



Smart Textiles

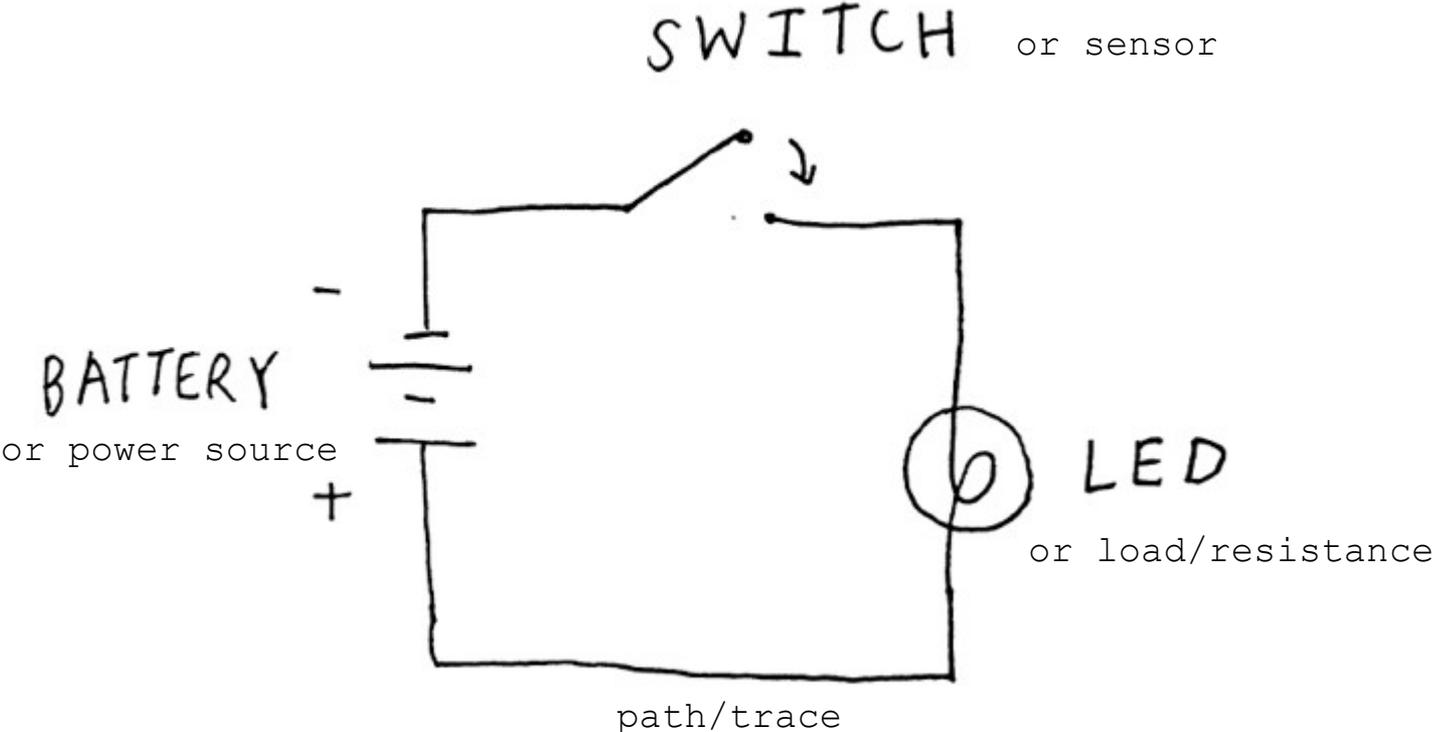
What is it?

- textile materials embedded with digital and electronic components
- textiles that can react to environmental stimuli
- e-textiles, soft circuits, wearable tech, wearable electronics...
- textiles derived or inspired by living organisms, previously unexplored



Materials Overview

Design: Basic Circuit



Path: Making Connections



conductive thread
(stainless steel / silver)



conductive fabric
(wide variety!)



conductive ink
(drawing/printing)

Conductive Materials

CONDUCTIVE WOOL

Conductive wool is perfect for felting. It is very fine conductive fibers (steel) mixed with normal wool, or with polyester. The one with wool works better for felting.

I have purchased this from Bekaert



You can make a conductive felt with conductive wool.

This method is used to make a conductive carpet for airplanes and other shielded place.

I have used needle felting method to make a conductive pattern on felt.



Switches



zippers



beads



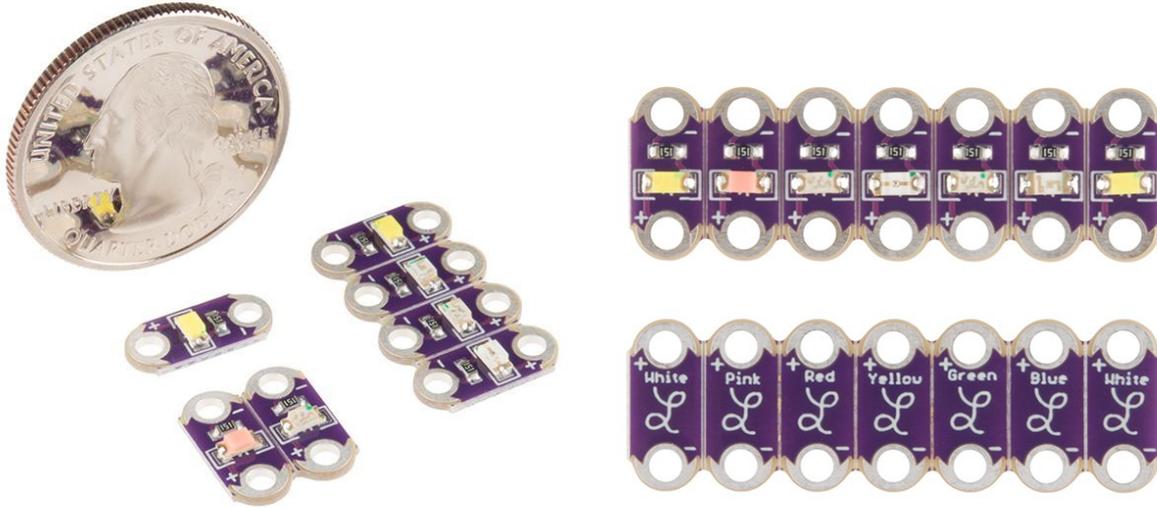
Buttons
& snaps

Sensors



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

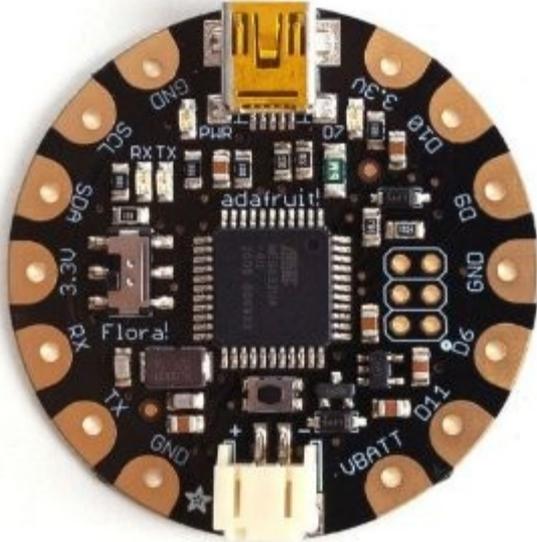
Sewable Electronic Components



Sparkfun Lilypad sewable LEDs

(Adafruit also makes sewable LED sequins)

