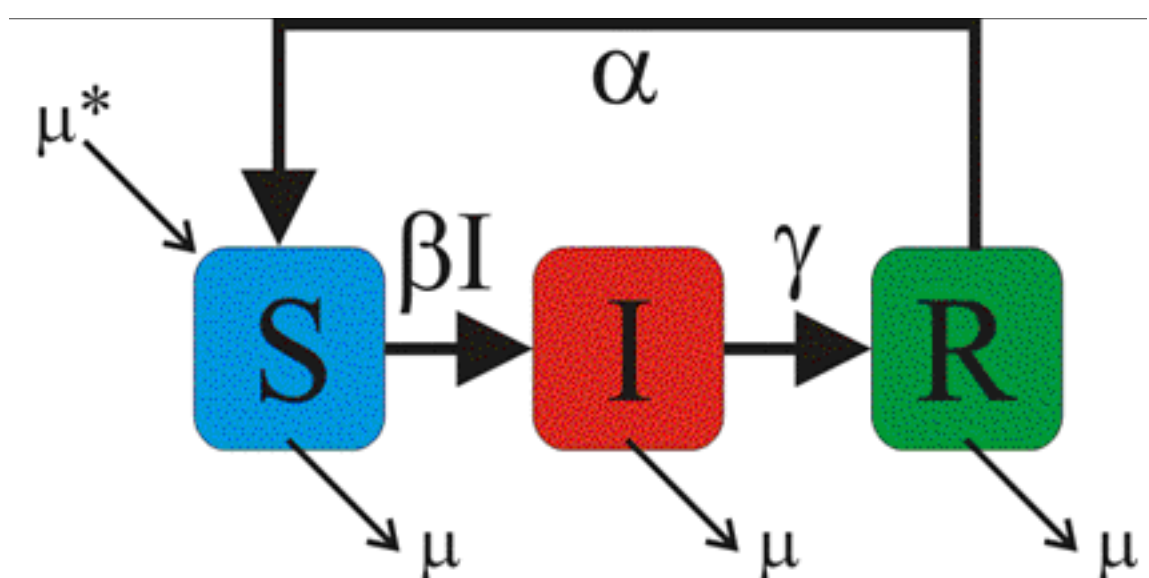
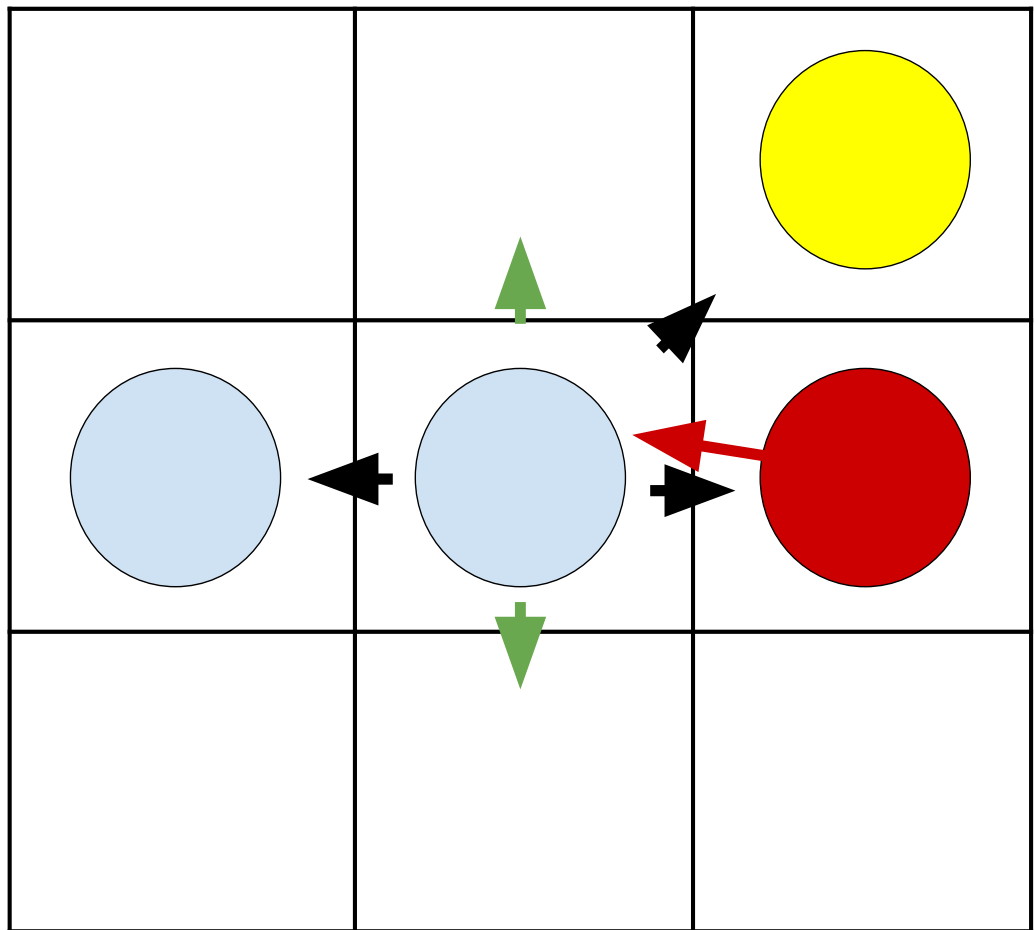


AGENT-BASED MODELING

Agent-based modeling allows us to go past simple stock and flow or difference equation models.



