

ID2209 HT23 Distributed Artificial Intelligence and Intelligent Agents

Homework 1 - GAMA and agents

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The purpose of this assignment is to get an introduction to the GAMA platform and to get familiar with the environment and agents. In this assignment we aim to implement a continuously running simulation of a festival scenario with guests, food/drink stores and an information center. The behaviour of the different agents is then observed and analyzed.

How to run

Run GAMA 1.9 and import Festival.gaml as a new project. Press main to run the simulation. The slide can be used to change the speed of the simulation. Note that changing the value of any of the global parameters (guestNumber, foodStoreNumber, drinkStoreNumber, etc.) will change specific aspects of the simulation.

Agents

Guest

The agents representing the guests in the festival simulation show dynamic behaviour depending on their thirst and hunger levels. These guests are visually represented as colourful spheres, with the color changing based on their current state. The guests autonomously decide to head to the information center when experiencing low levels of thirst or hunger. Upon reaching the information center, they make choices between obtaining a drink or food based on their immediate needs. These interactions with the environment of the guests create an engaging simulation of a festival setting.

Information center

The information center agent in the festival simulation serves as a central hub for communication and guidance. It is represented by a blue triangle and offers a centralized point for guests to seek directions and make decisions. The information center maintains lists of the locations of nearby food and drink stores and actively communicates with guests to guide them to the nearest shop based on their needs.

Food/Drink store

The food and drink store agents in the festival simulation play a crucial role in meeting the needs of guests. They are represented by green and gold pyramid shapes. During the festival the two traits thirst and hunger of the guest agents get drained. When they are on a low level they need to get replenished which can be done by moving to the stores. There are two types of stores. One to buy food and another one to buy drinks. The guest agents get the location of these shops by communicating with the information center.

Implementation

The main focus was on the implementation of the guest agents because they have the crucial role in this festival simulation as they are mainly responsible for any interactions in the simulation. In GAMA the behaviour of an agent is defined by reflexes. In case of the guest agents the `thirstyOrHungry` reflex for example checks if the guest is thirsty or hungry. If that is the case then the information center is set as target and the color gets changed. The `beFestive` reflex makes guests moving randomly when they have no target and sets the color to red. The `moveToTarget` reflex makes guests move to their target. The `reachInfoCenter` reflex is implemented so that when guests reach the information center, they decide whether to get a drink or food based on their thirst and hunger levels. The `isThisAStore` reflex has been implemented so that when guests reach a store, they replenish their attributes (thirst or hunger) based on the type of store.

