Week 4

Motors, Servos and Capacitive Touch

THE SERVO

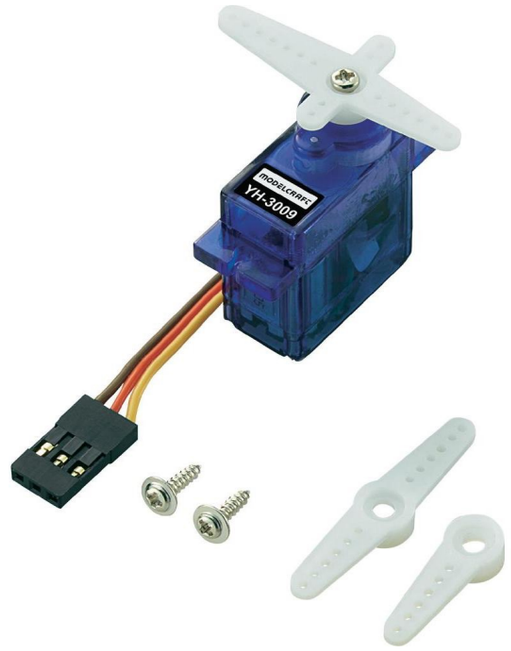
Your first actuator

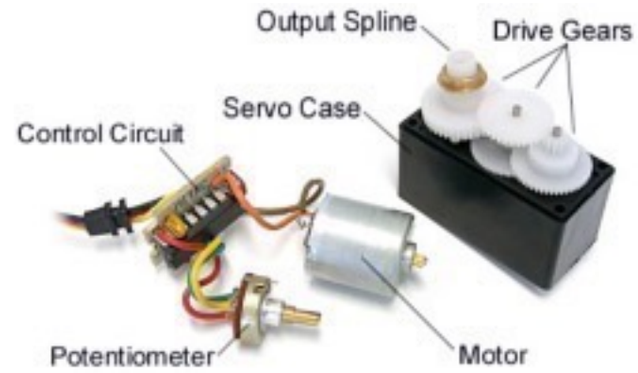
Can rotate 180 degrees
give or take depending on make

Uses the Arduino servo library to calculate degrees

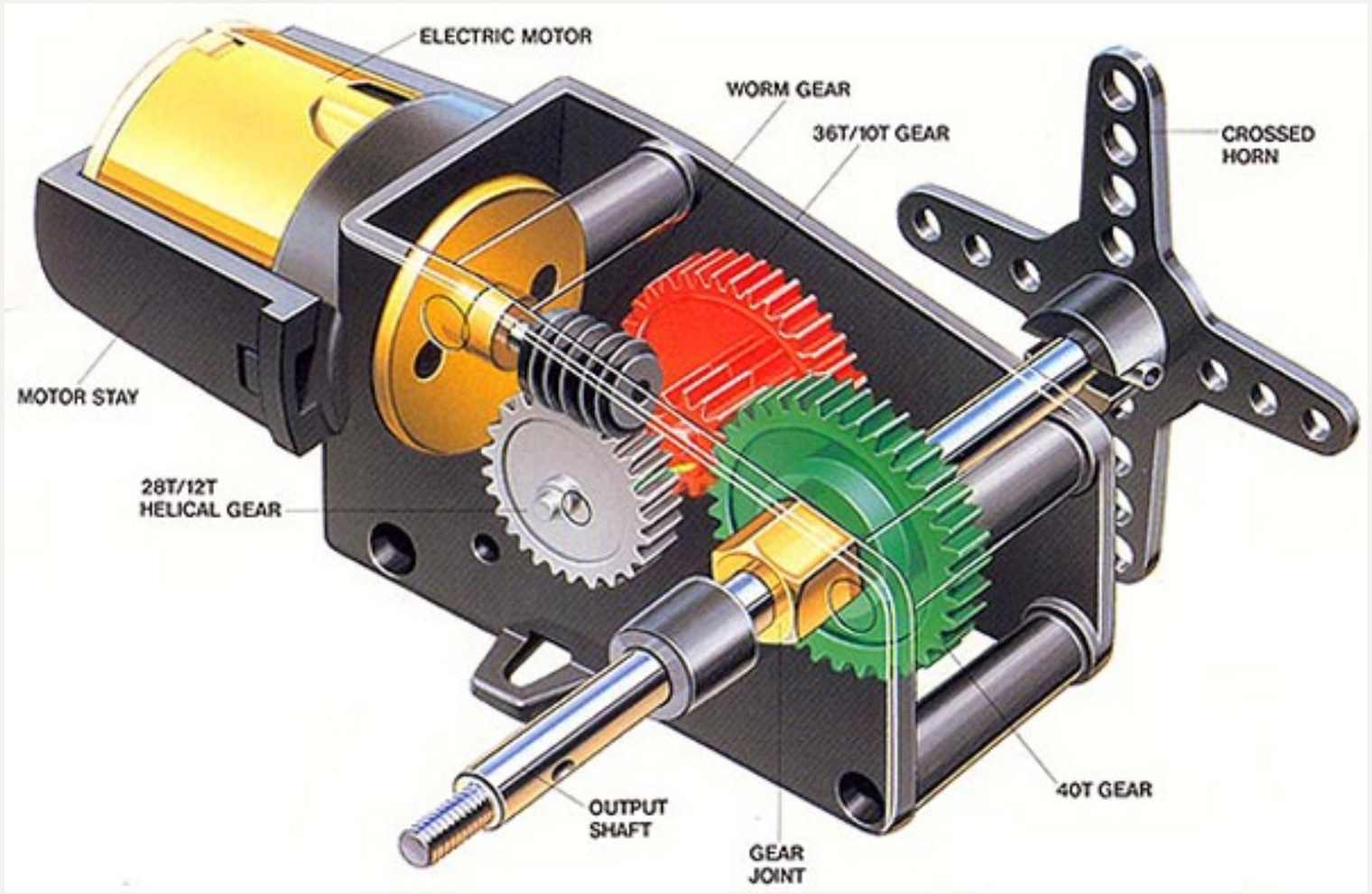
Has a small gearing system inside with a coiled motor & control circuit

Has a pot inside for rotation control





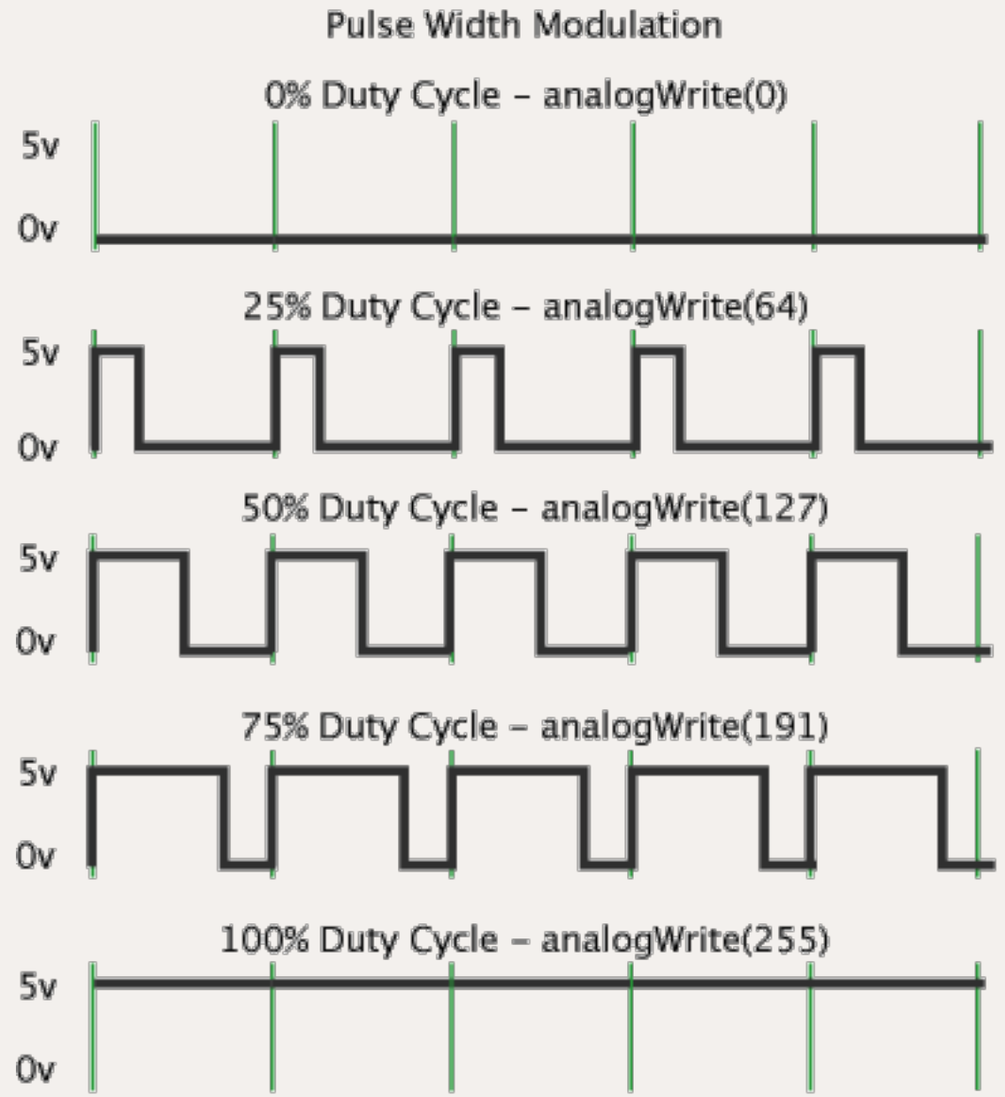
Your Servo Motor



More complex gears.
Turns from 0 - 180 degrees (almost)
Sensor on gear shaft provides feedback on positioning
Allows you to control it via PMW