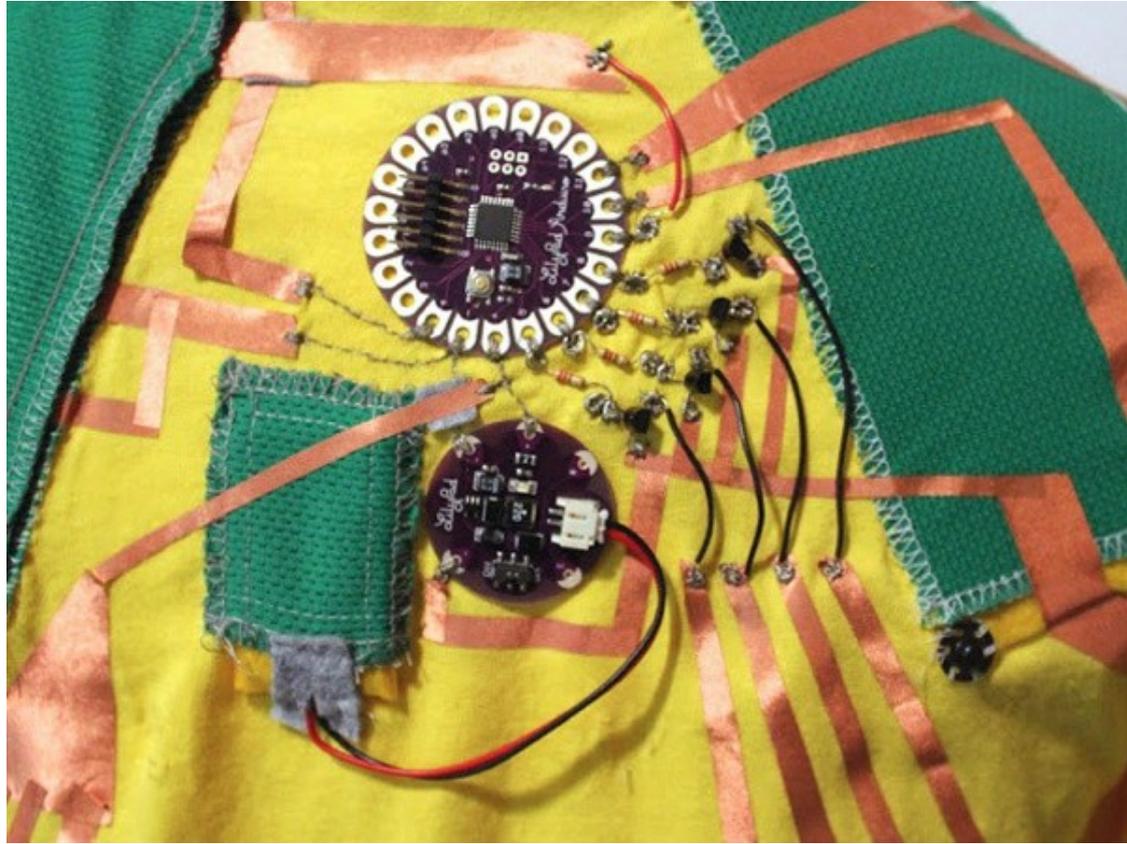
Sewable Microcontrollers



Adafruit Flora

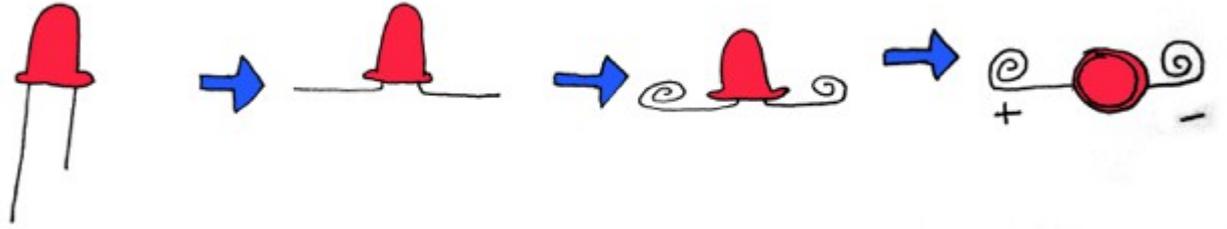


Arduino Gemma



Arduino LilyPad with FTDI plug-in!

DIY Sewable Electronic Components



good for diodes, capacitors and other things with "legs"

For those with soldering experience...



