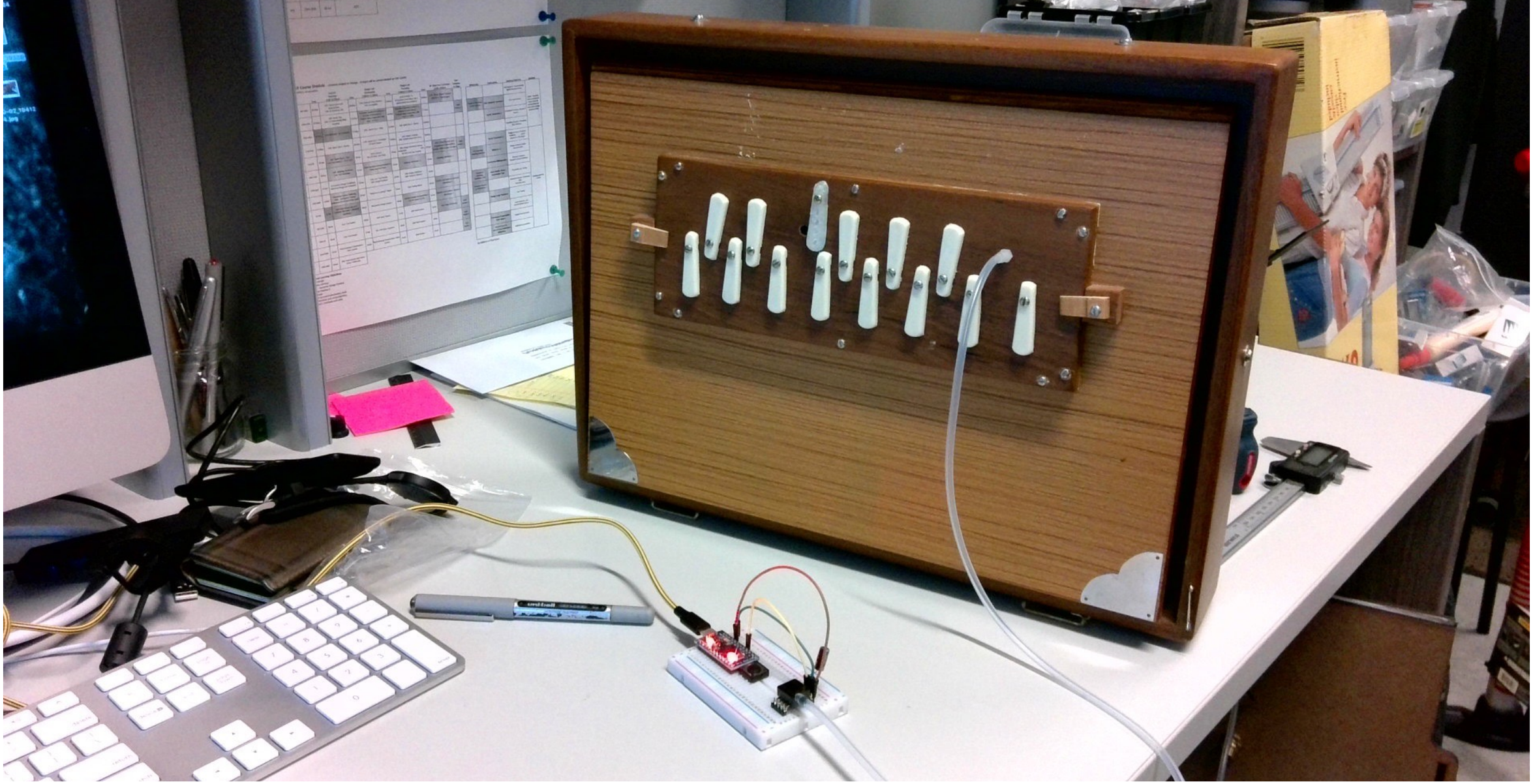
GRAVITY

UWTMC

Matt Borland - 2019

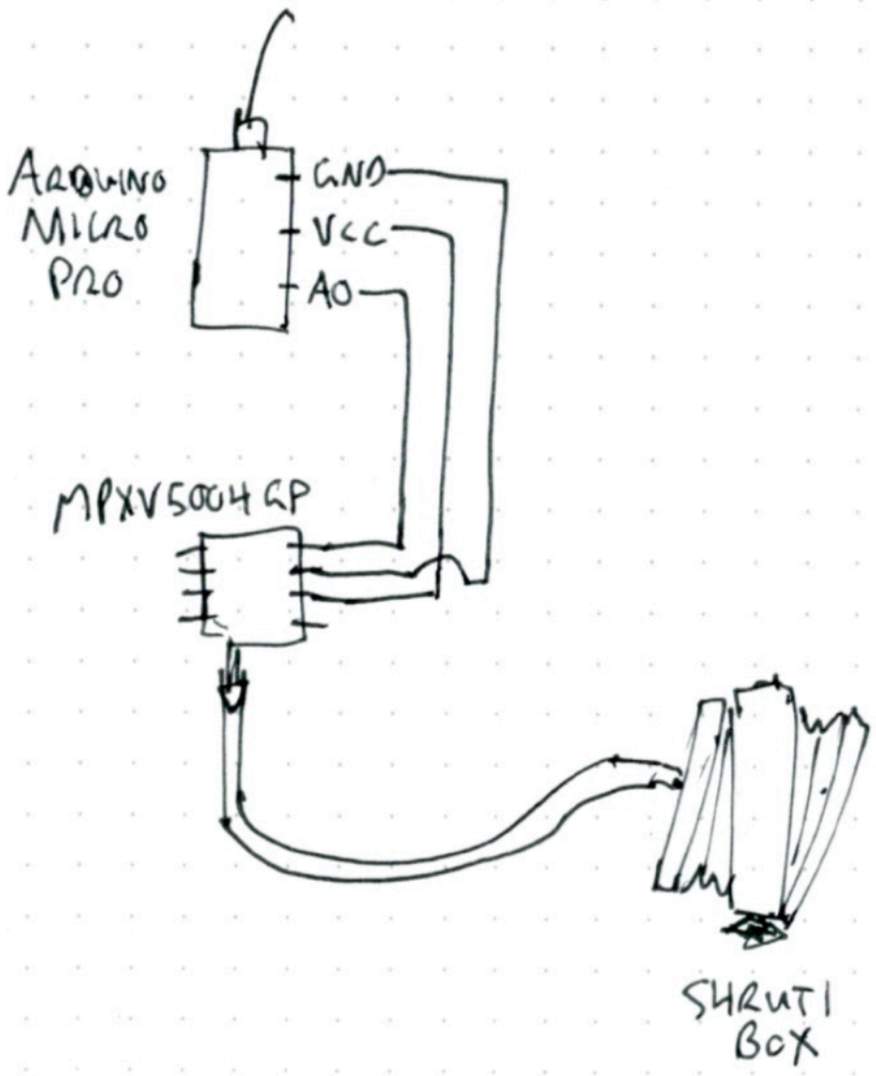


WE'RE USING GRAVITY TO CREATE MUSIC

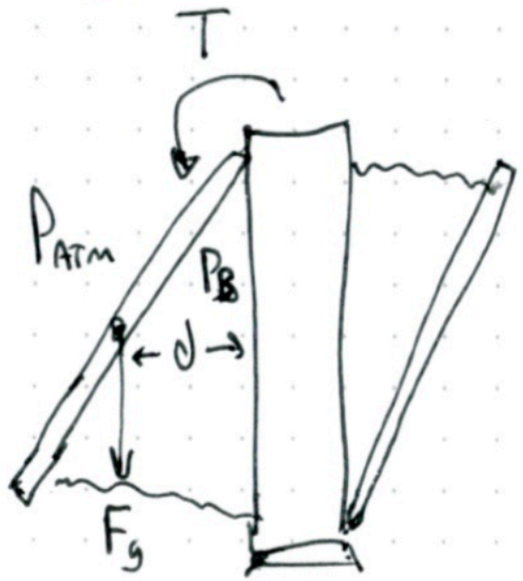
We'll use sensors to measure change in pressure as a function of gravitational force, then convert those readings to MIDI messages which your computer will then turn into musical sounds!

We'll also simulate gravity and make music on our computers.

UWTMC - GRAVITY



SHRUTI BOX



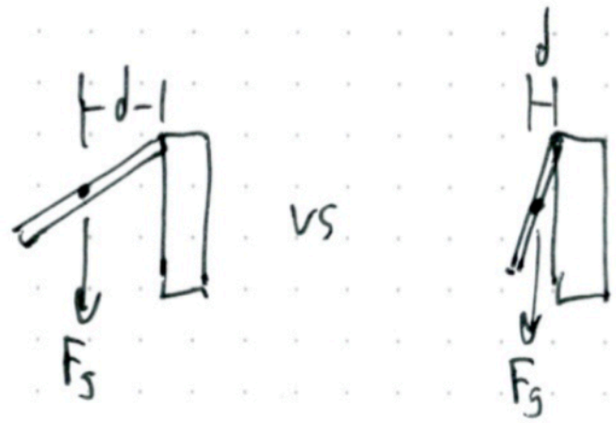
$$T = F_g d$$

→ THE APPLICATION OF TORQUE CREATES A PRESSURE DIFFERENCE BETWEEN THE AIR INSIDE AND OUTSIDE THE BELLOWS.

$$P_{SENSOR} = P_B - P_{ATM}$$

IMB

2019



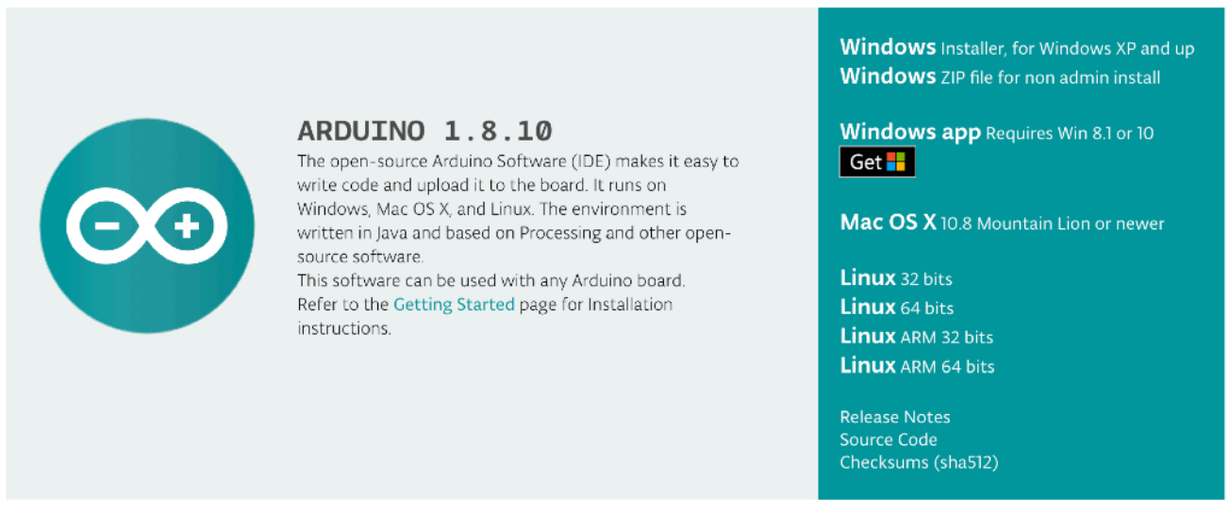
→ THE AMOUNT OF APPLIED TORQUE IS A FUNCTION OF THE ANGLE OF THE BELLOWS PLATE.

THIS IS THEN MAPPED TO CONTROL THE VOLUME OF OUR SYNTHESIZER.

DOWNLOADS

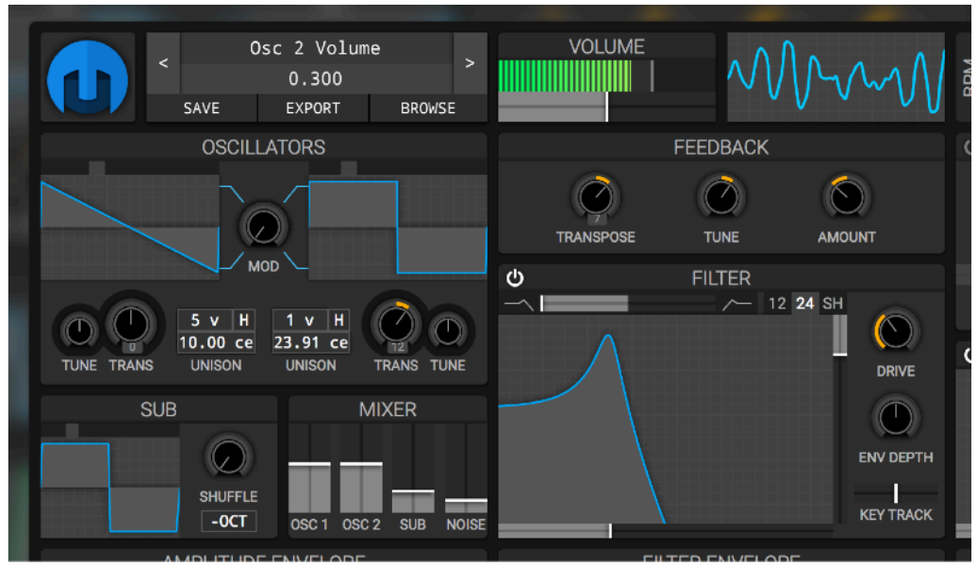
You need three pieces of software. All are free and multi-platform!

