

# Micro:bit Magic

Engaging K-12, CS1/2, and non-majors with IoT & Embedded

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## Outline

- Intros: Us, You, the micro:bit
- Setup
- “Hello, World!”: First Program
- Programming: Logic & Action
- Broadcast Basics & Firefly Fun
- Motor Mayhem & Awesome Audio
- Bluetooth Basics & Phone Phun
- Quick Tour: JavaScript & Building Blocks ?
- Quick Tour: IoT Insanity
- Conclusions

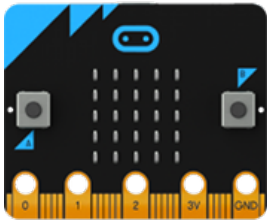
## Intros: Us & You

- Us
- You: Roll Call & Intros
  - Pair programming — pair up!

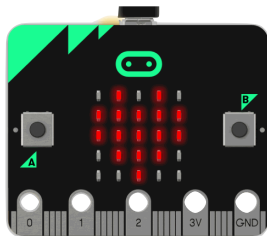


## Intros: the micro:bit

### Small

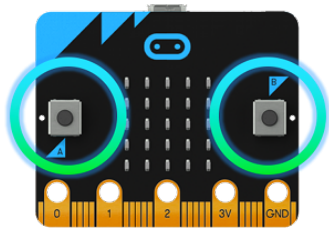


### LED Grid





### Buttons



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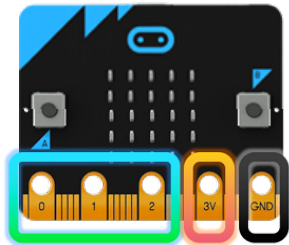
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### Connectors



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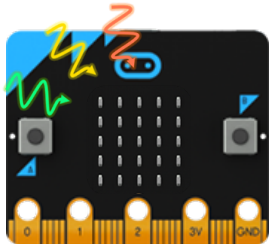
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### Light Sensor



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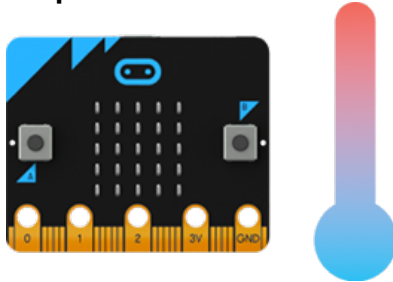
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## Temperature Sensor



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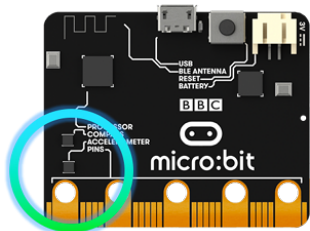
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## Accelerometer



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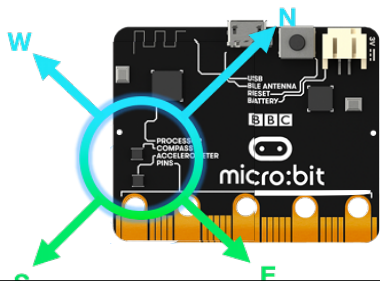
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## Compass



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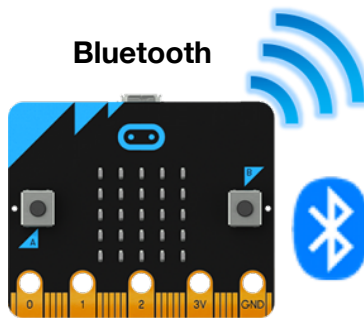
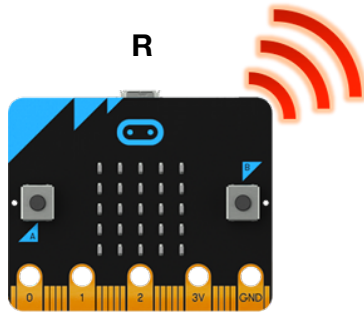
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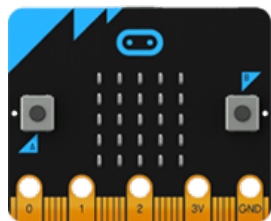
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Low Cost: ~\$13 US



