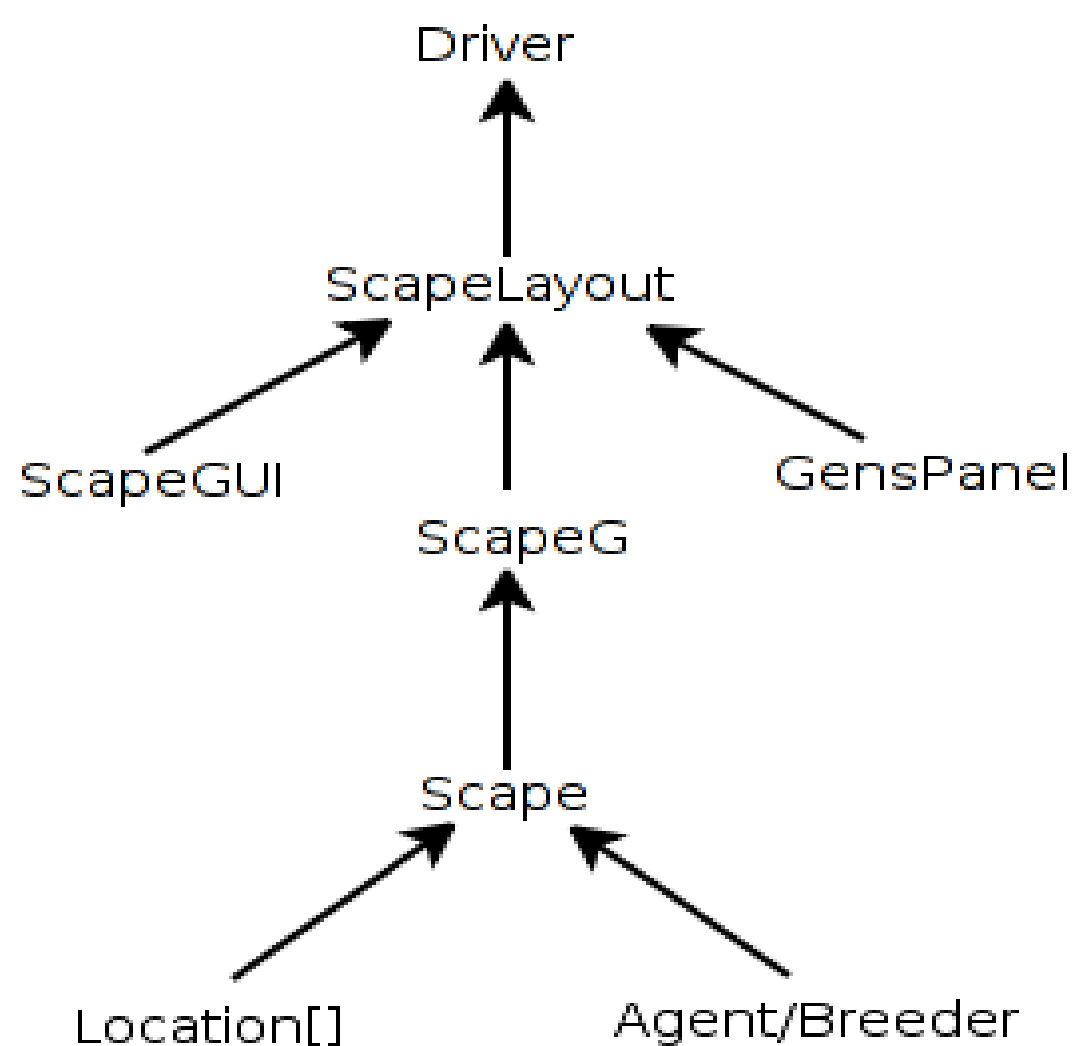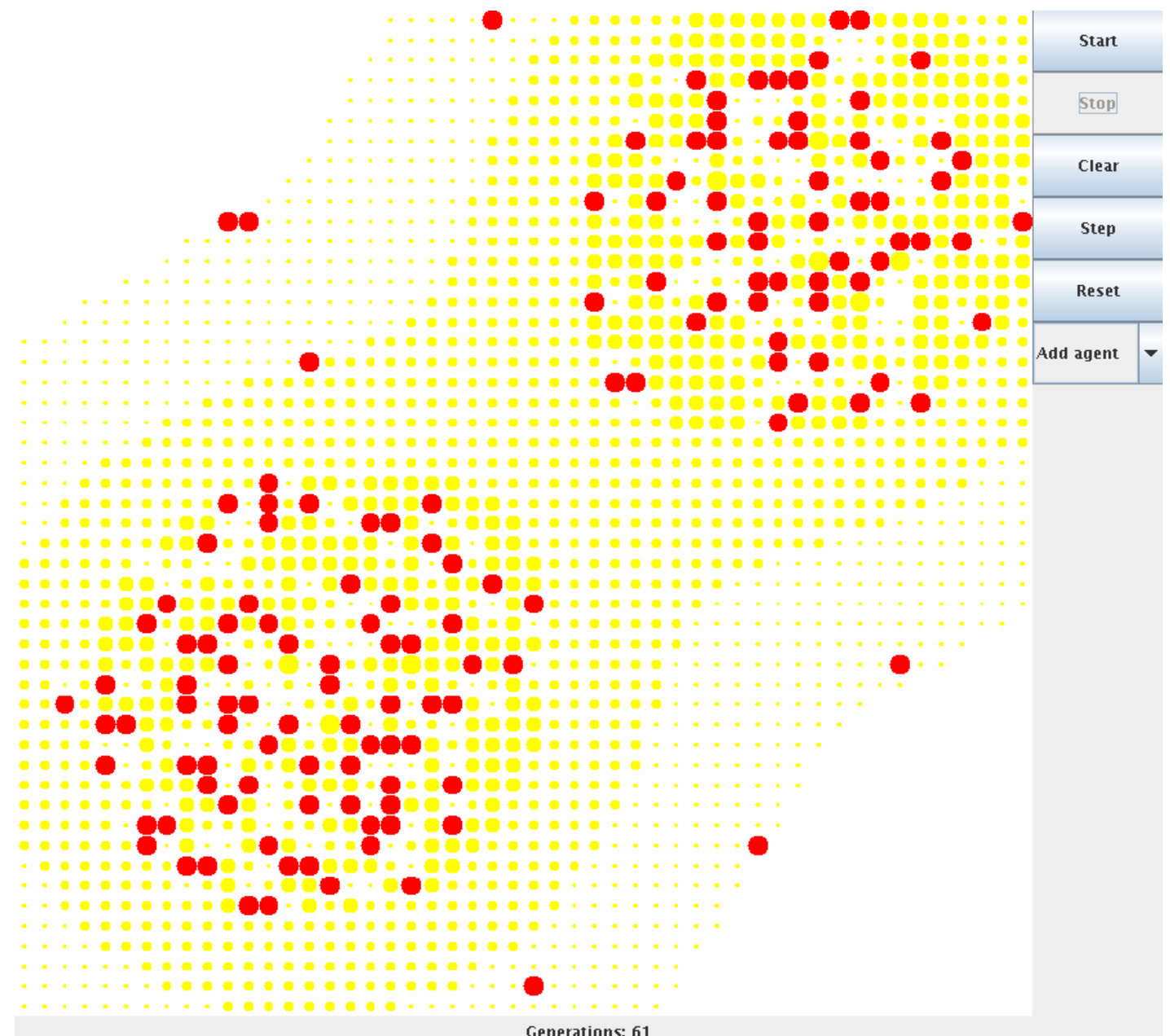# Sugarscape: An Application of Agent Based Modeling