Solder sewable connections onto SMD (surface mount) LEDs

Shape Memory Alloy



3-080
MuscleWires.com



1690Rev

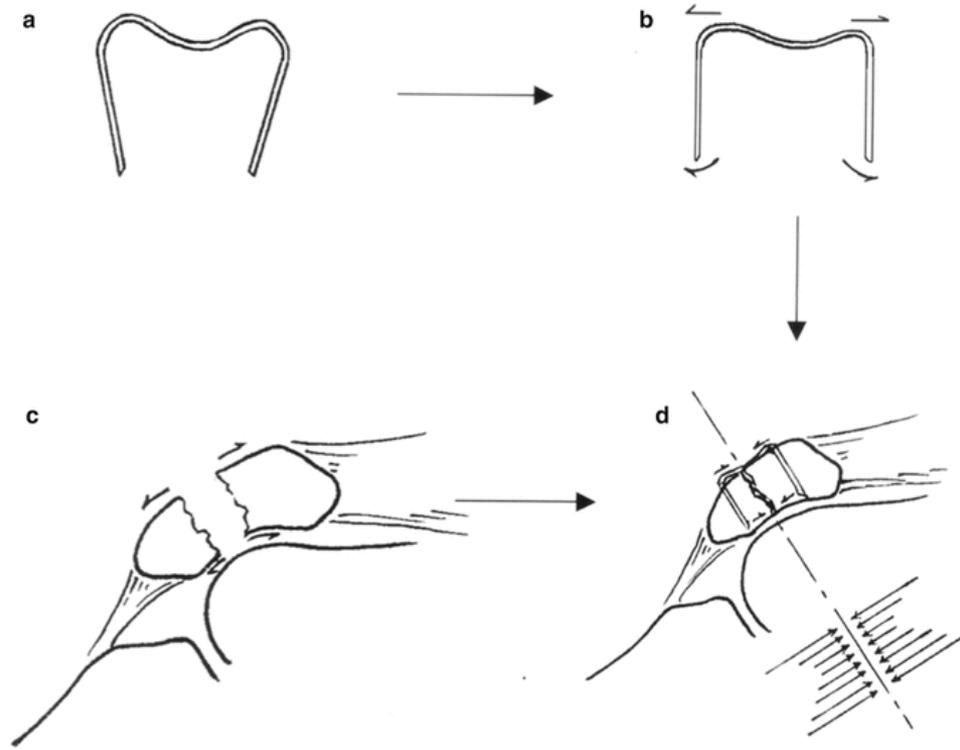
MuscleWires.com

MUSCLE WIRES®

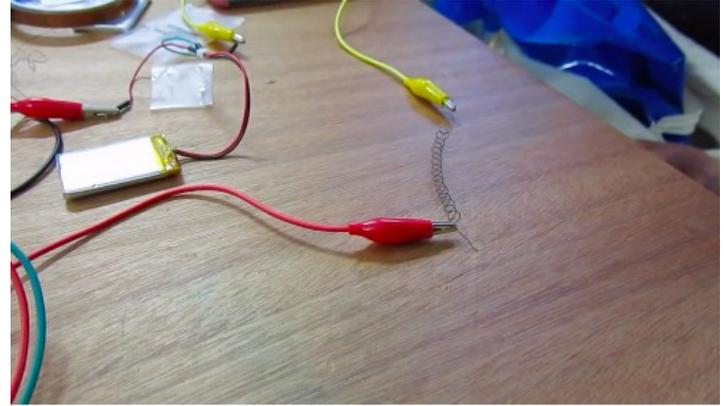
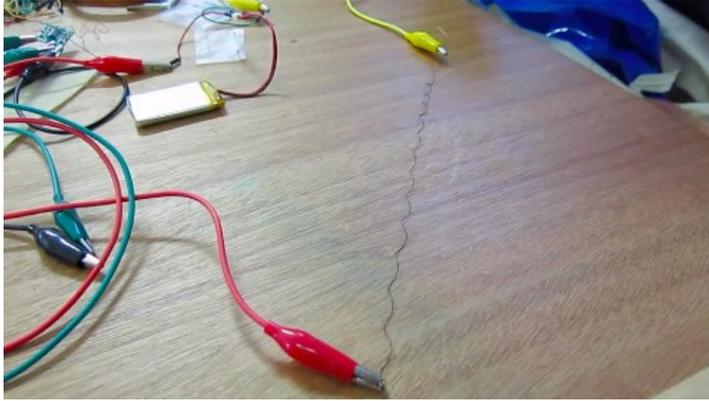
Metal wires that shorten in length when electrically powered!

Type:	Flexinol® LT
Diameter:	250 μm
Activation Temp:	70°C
Length:	5 Meter
Resistance:	18.5 Ω/m
Recommended Current:	1050 mA
Rec. Pull Force:	891 grams
Rec. Deformation:	3-5%

For more information see
Muscle Wires Product Brochure



medical staples used for clamping bone fractures



<https://www.kobakant.at/DIY/?p=7229>



moving fabric petals with SMA



<https://www.youtube.com/watch?v=yuYV3RrowWY>

Thermochromic Ink and Dyes

Materials that temporarily change their color in response to temperature fluctuations developed in the 1970s. They come in two forms: a liquid crystal and leuco dyes.





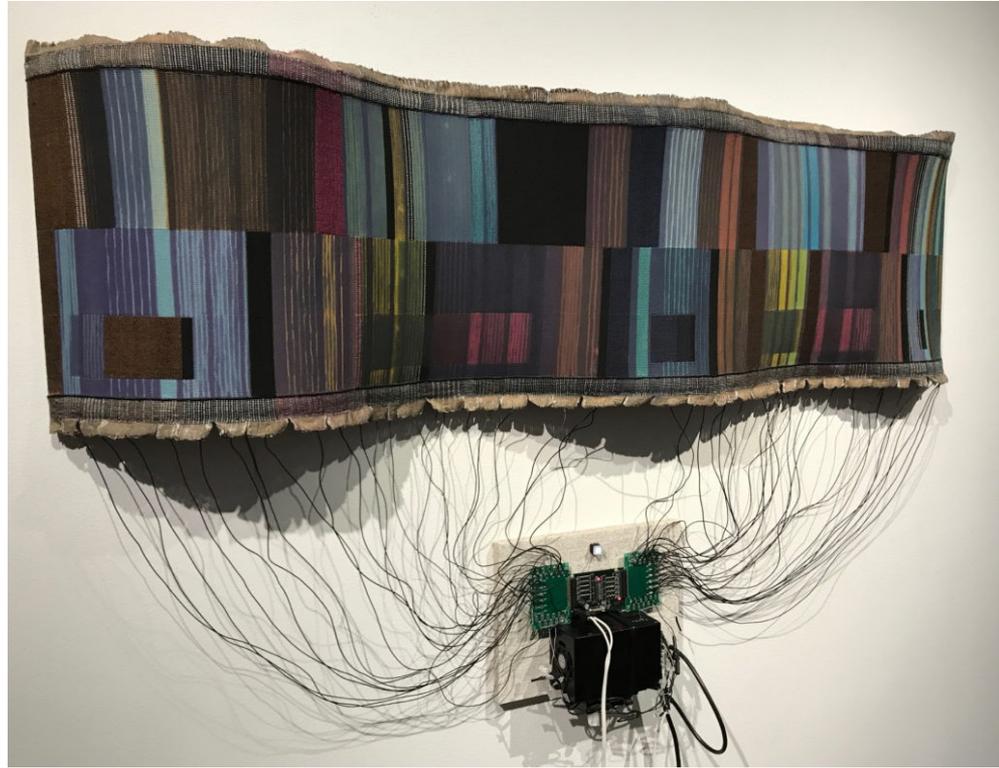
- Leuco dyes- switch between two chemical forms (color and colorless)

Leuco dyes are coloured when they're at a cool temperature but as the heat increases, they become nearly clear or translucent. This then allows them to reveal any patterns, words or colours that may be printed on the underlying layer of the ink.



Maggie Orth - Dynamic Double Weave
Programmable, electronic, color change textile

<https://www.youtube.com/watch?v=Wep18raY348>



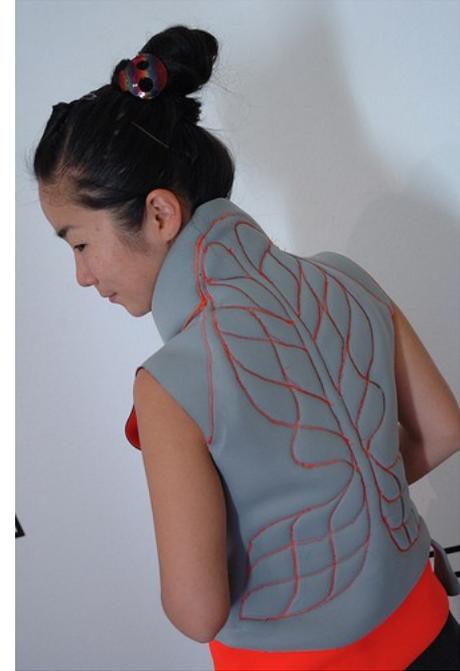


<http://www.nikolasbentelstudio.com/aerochromics>

Nikolas Bentel - Aerochromic Reactive Carbon Monoxide Shirt

when the shirt comes into contact with a concentrated area of carbon monoxide, the carbon monoxide is oxidized by chemical salts in the clothing - removing oxygen atoms from the ink in the process - which triggers the change of color.

