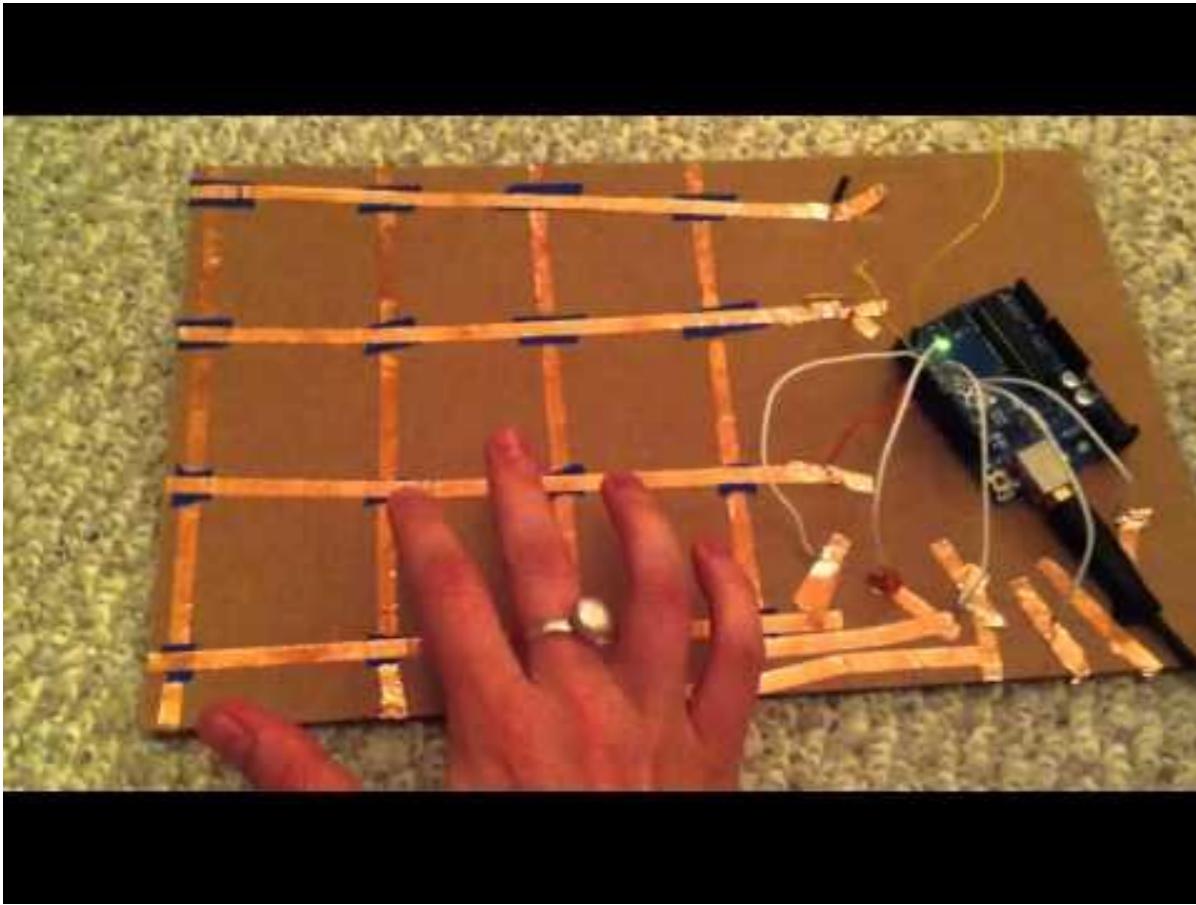

Arduino Music Sequencer

Jenna deBoisblanc
November 3rd, 2014







physical computing

**use programming to interact with
the physical world**

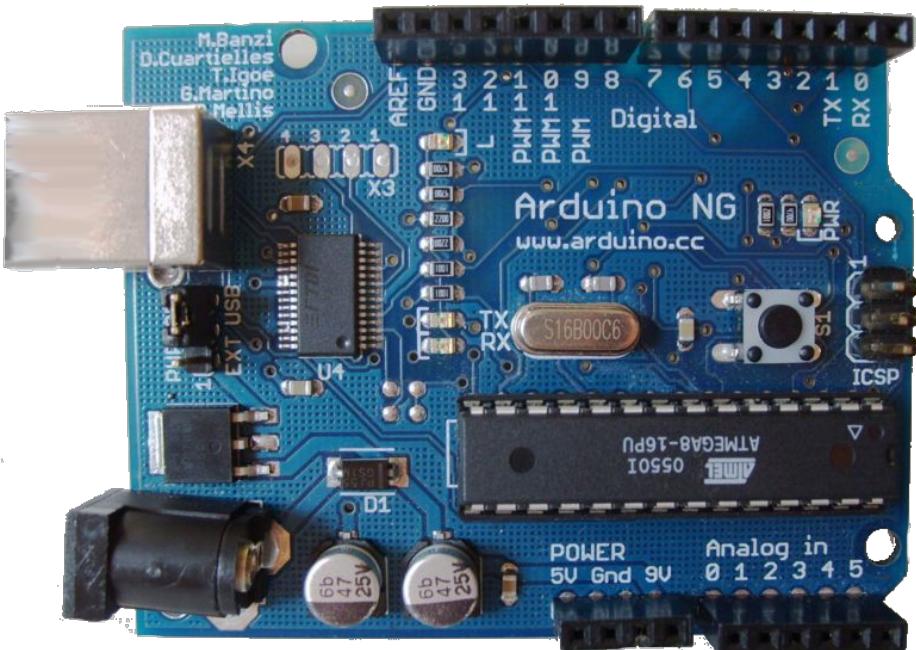
Overview