Download the Arduino IDE



Arduino IDE - a software platform used to program your microcontroller.

https://www.arduino.cc/en/Main/Software



Helm - a software synthesizer to make musical sounds with your computer.

https://tytel.org/helm/

DOWNLOADS

3.5.3 (3 February 2019)

Windows 64-bit
Windows 32-bit

Linux 64-bit
Linux 32-bit
Linux ARM
(running on Pi?)

Mac OS X

Processing IDE - a software platform used to create simple programs.

https://processing.org/download/

FILES

Workshops this term are at CML! All sessions run 3:30-5:30pm at Critical Media Lab, located in Communitech, 151 Charles St. W., Kitchener.

Sept. 18th: Deformation - MIDI Balloons: DeformationFiles.zip

Oct. 2nd: Gravity - Shruti Box: GravityFiles.zip

Oct. 23rd: Continuity - Seaboard and Bop Pad

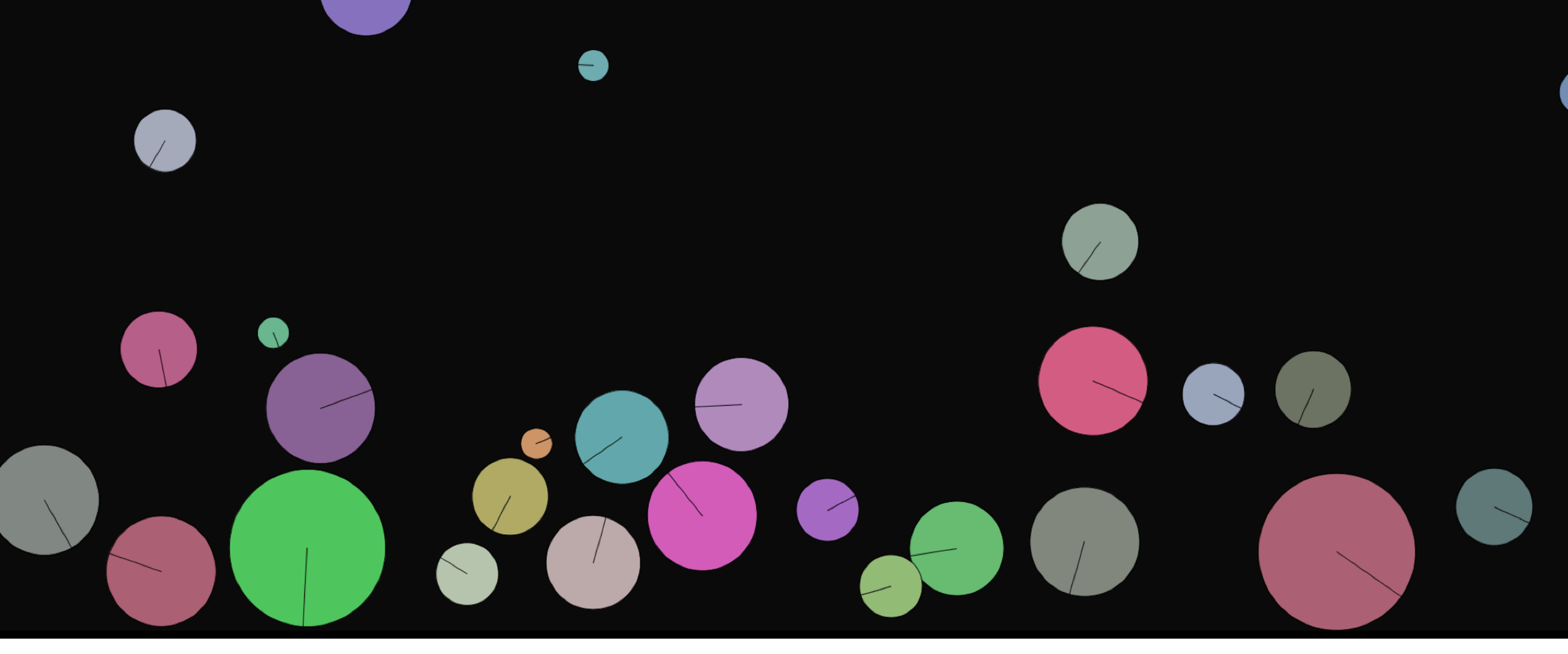
Nov. 6th: Complexity - Modular Synthesis

Nov. 20th: Exploration - Co-play Patch Tables

Files are available as a ZIP at https://uwtmc.com

LET'S DO IT!

Matt will explain everything, so follow along with him on the big screen. Ask questions if you're unsure - other people are probably in the same boat.

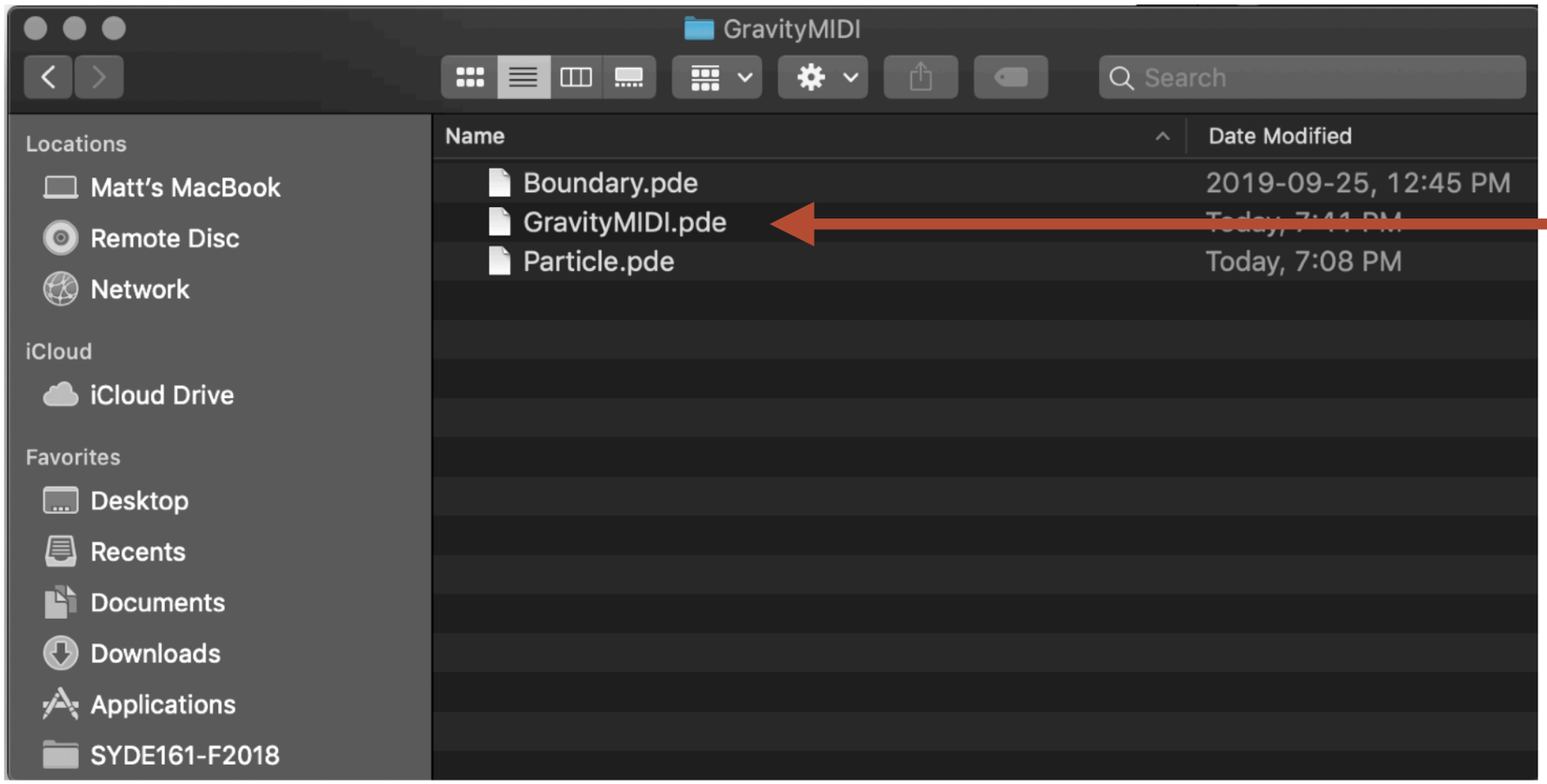


SIMULATING GRAVITY

UWTMC

Matt Borland - 2019

SIMULATING GRAVITY



Open "GravityMIDI.pde", the other files will automatically load.

SIMULATING GRAVITY – INSTALL LIBRARIES

Processing File Edit Sketch Debug Tools Help

GravityMIDI | Processing 3.5.3

Java ▾

GravityMIDI | Boundary | Particle | ▾

```
// The Nature of Code
// Daniel Shiffman
// http://natureofcode.com

// Modified by Matt Borland for UWTMC to make music by sending out MIDI messages

// Press keys in the "A" to ";" row of your keyboard to create particles
// where your mouse cursor is located.
// Each particle has a note associated with its radius and will send a
// MIDI message when it contacts a boundary or another particle

// Install the following libraries by going to the menu bar -> Sketch/Import Library/Add Library/
// Then search for and install:
// "the MidiBus"
// "Box2D for Processing"

import themidibus.*; //Import the library "The Midibus"
MidiBus myBus; // Create a MIDI bus instance to send and receive MIDI messages
int channel = 0;    // Zero-referenced MIDD channel to send messages on (values from 0-15)

// There are 10 keys you an press, so you need 10 pitch values here or else you'll create an error
// message and the program will crash
// These use the standard MIDI note numbers
int[] pitch = {60, 62, 64, 67, 69, 72, 74, 76, 79, 81}; //

// Import a bunch of libraries associated with the Box2D for Processing library
```

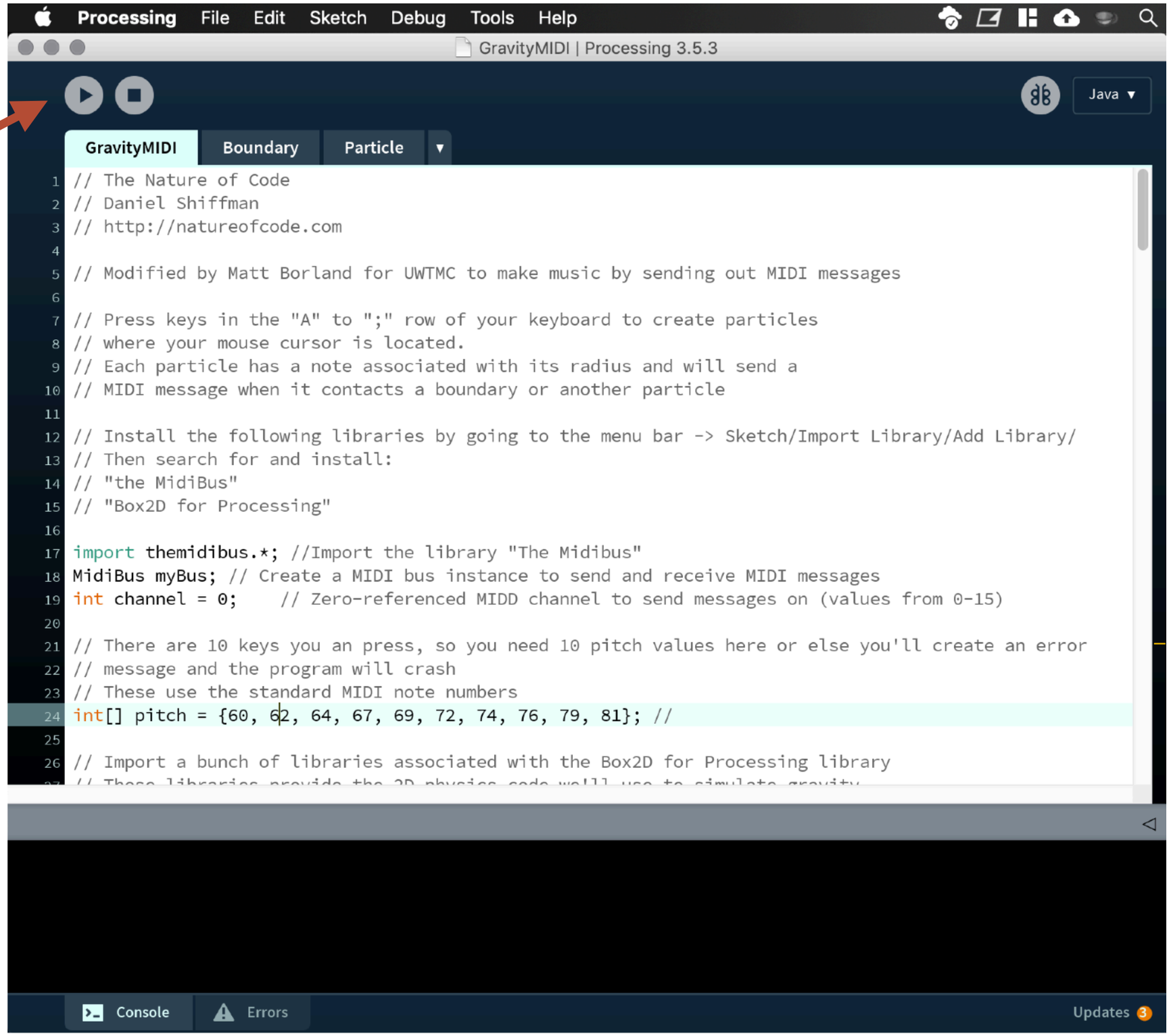
Console | Errors | Updates 3

Follow these instructions to install the required libraries.

