ID2209 – Distributed Artificial Intelligence and Intelligent Agents

Project - *Star Wars Festival* Report

Group 28

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1 Introduction

Welcome to *Star Wars Festival*! A festival where fans of all ages, kids and adults alike, of the acclaimed movie franchise *Star Wars* gather to celebrate and enjoy various attractions including having a drink at the *Mos Eisley Cantina* or watch on stage events related to all the *Star Wars* movies from the *Original Trilogy* to the new *Disney Star Wars* ones. You will also have the chance to meet Darth Vader and Yoda!

In this assignment we simulate a festival in which people are walking around the festival going from the main stage to the *Mos Eisley Cantina* depending on their interests and the events performing at the main stage. Throughout their stays at both places fans from different ages and preferences regarding the *Star Wars* movies will interact with each other and make social connections or leave according to their personal preferences in order to maintain their enjoyment during the festival.

2 How to run

Run GAMA 1.8 and import Project.gaml as a new project as well as the images (.png, .gif and .obj). Press *Project* to run the simulation. At the beginning of the file you can change how many agents of each species there are. The default values are: 20 *OTFans*, 20 *PrequelsFans*, 20 *DisneySWFans*, 1 *DarthVader*, 1 *Yoda*, 1 *Mos Eisley Cantina* and 3 *Stages*. In the simulation you can also make appear or silence logs regarding places or agent or include or not *DarthVader* or *Yoda* in the simulations.

3 Species

The first *Star Wars* movie was released in 1977 and ever since it has become a worldwide sensation. So much content related to this fictional world and story has been released throughout the years that several generations were caught up in it. Nevertheless, unfortunately some early loyal fans have developed a somewhat "less tolerance" for new content as it is now being produced by the new owners of the franchise *The Walt Disney Company*. And just as well, newer generations have a hard time accepting or appreciating the so called "old or classic cinema" which the OT now might be considered part of for some younger generations. Although the situation may not be as "black or white", for the sake of this project we have modified these different groups in order to make a more interesting interaction between them.

For the three types of fans we will explain furthermore bellow, we have established according to three types of fans. Each of them have a preference or a "level of tolerance" towards the three types of "Star Wars" products there are and that we have classified as:

- **Original Trilogy** = Star Wars Episodes IV (1977), V (1980) and VI (1983) ("A New Hope", "Empire Strikes Back" and "Return of the Jedi")
- **Prequel Trilogy** = Star Wars Episodes I (1999), II (2002) and III (2005) ("Phantom Menace", "Attack of the Clones" and "Revenge of the Sith")

- **Disney SW Trilogy** = Star Wars Episodes VII (2015), VIII (2017) and IX (2019) ("Force Awakens", "Last Jedi" and ["Rise of Skywalker"])

Some aspects, implementations and reflexes are shared among the three different fans so we will discuss these before hand and in each subsection of the fan's species we will point out what additional implementations they have.

Firstly, each species have a random value preference from a certain interval from 0 to 1 out of 1 in each category of products: ***Original Trilogy Preference***, ***Prequel Trilogy Preference*** and ***Disney SW Trilogy Preference***. Depending on the type of fan each will have different intervals.

Secondly, the fans are implemented so they move from stage to stage depending on the types of products being present in the stage show and according to their preferences. There's a ***hunger*** variable which is measured with a random value in an interval, randomly the value will be decreasing until it reaches 0. When it does, the fan will approach *the Cantine* to replenish the value. This behaviour is implemented through the ***get_hungry*** reflex that all the fans have defined in their species.

Additionally to the three types of fans, there are two so-called "cosplayers" or people dressed up as legendary characters of the franchise ***Yoda*** and ***Darth Vader***. These are wandering around the festival taking pictures with fans that decide to go to them. There are two boolean variables ***goingWithVader*** and ***goingWithYoda*** that are checked to see if they have an interest in taking a picture with them or maybe just following them for a while.