- What is an Arduino?
- Writing voltages
 - Blink
 - Fade
 - RGB LEDs
- Reading voltages
 - photoresistor
 - vibration sensor
 - button
- Neopixels
- Neopixels + Processing
- Monome

What is Arduino?

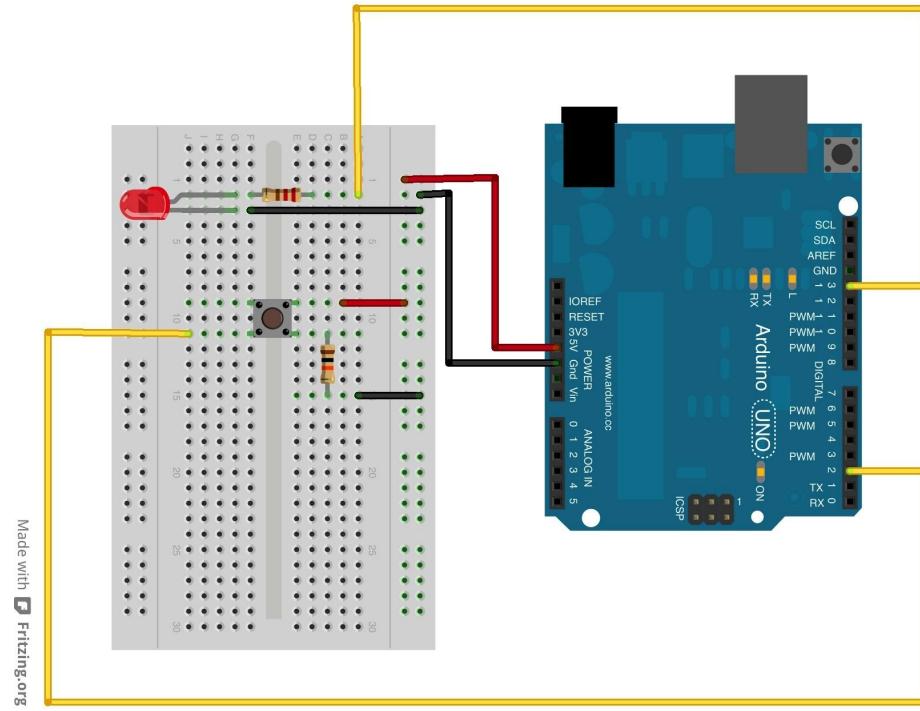
What is Arduino?

