UNIT PLAN

Build a Mini Arcade
with the Intel® Galileo Gen 2 board

Created by Oliver Chen, Cheryl Daisin, Shammi Jayaraj, Dustin Byars, Sruti Chigullapalli, Luke Filose, Romanna Flores on August 30, 2014

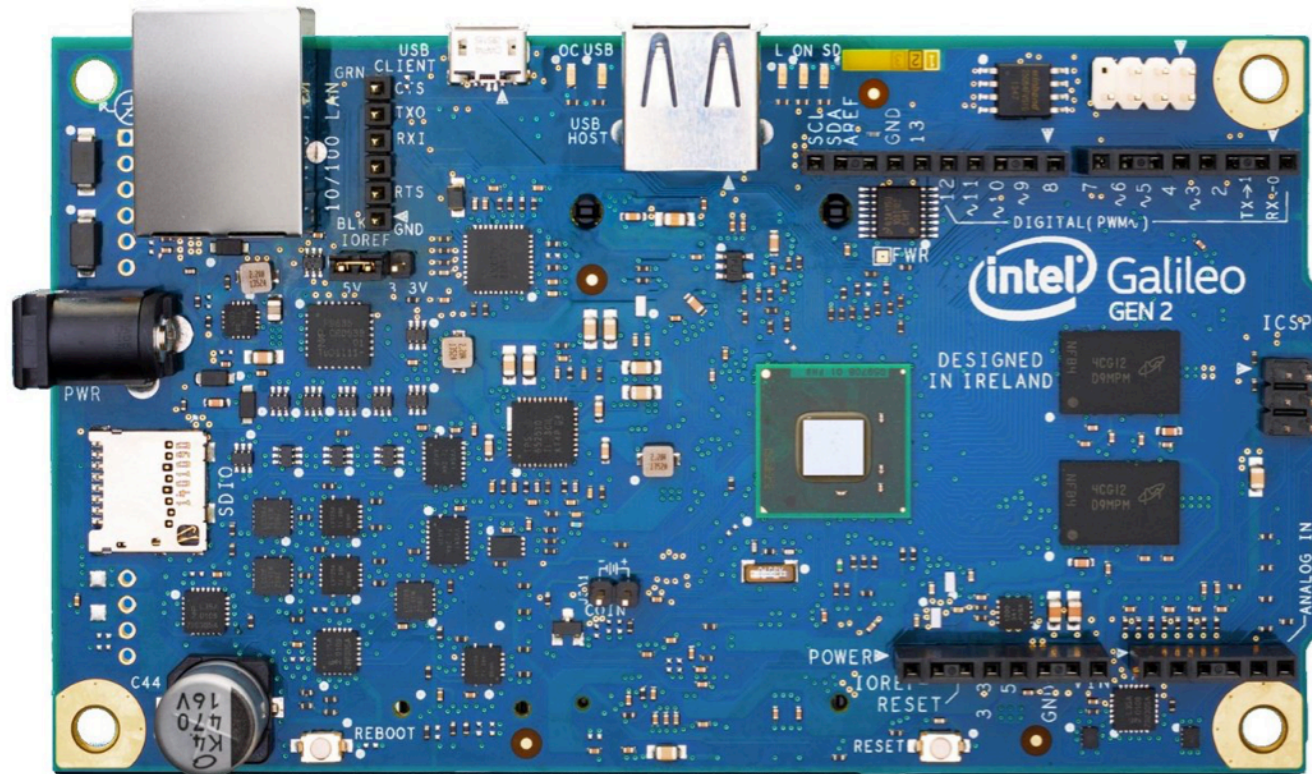**Last modified by Tom Seaman on September 25, 2015**

What Are Sensors?

A sensor is a device that responds to a stimulus, such as heat, light, or pressure. It then generates a signal that can be measured or interpreted.

Humans, animals and even plants have sensors that can detect the world around them.
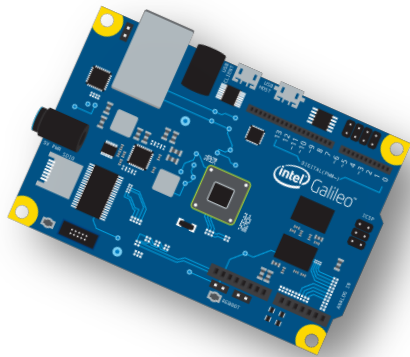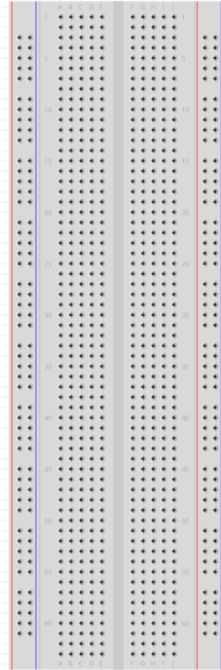
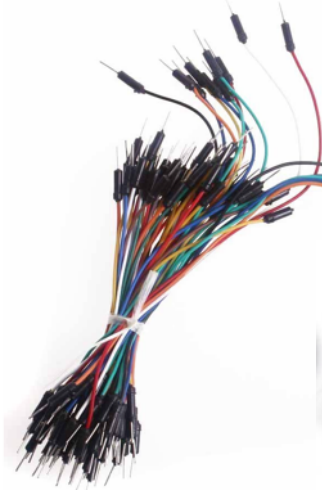# The Intel® Galileo Circuit Board

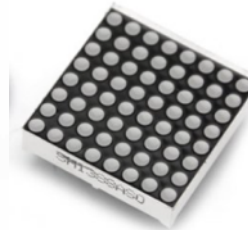What will you make?

What You Will Need

Intel® Galileo board
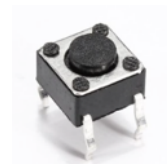(Including power cable, USB cable)

Breadboard

Jumper Wires

8x8 LED Matrix

Push Buttons
(Qty 3)

10k Resisors
(Qty 3)

In addition, you will need the Intel® Galileo board's power cable, USB cable, and a PC or Mac.