We can integrate discrete-time event modeling with a framework of individual ‘agents’ who each obey certain rules. When we populate them on a grid, and study the dynamics and interactions that occur, we can glean numerical and spatial conclusions about our model.

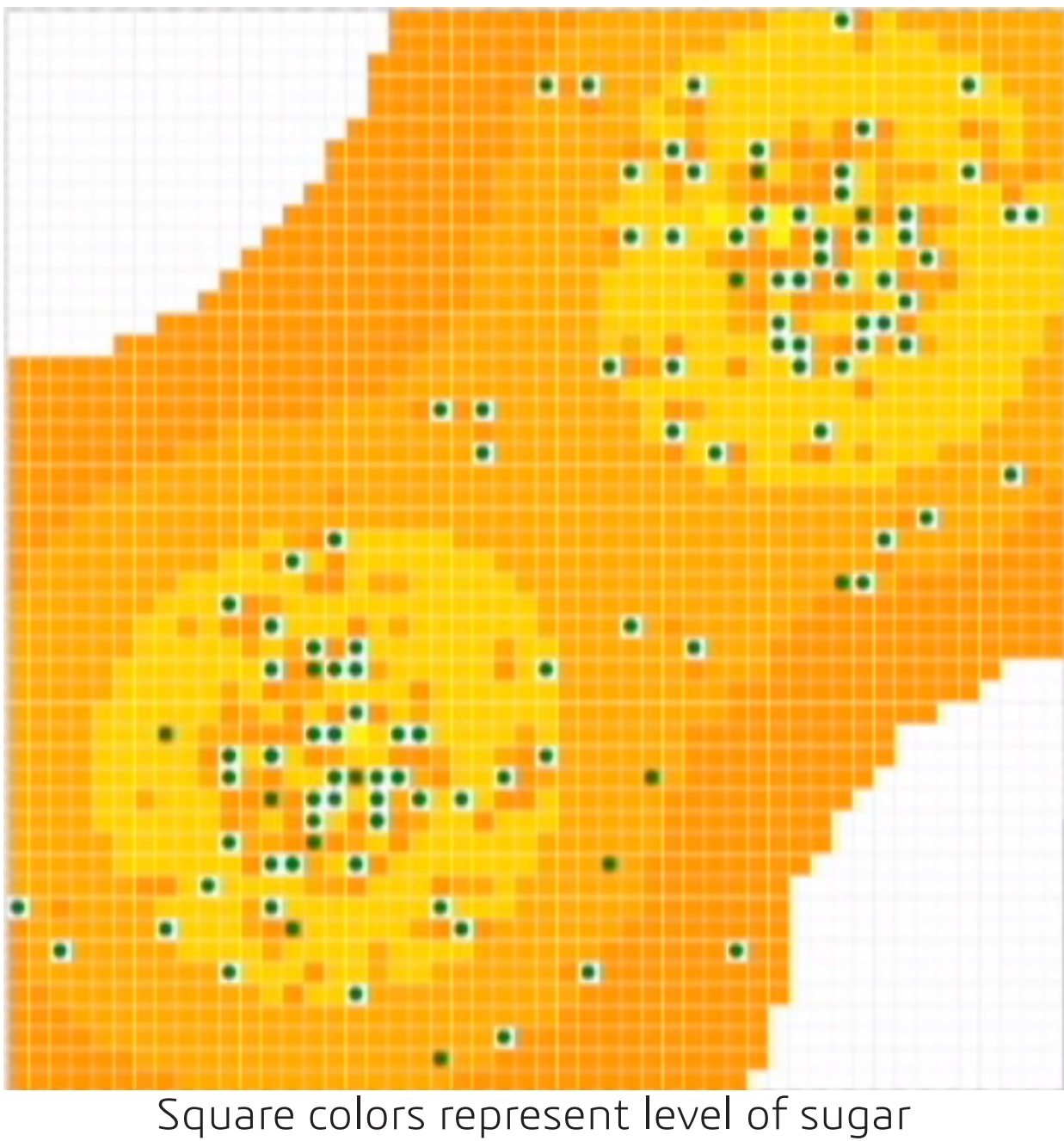


1. Move to adjacent square IF INFECTED
2. Infect any adjacent agents
3. π chance to Recuperate
4. $3 \times \beta$ chance to die IF UNINFECTED
5. α chance to contract if infected
6. β chance to die

Social modeling lies at the intersection of these concepts

SUGARSCAPE

Sugarscape is an agent-based social model that was created in 1981, and has been used to explore everything from warfare to systems of lenders and borrowers. It consists of agents roving across a grid in search of ‘sugar’, which allows them to survive.