open-source
hardware+software
tool for building
interactive
electronics projects

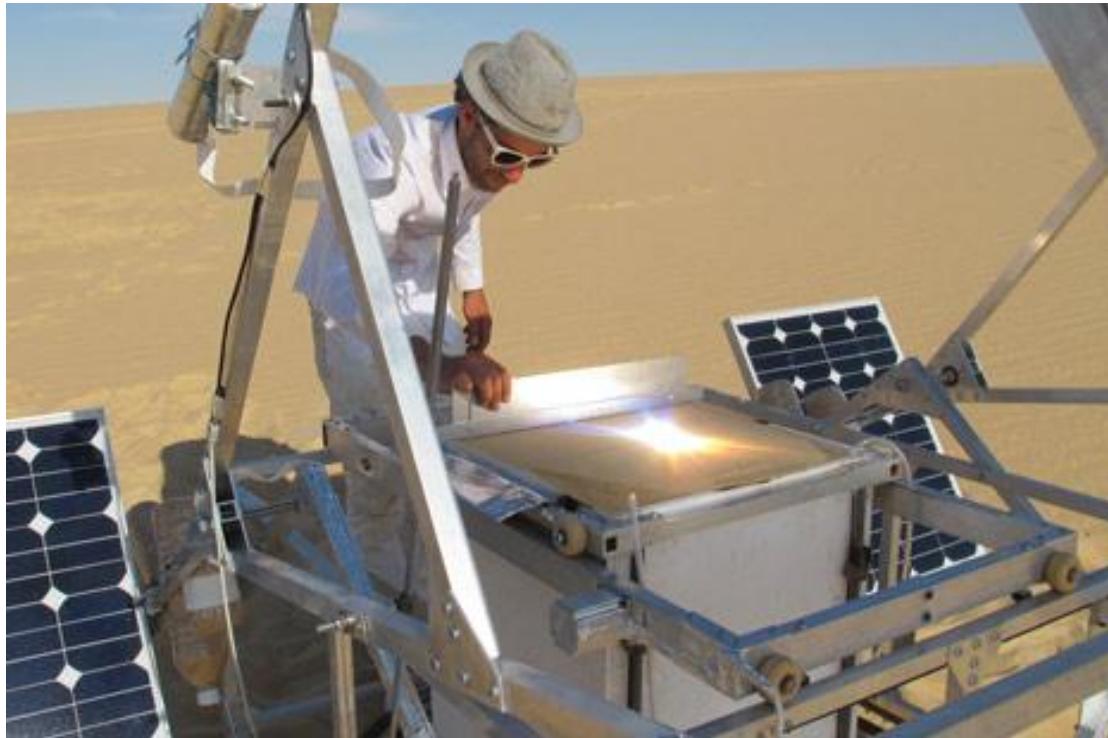


What can an Arduino do?

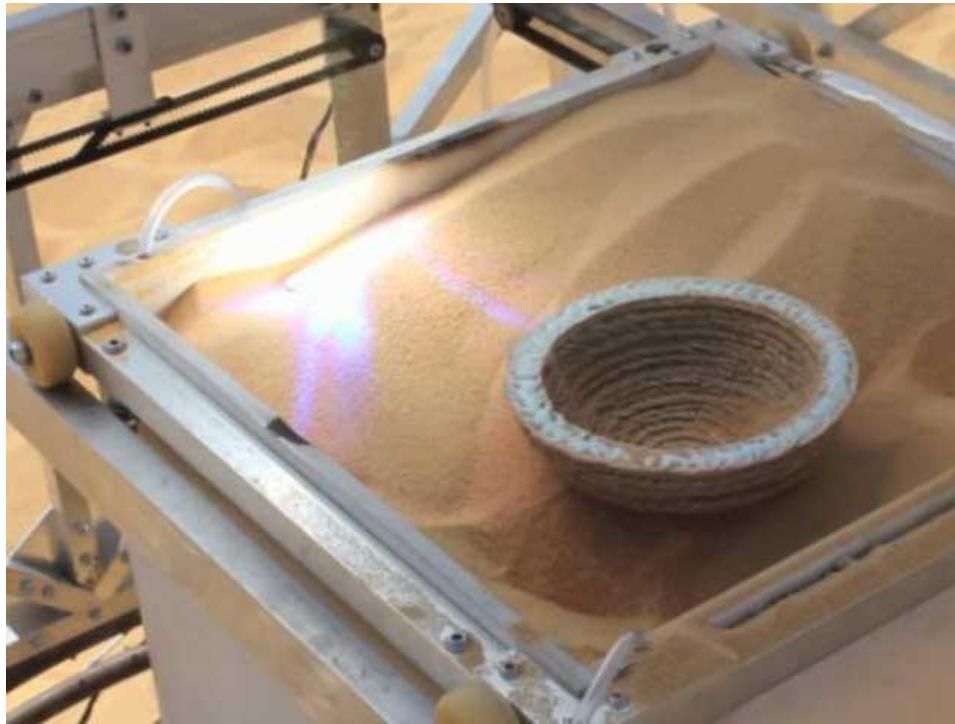
- write voltages
(control components)
- read voltages
(sense the world)