PWM (0-255)

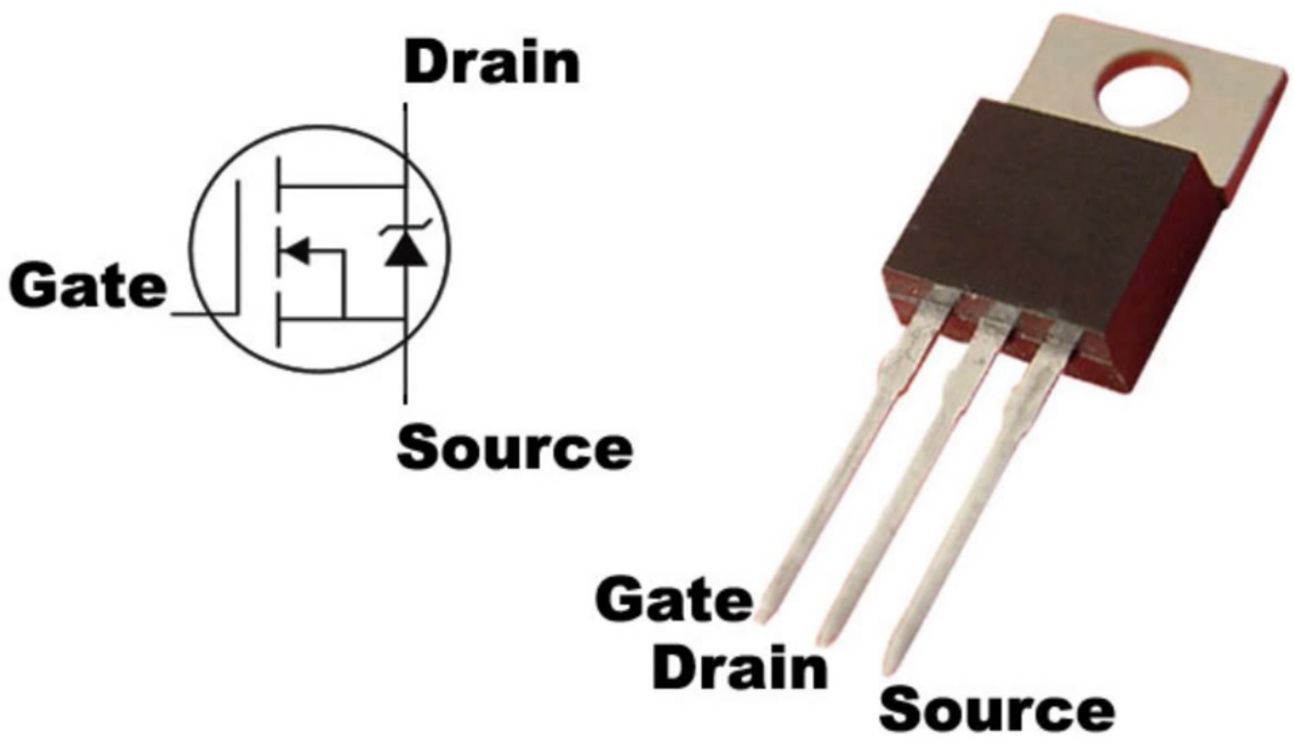
* makes a digital pin act analogish
* sends a little pulse every 20ms
* the length of the pulse indicates the value
* longer the value the higher the value and the more voltage sent
* they are indicated on the Arduino by a ~
* use it to turn a servo by a certain angle using the Arduino built in servo library



N Channel Mosfet

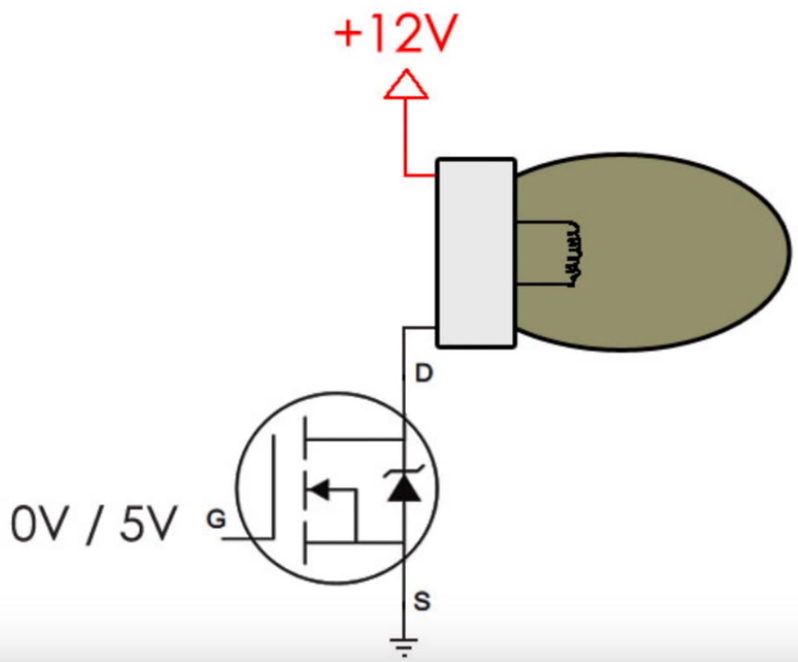
Gate - turns voltage on and off (0 - 5V)
Drain - pin that current drains into
(negative side of your load with positive side of your load to the positive source of your power source (external))
Source - (ground) source power flows out of (up to 100V)

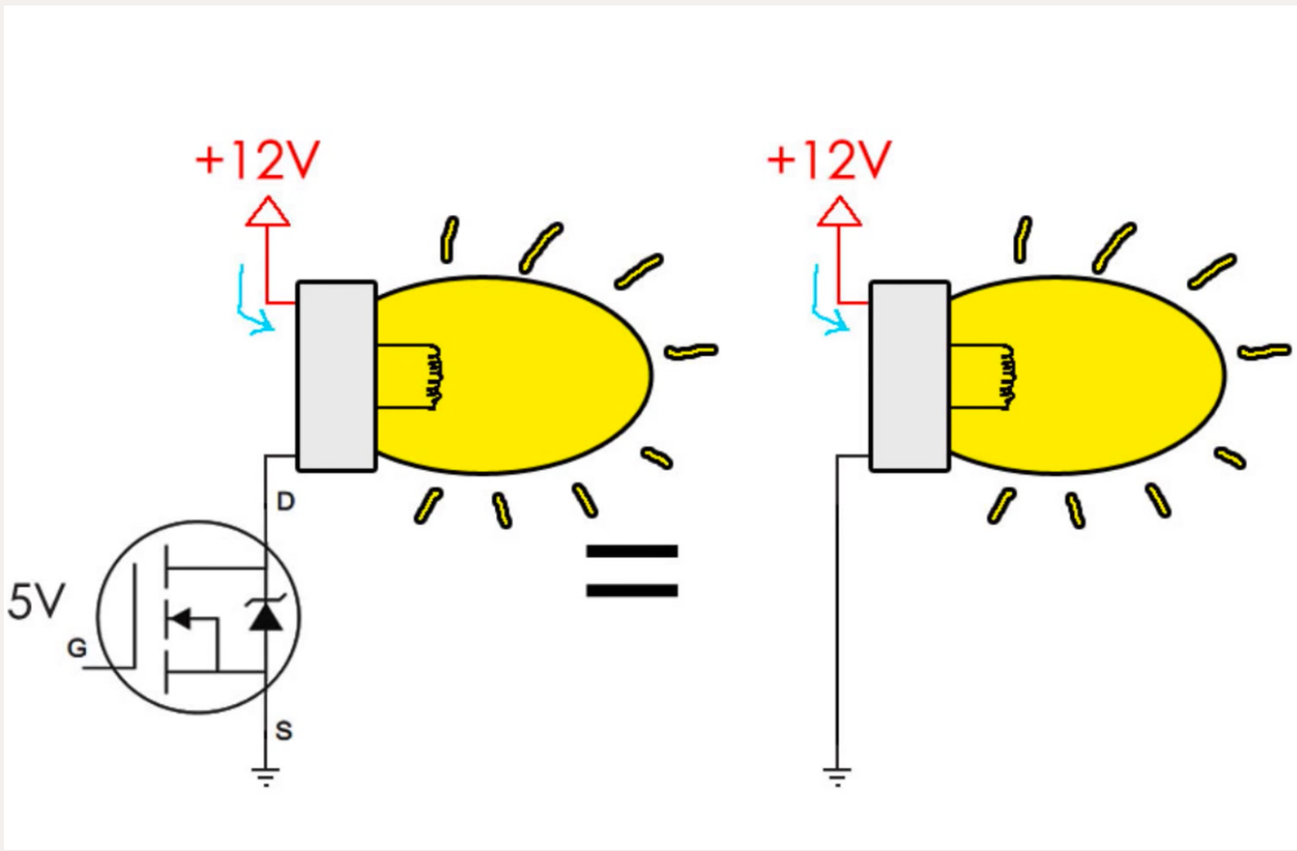
???
How did I know
what this was?
DATA SHEET



http://www.futurlec.com/Transistors/IRF520.shtml

Acts like a power switch, when you power the gate, the voltage can flow from 12V to ground.





