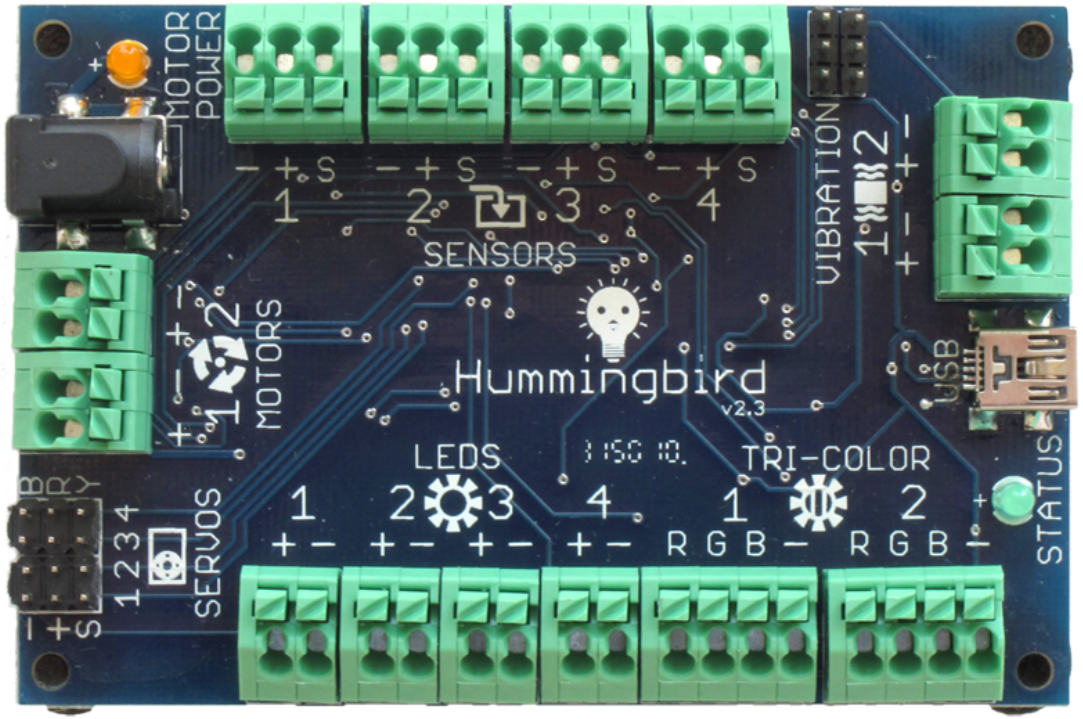
Design II
Kinetic Sculptures

How to use a Hummingbird kit to add movement to your sculptures

1. Identify the parts



Hummingbird Controller

You should also have a power adapter, a USB cable, and a screw driver in your kit

