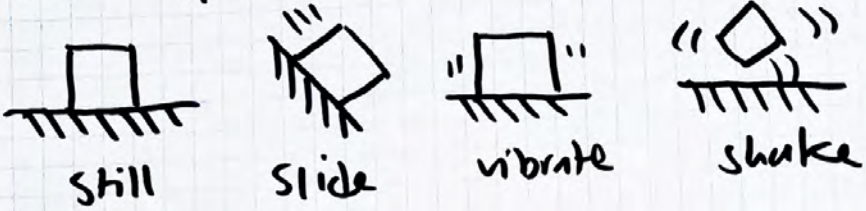
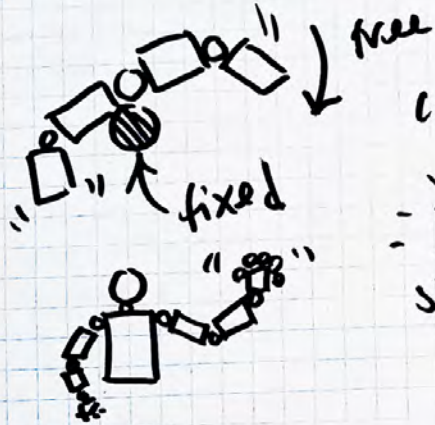
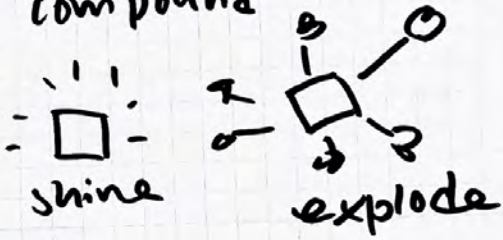
COGS 300 **Movement 04** Jan 22/26

warm up: make simple shapes move.

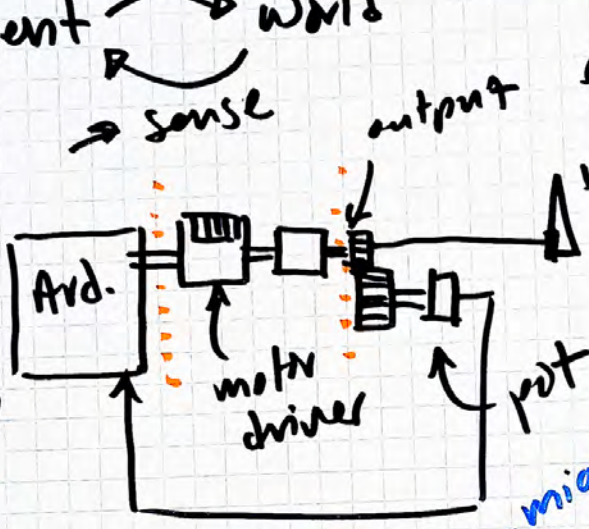




compound



agent → act → world
world → sense → agent

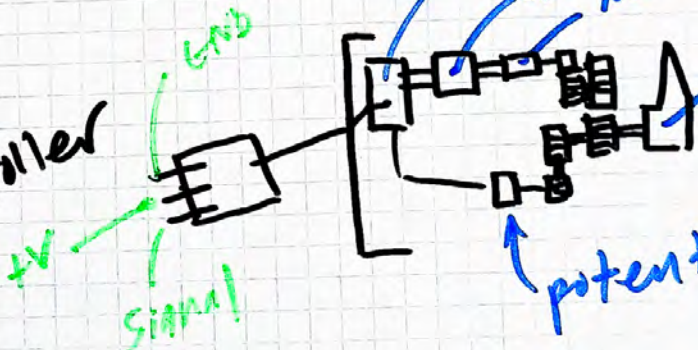


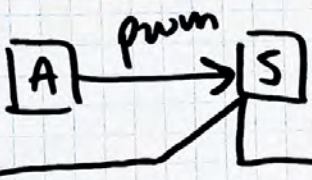
servo

microcontroller
driver
motor

Ard

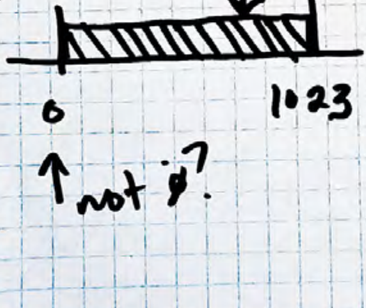
cheap micro controller






```
set = read(pwm)      get set point
pos = read(pot)      sense position
err = set - pos      calc. error
out = pr(err)        scale output
write(out)           drive motor
```

