COGS 300 Emergence 04 Mar 12/26

warm up: flow diagrams

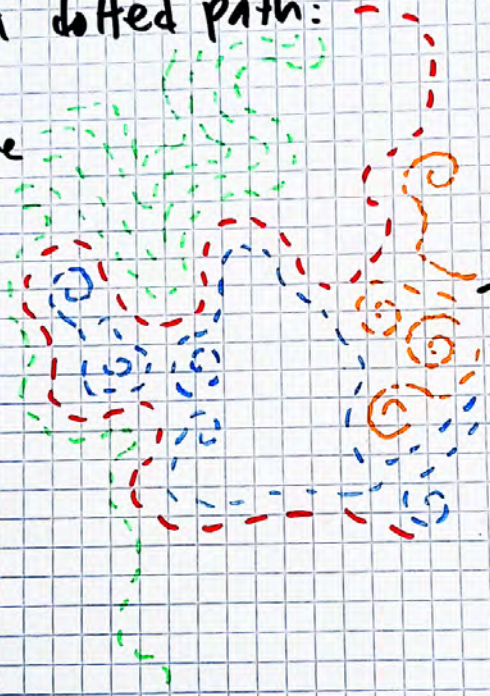
start a dotted path:

let it wander

add more paths:

follow + diverge

try to curl



can Langton's Ant learn?

↳ is state change learning?

Ant Hill

1 slot of memory
0-3 state.
NSEW

no more than 10.

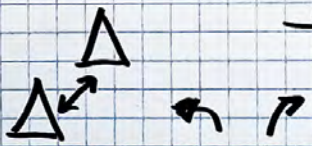
only build a wall
(Black / white)

★ How can you direct future ants towards the goal?

★ If the environment can have more states, can we converge to goal?

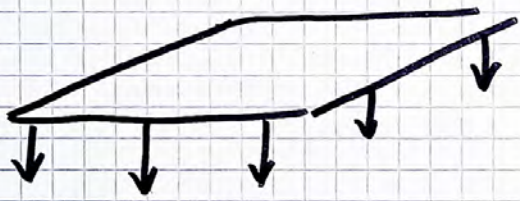
→ memory
↳ internal (small)
→ external (large)

→ sensing



Turn slightly towards path.

4 design challenges pick two.



lights.

make a robot that can modify the lights so that future robots can solve the maze better.

→ diagram → annotations
→ explanation

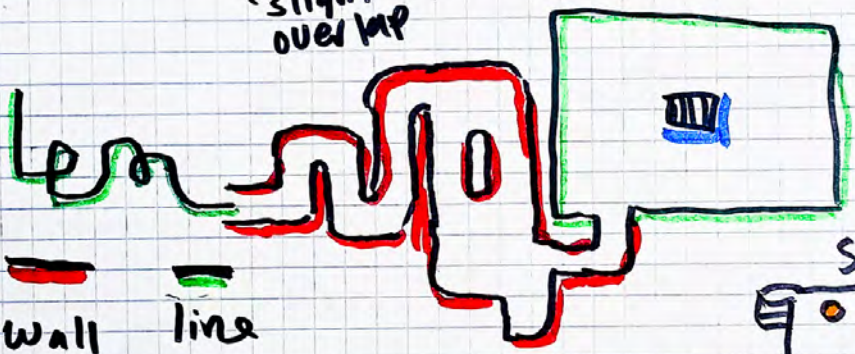
Assumptions: (make up your own)

lights in grid

space at 6 in.

↑ slight overlap

Initial maze: an bright

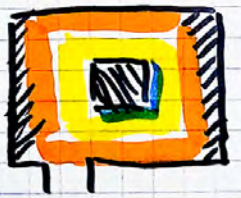


wall line

object

bright

dark

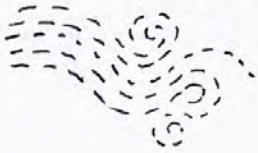


robot circles object, darkening further

future robots follow light

Emergence 04

Warm up: vector fields + flow.



Notice turbulence.
Is flow chaotic?
What makes it predictable?

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can Langton's Ant learn?

In one sense, yes. Learning as state change: it has memory.

where is the memory?

head state ↓↑→← + ...?

or is the memory in the environment?

agent + world are the same.

Let's make random Ant Hill Each move is rnd(NSEW). Bounce off of walls.

1 ant at a time.

Ant can have 1 slot of 10-state memory, ie. store 0-9.

can we improve perf?

random start + random goal but multiple runs from same pos.

Not much. Ant couldn't traverse enough to really make a diff.

→  wall is just wall, it doesn't know NSEW.

↓

4-state 1-slot could carry this.

what knowledge does this take?

can't remember pos — not enough space.

But what if the ant could build a wall?

☆ Design an alg. to build a wall.

modifying env. is a collective memory.

Let's try another soln. No wall, but ant can "drop" hints. Let's say orange from light to dark.

Ant can store last orange.

Now we get a gradient.

☆ Design alg. to drop hints and follow hints.

Now give the ant a 4-square front-facing sensor.

can choose highest gradient.

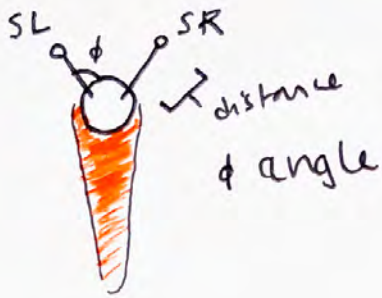
I claim this is intelligence. But at a system level.

→ memory mostly external
→ good/bad evaluation
→ goal-directed behaviour.
→ sensing.

To become intelligent, Conia would have to evolve memory, state-based dec. goal-directed behaviour, sensing.

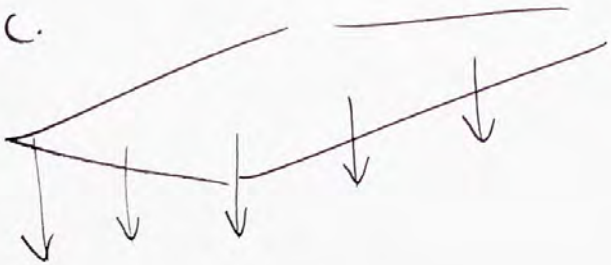
Emergence + swarms.

→ flocking
→ Traffic sim.
→ physarum
  ↳ video
  → sim.



Low decay: white noise almost
Hi decay: also noise. → Hi/low sensor.
complexity finds sweet spots.

✱ DC.



array of lights + Camera.

Design a learning bot using lights as units.

↳ Final exam.