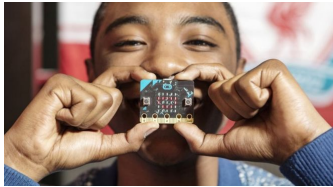


## Thanks: Micro:bit Educational Foundation

and Hal Speed

2015

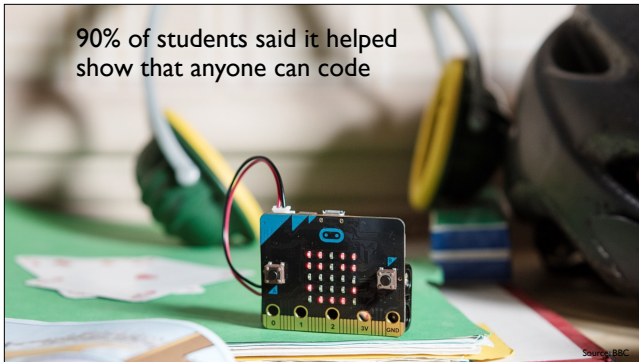
- BBC Make It Digital
- 29 partners
- 1 million micro:bit devices
- 11-12 year olds
- Across the U.K.



17 © Micro:bit Educational Foundation 2018  
@microbit\_uk @halSpeed



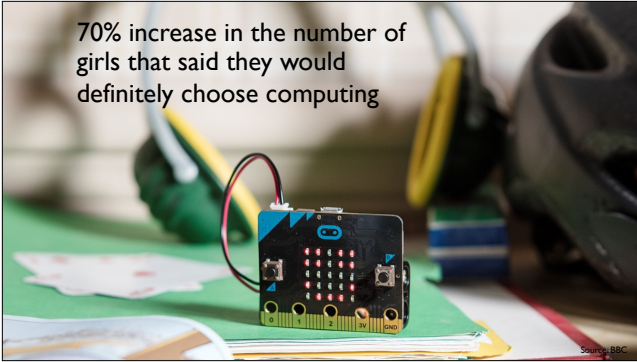
90% of students said it helped  
show that anyone can code



Source: BBC



70% increase in the number of girls that said they would definitely choose computing



Source: BBC

## 2016 Micro:bit Educational Foundation Formed

To empower children, parents and teachers around the globe to learn and innovate using the micro:bit

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2017

micro:bit available in the U.S.



10 New & Innovative EdTech Products Announced at ISTE 2017

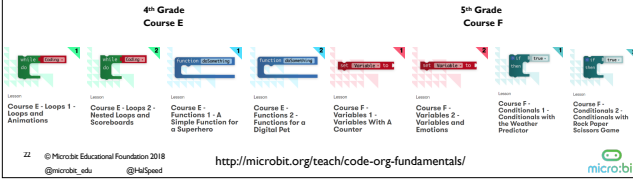
21 © Micro:bit Educational Foundation 2018 <http://www.gettingsmart.com/2017/06/10-innovative-new-products-announced-at-iste-2017/>  
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## Lessons Aligned to Code.org CS Fundamentals

- Lessons extend the concepts taught in the Code.org curriculum by using micro:bit and MakeCode
- Course E – Loop and Functions
- Course F – Variables and Conditionals



## Sample of Lessons

Lesson	Resources
Answering Machine	<ul style="list-style-type: none"> <li>5 Minute Lesson Plan (pdf) (pptx)</li> <li>Teacher Notes (pdf) (docx)</li> <li>Hex File (TIP: Save link for Mac, Save target for PC)</li> </ul>
Guess the Number	<ul style="list-style-type: none"> <li>5 Minute Lesson Plan (pdf) (pptx)</li> <li>Teacher Notes (pdf) (docx)</li> <li>Hex File</li> </ul>
Temperature	<ul style="list-style-type: none"> <li>5 Minute Lesson Plan (pdf) (pptx)</li> <li>Teacher Notes (pdf) (docx)</li> <li>Hex File</li> </ul>
Die Roll	<ul style="list-style-type: none"> <li>5 Minute Lesson Plan (pdf) (pptx)</li> <li>Teacher Notes (pdf) (docx)</li> <li>Hex File</li> </ul>

