Owen Martin

Mrs. Awde

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Quarter Three Report of Progress

Much of my effort during this quarter of AOIT III was expended on developing program content in lieu of the superfluous additions proposed in quarter two, such as creating Enemy and Target classes instead of an unrestricted environment and non-flickering paint effects. This was decided considering both the unnecessary nature of the suggested additions and the significant amount of code that would have to be rewritten to realize them. Nevertheless, the additions to the CELL program in quarter three were significant in many ways—the fundamental biological behaviors they simulate are collectively indicative of a genuine ecosystem.

The first change made to the program during this quarter was the creation of the Target class, whose function is to serve as a simulation of food in an ecosystem or, more specifically, the nutritional target of a non-photosynthetic species. The objects of this class are quite like those of the Particle class, which compose the CELL membrane, in that they have variable attributes for present and past positions. Considering the process of Verlet integration discussed last quarter, Target objects can have velocities and therefore move along random linear paths across the onscreen environment. When a Target object enters the radial boundary surrounding the center point of the CELL, it is converted into four Particle objects that are subsequently assimilated into the membrane's ArrayList of Particle objects. The Target object is then recreated with random velocity and initial position attributes.

After the addition of the Target class to the CELL program, it became logical to enable the focus entity to pursue the Target objects as a means of growing, like an organism's pursuit of food in the real world. This required the creation of a think() method, which operates in tandem with a choose() method to propel the CELL towards the nearest Target object. The think() method changes the focus entity's velocity according to the formula $Ad/(d+B)$ where A is the entity's maximum speed, B determines how quickly its velocity will approach this speed and d is the distance between its center point and the future location of the nearest Target object. Per the given formula, the velocity of the CELL will increase as its distance from the chosen Target object decreases. Because each Target object has a random velocity, it is possible that the speed limit imposed on the CELL prevents it from successfully assimilating its objective—in this event it will change its focus when a closer Target object passes by.

It would be remiss when creating an artificial ecosystem to exclude the existence of predatory species; in the case of the CELL program, an Enemy class was created to counteract the exponential growth resulting from the entity's consumption of Target objects. These Enemy objects have similar attributes to those of the Target class, with positions and velocities, but utilize the aforementioned think() method to track and hunt the focus entity. Like the Target objects, Enemy objects will disappear upon entering the radial boundary surrounding the center point of the CELL but will subtract Particle objects from its membrane instead of adding them. Enemies also reappear at random locations when they contact the focus organism.

Ultimately, the inclusion of AI, predators, and prey in the CELL program during quarter three significantly advanced its ability to simulate an artificial ecosystem; by creating digital facsimiles of ecological elements, the program became more effective at mimicking a microscopic environment. All that remains for the program's immediate development is the

procreation of sentient elements—the Target objects, or food, crop up spontaneously like many photosynthetic organisms, but Enemy objects and the target CELL must reproduce through cell division after consuming a specific quantity of prey. This is the final logic-based goal of the CELL program and will likely be achieved before the end of the fourth quarter.