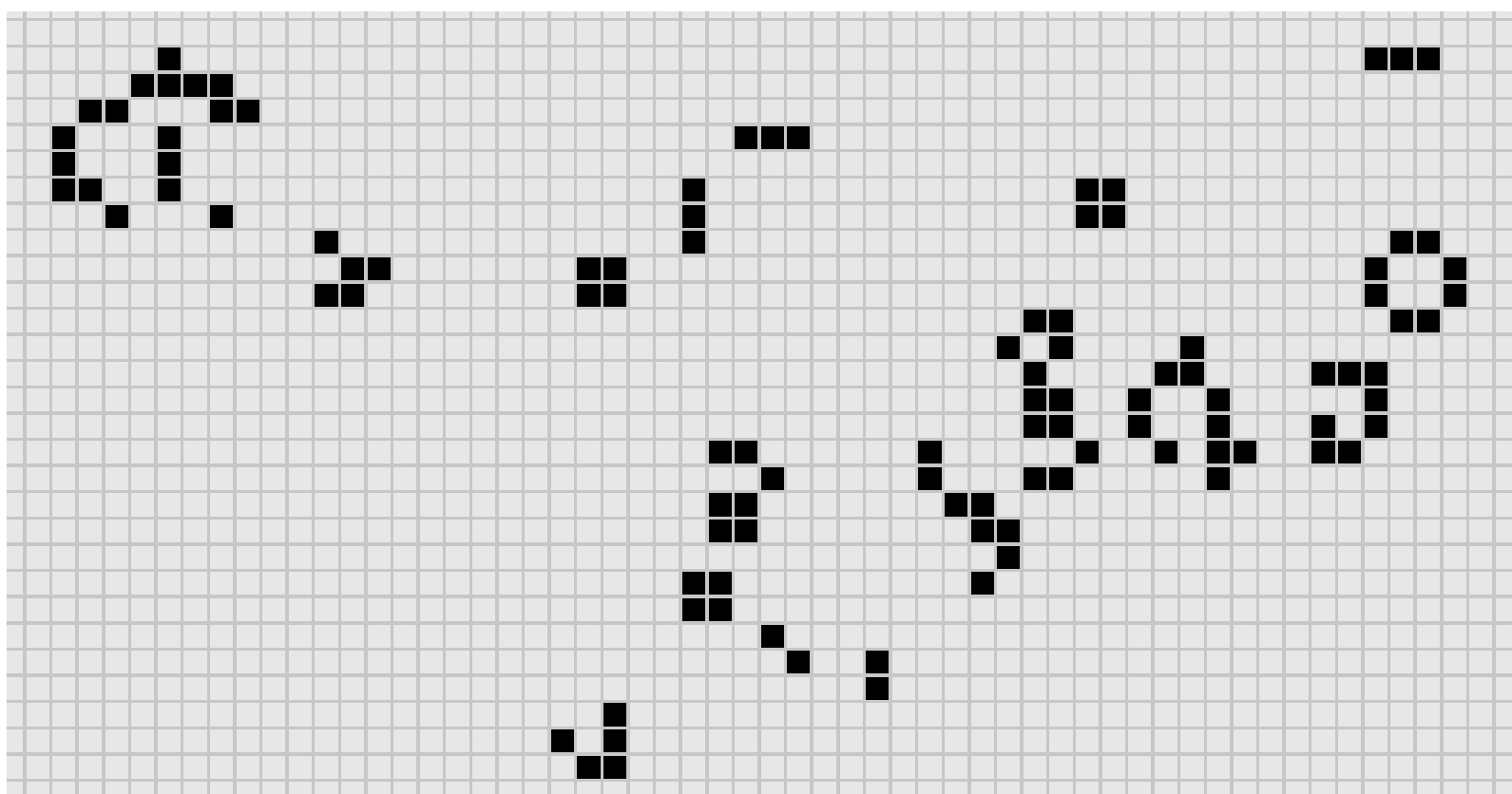


Square colors represent level of sugar

The classic implementation of Sugarscape involves studying wealth distributions. From many initial conditions and distributions of agents, a wealth distribution which mimics many modern countries emerges. The vast majority of agents fall into the lower class of the scape, with very few agents living with a large amount of collected wealth.