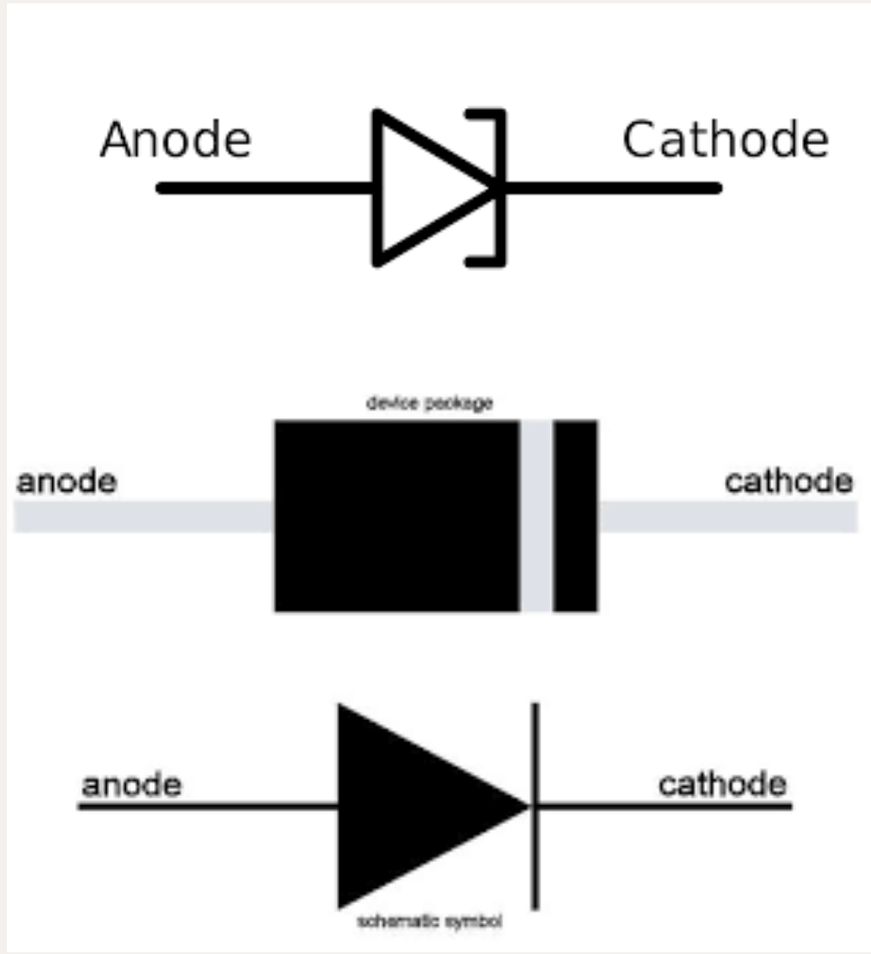
https://www.youtube.com/watch?v=Te5YYVZiOKs

The Diode

A component that allows current to flow in only one direction. Most diodes are semi-conductor diodes with p-n junctions.

In a device which consumes power, the **cathode** is **negative**, and in a device which provides power, the **cathode** is **positive**:

N-doped = spare electrons
P-doped = spare electron holes

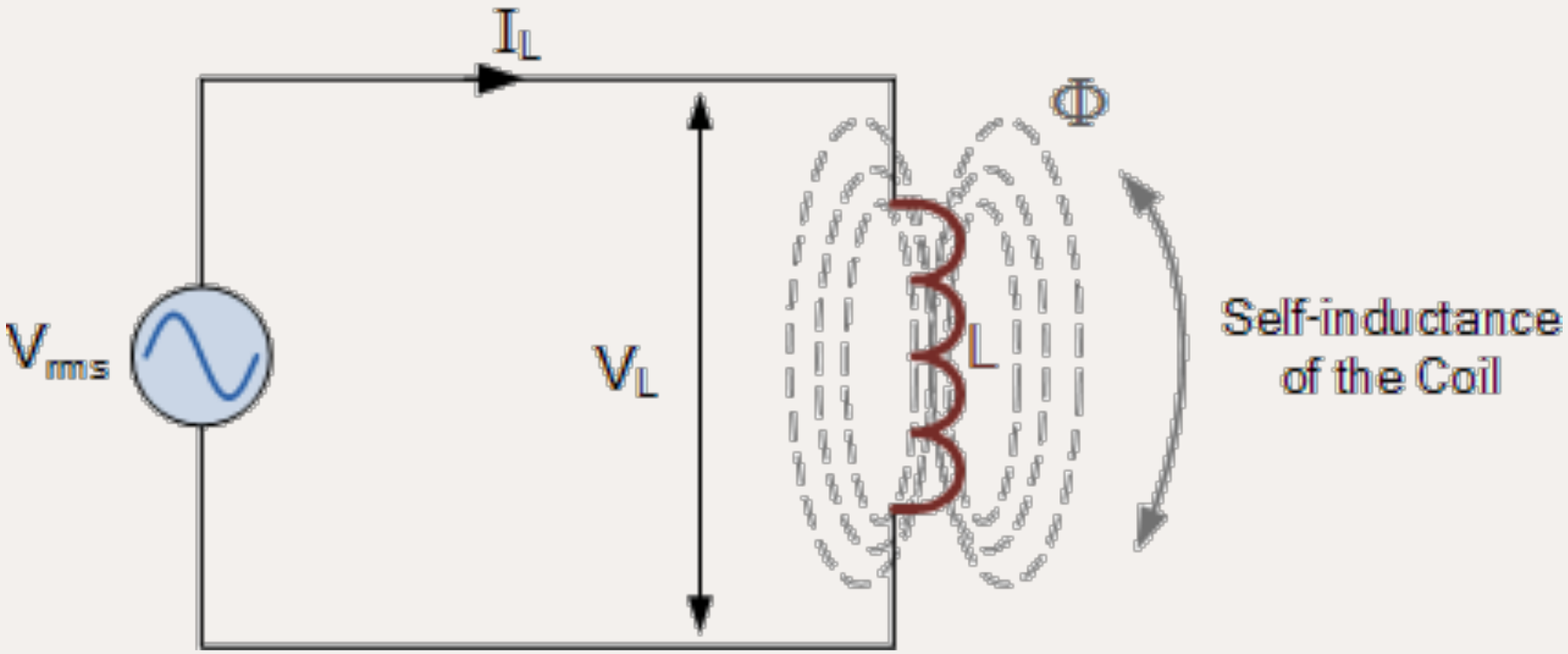


Hint: Put the grey line to +5


I HAVE
NO TIME
FOR YOUR
NEGATIVE
BULLSHIT.

Inductor

When you run voltage through a cooper wire you create a magnetic field. Manipulating this simple fact of nature gives us speakers, microphones and motors



Inductive Load

Anything with a coil and a magnet

Inductive vs Resistive loads

1) Inductive loads use magnetic fields. Examples - Motors, solenoids, and relays. If it moves, it's probably an inductive load.

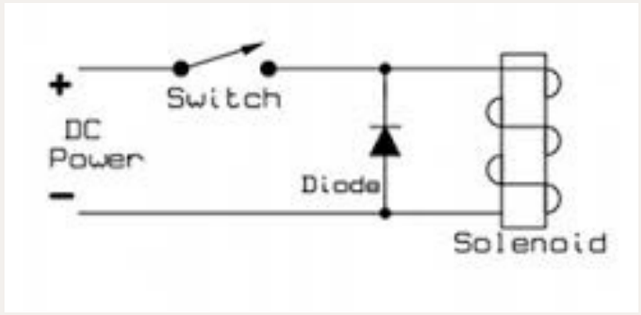
2) Inductive loads can cause blowback voltage. Circuits should be protected from this by diodes.

3) Blowback is caused by a surge of voltage created by the collapsing magnetic field in an inductor.

4) Resistive loads convert current into other forms of energy, such as heat. No risk of blowback.

