Fundamentals of Physical Computing

Instructor: Rob Faludi
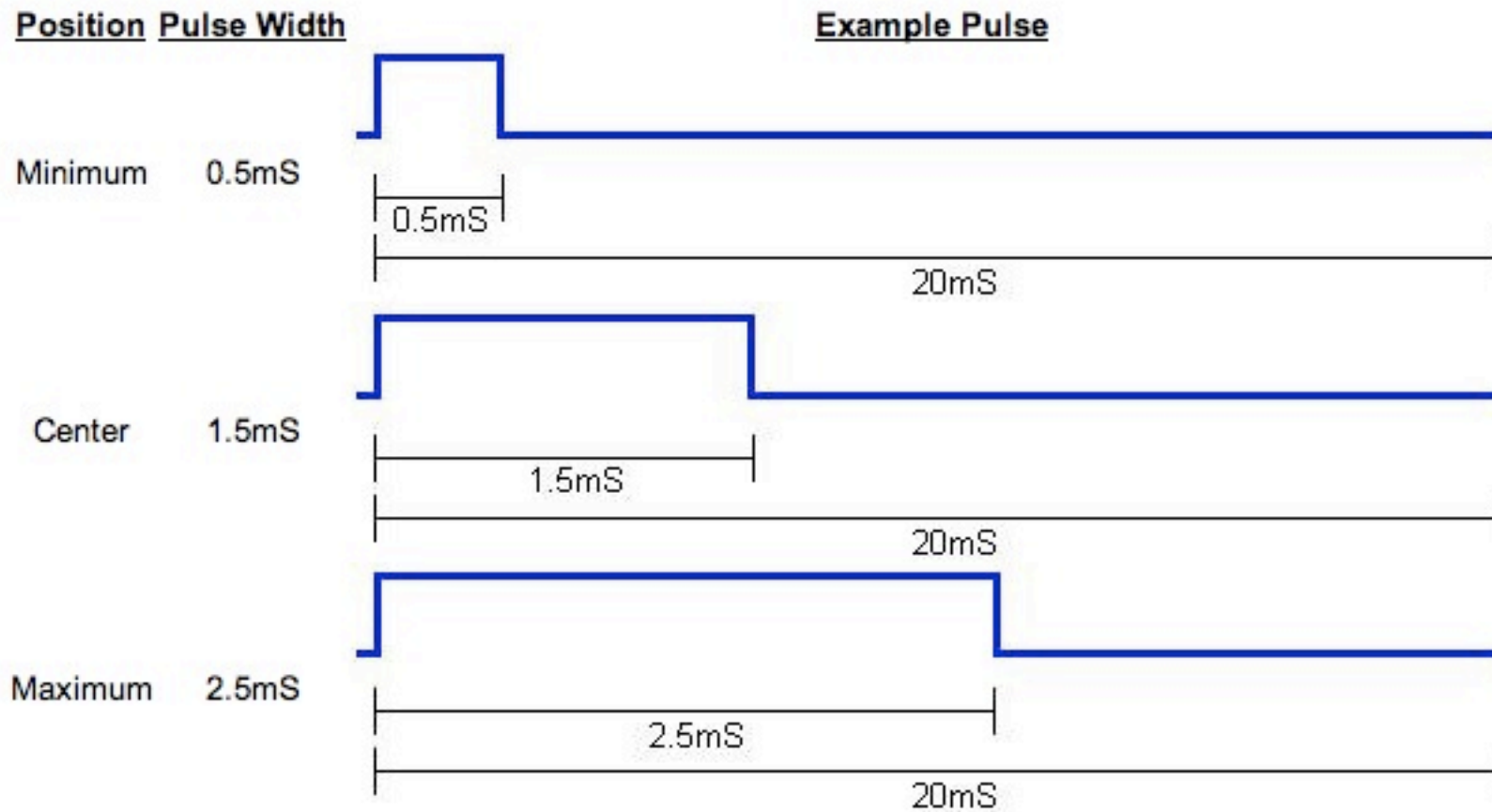
Plan for Today

- Lab Review

- Analog Output

- Servos & Sound

- Libraries

- Engagement

- Functions and More

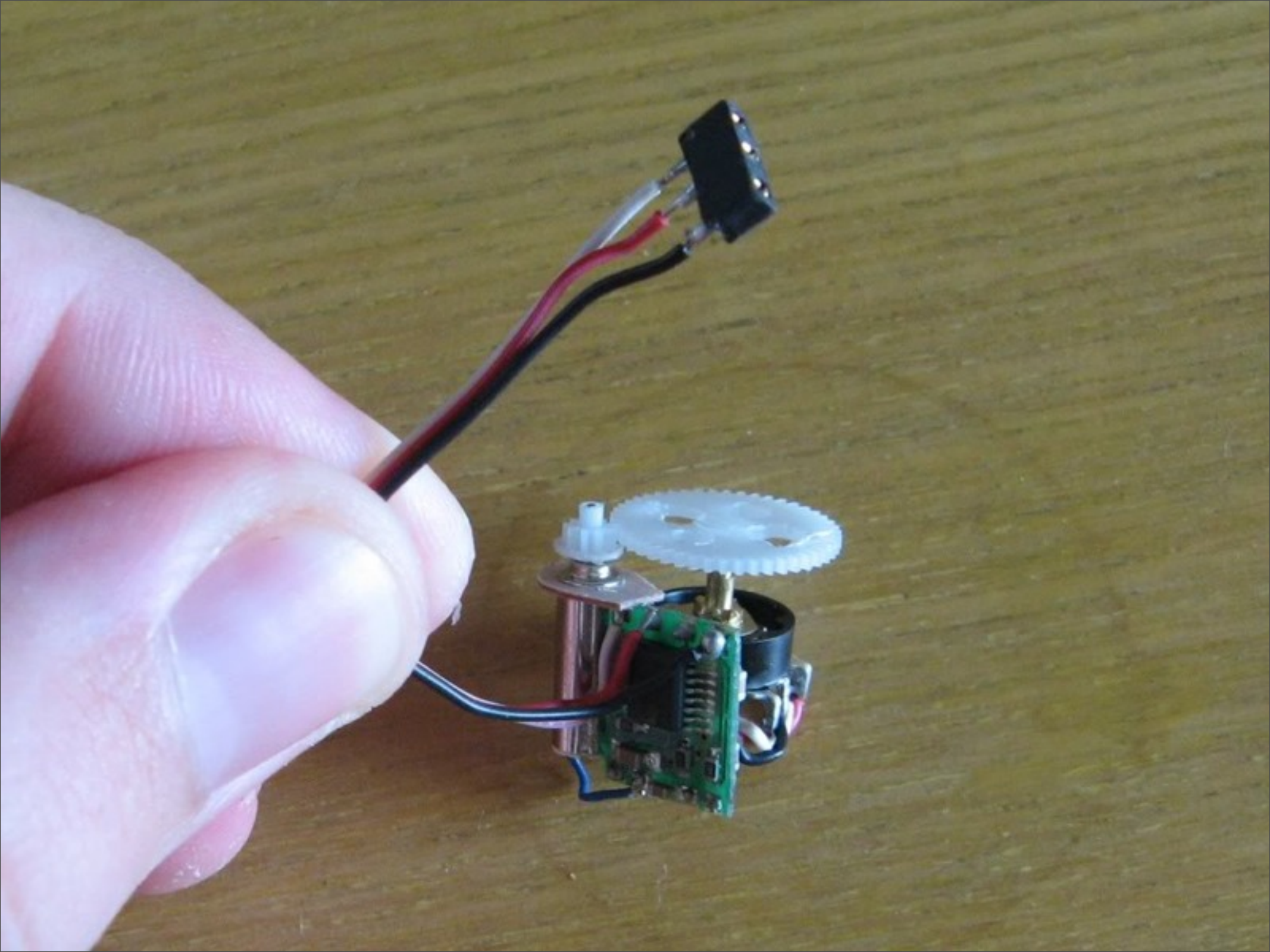- Affordances

- Readings & Assignments

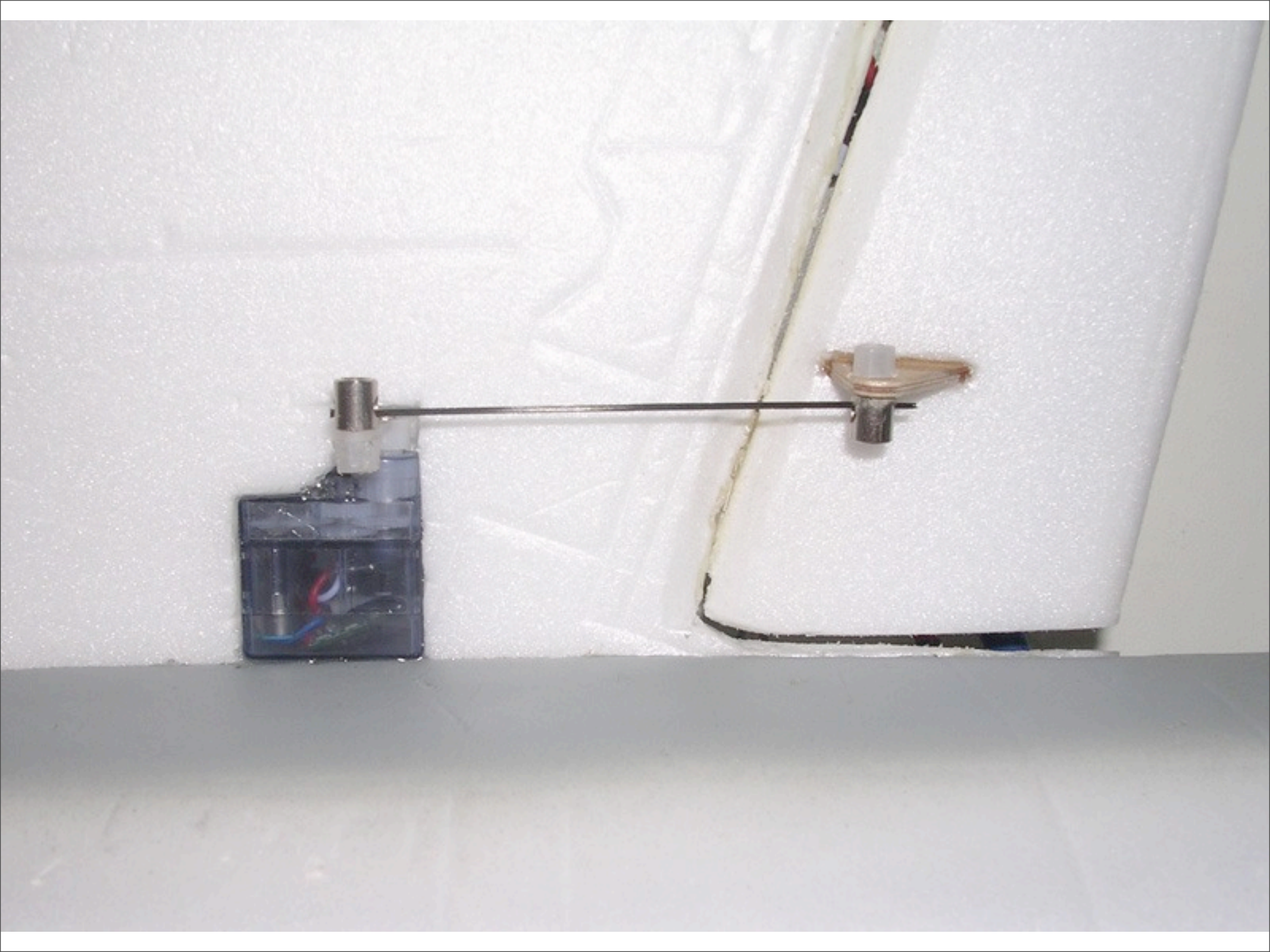# Lab Review

PWM

Pulse Width Determines <u>Position</u>
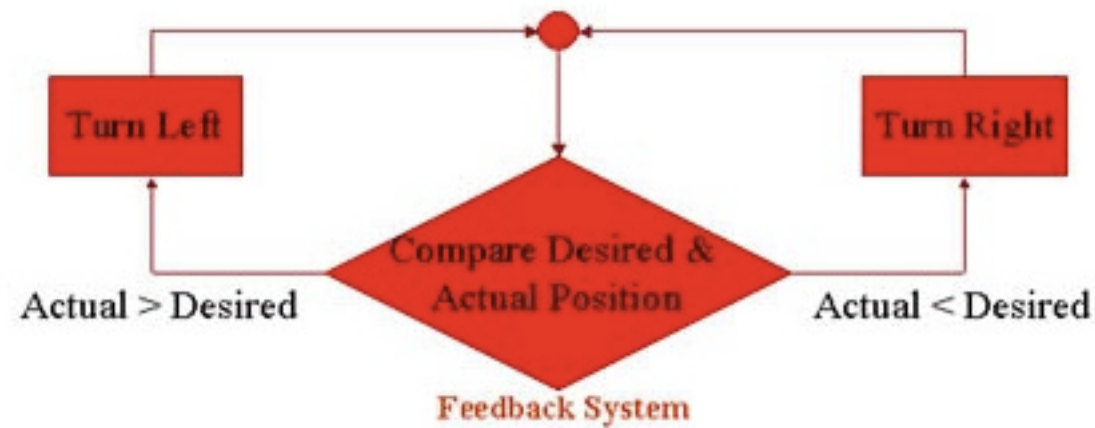

Position	Pulse Width	Example Pulse
Minimum	0.5mS	0.5mS / 20mS
Center	1.5mS	1.5mS / 20mS