SIMULATING GRAVITY – RUN THE CODE

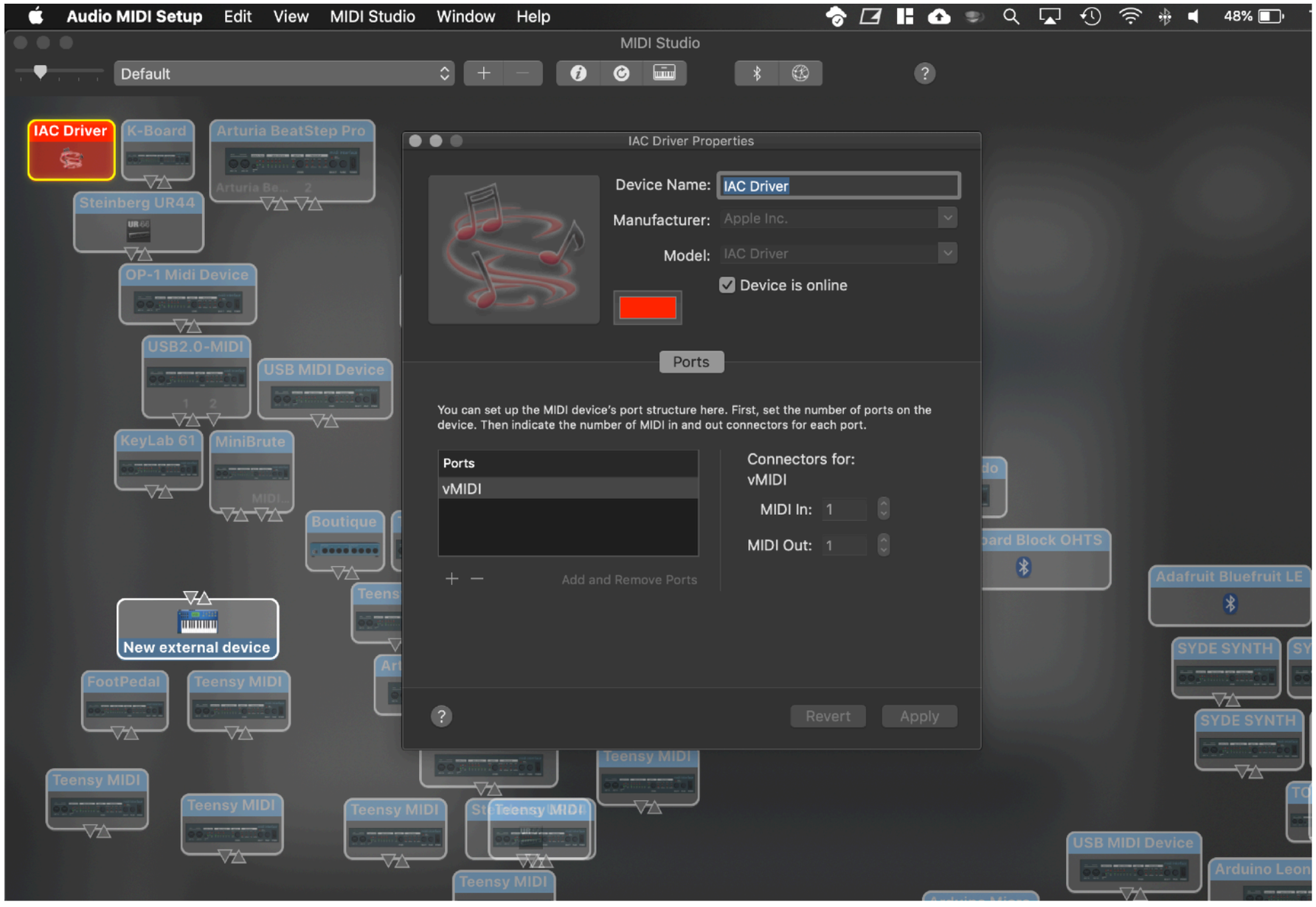
Press the run button to try to run the code.

It's not going to work because we need to set your midi port, but you need to run it to see what midi ports are available.



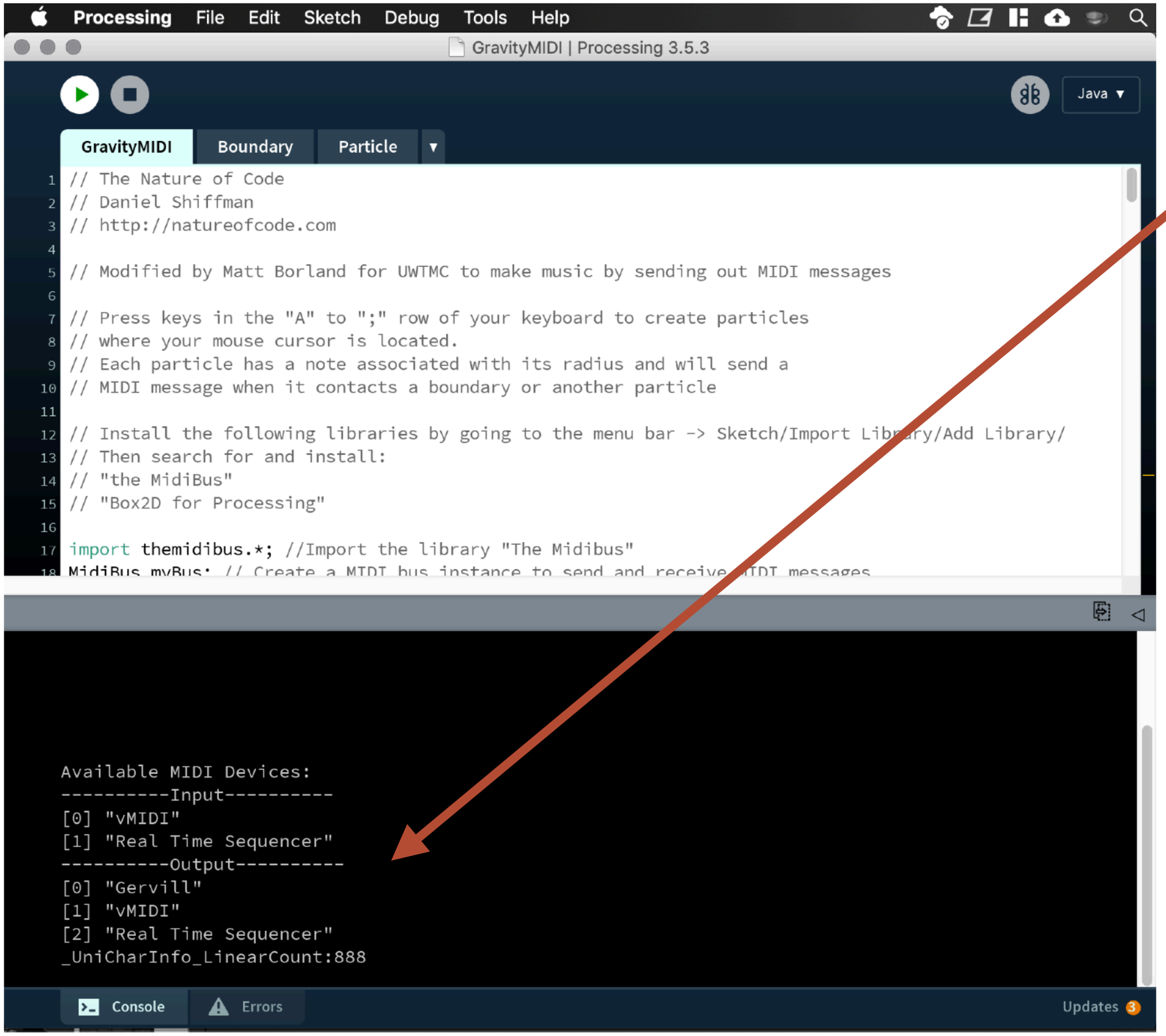
USING GRAVITY – VIRTUAL MIDI PORT ON MAC

On Mac OS you may have to turn on a virtual MIDI port. Open "Audio MIDI Setup" to get a window that lists all of your MIDI instruments. Double click "IAC Driver", and make sure the "device is online" box is checked.



Make a note of the port name - this is used in the Processing code.

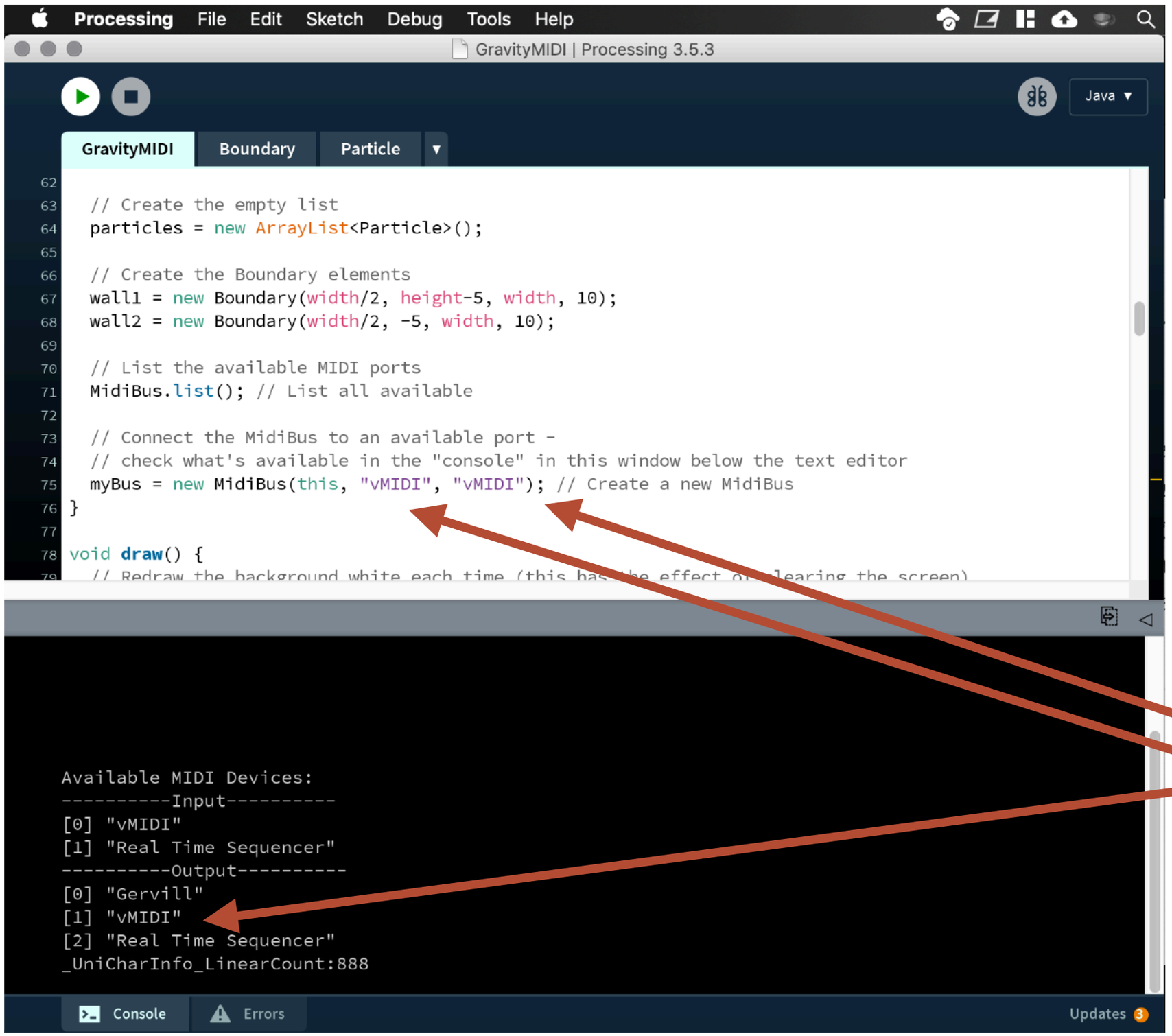
SIMULATING GRAVITY – SET MIDI PORT



The MIDI device name here is used in the setup code for the program, so make note of what options you have.