Diode Protection

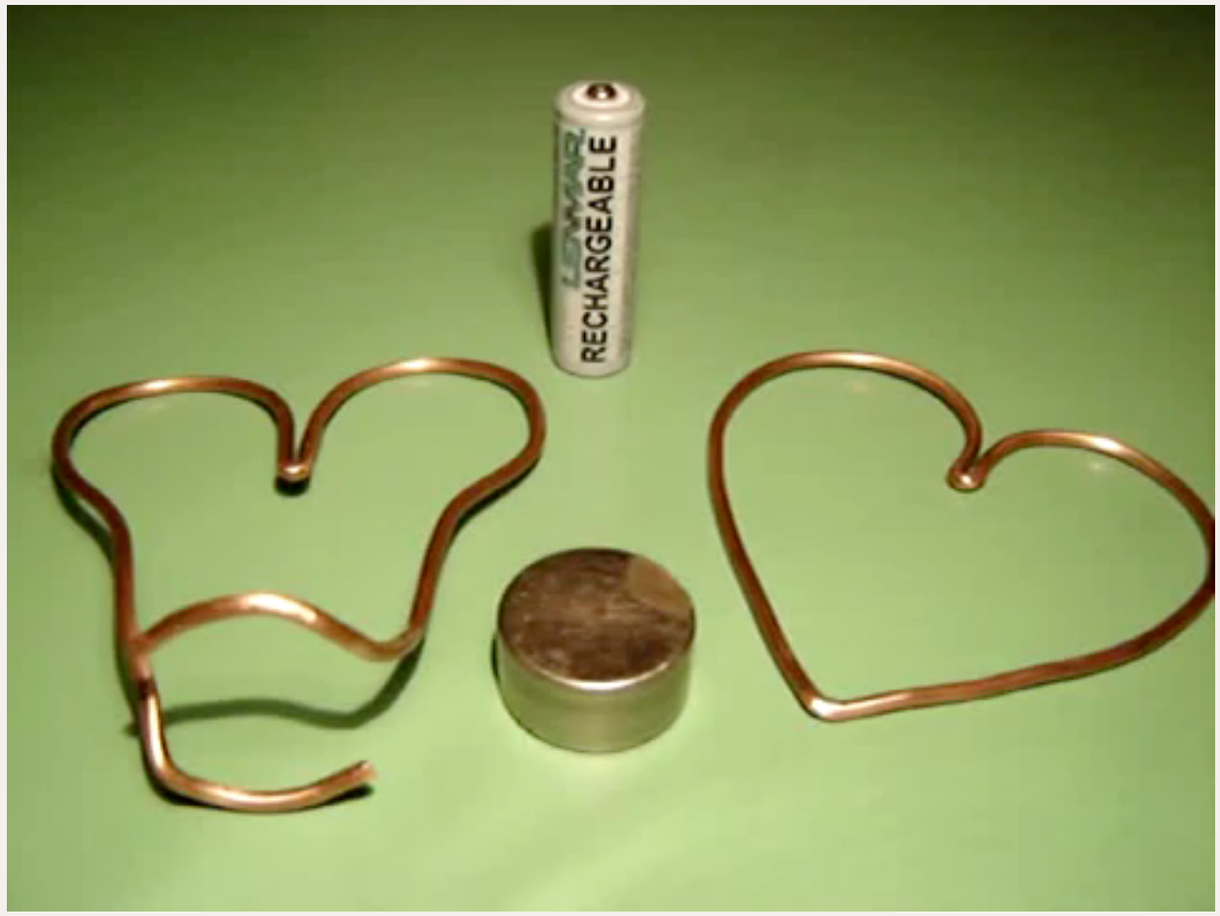
Anything with a coil and a magnet



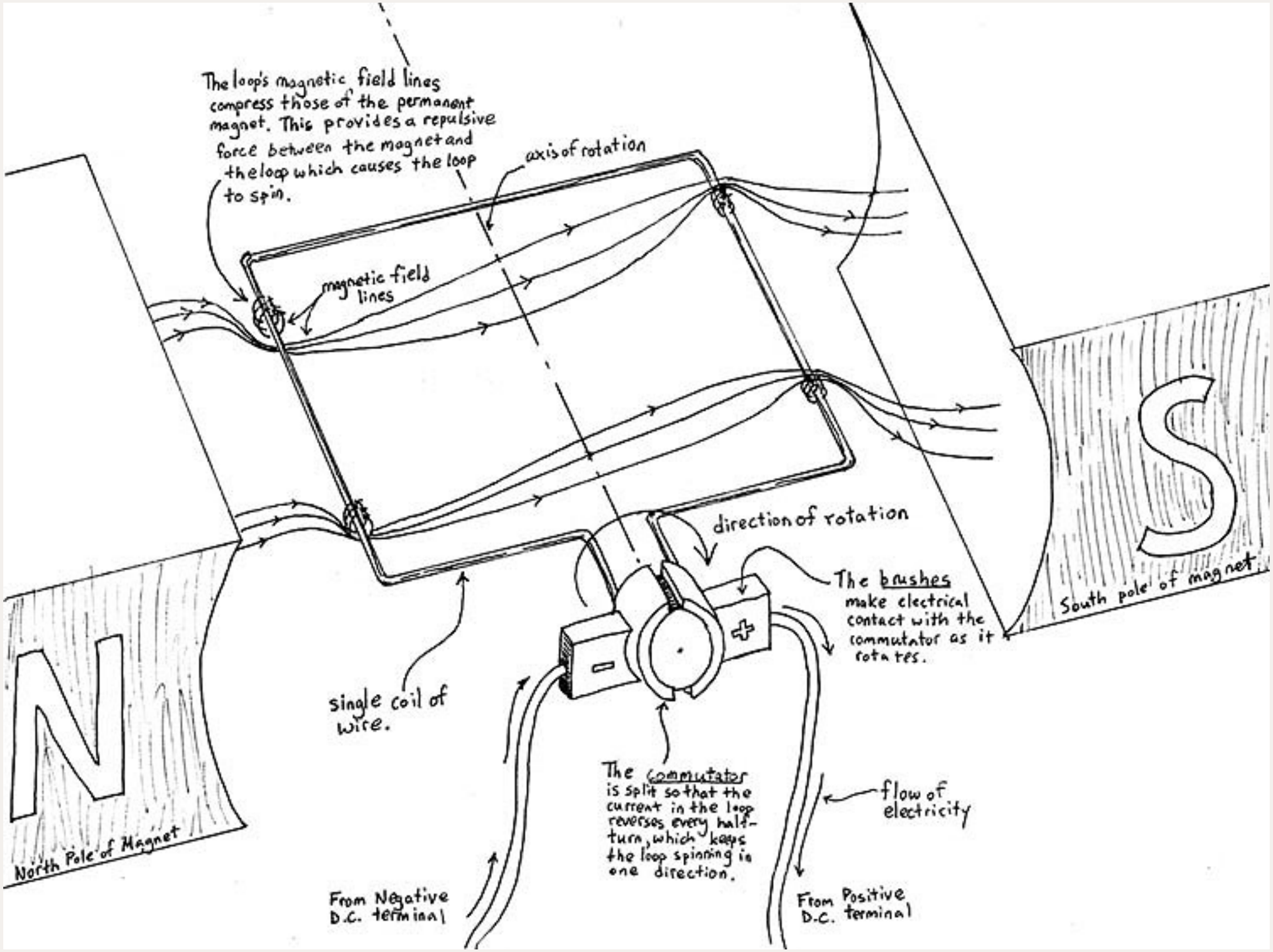
- Reverse polarity protection.
- Reverse-biased diode in parallel with an inductive load. Snubs the blowback current generated by the collapsing magnetic field.

How to make a motor

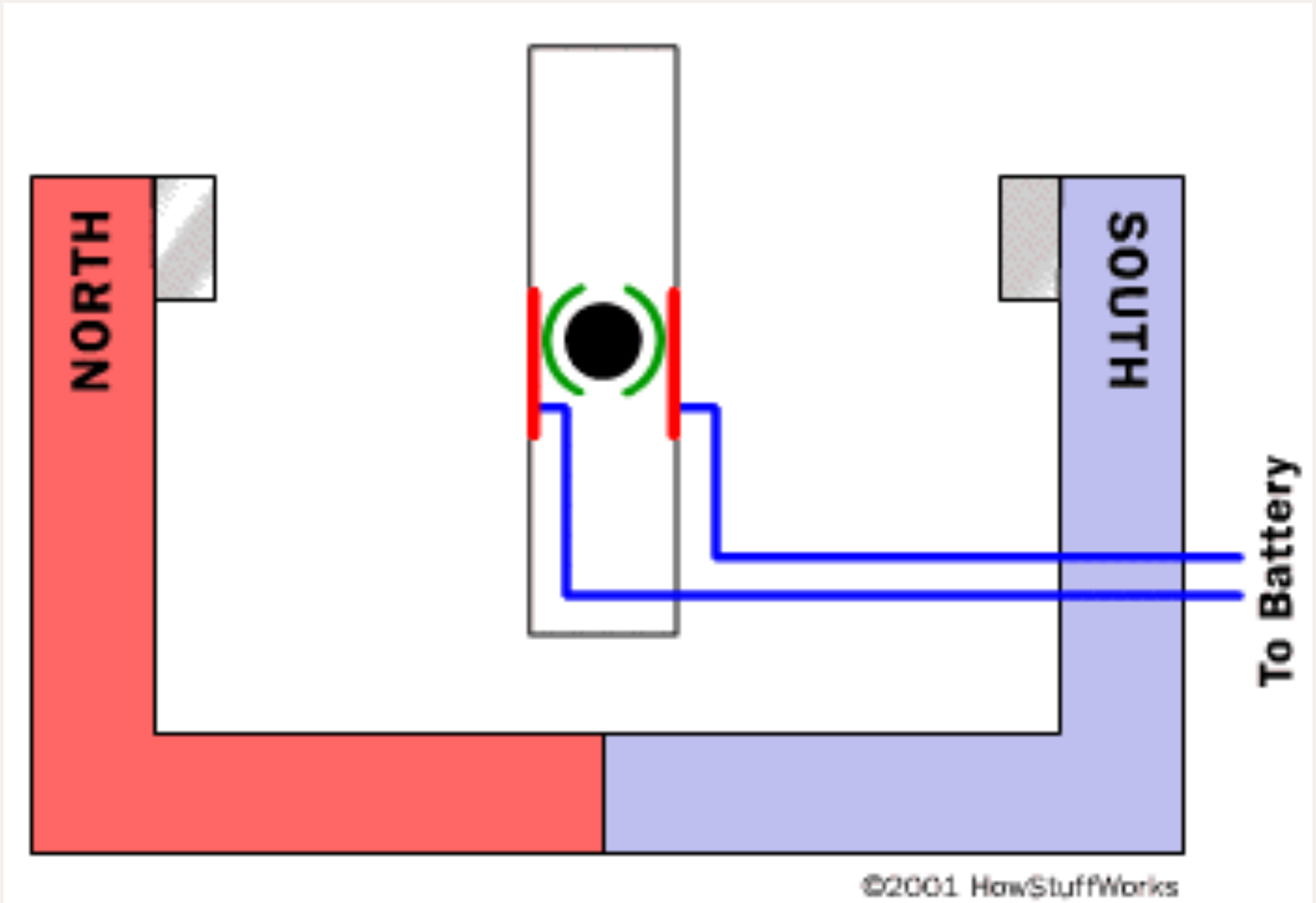
https://www.youtube.com/watch?v=iG0pzGcy4xU



