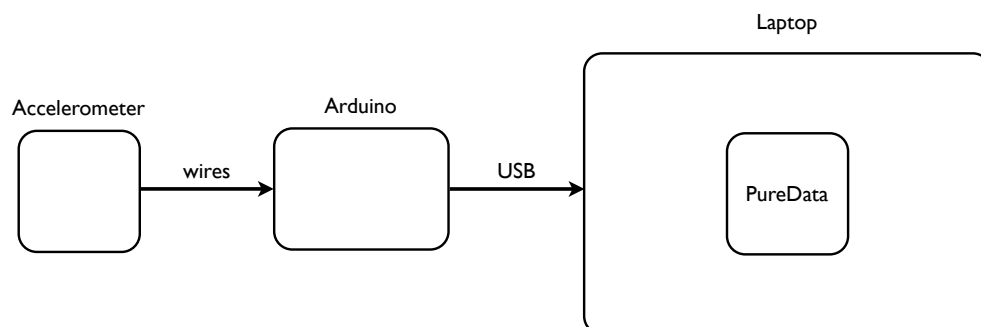


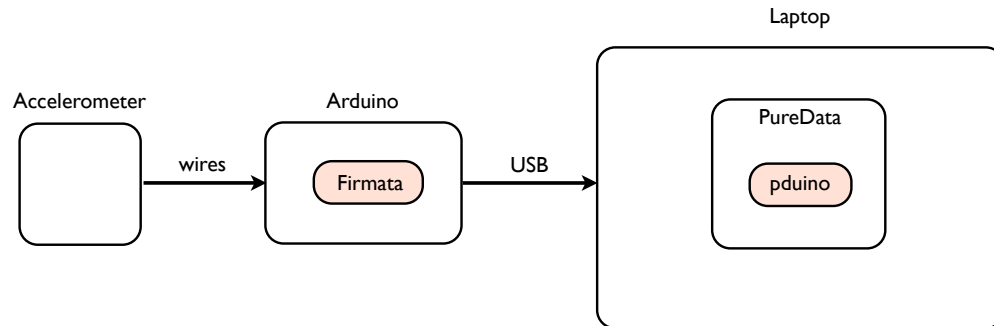
## Files from thumbdrive (or download)

- 'Workshop\_PdFiles'  
[http://stephiescastle.com/workshop\\_pd.zip](http://stephiescastle.com/workshop_pd.zip)
- Pick one:  
    'Workshop\_Software\_Mac'  
    [http://stephiescastle.com/workshop\\_mac.zip](http://stephiescastle.com/workshop_mac.zip)  
  
    'Workshop\_Software\_PC'  
    [http://stephiescastle.com/workshop\\_pc.zip](http://stephiescastle.com/workshop_pc.zip)

## Basic Setup

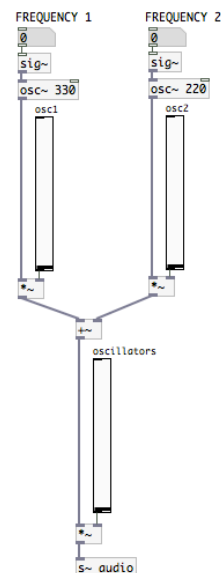


# Closer Look



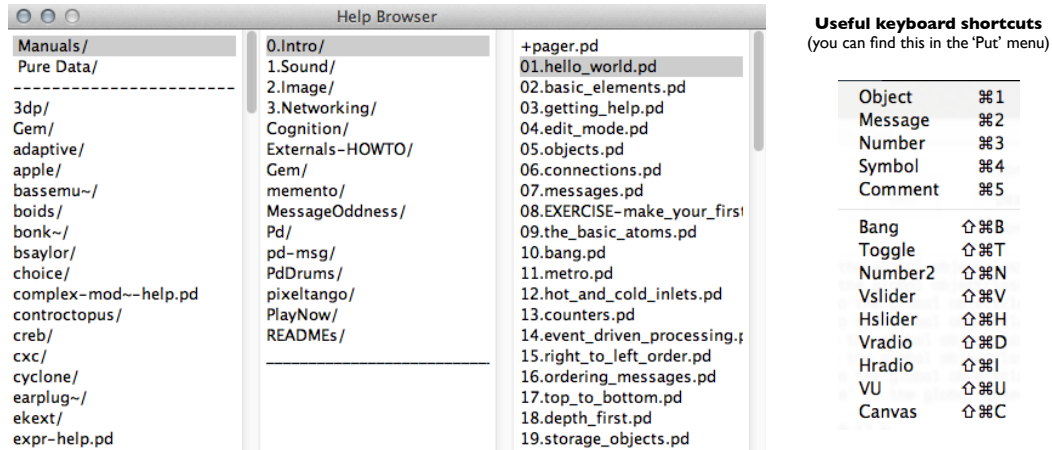
## Introduction to PureData

- <http://puredata.info/>
- real-time graphical programming environment
- audio, video, graphical processing
- inlets, outlets, “data-flow”



# PureData Basics

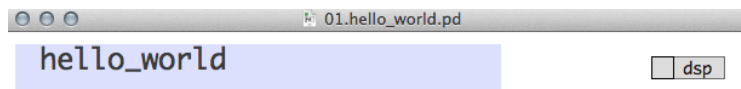
1. Open the 'Help Browser' (Help > Browser)
2. Select Intro Lesson '01.hello\_world.pd'
3. We'll walk-through lessons 1-7, 10-12, 15-16, 24



## Sound in PureData

In Pd, message processing is always running, but audio processing (DSP, digital signal processing) needs to be turned on and off.