Other components

- Motion subkit: DC motors, servo motors, servo extension cables

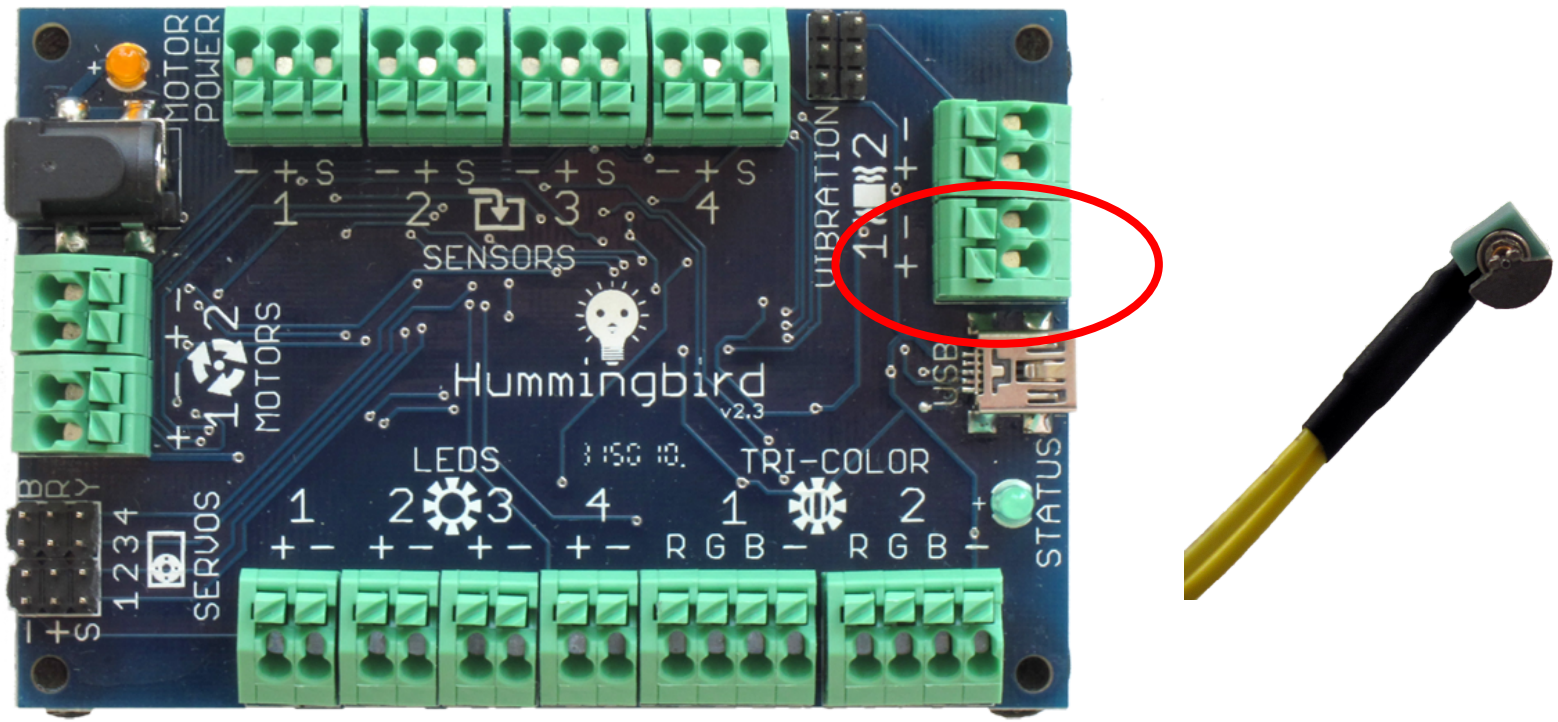
- Light and vibration subkit: single-color LEDs, tri-color LEDs (or RGB LEDs), vibration motors

- Sensors subkit: light sensor, temperature sensor, distance sensor, sound sensor, rotary knob

2. Connect Hummingbird to computer

- Connect Hummingbird controller and your computer using the USB cable
- Plug in the power adapter and connect it to the controller (needed when using motors)
- Open Birdbrain Robot Server
  - It should automatically detect that you have a Hummingbird connected
- Click the Open Snap! button to launch the programming environment