Your DC Motor

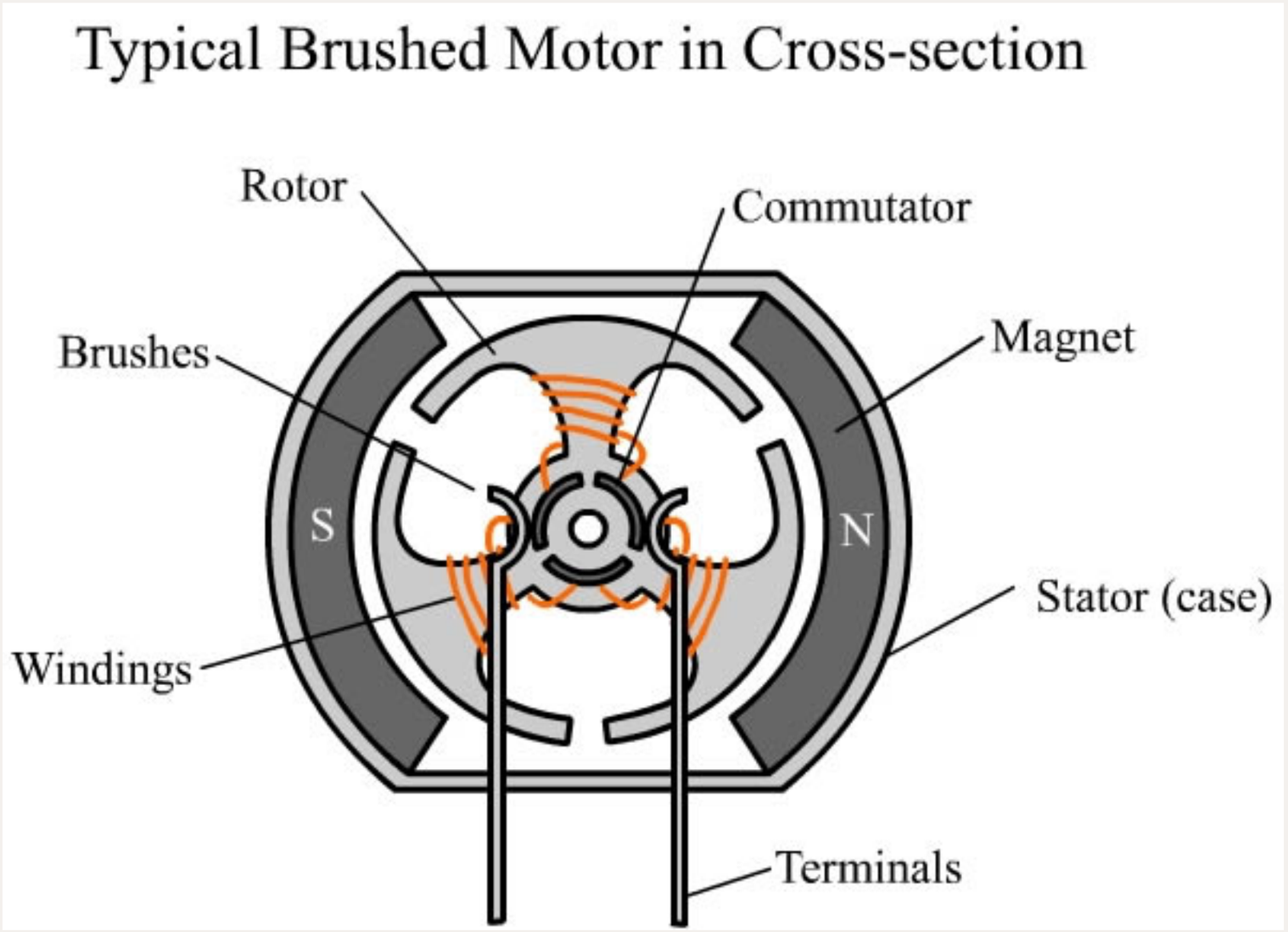


Your DC Motor



Want to flip the direction a motor spins?
Reverse the leads

Your DC Motor

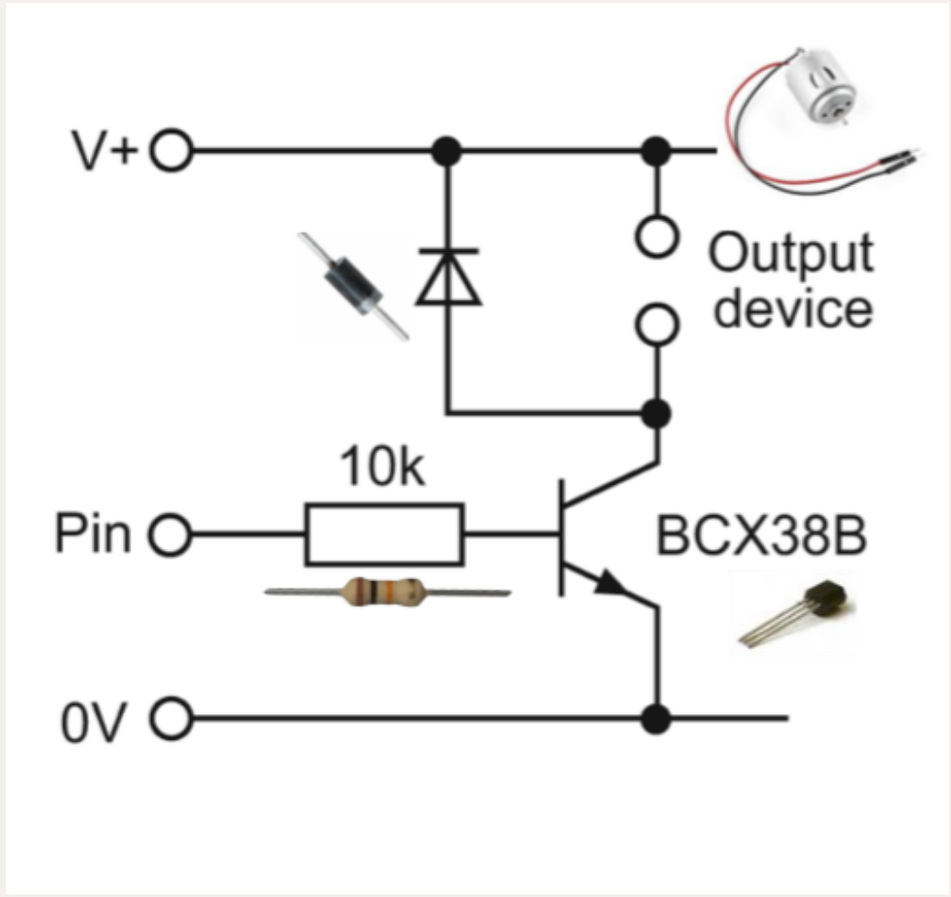


Low current load

Use this type of circuit for low current loads only

BCX38B darlington or other NPN transistor

(uyp to 60V, 800mA, power: 1 WaB)