Let's start by opening Sound lesson 01.hello\_world.pd



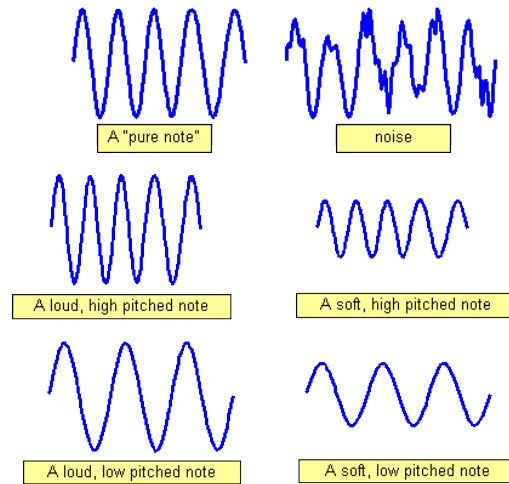
- 1 create a message box with the text: 200
- 2 create an object called: osc~
- 3 create an object called: dac~
- 4 connect the message box to the osc~ object's left inlet
- 5 connect the osc~ object to both inlets of the dac~ object
- 6 make sure your volume is set very low
- 7 turn on DSP by clicking the box on the upper right corner
- 8 click the message box to hear sound

pd how to type ~

# Audio Basics

- Oscillator: “Pure tone”
  - Set frequency / pitch
  - Set amplitude (volume)
- Samples (audio files)
  - Set amplitude
  - Play the file
- Terminology: Amplitude = Level = Gain = Volume

## Oscillators



# Sound in PureData

Open the patch I gave you: 1.audio.pd

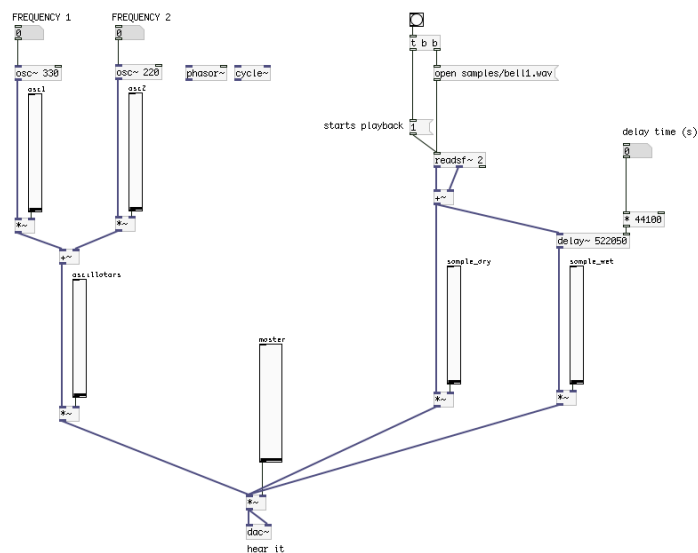
☒ dsp

Play specific frequencies

Human Audible Range: 20 - 20000

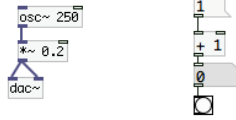
Recommended range: 200 - 13000

Play an audio file



# Tips in Pd

- Signal vs. data-flow



- trigger object helps to order actions from a single trigger



- loadbang sends a bang when the patch is first opened.



- Frequency = pitch

- Amplitude = gain = level = volume (range of 0-1)