Kobakant: *Massage Me*



Playing *Massage me* requires two people, one who wears the jacket to receive the massage and one who massages the person wearing the jacket. Soft flexible buttons are embedded in back of the jacket so that wearing it turns your back into a gamepad. All you need to do is to sit or lay down in front of a video game player and you will be able to enjoy a back massage while the game lasts.

Mi.Mu gloves

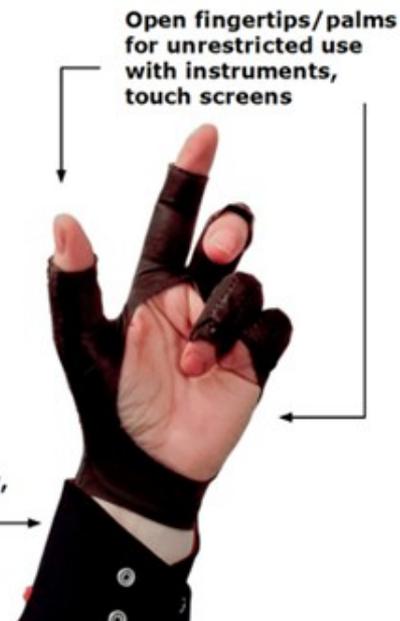
<https://mimugloves.com/>

Anatomy of a Glove

Electronics



Optimised for Music



<https://www.youtube.com/watch?v=ci-yB6EgVW4>

T.Ware's T. Jacket

<https://www.mytjacket.com/>



Tjacket
\$599.00

BUY NOW



Tjacket Basic
\$399.00

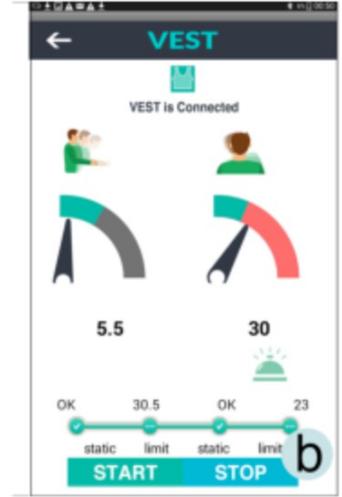
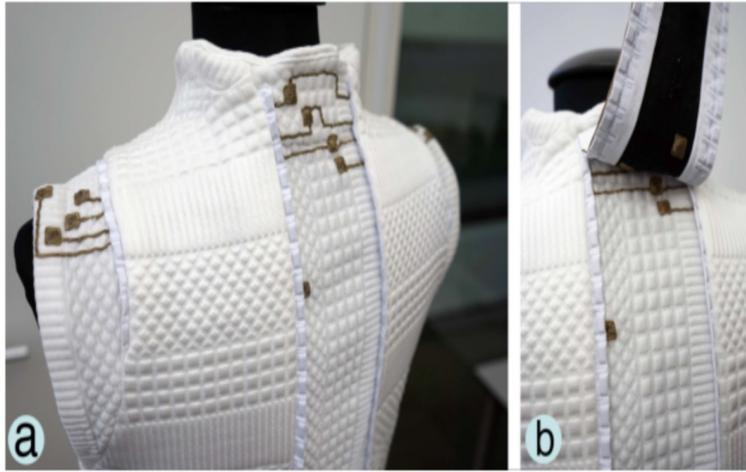
BUY NOW



Refurbished Tjacket
\$199.00

BUY NOW

The vest uses adjustable air pressure compression that is controlled automatically via a smartphone/tablet/iPhone/iPad app. A built-in sensor in the vest monitors user movement activity (sitting, standing, walking, rocking and running) which is an indicator of **arousal levels**, to help track if user's arousal regulation falls within the optimal band.Â



<http://www.by-wire.net/zishi-posture-sensing-garment-for-rehabilitation/>

Posture monitoring and correction technologies can support prevention and treatment of spinal pain or can help detect and avoid compensatory movements during the neurological rehabilitation of upper extremities, which can be very important to ensure their effectiveness. Zishi posture sensing garment is designed and developed by Qi Wang, PhD student of TU/e.