COMPLEXITY AND EMERGENCE

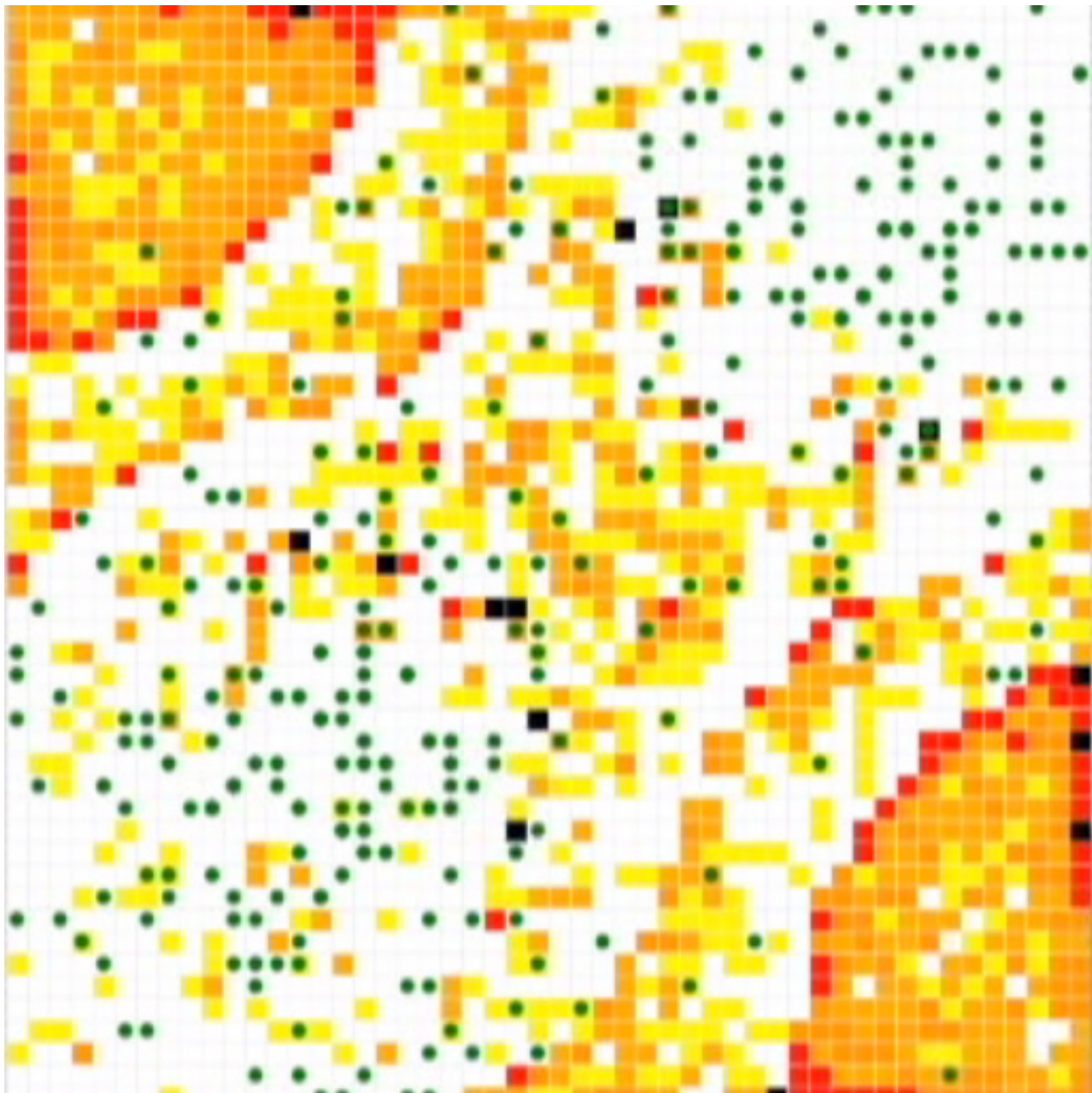
Complexity is poetically termed the edge of chaos. A small change can result in an unexpected yet understandable effect. The understandable effect or pattern that we look for is known as emergence.



Conway’s Game of Life is a two-dimensional cellular automata which exhibits very clear emergence. Cells on the grid either ‘live’ or ‘die’ based on the amount of neighbors they have. These simple rules create stable structures such as squares or rings, oscillating patterns known as ‘blinkers’, and even dynamic ‘gliders’ which move across the map and retain their shape. All of these are emergent structures.

A POLLUTION MOVEMENT MODEL

I used a Sugarscape model to analyze pollution collection. Agents manage to succesfully move the majority of pollution into the ‘dead zones’, while still creating a few ‘landfills in the rich zones. When agents were effective enough at moving pollution, it could raise the overall wealth to a level above no collection.



Square colors represent level of pollution