Examples: Solar Sinter



Examples: Solar Sinter



Examples: Cocktail Maker





Examples: pimpMyBike

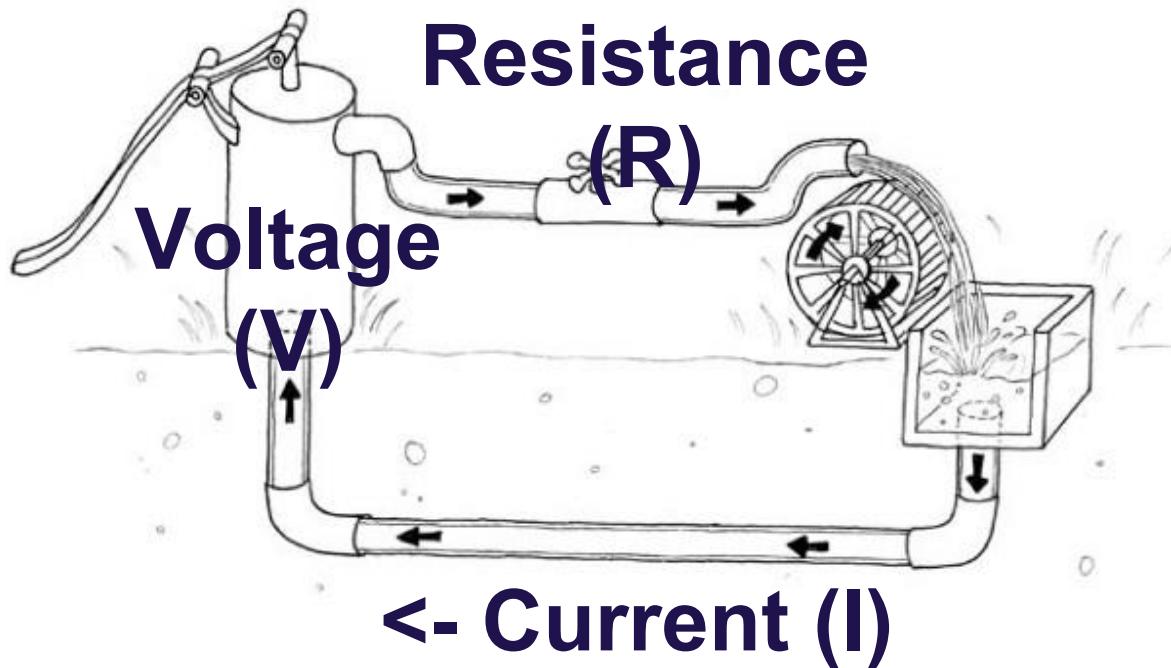


Included in the Arduino kit:

- Arduino Uno
- USB A to B cable
- Miniature breadboard
- Male to Male jumper wires - These are high quality wires that allow you to connect the female headers on the Arduino to the components and breadboard. 40 4" wires, 10 6", and 10 9" wires.
- 2 Tri-Color LEDs
- 2 Red LEDs - Light emitting diodes make great general indicators.
- 2 Green LEDs - Light emitting diodes make great general indicators.
- 2 Blue LEDs - Light emitting diodes make great general indicators.
- 2 buttons - To interface with outside world
- 2 Photocell - A sensor to detect ambient light. Perfect for detecting when a drawer is opened or when night-time approaches.
- 2 Thermistor - A sensor for detecting ambient temperature and temperature changes. 10K thermistor with a negative temperature coefficient.
- 1 piezo vibration sensor: Minisense 100.
- 2 Potentiometer: 2 adjustable 10K ohm potentiometer can be used to do ADC input experiments.
- 1K Ohm Resistors - 5 current limiting resistors for LEDs, and strong pull-up resistors.
- 5K Ohm Resistors - 5 current limiting resistors for LEDs, and strong pull-up resistors.
- A buzzer

