

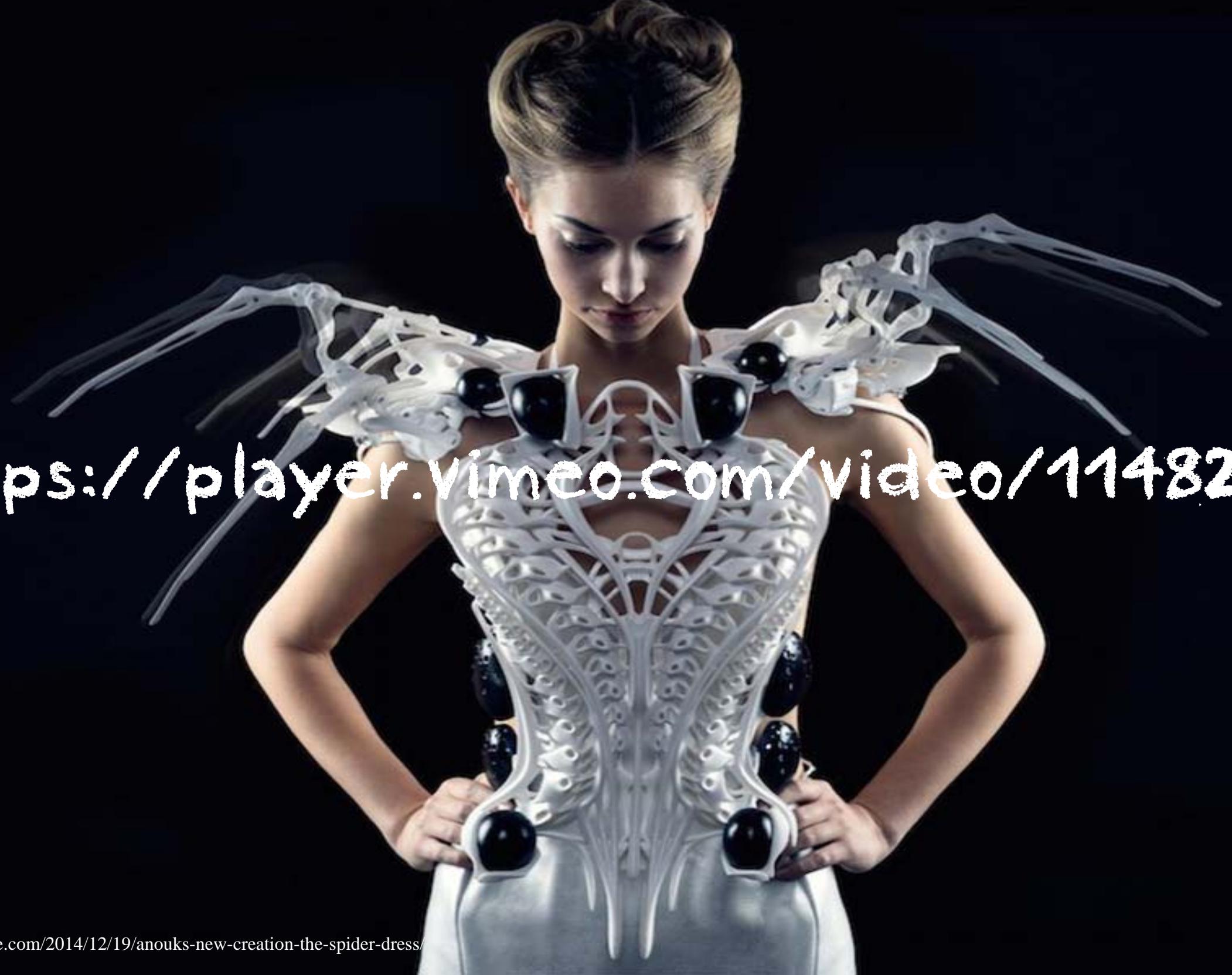
*girls
learning
code

Introduction to Wearable Technology With Trinket Pro

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@ksenia_nadkina

#learningcode
#wearables

Welcome to the Wonderful World of Wearable Technology!



<https://player.vimeo.com/video/114828162>

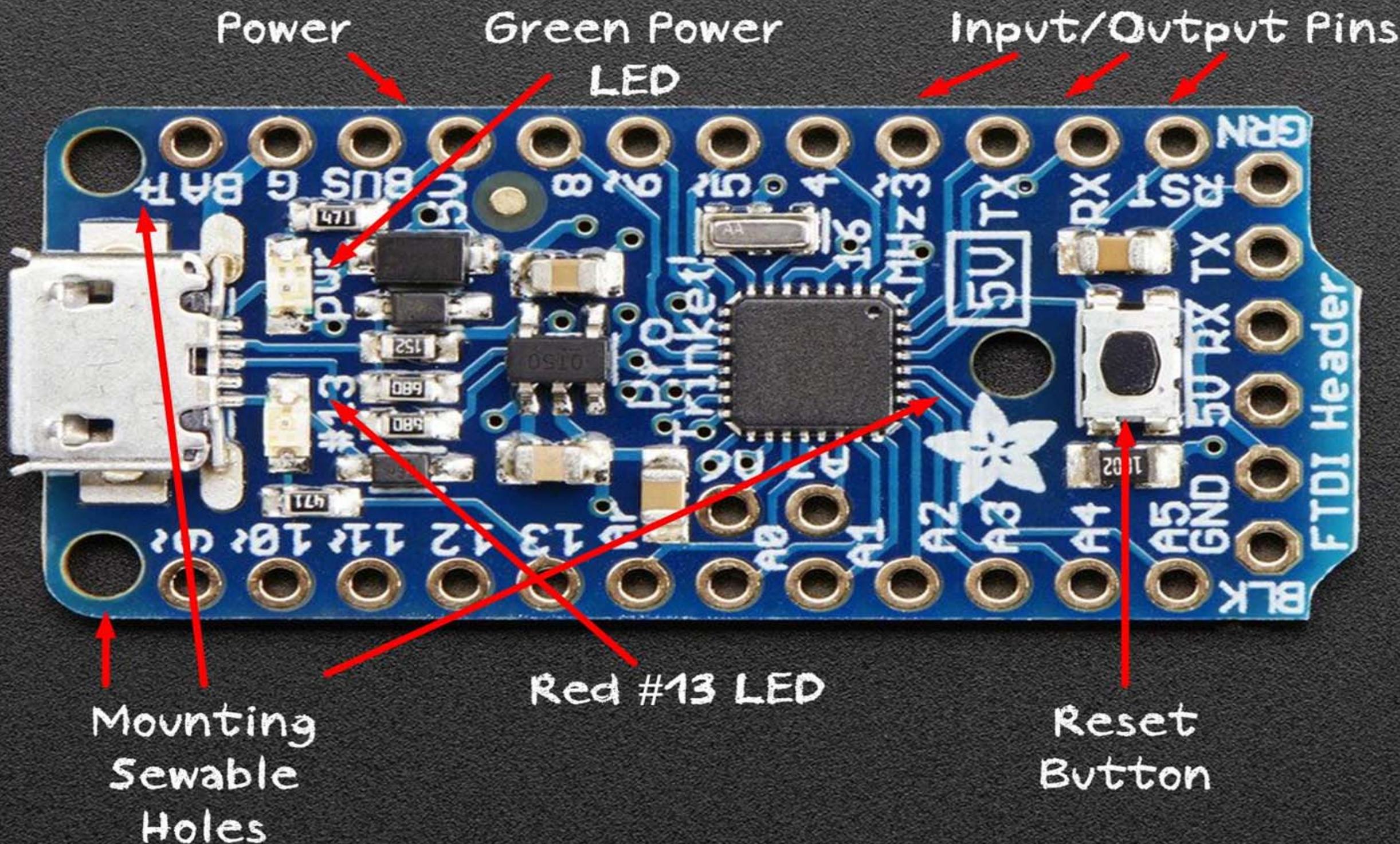




What is Wearable Technology?