Maximum	2.5mS	2.5mS / 20mS

Servos

Servo Motors

Motor + Potentiometer + Microcontroller

Feedback (negative)

Turn Left

Turn Right

Compare Desired &
Actual Position

Actual > Desired

Actual < Desired

Feedback System

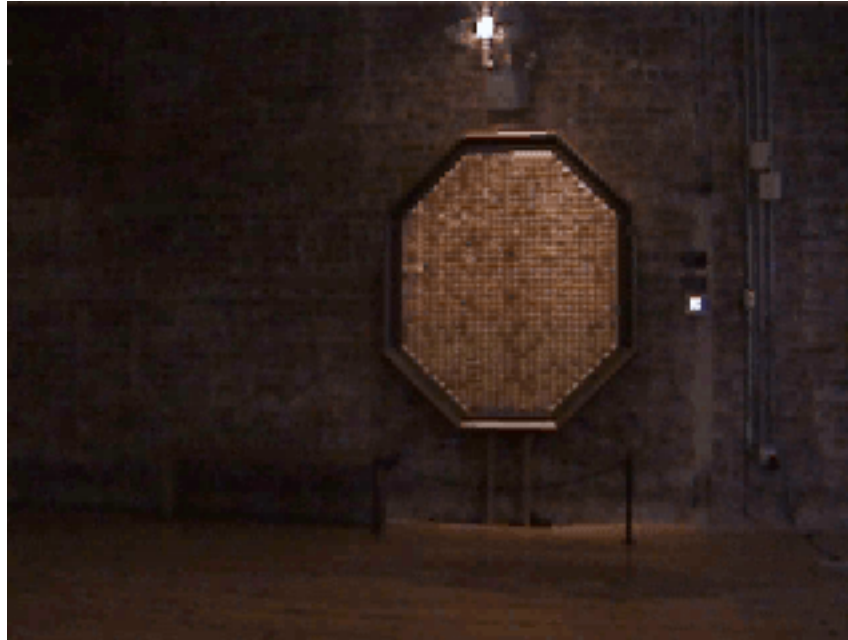# Model Airplanes

Danny Rozin

Danny Rozin

Libraries

Web Reference

Arduino   [search]

Buy | Download | Getting Started | Learning | Reference | Hardware | FAQ   Blog » | Forum » | Playground »

Reference   Language (extended) | **Libraries** | Comparison | Changes

Libraries

To use an existing library in a sketch, go to the Sketch menu, choose "Import Library", and pick from the libraries available. This will insert one or more **#include** statements at the top of the sketch and allow it to use the library.

Because libraries are uploaded to the board with your sketch, they increase the amount of space it takes up. If a sketch no longer needs a library, simply delete its **#include** statements from the top of your code.

Standard Libraries

- EEPROM - reading and writing to "permanent" storage
- Ethernet - for connecting to the internet using the Arduino Ethernet Shield
- Firmata - for communicating with applications on the computer using a standard serial protocol.
- LiquidCrystal - for controlling liquid crystal displays (LCDs)
- Servo - for controlling servo motors
- SoftwareSerial - for serial communication on any digital pins
- Stepper - for controlling stepper motors
- Wire - Two Wire Interface (TWI/I2C) for sending and receiving data over a net of devices or sensors.

