COGS 300 **Movement 04** Sep 18/25

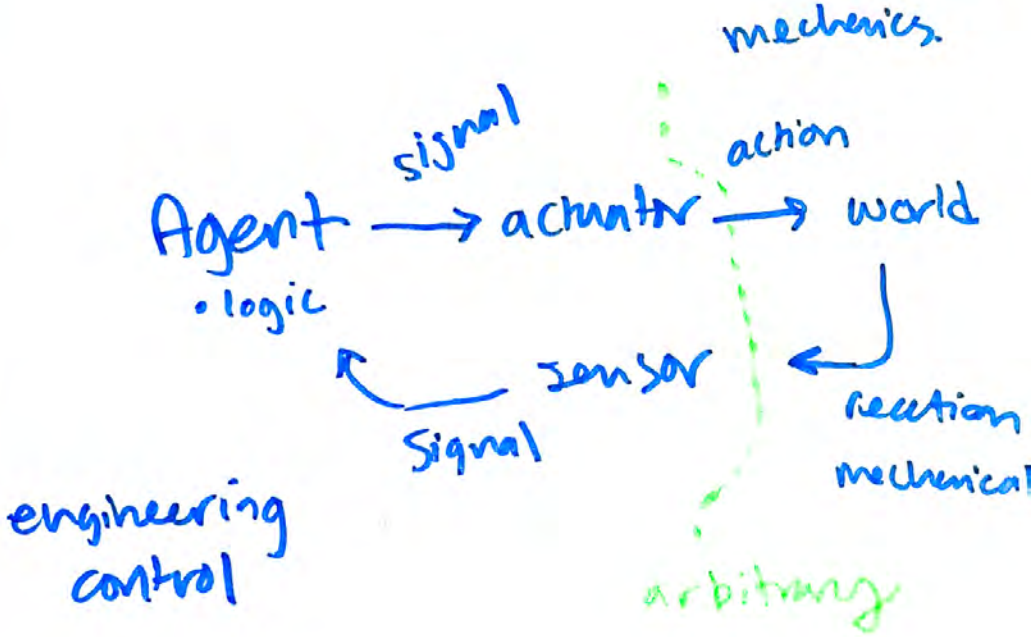
Warm up: Draw multi-link "robots". Try grounded + ungrounded.

How do they "move"?

What does it take to move?

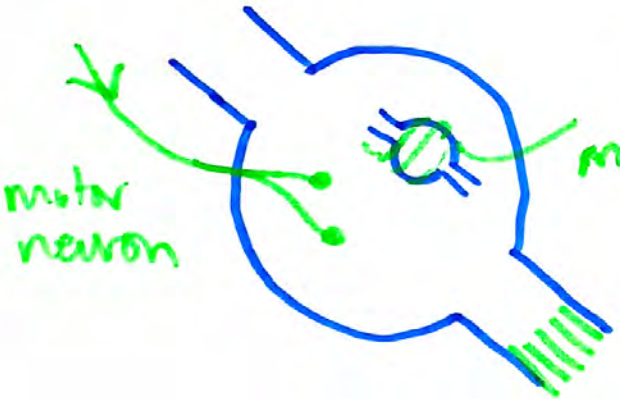
logic

if
els


mechanics.
signal
action
Agent
actuator
world
• logic
sensor
reaction
Signal
mechanical
engineering
control
arbitrary

Muscle movement

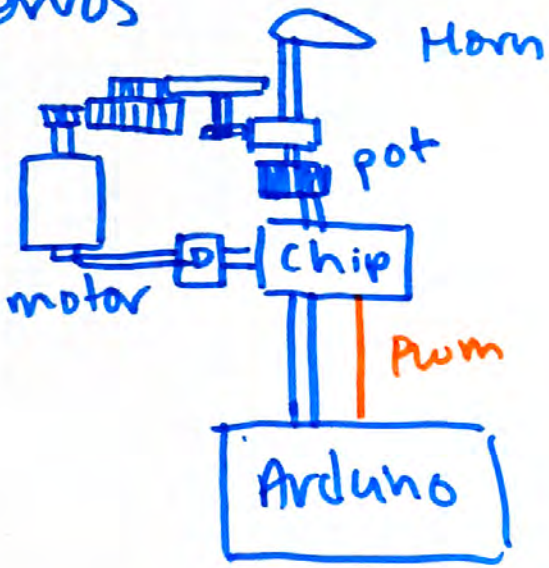
"model"

