An Introduction to E-Textiles

Class Logistics

In this class, students learn to create active and responsive textiles embedded with microcontrollers, handmade textile sensors, muscle wire, pneumatics, and/or electronics. This course provides an overview of the field, the current state of the art in e-textiles, and the possibilities and difficulties that arise from merging electronics with flexible materials. We do expect students to have basic circuit making and hand sewing skills in this class. We won't cover programming in this Micro - that can be learned in the Arduino Micro!

Instructors

Olivia Robinson (orobinso@andrew.cmu.edu)

Teaching Assistant

David Perry (dbperry@andrew.cmu.edu)

Class Website

https://courses.ideate.cmu.edu/99-360/f2018

Class Logistics

Class 1: 11/02 Instructor: Olivia Robinson

Discussion Topic: Crafting Soft Sensors

Lab: Soft Sensors & Conductive Textile Materials

Class 2: 11/09 Instructor: Jet Townsend

Discussion Topic: Electronic Components and Textiles

Lab: Gemma Microcontroller Sampler

Class 2: 11/16 Instructor: Olivia Robinson

Discussion Topic: Textiles and Movement

Lab: Pneumatics/Muscle Wire Explorations

Final Project due 11/30

Proposal Option: You will create a proposal for a project that utilizes techniques or concepts covered in the class. Should include: sketches, write up of materials, techniques and concepts used.

Skill Investigation Option: You will learn a new textile skill and create a sample to show what you have learned. Should include: photos of your sample, what resources and guides were used, and possible applications.

Format of Micro

- 1:30-4:30pm class time
- 4:30-6:30pm lab time
- Demo and discussions (3 hrs)
- Open Lab (2 hrs)
- Deliverables: Sample booklet and project
    - Due two weeks after last class

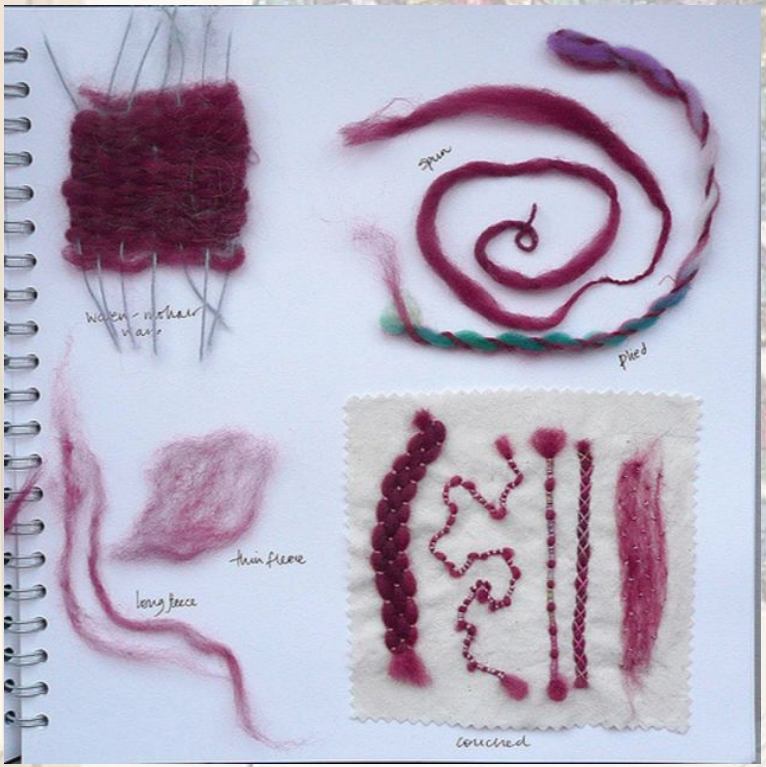
IDeATe Gallery Website:

http://ideate.xsead.cmu.edu/gallery/courses/ideate-e-textiles

Sign up early!! (new registrations are approved manually)

Sample Book

- Collection of different techniques and samples that can be used a reference tool
- 1” binder + plastic sheets



Final Project

For the final project, students will further investigate a skill covered or create a project proposal that incorporates techniques from the class.
http://ideate.xsead.cmu.edu/users/sign_in

Due: two weeks after our last class

IDEATE gallery documentation

Proposal Option: You will create a proposal for a project that utilizes techniques or concepts covered in the class. This project could be for another class or be for personal inquiry. Make sure to include:

- Sketches
- Write up of materials
- Techniques and Concepts used

Skill Investigation Option: You will learn a new textile skill and create a sample to show what you have learned. This skill could be one that we discussed in class (but did not cover in a demo) or one for personal inquiry. Make sure to include:

- Photos of your sample
- What resources and guides used
- What materials used
- Possible applications

What are *E-textiles*?

- Textile materials embedded with digital and electronic components
- Textiles that can react to environmental stimuli
- e-textiles, soft circuits, wearable tech, wearable electronics...

