

Creative Computing

Dr. Andrew DeOrio

14 September, 2014

Living Arts Workshop @ University of Michigan

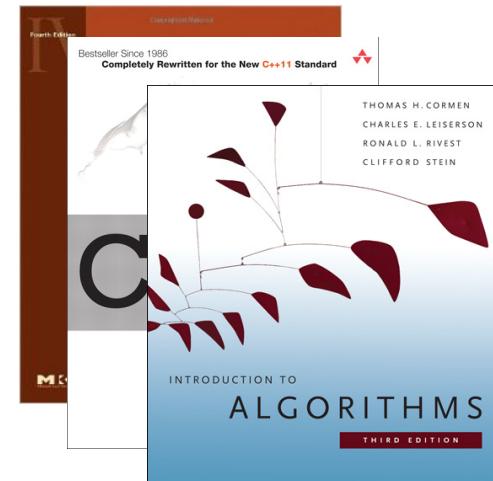
About Me

- Triple Wolverine
 - undergrad (EE), masters (EE) and PhD (CSE)
- Computer Science & Engineering faculty

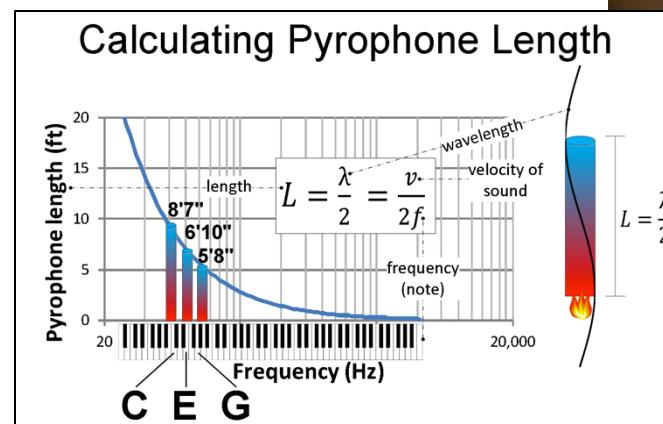


What is Engineering?

- The branch of science and technology concerned with the development and modification of engines ... or other complicated systems



- The creative application of scientific principles
 - My favorite definition



Manifestations of Creativity

- <http://www.youtube.com/watch?v=TF6cnLnEARo>



Some manifestations of creativity in the video we saw

- Johann Pachelbel (1653-1706) composer
- Jerry C, rock version (Canon Rock)
- Funtwo (Jae-Hyun Lim) performance, staging
- Les Paul, solid body electric guitar
- Thomas Edison, electric lighting
- Jerome Lemelson, inventor of camcorder
- Michael Faraday, electromagnetic induction

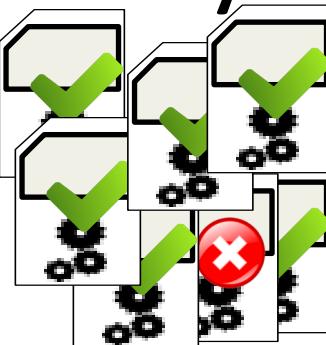
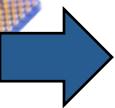
My creative process

- ... solves problems *and* decides what problems are worth solving
- ... uses scientific principles
- ... is a process, not a moment
- ... is a group endeavor

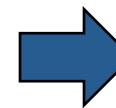
Example: My Research

pushl
%ebp
m
%esp

same test



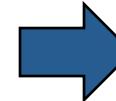
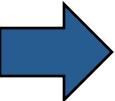
many different results



difficult to locate bug!



same card

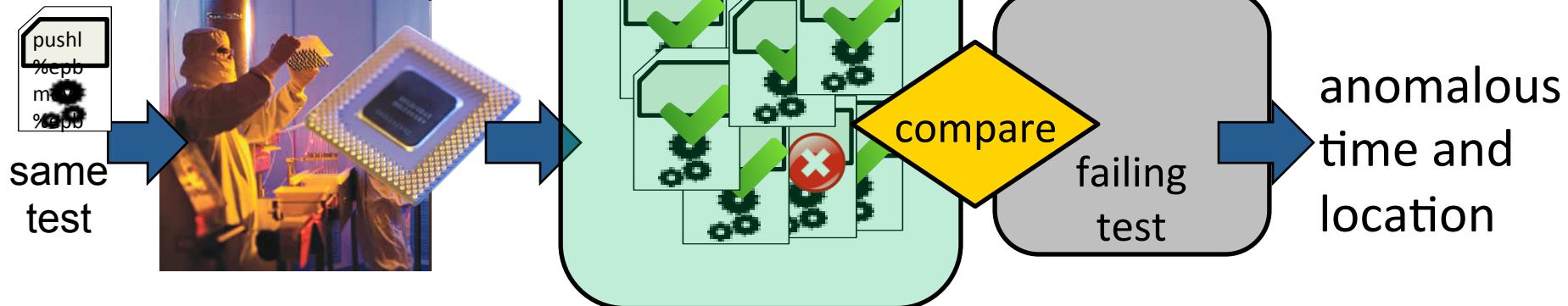


difficult to locate fraud!