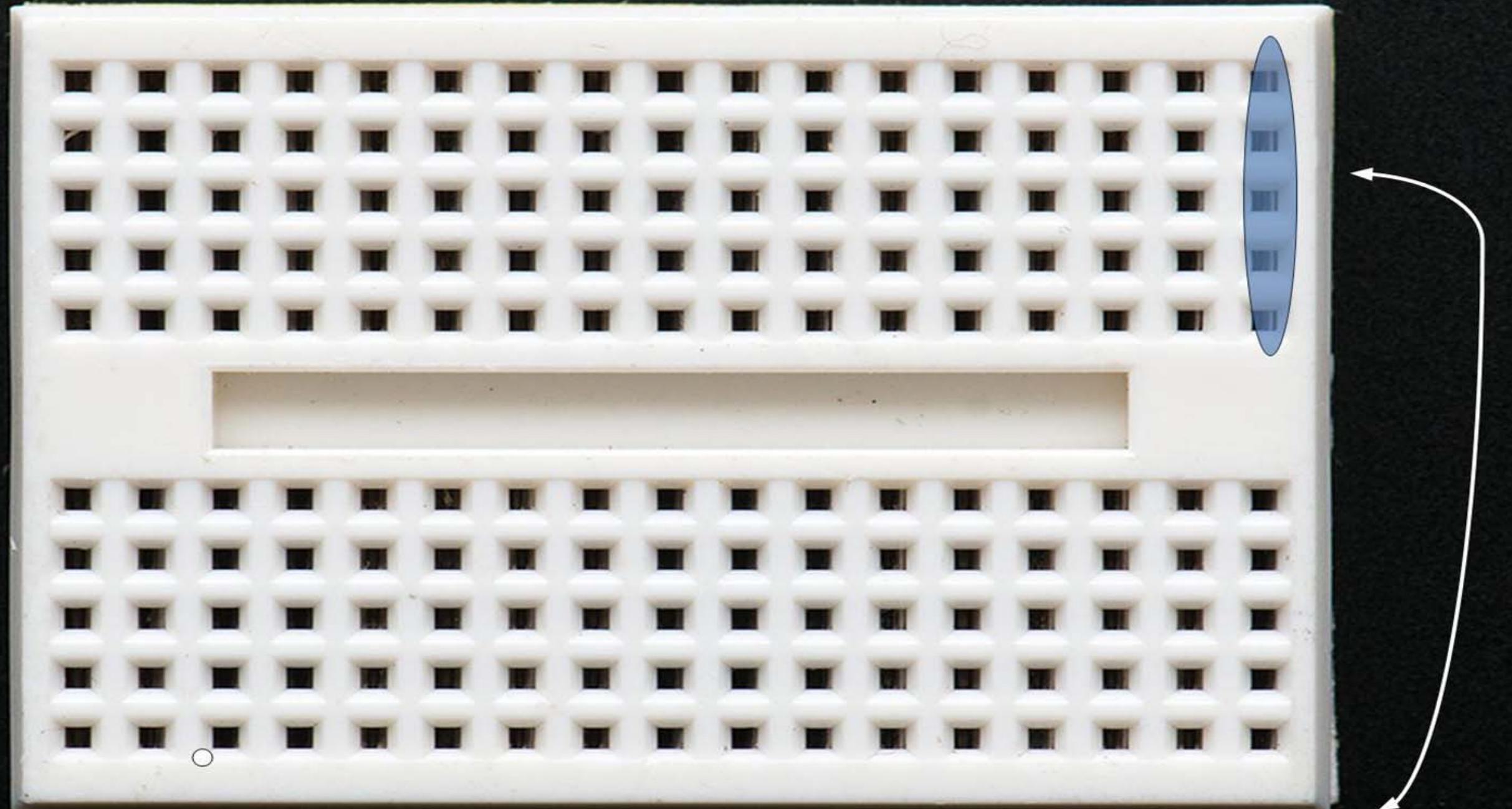
-how are we going to tell your bandana to light up?

Trinket Pro 5V



Mini Breadboard (half the size of the half of the breadboard)

Can you cut bread on the breadboard?

