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IntroCS1 pd7

HW54 -- Library Exploration Project

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HW54 -- Library Exploration Project - Slime Model

The slime model is a demonstration of the cells of a slime mold, which in nature are generally spread out. Under certain conditions, slime mold cells will begin to coalesce into a visible colony of cells. These conditions usually are situations of stress where there is not enough food. It was previously theorized that there were leader slime mold cells that spread chemicals to attract other slime mold cells. However, Evelyn Fox Keller and Lee Segel in 1970 found out that all slime mold cells secreted some sort of chemical that other slime mold cells also followed. Rather than intelligent leaders, it is emergent behavior created by following a simple set of rules.

To produce clumping behavior, each cell first checks to see if it can smell the chemical in their current patch, determined by the amount of chemical on the patch. If there is none, continue wandering about, otherwise run the turn-toward-chemical procedure to detect whether the patch in the front, left, or right has the most chemical, then move towards it.

The slime model in Netlogo simulates the behavior of slime cells when they begin to clump up. Turtles represent slime mold cells in this simulation. At the top left corner is a slider called “population” that adjusts how many turtles will be created and spread out throughout the world after hitting the setup button, emulating the spread out way slime cells are generally found. The GO button begins the simulation. There are four other sliders to adjust when running the

simulation. One slider is called wiggle-angle, which determines the maximum amount of degrees a turtle can turn left or right. As the wiggle angle increases, it takes slightly more time for the turtles to clump up because the turtles will travel in more different directions. The next slider is wiggle-bias, which determines a turtle's preference to turn right if the bias is greater than 0 or left if the bias is less than 0. When the absolute value of this slider increases a little bit, there is zero to a slight decrease in time it takes for the turtles to clump because they begin to travel in the same general direction. However, if the absolute value of the turn bias is very high, turtles will not form big clumps because they will just turn in tight circles all the time and do very little tracking. These two sliders simulate how a slime mold cell would "turn" on a surface.

The third slider below the setup button is the sniff-threshold, which determines the minimum amount of chemical that is present on a patch that causes a turtle to begin looking for more patches with more chemical. This simulates how sensitive a slime mold cell is to the chemicals laid down by other slime mold cells. If the sniff-threshold slider is low, turtles will form into clumps very easily as they track smaller concentrations of chemicals. As the threshold increases, the turtles will have more difficulty in forming clumps as they can only track very high concentrations. The last slider is the sniff-angle slider, which tells a turtle how far a turtle should search left or right to look for higher amounts of chemical. Increasing the sniff-angle decreases the size of clumps and the amount of time it takes for turtles to form clumps because the turtles will be more aware in its search for higher concentrations of chemicals. In real life, a cell would only check a limited area for higher concentrations.

There are three constants within the code. One is the evaporation rate of the chemical, which is 0.9. Every turn that passes by, each patch has the amount of chemical on it multiplied by 90%, effectively removing 10% of the current chemical amount. The next constant is the

diffusion rate, which makes use of the diffusion primitive. The diffusion rate is 1, which means 100% of a patch's chemical variable is distributed equally among its eight neighboring patches. The last constant is the amount of chemical deposited by each turtle, which is 2. These constants are limitations in the code as they have no slider that adjusts these constants.