Simple Circuit

circuit water analogy



resistor calculator

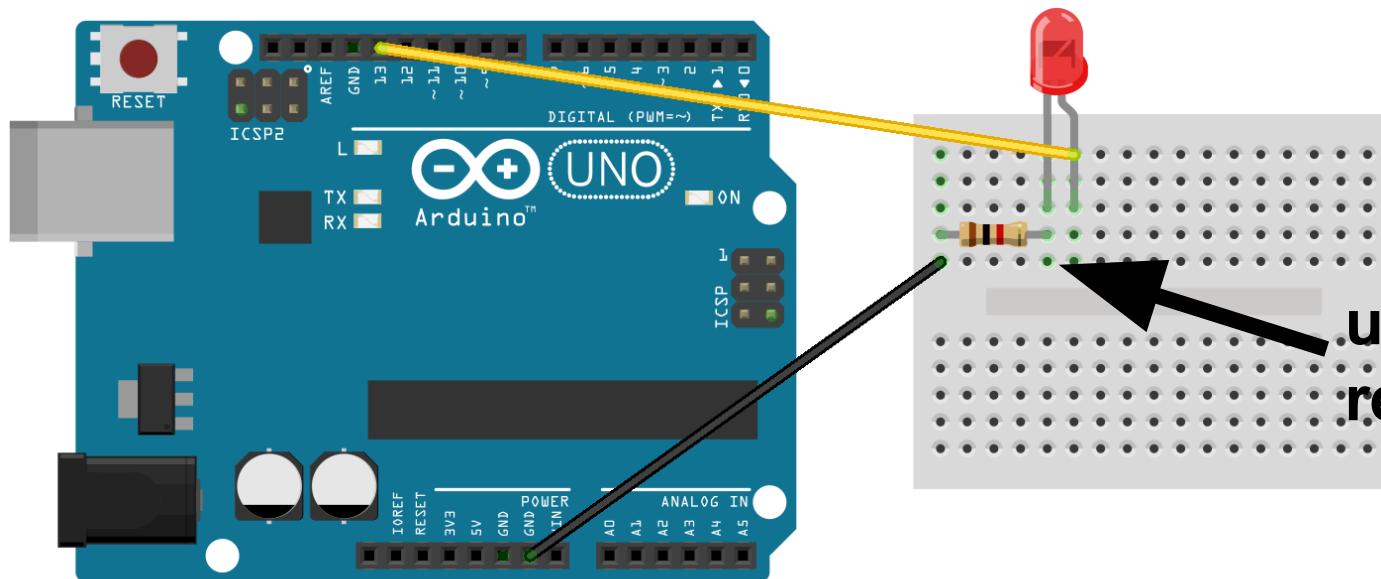
What value are the resistors?

<http://www.digikey.com/en/resources/conversion-calculators/conversion-calculator-resistor-color-code-4-band>

Writing

(**output:** making things move, light up, beep, etc.)

e1: Blink Circuit



e1: Blink Sketch

- can you make the LED
blink faster?
- **slower?**

Writing Functions

`digitalWrite(pin, value)`

- where value is **HIGH** or **LOW**
- use any pins

`analogWrite(pin, value)`

- where value is **0-255**
- use digital **pins** with the **~** (PWM)

Blinking $\frac{1}{2}$ as bright

What do we need to change about the original Blink circuit to make the LED **blink half as bright?**

(hint: 2 changes)

e2: Fading

“for loops”