Your options will be different than mine!

SIMULATING GRAVITY – SET MIDI PORT

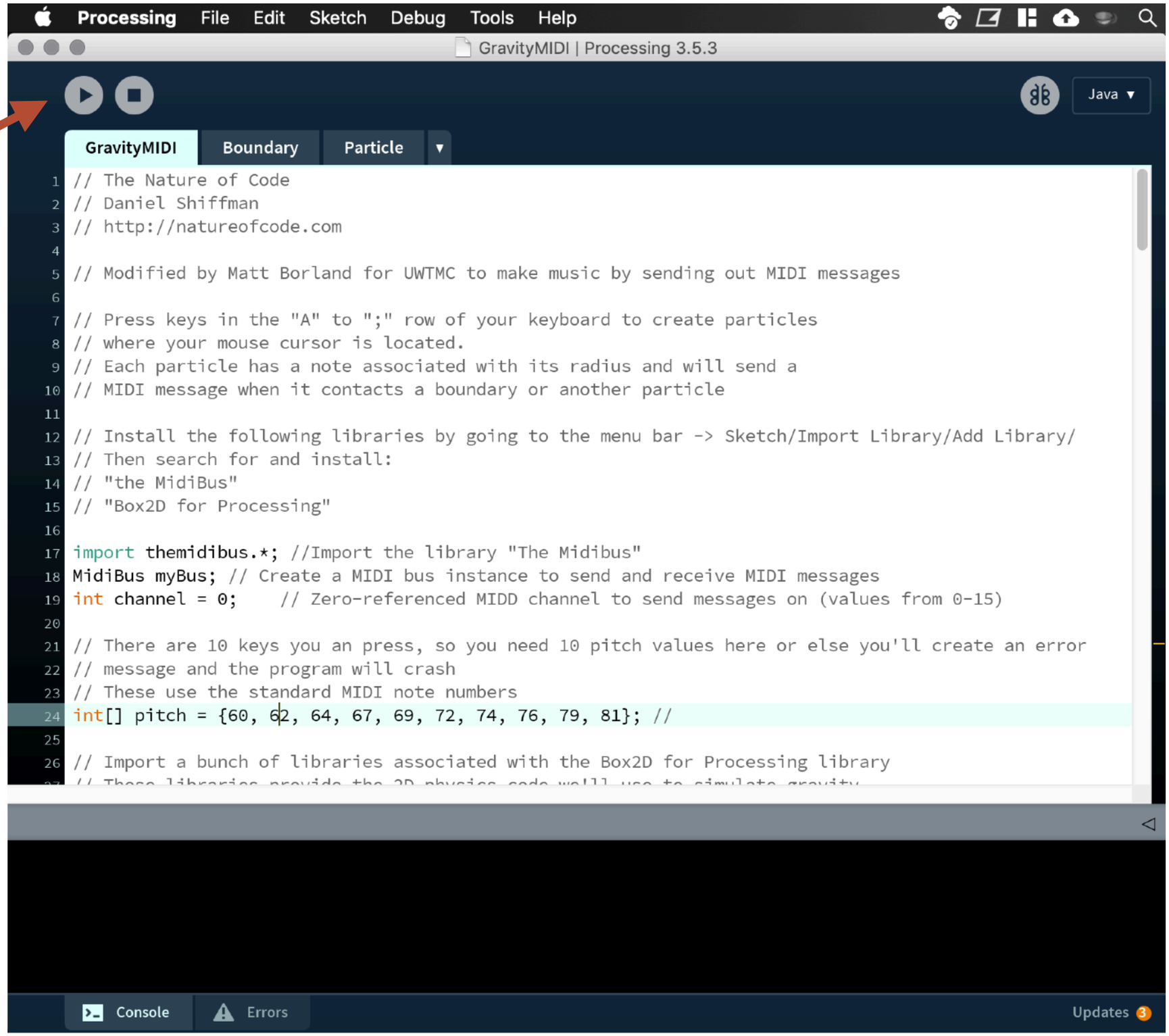


Scroll down to the setup loop so you can set your MIDI ports.

On Mac this variable should match the name of the port found in "Audio MIDI Setup" two slides ago.

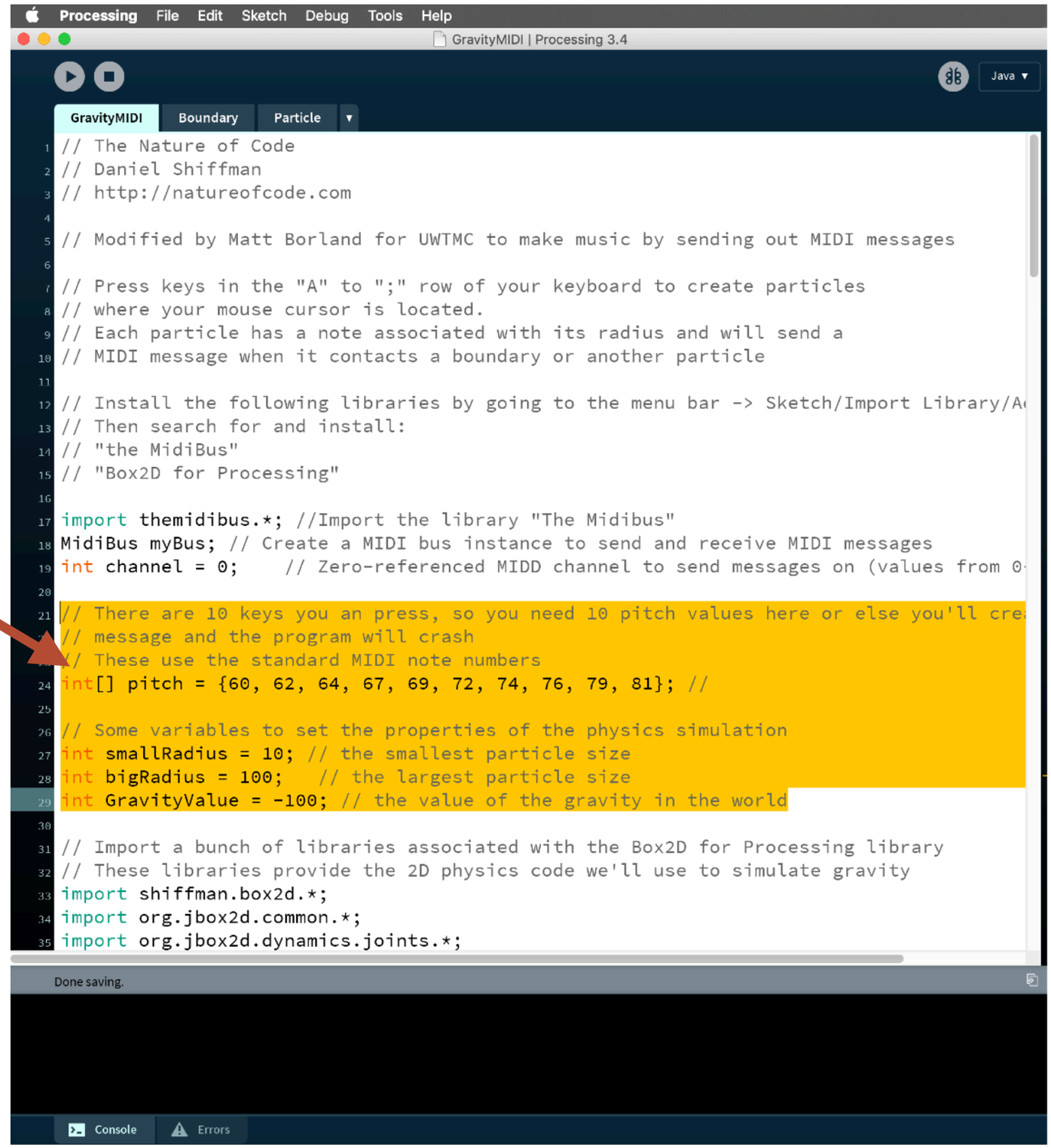
SIMULATING GRAVITY – RUN THE CODE AGAIN

Press the run button to try to run the code. Hopefully it works this time!

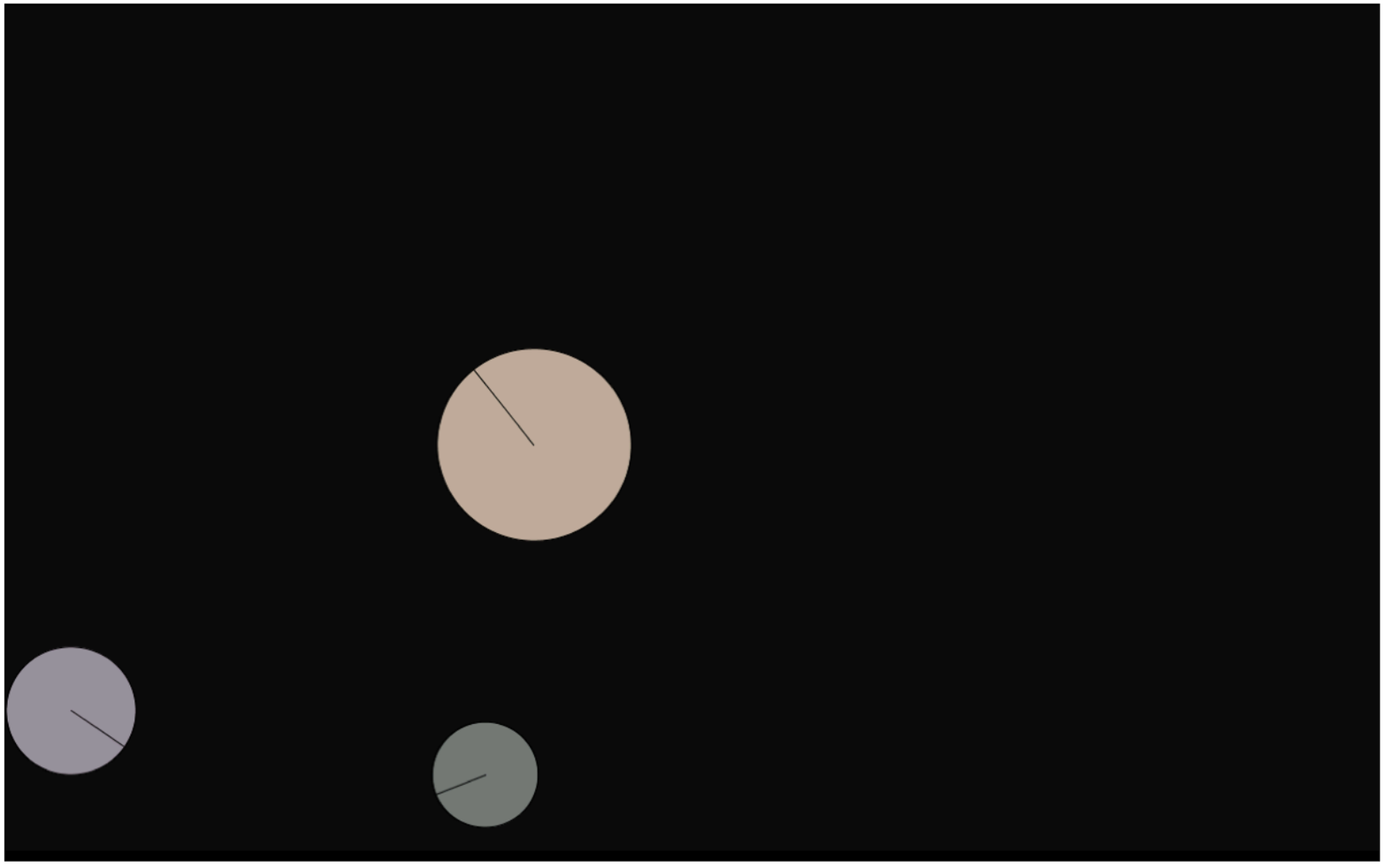


SIMULATING GRAVITY – CHANGE VARIABLES

These are the variables in the code you can change easily. Follow the instructions and think about what each one means. You can make the program crash if you choose bad numbers, so if your code stops working, come back tot these values.