Figure 1

Reading Resistors

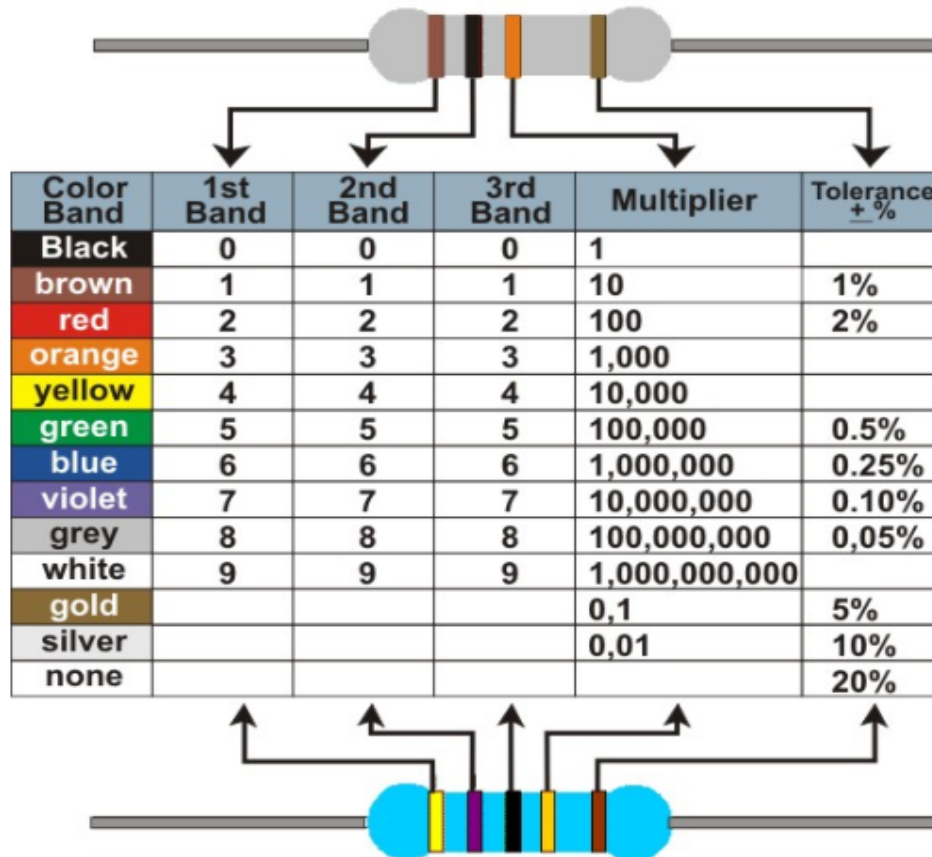| Color Band	1st Band	2nd Band	3rd Band	Multiplier	Tolerance ± %
Black	0	0	0	1	
brown	1	1	1	10	1%
red	2	2	2	100	2%
orange	3	3	3	1,000	
yellow	4	4	4	10,000	
green	5	5	5	100,000	0.5%
blue	6	6	6	1,000,000	0.25%
violet	7	7	7	10,000,000	0.10%
grey	8	8	8	100,000,000	0,05%
white	9	9	9	1,000,000,000	
gold				0,1	5%
silver				0,01	10%
none					20%