In the case where the fans have nowhere to go to, the ***choosePlace*** sends a cfp message to all the stages asking what shows they are having. These will answer through their ***replyShows*** reflex with information of their current show to which these will read through the ***read_informs*** reflex and decide, based on the score, what stage to go to. And the fans do so through their reflex ***read_proposes***.

The ***read_informs*** reflex is in charge of receiving notifications from stages and other agents and changing the destination in case they prefer it better. It computes the different Star Wars product types preferences established by the show happening at the moment in each stage and according to each fan's preferences they decide to go to one of them.

3.1 OTFan

It's represented by a blue sphere. These species has the following level of tolerance or preference towards the different Star Wars products:

- **Original Trilogy Preference** has a random value preference from the interval 0.8 to 1 out of 1, therefore, having a high preference for this product.
- **Prequel Trilogy Preference** has a random value preference from the interval 0.0 to 0.5 out of 1, therefore, having a middle to low preference or tolerance for this product.
- **Disney SW Trilogy Preference** has a random value preference from the interval 0.0 to 0.3 out of 1, therefore, having a low tolerance or preference.

This species has been modeled after an adult version of fan. Members of this species can have a child (relationship) that belongs to the *DisneySWFan* species and/or smoke (be smokers).

Additionally, the OTfans have the ***generous*** variable, that is, a variable that picks a random interval value from 0.0 to 1.0 which establishes the probability of buying a drink from a "buy drink" request by *PrequelFan* fans. *OTfans* have also a reflex, ***replyBuy***, to respond to requests from the *PrequelFans* species to buy them drinks. The reason for this is to make the species interact through FIPA and also because *OTFans* are interested in more *PrequelFans* "converting" to the Original Trilogy fandom as they

want more people to support that trilogy for future Star Wars products' inspiration. They'd decide to buy a drink or not depending on the variable described previously that limits the amount of drinks it buys.

Furthermore, it would explain how the *PrequelFans* would, as a response to the OTFans' answer, send messages to other *PrequelFans* to join them.

Every fan species has a ***eating*** reflex with a shared basic structure but each of them has several variants. For instance, in this case, the *OTfans* will first eat. After that, they'll check if there is more than 10 *DisneySWFans* in a certain distance measured by a circular radius it will leave the Cantine. The reason behind this behaviour is due to the fact that in the "real world" both types of fans don't get along that well, so much so, that they would leave the place if there are more than they would tolerate. Nevertheless, there are certain exceptions in this reflex like should an *OTfan* be in the Cantine eating with their *DisneySWFan* child they would not leave. This behavior is implemented due to how *OTfans* have children that are considered *DisneySWfans* so they couldn't leave their children behind.

The ***check_smoking*** reflex is also uniquely for the *OTfans*. In it, the OTfan/parent checks if there is anyone smoking and if there is and the *OTFan* has a kid with them they will ask their kid to leave so the smoke doesn't affect them. They receive the child's response through their ***read_agrees***. One last child-related reflex is ***find_child*** where the parent, randomly, if it isn't eating and has a child, searches for their child and goes to their location.

Finally, the reflex ***chooseYodaRandom*** evaluates randomly if this agent decides to follow *Yoda* for a while and the ***notFollowYoda*** when to stop following. Keeping in mind that this can always be interrupted by hunger o a show with a higher preference starting.

Due to the volume of code implemented for this project, other reflexes related to the motor functions and simpler behaviours like wandering, going and stopping when it reaches a location are not mentioned in this project report as they don't have a bigger role respect to other functionalities implemented.

3.2 PrequelsFan

It's represented by a red sphere. These species has the following level of tolerance or preference towards the different Star Wars products:

- **Original Trilogy Preference** has a random value preference from the interval 0.7 to 0.9 out of 1, therefore, having a medium-high preference for this product.
- **Prequel Trilogy Preference** has a random value preference from the interval 0.7 to 0.10 out of 1, therefore, having a high preference or tolerance for this product.
- **Disney SW Trilogy Preference** has a random value preference from the interval 0.0 to 0.5 out of 1, therefore, having a low tolerance or preference.

As mentioned previously in *OTfan* species description, the ***eating*** reflex has a complimentary request via CFP to all the other *OTFans* to buy drinks in this species.