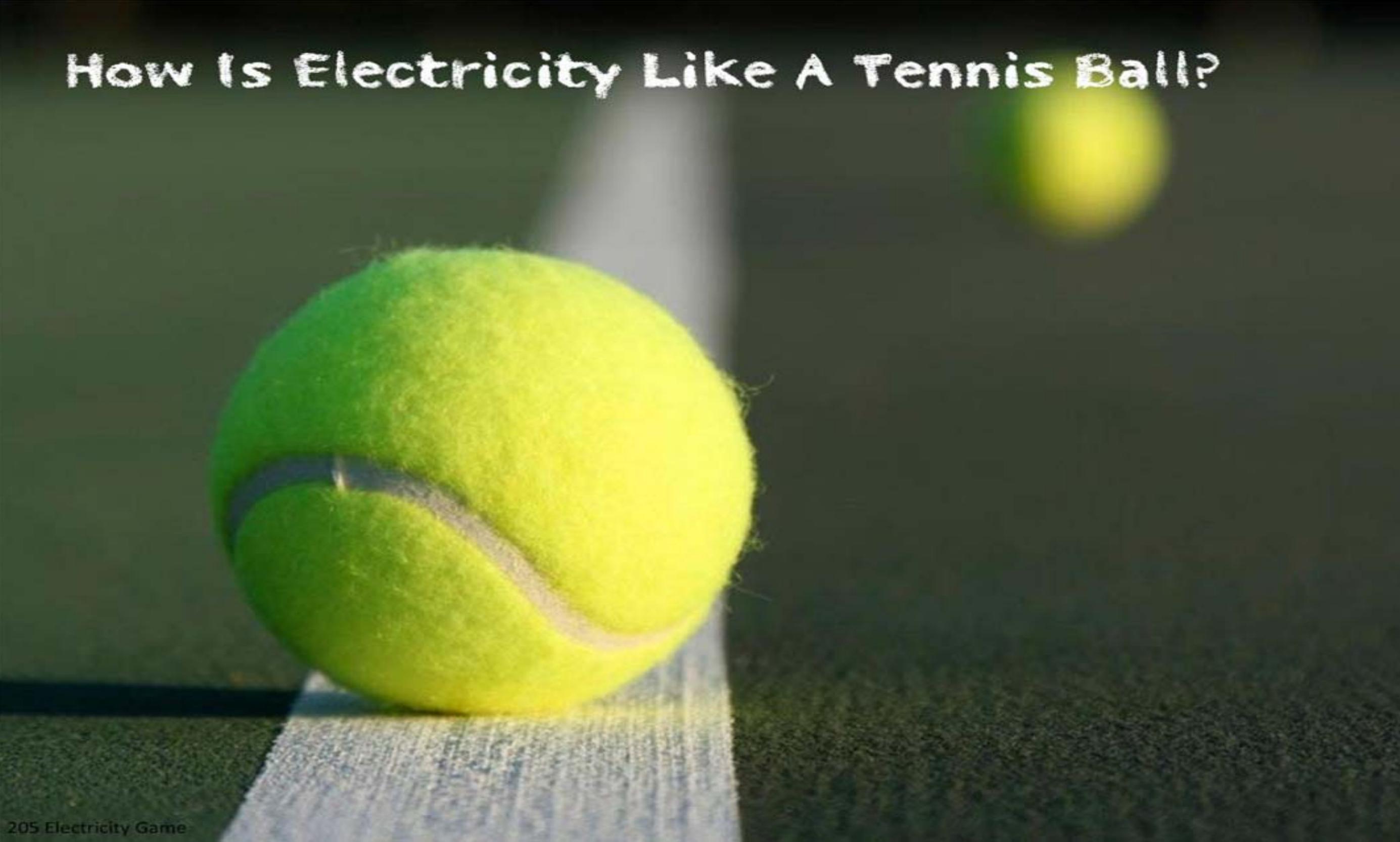


These five holes are connected inside the breadboard so you can use them to hook parts together

Let us take a step back... Electricity 101

- how does electricity work?
- how is electricity like an Olympic Sprinter

How Is Electricity Like A Tennis Ball?



Lemon Experiment

- in groups
 - get help from your mentor
 - you will need: lemon, 1 cent coin, alligator clips, 1 galvanized nail, 1 LED
-
- why does it work?
 - why doesn't it work?
 - is the electricity in the lemon?
 - what did we learn?

Lemon Experiment

- roll the lemon to break up the juice packets inside
- stick one galvanized (covered in Zinc) nail and one copper coin
- Zinc is the **anode**, which means it is getting oxidized, aka it is losing electrons
- Copper is the **cathode** which means it is getting reduced aka it is gaining electrons
- the lemon juice is the electrolyte

LEO says GER!!!!

L - lose

E- Electrons

O - oxidation

G-Gain

E-Electrons

R-Reduction

Now back to your Trinket!!!

- Trinket is a simple computer or microcontroller
 - Trinket is powered using a power source from your computer or a battery
 - computers run programs
-
- What programs do you see on the computer?
 - What programs does mom or dad use on the computer?

Now, let's program something
amazing - a super awesome
blinking light program ... by you
and your Trinket!

The Arduino Workbench

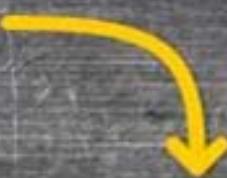
Install this!

1



<http://arduino.cc/en/main/software>

2 Do this!



Connect your Arduino to your computer

Load and run this!

3



File -> Examples -> Basics -> Blink

File Edit Sketch Tools Help

- New Ctrl+N
- Open... Ctrl+O
- Sketchbook
- Examples
- Close Ctrl+W
- Save Ctrl+S
- Save As... Ctrl+Shift+S
- Upload Ctrl+U
- Upload Using Programmer Ctrl+Shift+U
- Page Setup Ctrl+Shift+P
- Print Ctrl+P
- Preferences Ctrl+Comma
- Quit Ctrl+Q



- 01.Basics
 - AnalogReadSerial
 - BareMinimum
 - Blink**
 - DigitalReadSerial
 - Fade
 - ReadAnalogVoltage
- 02.Digital
- 03.Analog
- 04.Communication
- 05.Control
- 06.Sensors
- 07.Display
- 08.Strings
- 09.USB
- 10.StarterKit
- ArduinoISP
- EEPROM
- Esplora
- Ethernet
- Firmata
- GSM
- LiquidCrystal
- Robot_Control
- Robot_Motor
- SD
- Servo
- SoftwareSerial
- SPI

Go to Tools:

- select "Pro Trinket 5V/16MHz (USB)" in Boards (if you don't have it, you will need to go to Boards Manager and install the correct board type)
- Both Windows and MAC will choose the correct COM port
- select "USBtinyISP" in Programmer (Macs already have it installed). For Windows, unless the driver installs automatically, go to Device Manager → right click "USBtinyISP" and update driver software using the files from the jump drive

Parts of an Arduino program

1 setup

Your Arduino does this once, like waking up in the morning

2 loop

then it keeps doing this forever, like a cat chasing its tail!

remember ..

setup then loop loop loop loop loop loop...

Make me blink!

```
void setup() {  
    <-- remember we  
    do this once  
    pinMode(13, OUTPUT);  
}
```

```
void loop() {  
    digitalWrite(13, HIGH);  
    delay(1000);  
    digitalWrite(13, LOW);  
    delay(1000);  
}
```

hey arduino! use
connector number 13
as a digital control!!

turn it on (light up
the light)

turn it off now

<- then we keep
doing this forever

Make me blink!

Blink_Done | Arduino 1.0.1

File Edit Sketch Tools Help

Blink_Done

```
void setup() {
  pinMode(13, OUTPUT);
}

void loop() {
  digitalWrite(13, HIGH);
  delay(1000);
  digitalWrite(13, LOW);
  delay(1000);
}
```