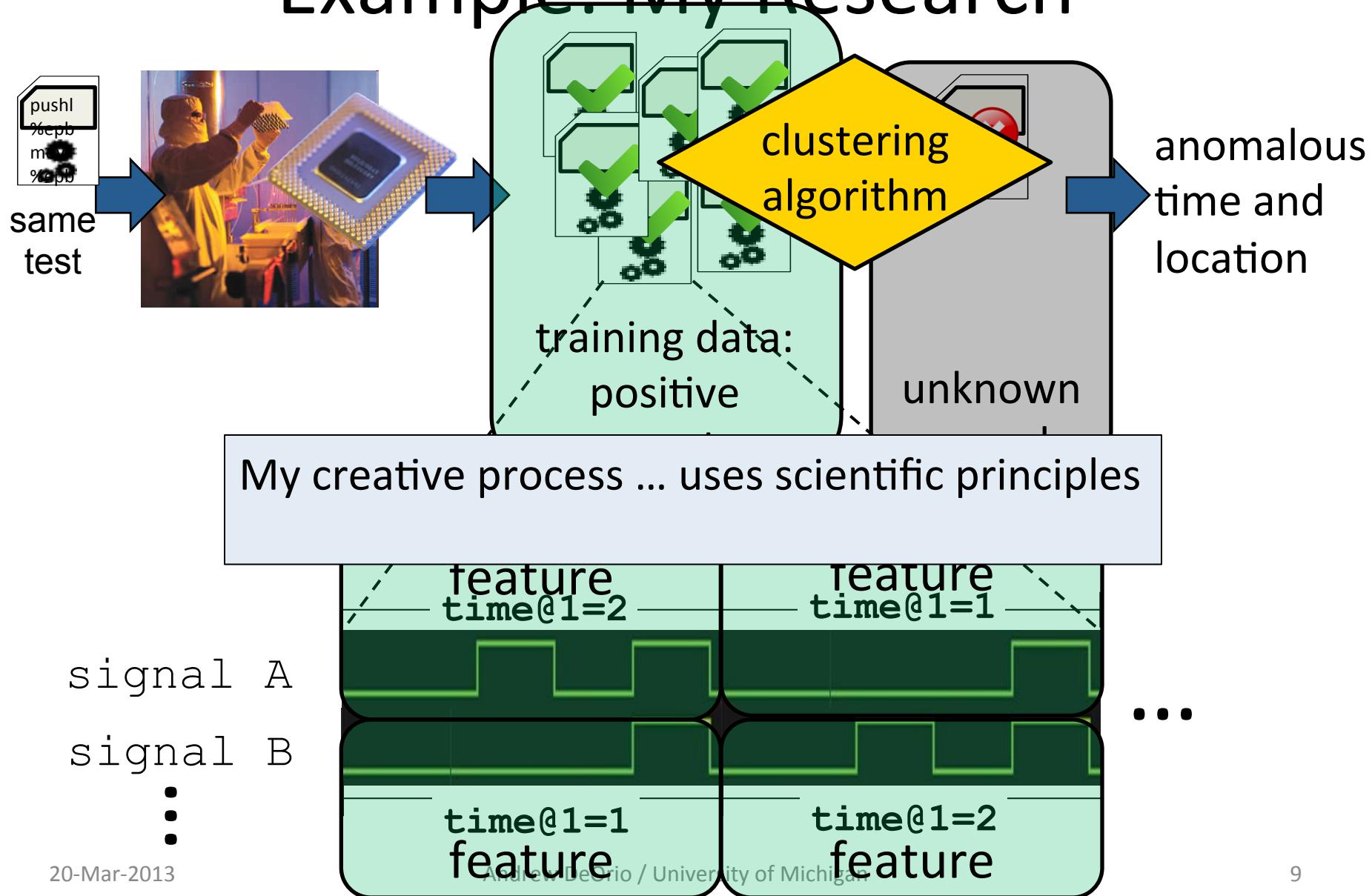
many different transactions

My creative process ... solves problems *and* decides what problems are worth solving

Example: My Research



Example: My Research



Example: My Research

- This idea developed over four years
- Working at Intel ... I saw the problem
- First idea didn't work *at all*
- Second idea didn't work *at all*
- Third idea worked, but not very well, and didn't use machine learning
- ...

My creative process ... is a *process*, not a moment.
(We call this *prototyping* and *iteration* in engineering.)

Example: My Research



The banner for DATE 13 (Design, Automation & Test in Europe) is displayed at the top. It features the acronym 'DATE' in white with a red '13' over it, surrounded by yellow stars on a blue background. To the right, text reads 'Design, Automation & Test in Europe', '18-22 March, 2013 - Grenoble, France', and 'The European Event for Electronic System Design & Test'.

Machine Learning-based Anomaly Detection for Post-silicon Bug Diagnosis

Andrew Deorio^M, Qingkun Li^I,
Matthew Burgess^M and Valeria Bertacco^M

 University of Michigan

 University of Illinois

My creative process ... is a group endeavor

Example: Human Circuit

- Problem: pedestrians are often “in their own world” while walking between classes. How can we encourage them to connect with each other and their surroundings?
- Solution: Human Circuit
 - “Be the photographer, camera and subject by completing the circuit!”



My creative process ... solves problems *and* decides what problems are worth solving