SIMULATING GRAVITY – RUN THE CODE

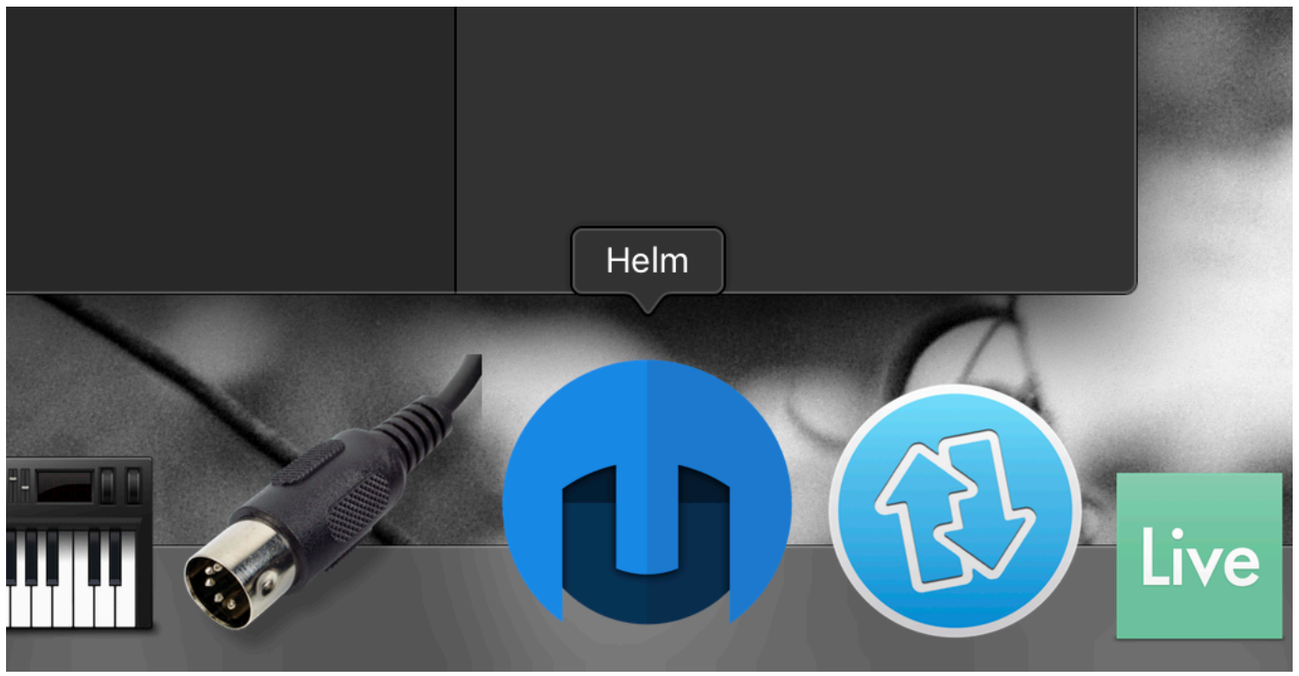


Your screen should fill up with the program running the simulation.

Press keys in your "A" to ";" row to create particles which will follow the laws of gravity.

Each collision will send a MIDI message which we'll interpret in a synthesizer and turn into sound!

OPEN HELM – SOFTWARE SYNTHESIZER



Helm - a software synthesizer
to make musical sounds with
your computer.

https://tytel.org/helm/

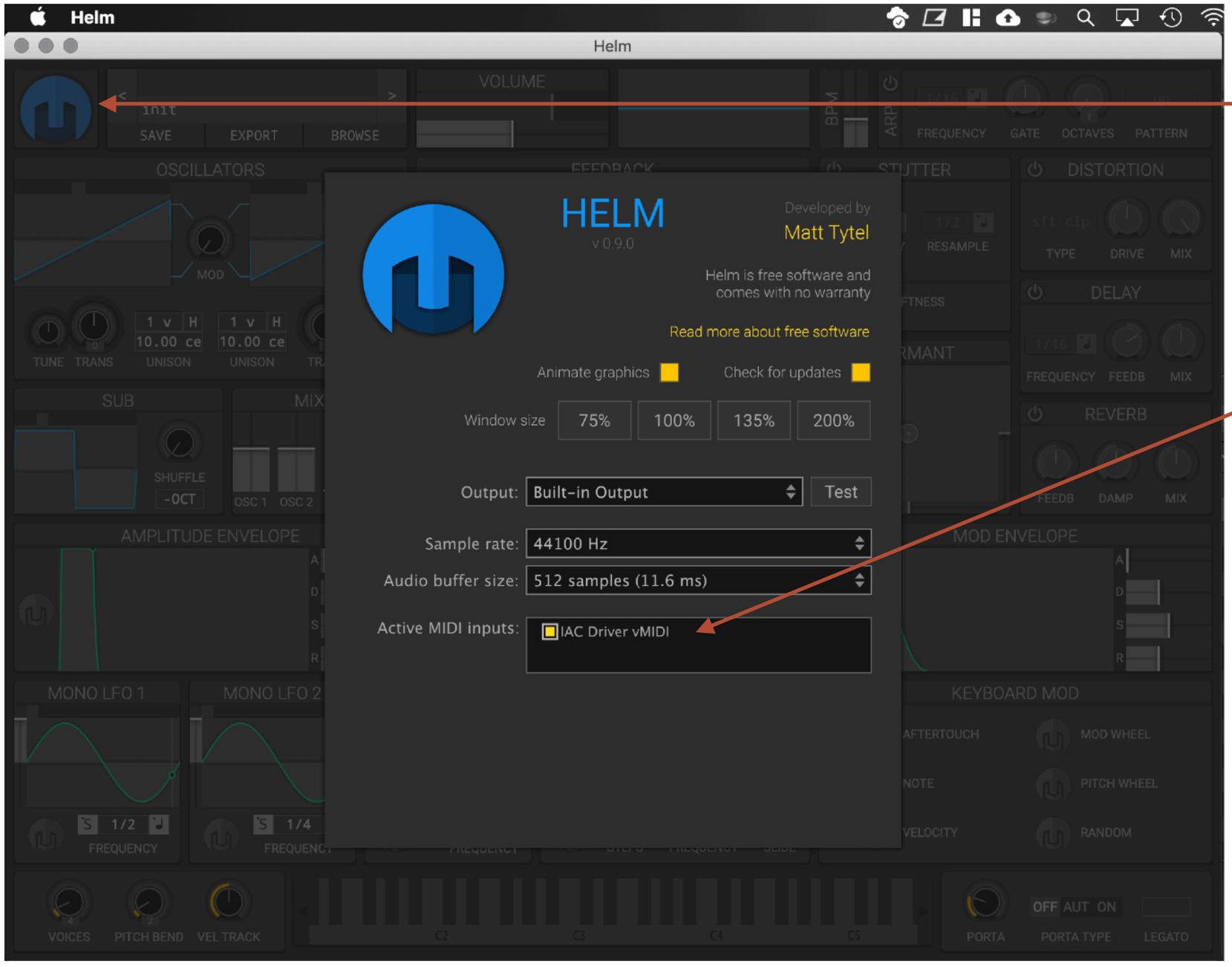
SETUP HELM

Click here to open the menu to select a sound

Make sure your laptop's speakers are on and turned up!

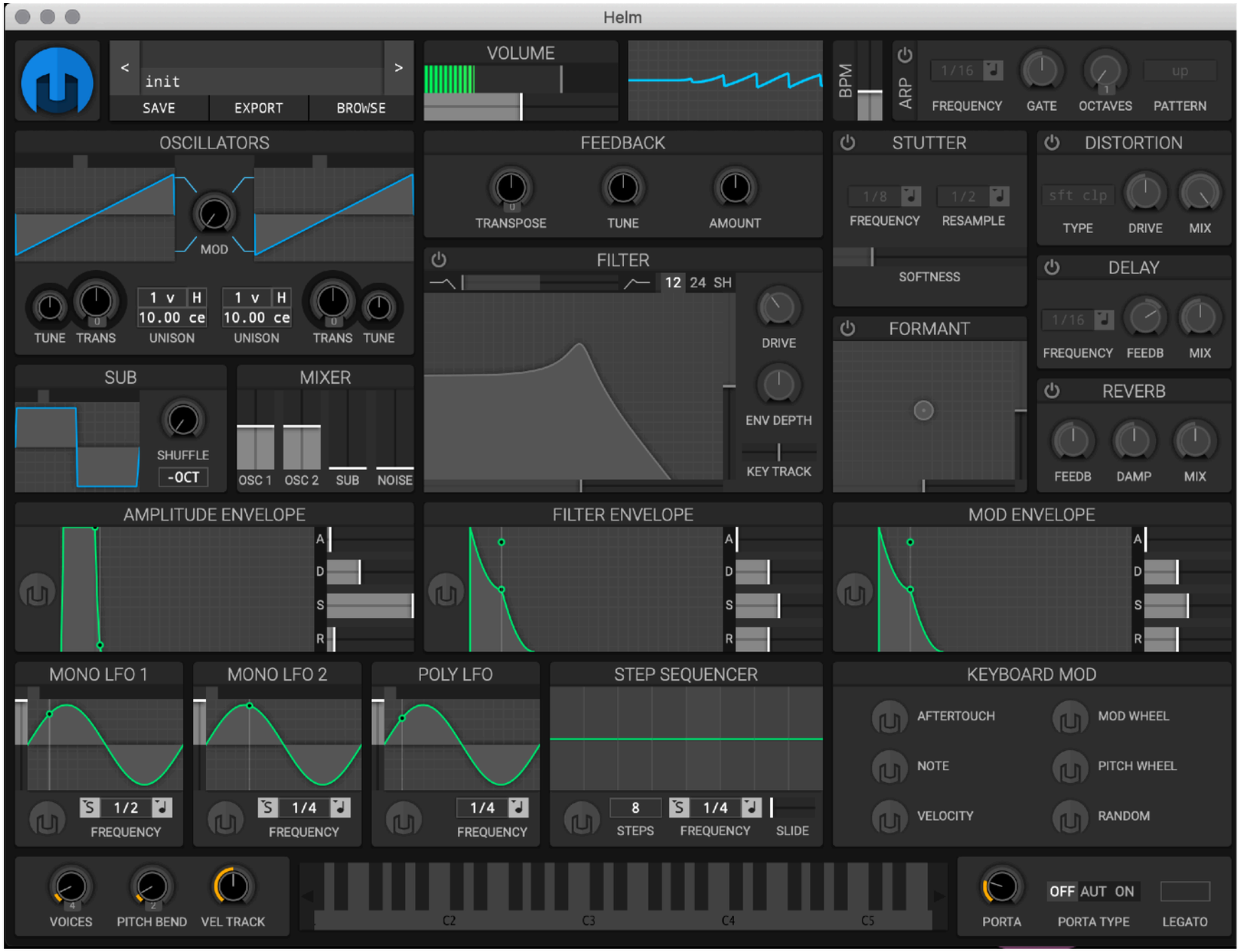
Try different sounds, then click done.

SETUP MIDI

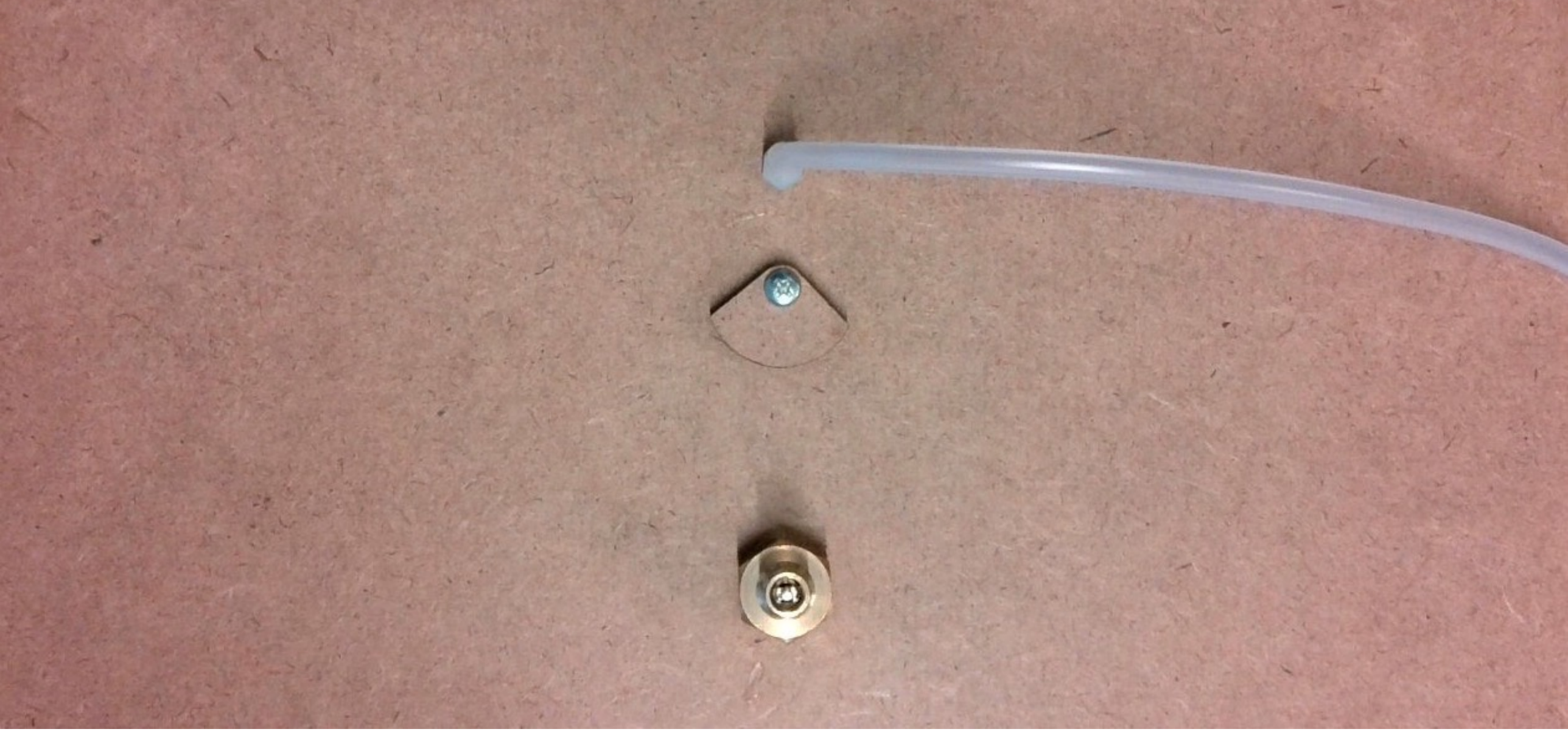


Click the HELMet and then check that you see IAC driver selected under active MIDI inputs.