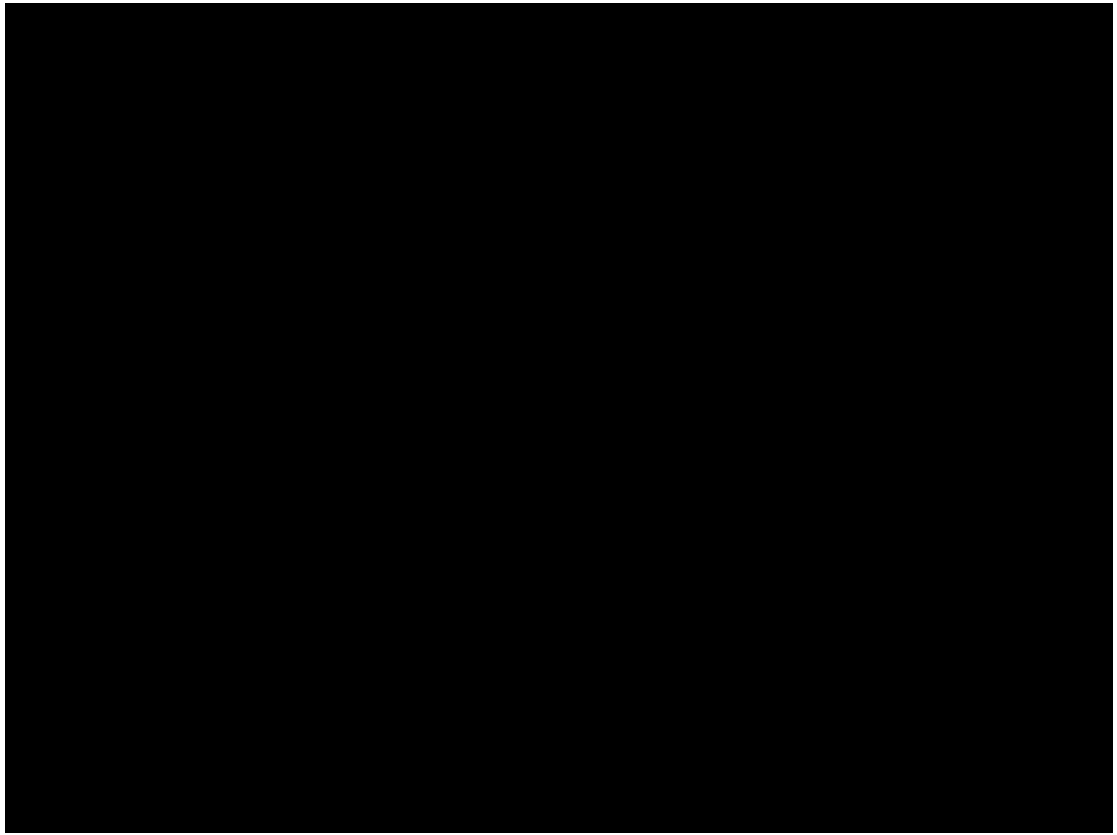
Smart textiles are fabrics that have been developed with new technologies that provide added value to the wearer.

“ **Wikipedia**

What makes smart fabrics revolutionary is that they have the ability to do many things that traditional fabrics cannot, including communicate, transform, conduct energy and even grow.

