Food Chain Simulation using Allosphere

MAT201B Computing with Media Data
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Date: Mar 18th 2020

1. Introduction

The term food chain was first coined by British animal ecologist C.S.Eiton in 1927[1]. In the ecosystem, a link between various organisms due to food is called the food chain.

In this project, I use four different things to represent four creatures in the ecosystem, namely birds, bird predators (such as condors, etc.), ordinary beneficial insects, and poisonous pests. By writing programs, they can simulate the predation and predation of various organisms in nature in an ecosystem built using AlloSphere to achieve dynamic balance.
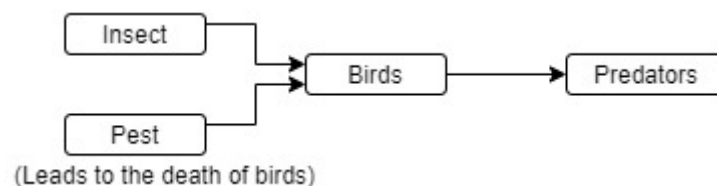

Figure 1.1 The food chain in this project

2. Procedure

2.1 Establish the creatures

In this project, we use triangular pyramids to represent various creatures by changing their color and size. White represents bird predators and orange represents birds. Green represents beneficial insects, while purple represents poisonous pests.

Figure 2.1 Four different creatures' representation

Taking into account the actual size effect, we set the size of the bird predator to the largest, followed by the bird, the two insects are the same size, but both are smaller than the birds.

2.2 Creatures' moving

Bird predators and two insects move freely within this range in different speed. Birds march in the form of boids[2], that is, a group of birds that are close to each other and move in the same direction.
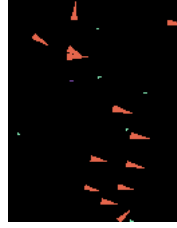
Figure 2.2 An example of boids moving

2.3 Creatures' preying

When the distance between the predator and the bird is close, the predator will find the bird. When a predator finds a bird, the bird changes its flight direction to avoid the predator's pursuit. However, because birds generally do not fly as fast as predators, some birds will be caught by predators and eaten. Here we set another distance radius. If the distance between the predator and the bird is smaller than this radius, we judge that the predator catches up with the bird and the bird is eaten.
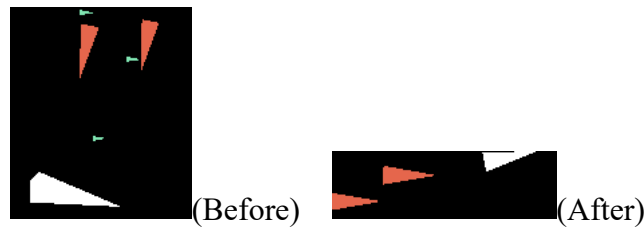

(Before)   (After)

Figure 2.3 An example of birds escaping

At the same time, in order to create an atmosphere, we also set up background music. As the predator searches for birds, the sound of birds flying is played. When predators catch birds and eat, we play chewing sounds.

2.4 Creature's parameter adjustment

Among the parameters mentioned above, the default values we set here are close to the actual situation in nature. If you want to change the relevant parameters, such as the size of birds, predators, insects, or the radius threshold at which predators find the prey, or the moving speed and turning speed of various creatures. For the function of adjusting parameters, we use the GUI interface that comes with allolib[3] to implement it here.
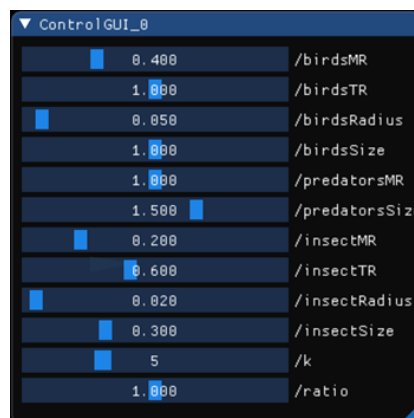

Figure 2.4 An example of GUI interface.

3. Result

In this project, through the writing of the program, we successfully established an ecosystem that simulates the food chain. At the same time, we realized all the functions mentioned above. Users can control various creatures by adjusting parameters through the control GUI interface. If possible, users can even set the predator's speed very low, slower than birds, and even they can't catch food all the time.

Figure 3.1 The main interface of the system

4. Conclusion

Although this project implements a simple food chain, there are still many shortcomings.

First, in order to facilitate the simulation of the predation function, I directly put the prey or bird to a new location. We should actually wipe off the original creature and regenerate a new one.

Moreover, producers in the food chain, such as green plants, and decomposers, such as various bacteria and fungi, I have not drawn. At the same time, I only drew a three-level food chain. The actual food chain is much more complicated. There may be four to five levels. The relationship between members is also very complicated.

5. Reference

[1]: Morgan, K., Marsden, T., & Murdoch, J. (2008). Worlds of food: Place, power, and provenance in the food chain. Oxford University Press on Demand.
[2]: Hartman, C., & Benes, B. (2006). Autonomous boids. Computer Animation and Virtual Worlds, 17(3-4), 199-206.
[3]: https://github.com/AlloSphere-Research-Group/allolib