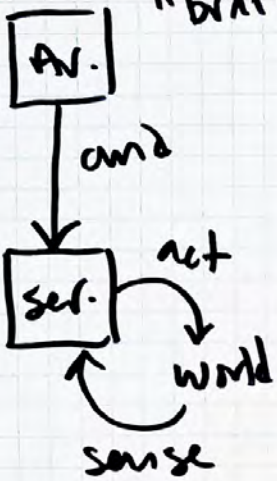
$$pr(x) = map(x,\ \overset{in}{lo},\ \overset{in}{hi},\ \overset{out}{lo},\ \overset{out}{hi})$$



$$\frac{70}{100} = 0.70 = 70\%$$

$$x = 70\% = 0.70 \times X = 716.1$$

$$map(\cdot) \cdot \frac{1}{5} = c$$



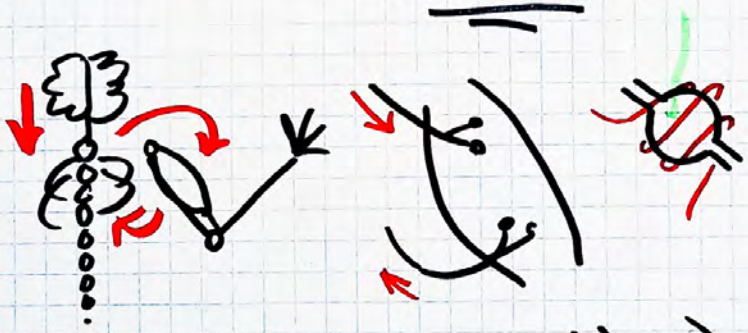
subsumption

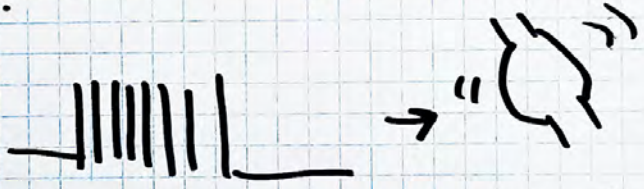
control

↓ subsume

module

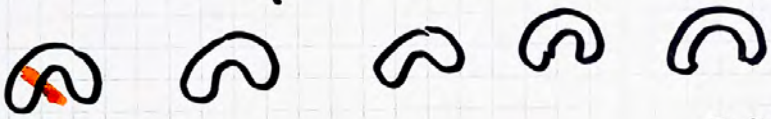
distributed

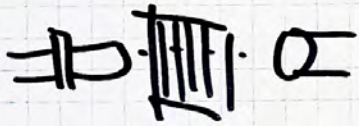




☆ How do you make the Arduino sense the servo?

★ How do you count rotations?





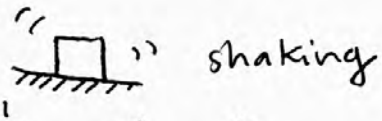
Movement 04

Warm up: simple objects in motion.

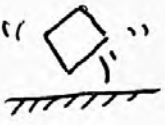
still

slide.

at fast!



shaking



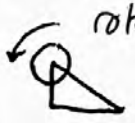
shaking a lot

falling

fixed

shine

ghost



rotating

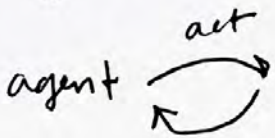
explode

constrained

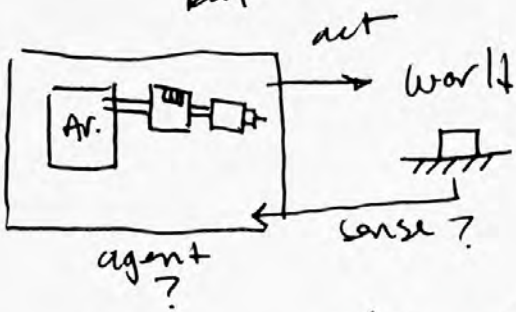
light

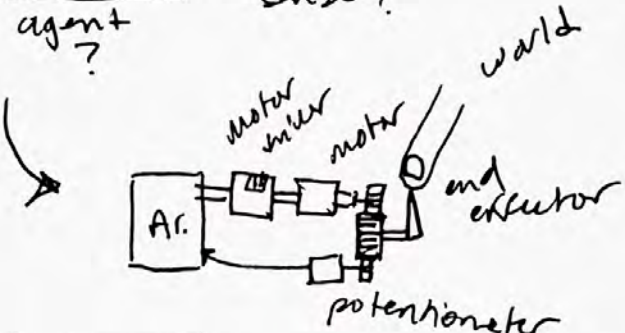
heavy

Last time: motor driver, rotational
Today: servos + encoders.