3. Plug in a vibration motor to Port 1

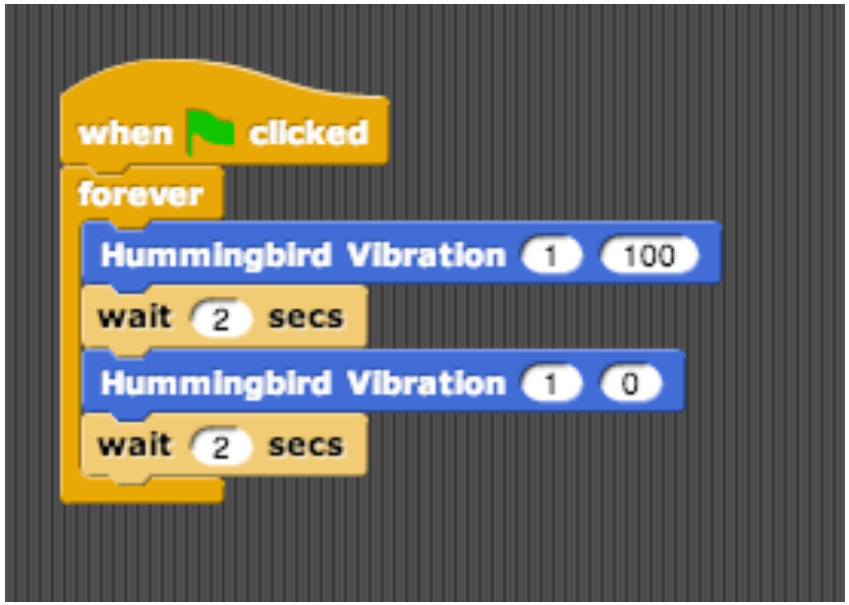


Twist wires together, push down on green notch with screwdriver, feed wire in, release. Give it a gentle tug to make sure it’s secure.

4. Learn some Snap! basics

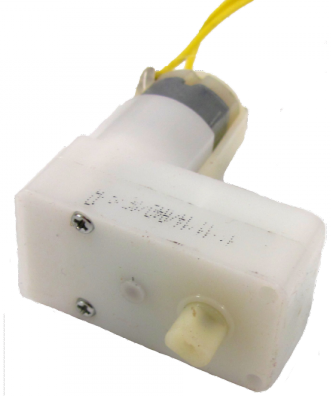
- Many of the blocks are for controlling the “sprite” - they are not relevant for this project
- The blocks we will be using are:
  - Motion: Hummingbird servo, motor, vibration motor blocks
  - Looks: Hummingbird LED and Tri-Color LED blocks
  - Sensing: 8 Hummingbird sensing blocks
  - **Control: These blocks help us write the logic of the programs**
  - **Operators: These blocks help us perform mathematical, comparison, and logic operations**
  - **Variables: These blocks let us “remember”**

5. Write a simple program to control the vibration motor



- How do you change the frequency of vibration?
- What do the numbers after “Hummingbird Vibration” mean?
- What if you replaced the ***forever*** loop with a ***repeat*** loop?

6. Controlling a DC motor



Challenge:

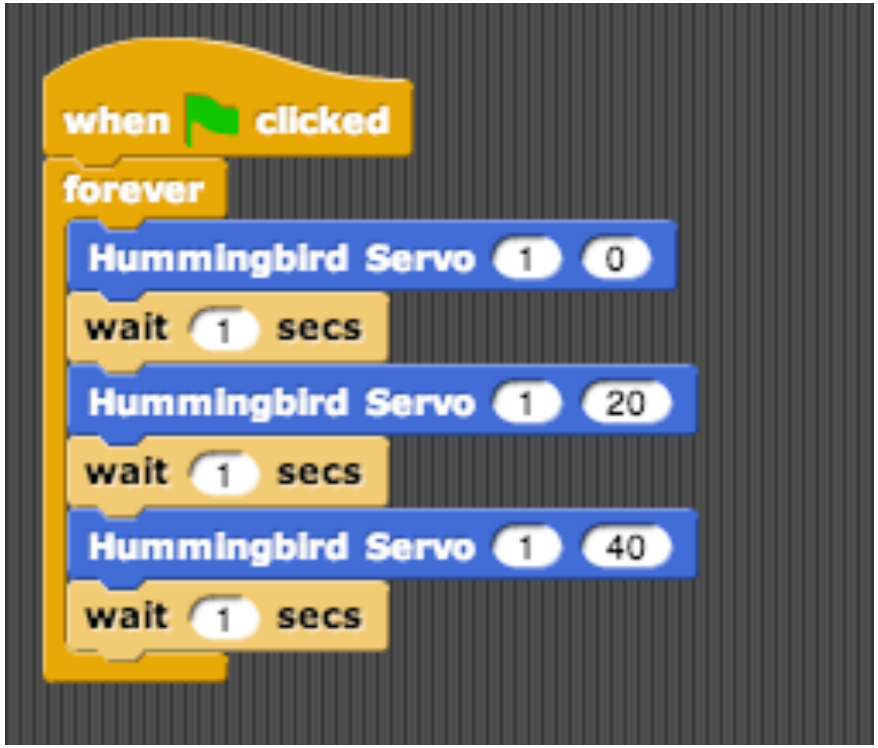
Can you now use a DC motor and write a simple program to spin it one way, turn it off, then spin it the other way?