SETUP HELM



You should hear sound and see things flashing and changing on screen if you have particles running in your simulation.



USING GRAVITY

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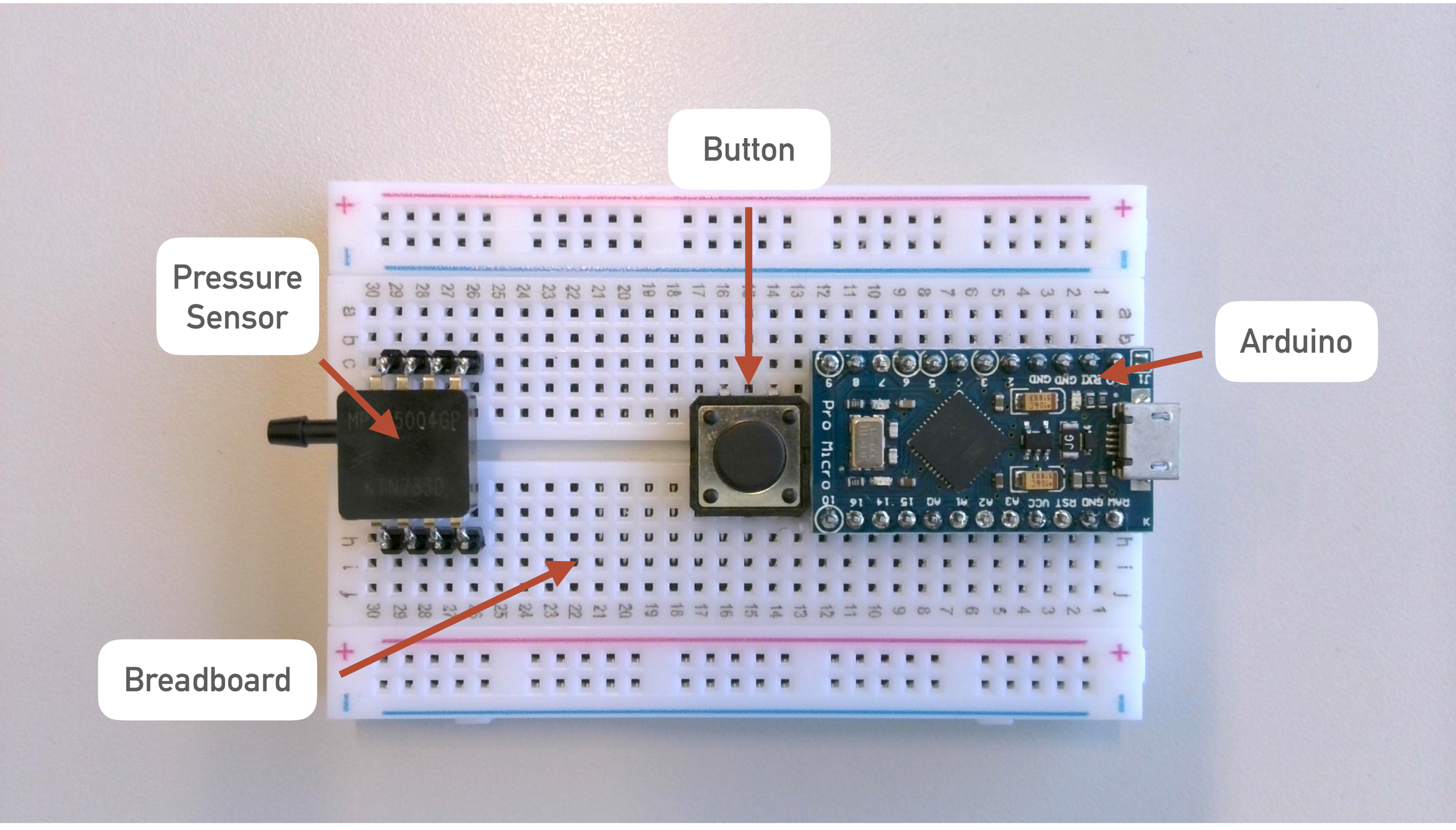
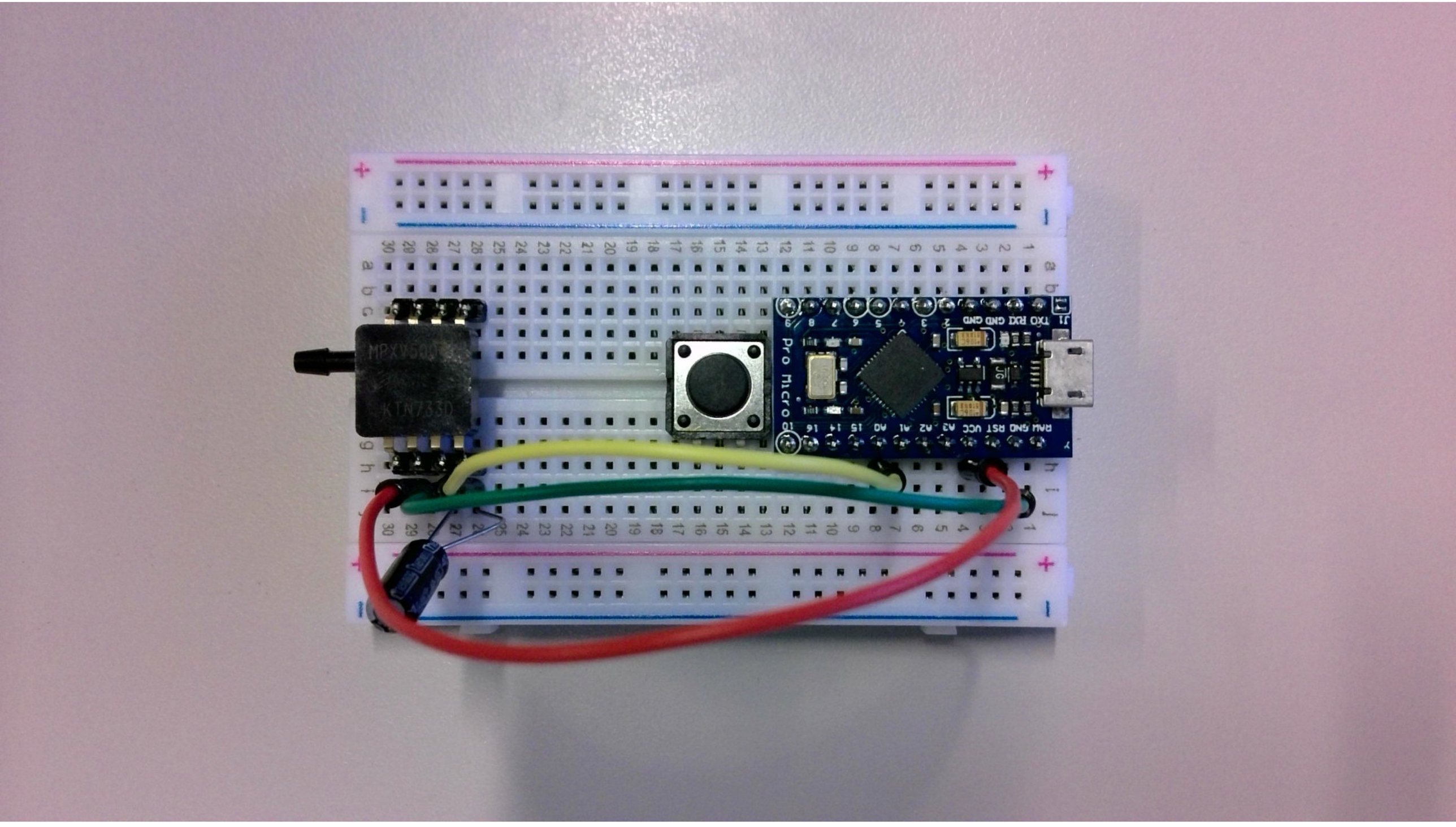
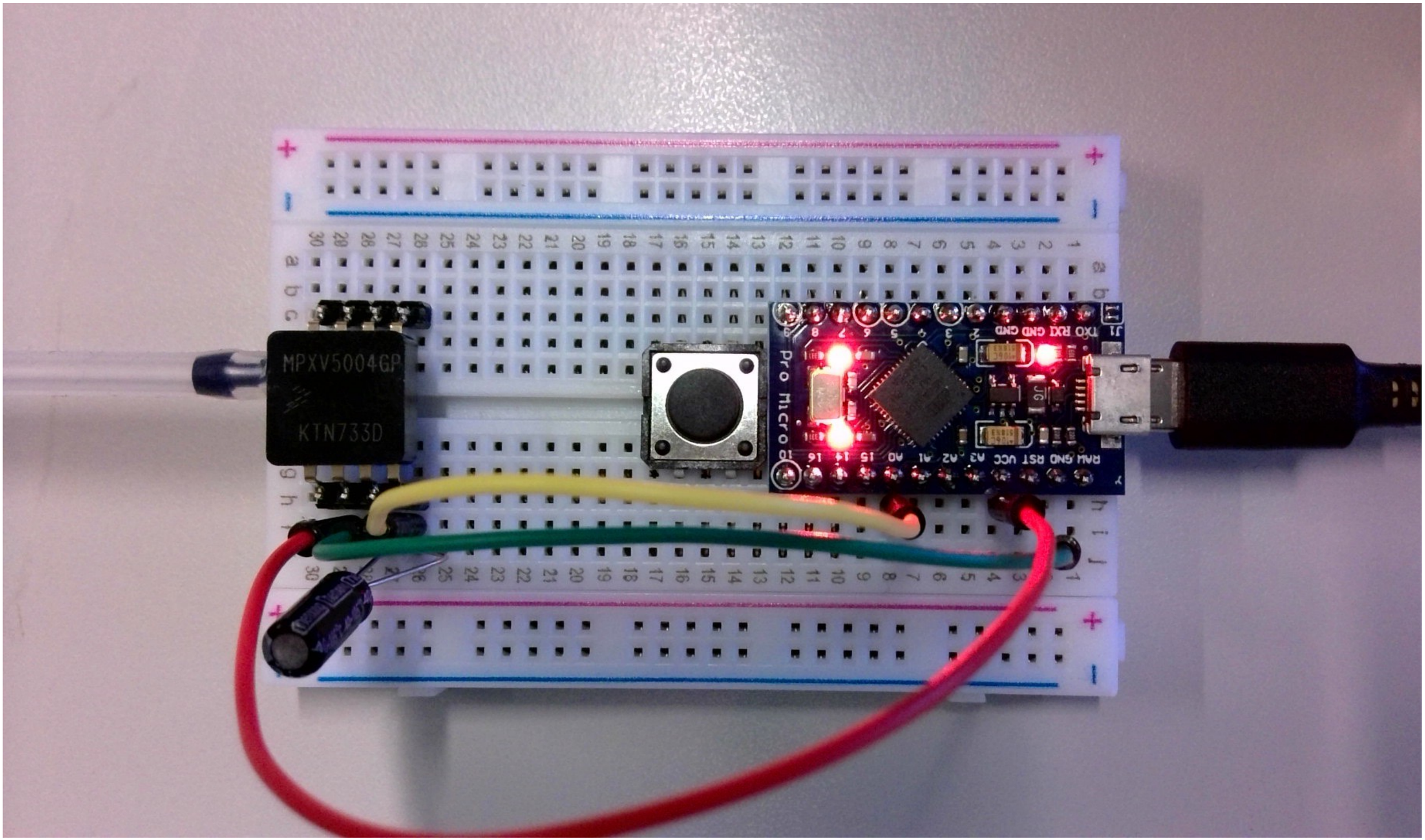
HOOKING UP YOUR SENSORS! FOLLOW MB ON THE PROJECTOR