## STEM Lessons



<https://makecode.microbit.org/projects>



## Third-Party Curricula



Microsoft MakeCode Intro to CS  
<https://aka.ms/intro2cs>

- |                           |                               |
|---------------------------|-------------------------------|
| 1. Making                 | 8. Coordinate Grid System     |
| 2. Algorithms             | 9. Booleans                   |
| 3. Variables              | 10. Music and Arrays          |
| 4. Conditionals           | 11. Bits, Bytes, and Binary   |
| 5. Iteration              | 12. Radio                     |
| 6. Review/Mini-Project    | 13. Arrays                    |
| 7. Coordinate Grid System | 14. Independent Final Project |



PLTW

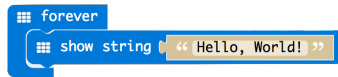
PLTW Gateway:  
Computer Science for  
Innovators and Makers  
[https://www.pltw.org/our-program/  
pltw-gateway-  
curriculum#curriculum-4](https://www.pltw.org/our-program/pltw-gateway-curriculum#curriculum-4)

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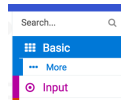


## “Hello, World!”: First Program

- Block-based editor
- Built-in simulator
- Deployment to Micro:bit



Block Color Indicates Palette



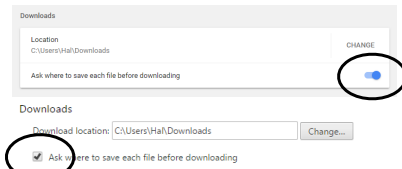
## Setup

- Hardware Handout — *Thanks Microbit Foundation!*
  1. Pull out the micro:bit box / open
  2. Connect via USB cable
- Browser
  1. Open [microbit.org](https://microbit.org)
  2. Select “Let’s Code”
  3. Click “Let’s Code” button



## Chrome Setup

- chrome://settings/downloads - OR - Show advanced settings...

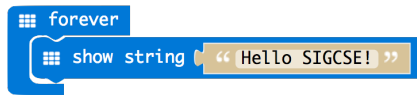


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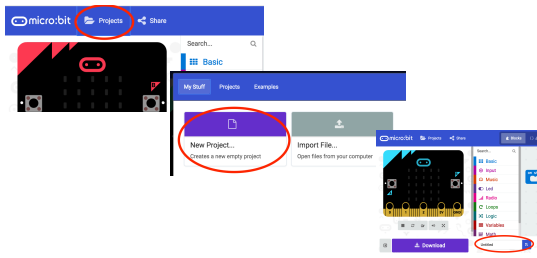


## Personalization!

- Hello Bill / Hello Michael / Hello ....



## New Project: Projects > New Project...

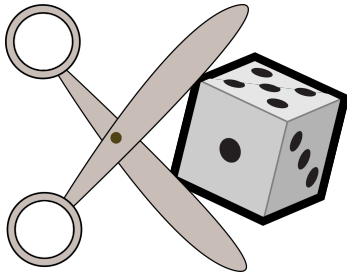




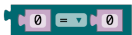
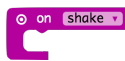
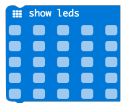
## Programming: Logic & Action

- Picking between *three* tough choices
- Cookie, Cake, Pie
- Super Strength, Invisibility, Telekinesis
- ...

## Obvious Solution...



## Parts

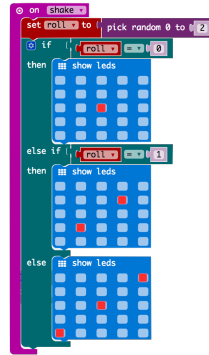


1. Color indicates Palette
2. Incremental Development:  
Try parts in Simulator



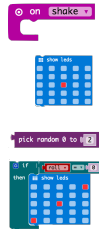
## Solution

Pro Tip: Blocks with a button have additional features (else-if)



## Concepts

- Event driven programming
- Bitmapped Graphics
- Ranges & Representations
- Logic

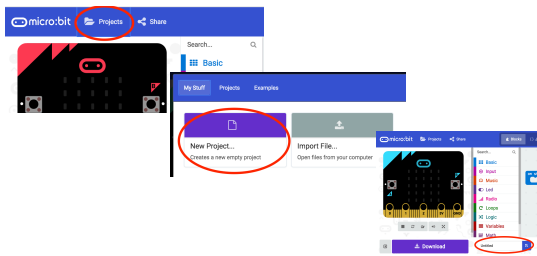


## Pedagogy

- Active Learning
- Discovery Based
- Constructionist



## New Project: Projects > New Project...



## Broadcast Basics

- Radio Palette: Broadcast Based Radio Transmissions
- String, Number, Key/Value Pairs, ...