Result

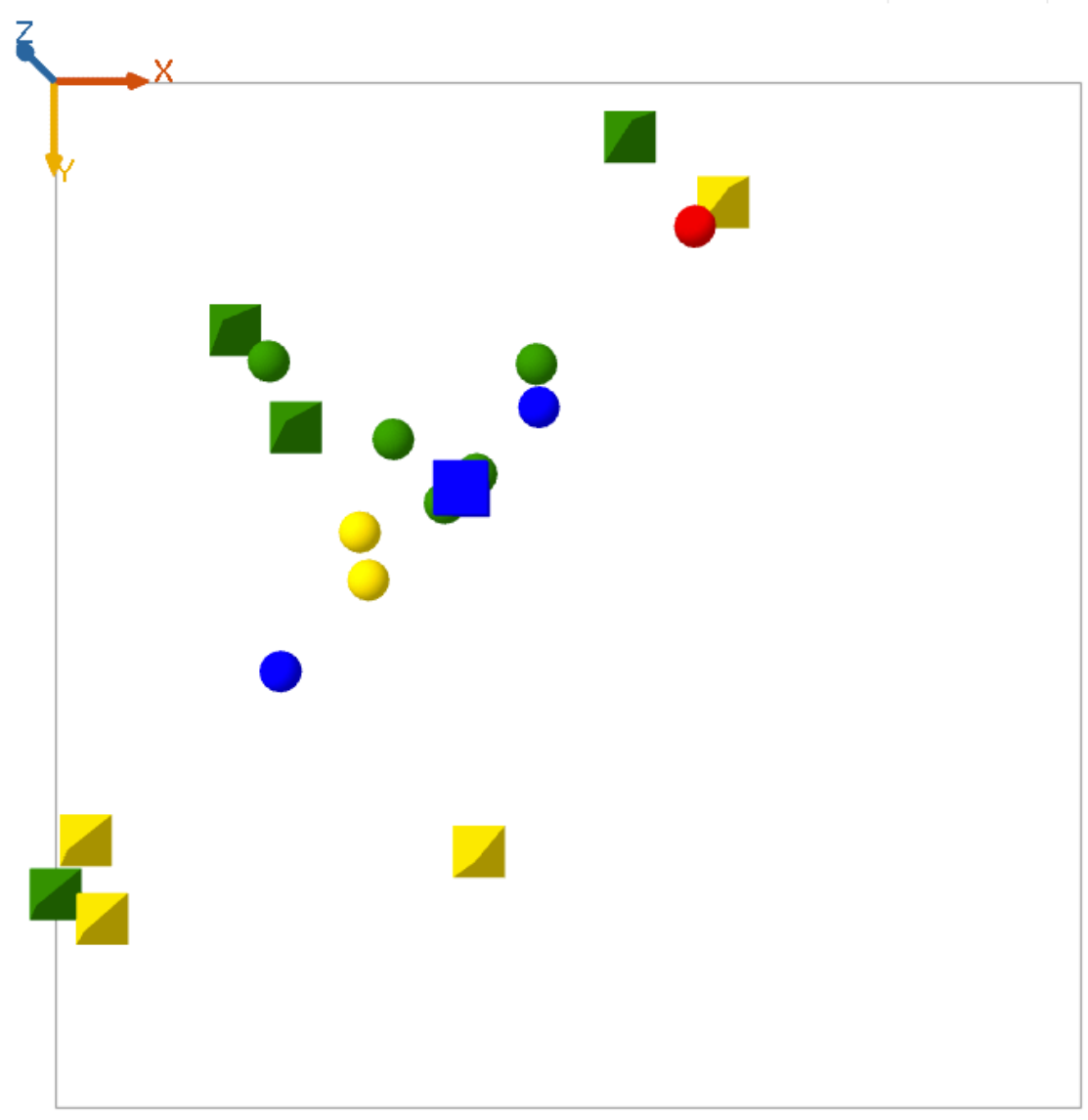
As you can see in the following screenshots the festival simulation runs as expected.