Selfies Meet Circuits

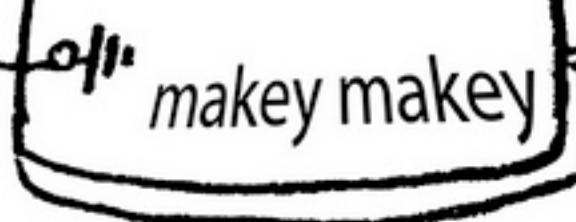


My creative process ... uses scientific principles

flickr



python™



Example: Human Circuit



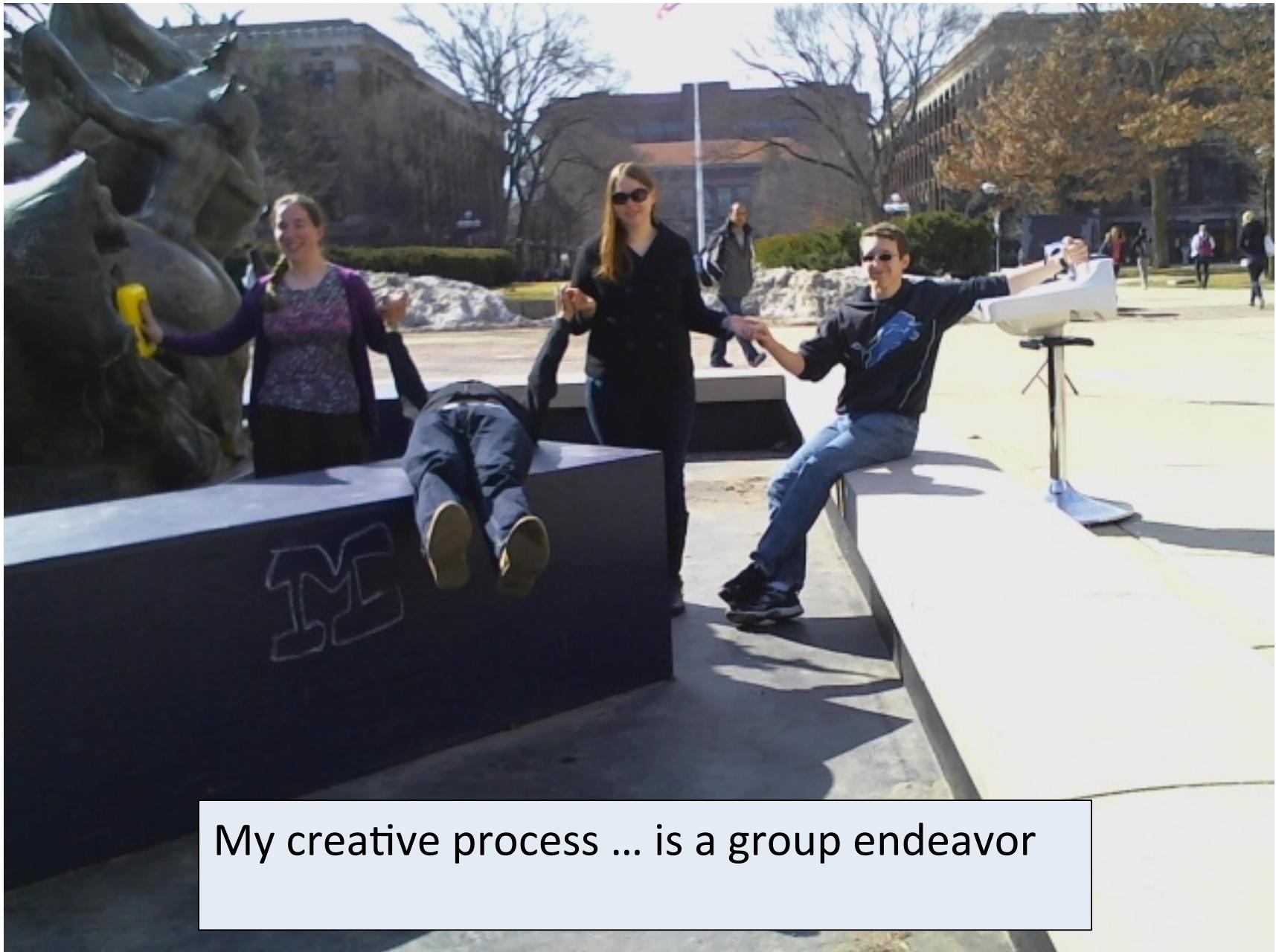
Example: Human Circuit



My creative process ... is a *process*, not a moment.
(We call this *prototyping* and *iteration* in engineering.)







My creative process ... is a group endeavor

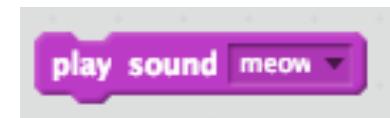
Computing

- Computers process information by taking input and transforming it with logic to output
- Today we will use logic and inputs as our tools to solve a problem



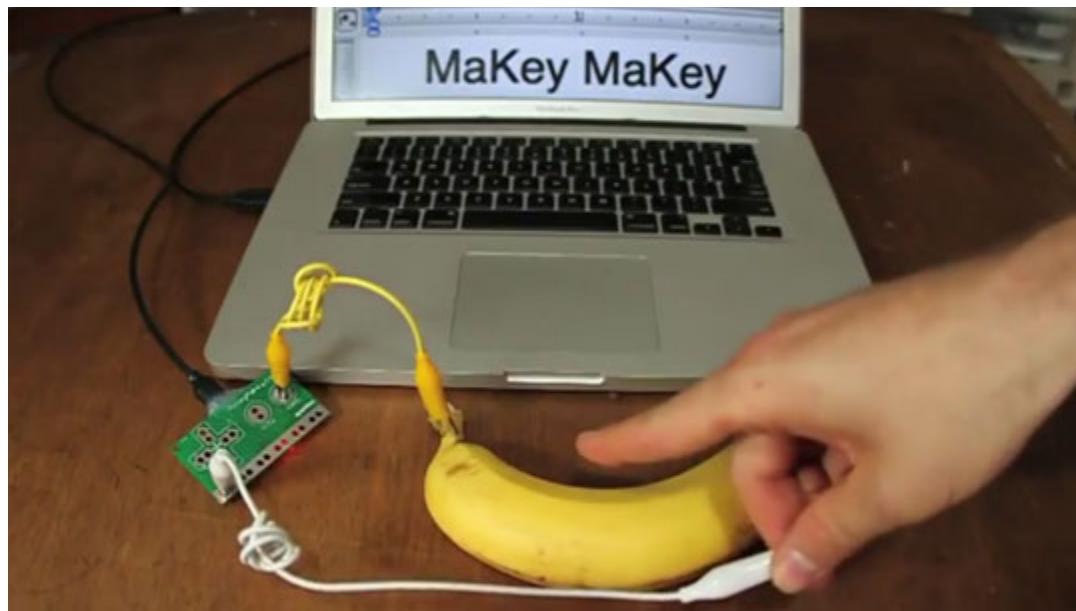
Learn How to Program in 60 Seconds

- <http://scratch.mit.edu>
- Statements
 - One thing at a time, top-to-bottom
 - Example: play cat sound
- Branching
 - Play cat sound *if* space bar is pressed
- Looping
 - Play cat sound if space bar is pressed. Check again if space bar was pressed. *Repeat.*



