Introduction to Soft Circuits

Sew a Light-Up Felt Monster

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The Hacktory
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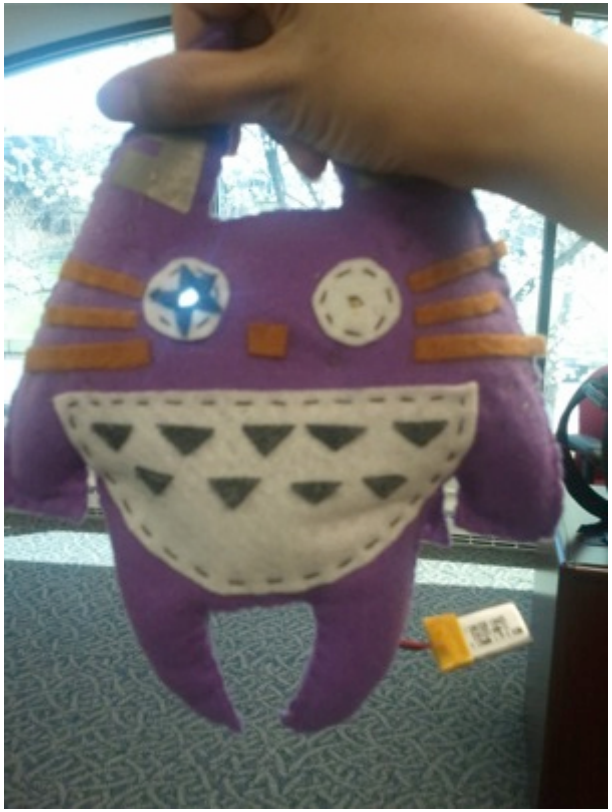

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Today's Agenda

- Introductions
- Project Overview
- Basic Sewing
- Get Started! (30 min.)
- Basic Circuits
- Keep Going! (45 min.)
- Clean Up, Wrap Up (15 min.)

This project was developed by Dr. Yasmin Kafai at the University of Pennsylvania, under NSF Grant No. 1238172.

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What Are E-Textiles?

Garments & craft projects that include circuitry and/ or electronics

- Originally, embedded wires and modified through-hole components
- Today, conductive thread and components designed to be sewable, including LilyPad Arduino and Flora

Photo & design by Tim Bieniosek

From Basic...

