

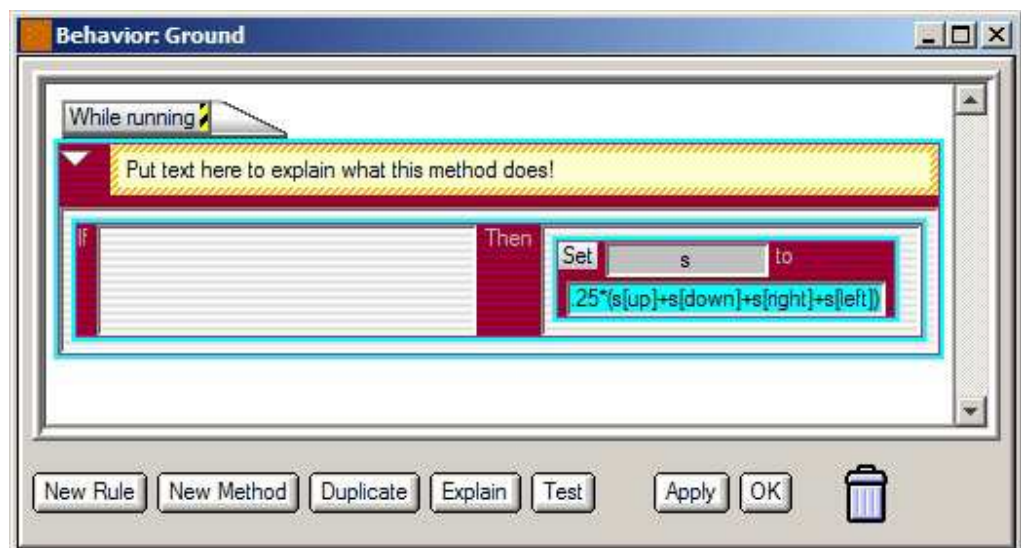
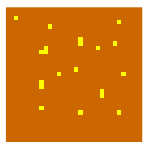
Journey Project Summary Part II – A.I.: Diffusion and Hill Climbing

Overview: In Part I of this project, the chaser agent simply moved around randomly on the ground. In this next phase of the design, the chaser will intelligently seek the traveler agent using a computational thinking pattern called “hill climbing.” Imagine the traveler agent emits a scent. Hill climbing is an algorithm to find the direction in which the scent is strongest. The scent will be propagated by the ground agents using a computational thinking pattern called “diffusion.” Diffusion is a fundamental physical process by which matter moves down a gradient from highest to lowest concentrations. The closer to the source of the scent, the greater its amplitude. This project will use a simplified form of the discrete diffusion equation. This phase of the project introduces the concept of an “agent attribute,” which is unique information that is stored within each occurrence of an agent. The typical computer science term is called a local variable. The ground agent will have the behavior below; the single action is to calculate and store the average of the four surrounding agents’ agent attributes. We have given the arbitrary name of the agent attribute “s” (for scent).

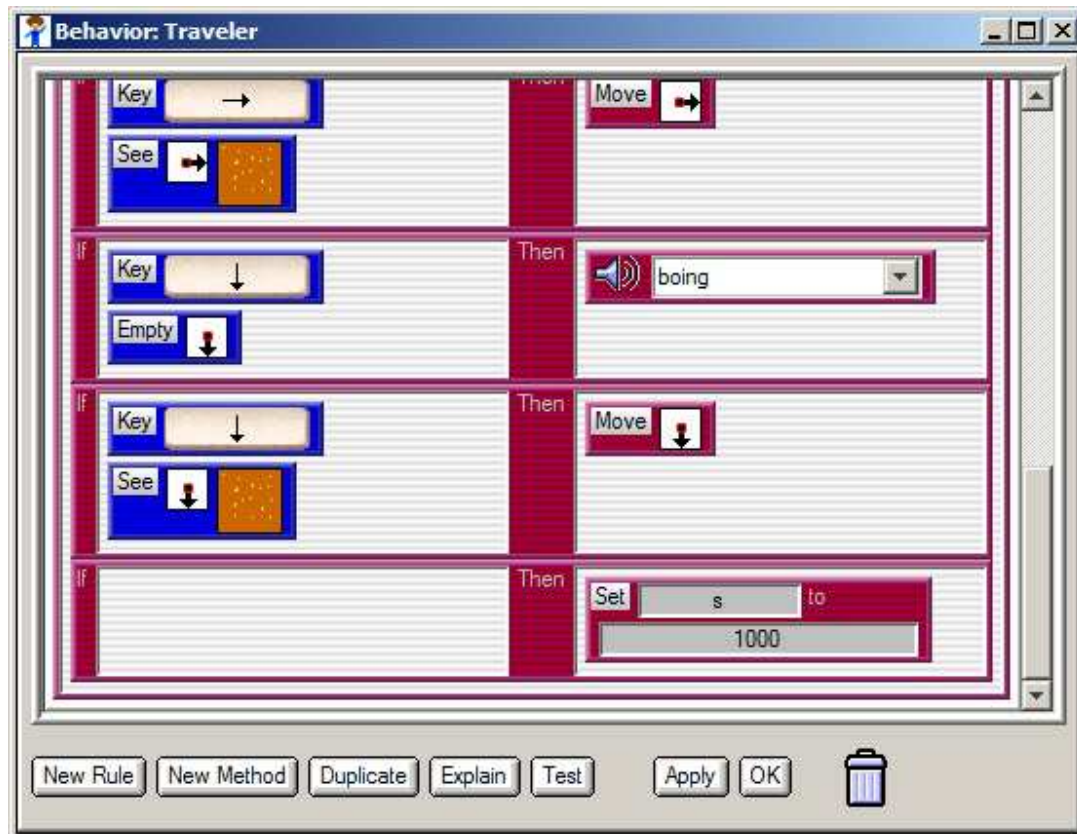
Ground agent has behavior:

The “set” action sets each ground agent’s attribute “s” to the average of the attributes in the agents above, below, and on each side:

$$s = 0.25*(s[\text{up}]+s[\text{down}]+s[\text{right}]+s[\text{left}])$$



Traveler behavior: give the traveler a scent: Add a rule to set the traveler's agent attribute, "s". Note the placement of this unconditional rule.



(Note: This is only a partial view of the traveler's behavior. Refer to the first phase of the Journey project to see all the rules that precede the final one in the list.)

Chaser revised behavior: Chaser examines agent attributes of surrounding cells to determine which direction to move. Note the use of a method to make the decision. The figure below shows rules for the first two directions. The subsequent figure shows the entire behavior.



The screenshot shows a software window titled "Behavior: Chaser" with a scrollable list of rules. The first rule is under the "While running" category and consists of a yellow instruction box, an "If" condition set to "Once every .5 Secs", and a "Then" action of "Make navigate". The second rule is under the "On navigate" category and contains three conditional blocks. The first block has "If" conditions for "s[up]" and "s[down]" with a ">=" operator, and a "Then" action of "Move" with an up arrow. The second block has "If" conditions for "s[up]" and "s[left]" with a ">=" operator, and a "Then" action of "Move" with a right arrow. The third block has "If" conditions for "s[right]" and "s[up]" with a ">=" operator, and a "Then" action of "Move" with a right arrow. At the bottom of the window are buttons for "New Rule", "New Method", "Duplicate", "Explain", "Test", "Apply", "OK", and a trash icon.

Chaser full behavior:



Behavior: Chaser

While running

Put text here to explain what this method does!

If Once every .5 Secs Then Make navigate

On navigate

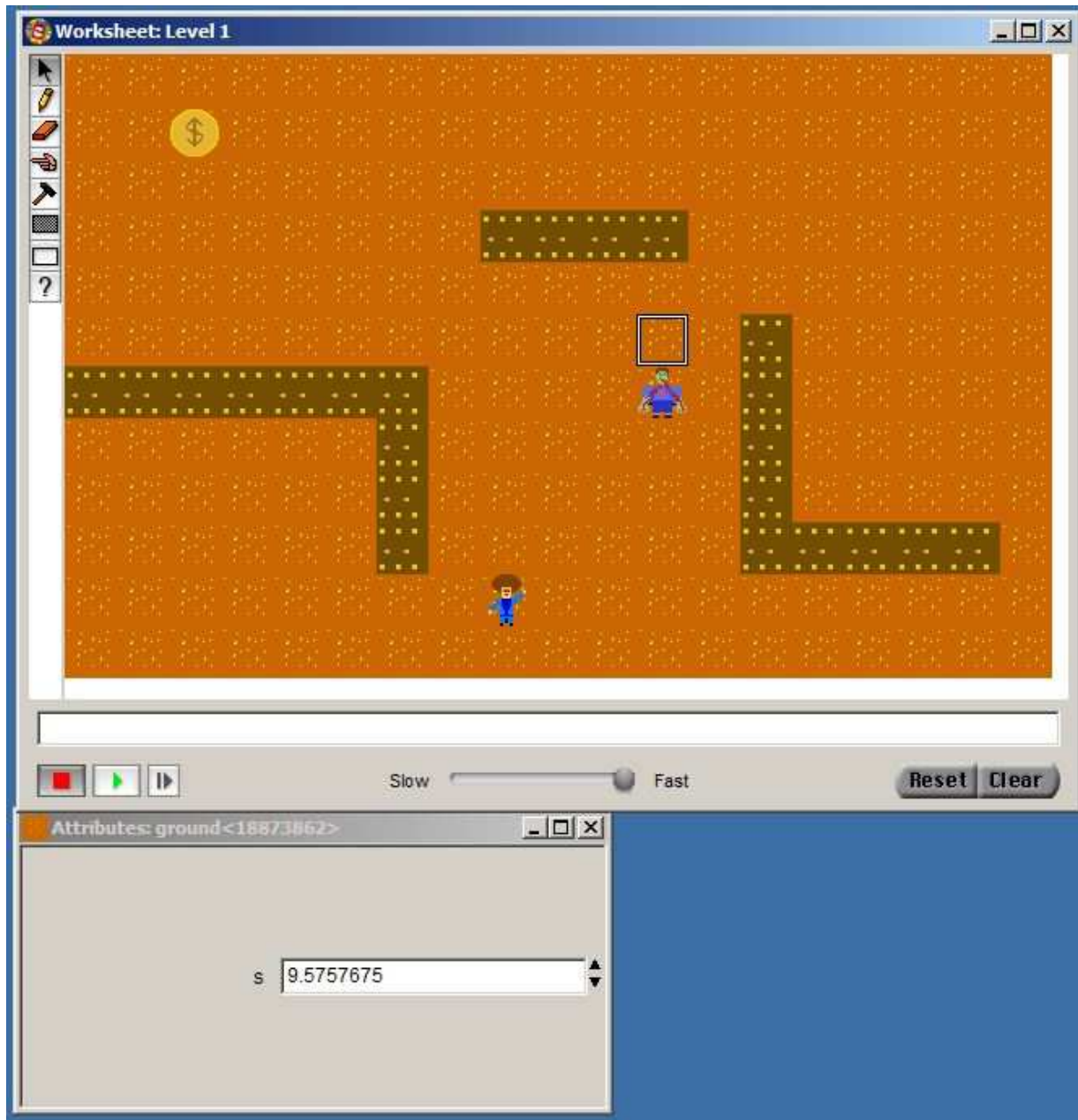
Put text here to explain what this method does!