Using Libraries

- path to libraries starting with Arduino 17:
  Documents/Arduino/libraries

- including the library:
  #include <library.h>

- declaration:
  Object myinstance;

- setup
  myinstance.enable(7);

- commands
  myinstance.dostuff(27, 3);
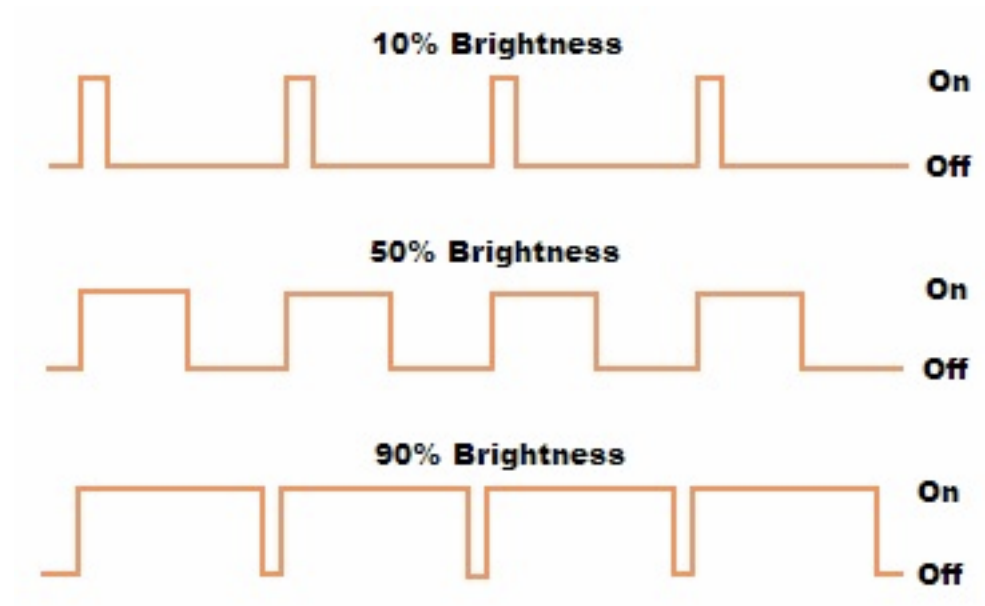
Adding from menu
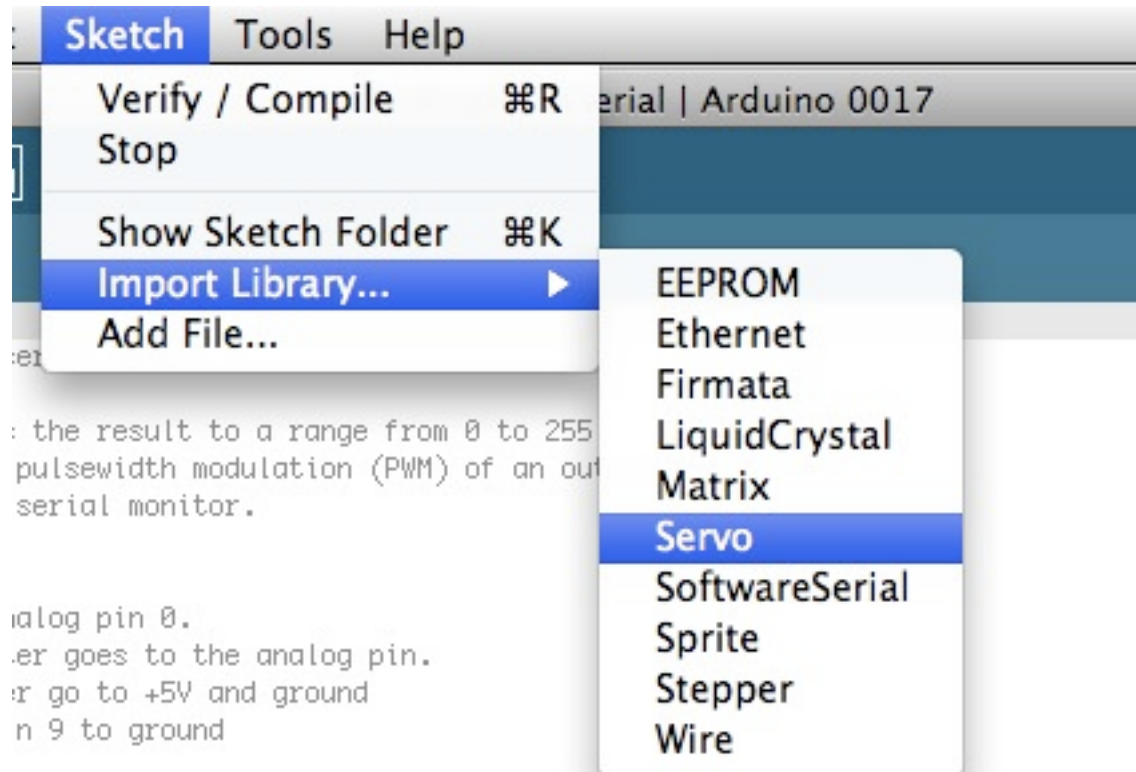
Servo Library