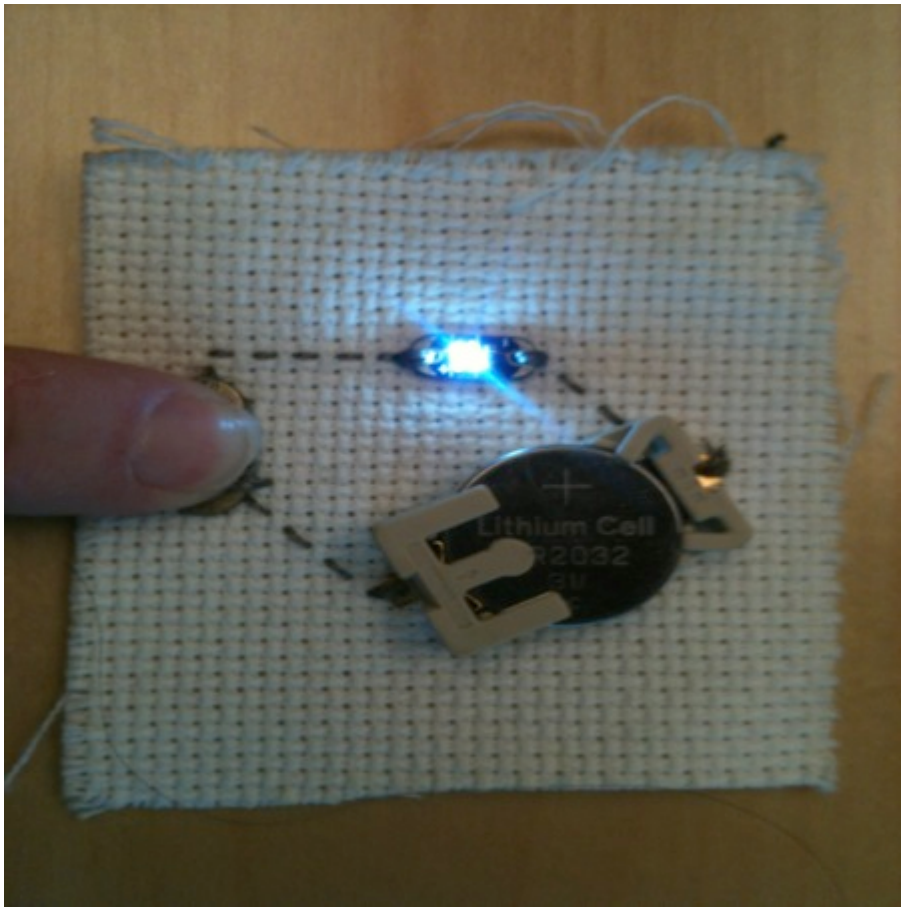

Photo & design by NancyLee Bergey

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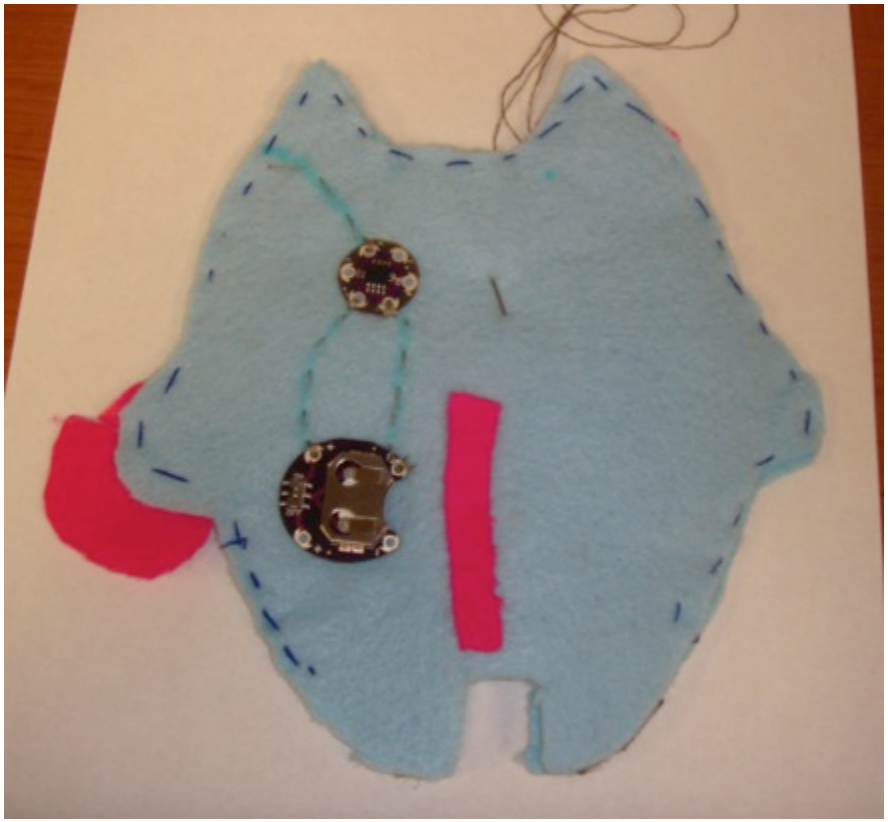
...to Elaborate

Photo & design by Becky Stern

Today's Activity



Designing and sewing a felt toy with lights on it, using conductive thread, sewable battery pack, LEDs and switches, and the LilyTiny, a pre-programmed microcontroller. (Also beads, sequins, feathers, and whatnot.)