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- **Abstract:** Computer scientists have long tried to simulate things like life or human culture with computer programs. Agent based modeling is an effective strategy for this, using the idea that many complex phenomena come from the interactions of simpler pieces. Sugarscape is an implementation of agent based modeling that simulates human society and culture.

- **Background:** Agent based modeling grew out the idea of *cellular automata*, and may be considered a more complex form of these. A cellular automaton is a grid of cells, each of which can be in one of several states. Which state each cell is in is determined by local rules, which usually rely on what states neighboring cells are in to determine a given cell's new state. One well known cellular automaton is Conway's Game of Life, where cells have only two states. In agent based models, there are relatively simple rules that govern the behavior of agents; from the interactions of these agents, which may or may not be based on a grid, complex behaviors emerge. One of the earlier agent based models was *Boids*, which simulated the behavior of flocking birds. In general, each agent tries to avoid crowding the other agents, while staying near them and flying in the average direction of nearby agents. From these simple rules, flocks of agents that travel across the "map" arise.

My program while it is running. Agents are red circles; the size of the yellow circles shows how much sugar is there.

The structure of my program

Rules

- Sugarscape Growback Rule G(A): At each location on the scape, sugar grows back at the rate of A units every unit of time until the amount of sugar is the maximum allowed at that location.

- Agent Movement Rule M: Each agent looks as far as it can in the four permissible directions: north, south, east and west. The agent then moves to the closest unoccupied location with a maximal amount of sugar and collects the sugar at that location.

- Breeding Rule S: Agents have ages and genders. When two agents of opposite genders are next to each other, a new agent (their "child") will be created next to one of them with half of the sugar from each of them (so that it doesn't immediately starve to death).

- **Conclusions:** Agent based modeling is a powerful technique for simulating complex systems. However, it has its own pitfalls to avoid involving the interactions of its many elements.