOYS & GIRLS CLUBS
OF AMERICA**

IN CLOSING

**E-TEXTILES ARE NOT JUST EMBEDDED
ELECTRONICS IN CLOTHING, THEY ARE
NEW OPPORTUNITIES TO AUGMENT AND
TRANSFORM THE HUMAN EXPERIENCE**

E-TEXTILES GENERATION ONE

WHERE SHOULD WE GO FROM HERE?



LEAD GRADUATE STUDENTS



Matt Mauriello
Social Fabric Fitness



Michael Gubbels
Social Fabric Fitness



Leyla Norooz
BodyVis



Ladan Najafizadeh
ILikeThisShirt



Seokbin Kang
ILikeThisShirt, BodyVis



Majeed Kazemitabaar
MakerWear

FUNDING



PARTNERS

Erogear
Runkeeper
Boys and Girls Club
Prince George's County School District

Casa de Maryland
KID Museum
FutureMakers
UMD Kidsteam

Center for Young Children (CYC)
UMD STEM M.Ed Program

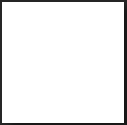
ICON CREDITS



T-Shirt

by Josh

<http://thenounproject.com/term/tshirt/8009/>



Volcano

by Hunotika

<http://thenounproject.com/term/volcano/42791/>

FONT CREDITS

NEXA RUST SANS BLACK

NEXA RUST SANS BLACK 02

NEXA RUST SLAB BLACK SHADOW 01

Segoe Condensed

Segoe UI Light

Segoe UI Semibold

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COMPUTER SCIENCE
UNIVERSITY OF MARYLAND

makeability lab

UNIVERSITY OF
MARYLAND

I'M
ECO-CONSCIOUS



**I LIKE
THIS BAND**

**THE
CURE**



**Boys
Don't
Cry**

**I SUPPORT
THIS GUY**