HOOKING UP YOUR SENSORS! SEE THE SCHEMATIC

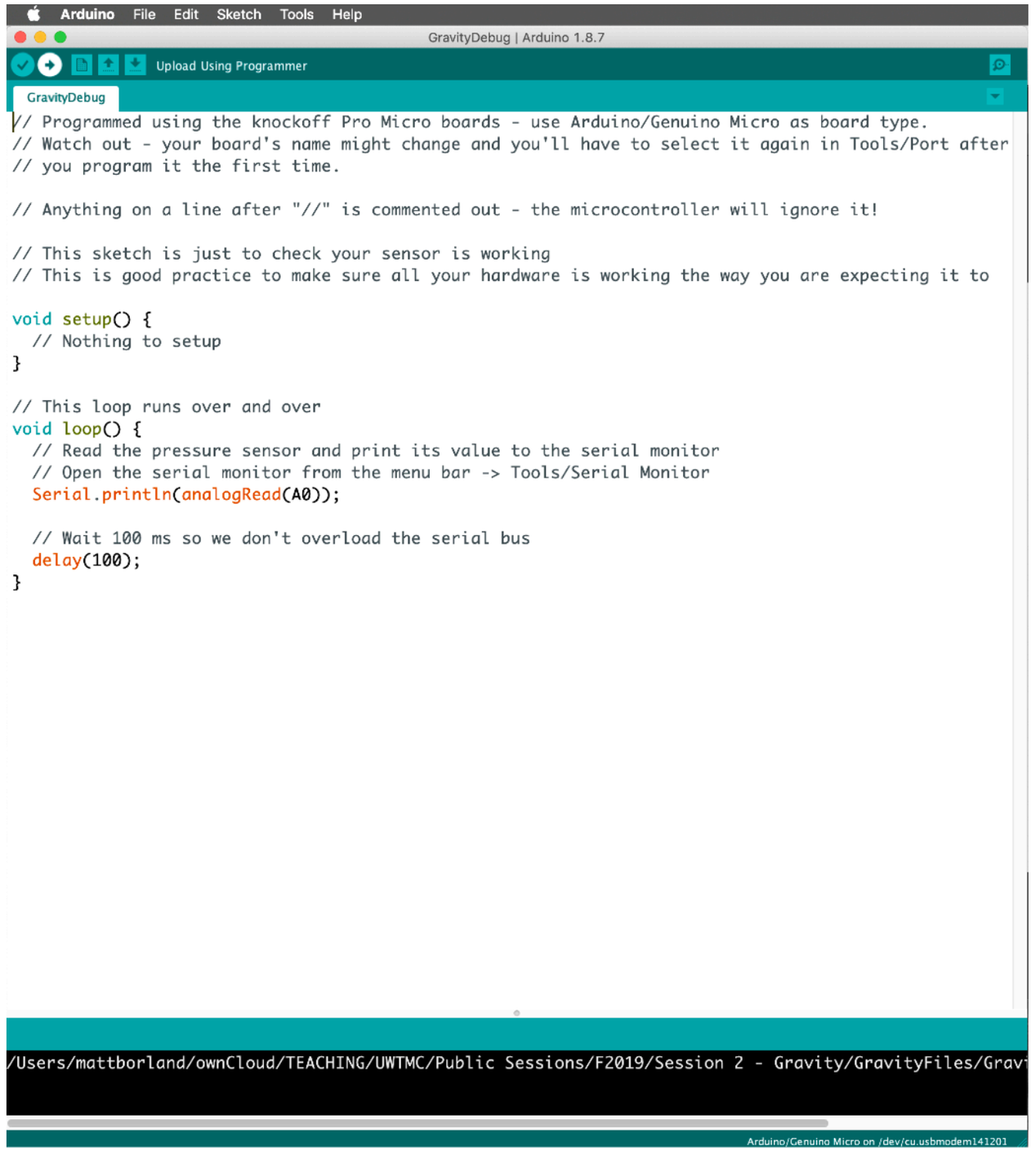


PLUG IN USB AND THE PRESSURE TUBE

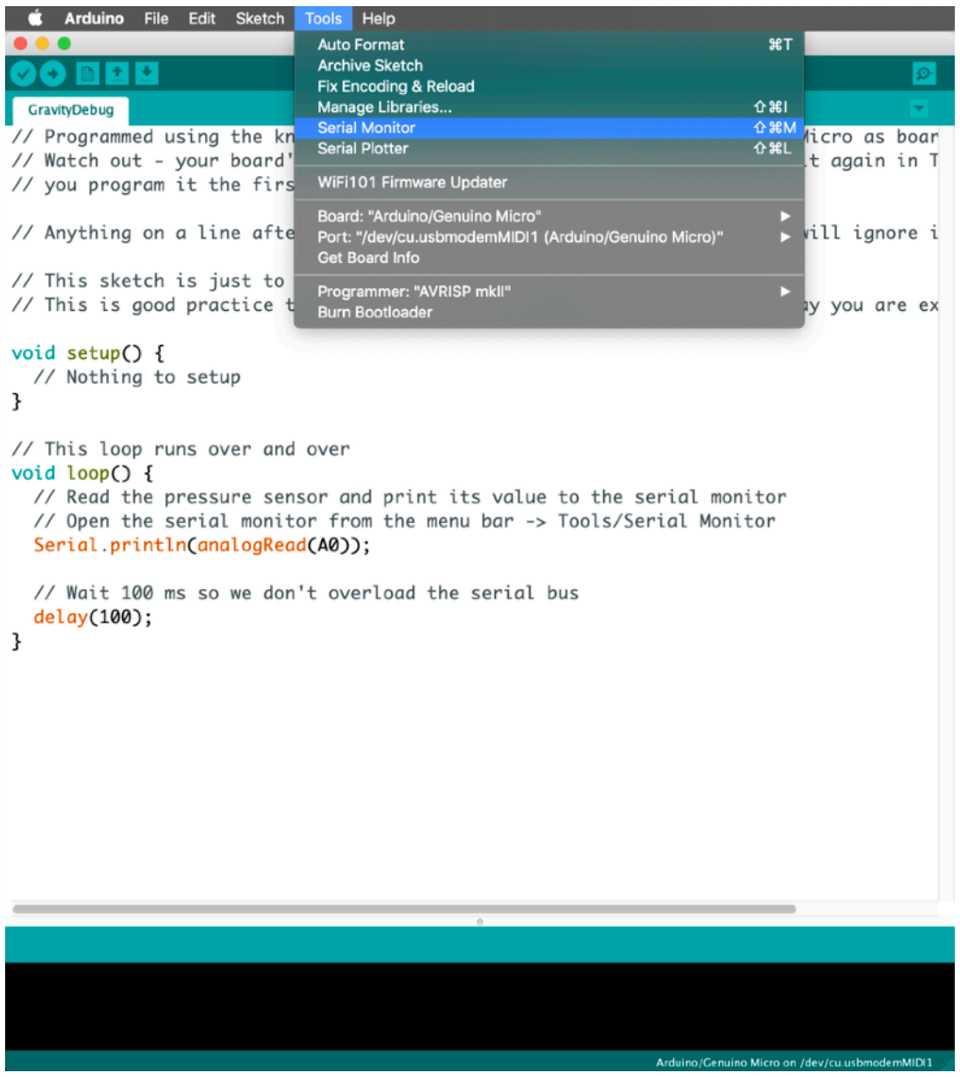


OPEN ARDUINO IDE – UPLOAD GRAVITYDEBUG.INO

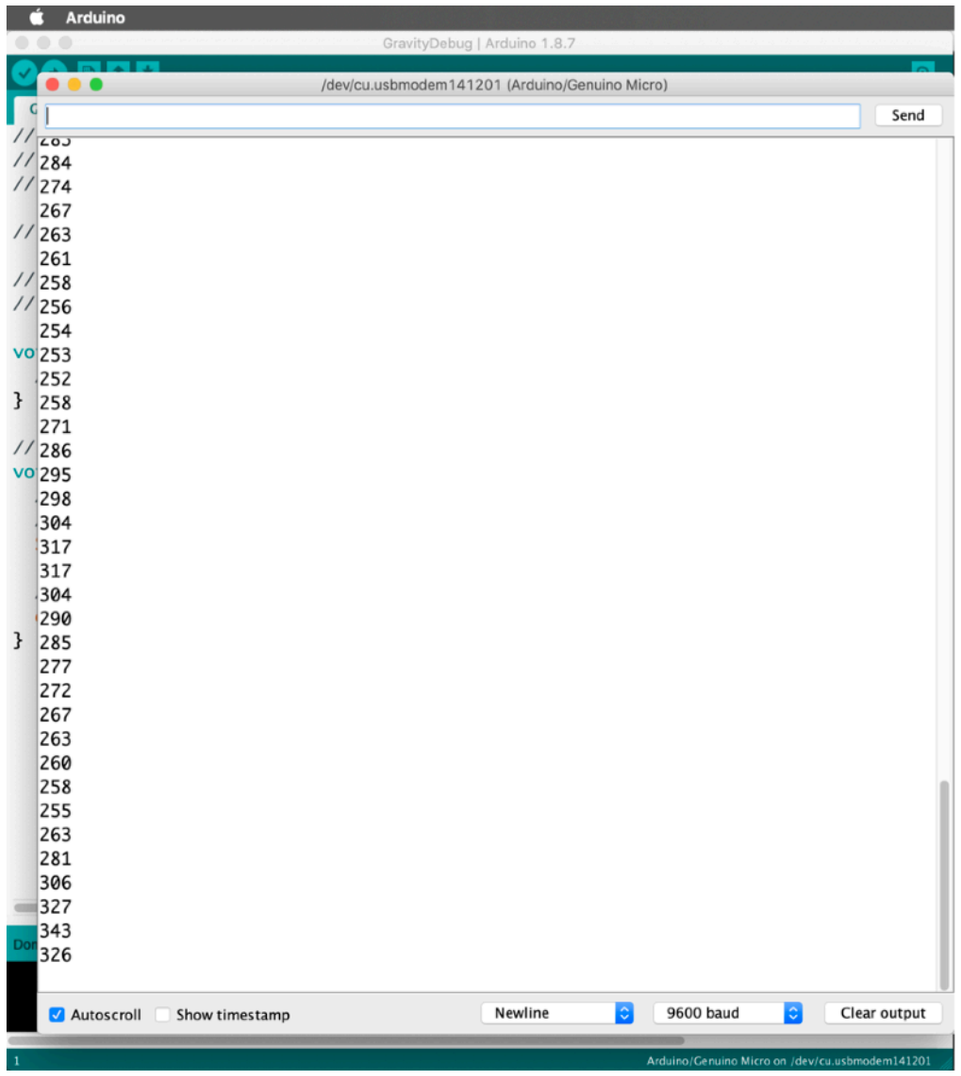
Program your board with the debugging file to see if your sensor is working and to figure out the range of values you will see when playing the instrument.



OPEN HELM – RUN GRAVITYDEBUG.INO AND CHECK OUTPUT



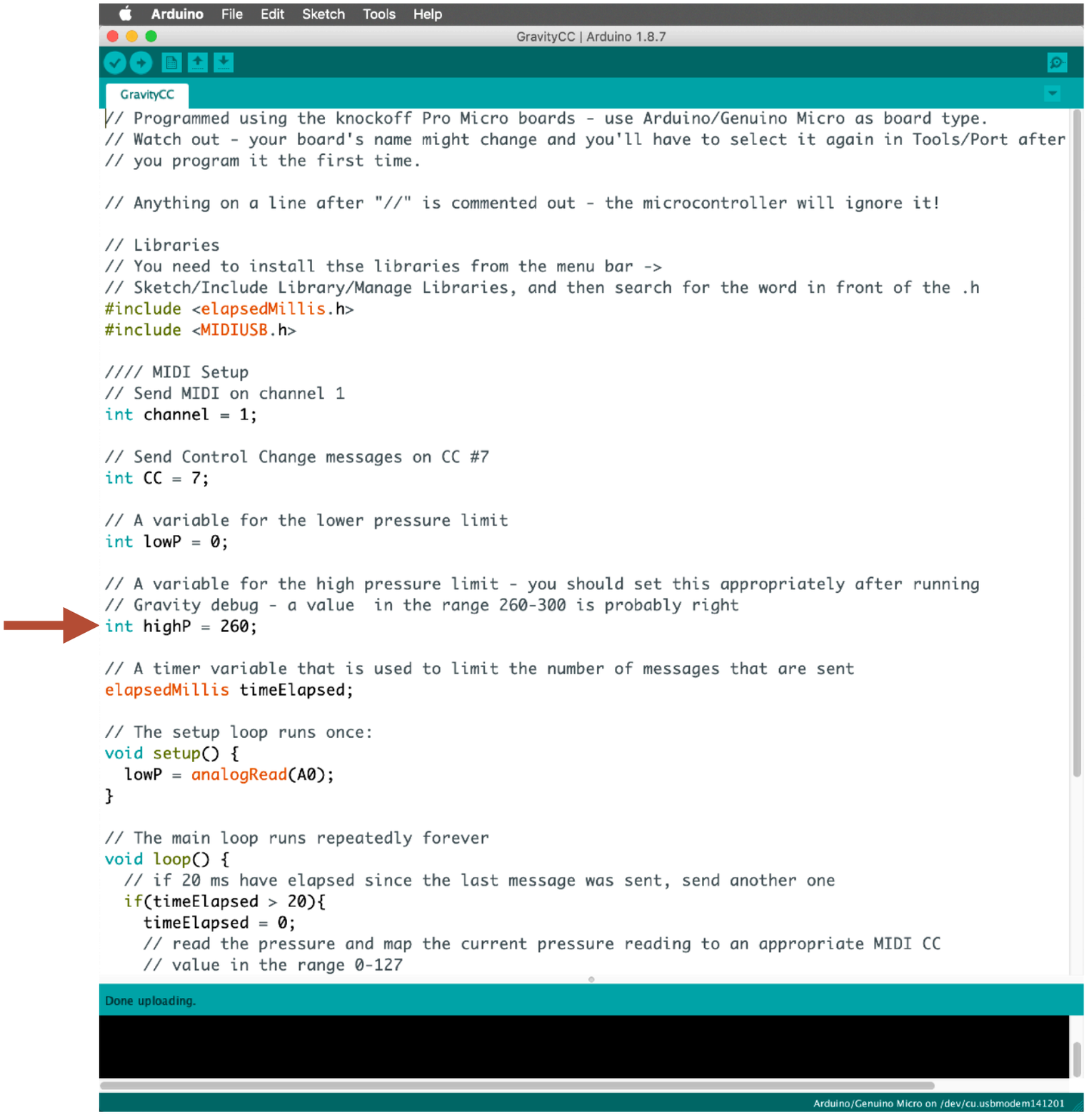
Open the serial monitor from the menu bar.