Figure 2

Practice with Resistors

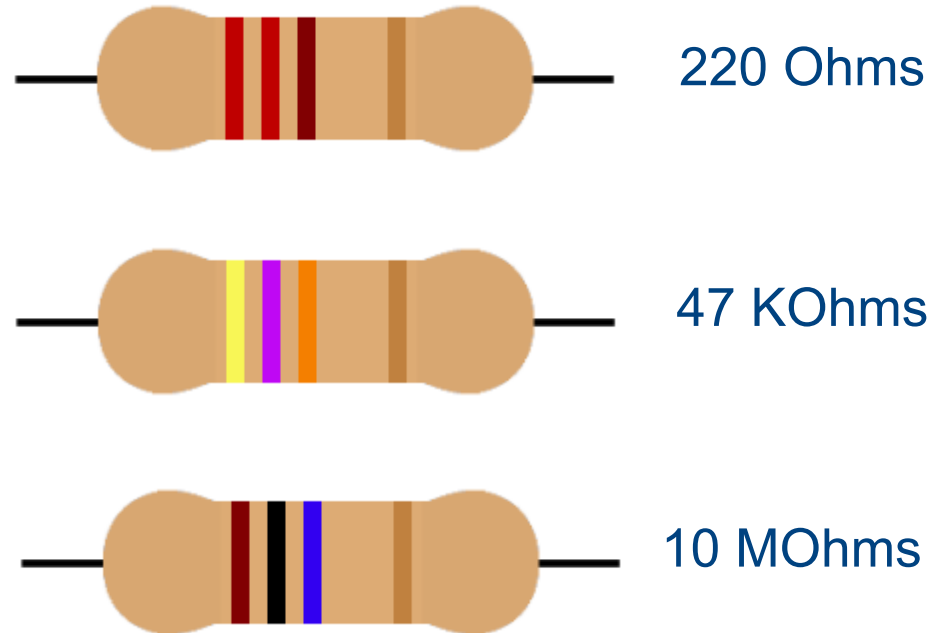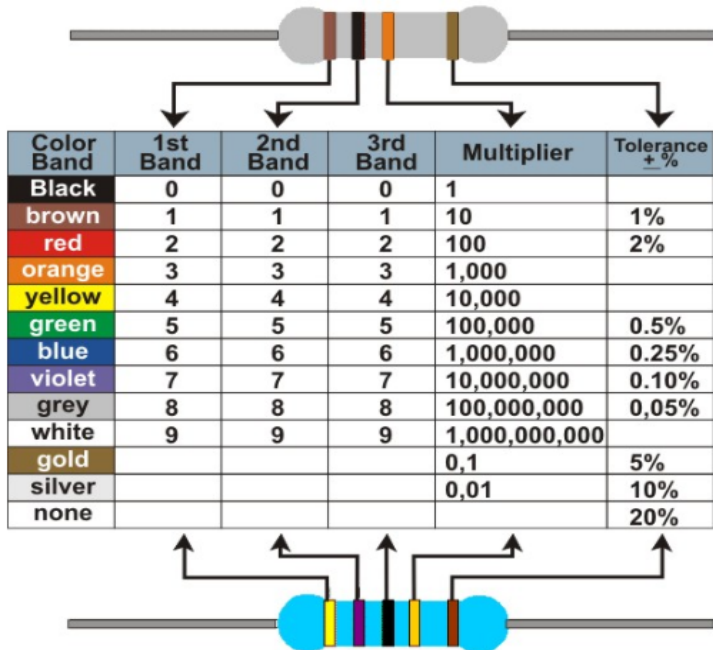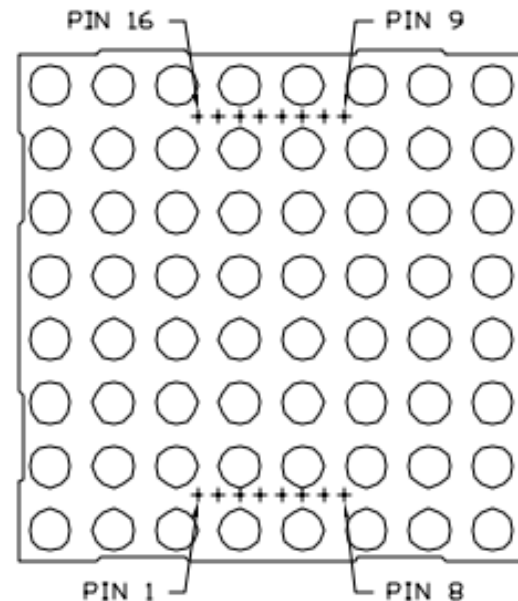| Color Band	1st Band	2nd Band	3rd Band	Multiplier	Tolerance ± %
Black	0	0	0	1	
brown	1	1	1	10	1%
red	2	2	2	100	2%
orange	3	3	3	1,000	
yellow	4	4	4	10,000	
green	5	5	5	100,000	0.5%
blue	6	6	6	1,000,000	0.25%
violet	7	7	7	10,000,000	0.10%
grey	8	8	8	100,000,000	0,05%
white	9	9	9	1,000,000,000	
gold				0,1	5%
silver				0,01	10%
none					20%

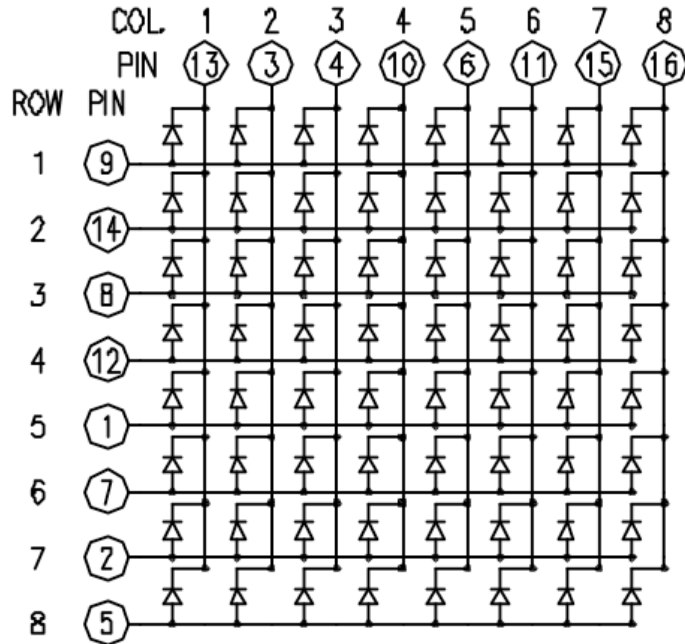220 Ohms

47 KOhms

10 MOhms

Figure 3

Mini Arcade 8x8 LED Matrix

To load the code for the 8x8 LED Matrix, open a browser and select **File → Open** and locate and select the file dot-matrix-code-generator/dot-matrix-code-generator.html

Figure 5

Coding Tips

```
/*
  Blink
  Turns on an LED on for one second, then

  This example code is in the public doma
 */

// Pin 13 has an LED connected on most Ar
// give it a name:
int led = 13;

// the setup routine runs once when you p
void setup() {
// initialize the digital pin as an outpu
  pinMode(led, OUTPUT);
}

// the loop routine runs over and over aga
void loop() {
  digitalWrite(led, HIGH);   // turn the L
  delay(1000);               // wait for a
  digitalWrite(led, LOW);    // turn the L
  delay(1000);               // wait for a
}
```

{ Curly Brackets }

Any code you write inside the curly brackets will be executed when the function is called.

// Comments

Comments are notes you leave for yourself that the computer ignores. To write a comment, add two slashes // before you're the text you want ignored.

Case sensitivity

Pay attention to the case sensitivity in your code.