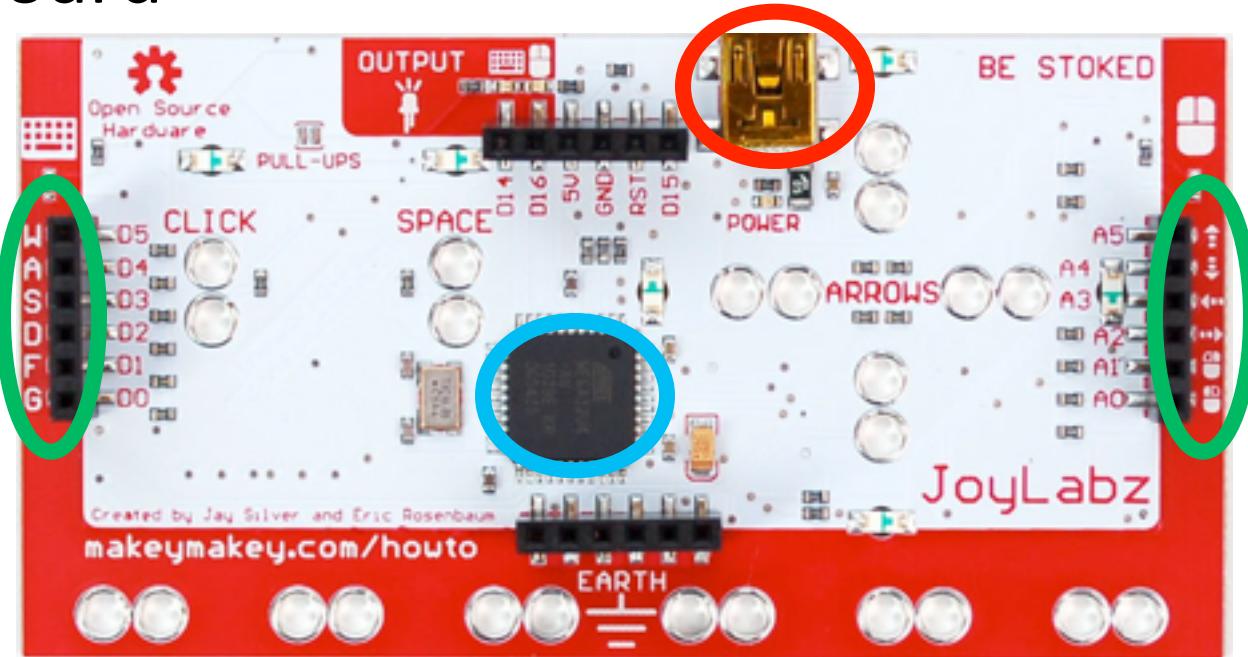
Computer Hardware in 60 Seconds

- Today, we will create new input devices for a computer using a Makey Makey

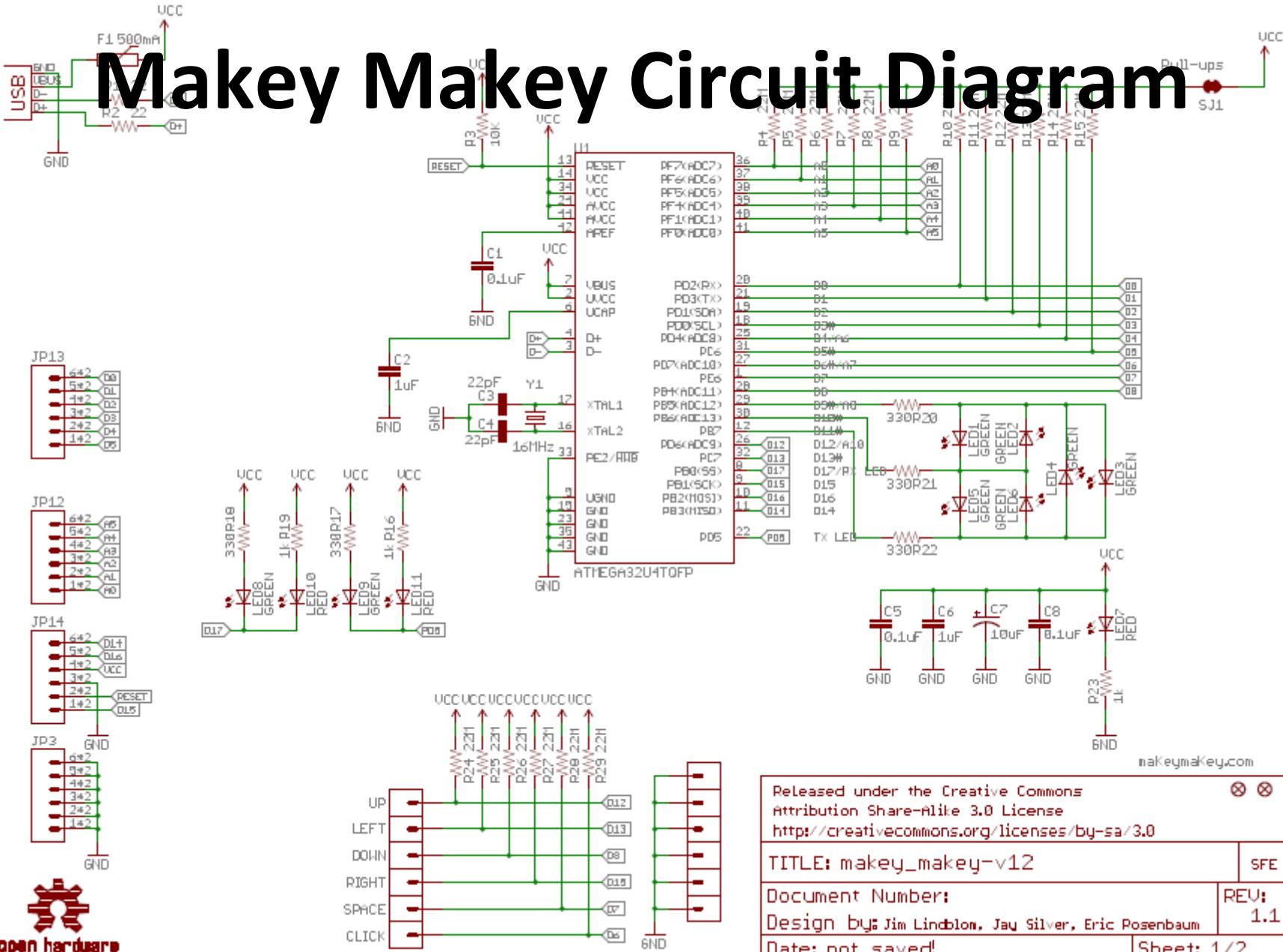