green circles -> hungry guests

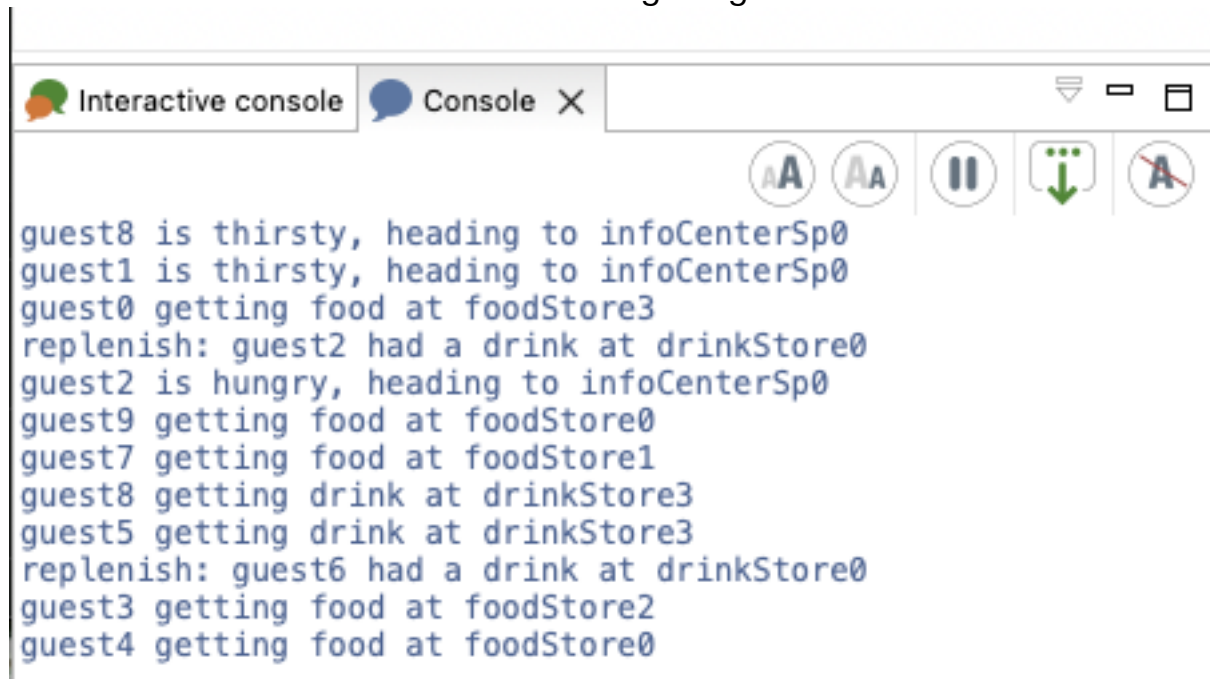
yellow circles -> thirsty guests

red circles -> random moving/dancing guests who are enjoying the festival

blue circles -> guests which decide to head to the information center when experiencing low levels of thirst or hunger



In the log of the festival simulation we can see for example guest8 that is heading to the information center and afterwards getting drink at a drink store

A screenshot of a web-based interactive console. The window has a title bar with 'Interactive console' and a 'Console' tab. Below the title bar are several icons: a green speech bubble, a blue speech bubble, a pause button, a green arrow pointing down, and a red 'X' button. The main area of the console displays a log of simulation events in blue text. The log shows various guest actions such as heading to the info center, getting food, and getting drinks, along with replenishment events for drink stores.

```
guest8 is thirsty, heading to infoCenterSp0
guest1 is thirsty, heading to infoCenterSp0
guest0 getting food at foodStore3
replenish: guest2 had a drink at drinkStore0
guest2 is hungry, heading to infoCenterSp0
guest9 getting food at foodStore0
guest7 getting food at foodStore1
guest8 getting drink at drinkStore3
guest5 getting drink at drinkStore3
replenish: guest6 had a drink at drinkStore0
guest3 getting food at foodStore2
guest4 getting food at foodStore0
```

