PARIS
LODRON
UNIVERSITÄT
SALZBURG

Weekly Assignment in *Spatial Simulation (3)*

Lecturer:	Wallentin, Gudrun
Stu-Name:	Chen, Yuzhou
Stu-number:	s1104123
Major:	Applied Geoinformatics

Winter semester, 2023

Assignment #3 Calendar week 42 / 2023, Winter semester Course Date: 19.10.2023

Introduction

GAMA offers built-in statements enabling simulation of species' movement behaviors to comprehend biological interactions within ecosystems. The task of this assignment is to track the movement of 3 species and visualize their action neighborhoods associated with the time steps. In order to better depict the typical movement and covering area, I designed a model named "Ass3-MovementModel".

Methods

There are 3 typical intrinsic types of movement in GAMA coding, including *wander*, *move* and *goto*, which can be called straightly by *do* statement. These movement can't be visualized to action neighborhood without the help of Geometry data type, which contains point, line, or poly vectors. There is a code provided that has 1 global part, 3 species and 1 experiment part. At the beginning, a global part is defined to initiate cows, sheeps and goats with individual number. When it comes to the definition of species, the first thing is to add "skills:[moving]" at the start line, so that *do* actions can be triggered. Each species consists of two parts: *reflex* and *aspect*. Where *reflex* is used to define actions, specify the range of movement or perception, and assign values to geometry features. *Aspect* is used to define GUI drawing rules, implemented through draw statements, which support direct drawing of geometry features. In this assignment, each move pattern matches with a movement behavior of a species: 1) cows do wander; 2) sheep do move; 3) goats do goto, leaving different covering areas compared to each other. **Cows** *wander* within a limited range of 90° with a speed of 2, using amplitude facet to specify. "cow_area1" stands for the action area with a shape of sector, which can't be defined directly by geometry, so I use *intersection* to create a logical AND sector region by circle and cone like "circle(speed) intersection cone(heading-45,heading+45);", where heading stands for the current moving direction. "cow_area2" works the same. Then *aspect* follows to define the way to draw both agents themselves and neighborhoods. **Sheep** *move* continuously to the south and can smell wolves at a distance of 3. According to the document, heading angle starts from the east and increases in a clockwise direction, so south is "heading:90.0". Move action generate a straight line from start to end, so it can be tracked using line feature with a length equal to the speed. Similarly, the position of wolf can be defined as a point, just in-line with the sheep, using "point(self.location+{0,-3});" is enough. **Goats** *goto* the origin. Unlike the others, *goto* needs a target facet while being called, thus indicating a fixed direction for the goats. So in every time step, goats move in a straight line, which can be create using "circle(speed)" to cut the line that runs from current position to the origin. When it comes to visualization, the predefined *aspect* types of each species can be called in experiment part and properties like "transparency" can be customized.

Results

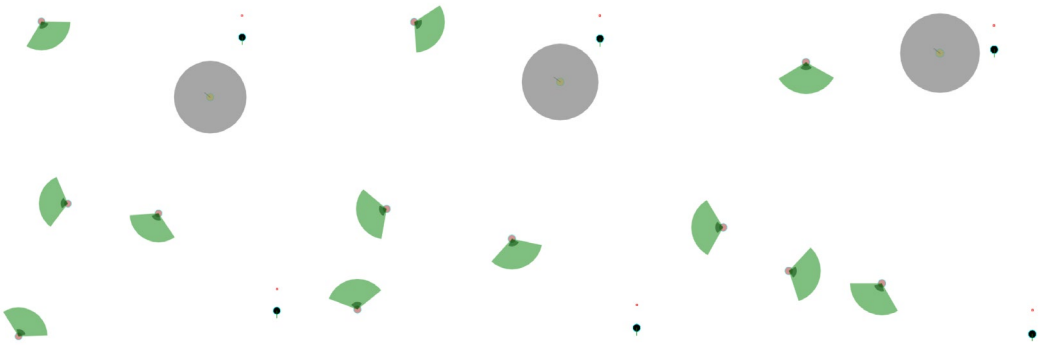

Fig 1. Result of Time Step 2 Fig 2. Result of Time Step 4 Fig 3. Result of Time Step 7

Discussion

1. Setting the aspect statement is akin to configuring the font family in Python chart drawing. In GAMA, this feature enables users to systematically customize a graphical style of graphics and call it in the experiment part using key-value pairs of aspect facet, where the value represents the name of the family. This offers a modular form of reuse for displaying various phenomenon in the same species.
2. How to define wolf area? We have argued on it. I think it is better to use "point" rather than using "line area" to identify the perception neighborhood, because 3 is like an alarming distance for the sheep, which may become useless when the wolf approaches the sheep, within 3 meters.
3. In this assignment, sheep move in a due direction. What if there is a angular deviation on the direction? The vector "{0,speed}" should be calculated according to the specific angle with trigonometric functions.