Tips/Hints:

- You need to plug this into a “Motor” port (different from the Vibration Motor ports).
- If it helps, you can attach a wheel onto the motor to more easily see the direction it’s spinning.
- Numbers can go negative!

7. Controlling a Servo

- A servo is a type of motor where you can specify the angle (0 to 180) and the motor will maintain that angle
- Note: there are three wires going to a servo (black=negative, red=positive, yellow=signal)



How can you program it to go all the way to 180?

8. Saving your project to the Cloud

Two options:

- Save it locally on your browser/computer
- Save it to the Cloud using the Bourn Lab account

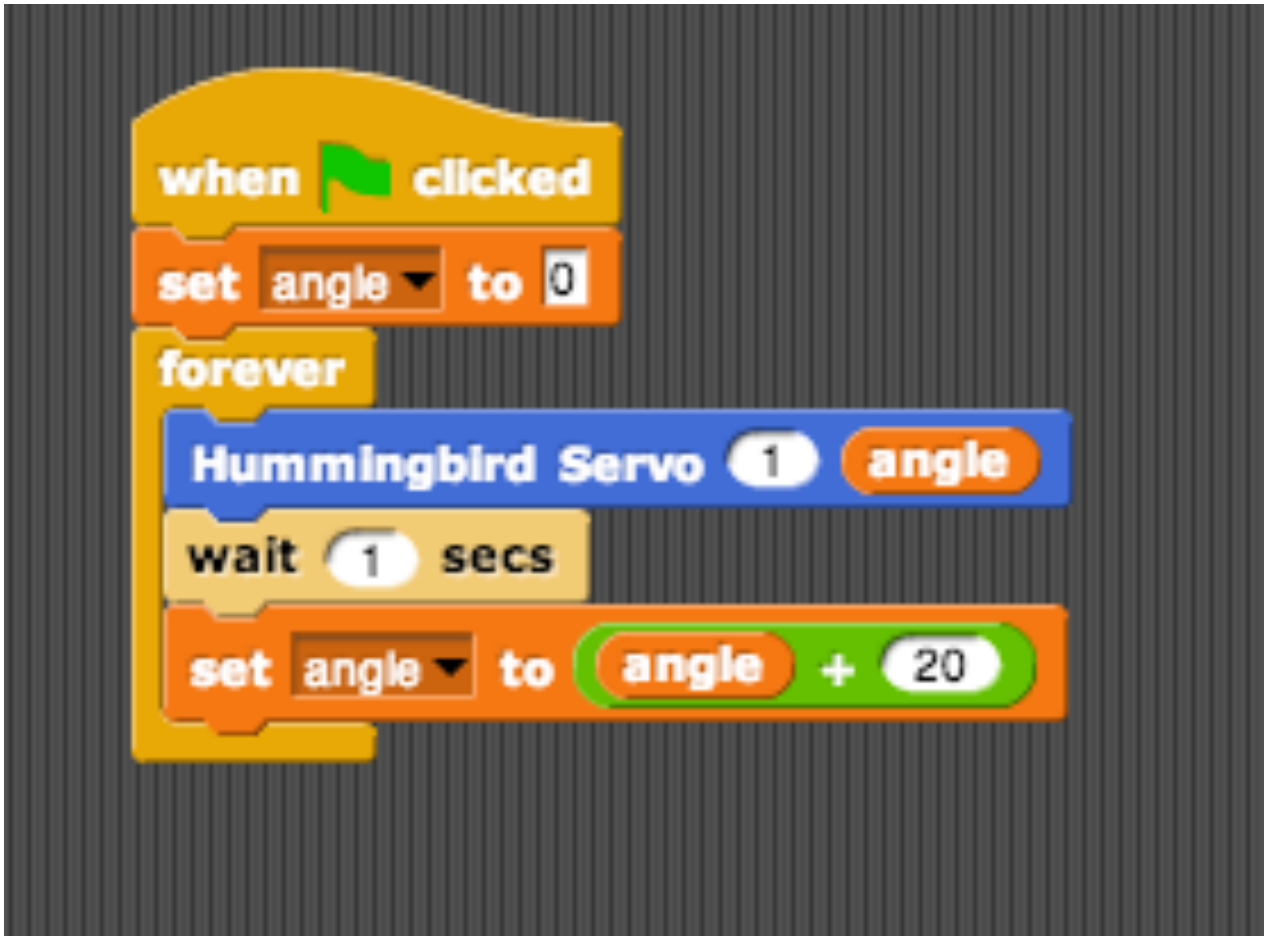
Username: bournidealab Password: castilleja