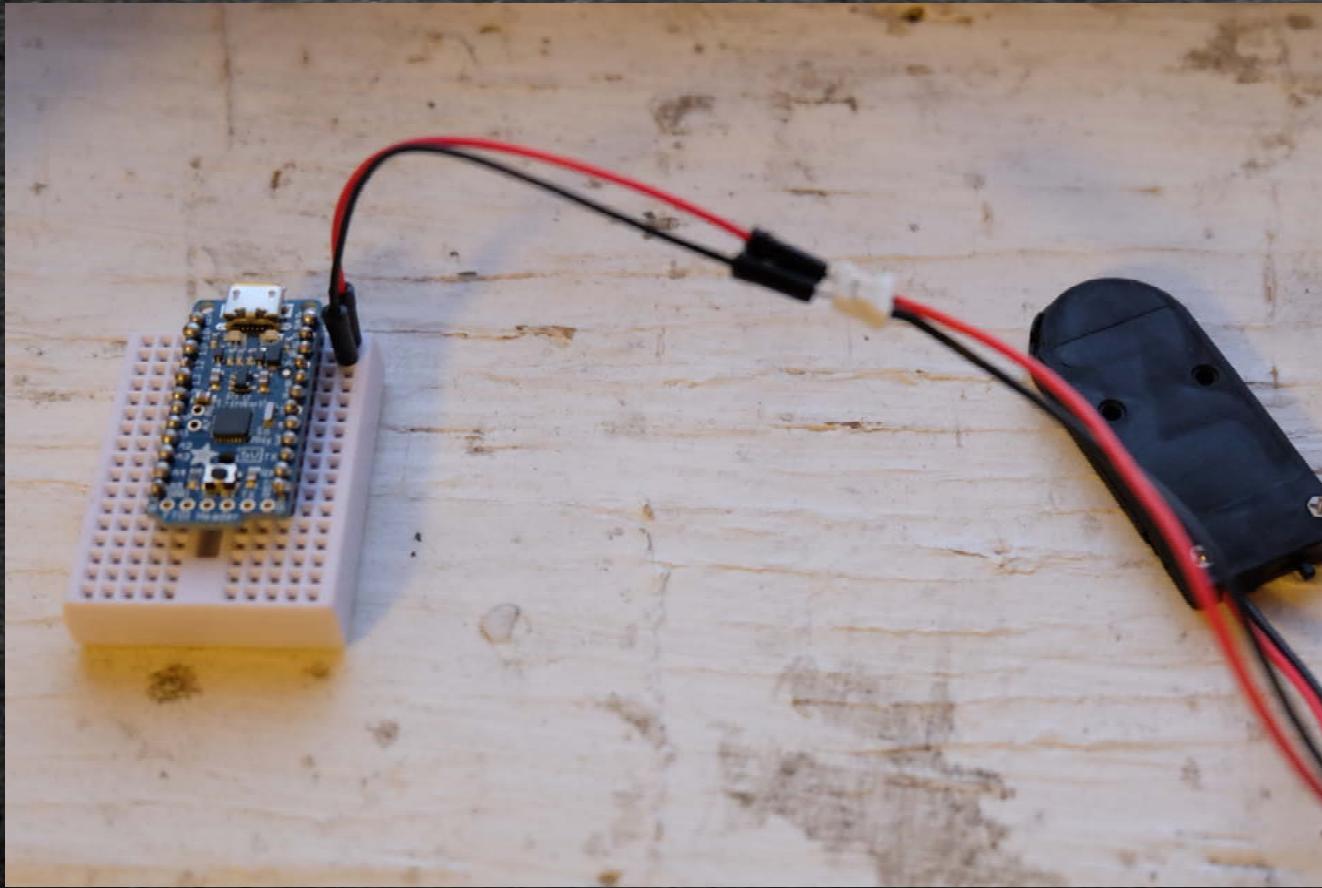
type in this
program, then
click the arrow
to start your
Arduino

Blink!

- 1/ How can you make your light blink faster or slower?
- 2/ Why is time in thousands?
- 3/ How often does your Arduino do the SETUP part?
- 4/ How often does your Arduino do the LOOP part?



Let's add a battery holder...

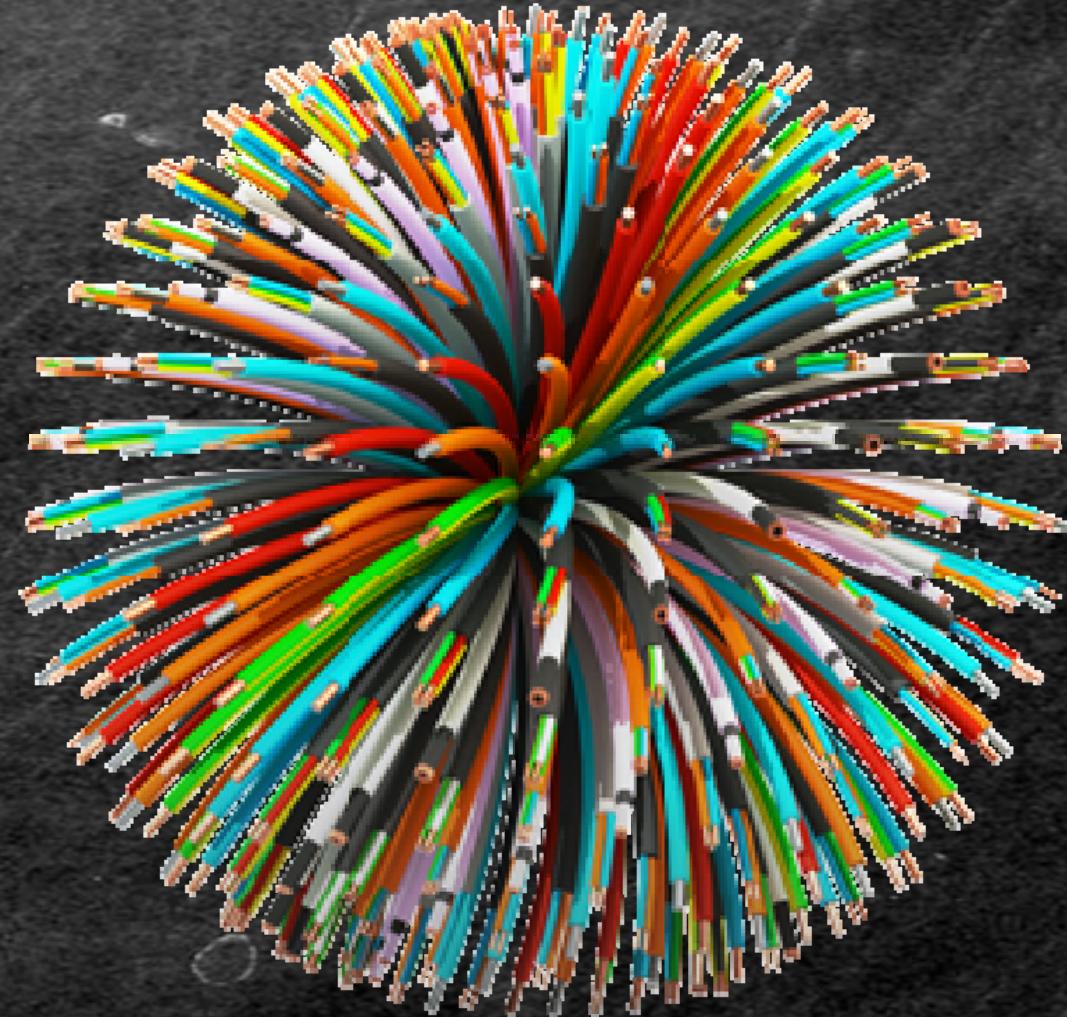


Insert black cable into
black battery
connection and
connect next to G on
your board. Red goes
into red and connects
to BAT+