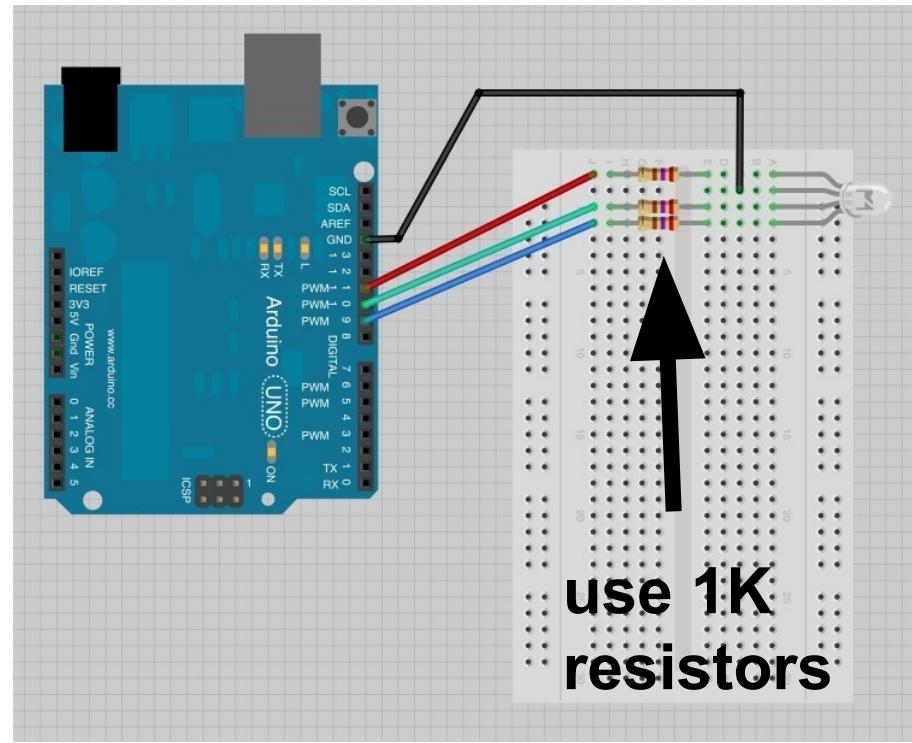
A diagram illustrating the structure of a for loop. A yellow bracket labeled "parenthesis" covers the entire loop header. Inside, a green arrow points down to the first part of the header, labeled "declare variable (optional)". Below this, four arrows point to the four parts of the header: "initialize" (to "int x = 0"), "test" (to "x < 100"), "increment or decrement" (to "x++"), and a final arrow pointing right from the end of the header to the opening brace of the loop body.

```
for(int x = 0; x < 100; x++) {  
    println(x); // prints 0 to 99  
}
```

<http://arduino.cc/en/Reference/For>

e3: RGB LED

The long leg is the “cathode” and it’s connected to ground.



e3: RGB LED

change the R,G,B values to mix colors!

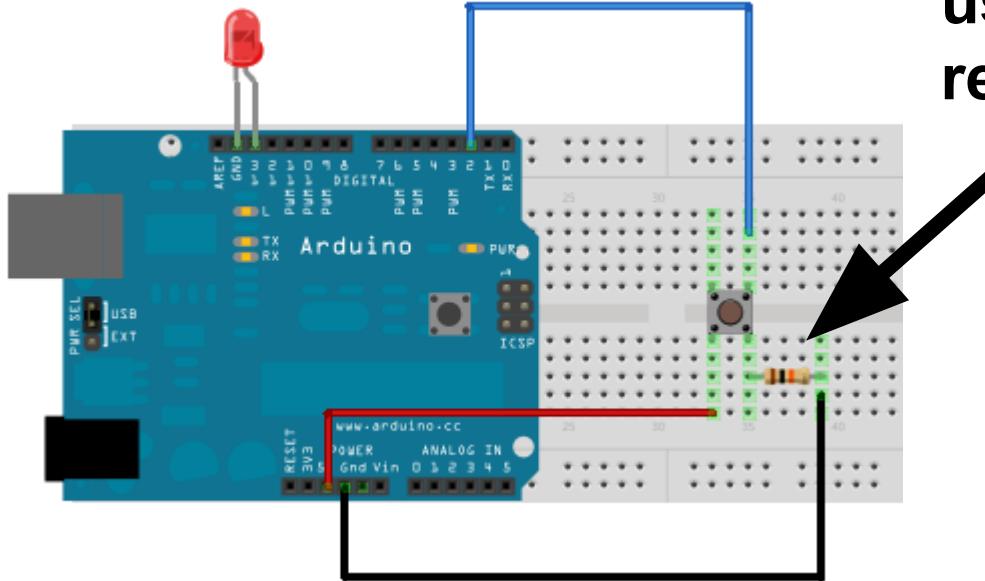
<http://www.colorpicker.com/>

Reading

(input: reading sensors: light, sound, temperature, ...)

e4: Button Circuit

use 5K
resistor



e4: Button Sketch

What function reads the value of the button pin?