Make sure to use your name as part of your project name (this is a shared account!)

http://www.hummingbirdkit.com/learning/tutorials/example-robots#dragon

9. Using variables and to write better and cleaner programs

- Variables allow you to store small bits of information and then use that info later on in a program
- For the servo program we wrote previously, let’s store the angle as a variable
- How can you rewrite the program to make the servo go from 0 to 180?
  - Hint: It should take you a lot less blocks to write this program than before!


when clicked
set angle to 0
forever
Hummingbird Servo 1 angle
wait 1 secs
set angle to angle + 20

10. Make a windshield wiper

Challenge:

Using the servo motor, write a program that will use the servo to make a repeating windshield wiper motion.

Tips:

- Switch out the attachments on the servo to see the motion better
- There are many many ways to do this - there is not a single correct answer! Try stuff out! Have fun!

13. Controlling LEDs

- Controlling other outputs (e.g. LEDs) is very similar to controlling motors
- LEDs are “polarized” (black=negative)
  - Single-color LEDs

  - Tri-Color LEDs

14. Adding inputs: getting info about the outside world

- Plug in a light sensor to Sensor Port 1
- Store what the sensor is reading into a variable

15. Linking inputs to outputs

Challenge:

Using the light sensor as input and single-color LED as output, can you build a night light that turns on only when it’s dark outside?

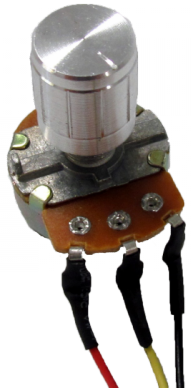
Tips:

- You will want to explore the “if-else” control block (a ***conditional*** statement)

16. Final challenge!!

Open up your windshield wiper program (I hope you saved it!)

Modify it so that you can now use the rotary knob input to control the speed of the wipers.