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Starting Knot

1. Make an X near the end.

2. Grip the X with thumb & index.

3. Roll thread off finger with thumb.

4. Tighten loops into large knot.

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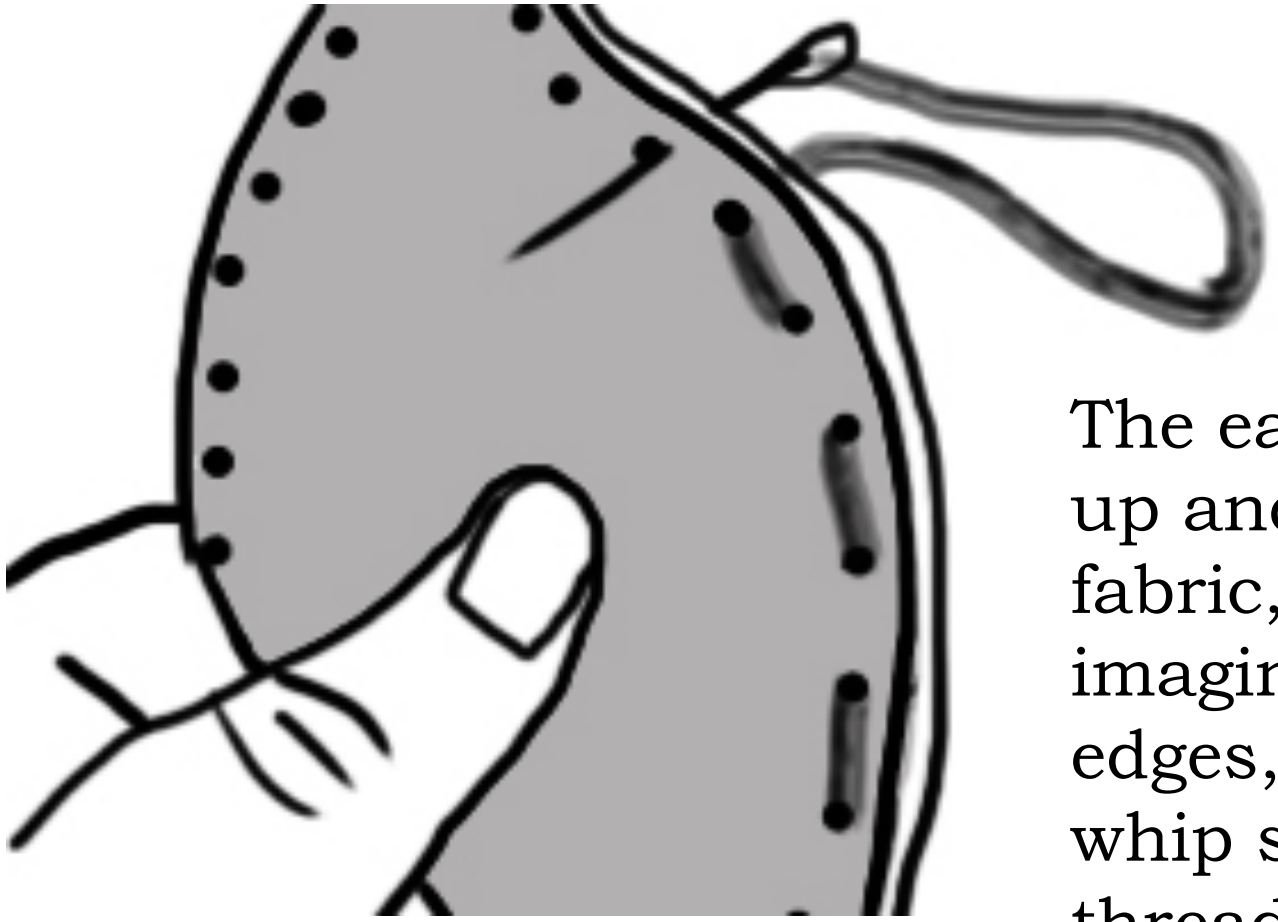
Running Stitch



The easiest stitch just goes up and down through the fabric, following an imaginary dotted line. For edges, you can also use a whip stitch, looping the thread around to hold them together.

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Light Up an LED

Use one battery, one battery holder, one LED, and two alligator clips to light up an LED.