In the ***read_proposes*** it has an additional condition that is if the *OTFan* agreed to buy drinks, the *PrequelsFan* will invite more *PrequelsFans* to the Cantine. If, on the contrary, they reject their proposal to buy them a drink it replies with a "No problem!".

Moreover, in their ***read_informs*** reflex they check if there is someone buying drinks in response to the inform sent by the *PrequelsFan*. Besides checking the proposals sent by the Stages about the shows happening at the moment and checking where Darth Vader is.

Additionally, this species have a variable ***noise_resistance*** which determines the limit of noise an agent

is able to handle in the Stage. Its value is checked in the ***check_noise*** reflex and if the mean level of noise is higher it leaves the stage.

3.3 DisneySWFan

It's represented by a yellow sphere. These species has the following level of tolerance or preference towards the different Star Wars products:

- **Original Trilogy Preference** has a random value preference from the interval 0.5 to 0.8 out of 1, therefore, having a good tolerance for this product.
- **Prequel Trilogy Preference** has a random value preference from the interval 0.5 to 1.0 out of 1, therefore, having a middle to high preference or tolerance for this product.
- **Disney SW Trilogy Preference** has a random value preference from the interval 0.7 to 1.0 out of 1, therefore, having a high tolerance or preference.

In their initialization, they are assigned a parent with a 50/50 percent chance and the parent will always be a *OTfan*. Like the other types of fans, this species will leave *the Cantine* if there are too many *PrequelsFans* in their ***eating*** reflex. The reason behind this behavior, which again is altered and it may be an hyperbolized reaction of these sort of fans for the sake of making the interaction more interesting and varied, is that as noted that *DisneySWFans* are generally children or a young audience, *PrequelsFans* are teenagers and young adults and sometimes they "don't mix well". Nevertheless, there's a condition which is if they are in *the Cantine* with their parents they cannot leave.

Complementary to the OTfan parents request for the DisneySWFan child to leave if there is someone smoking, the child has a ***read_request*** where it evaluates them as well as the same for the ***find_parent*** reflex in the case they need to reunite with their parents.

3.4 DarthVader

Darth Vader is the evil leader of the *Empire* which governed the galaxy in the *Original Trilogy*.

In this simulation, however, this character is impersonated by a person for fans to get a picture with and it is a single agent primarily. Through the ***appear*** and ***disappear*** reflex it chooses where and when he will appear or disappear in the map. When it does, it send an inform messages to all the fans triggering their evaluation of whether they want to approach him to take a picture or not.

He has a ***stress*** variable that when there are too many people close to him to take pictures it reacts by "scaring" the crowd. This is checked through the ***get_stressed*** which sends a message to all the fans near him to go away.

3.5 Yoda

Master Yoda is a famous and powerful small, green creature known to be a *Jedi* master who fled to the distant planet of *Dagobah* after the *Empire* started to persecute and execute all Jedi knights in the galaxy.

In this simulation, however, this character is impersonated by a person for fans to get a picture with and it is a single agent primarily. Like *Darth Vader*, *Yoda* is a single agent that performs almost the same interactions as him with the difference residing in that when it gets close to Darth Vader it must pull away. This behavior is implemented as in the story of Star Wars they both belong to different sides, one is the oppressing and the other is the oppressed so they'd interact theatrically for the enjoyment of the fans.

Instead of appearing and disappearing, *Yoda* is always roaming around and, if it gets stressed, it will run away, instead of "scaring" people.

3.6 Cantine

The Mos Eisley Cantine is a famous bar/restaurant from the *Star Wars* franchise universe, it is located in the planet *Tatooine* and it's the place where aliens from all around the galaxy go to drink and eat.

In our simulation it serves no bigger purpose as its behavior is handled through the different fans. It's mainly in charge of replenishing the *hunger* of the fans and it hosts the interactions between them. Nevertheless, this interactions are handled through the different decisions the fans make in certain situations. It's equivalent to the *Bar* species.