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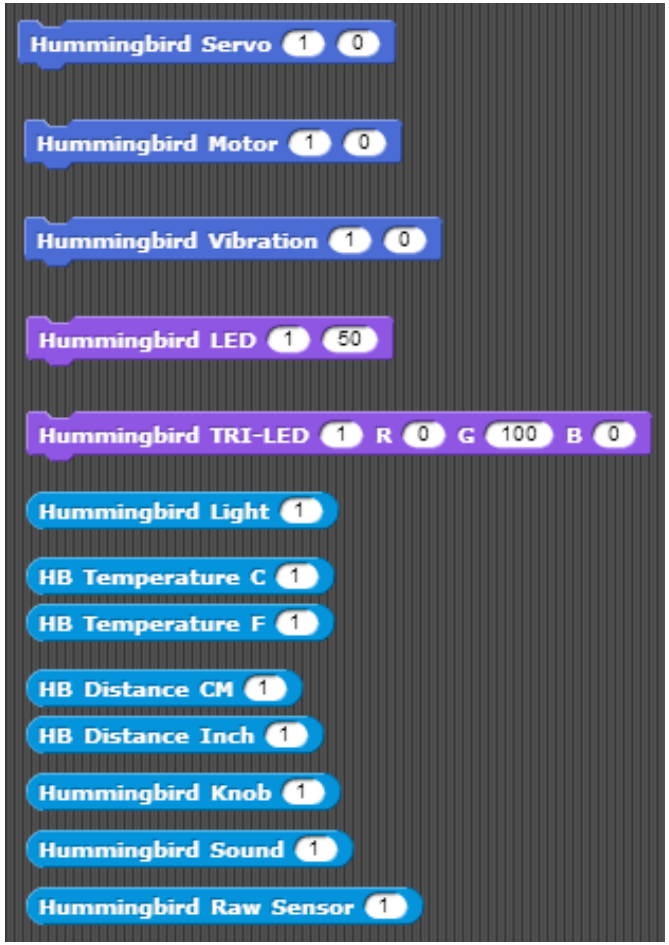
Also… If you want to use the Laser Cutter to cut out pieces

- Create your designs in Adobe Illustrator
- Materials we have: thin or thick wood/Duron (24”x16”), thin cardboard (24”x18”), acrylic scraps
- Send as attachment to bournlaser@castilleja.org
- Email Ms. Chau to figure out a time you can come use the laser cutter

Tips:

- Understand the difference between vector (cut) lines and raster (engraved) lines
- Vector lines that will be cut with the laser cutter <u>must</u> be drawn as lines or as part of shape, i.e. no fancy brushes



Motion Commands

- **Hummingbird Servo:** Sets servos 1 through 4 to a value from 0 to 180 degrees.
- **Hummingbird Motor:** Sets motor port 1 or 2 to a value from -100 to 100.
- **Hummingbird Vibration.** Sets vibration motor 1 or 2 to an intensity value from 0 to 100.

Looks Commands

- **Hummingbird LED:** Sets the intensity of light on a single color LED on ports 1 through 4. Intensity ranges from 0 to 100.
- **Hummingbird TRI-LED R G B:** Sets the full color LED at port 1 or 2. The R, G, and B arguments control the intensity of the red, green, and blue elements in the tri-color LED. Range is 0 to 100 for each color.

Sensing Commands

All sensing commands allow the user to specify a number corresponding to the port the sensor is on. For example, a distance sensor on port three would be read by HB Distance CM 3 or HB Distance Inch 3.

- **Hummingbird Light:** Returns the value of a light sensor, range is 0 to 100.
- **HB Temperature C:** Returns the value in Celcius of a temperature probe.
- **HB Temperature F:** Returns the value in Fahrenheit of a temperature probe.
- **HB Distance CM:** Returns the distance to an object from a distance sensor in centimeters. The range is 8 to 60 cm with the kit's range sensor (a value greater than 60 cm should be considered as not seeing an object).
- **HB Distance Inch:** Returns the distance to an object from a distance sensor in inches. The range is 3 to 24 inches with the kit's range sensor (a value greater than 24 inches should be considered as not seeing an object).
- **Hummingbird Knob:** Returns the value of the hummingbird's knob; range is 0 to 100.
- **Hummingbird Sound:** Returns the value of a sound sensor, range is 0 to 100.
- **Hummingbird Raw Sensor:** Returns the raw sensor value at the port; range is 0 to 100 and corresponds to the DC voltage at the port. A voltage of 5V is equivalent to a reading of 100, and a voltage of 0V is equivalent to a reading of 0.