Servo

- including the library:
  #include <servo.h>

- declaration:
  Servo myservo;

- setup:
  myservo.attach(9);

- commands:
  myservo.write(110);

Tone Library

PWM and Sound

- Why won't PWM make tones?

Tones

- #include <Tone.h>

- Tone tone1;

- tone1.begin(13);

- tone1.play(1000, 2500);

- tone1.stop()

Engagement

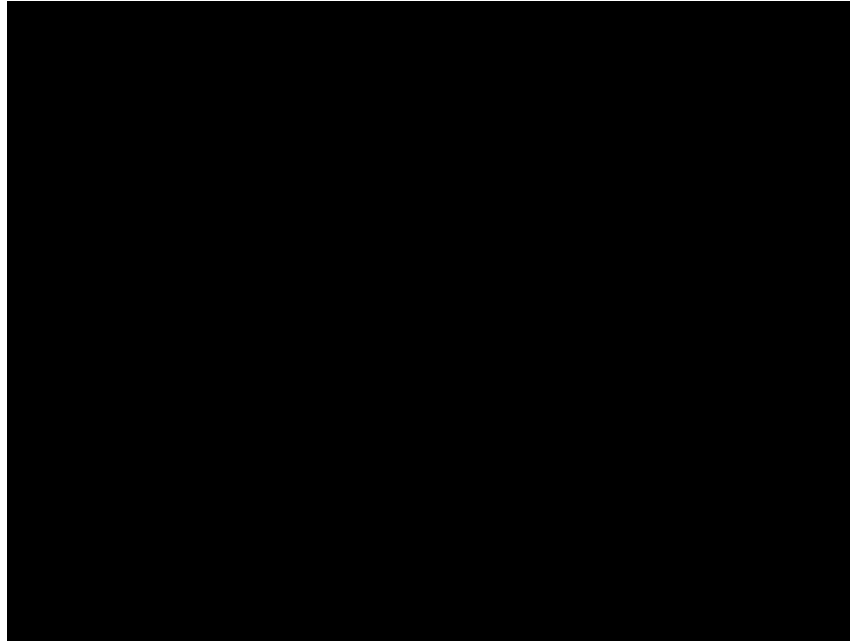# List of things that make engaging interactions

- …

Engaging

- Sound

- Physicality

- Surprise

- Beauty

- Learning

- Depth

- Discovery

- Feedback

- Mapping

- Control

- Richness, multiple senses

Kelly Dobson

Kelly Dobson

Functions!

Function Purpose

- organization

- reuse

- factoring / modularity

- error reduction

- code reduction

- ease of debugging

Function Structure

Anatomy of a C function

Datatype of data returned, any C datatype.