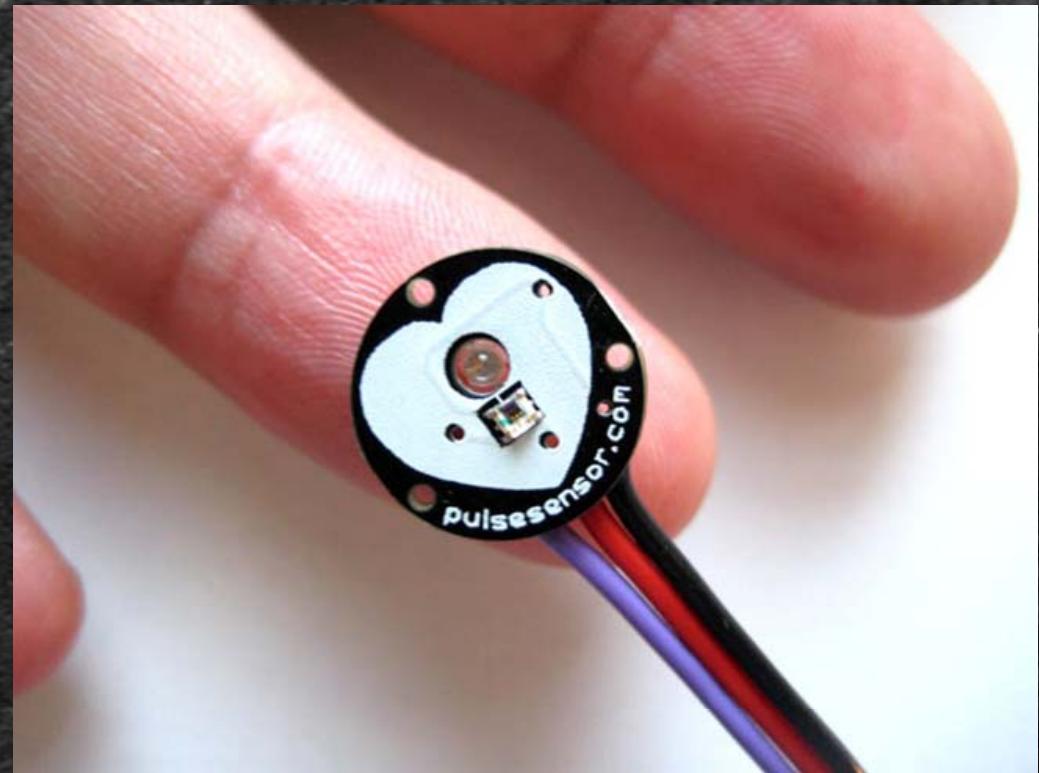
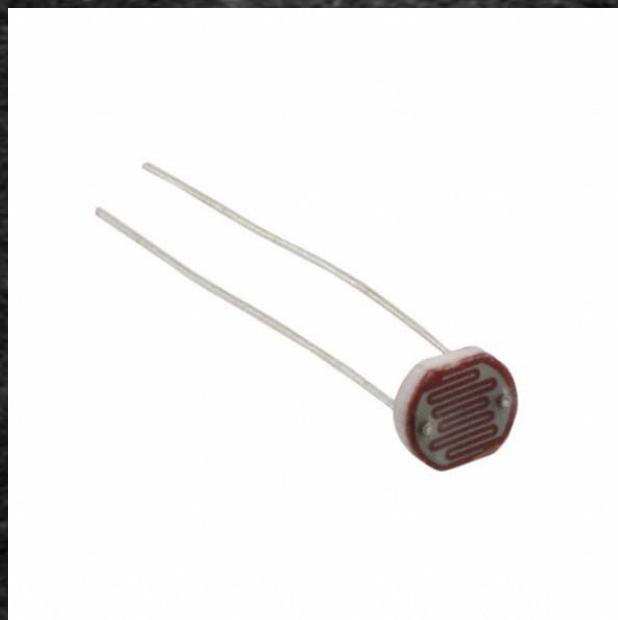
☺ Don't forget the batteries ☺

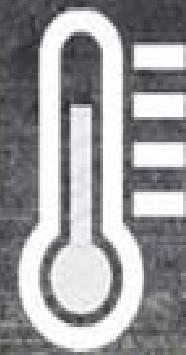
Woah!!!! So many cables....

we usually use red
cables for power
and black ones for
ground



Lights are fun, but sensors are waaaay
cooler!





Temperature



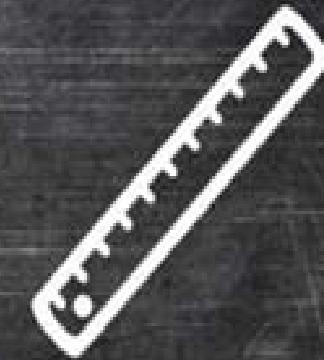
Light



Motion

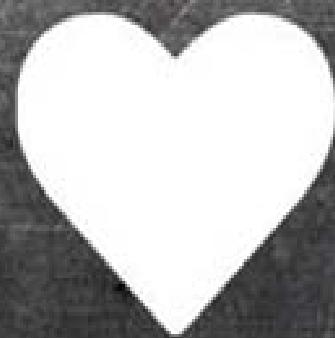


Sound



Distance

Your trinket can measure many things in the world around it. This is called sensing...



Heartbeat



Force



Orientation

How many senses do you have?



Now imagine you had superpowers!

Choose your super awesome sensing superpower... your choices are....

- light sensor
- vibration sensor
- force sensor



You can sense this:

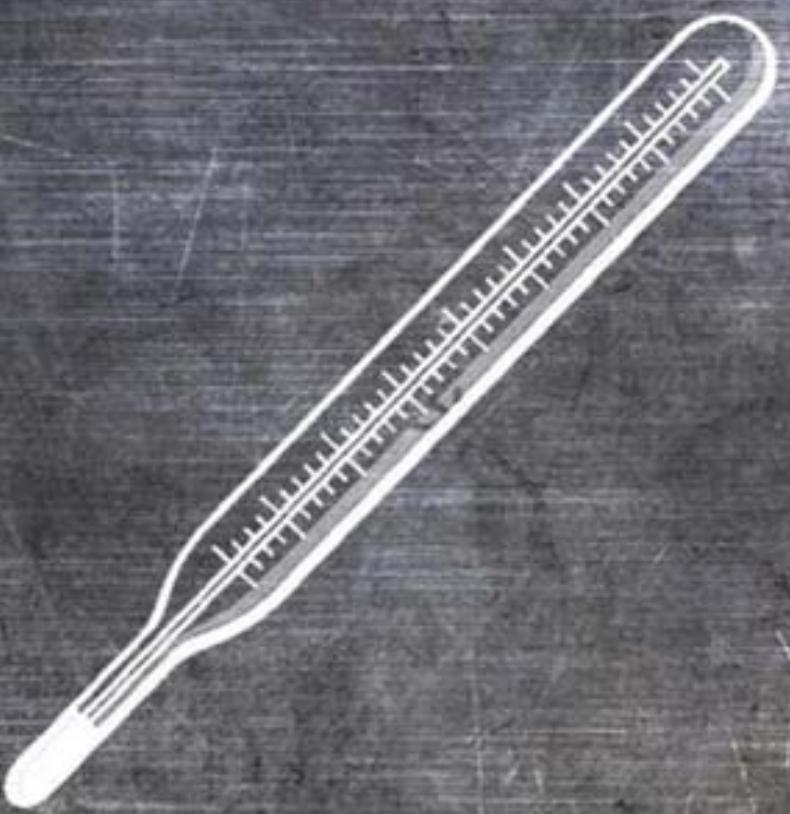
- light sensor
- vibration (touch) sensor
- force sensor

To become this:

- light up!!!!(analog)
- light up!!!!(digitally)

What exactly is analog vs digital?