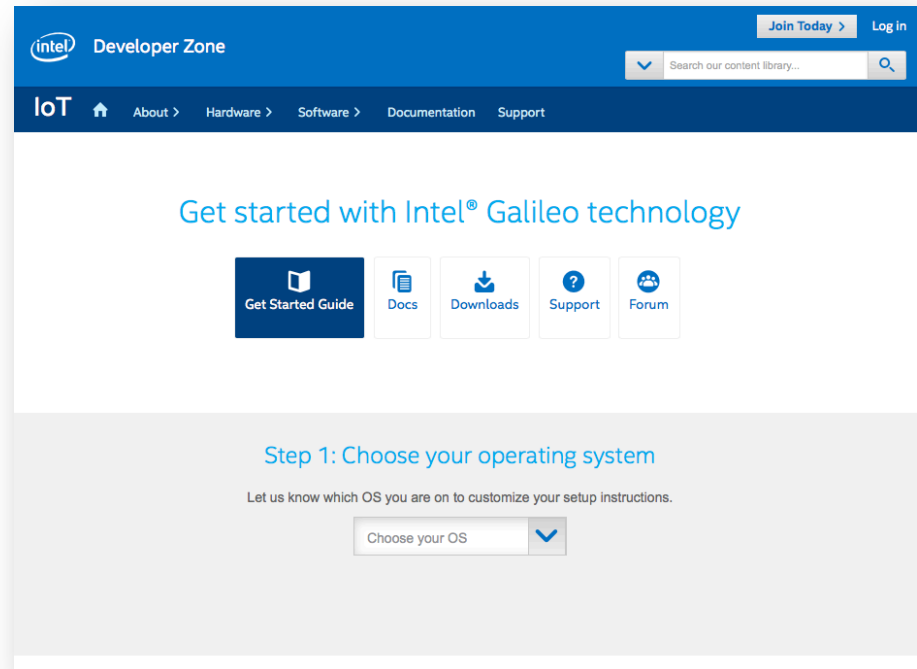# Connect the Galileo Board and Install Software

Note: If the set-up is done ahead of time, skip this step and proceed to the next slide, Build the Circuit.

Step-by-step instructions for connecting Galileo are found here:

https://software.intel.com/en-us/iot/ library/galileo-getting-started.

Within the step-by-step instructions, when prompted to choose a development environment, choose Arduino.

Proceed all the way through the getting started exercise to the point where you blink the LED on the Galileo board. This affirms the set-up was done correctly.

Caution!

Always make sure the Galileo board is plugged in BEFORE connecting the USB cable to the computer!

Also, always unplug the USB cable BEFORE disconnecting the power from the Galileo.

Doing these steps in the wrong order can permanently damage your board.

Install the Sketches

Note: If the set-up is done ahead of time, skip this step and proceed to the "Build the Circuit" slide.

Instructions for Windows or Mac:

1. Download to the PC's desktop the file called **IESC.zip**. (The file is attached to the unit plan "Make a Mini-Arcade" housed in the Idea Showcase in engage.intel.com.)

2. Unzip the file. This will unpack the zip file and place all the relevant files in a folder called **IESC** it creates for you on the desktop.

3. Remember to tell your students that the sketches they will need to run for the activities are located inside this **IESC** folder.

Stacker
Sprites
Rock Paper Scissors

Mini Arcade Stacker

Build the Circuit

You will need

1. 8x8 LED
2. Three buttons
3. 24 male-to-male jumper wires
4. Three 10K-ohm resistors

Load the Sketch

1. In Arduino IDE: **File → Open**
2. On the desktop, open in succession the folders **IESC → MiniArcade → stacker_8v8**.
3. Within the **stacker_8v8** folder, select the file called **stacker_8v8.ino.**
4. Click **Verify** (checkmark)
5. Click **Upload** (right arrow)