"void" if nothing is returned.
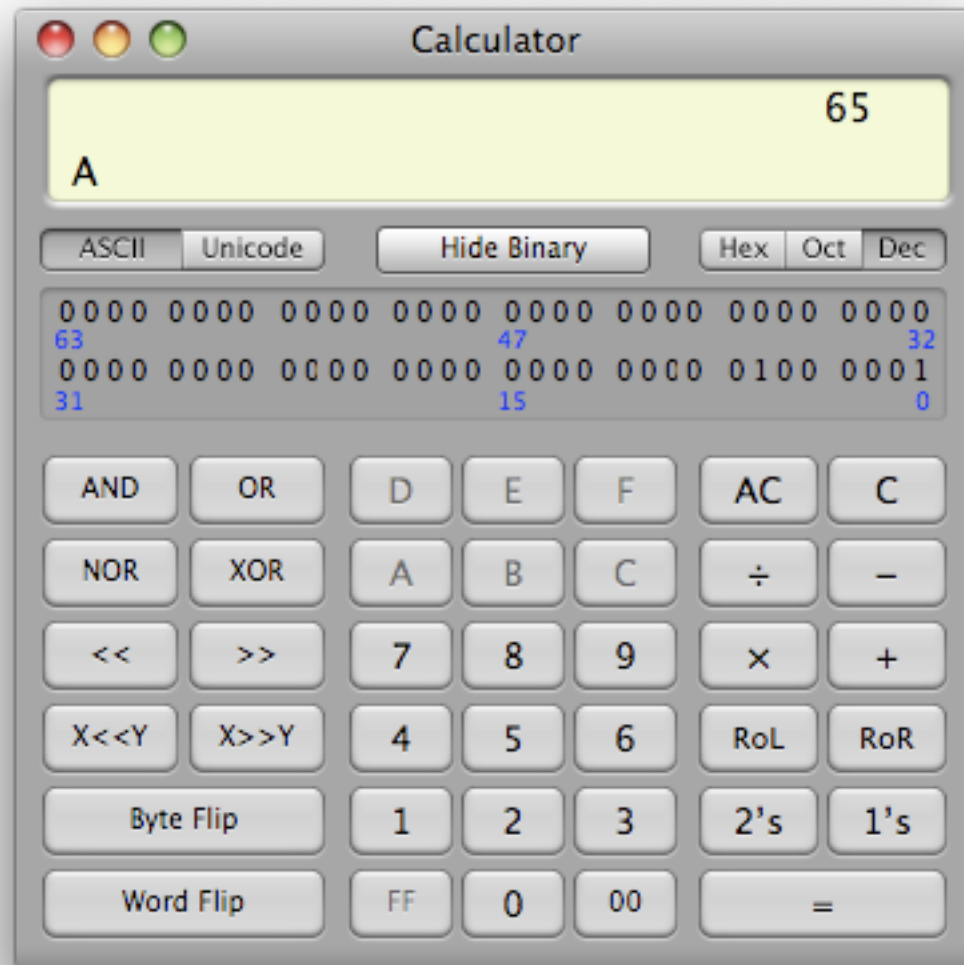
Function name

Parameters passed to function, any C datatype.

```
int myMultiplyFunction(int x, int y){
int result;

result = x * y;
return result;
}
```