Analog things and digital things



Thermometer



Light Switch

Is this question about a digital or
analog thing --

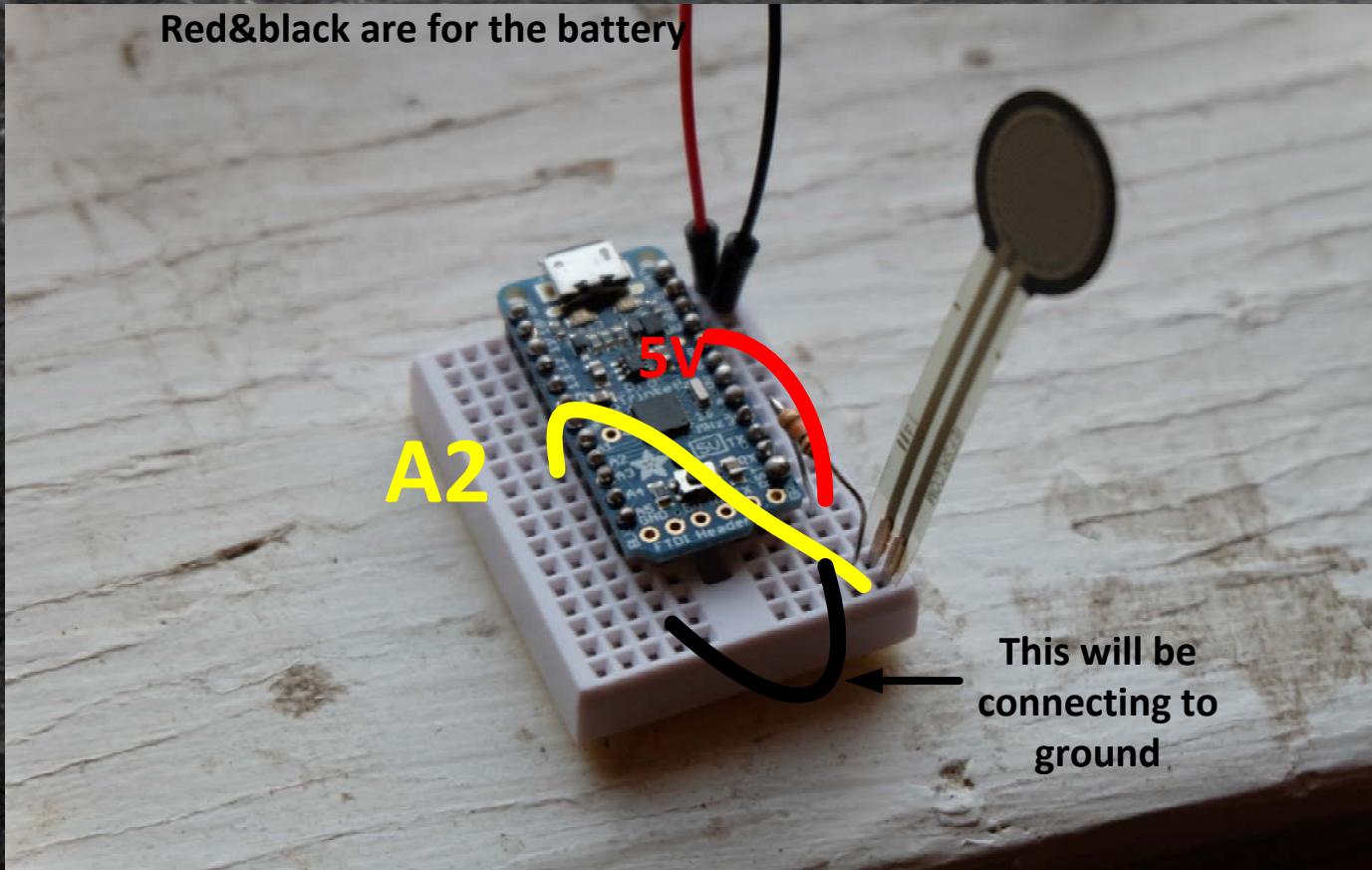
Did it rain more than 25mm today?

- a) neither
- b) it depends if it is still raining
- c) analog
- d) digital



Wire your force sensor to the Trinket like so...