Play the Stacker redemption game

Press the button connected to A0 and stack the bars to the top to win

Need help? Troubleshooting page in this doc
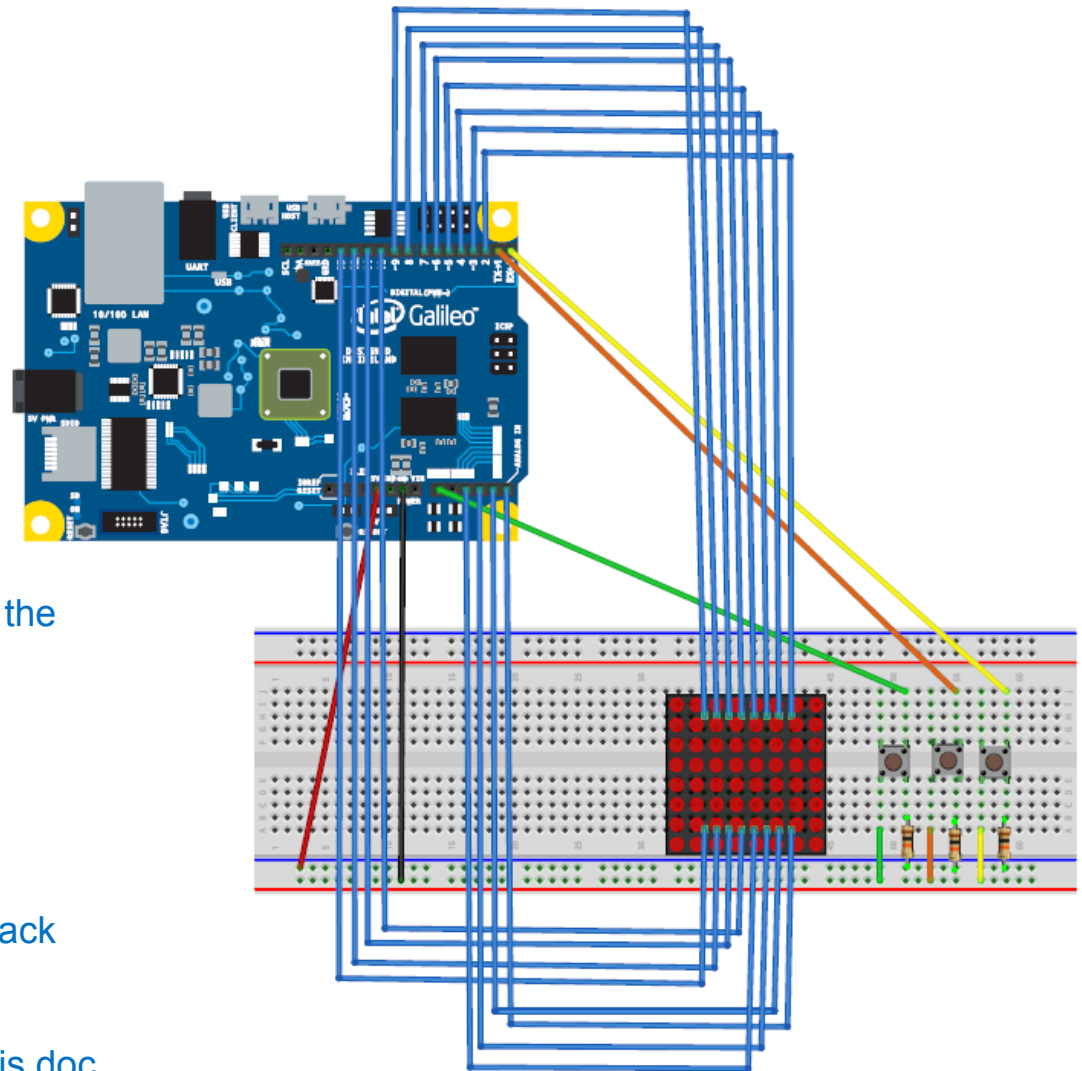
Challenge: Can you change the speed?
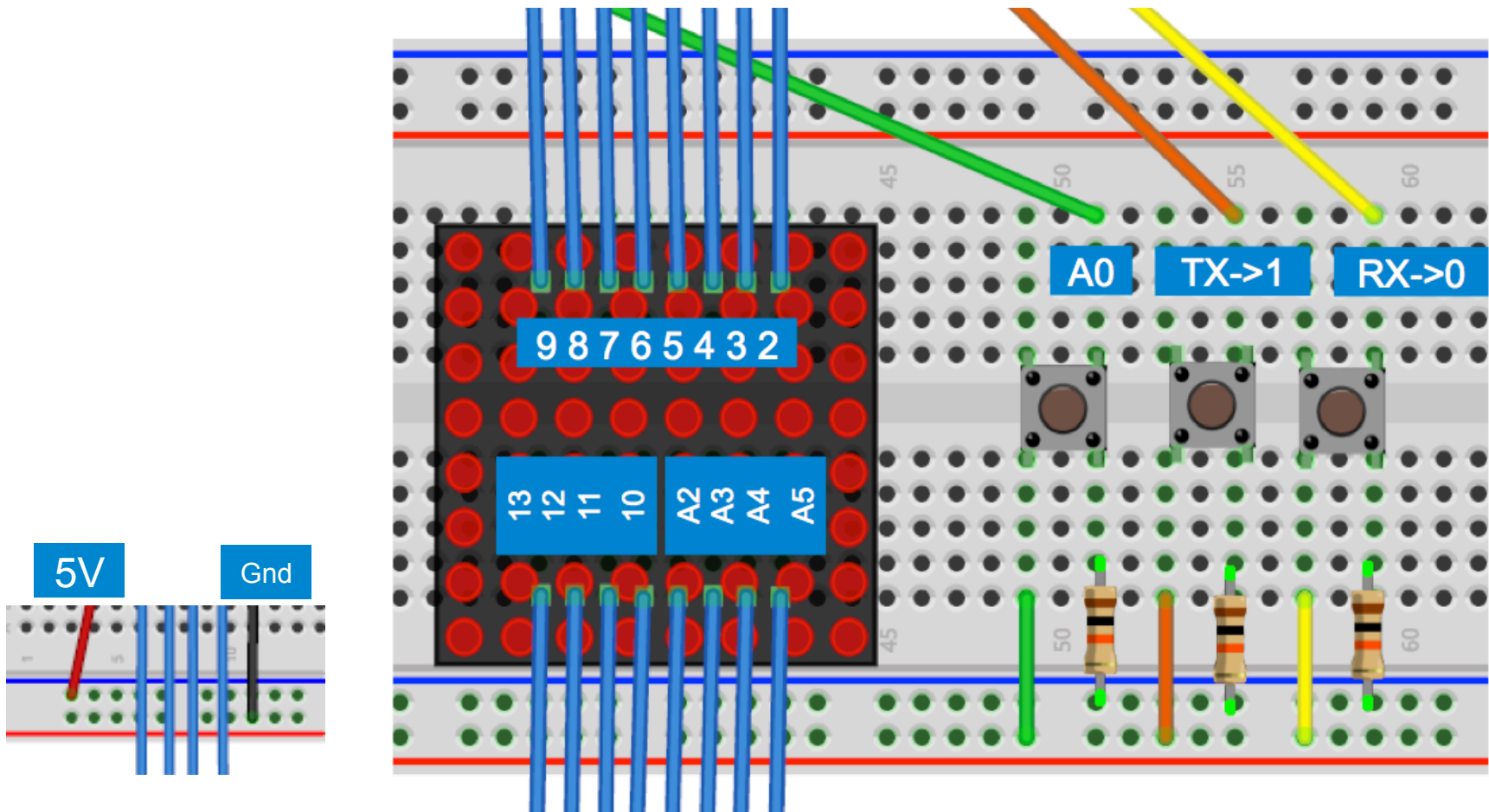