Computer Hardware in 60 Seconds

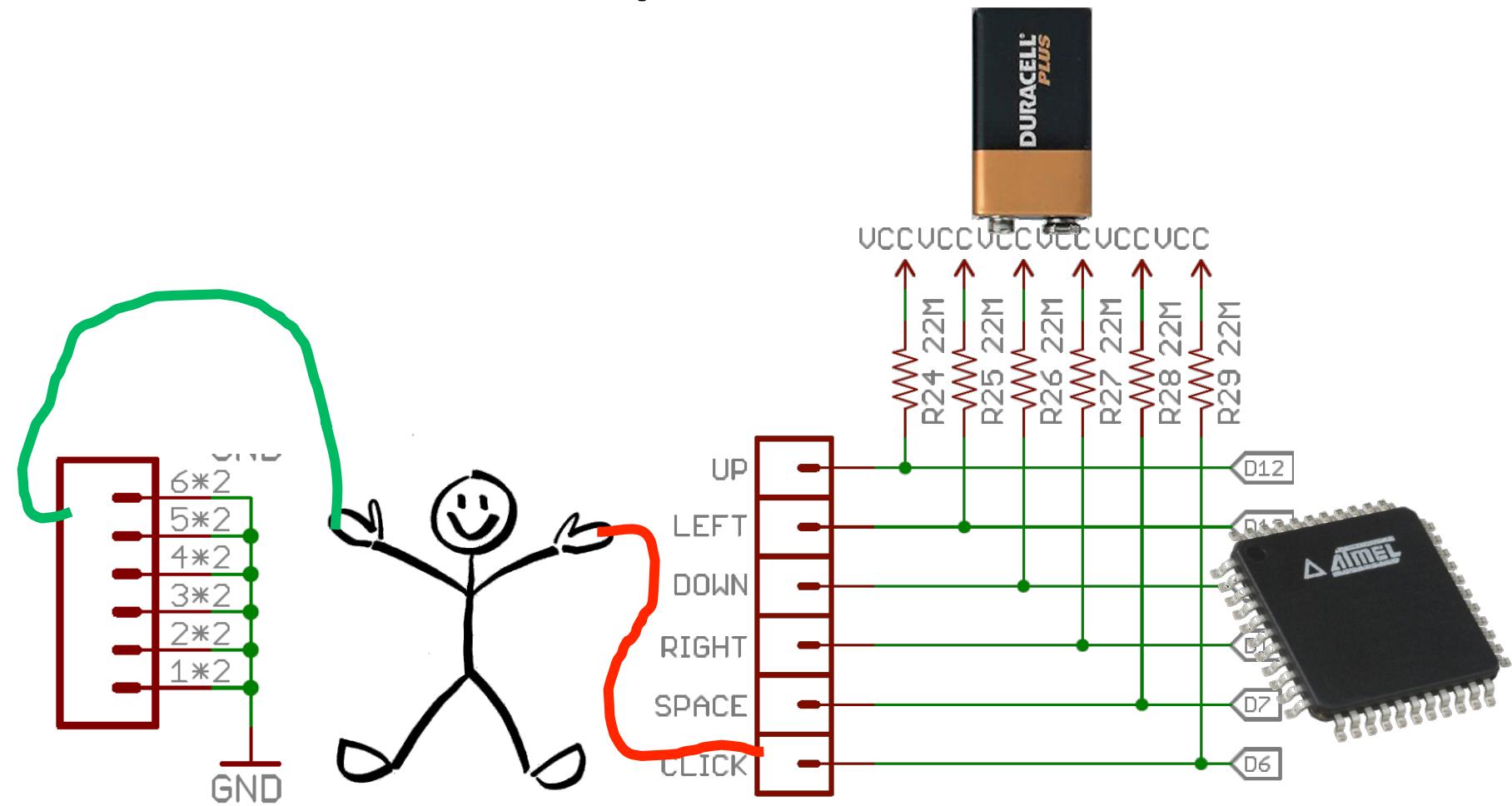
- A **tiny computer** (Atmel ATMega32u4) takes **input** with wires, and provides **output** to your computer by mimicking a USB mouse and keyboard