3.7 Stage

There are mainly 3 positioned in three corners of the festival but more can be added. They each are assigned randomly a show that belongs to one of the three types of Star Wars products mentioned earlier:

- **Original Trilogy** = Star Wars Episodes IV (1977), V (1980) and VI (1983) ("A New Hope", "Empire Strikes Back" and "Return of the Jedi") – Figure 1
- **Prequel Trilogy** = Star Wars Episodes I (1999), II (2002) and III (2005) ("Phantom Menace", "Attack of the Clones" and "Revenge of the Sith") – Figure 2
- **Disney SW Trilogy** = Star Wars Episodes VII (2015), VIII (2017) and IX (2019) ("Force Awakens", "Last Jedi" and ["Rise of Skywalker"]) – Figure 3

Figure 1. Star Wars Original Trilogy themed Stage shows

Figure 2. Star Wars Prequel Trilogy themed Stage shows

Figure 3. Star Wars Disney Trilogy themed Stage shows

The shows are also randomly ended through the ***decrease_time*** reflex, which decreases the time of the show,***showTime***. When a show ends, a new random show starts, and the stage notifies all fans through an inform message in the ***new_show*** reflex. Apart from that, the Stage species replies to the requests sent by the fans about the current shows happening in them.

We added a picture representing each type of show so we can see when they change and how the fans move in response to that.

4 Implementation

When we decided the topic of the project, we started with the code from Lab 1 as a template. We modified and added the basic templates for every agent and started with the hunger behaviour of the fan agents. We later proceeded to implement the going to the Cantine triggered by the *hunger* variable. After this, we included the interactions within the Cantine and the FIPA communication.

It was hard to come up with a decision-making process for agents to go through as we were figuring out how we wanted the festival to function. Soon enough we realised we could make their communications

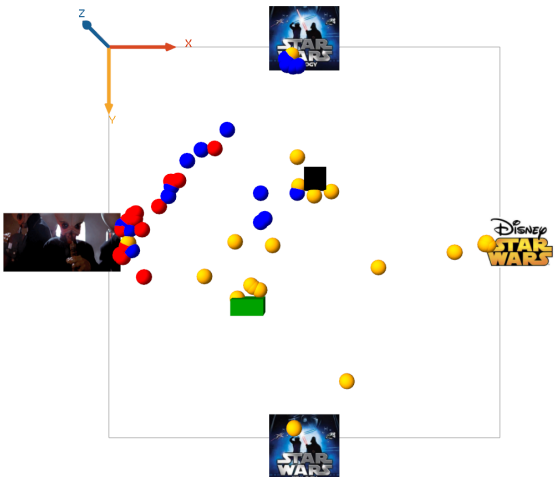


Figure 1: Set up of the agents

between the stages and the fans be more frequent if the stages showed a show cycle which would be swapping from one type to another of the Star Wars products themes established earlier. Afterwards it all came rolling out of our heads and we implemented the informing the agents, choosing and changing stages, and the interactions that happened there.

When all of what we have implemented so far was working, we proceeded to add new agents we were missing: Darth Vader and Yoda. Each with its own personality and way of attracting people. Also, random behaviours inside the agents and tweaking parameters to make everything seem more realistic.