## Receiver

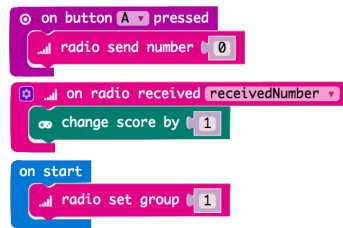


"Game" blocks in "Advanced"  
Section of Palette

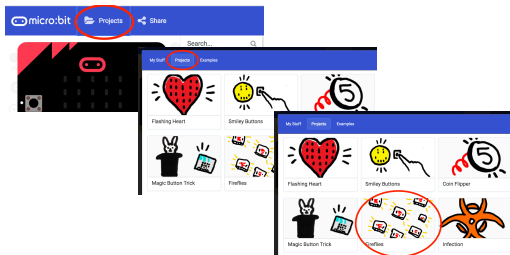
▼ Advanced



## Full Boadcaster

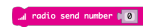


## & Firefly Fun



## Concepts

- Broadcasting



- Network Addresses

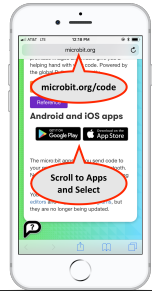


- Asynchronous clocks / Sync problems



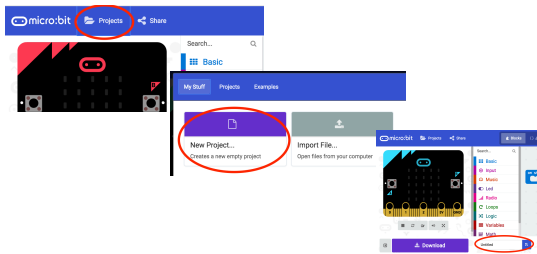


## Break & App Install Android & iOS



Android  
(optional)  
Search for &  
Install  
Bitty  
Controller  
(\$1.99)

## New Project: Projects > New Project...



## Goody Bag: Hardware

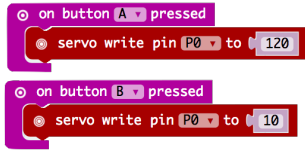


## Motor Mayhem

An Intro to Servos  
(Unfortunately, very poor quality servos...)

## Motor Mayhem

An Intro to Servos  
(Unfortunately, very poor quality servos...)



## Inchworm Insanity

• <https://makecode.microbit.org/projects/inchworm>




## Awesome (?) Audio

## Concepts

- I/O

## Bluetooth Background

- Uses different protocol than  Wi-Fi Radio
- Not a group broadcast

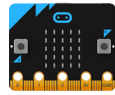


## Bluetooth Background

Central



Peripheral



## Bluetooth Background

Central

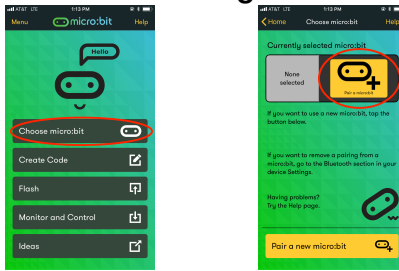


## Bluetooth Background

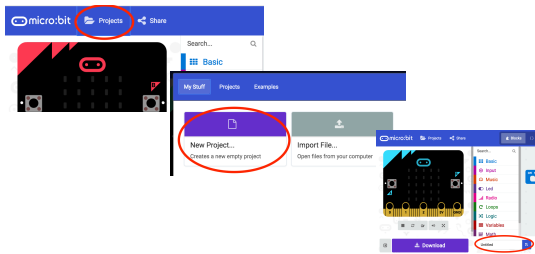
- Bluetooth has various levels of security
  - “Pairing” — Forming a “permanent” bond  
(Exchanging security info. once and storing it)
- Block editor supports three types
  - No pairing (insecure)
  - Just Works (default. Pretty safe here)
  - Passkey Pairing (more secure)