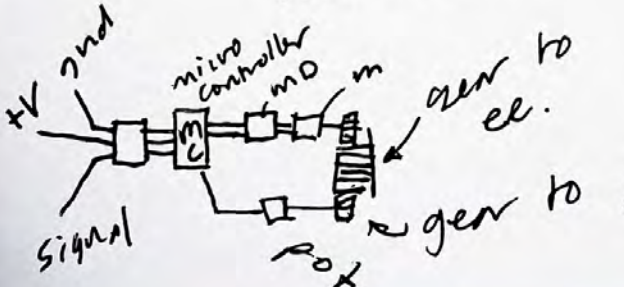
but



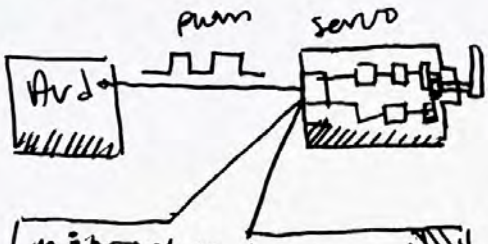


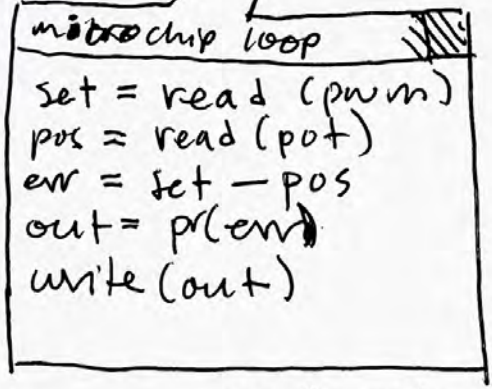
agent ↔ world
a bit clumsy...

servo: what if we just took all that stuff and made it small?



☆ Build servo circuit





pwm = 180° = set = read (pwm)
pos = read (pot) = 100°
err = 180° − 100° = 80°
out = pr(80°)

write (out) ↑ some proportional function

↑ fast or slow

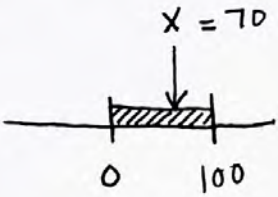
pr(x) = map (x, 0, 180, 0, 255)
(x = 80°)

or

pr(x) = min (5*x, 255)

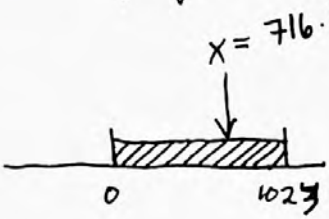
you choose.

map(x, lo_{in}, hi_{in}, lo_{out}, hi_{out})



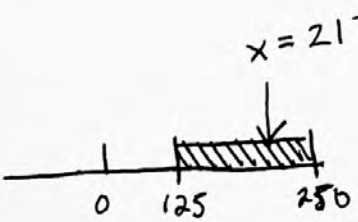
$\frac{70}{100} = 70\%$

range

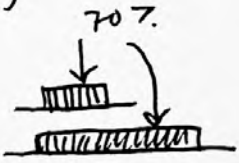


$\frac{716.1}{1023} = 70\%$

$0.70 \times 1023 = 716.1$



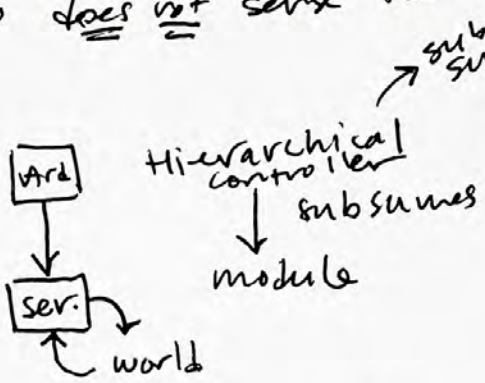
why?



Hi = 250
Lo = 125
diff = Hi − lo = 125
125 * 0.70 = 87.5
x = 87.5 + diff = 212.5

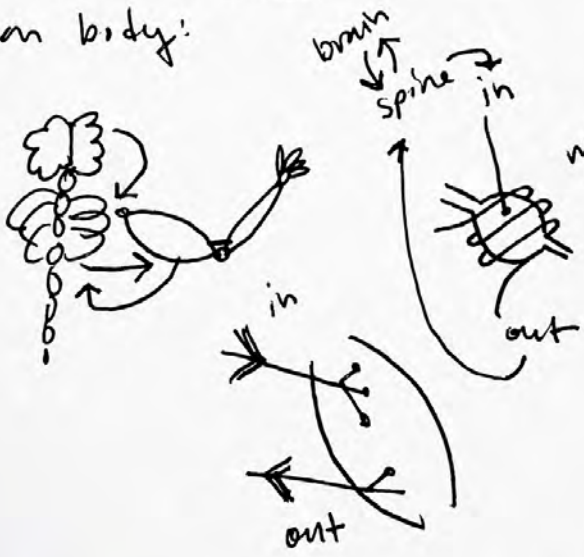
gr. 6 math ... but difficult w/o practice!

Almost all robot arms use servos.
But although the servo does sense itself, the Arduino does not sense the servo.



This is a distributed system.

Human body:



Ask the question: if processing is happening in the muscle that the brain doesn't know about, is it part of the intelligent system?

☆ Design a continuous servo.

Knowing what you to about sensors, incl. pots, there's a reason you can't "just" have a continuous servo.

→ alg.

→ mechanics.

→ sensors?

robot arm.