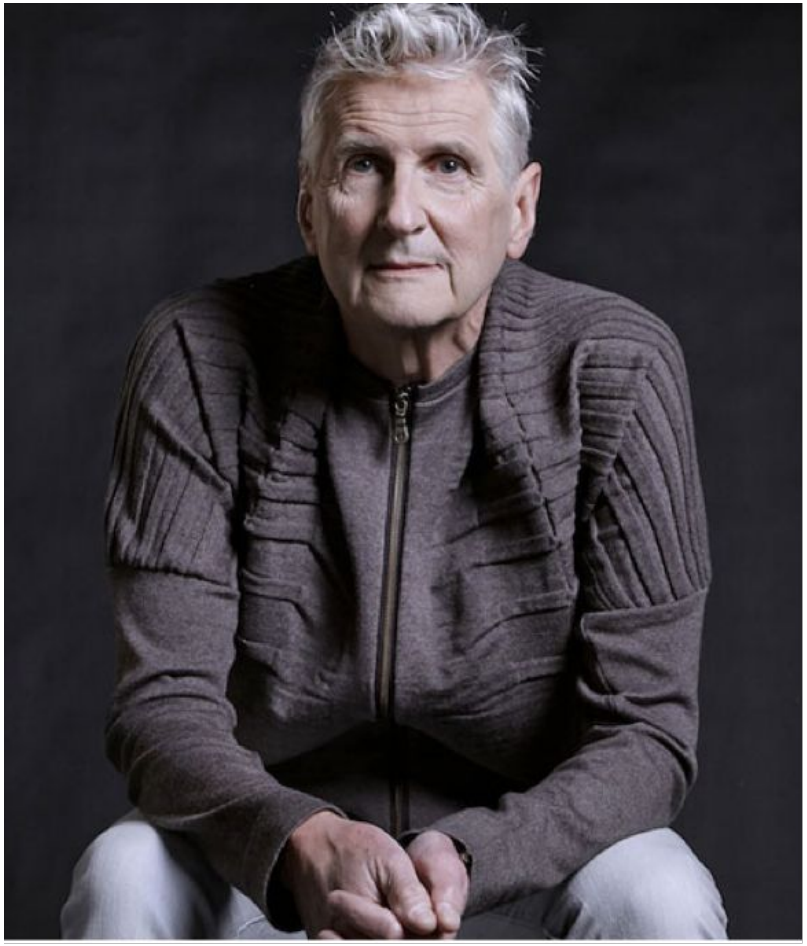
Pailes-Friedman
Pratt Institute

Spider Dress

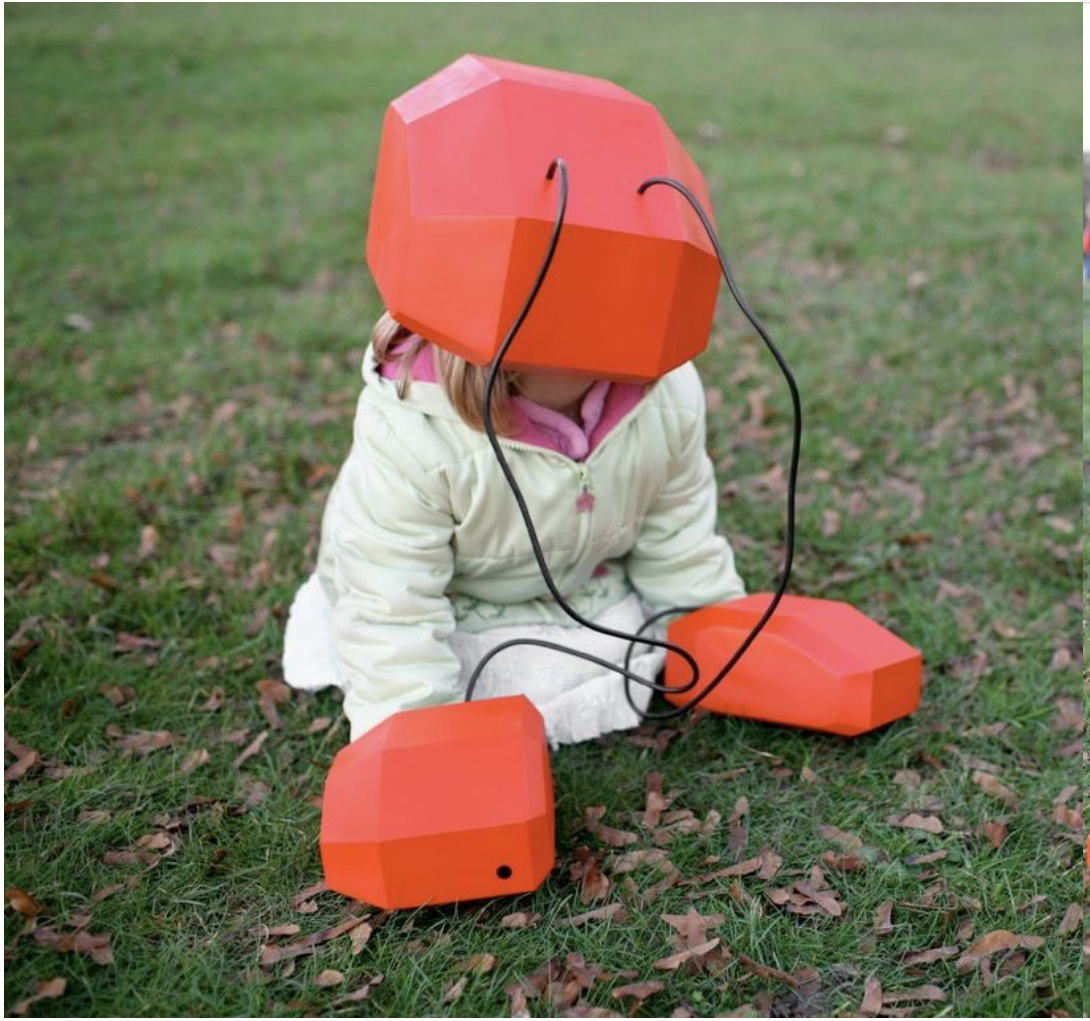


Nike’s Self Lacing Shoes

Medical Textiles



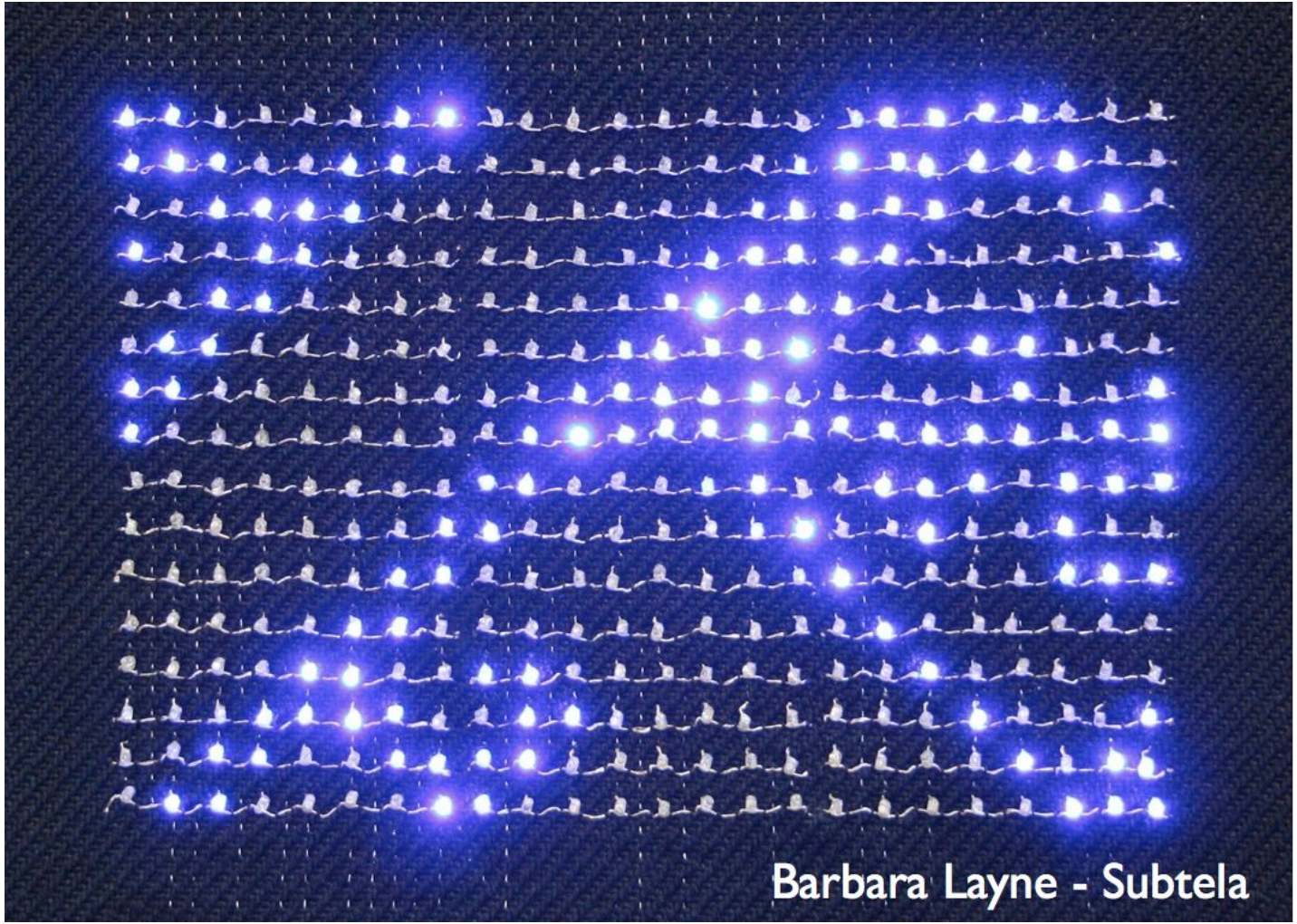