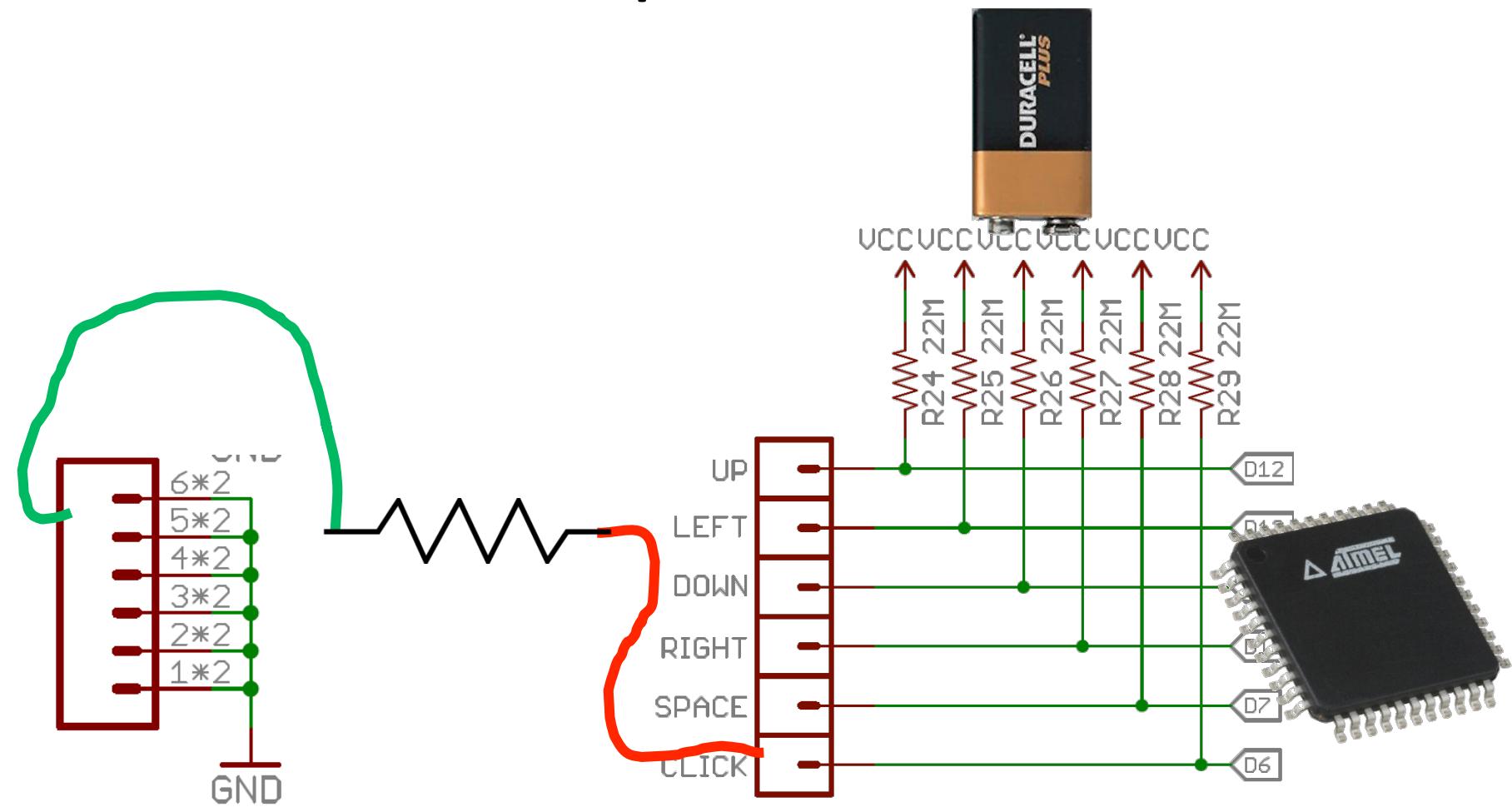
Makey Makey Circuit Diagram



Input Circuit

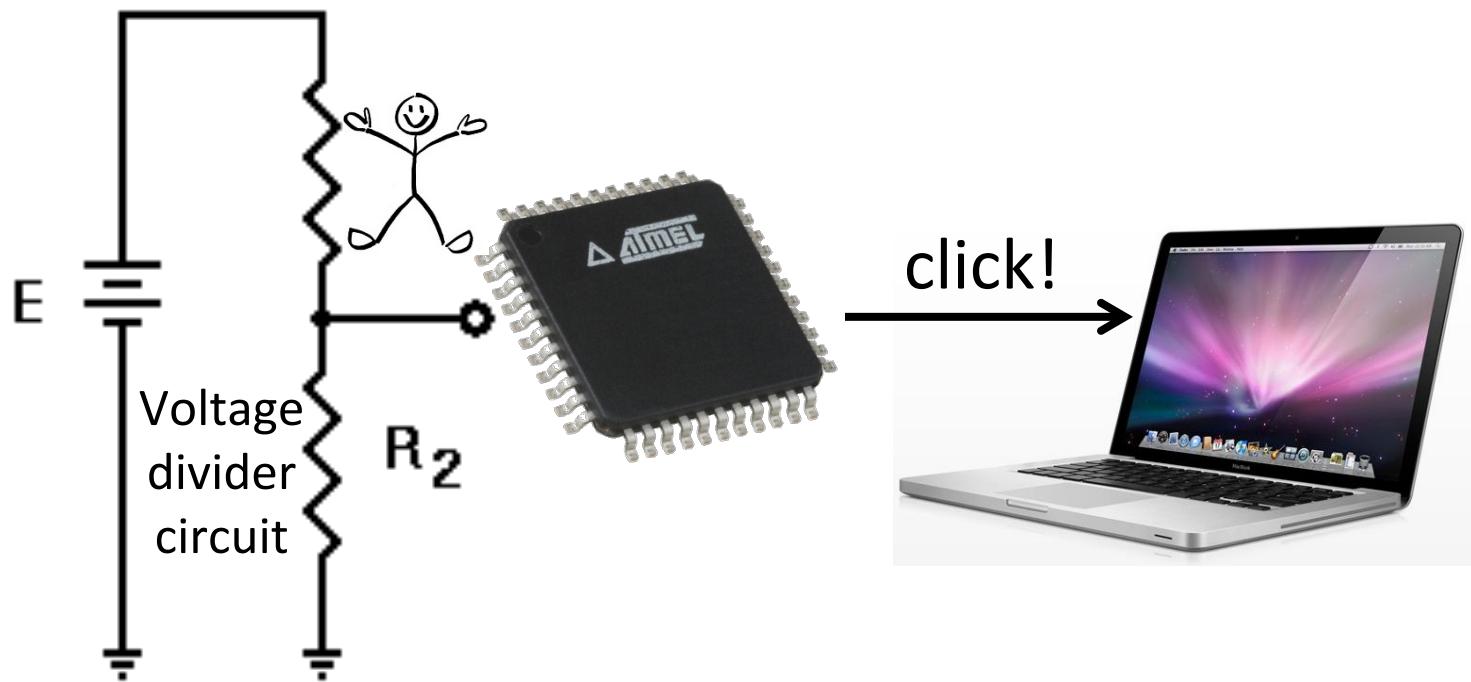


Input Circuit



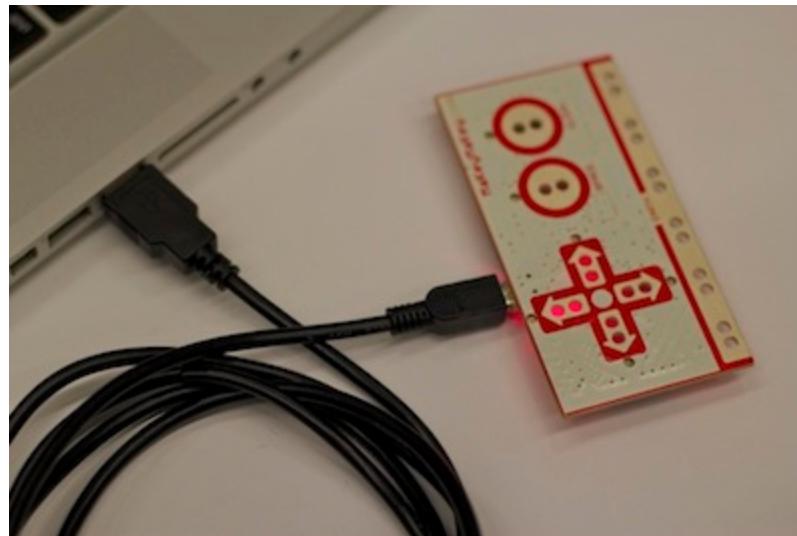
Input Circuit

- Chip senses change in voltage when you complete the circuit
- Chip sends "click" or key press to computer



Makey Makey Quick-start

- **Plug in USB**
- Small side of USB cable plugs into MaKey MaKey, big side plugs into computer.



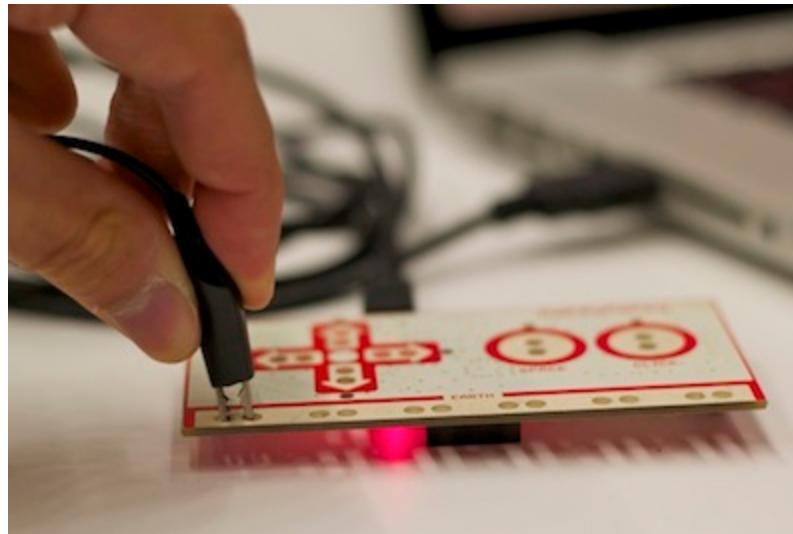
Makey Makey Quick-start

- **Close Popup Window**
- Your computer may ask you to install drivers or do other setup. You can click cancel or close the window.