Figure 6

Mini Arcade: Stacker

Figure 7a
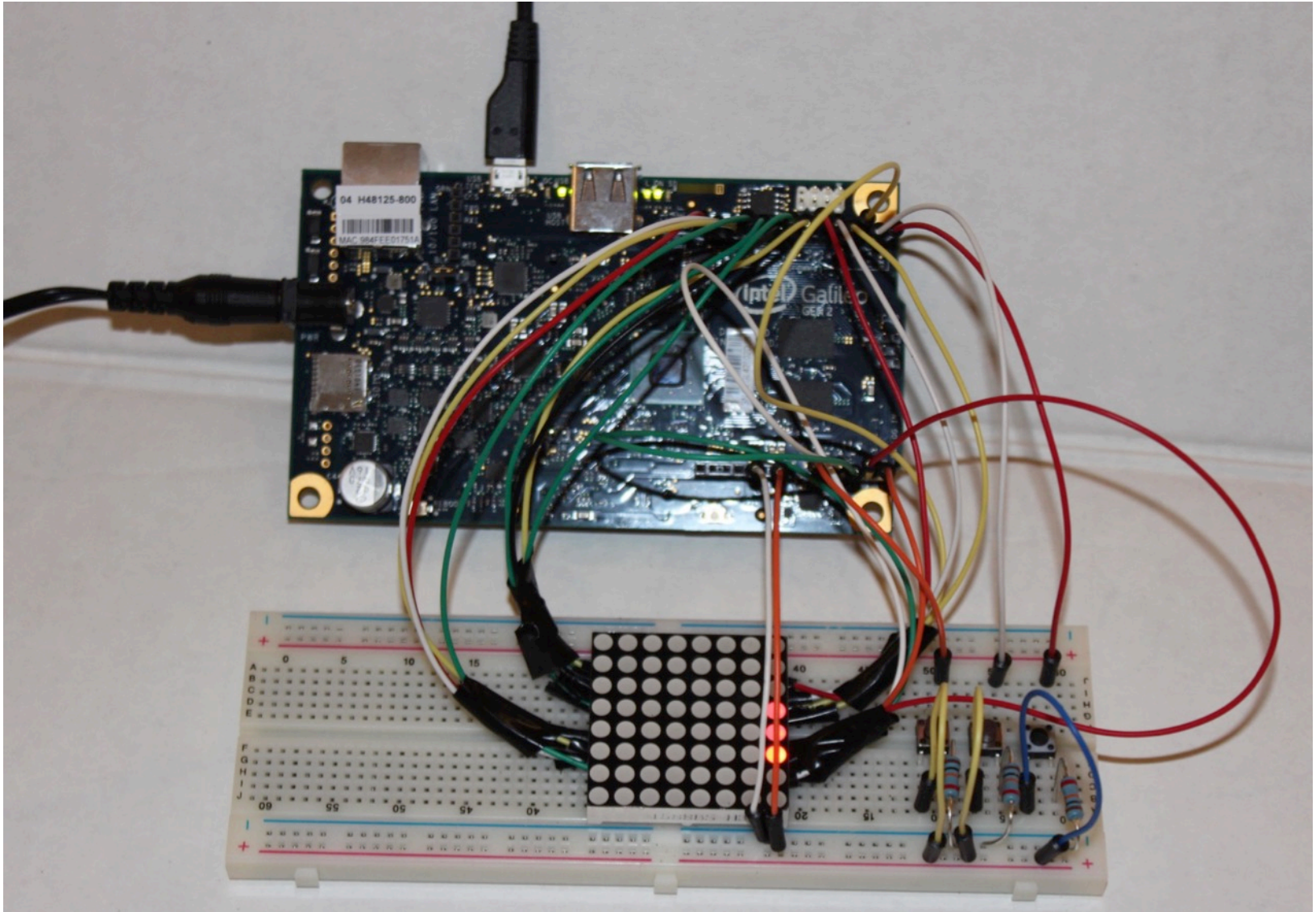
Mini Arcade: Stacker

Figure 7b

Mini Arcade: Sprites

Build the Circuit

You will need

1. 8x8 LED

2. Three buttons

3. 24 male-to-male jumper wires

4. Three 10K-ohm resistors:
   Brown Black Orange

Load the Sketch

1. In Arduino IDE: **File → Open**

2. On the desktop, open in succession the folders
   IESC → MiniArcade → animator_8v8.

3. Within the **animator_8v8** folder, select the file
   called **animator_8v8.ino.**

4. Click **Verify** (checkmark)

5. Click **Upload** (right arrow)

Play Sprite Game

At ?, push button for animation

     A0 – Face
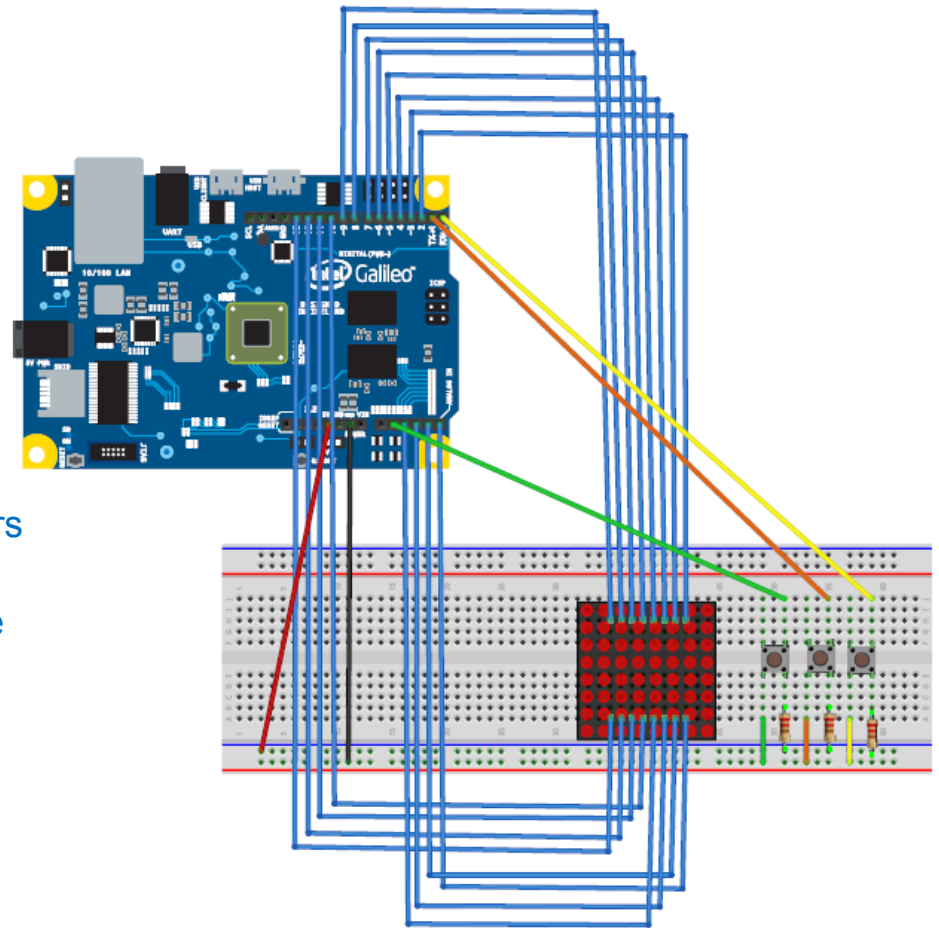   Tx1 – Space Invaders
     Rx0 – Pacman