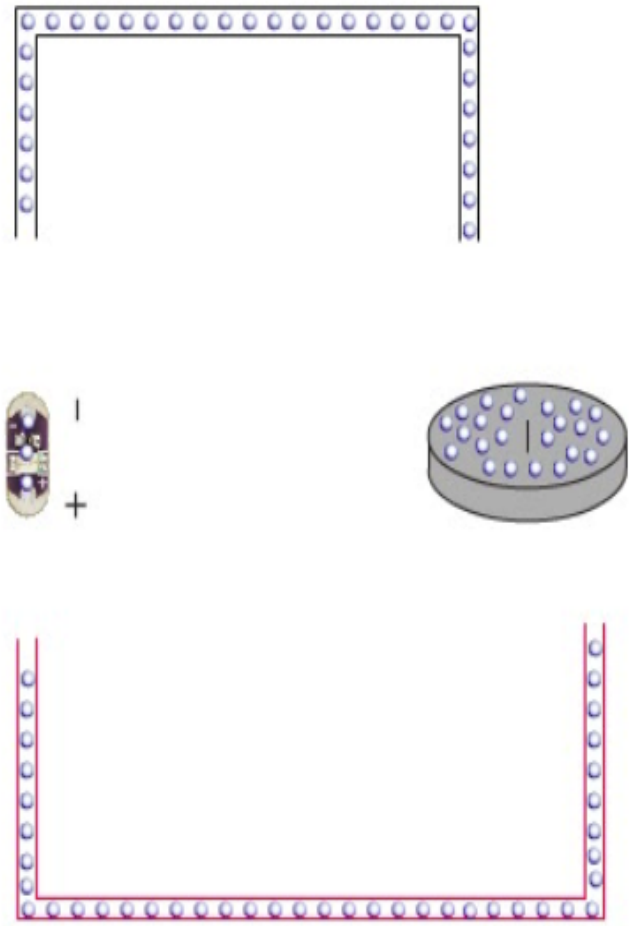
Light Up an LED

Use one battery, one battery holder, one LED, and two alligator clips to light up an LED.

What did you learn?

- Positive on the battery to positive on the LED
- Negative on the battery to negative on the LED
- Battery goes into the holder + (smooth) side up
- The switch needs to be turned on

What's Going on Inside the Circuit?



- The battery has two ends, one with high voltage (electric potential) and one with low voltage.
- If we create a path from the V+ side of the battery to the V- side, the current will follow it.

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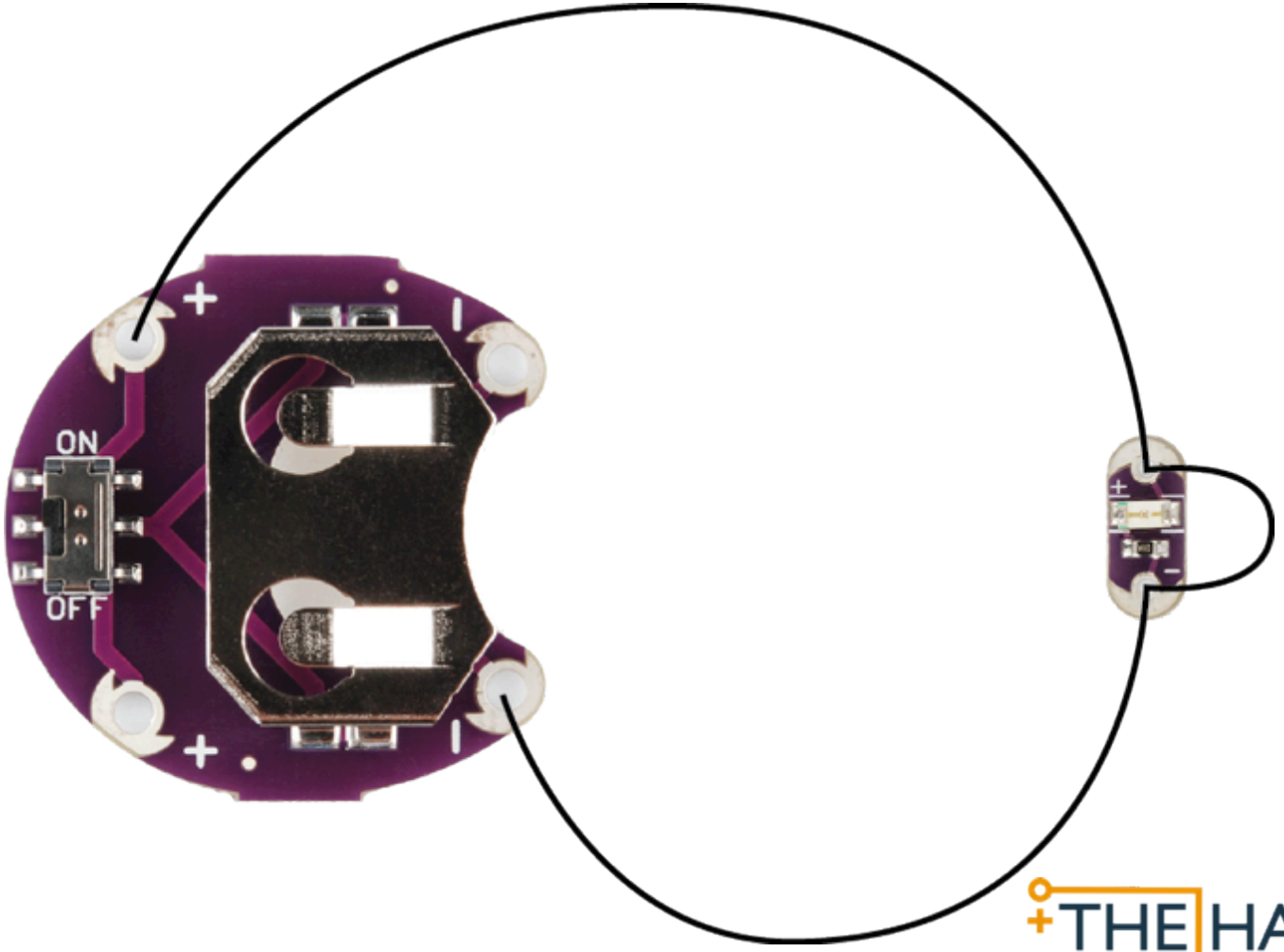
Short Circuits