Condition	Action
is s[up] >= s[down]	Move ↑
is s[up] >= s[left]	
is s[up] >= s[right]	
is s[right] >= s[down]	Move →
is s[right] >= s[left]	
is s[right] >= s[up]	
is s[down] >= s[up]	Move ↓
is s[down] >= s[left]	
is s[down] >= s[right]	
is s[left] >= s[up]	Move ←
is s[left] >= s[down]	
is s[left] >= s[right]	

New Rule New Method Duplicate Explain Test Apply OK

Agent attributes in ground cells allow chaser to determine next move using hill climbing computational thinking pattern:

Value of agent attribute “s” (‘scent’ of the traveler) in the cell above of chaser:



Value of agent attribute “s” (‘scent’ of the traveler) in the cell to the left of chaser:

The image shows a game environment window titled "Worksheet: Level 1". The environment is a grid with a brown background and a pattern of small yellow dots. There are several obstacles represented by dark green rectangles with yellow dots. A yellow circle with a dollar sign (\$) is in the top left. A blue character (traveler) is in the center, and a red character (chaser) is at the bottom. A white square highlights the cell to the left of the traveler. Below the game area is a control panel with a red stop button, a green play button, a black next button, a "Slow" slider, a "Fast" slider, and "Reset" and "Clear" buttons. At the bottom, there is an "Attributes: ground <30592542>" window with a text input field containing the value "47.268387" next to the label "s".

Value of agent attribute “s” (‘scent’ of the traveler) in the cell to the right of chaser:

The image shows a software interface for a maze game. The main window is titled "Worksheet: Level 1" and contains a maze with a brown background and dark brown walls. A yellow dollar sign icon is in the top left. A blue character (traveler) is in the center, and a smaller blue character (chaser) is at the bottom. A small square is highlighted to the right of the traveler. Below the maze is a control panel with a red stop button, a green play button, a right arrow button, a "Slow" to "Fast" speed slider, and "Reset" and "Clear" buttons. At the bottom left, a console window titled "Attributes: ground<16301511>" shows the attribute "s" with a value of 7.693629.

Cell below the chaser has largest value of agent attribute “s” (‘scent’ of the traveler):

The image shows a software interface for a simulation. The main window is titled "Worksheet: Level 1" and contains a maze environment. The maze is composed of orange cells with a grid pattern, and dark green walls with a dotted pattern. A yellow circle with a dollar sign (\$) is located in the upper left. A character in a blue suit (the traveler) is positioned on a cell that has a white border. A character in a blue suit (the chaser) is positioned at the bottom center. Below the maze is a control panel with a red stop button, a green play button, a grey next button, a speed slider from "Slow" to "Fast", and "Reset" and "Clear" buttons. At the bottom, there is a panel titled "Attributes: ground<16603245>" which contains a text input field with the value "s 52.179317".

Note that conversational programming color indicates chaser's next move will be down.