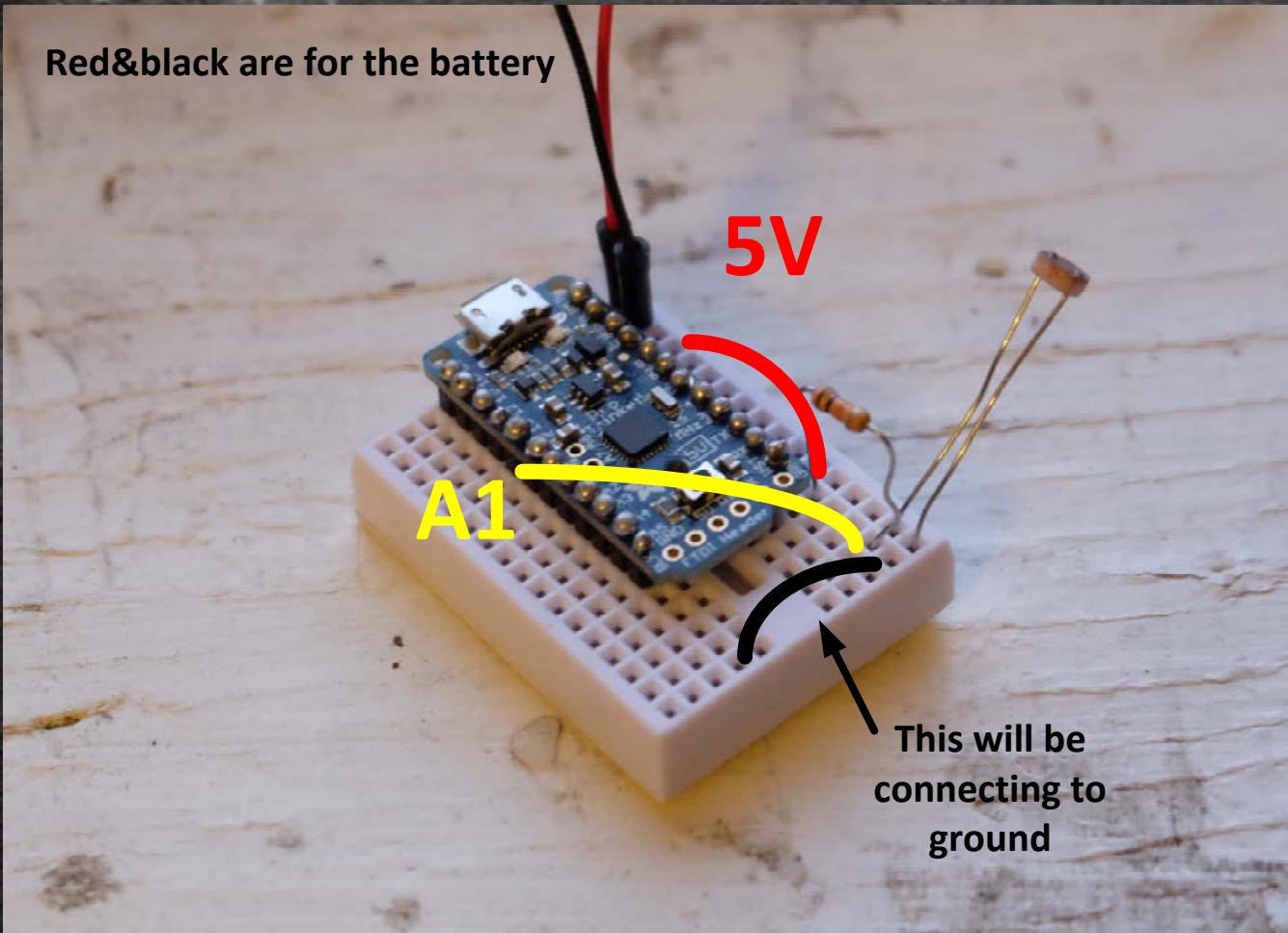
Red&black are for the battery



The resistor for the force sensor is brown-black-orange-gold (10kohm)

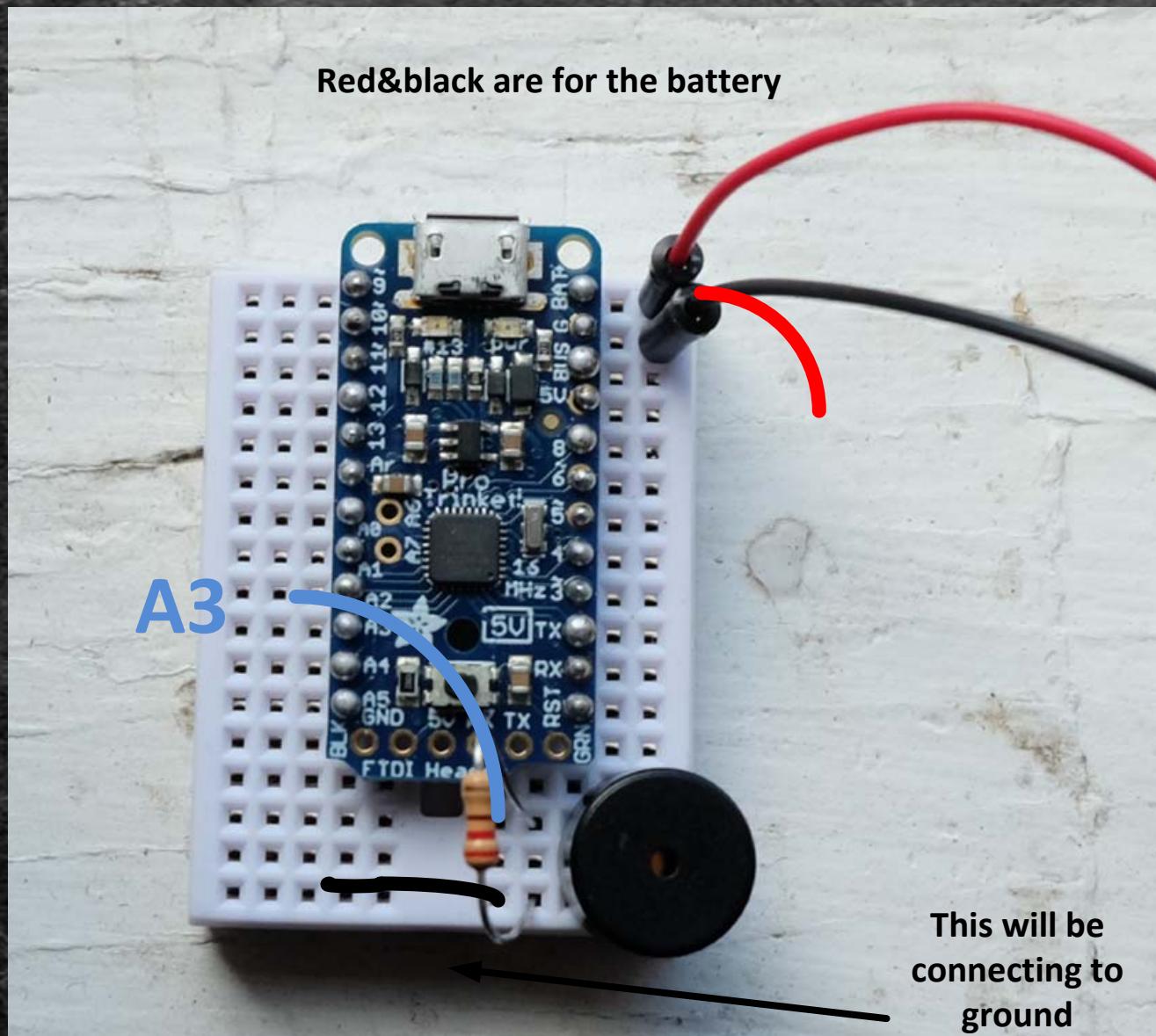
Don't forget how the breadboard is connected...
(is it vertical or horizontal?)

Wire your light sensor to the Trinket like so...



The resistor for the light sensor is brown-black-orange-gold (10kohm)

Wire your piezo sensor to the Trinket like so...

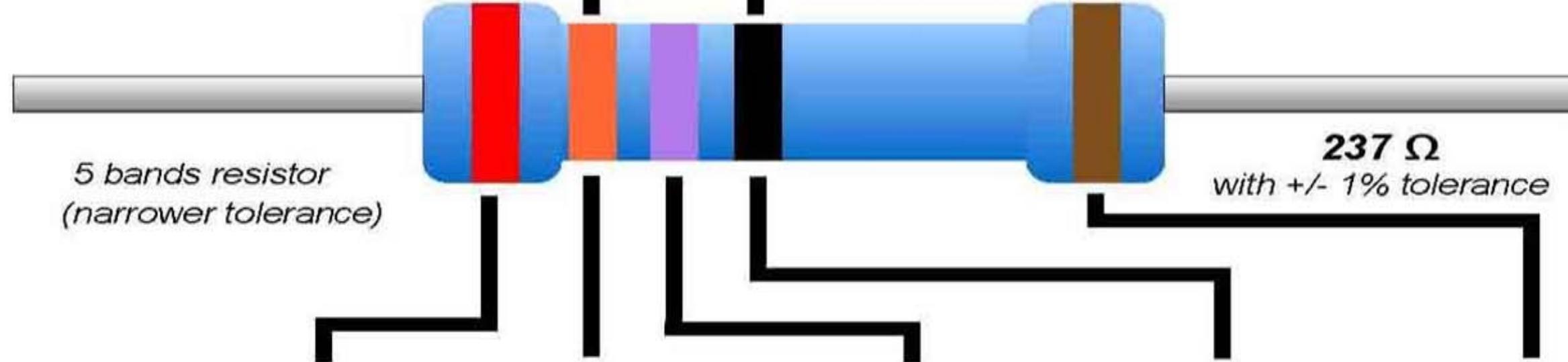


The resistor for the piezo sensor is brown-black-orange-gold (10kohm)



Let's take a step back now.. Why are the resistors different colours?

