

User's Manual

Intro

Thank you for placing interest in this artificial life simulation, created by TOPS students Andrew Li, Ava Pun, and Jasmine Zhu. The program simulates a flock of bird-like objects, also known as 'boids', and can be customized by the user to suit their needs. In order to get the most out of this simulation, you must understand first how the boids move. The movement of a boid is controlled by three main factors:

- **Cohesion**
A boid moves towards the average position of its flock-mates (boids within its vicinity).
- **Avoidance (Separation)**
A boid moves away from other flock-mates in order to maintain a set distance between them. It also attempts to move away from obstacles and predators.
- **Alignment**
A boid moves towards the average heading of its flock-mates (average location where nearby boids are headed).

Just by following these three simple rules, the movement of a group of boids can become very lifelike and realistic, resembling that of a flock of birds or a school of fish, almost behaving with a sort of intelligence. You, as the user, can adjust many of the settings affecting the movement/behaviour of the boids.

Getting Started

Download the contents of the zipped file, "Boids.zip", and extract the contents. Double-click on the file named: "Boids.jar" to run the simulation. "HigashiOme-Gothic.ttf" is the font used in the simulation- it will import automatically.

Functions

Starting and Pausing the Simulation

To start the simulation, simply click on the 'Simulate' button. You can also pause the simulation by clicking the 'Simulate' button again.

Adding Boids

To add a boid, left-click where you would like for it to appear in the window. The "Simulate" button will start the simulation, and you can adjust the speed by moving the speed slider. Boids are represented as small coloured circles.

Adding Obstacles

To add an obstacle, right-click where you would like the obstacle to be placed. Obstacles are represented by squares.

Adding Predators

To add predators, hold down the Shift key and left-click where you want the predator to appear. Predators are represented by large coloured circles.

Adding Walls

The walls are “off” by default. Boids will pass straight through them and appear on the other side of the screen. To turn them on, click on the button that says, “Walls: Off.” The button title should change to, “Walls: On,” and should you want to turn them off, simply press the button again.

Clearing Entities

The rightmost three buttons on the control panel are preceded by the word “Clear:”. To remove all boids from the screen, click the button that says “Boids.” You can also remove all predators or obstacles in a similar manner.

Enabling Tails/Trails

Boids and predators have no tails by default. To add tails/trails to boids and predators, click on the button at the bottom of the window that says “Tails: Off.” We don’t recommend turning on tails when you have a **large number of entities** (boids and/or predators) on screen because this function tends to make the program run more slowly.

Changing the Theme

There are two themes in this program—“light” theme and “dark” theme. To toggle between them, click on the button at the bottom of the window that says “Dark:”. Upon changing themes, the button will change to “Light”, and will allow switching back to the Light theme. The default theme is “dark” (hence a black background). Similarly, the light theme consists of a white background and the colors of all boids, predator and obstacles will become the opposite of what they are in the dark theme.

Getting Help

The controls and some extra notes are provided directly in the simulation in the Info screen, which can be opened by pressing the “Info” button found at the bottom of the screen.

Settings (sliders)

1. Speed

This slider affects the overall speed at which the simulation “plays.” Moving the slider to the right makes boids and predators move faster, and vice-versa. This slider is found in the upper left of the main screen, not in the Settings panel.

2. Avoidance Radius

A boid will be “repelled” by other boids in its “surrounding neighborhood.” This slider controls the size of the “surrounding neighborhood” of a boid in terms of avoidance.

3. Cohesion Radius

A boid will move towards the average position of the boids in its "surrounding neighborhood." This slider controls the size of the "surrounding neighborhood" of a boid in terms of cohesion.

4. Avoidance Strength

Boids will repel each other if they are too close (within the avoidance radius). This slider controls the amount by which the boid will be repelled. In other words, avoidance strength dictates how far away the boid will move from boids within the avoidance radius.

5. Cohesion Strength

Boids will be attracted to one another if they are within the cohesion radius of each other. This slider controls the amount by which the boid will be attracted. In other words, cohesion strength dictates how much closer the boids will move towards other boids within the cohesion radius of them.

6. Obstacle Strength

This slider controls the amount by which boids will be repelled from the obstacles you place.

7. Chase Strength

This slider controls the amount by which a predator will move towards the boid it is targeting.

8. Chase Radius

This slider controls the distance a boid has to be from a predator for the predator to "detect" its presence and start chasing it.

9. Predator Speed

This slider controls the speed of the predators.

10. Boid Speed

This slider controls the speed of the boids.

11. Randomness

This slider dictates how erratically the boids will move.

Limitations and Bugs

- The walls are not impermeable - if sufficient boids are placed, their flocking movements will override the wall avoidance factor. However, this should not be required in architecture/city planning related research simulations.
- Turning on walls when there are boids off screen (or on the edge of the screen) traps those boids in the corners of the screen.
- When you add tails to the boids and predators, the program will 'lag' more than it would without tails.
- This program is meant to simulate the movement of flocking animals, not to simulate an ecosystem. Therefore, boids and predators will not reproduce, and predators do not have to consume boids to survive.