# Intro to Arduino

- <http://arduino.cc>
- Microcontroller that can receive input from sensors and relay data to the computer
- We'll load a program onto it that can talk directly to PureData via the pduino object

```

SimpleAnalogFirmata | Arduino 1.0.1

SimpleAnalogFirmata

/*
 * Firmata is a generic protocol for communicating with microcontrollers
 * from software on a host computer. It is intended to work with
 * any host computer software package.
 *
 * To download a host software package, please click on the following link
 * to open the download page in your default browser.
 *
 * http://firmata.org/wiki/Download
 */

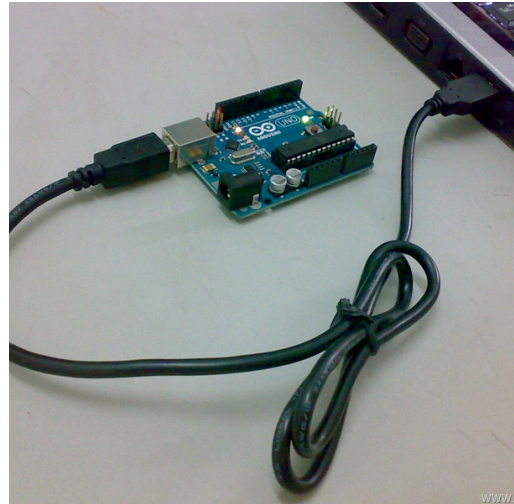
/* Supports as many analog inputs and analog PWM outputs as possible.
 * This example code is in the public domain.
 */
#include <Firmata.h>

byte analogPin = 0;

void analogWriteCallback(byte pin, int value)
{
  if (IS_PIN_PWM(pin)) {
    pinMode(PIN_TO_DIGITAL(pin), OUTPUT);
    digitalWrite(PIN_TO_PWM(pin), value);
  }
}
    
```

# Configure the board

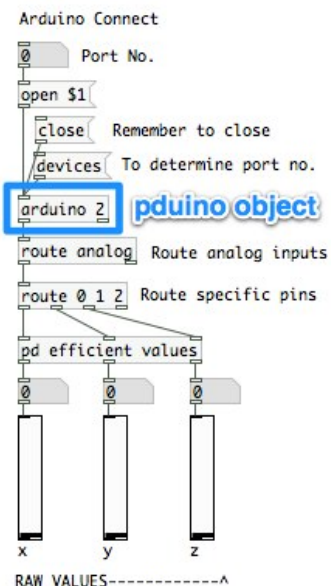
1. Connect board to laptop with USB cable and launch the Arduino application
2. Select your board:  
Tools > Board > Arduino Uno
3. Select your serial port:  
Tools > Serial Port > dev/tty.usbmodem
4. Open 'SimpleAnalogFirmata':  
  
File > Examples > Firmata > SimpleAnalogFirmata
5. Press the upload button
6. Wait for 'Done uploading' message, then quit the application and unplug the board



# Install pduino object

1. <http://at.or.at/hans/pd/objects.html>
2. Unzip Pduino-0.5
3. Move the .pd files to your patches folder. (I added them to a subfolder called 'Externals')
4. Add the patches folder to your paths in Pd:

Pd-extended > Preferences > Path



# Connect sensor to board

Caution: **unplug your board when connecting the sensor.**  
This is to prevent damage to the board or sensor if the wrong pins are connected (power and ground are the ones to be wary of)

- VCC -- 3.3 V (power)
- GND -- GND (ground)
- XOUT -- A0 (analog pin 0)
- YOUT -- A1 (analog pin 1)
- ZOUT -- A2 (analog pin 2)

# Connect Sensor to PureData

- Plug in your board once the sensor is connected
- Open PureData
- open the patch: l.audio\_arduino.pd

# Data → Sound

- Scaling / Mapping
  - change parameters (volume, pitch, etc.)
- Averaging
  - smoothing
- Events / Triggers

## Scaling / Mapping

- High Sensitivity: zoom in / magnify
- Low Sensitivity: zoom out
- Segmented: scaling a particular range of numbers (e.g. high numbers only, low numbers only, etc.)



# Averaging

- Smoothing: averaging a few numbers
- Immediate “jumpy” response: no averaging

## Events / Triggers

### Basic Method

- Set a threshold
- When the acceleration crosses that threshold, a “bang” is triggered

# Quick Start / Downloads

## Arduino 1.0.1

You don't need to install the USB driver (new feature of the Arduino Uno board)

<http://arduino.cc/en/Main/Software>

- **PureData:** pd-extended, with all the bells and whistles  
<http://puredata.info/docs/StartHere/>
- **pduino:** object we'll be using in PureData to talk to the arduino. Note: Do not download the Firmata library--this is only necessary for older arduino boards)  
<http://at.or.at/hans/pd/objects.html#pduino>

# Resources

## Online

- Arduino website:  
<http://arduino.cc>
- PureData website:  
<http://puredata.info>
- Pd objects:  
<http://flexatone.net/docs/pdg/>
- Floss Manuals:  
<http://en.flossmanuals.net/pure-data/>
- SparkFun (sensors, components):  
<http://sparkfun.com>
- Jameco (cheaper sensors, components)  
<http://jameco.com>
- Google!

## In LA

- CRASHspace Pd patching circle  
<http://puredata.info/community/groups/lapc>
- Radioshack
- All Electronics (Van Nuys)  
<http://www.allelectronics.com>
- Apex Electronics (Sun Valley)  
<http://apexelectronic.com>

# Wireless

- Xbee kit:  
<https://www.sparkfun.com/products/9897>

Xbee Tutorial:  
<http://www.sparkfun.com/tutorials/192>

- Arduino Fio:  
<http://arduino.cc/en/Main/ArduinoBoardFio>

Fio Setup:  
<http://arduino.cc/en/Main/ArduinoBoardFioProgramming>