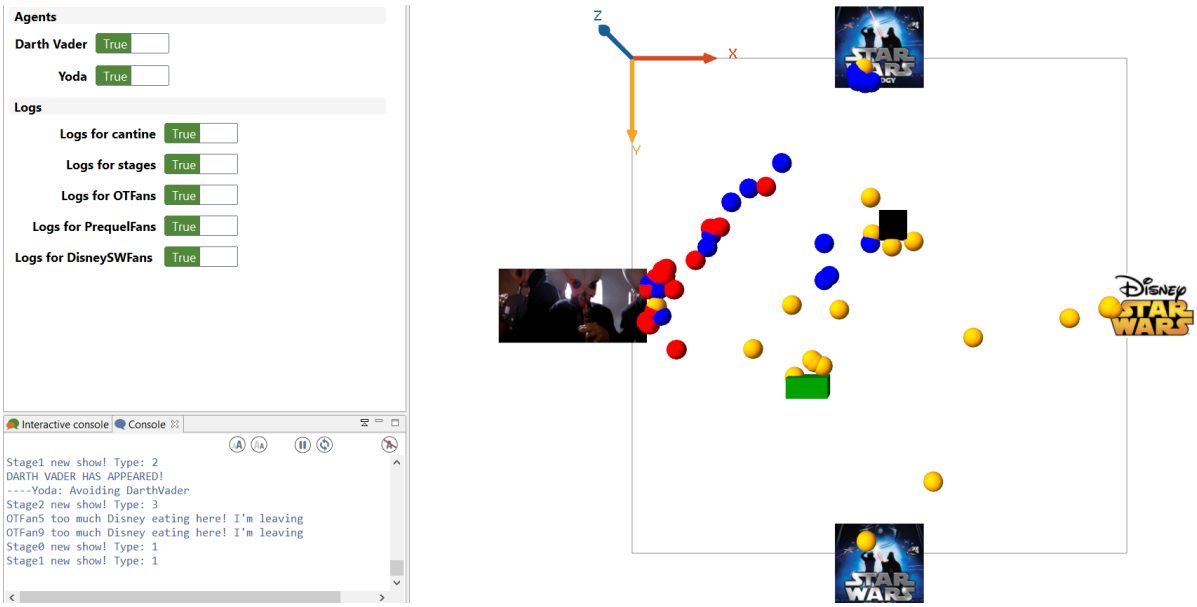


Figure 2: Set up of the festival with the possibility of not showing some logs or the Darth Vader and Yoda agents

We also implemented controls for the simulation and graphs to see some results. Finally, we added some pictures for the locations and changed the shape of the agents to distinguish them better.

5 Results and Conclusion

When implementing the lab we felt comfortable with the new programming language. We had learned much through the labs and have figured out more or less the power of the tool. We felt comfortable enough to even research more about, we find out a way of attaching or importing image files to the simulation or to a certain species. So we decided to make it more visually appealing and given there are some famous iconography identifiable by the main stream audience we decided to experiment on what we have learned. We added the GIF with the iconic Cantine band playing in the background to represent the Cantine, we used different images to represent the theme of the show hosted at the stages at any given time and imported two Object files of Darth Vader and Yoda to represent these two agents and make them stand out or help us differentiate between the fans and these.

Figure 1. Screenshot of Yoda .OBJ model

Figure 2. Screenshot of Darth Vader .OBJ model

Here you can see a screenshot of the festival simulation portraying the behaviors implemented and the images attached to each species and agents:

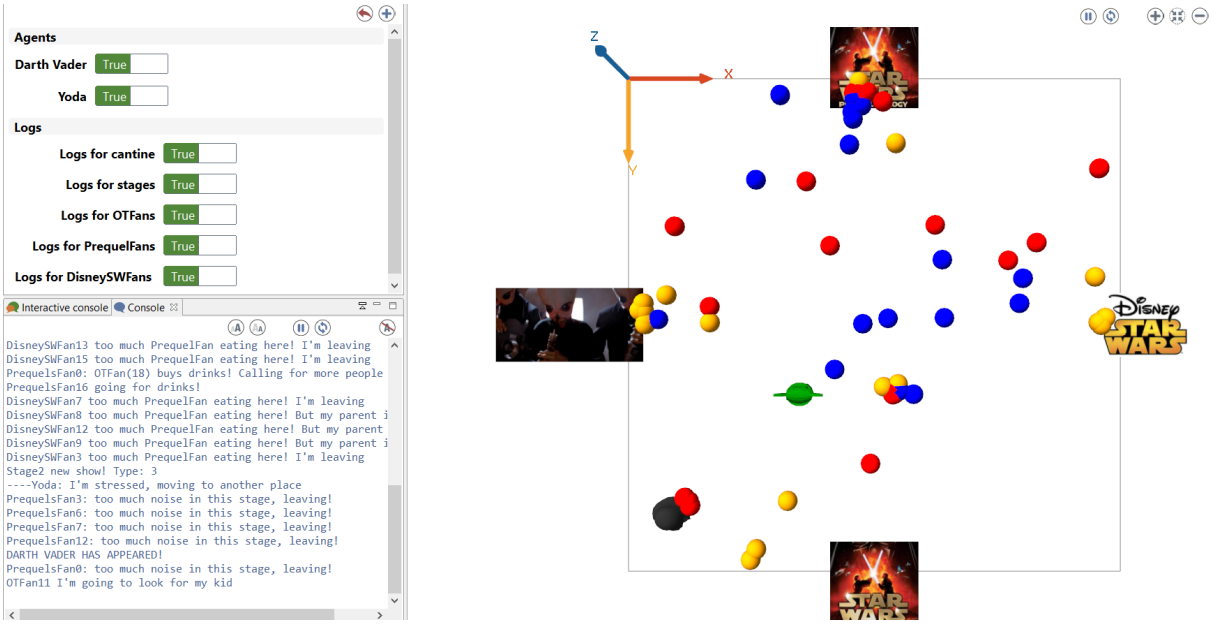
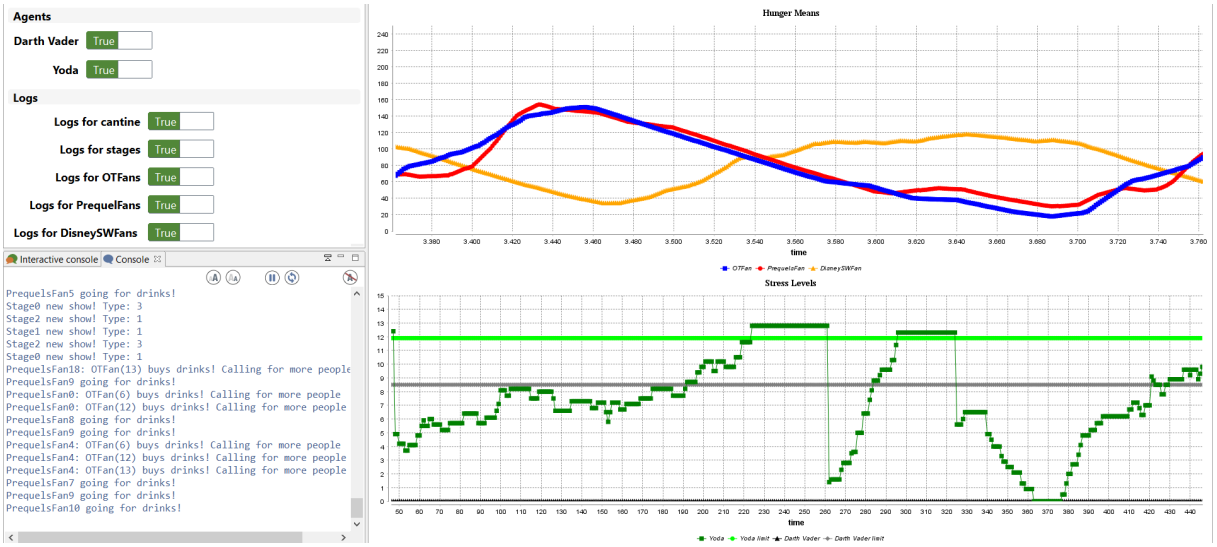


Figure 3. Simulation with all the actors shown

Moreover, here we can appreciate some graphs that showcase the behavior of hunger and stress levels.



The *Hunger Means* graph, which shows the average Hunger values at each time, we can appreciate certain similar behavior between the *PrequelsFans* and the *OTFans*, and how it contrast to the almost opposite hunger development of the *DisneySWFan*. On the other graph for the *Stress levels* we had some problems to convey both stress levels of Darth Vader and Yoda because the simulation seem to have rendering issues with the .OBJ files. So here we showcase the stress levels of Yoda.

