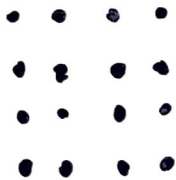


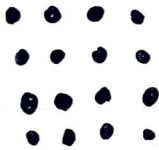
# LII - Swarms II

mindful exercise.

Draw a field of dots



What makes a dot stand out?  
Try varying properties.



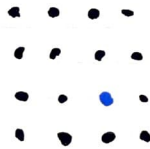
vs



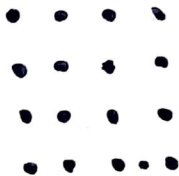
vs



vs

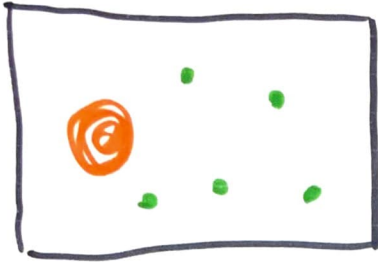


vs

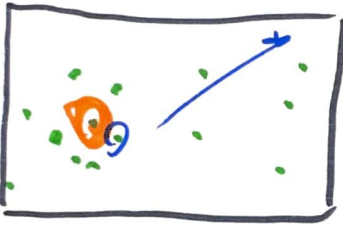


etc.

# Bees → Beecluster algorithm



- bees like being  $\sim 36^{\circ}\text{C}$
- move randomly
- moving up a gradient is not easy not the goal



emergent property  
of clustering w/o  
any or bee "max"  
in

- move randomly
- stop when they encounter another "bee"
- stop a little longer depending on light/heat

→ what robots need?

which sensors?

where on the body?

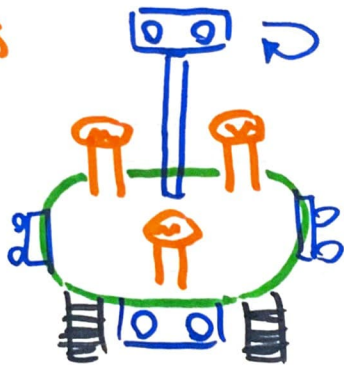
how would they work?

space?

→ photoresistors

→ 2 DC motors

→ ultrasonics



deterministic →  
probabilistic

emergent  
individual  
group

→ statistical  
guarantees  
guarantees

Why bother?

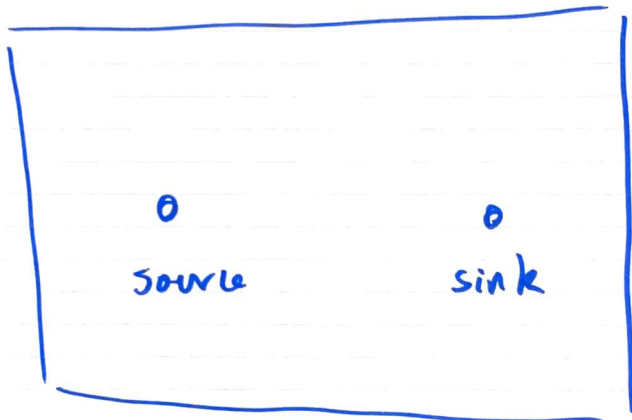
- individual robots are cheap.  
easier to manufacture  
if one breaks, you don't care

distributed systems  
are robust = Swarms

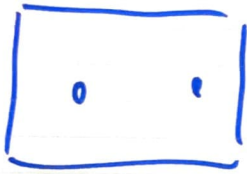
- more efficient  
trade off space vs. time
  - model real world behaviours.
  - forces you to be strategic + realistic.
- large-scale mapping/navigation  
→ dangerous jobs → small jobs quickly  
→ war → self-assembly

# BEECLUST.

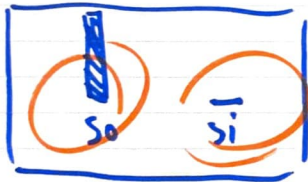
- move randomly
- stop @ another bot
- wait longer if brighter



- "bees" can be in 2 states food/no
- can tell each other's states
- source → sink

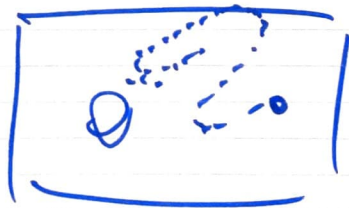


- Random
- stop @ bee
- check state change
- wait w 30s on change.



↓  
like black/white

memory?



→ what parts of human intelligence  
are swarm-like?