

Emergent Engineering?

The Boids Algorithm

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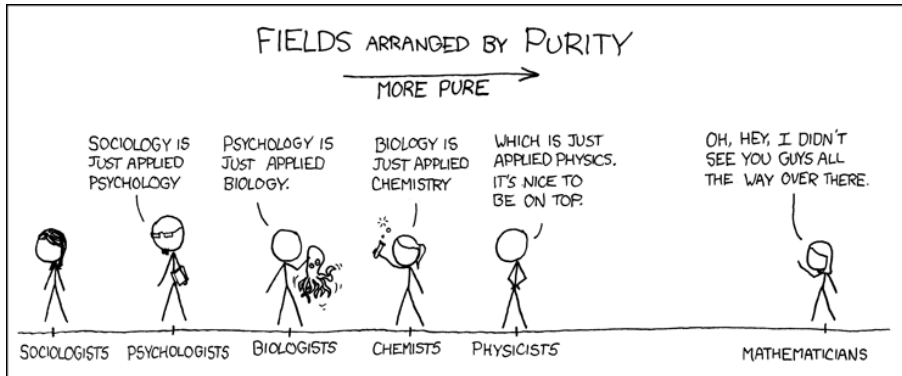
SASE Labs UMN

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Motivation

- Emergence is an idea to keep in mind for all majors
- Genetic algorithms and ANNs, which are emergent algorithms, are successful
- Swarm intelligence is pretty promising for nanorobots doing tasks like tumor killing



Introduction

- What is emergence?



- What is the Boids algorithm
 - Another history lesson

Simple rules

- Steer to avoid crowding
- Steer in the general direction of your neighbors
- Steer so that you are generally in the middle of the pack

- Main loop

```
    for each boid
        avoid()
        follow()
        center()
    end
drawBoids()
```

- Center

```
center, numNeighbors = 0
for each otherBoid
    center = center + otherBoid.center
    numNeighbors = numNeighbors + 1
end
if numNeighbors > 1
    center = center / numNeighbors
end
velocity = (center - curPos) * avoidFactor
```

- Can you guess the pseudocode for follow and avoid?

Let's try it out: <https://sase-labs-2021.github.io/boids>

Next steps

- Can you extend the Boids algorithm? Perhaps add a predator that scatters the boids? Or implement the algorithm in 3d?
- Find a game you like that you can interact with programmatically. Can you write a genetic algorithm for playing that game?
- Watch [this cool video](#)