Social Body Lab: *Prosthetic Technologies of Being (Nautilus)*

<https://vimeo.com/89654806>





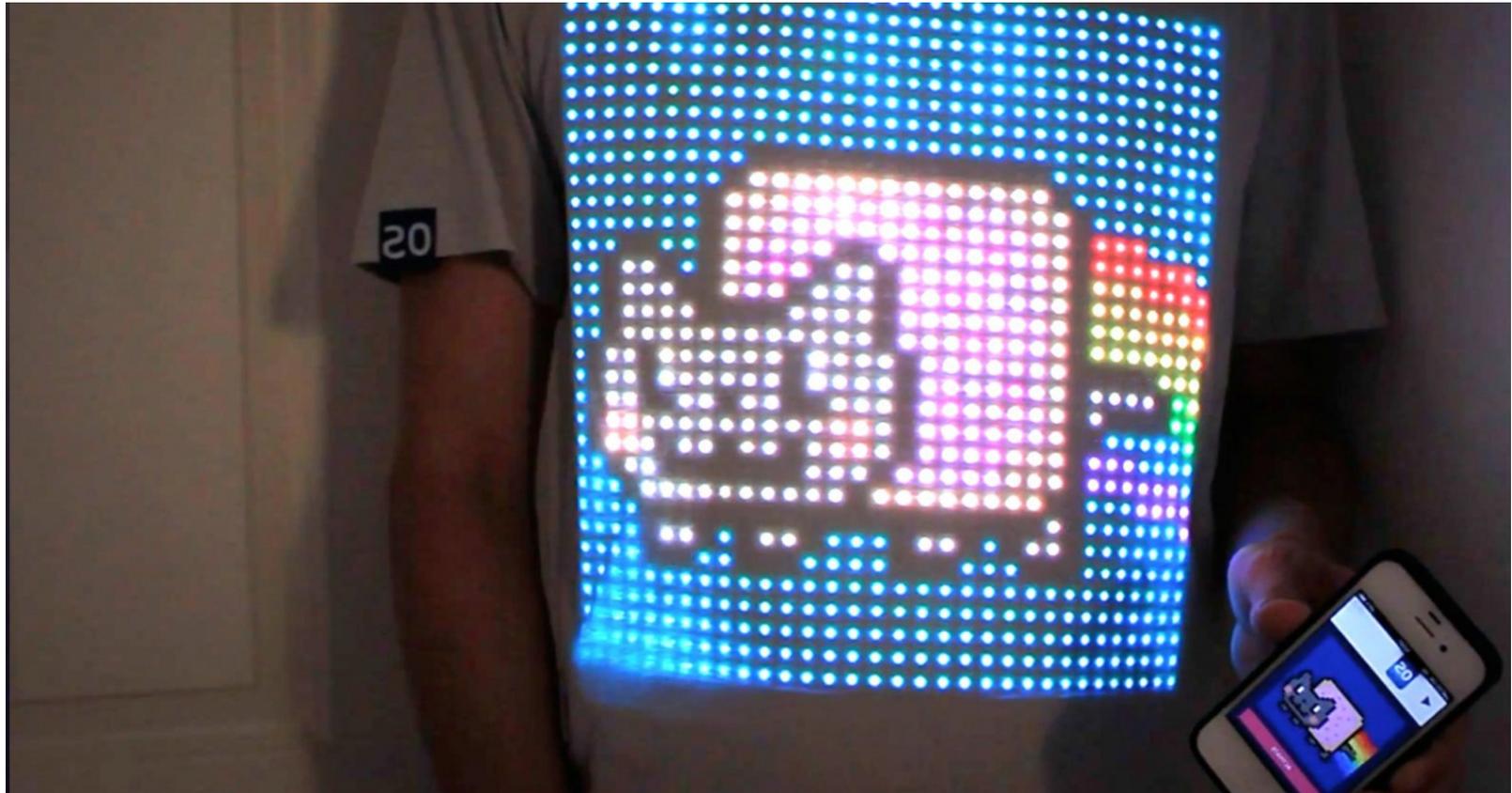
© Microsoft Research

Halley Profita + Microsoft Research: Lightwear Prototypes for Seasonal Affective Disorder as alternative to light boxes. This is light therapy on the go.



Cute Circuit + EasyJet: Engineer uniforms for airplanes, using LED matrix displays

<https://www.youtube.com/watch?v=dwg-A6LxmIE>



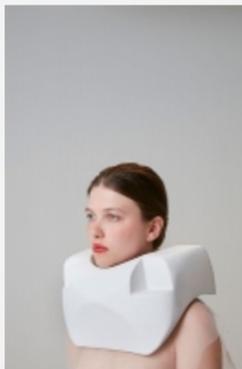
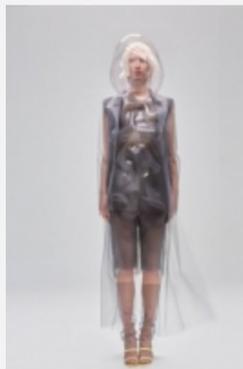
<http://www.geekmomprojects.com/led-matrix-shirt/tutorial> on how to program your own t-shirt

Forster Rohner Textile Innovations of Switzerland

<https://www.youtube.com/watch?v=p09Tgm-i25U>

ying gao

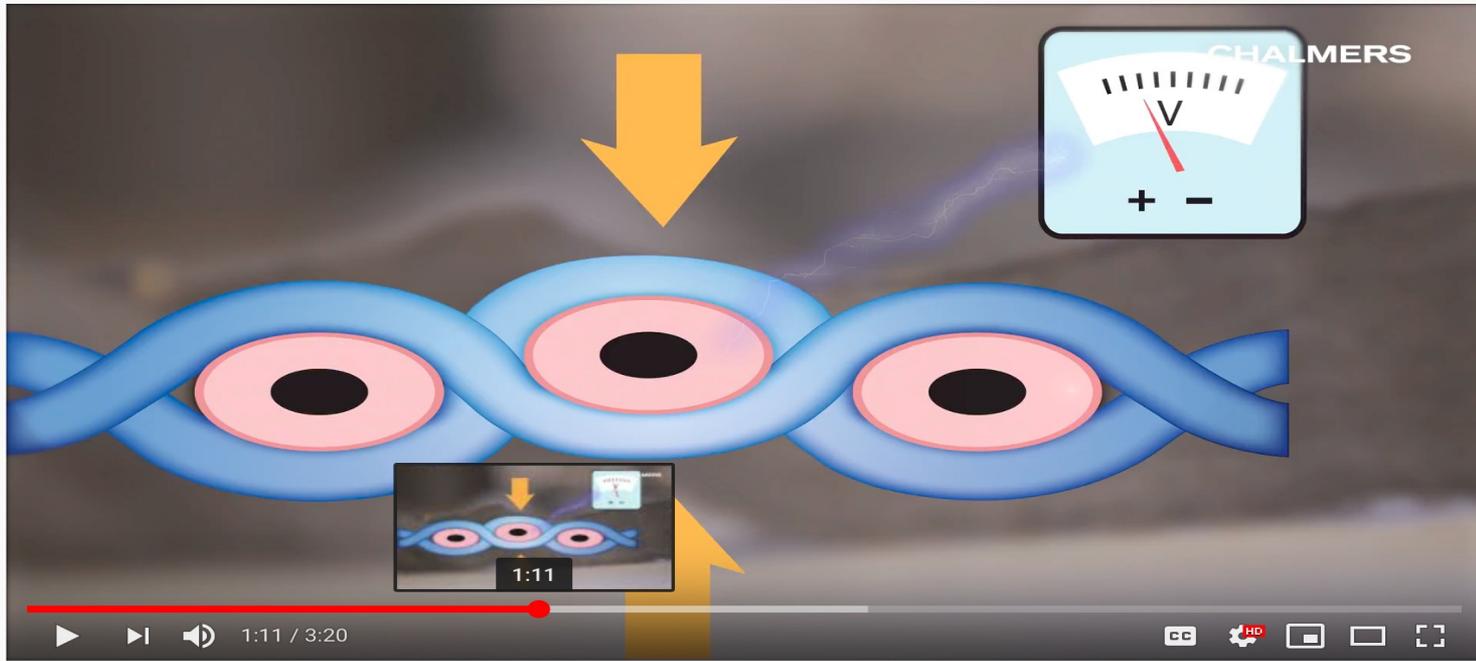
interactive projects
projects and collections
the capsule (film)
press
profile
exhibitions and shows
contact
collaborators
credits



flowing water, standing time
possible tomorrows
neutralité : can't and won't
incertitudes
(no)where (now)here
dear paul
playtime
walking city
living pod
the show still goes on



<http://yinggao.ca/interactifs/projets-interactifs/>



<https://www.youtube.com/watch?v=8kAchXoQaz0>

Electricity generating textiles
Chalmers University of Technology

Will 3D Printing Tech Revolutionize The Fashion World?

<https://www.youtube.com/watch?v=WquJ7PEqYi8>



Will 3D Printing Tech Revolutionize The Fashion World?