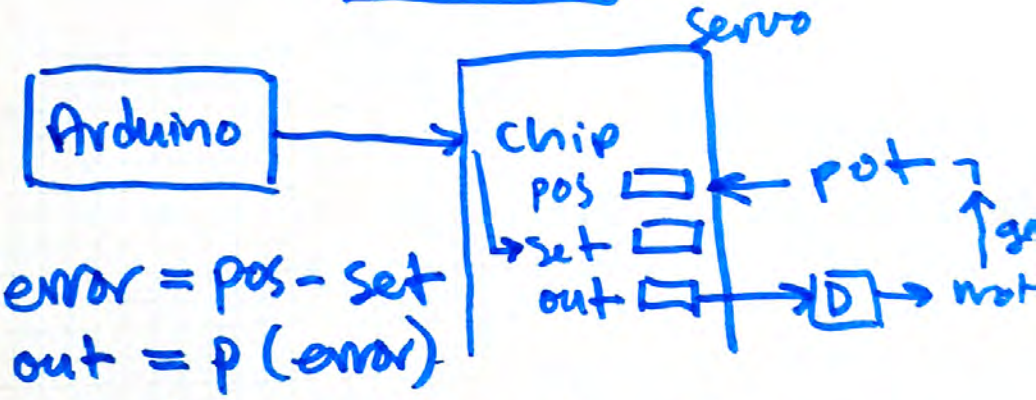


proprioception

button

Servos





→ Make 2 DOF Device

Grounding

More grounding = higher accuracy = lower freedom

high control over position

inverse kinematics

subsumption / hierarchical / modular

module: servo

distributed system

Control

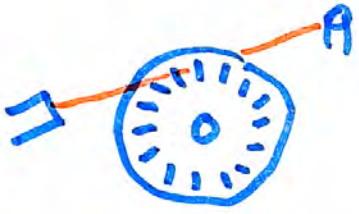
PWM Signal

PID

proportional Integral Derivative.

error = set − pos.

encoders.



subsumption architecture

understand human movement?

COGS 300 Movement 04 Sep 18/25

What does it take to move?