Need help? Troubleshooting on page 16

Figure 8

Challenge!

Can you create your own animation with an 8x8 Character Generator?

Instructions:

1. Open a browser such as Chrome, Firefox, or Safari.

2. In the browser menu bar, click on **File → Open** and navigate to the dot-matrix-code-generator folder. Do this by starting at the desktop, and open in succession the folders **IESC → Mini_Arcade → dot-matrix-code-generator**, and then selecting the file **dot-matrix-code-generator.html.**

Mini Arcade - Rock Paper Scissors

Build the Circuit

You will need

1. 8x8 LED matrix
2. Three buttons
3. 24 male-to-male jumper wires
4. Three 10K-ohm resistors:

Load the Sketch

1. In Arduino IDE: **File → Open**
2. On the desktop, open in succession the folders **IESC → MiniArcade → rock_paper_scissors_8v8**.
3. Within the **rock_paper_scissors_8v8** folder, select the file called **rock_paper_scissors_8v8.ino.**
4. Click **Verify (**checkmark)
5. Click **Upload** (right arrow)

Play the Rock-Paper-Scissors Game

1. At the ? prompt, push A0 button for 1 player
2. After countdown choose your throw
   A0 – Rock, Tx1 – Paper, Rx0 – Scissors
3. 8x8 shows Player Throw, Computer Throw, and Winner

Need help? Troubleshooting on page 16
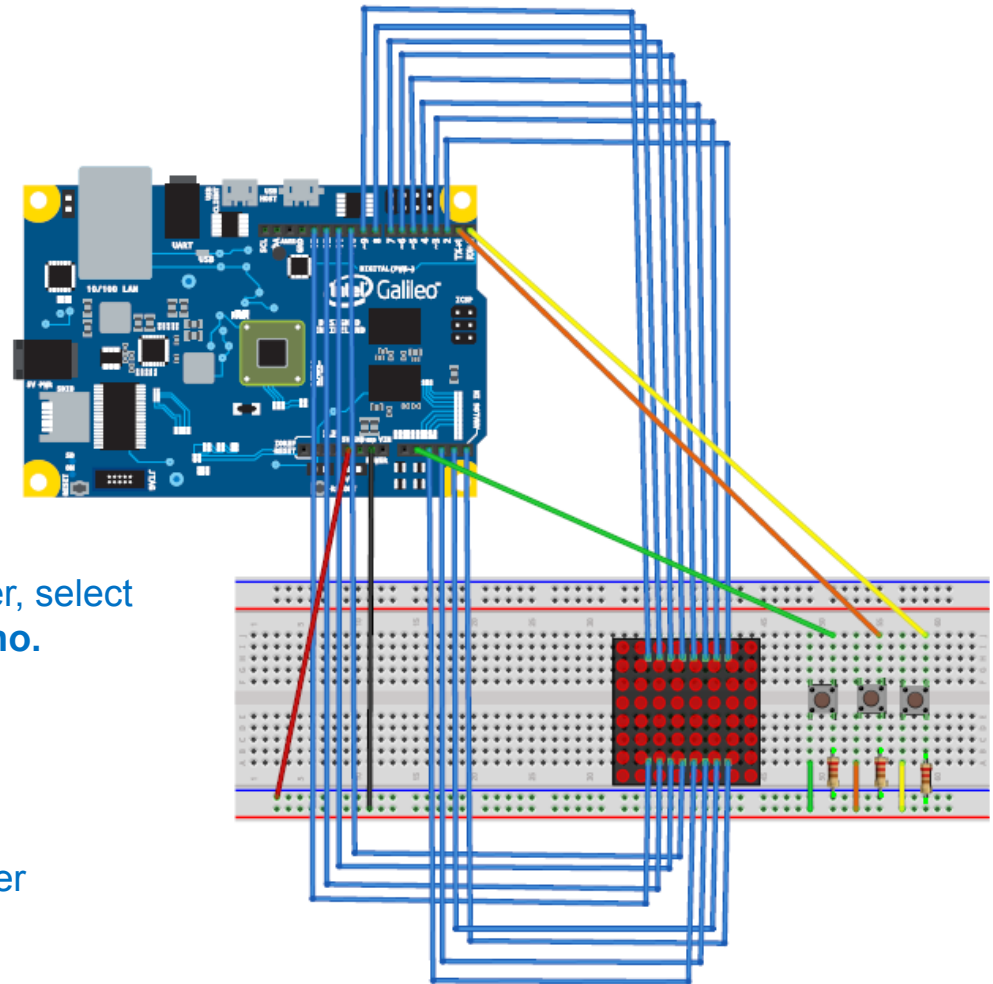***Challenge:*** Can you implement best 3 out of 5