If we follow the graph, we can see how throughout its interaction with the people it seems to be slowly increasing and surpassing the limit of stress when coincidentally the three types of fans are in the same level of hunger. We may attribute this spike as something coincidental or it could indicate that because the decision to visit the *Cantine* to replenish the hunger is related to the hunger value and the decreasing reflex that controls it, it can be possible that at that exact moment the average fan is not hungry enough to go to the Cantine to eat which added up to the decreasing graphs (which mean they have replenished their hunger) it leaves more fans to concentrate on the different attractions the festival offers. Among them its the "selfie with Yoda", hence the stress level spike.

Additionally, we can monitor the different logs being outputted in the console, bellow we can see a fragment:

```
Stage0 new show!  Type:  2
Stage1 new show!  Type:  2
Stage2 new show!  Type:  2
----Yoda:  I'm stressed, moving to another place
DisneySWFan16 I'm going to look for my parent
PrequelsFan1:  too much noise in this stage, leaving!
DisneySWFan5 I'm going to look for my parent
OTFan10 I'm going to look for my kid
Stage0 new show!  Type:  3
Stage1 new show!  Type:  2
DisneySWFan4 I'm going to look for my parent
Stage2 new show!  Type:  3
DisneySWFan16 I'm going to look for my parent
----Yoda:  I'm stressed, moving to another place
```

```
----Yoda:  I'm stressed, moving to another place
PrequelsFan2:  OTFan(8) buys drinks!  Calling for more people
PrequelsFan18 going for drinks!
PrequelsFan6:  OTFan(8) buys drinks!  Calling for more people
PrequelsFan6:  OTFan(13) buys drinks!  Calling for more people
PrequelsFan17 going for drinks!
PrequelsFan4 going for drinks!
Stage0 new show!  Type:  1
DisneySWFan6 too much PrequelFan eating here!  I'm leaving
DisneySWFan0 too much PrequelFan eating here!  I'm leaving
DisneySWFan2 too much PrequelFan eating here!  But my parent is here
DisneySWFan9 too much PrequelFan eating here!  I'm leaving
DisneySWFan11 too much PrequelFan eating here!  I'm leaving
DisneySWFan13 too much PrequelFan eating here!  I'm leaving
DisneySWFan1 too much PrequelFan eating here!  I'm leaving
DisneySWFan2 too much PrequelFan eating here!  But my parent is here
----Yoda:  I'm stressed, moving to another place
DisneySWFan5 too much PrequelFan eating here!  I'm leaving
PrequelsFan14:  OTFan(5) buys drinks!  Calling for more people
PrequelsFan2 going for drinks!
PrequelsFan13:  OTFan(5) buys drinks!  Calling for more people
PrequelsFan11 going for drinks!
Stage2 new show!  Type:  2
----Yoda:  I'm stressed, moving to another place
Stage1 new show!  Type:  2
PrequelsFan1:  too much noise in this stage, leaving!
DARTH VADER HAS APPEARED!
```

In the above extract we can see how the behavior of the different types of fans interact with the environment: Yoda, the stages, other fans. We can see a variety of different behaviors as a direct consequence or not of the position they are standing and their interactions, for instance we see how *DisneySWFan16* and *5* decide to go look for their fathers, *PrequelsFan1* leaves the stage because there's too much noise, Stages0 and 1 have new shows, some of different types even. And we have what we could call a "chain event" when word goes around that generous *OTFans* (*OTFan8* and *13*) are buying drinks to *PrequelsFans*. And right after that, we can see that that event has caused another event which is the leaving of the *DisneySWFans* which seeing how the Cantine was getting full of PrequelsFans due to that drinking invitation.

In conclusion, we believe overall we have learn a lot about Agents and how they interact with each other and how FIPA communication is a very effective channel of communication between them. With this sort of experimental software, GAMA platform, it is easy to create a simulation to study certain behaviors. It can be used for crowd control and other endless field applications. And furthermore, with the provided tools to measure and generate visual representations like graphs and charts it provides a good way to represent the data being monitored. Sometimes with the logs in the console is hard to keep track of the order in which the events occur but with the tools provided by GAMA it can be followed much better. Overall we are proud of what we have achieved in this project and hope we get the chance to work with this technology in the future.