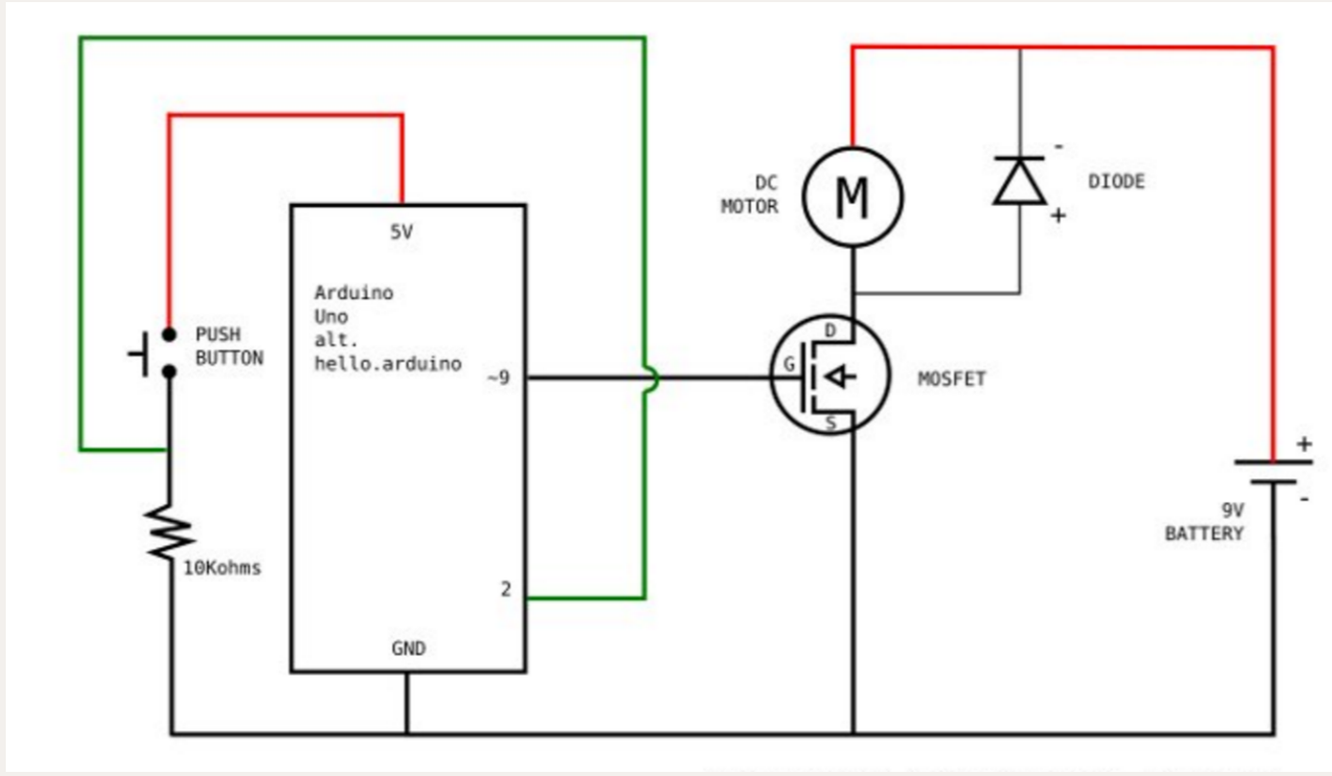


High current load

Use this type of circuit for high current loads only

Use a heat sink for high currents (see how warm the tab gets, during use)

IRF530 power MOSFET(up to 14A 100V!)



P = I(to the)2 R

Symbols for Components

Wires crossing – no contact

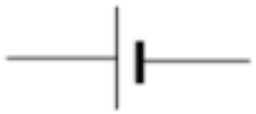
Junction (wires joined)

Junction

Switch (normally open)

Switch (normally closed)

Two- way switch



Single cell

Battery of three cells

Power supply (DC)

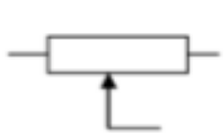
Power supply (AC)

Ammeter

Voltmeter

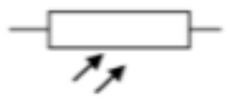
Resistor

Variable resistor



Variable resistor or potentiometer

Thermistor

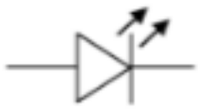


Light dependent resistor (LDR)

Fuse

Earth

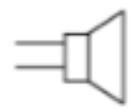
Diode



Light-emitting diode (LED)

(Signal) lamp

Filament lamp



Loudspeaker

Electric bell

Buzzer

Microphone

Motor

Generator

Transformer

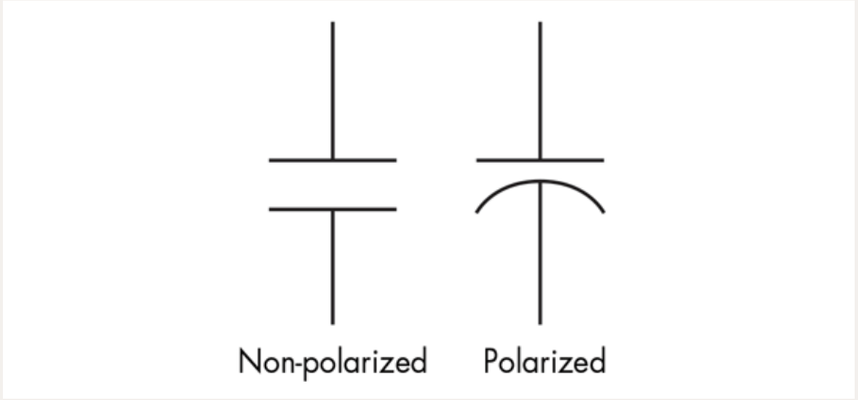
Capacitor

Stores electrical current for a duration

Measured in Farads.

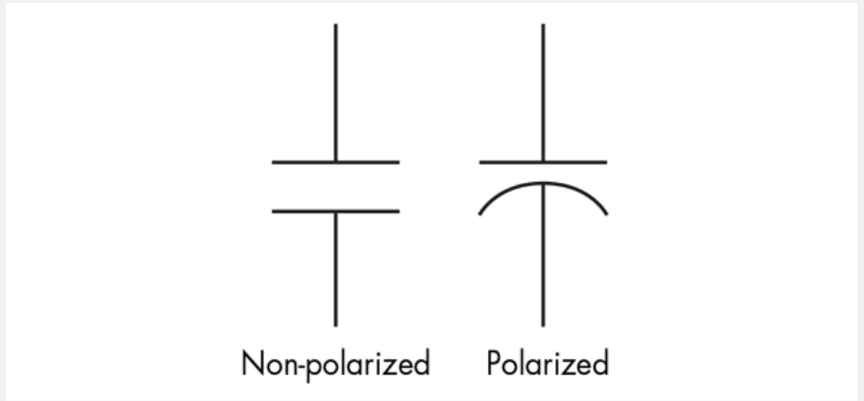
Typical capacitance values range from about 1 pF

(10–12 F) to about 1 mF (10–3 F).



Capacitor

Has two sides - two “plates” and when enough charge builds up a current flows between them.



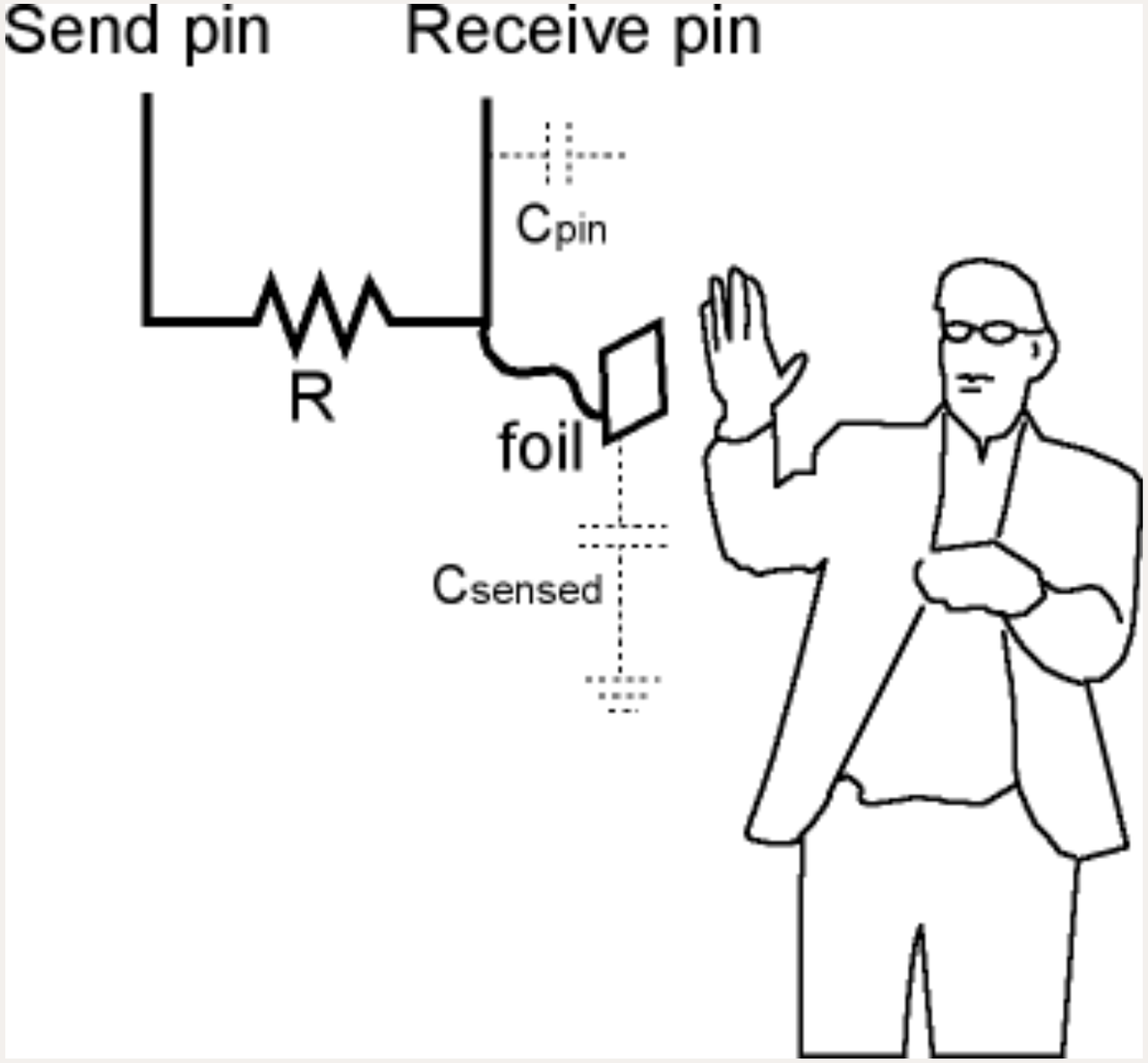
Can serve to regulate uneven current flow