Reading Functions

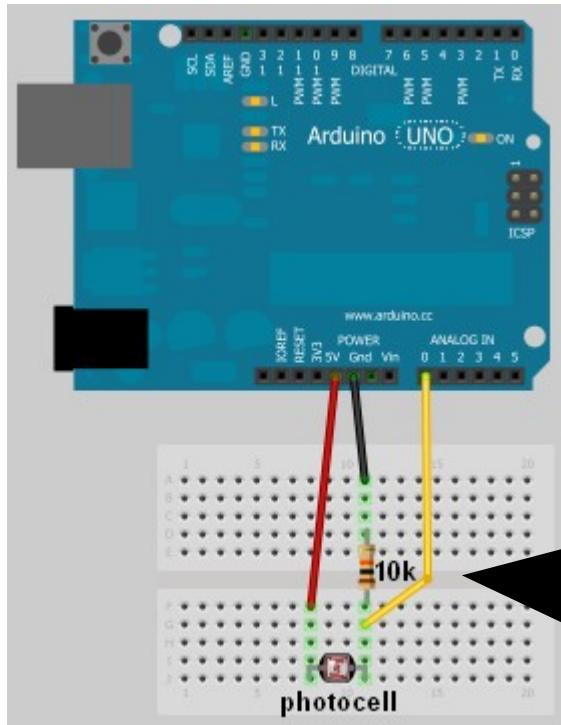
`digitalRead(pin)`

- returns **HIGH** or **LOW**
- use any pins

`analogRead(pin)`

- returns a value **0-1023**
- use Analog Input pins

e5: Photoresistor



use 5K
resistor

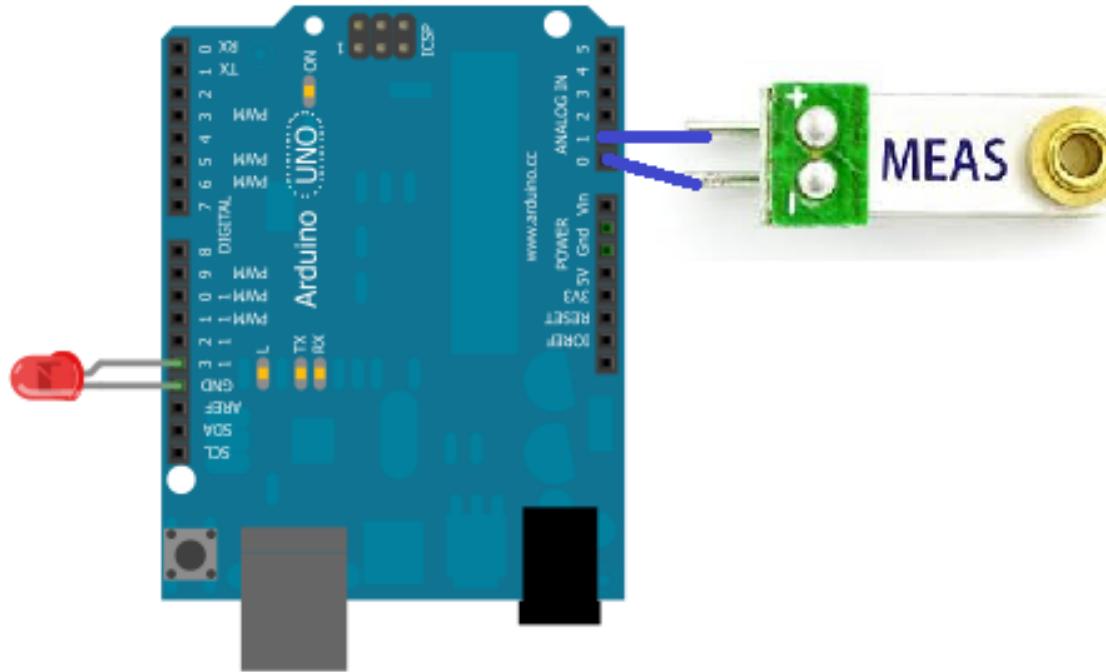
e5: Photoresistor

```
// define a pin for Photoresistor
int lightPin = 0;

void setup() {
    // Begin serial communication
    Serial.begin(9600);
}

void loop() {
    // Write the value of the photoresistor to the serial monitor.
    int reading = analogRead(lightPin);
    Serial.println(reading);
}
```

e6: Vibration Sensor



e6: Vibration Sensor

```
int GroundPin= 0;  
int sensePin= 1;  
  
void setup() {  
    Serial.begin(9600);  
    pinMode(GroundPin, OUTPUT);  
    digitalWrite(GroundPin, LOW);  
}  
  
void loop() {  
    int reading = analogRead(sensePin);  
    Serial.println(reading);  
}
```

e6: Vibration Sensor

Can we make an LED light up when the vibration sensor value is >500 ?