Actuation

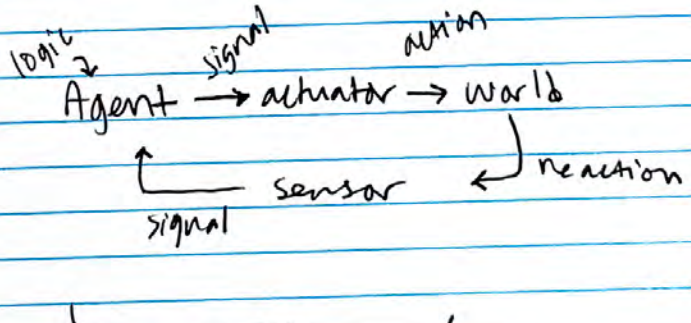
- power
- actuator
- mechanics

sensation

- power
- sensor

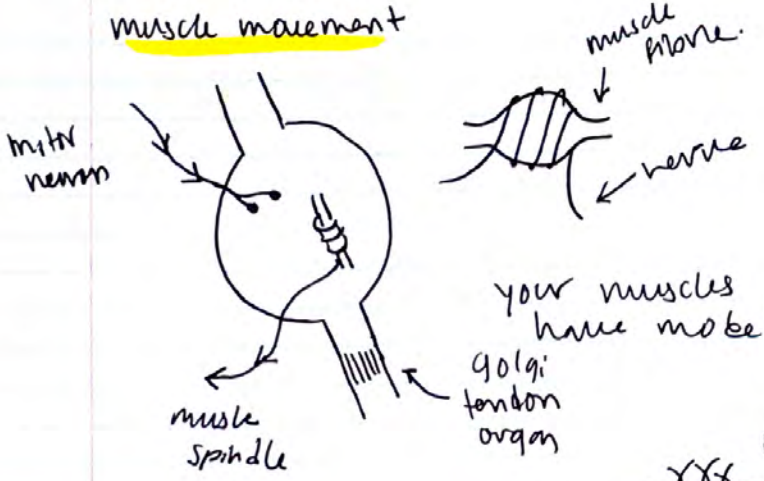
- control

signal logic.



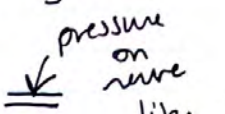
general engineering control diagram.

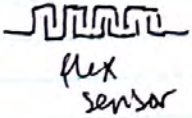
muscle movement



your muscles have models!

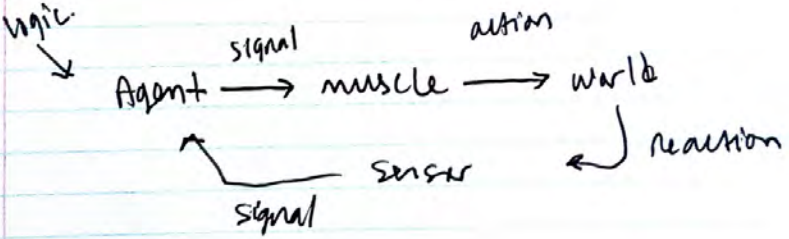
flex sensor?
button?
potentiometer?
} all models.



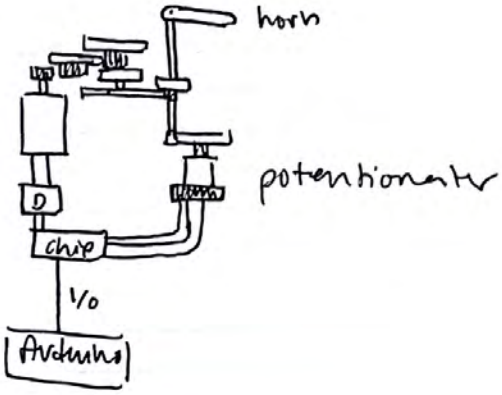


potentiometer

joint angle sensor.

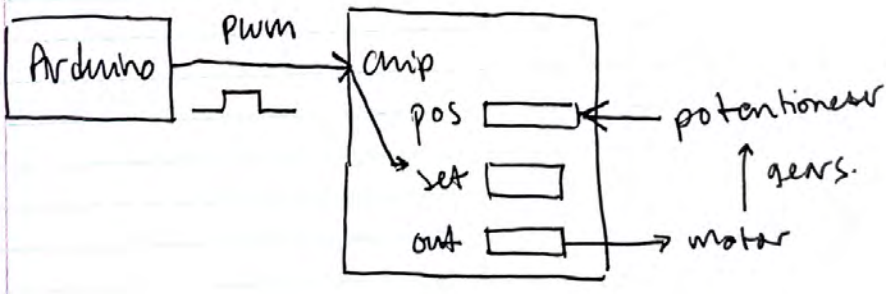


servos: the full loop in one module.



Try them now! ☆ servo demo.

How is this working?



error = pos − set

out = p(error)

↳ feel it w/ hands!

Design a continuous servo.

You can feel that the servo is mechanically blocked.
That's because potentiometers have a physical limit

can only turn so far...

need → feedback!

Preview for next week:

- Optical encoder
- localization

→ inverse kinematics + grounding
→ modular / hierarchical / subsumption architecture.
→ Hen ex.