Make MaKey Quick-start

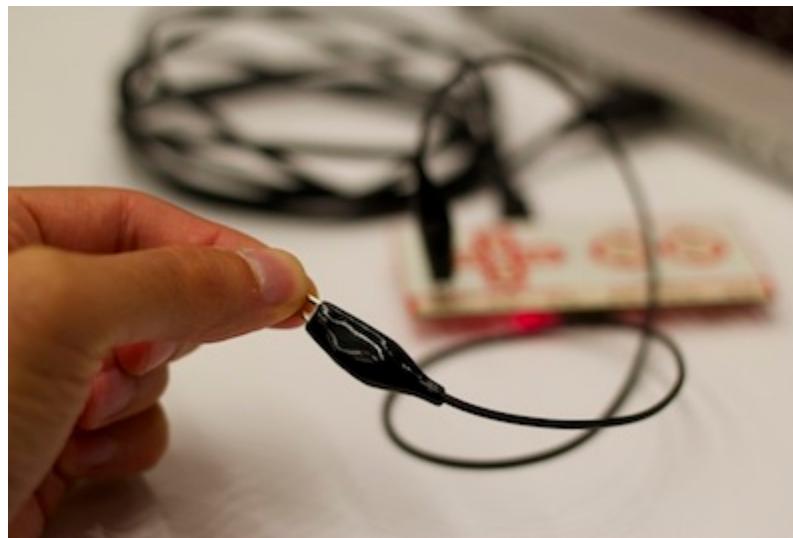
- **Connect to Earth**

Connect one end of an alligator clip to "Earth" on the bottom of the front side of MaKey MaKey.



Make Makey Quick-start

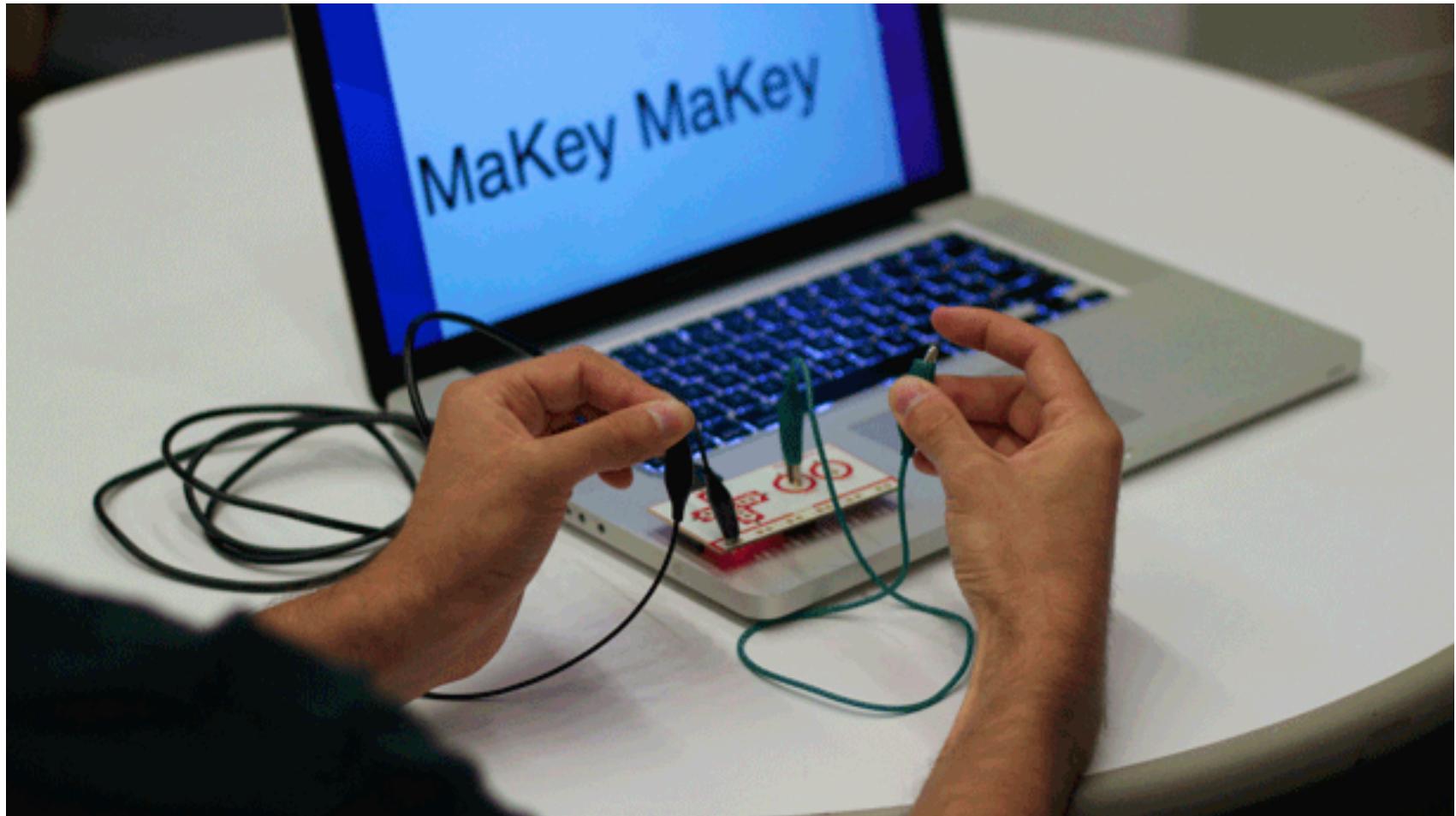
- **Connect to Yourself**
- Hold the metal part of the other end of the alligator clip between your fingers. You are now "grounded."