Will the LED light up in the circuit below?



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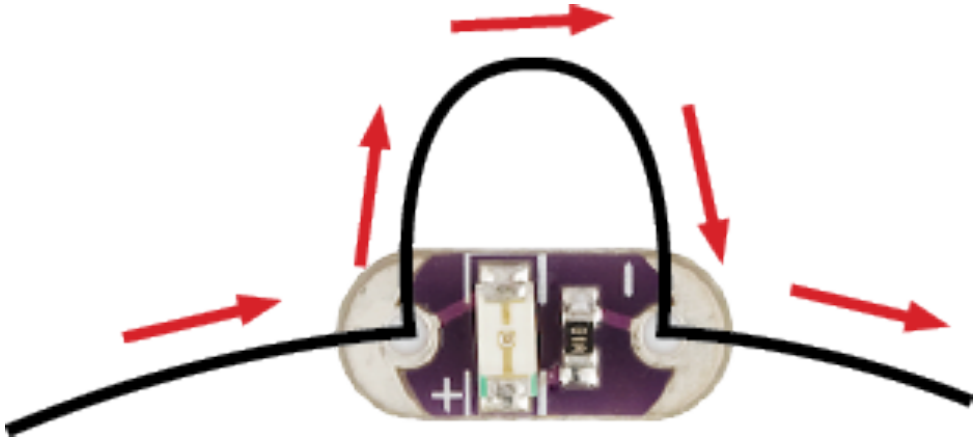
Short Circuits

Electrons want to take the easiest path. Flowing through conductive thread is easy, but flowing through an LED is harder.

Electrons will go through an LED if the battery is powerful enough to push them through.

If you accidentally give the electrons a shortcut around the LED, they won't go through it!



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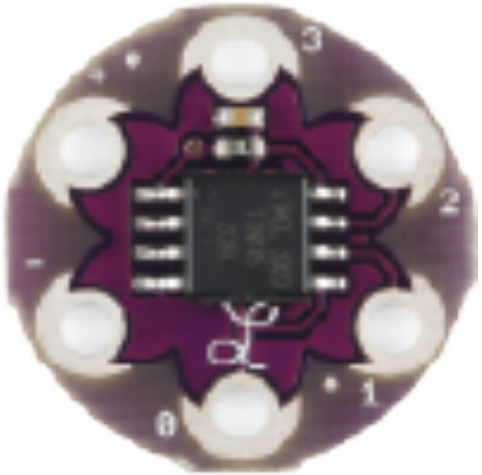
The LilyTiny