Well.. The colour stands for the rating, different colour combinations mean different ratings for resistors. Check out the next slide and answer which rating is the red-red-brown-gold resistor?



Color	1 st Band	2 nd Band	3 rd Band	Multiplier	Tolerance
Black	0	0	0	x 1 Ω	
Brown	1	1	1	x 10 Ω	+/- 1%
Red	2	2	2	x 100 Ω	+/- 2%
Orange	3	3	3	x 1K Ω	
Yellow	4	4	4	x 10K Ω	
Green	5	5	5	x 100K Ω	+/- 5%
Blue	6	6	6	x 1M Ω	+/- 25%
Violet	7	7	7	x 10M Ω	+/- .1%
Grey	8	8	8		+/- .05%
White	9	9	9		
Gold				x .1 Ω	+/- 5%
Silver				x .01 Ω	+/- 10%

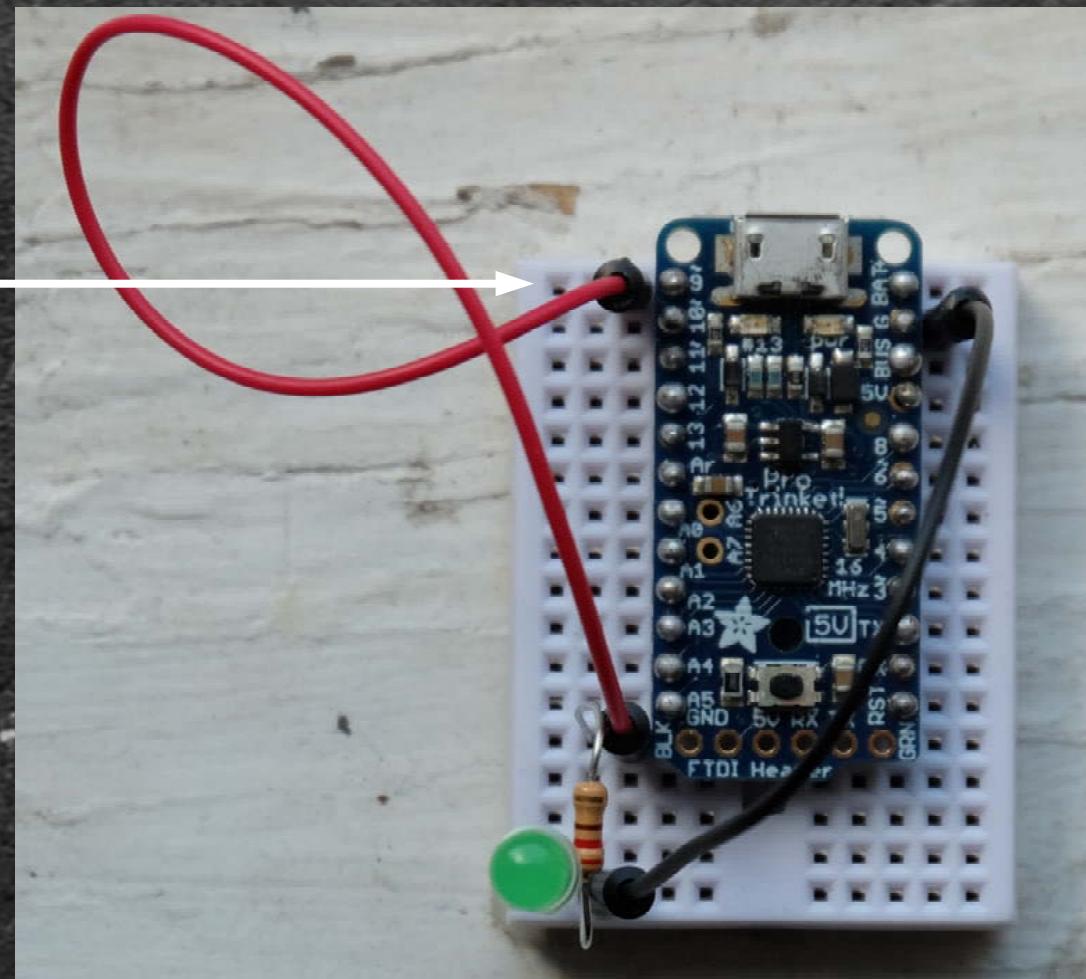
Wire the output LED to the Trinket like so...

Red wire to pin 9

The colours of the resistor are red-red-brown-gold

The shorter leg of the LED should be connected to the black (ground wire)

Black wire to Ground





This is the instruction (code) to make your secret superpower come to life...

- open the Arduino (extension .ino) file called in your folder and examine it
- now press the reset button on the Trinket and upload the code

Does it work? No? Let's troubleshoot...



Hands-on...

- if you need soldering/sewing supplies, grab a mentor and let them help you
- your input should be on your mini breadboard
- your output should be sewn onto the bandana or t-shirt (this is the part where we will solder the ends of the LED onto a longer wire and sew it onto your clothing piece)
- now go to the soldering station for a demo

Now find your Trinket and battery a place on your bandana or t-shirt.

Hint: you can use scissors, tape, glue, needle and thread (ask for help from your mentor)

Now imagine you had
ten or even ONE
HUNDRED (!!!) LEDS sewn
onto your clothes...

All controlled by the little
Trinket!





Have extra time???

- exchange sensors with your neighbour
- wire the different input
- upload the code again
- doesn't work? ask for help from your peer!

What did we learn???

- computers can be small and you can sew them onto your clothes
- electricity is like an Olympic sprinter
- sensors can sense things and they are wearable
- we can now program computers!!!! Yay
- programming is easy and fun ☺

Thank you!!!!

- Kath Blair
- Jocelyn
- Kylie
- Jenn
- Commons Co-working Space
- Faya
- Andrea

- Daniel
- Robyn
- Ana
- Carrie
- Jim
- Darcie
- Caitlin



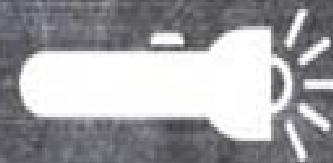
Check out these neat sites for more
wearable tech ideas:

- www.madewithcode.com/projects/fashion
 - www.linkitz.com
 - www.ringly.com
 - www.choosemvse.com
 - www.jawbone.com
 - www.makefashion.ca

YAY YOU!!!



Temperature



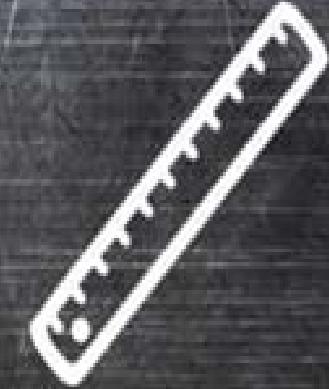
Light



Motion



Sound



Distance

NOW ... TIME FOR PRESENTATIONS



Heartbeat



Force



Orientation