Challenge 1

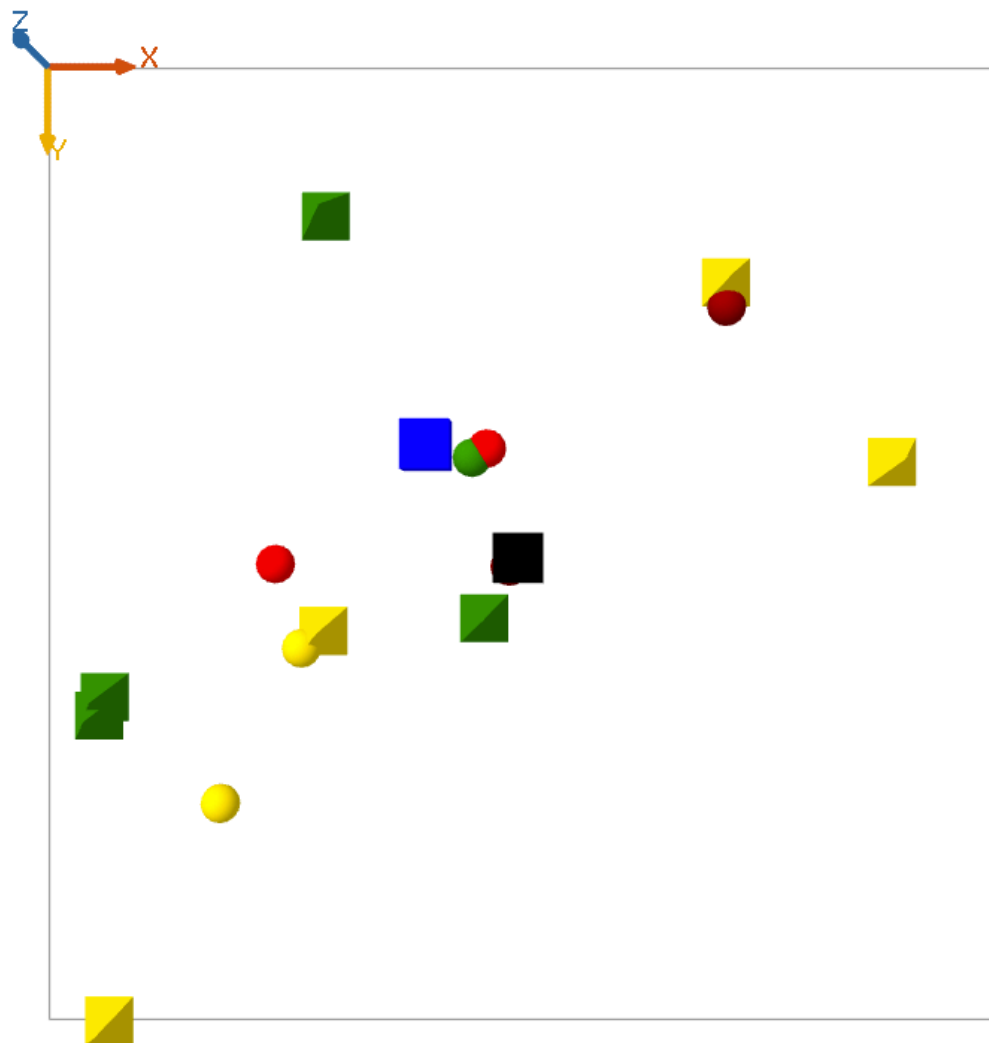
To establish a memory system for agents to recall visited places, we utilize a list called "guestbrain," which functions as an array storing information about whether a guest has visited a food store or drink store, along with the location of that store. For inquiries about guests in proximity, the "ask guest distance" statement is employed. This serves the purpose of searching for guests within a specified range.

We also modified the code to track the distance traveled by each guest and updating the total distances with and without the brain. By observing this we can conclude that the "brain" reduces the total distance traveled. This is the case because if the brain contains information, the guest decides to visit a store based on its previous experiences to reduce the overall distance traveled. The potential reduction in total distance traveled comes from the fact that guests with a memory (brain) may choose to visit stores they've been to before, potentially located closer to their current position than a random store.

Challenge 2

In this the scenario some misbehaving guest agents should be removed from the festival.

To handle these misbehaving guests at the festival, we've introduced a new agent, the security guard. The process is implemented with the information center using the "checkForBadGuest" reflex to identify these troublesome guests. Once identified, the security agent utilizes the reflexes "catchBadGuest" and "badGuestCaught," along with the die functionality, to remove these problematic guests.



Total distance traveled without brain: 14372.14580985466
 Total distance traveled with brain: 8350.668807068592

Interactive console

Console X

AA

AA

II

↓

A

```

guest0 getting drink at (added to brain) drinkStore2
guest4 is hungry, heading to infoCenterSp0
guest3 getting drink at (added to brain) drinkStore1
replenishStringguest2 had a drink at drinkStore0
guest2 is hungry, heading to infoCenterSp0
replenishStringguest7 ate food at foodStore1
replenishStringguest1 ate food at foodStore0
guest1 is thirsty, heading to infoCenterSp0
guest9 getting drink at (added to brain) drinkStore1
guest2: exterminated by cop!
replenishStringguest0 had a drink at drinkStore2
guest5 getting food at (added to brain) foodStore1
  
```

Conclusion

In conclusion, this assignment provided valuable insights into the GAMA platform, enabling a foundational understanding of agent-based modelling and simulation. The implementation of a festival scenario with dynamic behaviour of agents, different attributes and reflexes helped us a lot to learn more about the implementation of a simulation by using GAMA. Overall, it was a very useful assignment and we are looking forward to the next one :)