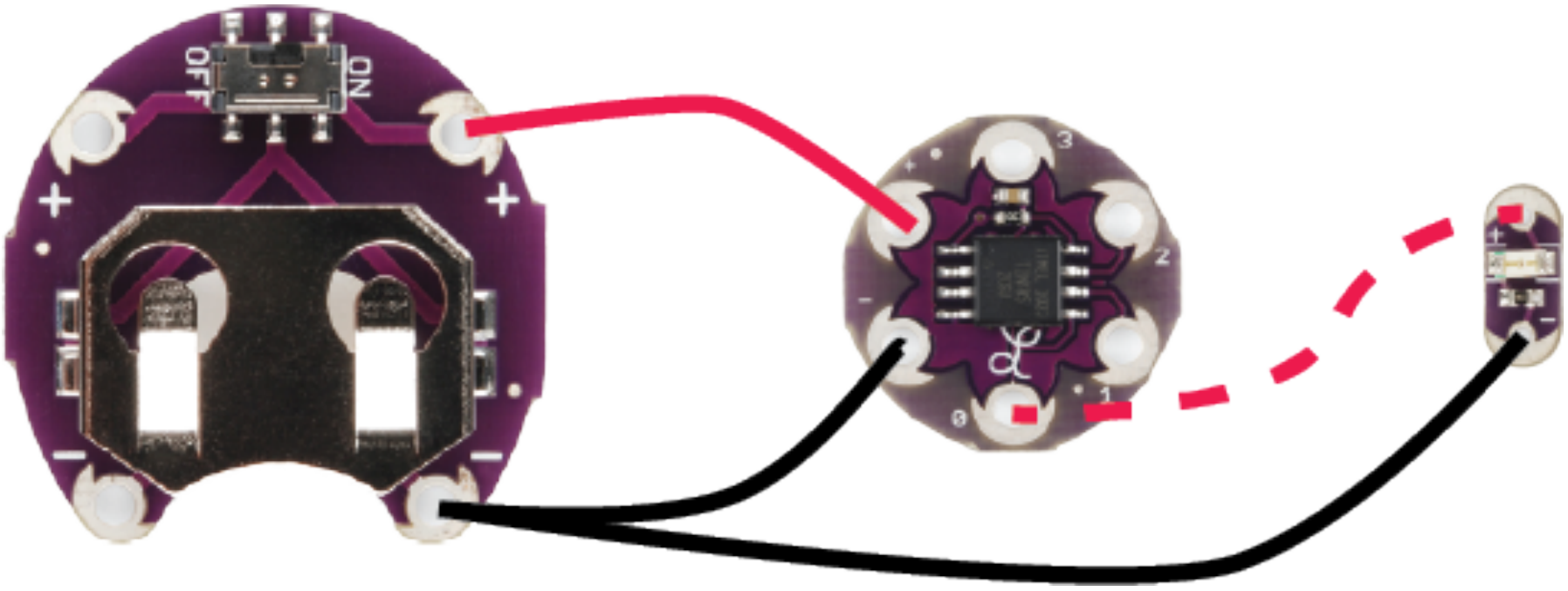


Instead of a simple on/off switch, the LilyTiny gives us more control over our LEDs by changing the voltage flowing to them. Each numbered pad on the LilyTiny has a different effect: fade (0), heartbeat (1), blinking (2), and random (3).