Pauline von Dongen

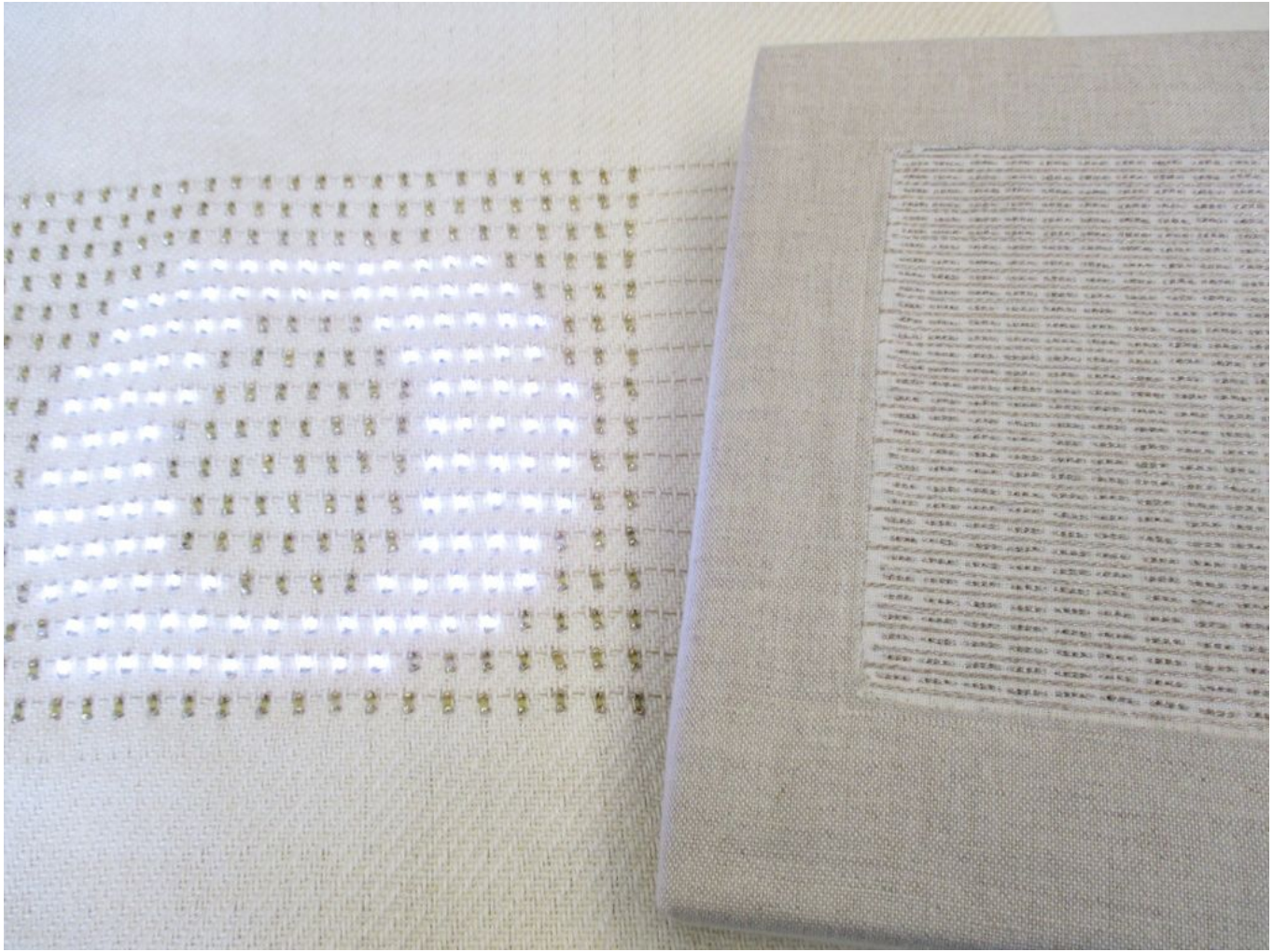


Chris Woebken
Kenichi Okada

Jen Liu

Jen Liu


Barbara Layne - Subtela

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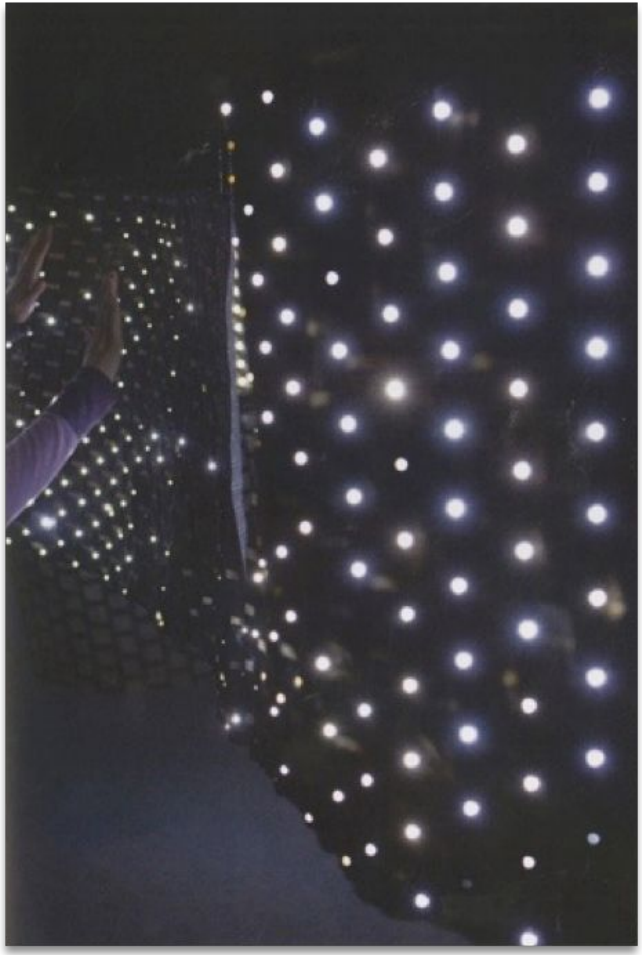


Zane Berzina

Haley Profita + Microsoft Research: Lightwear

For Seasonal Affective Disorder

Cute Circuit + EasyJet: Engineer uniforms for airplanes

Sharewear by Di Mainstone

https://vimeo.com/55216258

How to get started...