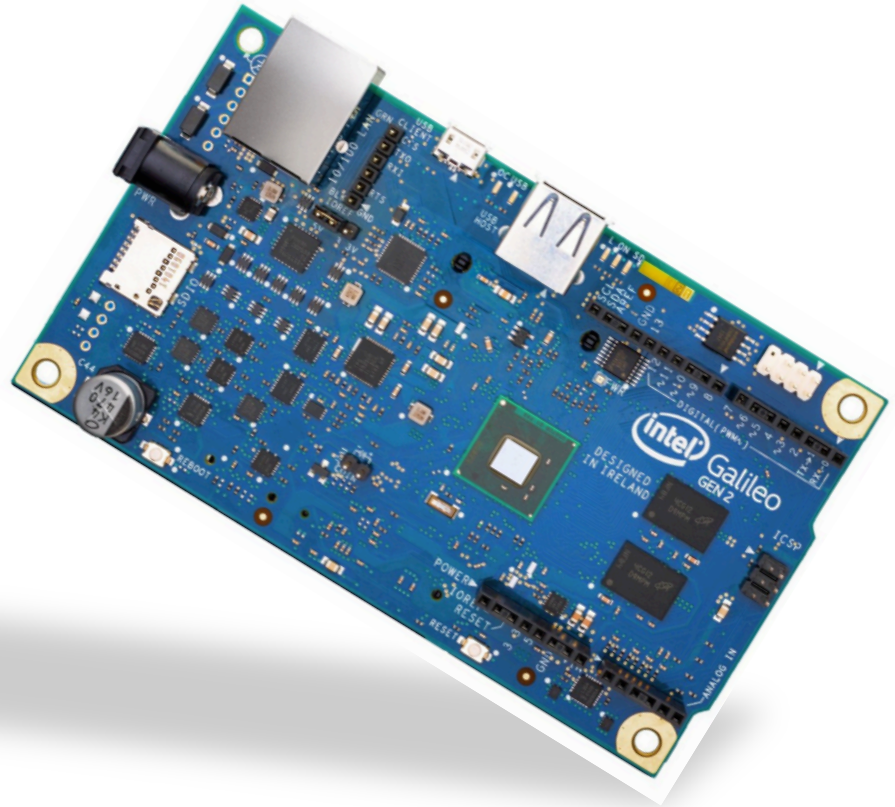Figure 9

Wrap-Up Discussion

What did we learn?

Using the Intel® Galileo board and the same set of sensors and output devices, what are some other types of video games we could create?

Can you think of any interesting ideas for innovative Interactive devices for the home?

How about ideas for wearable technology?

What kinds of careers are available to people who enjoy this kind of activities?

Troubleshooting Guide

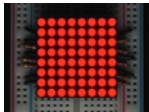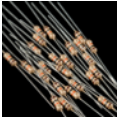| Problem	Resolution
Sketch not working	1. Check Arduino IDE set to correct model, and Port 2. Check Galileo Port visible in device manager 3. Try resolution for port not visible 4. Try upgrading the firmware 1. Aurdino IDE Help -> Galileo Firmware Update 2. Click OK, if you have external power (This step should take ~5 minutes)
Galileo port not visible in device manager	1. Unplug USB 2. Unplug and replug power 3. Replug USB 4. Wait 5. If not visable after 2.5 minutes, reboot PC and repeat steps 1-4. 6. If still not visable check if *Gadget Serial v2.4* is in device manager
Gadget Serial v2.4 in device manager	1. Install Galileo Driver
Sketch upload complains about missing /dev/tty** Or upload just hangs	Port may be locked, try steps under Galileo port not visible.
Sketch upload complains about missing libraries	1. Close all arduino IDE instances 2. Install Grove libraries page 10 3. Restart arduino IDE

Bill of Materials

Bill of Materials

	Part	Where to buy	Price	Qty	Extended
	Intel® Galileo board	http://www.intel.com/buy/us/en/product/emergingtechnologies/intel-galileo-gen-2-board-462661	**$ 65.00 ea**	**1**	**$ 65.00**
	USB Cable – A/Micro B	http://www.adafruit.com/products/592	**$ 2.95**	**1**	**$ 2.95**
	Mini Pushbutton Switch	https://www.sparkfun.com/products/97	**$ 0.35 ea**	**3**	**$ 1.05**
	Resistors 10k-ohm	https://www.sparkfun.com/products/11508	**$0.95 / 20pk**	**1**	**$ 0.95**
	Jumper Wires male-male	https://www.sparkfun.com/products/11026	**$4.95 / 30pk**	**1**	**$ 4.95**
	8x8 LED Matrix	http://www.adafruit.com/products/455	**$3.95 ea**	**1**	**$ 3.95**
	Breadboard	http://www.adafruit.com/products/239	**$5.95 ea**	**1**	**$ 5.95**

Several retailers carry these parts including Sparkfun, Adafruit, Mouser, DigiKey, and others.

If you like this unit plan, you might like one of these other unit plans introducing students to making and coding:

For Teaching Coding and Computer Science
Let's Learn Computer Science 1
Let's Learn Computer Science 2
Let's Learn Computer Science 3
Let's Learn Computer Science 4
Create Your Own Flappy Game

For Teaching Making, Engineering, and Science
Creating with Technology
What Will You Make?
Electrical Engineer for a Day
Unlocking Possibilities
Inspiring Young Engineers
Make a Pong Video Game
Make a Mini Arcade
Make a Smart Toy
Make a Smart Light Sensor
Make a Smart Temperature Sensor

To download these and other open-source unit plans, please visit
https://engage.intel.com/community/teachersengage/showcase

Additional Resources

For an introduction to the benefits of teaching making and coding, and tips for bringing hands-on activities to your classroom, see Gary Stager's paper, "Guide to Creating and Inventing with Technology in the Classroom," found here:

http://innovationtoolbox.intel.com.au/wp-content/uploads/2015/05/18009_IntelEdu_Guide2Making_FA_LR_singles.pdf