This is you, the carpet and your childhood friends.

You can measure this with your arduino. For more info see here: https://www.youtube.com/watch?v=ZYH9dGl4gUE

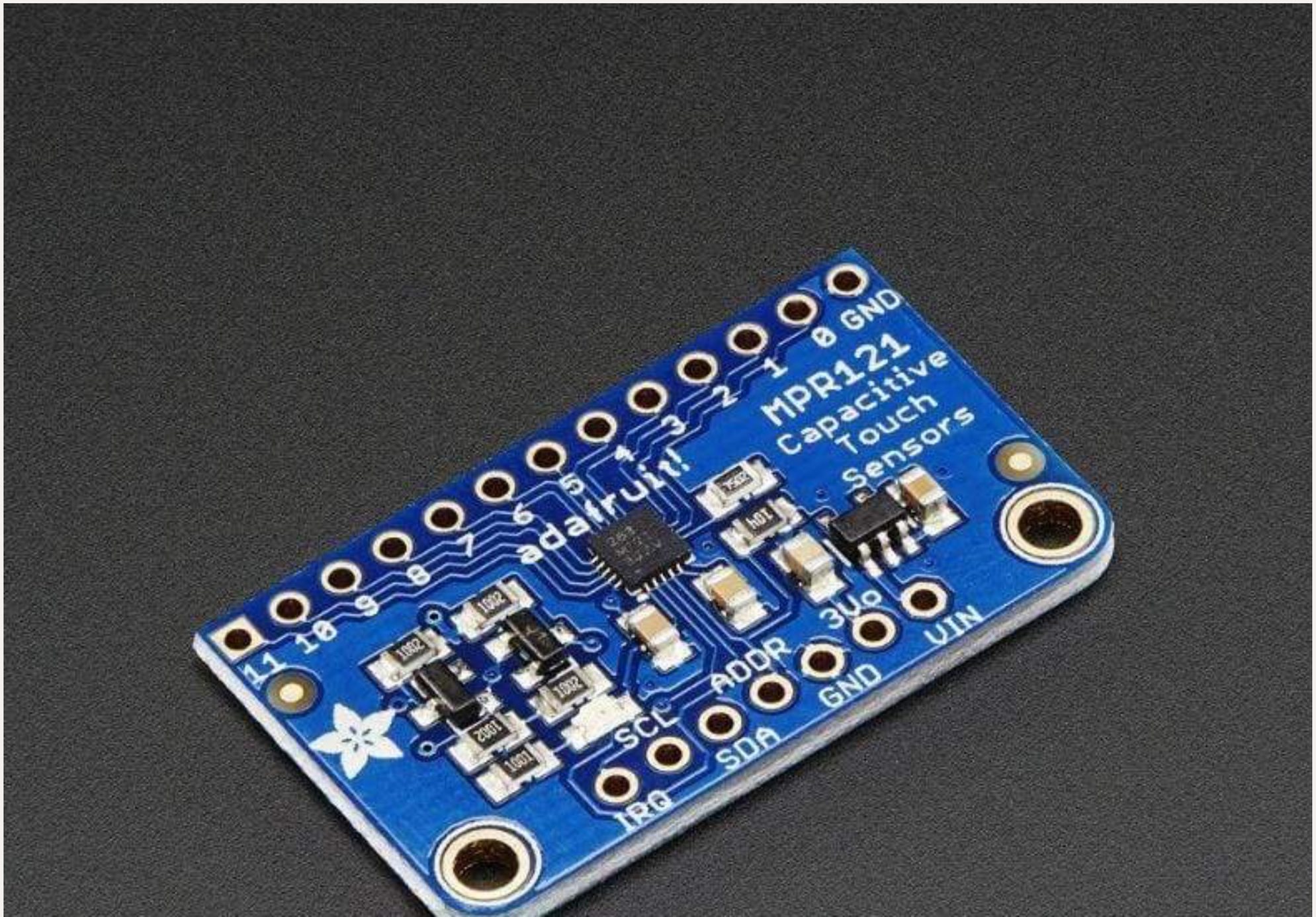
Capsense Library for Capacitive Touch

http://playground.arduino.cc/Main/CapacitiveSensor?from=Main.CapSense



MPR121

https://learn.adafruit.com/adafruit-mpr121-12-key-capacitive-touch-sensor-breakout-tutorial



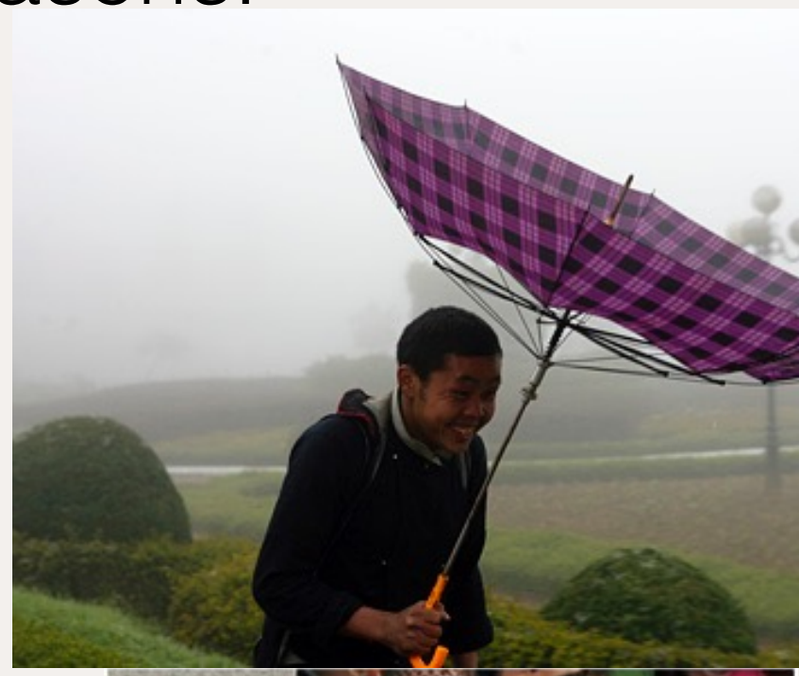
Wobble Garden

https://www.youtube.com/watch?v=6vvGpJxDWTY

Behavior

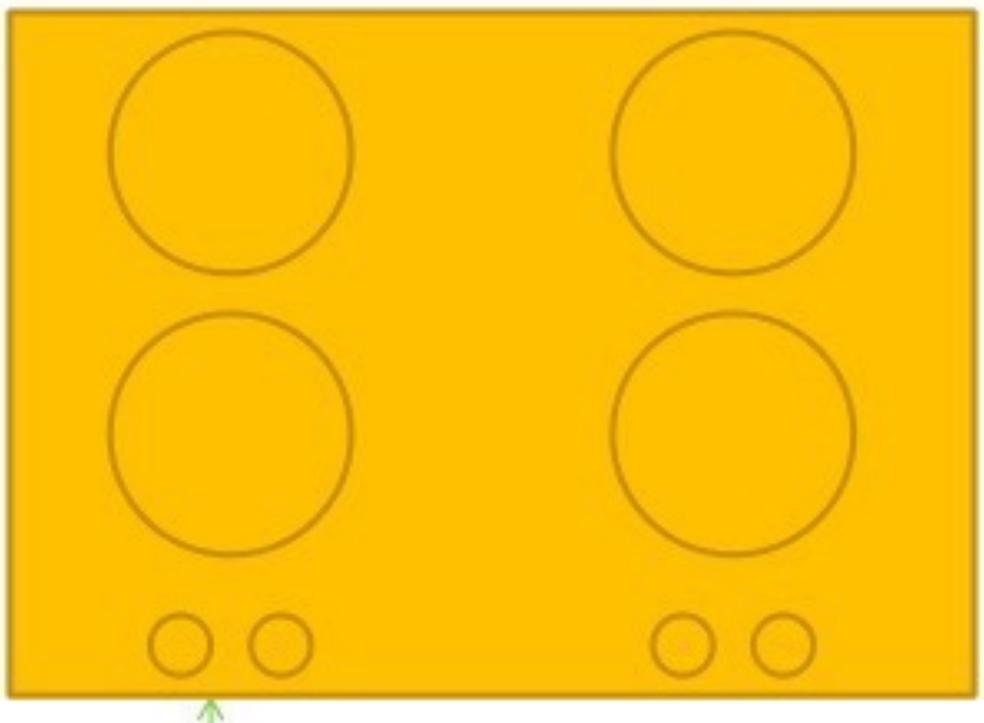
We can have precise behavior on how to do a task without precise knowledge of the task due to 4 reasons:

* Information is in the world:
* Great precision is not required
* Natural constraints are present
* Cultural constraints are learned

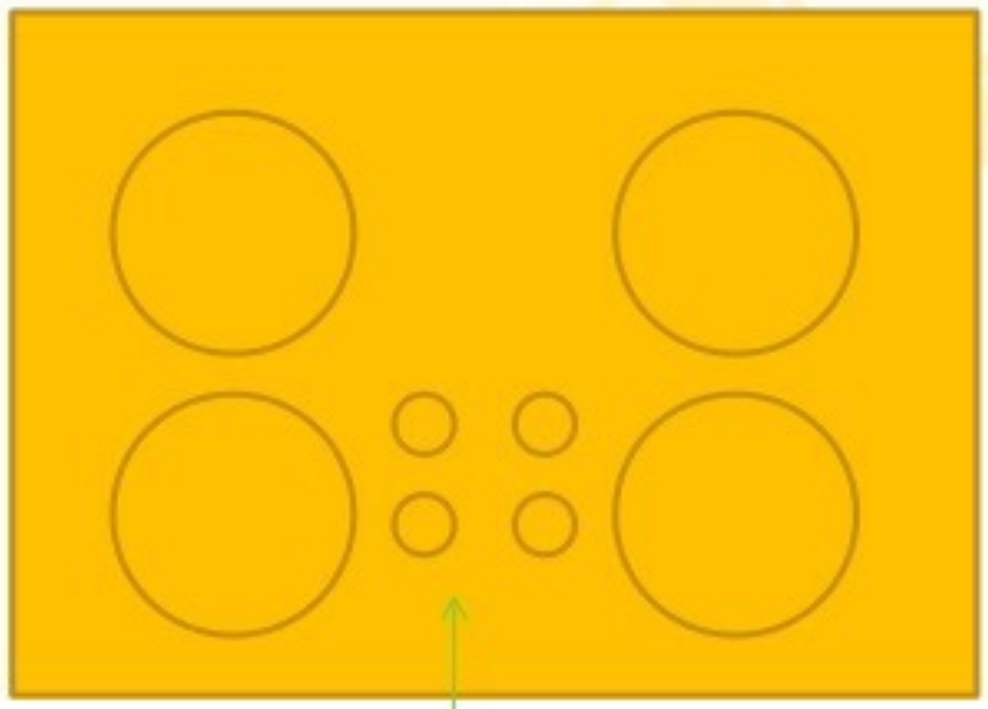


Knowledge in the Head vs. Knowledge in the World

- Donald Norman

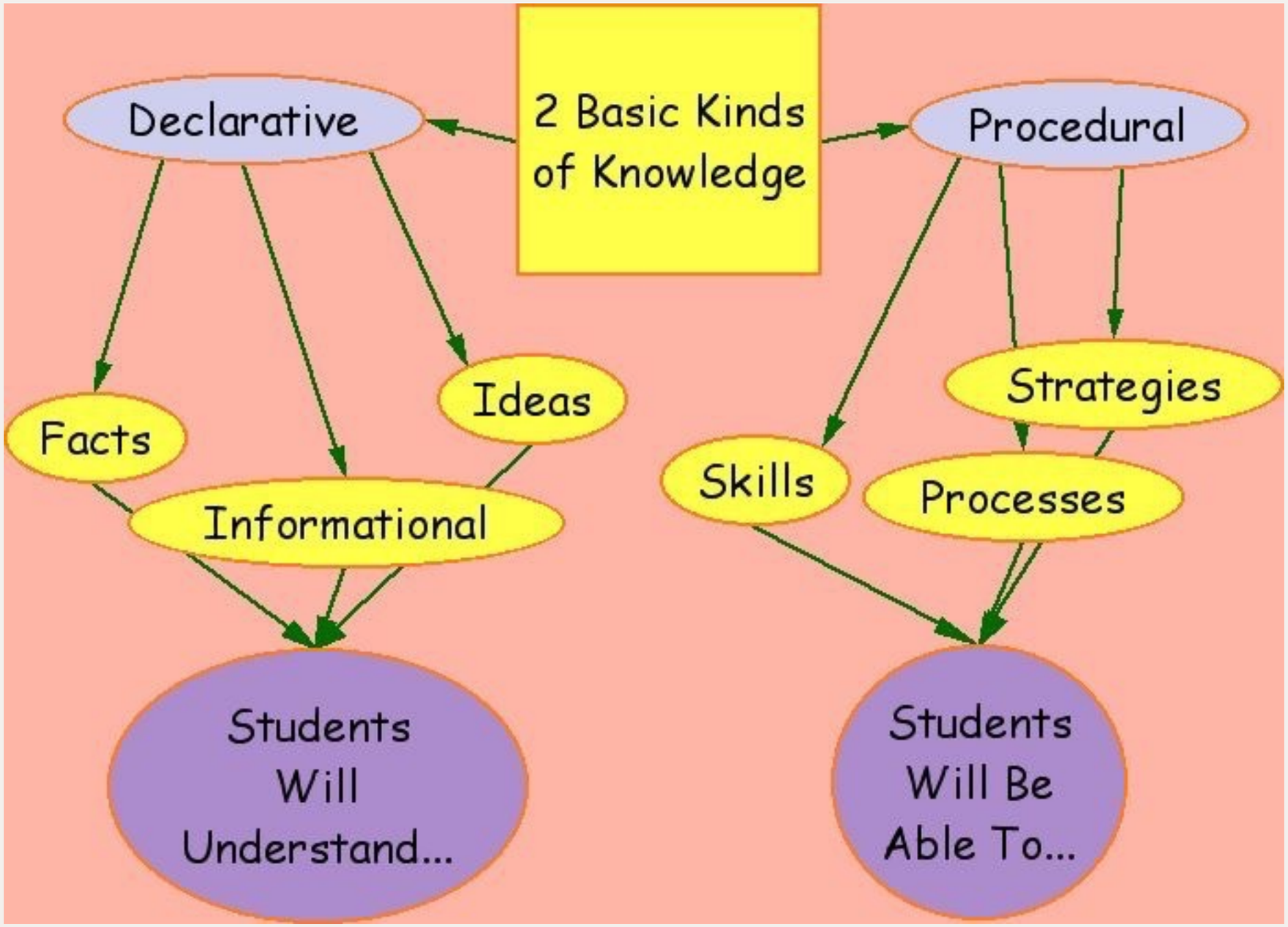


Requires memory or cognitive processing



Knowledge is embedded in the interface

Different kinds of knowledge

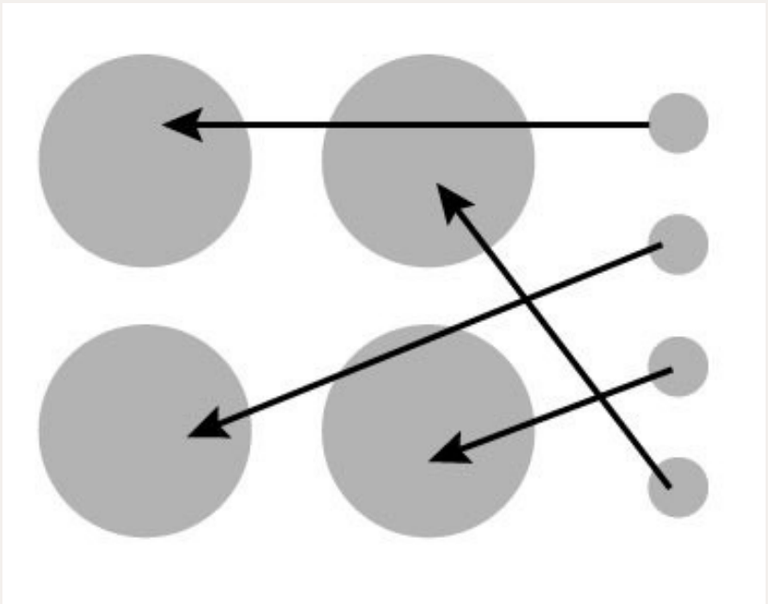


Constraints

Constraints are important in suggesting what we should do - so they should not be deceiving.

An object should suggest (afford) what it does (only one predictable outcome- GOOD MAPPING).

For example: an array of identical looking switches is a bad design



Constraints

Physical constraints – physical limitations, based on shape, size, etc.

Semantic constraints – limitations based on the meaning of the situation

Cultural constraints – limitations based on accepted cultural conventions

Logical constraints – logically induced limitations