

COGS 300

Emergence 03

Oct 28/25

Last week, we learned about cellular automata, particularly extensions of Conway's Game of Life. Importantly, the Agent-world distinction was not really there for these Automata.

As we move into swarms, although our simulations are at a higher level, I want you to imagine that there is an underlying automata behind every pixel. Automata are sort of "atom" level, whereas swarms are sort of "cell" level.

For swarms, we start to move towards an agent-world distinction. But some agents directly reconfigure their worlds. (like Langton's Ant).

Physarum is a slime mold.

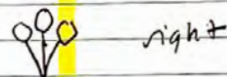
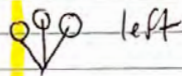
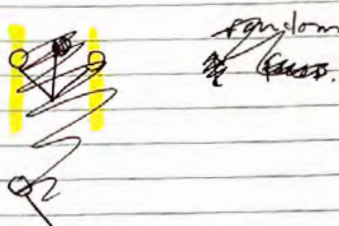
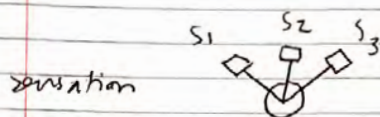
→ Video

Despite the simplicity of a slime mold relative to us, it is both intelligent and hard to simulate. We'll explore a simple agent-based particle simulation.

→ Sage Jensen's simulator.

Agent

actuation $\circ \rightarrow$ moves forward
 $\circ \curvearrowright$ rotates.
 $\text{---} \circ$ leaves a trail.
 $\text{---} \circ$ angls.



★ Play w/ snake's sim to discover emergent effects.

- scale of effect
- structure vs. random
- forms (tentacles vs ...)

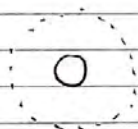
↳ compare to Langdon's Ant + GOL

* traffic waves. \rightarrow emergent effects.

\hookrightarrow \sim PID behaviour. \sim 1D env.

* flocking (Shibata).

2D sim.



sense
radius.

$\bigcirc \rightarrow \leftarrow \bigcirc$ cohesion force

$\leftarrow \bigcirc \bigcirc \rightarrow$ sep. force.

* what counts ^{super-} "agents"?

\hookrightarrow try different thresholds of force + rad.

\rightarrow measure statistically?

\rightarrow design experiment.

if time: make agents goal directed.

\rightarrow live/die? \rightarrow resources?

\rightarrow hunts in env?

play room.

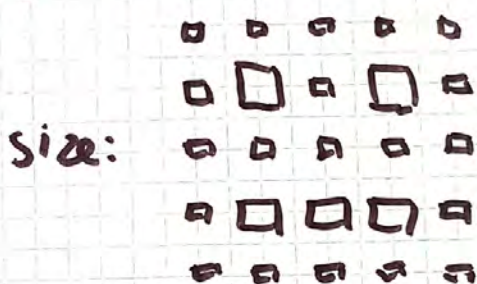
exp.

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Warm up: Make a shape emerge
by only varying one
property. Eg. shape:



alignment? colour? Think "magic eye"

Agent



↑
FWD



↑ left



→ right