Make Makey Quick-start

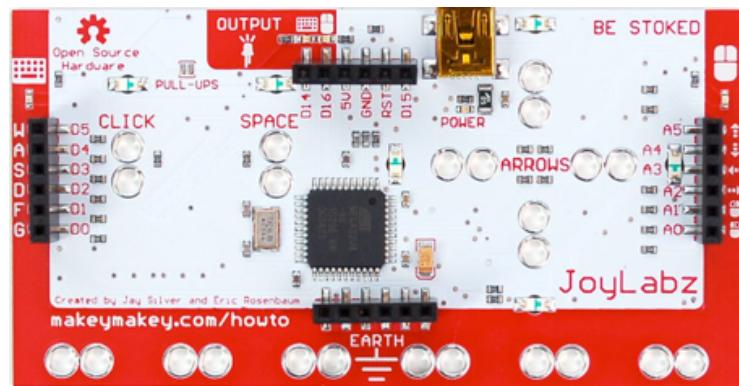
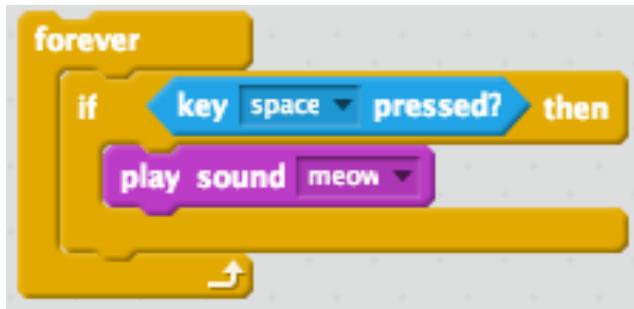
- **Connect to "Space" and Try It**
- While you're still grounded, touch the round "Space" pad on the MaKey MaKey. You should see a green light on the MaKey MaKey, and your computer will think the space bar was pressed. If you click in the text area below, you can make the cursor move. You can also complete the circuit by connecting another alligator clip to "Space."

Make MaKey Quick-start



Task

- Use a Makey Makey and/or Scratch to solve a problem
- First, a simple test: reproduce the quick-start
- How can Scratch and a Makey work together?

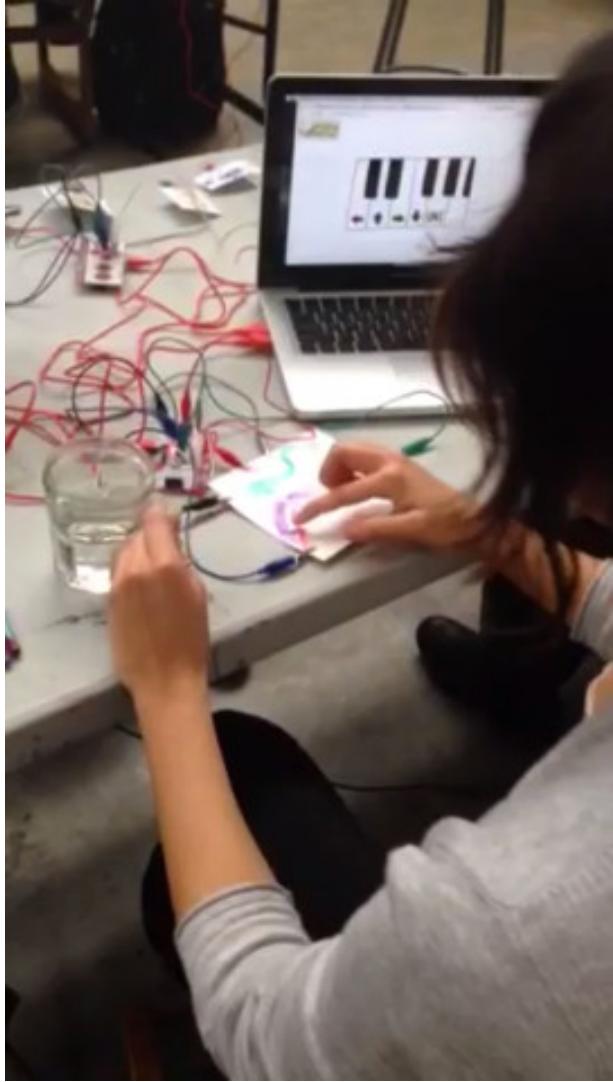


Demos

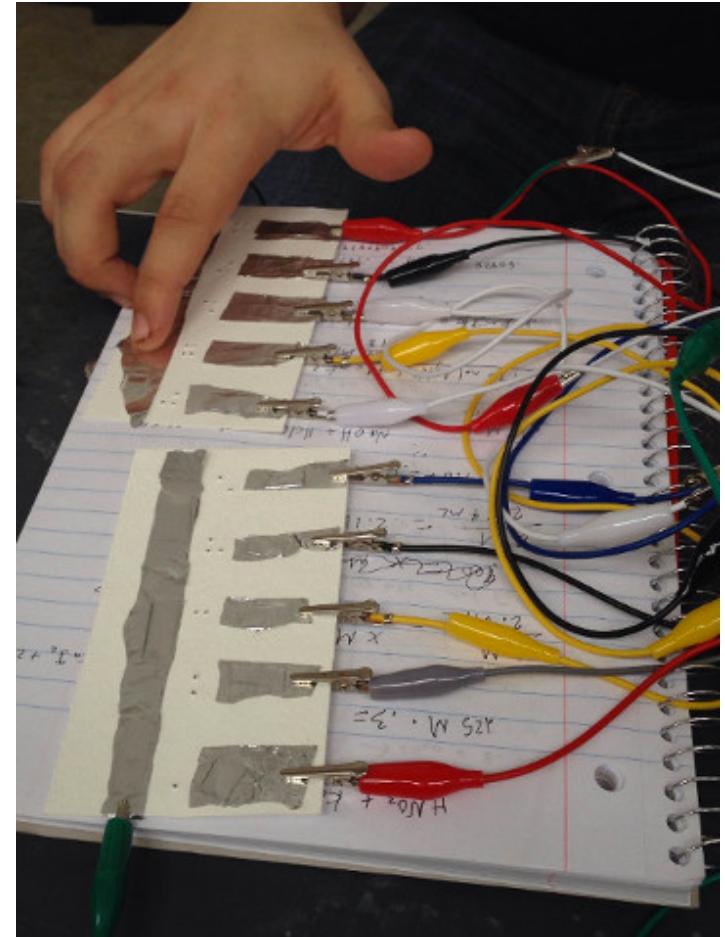
- 10 min: half of your group shows demo, half visits other groups
- 10 min: swap

Discussion and Debrief

- Did your group experience any failures?
- What would you do next?
- How can you relate this workshop to what you do (your major)?



More on computing: EECS 183
“Elementary Programming
Concepts”



More on creativity: UARTS 250
“Creative Process”