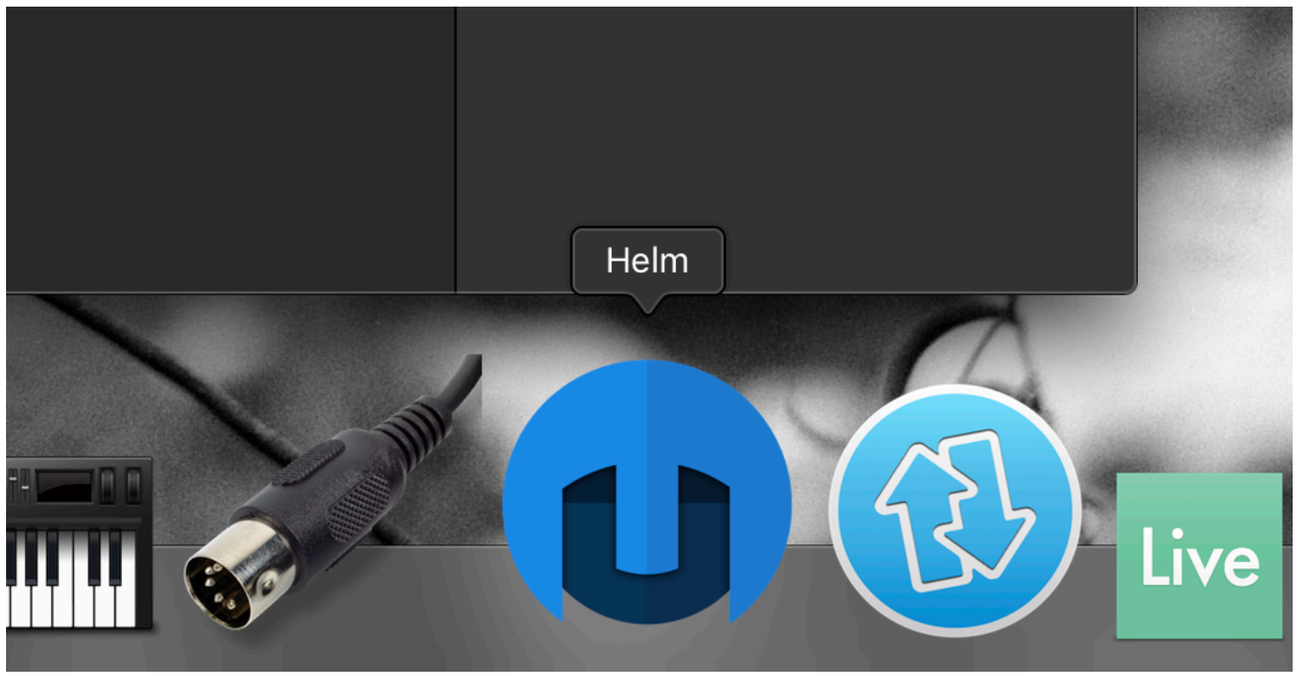
Play the instrument and see what the biggest value your sensor typically outputs.

OPEN ARDUINO IDE – UPLOAD GRAVITYCC.INO

Program your board with the MIDI file to send MIDI CC Messages that correspond to the pressure level inside the shruti box. You need to adjust the "highP" value with the number you found as the max pressure when using the debug file. You can change this and re-upload if the instrument doesn't play the way you want it to.



OPEN HELM – SOFTWARE SYNTHESIZER



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SETUP HELM – SOUNDS

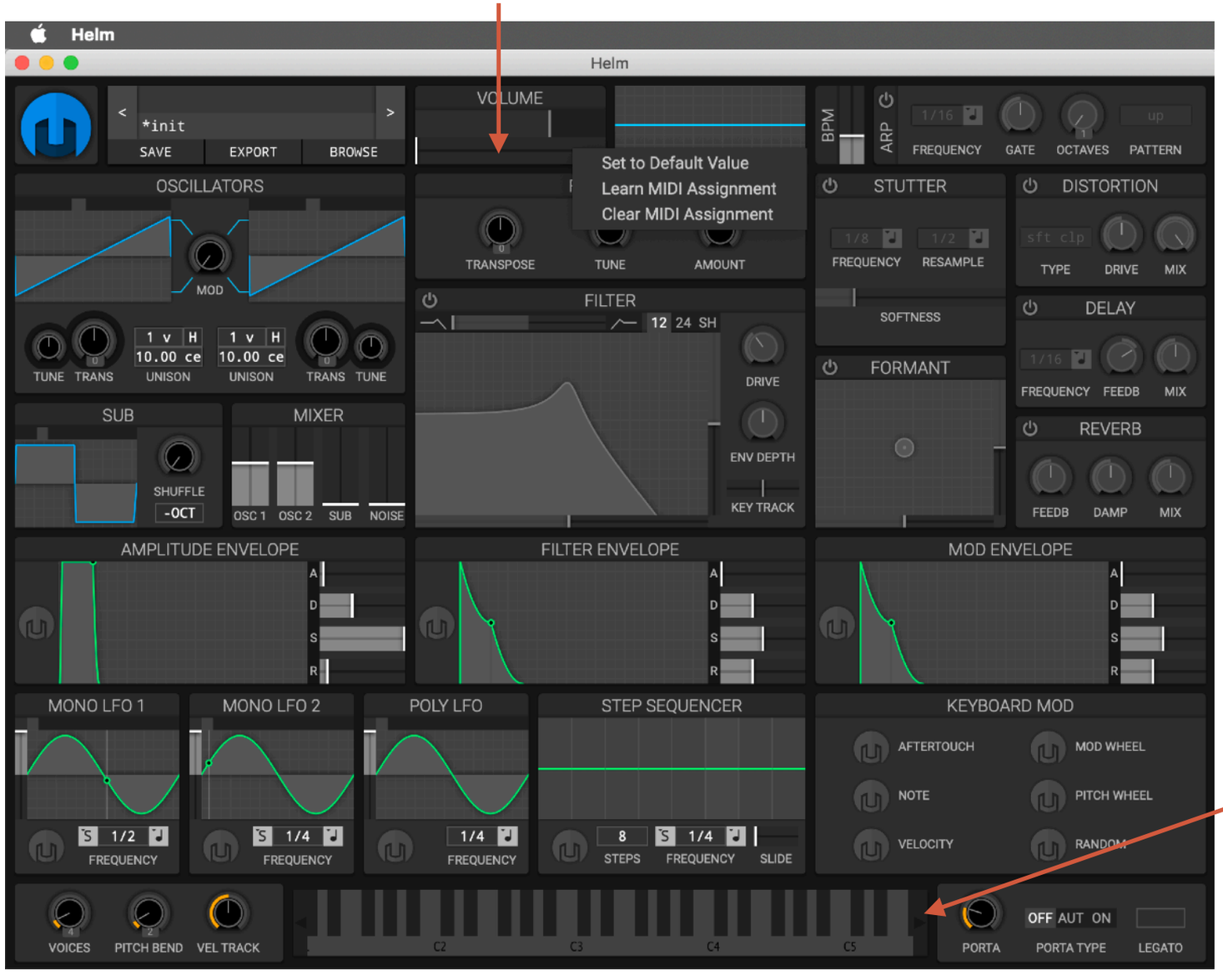
Click here to open the menu to select a sound

Make sure your laptop's speakers are on and turned up!

Try different sounds, then click done.

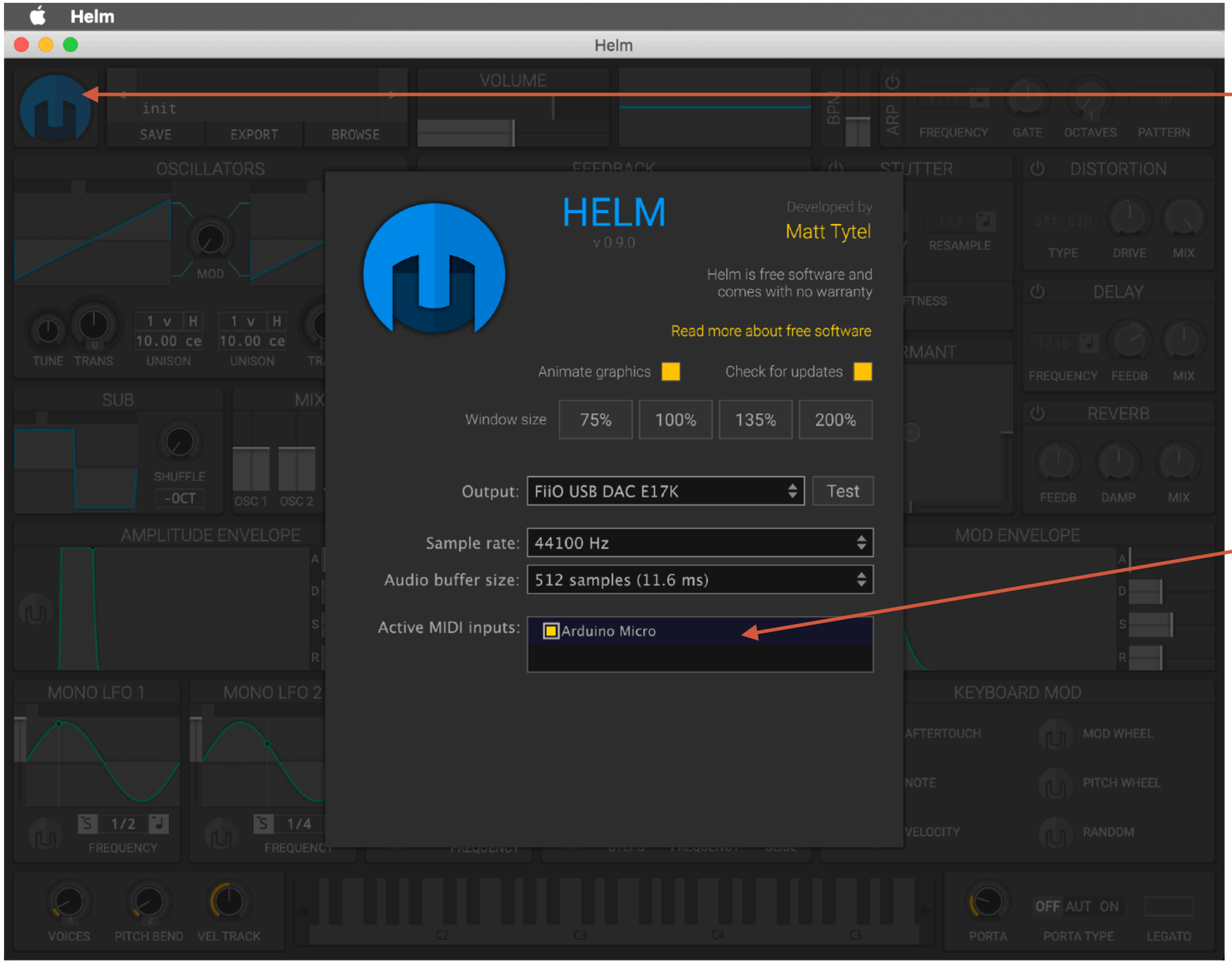
SETUP HELM – MAP CC TO OVERALL VOLUME

Right click on this bar below VOLUME, then click "LEARN MIDI ASSIGNMENT. You should then see this bar slide back and forth as you squeeze the shruti box. If the bar is all the way down, you won't hear anything because you've turned the volume all the way down!



The Arduino only sends CC messages, so no notes will be played. You need to play them by using your computer keyboard. The "A" to "L" row are the white keys of a piano. You'll see them light up here as you play them.

NOT WORKING? CHECK THE MIDI PORT



Click the HELMet to get this dialog to open.

You should see "Arduino Micro" as a MIDI input, with a yellow box showing it is selected.