Electronics + Textiles ≠ E-Textiles

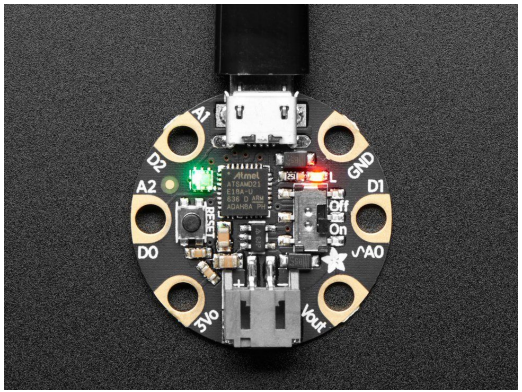
Both systems must be carefully designed simultaneously in order to succeed. This includes planning ahead of time to determine:

1) How the electronic system will be attached to the fabric
2) Where the power system and circuit boards will be stored
3) Whether the fabric is strong enough to support this extra weight
4) How is the circuitry affected when interacting with the body

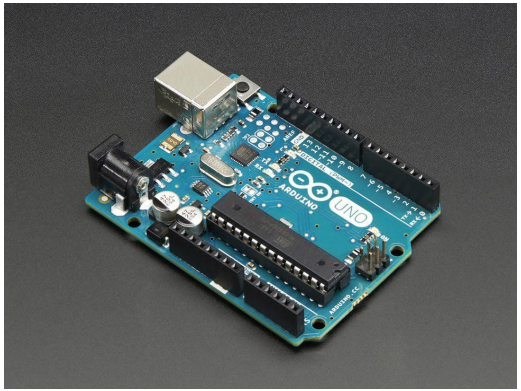
Fabrics stretch, Circuits don't (currently).

The constant struggle with E-Textiles is figuring out methods to ensure that the circuits integrate well with the fabric. If the circuitry does not have enough support then the circuitry will break; at the same time, if the fabric is too structured to support the circuitry, then it will be uncomfortable to use.

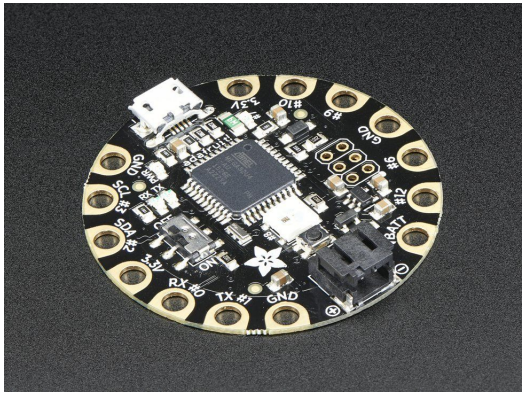
Some Wearable Microcontrollers!



Gemma

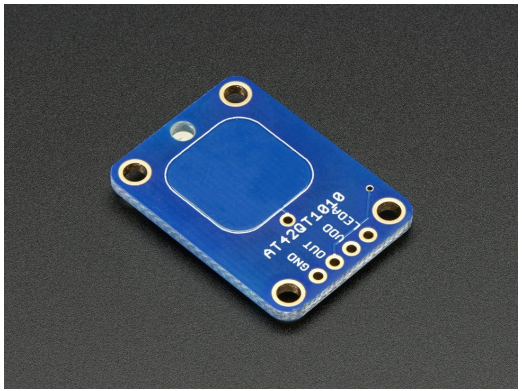


Arduino



Flora

Some Common Sensors!