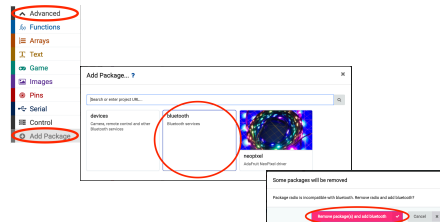
## Pairing



## New Project: Projects > New Project...

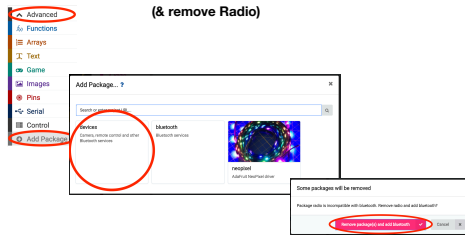


## Remove Add Bluetooth (& remove Radio)

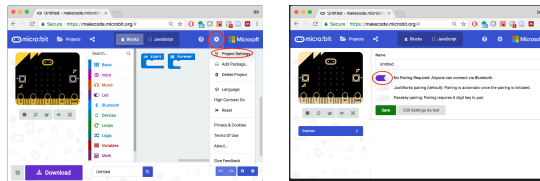




## Remove Add Bluetooth (& remove Radio)

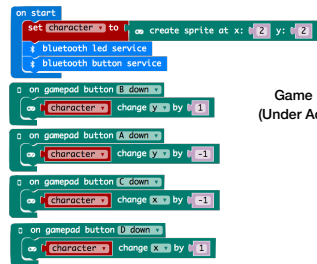


## Project Settings



## Program

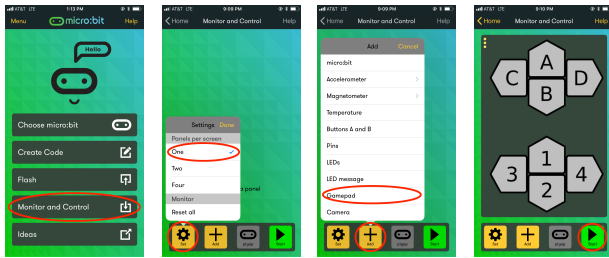
Devices Palette



Game Palette  
(Under Advanced)



## App Configuration



## Apps for Data Logging: bittydatalogger

## Program

```
on start
  * bluetooth accelerometer service
  * bluetooth temperature service
```



## Concepts

- Data Formats (CSV vs. JSON)
- Data Analysis

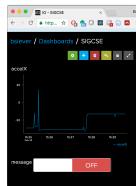
**Question: Can this bootstrap advanced topics?**

**Text Based Languages: JavaScript!**



## IoT Example

## AdaFruit.io



## Misc.

- C (C++) / Arduino
- Phone acts as border router
- AdaFruit.io can tie into other services:
  - Texts/Notifications (IFTTT), Webhooks, etc.



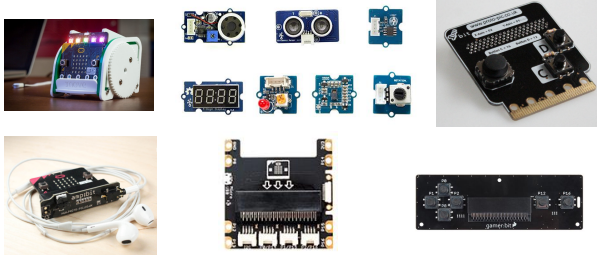
## Demo

<https://io.adafruit.com/bsiever/dashboards/sigcse>

## Hardware







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<http://microbit.org/assets/documents/microbit-accessories.pdf>



## U.S. Resellers



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<http://microbit.org/resellers/>



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## Misc.

- Address Safety!
- Low voltage / low current vs. Mains power

**Bill's SIGCSE Blog Post**  
**<http://bit.ly/sigcsemb>**

**Questions / Discussion**