The Basic LilyTiny Circuit

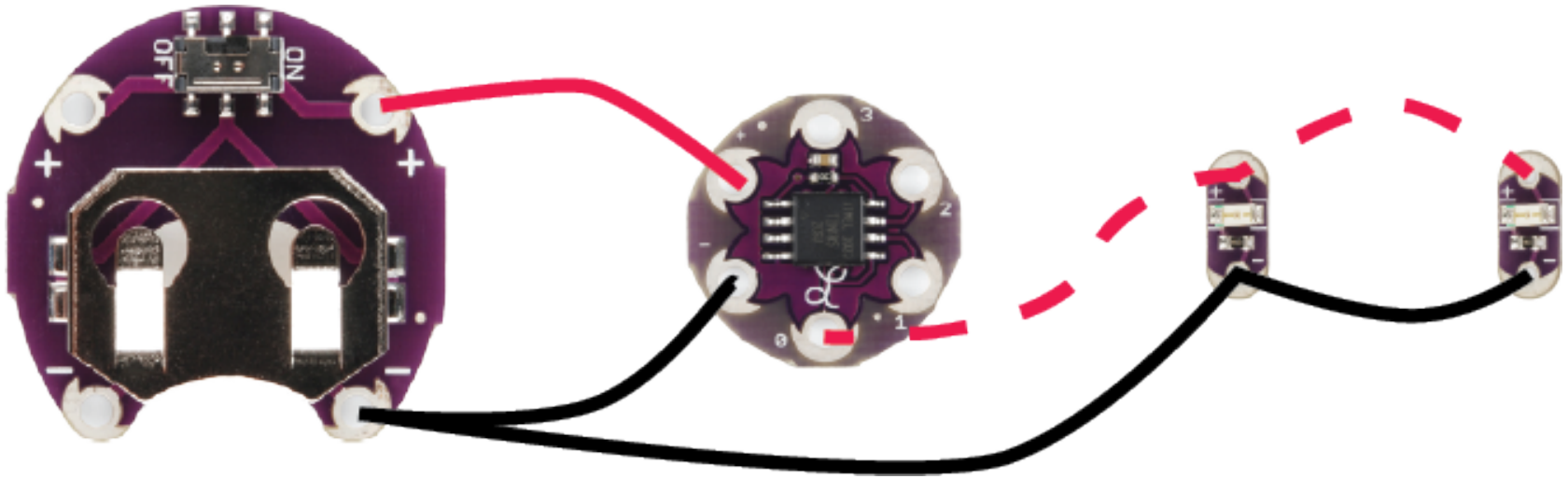
Power the LilyTiny with the battery: (+) to (+), (-) to (-)

Connect the (+) pad of the LED to the effect pad of the LilyTiny, and connect all the negative pads together:



Connecting More LEDs

To connect more than one LED to each effect, we use a parallel circuit:



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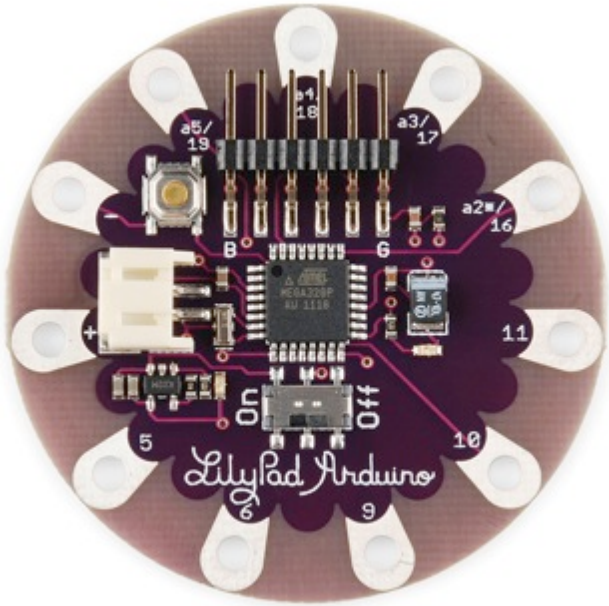
Going Further: LilyPad Arduino

The LilyPad is like the LilyTiny, except we can program it to do whatever we want!
It is a sewable Arduino board with multiple input and output pads.



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Suggestions for Success

- Check the back for knots and loose threads; these can cause short circuits.
- Needles are sharp, handle with care!
- Leave the battery off until you're ready to test, to avoid shocks & draining.
- Use alligator clips to test the LilyTiny patterns before starting to sew.
- If you have to cross conductive thread lines, use fabric as an insulator.
- Use regular thread for ribbon and sequins.

Resources

- Upcoming Hacktory classes on Circuits (7/9), Arduino (8/5), and many more!
- Project Night, every week; Soft Circuit Saturday, every month
- Cool project tutorials at eCrafting.org, Adafruit, and Sparkfun
- Purchase sewable electronics from Adafruit or Sparkfun; Radio Shack also has Arduinos

Happy crafting!

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