53,065 views · Jul 20, 2016

👍 607 🗨️ 12 ➦ SHARE 📌 SAVE ⋮

Kombucha Leather-microbial
cellulose



SCOBY: Symbiotic Colony of
Bacteria and Yeast



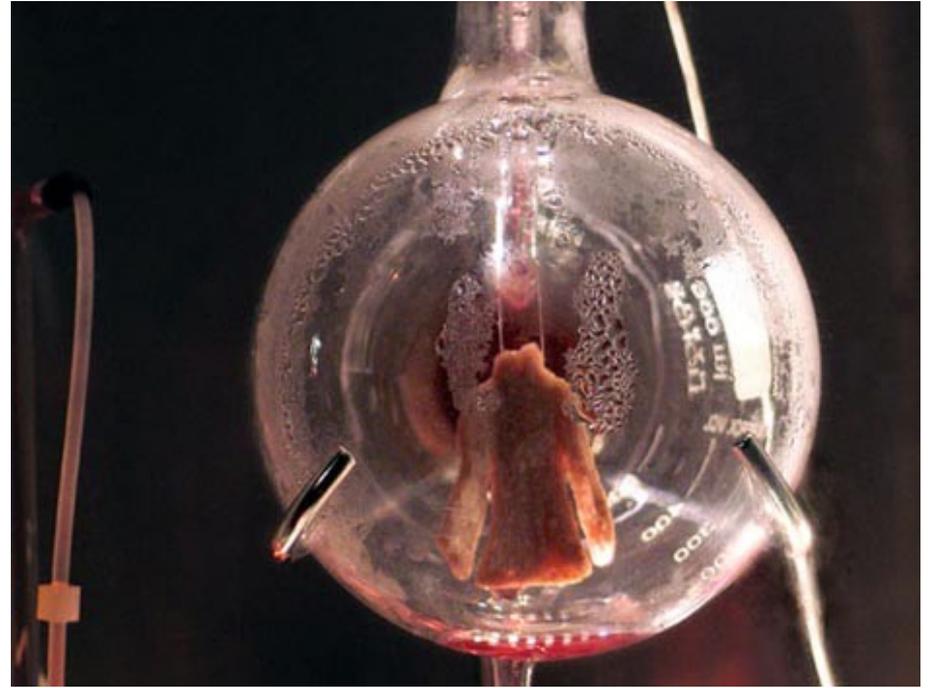
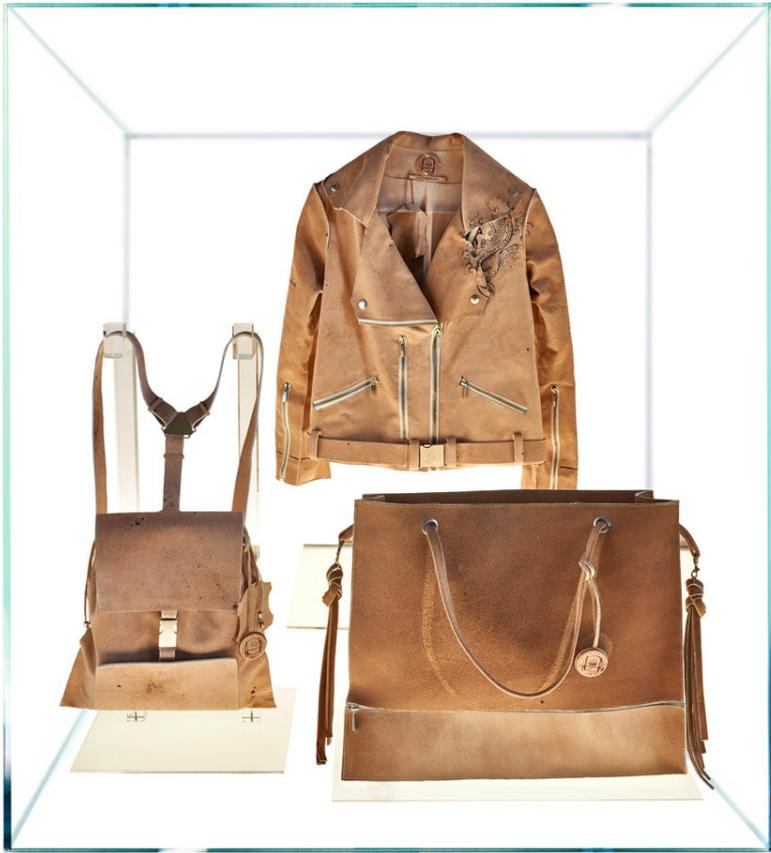


Image: ScobyTec

<http://scobytec.com/portfolio>

Suzanne Lee, BioCulture





Symbiotica: *Victimless Leather*

grown using a combination of 3T3 mouse cells and human bone cells.

<https://labiotech.eu/bioart/pure-human-leather-tina-gorjanc/>

Tina Gorjanc: *Pure Human*



Jae Rhim Lee: *Mushroom Burial Suit*

<http://coeio.com/>





Traditional Japanese food made from soybeans fermented with *Bacillus subtilis* var. natto