(hint: check out the button sketch)

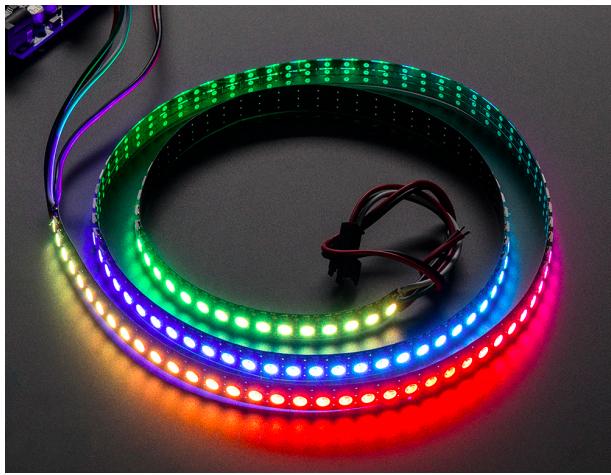
e7: Capacitive Sensors

plug an LED into pin 13

plug a jumper into digital pin 2

NOTE: This is an example of writing a user-defined function that's called in the loop.

Neopixels



Neopixels

What is a Neopixel?

What is a library?

Neopixel Library

Install Neopixel library & follow instructions

Move **Adafruit_Neopixel** to your libraries folder:

(home) > Documents > Arduino > Libraries

Strandtest

File > Examples > Adafruit_Neopixel > strandtest

e8: Neopixels

```
#include <Adafruit_NeoPixel.h>
#define PIN 2
Adafruit_NeoPixel strip = Adafruit_NeoPixel(5, PIN, NEO_GRB + NEO_KHZ800);

void setup() {
    strip.begin();
    strip.show();
}

void loop() {
    //functions go here
    strip.setPixelColor(0, 255, 0, 0);
    strip.show();
}
```

Useful Neopixel Functions

- strip.**begin()**
 - call once in the setup
- strip.**show()**
 - call everytime you want to refresh LEDs after pin colors have been set
- strip.**setPixelColor(pinNumber, redValue, greenValue, blueValue)**
 - color values are 0 to 255
- strip.**setBrightness(brightnessValue)**
 - brightness is between 0 (off) and 255 (brightest)

Neopixel Challenges

1. Make all of the LEDs Red
2. Make all of the LEDs Blue
3. Make the LEDs blink

Processing

Visual Programming Language

Check out the example files!

file > examples

e9: Processing -> Arduino

Let's make an LED blink when we click the screen.

e6_Processing2Arduino

- > **e6_ArduinoLED** uploaded on Arduino
- > **e6_Processing** opened in Processing

e10: Arduino -> Processing

Let's send "Hello World" from the Arduino to Processing and print it out on the screen.

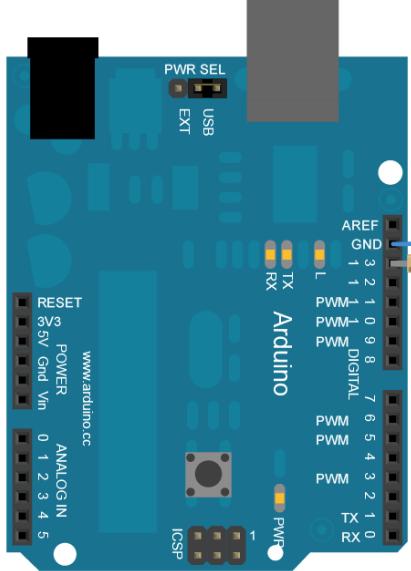
e7_Arduino2Processing

- > **e7_Arduino** uploaded to the Arduino
- > **e7_Processing** opening in Processing

Monome

The Copper Tape Grid

1. **Lay 4 columns of copper tape**
(or however many columns you'd like to use; make sure to adjust the code accordingly)
2. **Lay clear tape over the columns** everywhere that the columns will intersect with rows
(rows and columns need to be electrically isolated)
3. **Attach a jumper to each row and each column** of copper tape (I just used copper tape to make the connection) and to the Arduino
4. **Stick an LED in pin #13** on the Arduino.



N

Code

open the Processing sketch:

monome > Processing_monom > Processing_monom.pde

upload the Arduino sketch:

monome > Arduino_monom > Arduino_monom.ino

Reference to Print

<http://tinyurl.com/arduinoRef>