Capacitive Touch

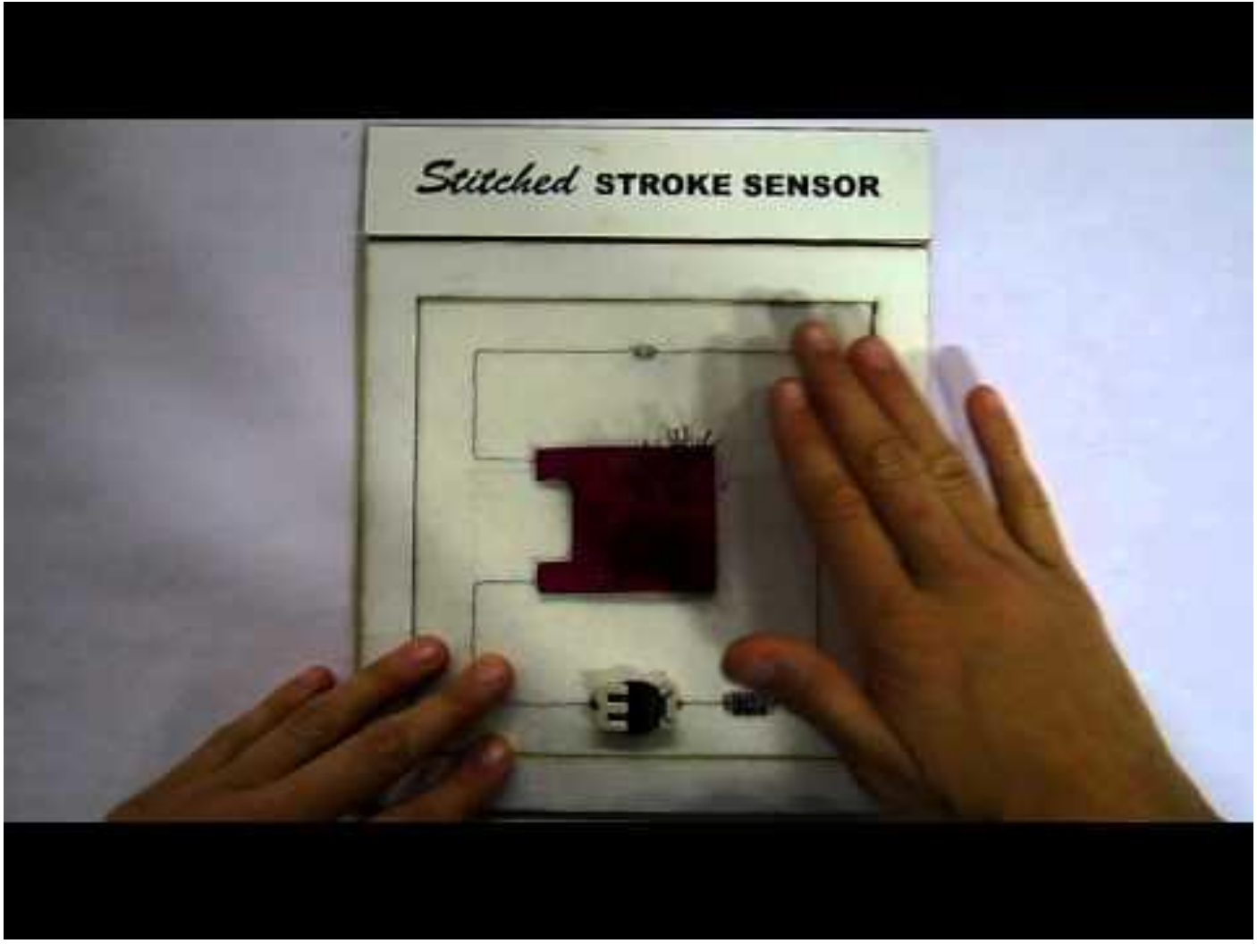
IMU

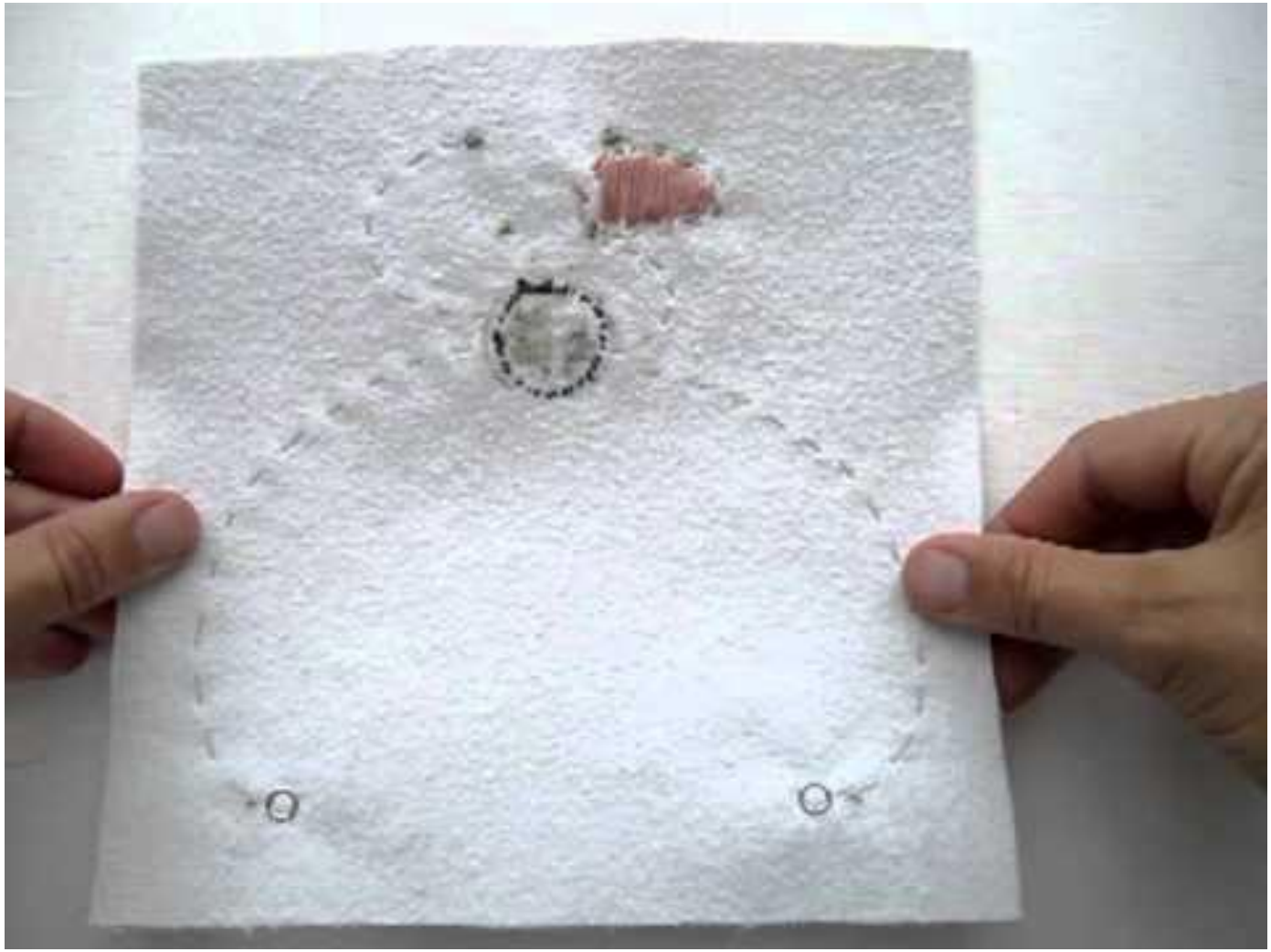
Pulse Rate

Homemade Sensors

from top left:
stroke sensor,
knit/crochet sensor,
soft push button,
pom pom switch,
fabric potentiometer