alkaline ferment



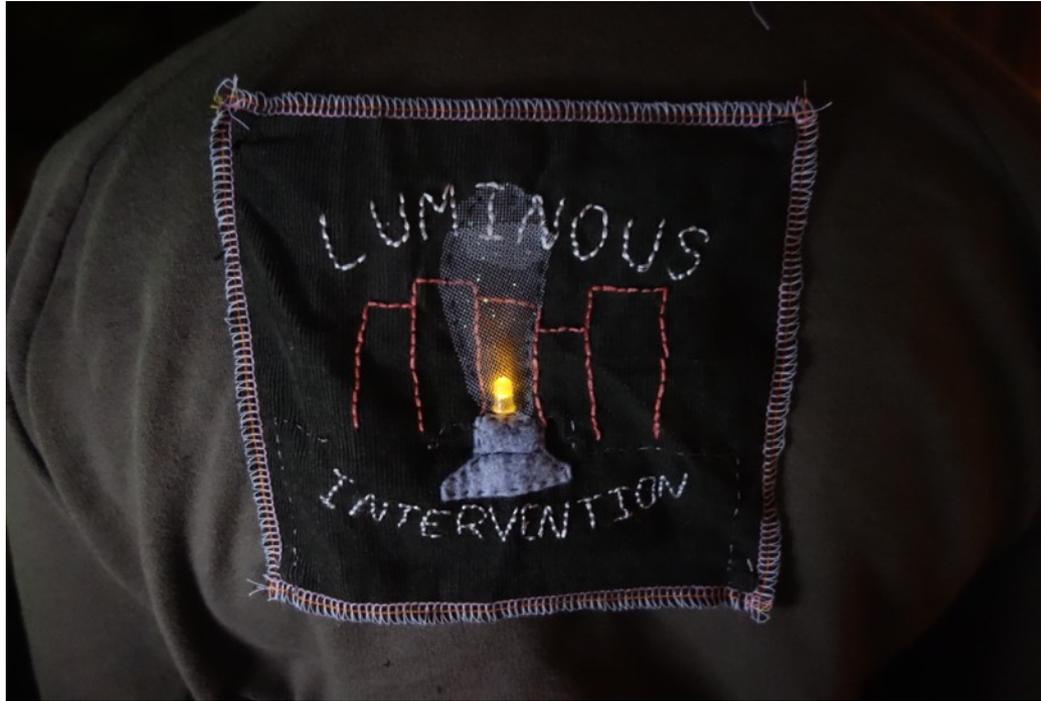
Biologic - Lining Yao

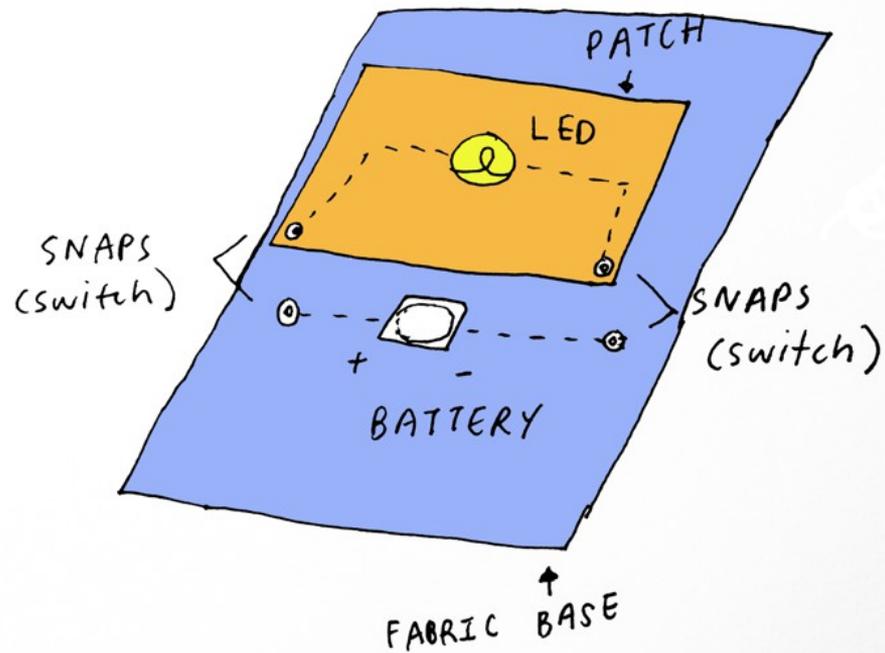
<https://vimeo.com/142208383>

Lining Yao and her Tangible Media Group at MIT Media Lab have been growing Natto bacteria and exploring how they can be used as bio-actuators - making textile become "alive" reacting to a change of the environment. Natto bacteria have been traditionally used in Japan to ferment food and Lining discovered they have a specific property: they are able to contract and expand according to the level of humidity in the air.

DEMO TIME !

Sewn LED Patch

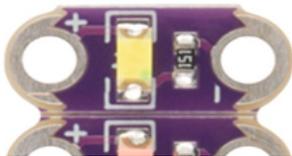




Important note!

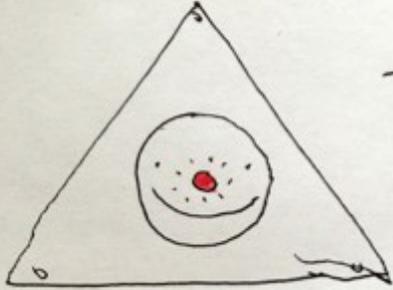


Positive side

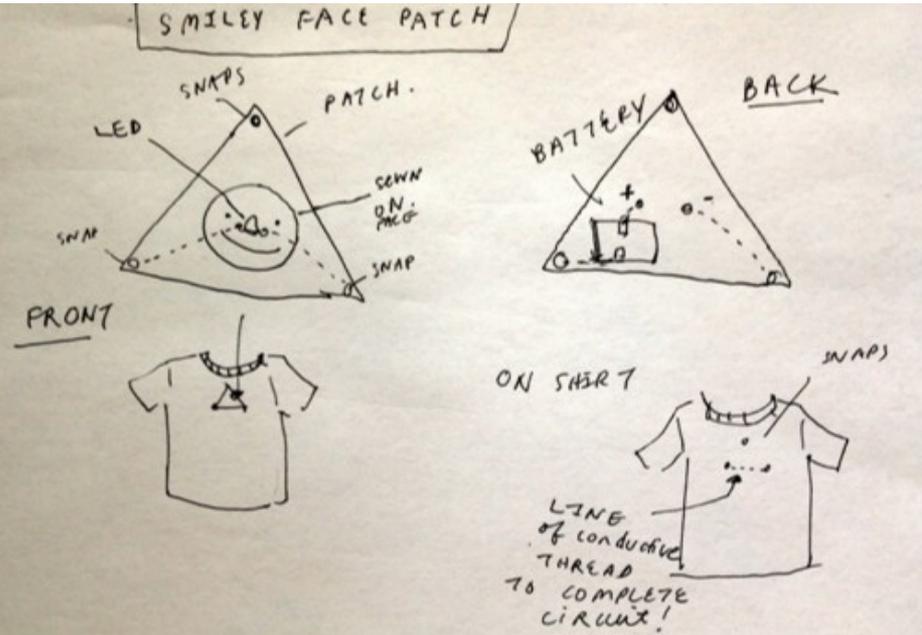


Design it

SMILEY FACE PATCH



- Triangle PATCH
- embroidered smiley face
- Light up LED nose when you SNAP the patch on!



- Draw out what you want to make!
- Make sure you include placement of traces and components

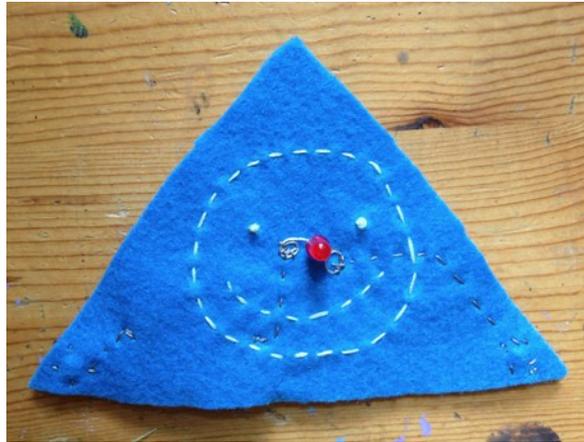
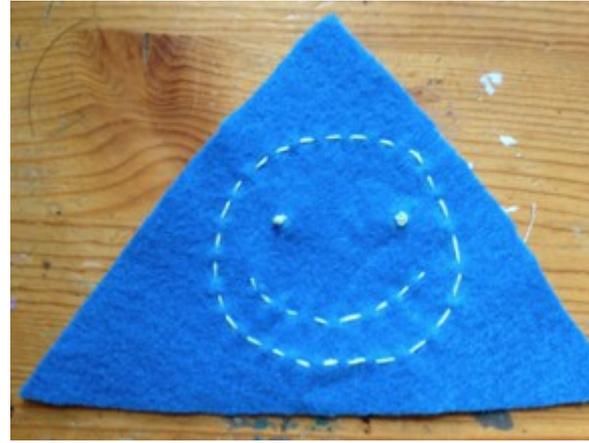
Important note!

Do not connect the legs of the LEDs or both sides of the battery pack together. When this happens, you are creating a short circuit!

Current likes to the flow through the path of least resistance and will not provide current for your components if they are connected this way!