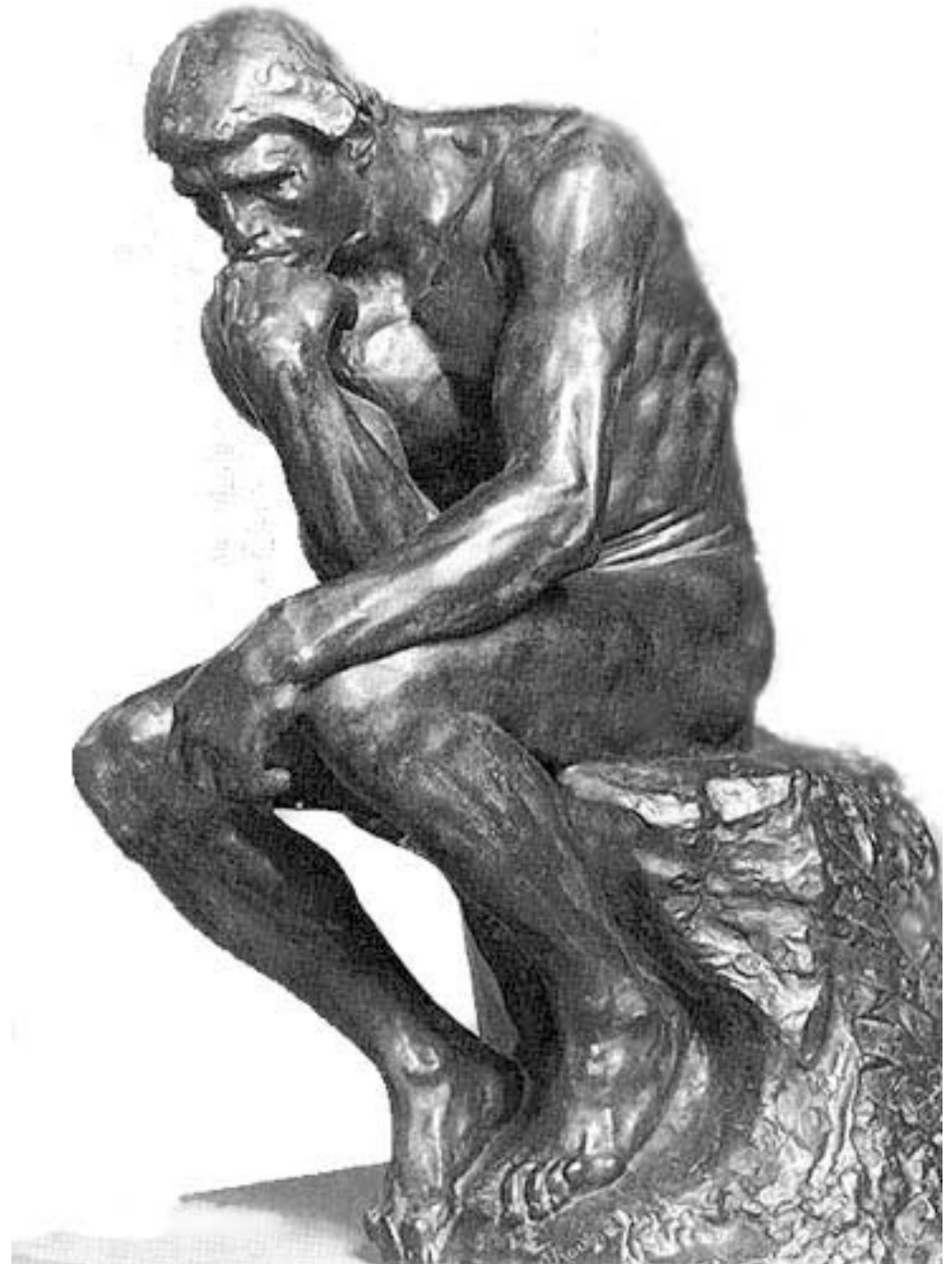Return statement, datatype matches declaration.

Curly braces required.

Math Fun

Affordances

Thinking

is not for thinking

Thinking is for doing

– Susan T. Fiske

Basics

- J.J. Gibson (1904-1979), Princeton, direct perception (James Jerome)

- "affordance", I have made it up!

- things have properties

- beings have properties and capabilities

- affordance isn't a thing or being

- affordances are intersections

What's an Affordance?

- is this chair an affordance?

- what do stairs afford?

- can we say what something affords without specifying to who?

- therefore affordance cannot be an object property

- context is important too: knives are tools, dangers

- not all enabling, an affordance can be injurious

Intersections

- ground : locomotion, support, death for birds

- air : movement for us, locomotion for birds, safe in front, dangerous below

- water : locomotion when we swim, support for water bugs

- apples : <you do it>

- other animals, other people : <you do it>

Perception

- Thinking is for doing (Susan Fiske, Harvard, Princeton)

- affordances ≠ perception (specification is separate from reality)

- covered hole vs. painted hole

- Norman gets it wrong, then corrects himself

Direct Perception

- understanding graspable as easily as understanding red

- things speak to us: a ball says throw me, a handle says grasp me

- exteroperception meets proprioception: integration of two perceptual worlds

- Gibson says we perceive affordances, not qualities, and he makes an excellent point because we seem to <u>feel</u> affordances

- He feels it's the point of perception. Continuous process of perceiving action possibilities

Affordances are Everywhere

- concealment

- feeding

- fighting

- fleeing

- reproduction

- Let's go find some!

Affordance Treasure hunt

- An affordance for you

- Something that object doesn't afford you

- An affordance for someone else

- An affordance for something else

- A perceived affordance that isn't real

- A real affordance that isn't (easily) perceived.

- An attempt to lock out an affordance.

- An attempt to extend an affordance.

- Any affordance you think will surprise us

Readings and Assignments

- Readings

  - Physical Computing, chapter 6

  - Arduino, chapter 5

- Assignment

  - Analog Output Lab