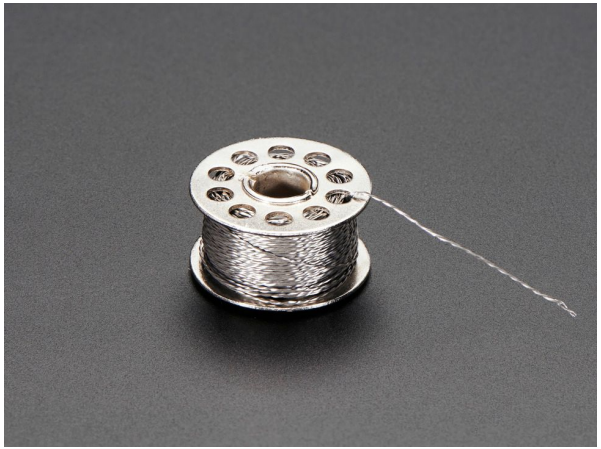
Kobakant: HOW TO GET WHAT YOU WANT


Stitched STROKE SENSOR



Plusea / Hannah Perner-Wilson

Some Path Making Connections



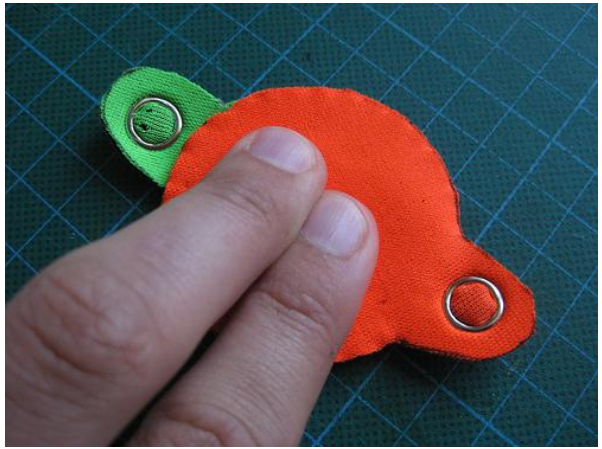
conductive thread
(stainless steel / silver)

conductive fabric
(wide variety!)

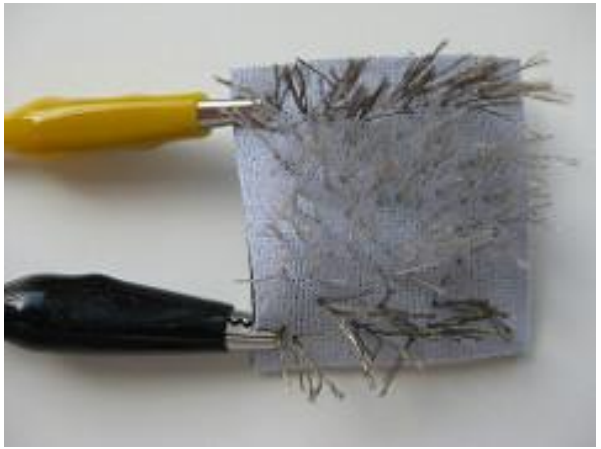
conductive ink
(drawing/printing)

Homemade Soft Sensors

Push button



Pressure sensor
(with velostat or Eeontex)



Stroke sensor

Homemade Soft Sensors

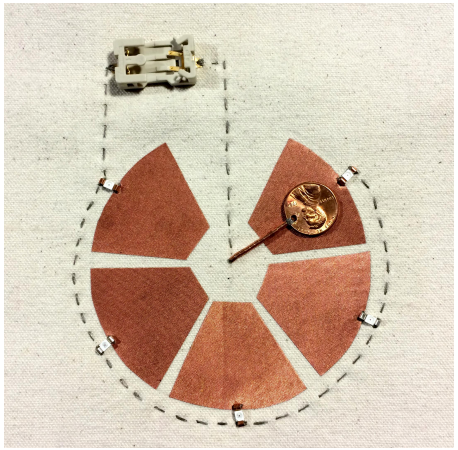
Potentiometer

Pom Pom squeeze sensor

Bend sensor

Homemade Soft Sensors

Knit / Crochet stretch sensor



Tilt sensor

???

Make up your own sensor

(if there is enough time)

Useful URLs

Places to Purchase e-textile materials:

Sparkfun.com
Adafruit.com
LessEMF.com

Places to learn more on your own:

Kobakant.at
Plusea.at
Sparkfun.com
Adafruit.com

Demo Time