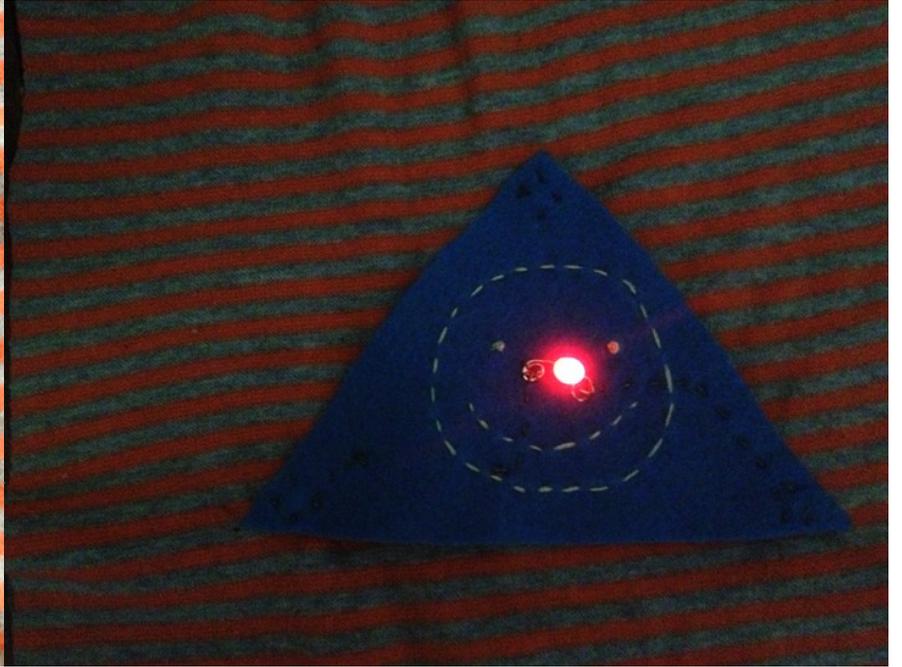
Yes you will have to tie and knot off your thread.

Sew it



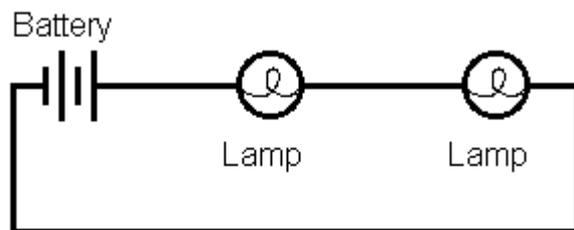
Sew it some more



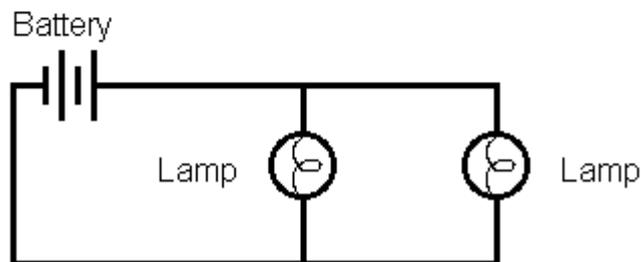


Adding More Lights: Series & Parallel

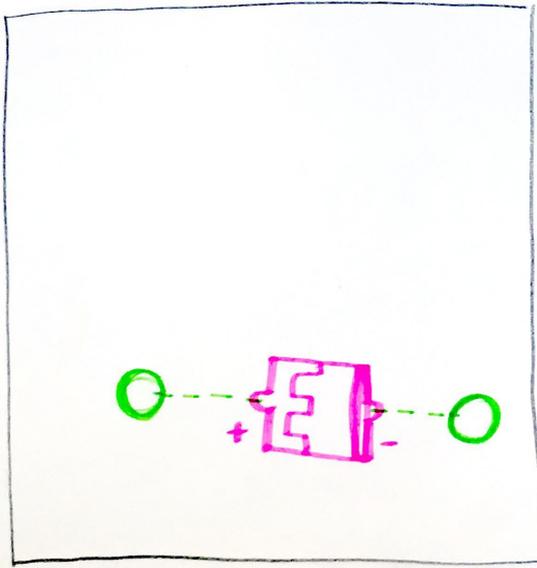
SERIES



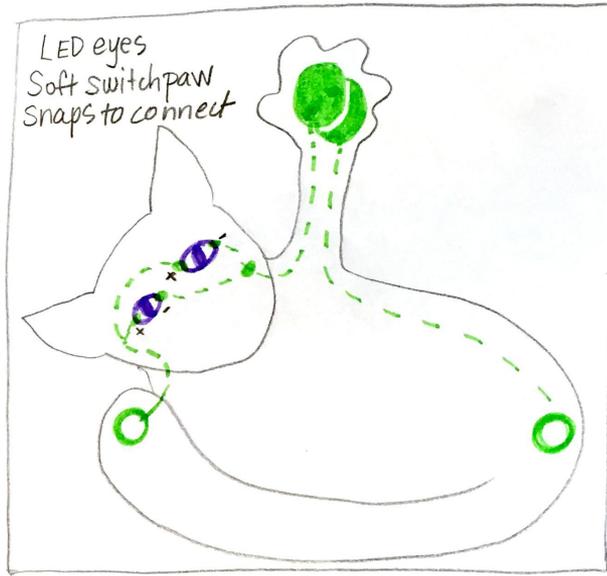
PARALLEL



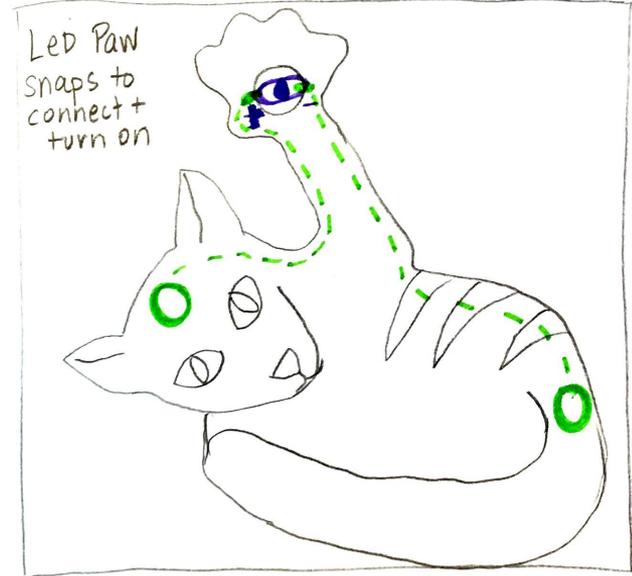




Canvas fabric
with battery and
silver snaps



Design with cat
paw as soft
switch and LED
eyes in parallel



Design with one
LED in cat paw

-  = snaps
-  = soft switch
-  = steel thread
-  = LED
-  = coin cell battery holder

Troubleshooting

- Is your battery and/or LED connected the right way?
- Do you have any short circuits? Are any of your threads touching each other?
- Is your thread making secure connections with components?

Additional Resources

Tutorials

- [Kobakant: HOW TO GET WHAT YOU WANT](#)
- [Make: Wearable Electronics](#)

Materials

- [lessEMF](#)
- [adafruit](#)
- [sparkfun \(conductive thread spool\)](#)