

# **ID2209 – Distributed Artificial Intelligence and Intelligent Agents**

**Project**

**Group 23**

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## Introduction

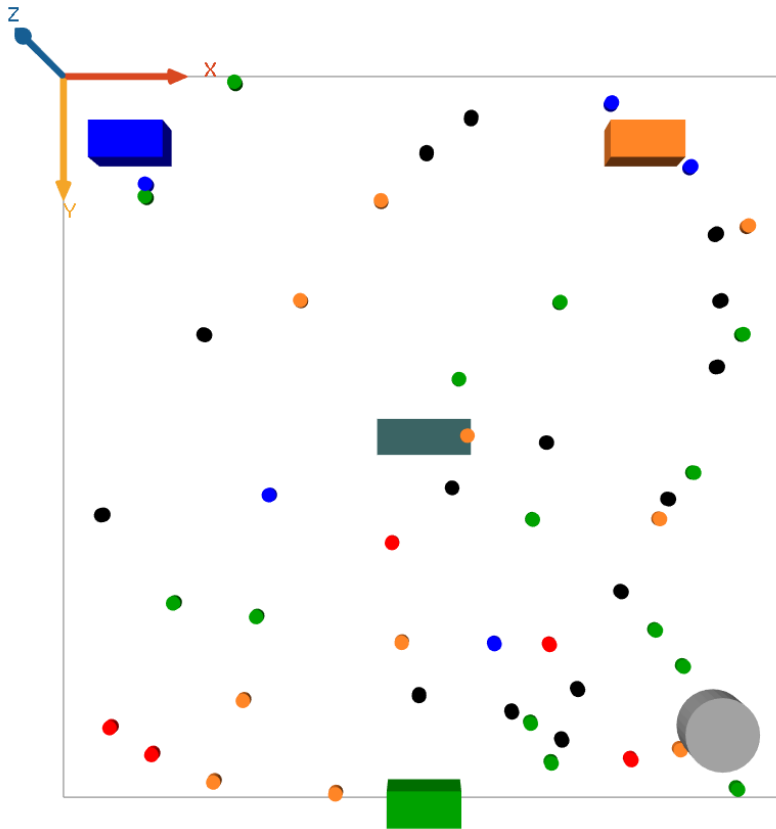
The main goal of the Final project was to implement behaviour and interactions between different types of festival guests. What should happen when different type of agents and people meet? Where the agents meet can affect their behaviour but also different traits that affect how they behave. We were supposed to fulfill some minimum requirements and were allowed to use former assignments as a base. There should also be some monitoring of data and conclusions drawn of the created simulation.

As a challenge there could be Belief, Desire and Intention behaviour implemented in some agents or Reinforcement Learning implemented with a different platform than Gama. We decided to not continue with the Reinforcement Learning part because it was considered too time consuming.

# Approach

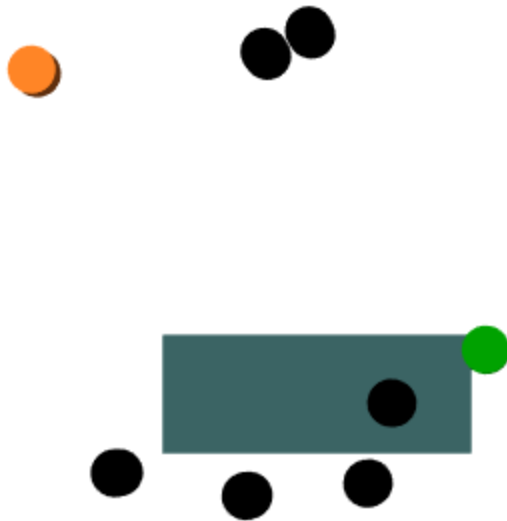
## Base Assignment - Festival Personalities

The base assignment with minimal requirements were implemented by creating 5 types of FestivalGuests which are RockFan (black), ChillGuy(green), Thief(red), Police(blue) and Journalist(orange). As a complement the following places were created: PhotoArea(orange), Stage(center), Pub(green), Casino(grey), PoliceStation(blue) and here the agents could meet and interact.



ChillGuy/BadGuy - Could go to the Pub to take a drink or to the Stage to dance. But this is not usually initiated by himself but by the RockFan that asks him if he wants to. The answer to RockFan depends on the mood of ChillGuy and where they meet. He could also initiate contact with RockFan if he is curious. The ChillGuy can also become a BadGuy if he gets angry. Then he will fight with other ChillGuys and it depends on who will win. If not they will just smalltalk. The other initiating Interactions are Thief that are asked nice what he is doing. Also the Police is asked how it is going to catch the thieves. The Journalist is asked about photo information. He can also go to the PoliceStation to collect lost money or to PhotoArea to collect Photo. Traits that affect the

rules of ChillGuy are generous,acceptdrink, wantstodance,startafight, fightwinorlose and takeapic.



*RockFan11 says hello.*

*ChillGuy6 says hello back*

*RockFan11 saysDo you want to dance?*

*ChillGuy6 saysYes I want to dance*

Interaction Between RockFan and Chillguy depending on ChillGuys wantsToDance trait.

RockFan - Can go to the Pub to take a drink or to the Stage to dance. He asks the ChillGuy if he wants to join him dancing or to leave him alone. He could also call another RockFan by initiating a FIPA message and decide to meet another RockFan at the Stage or by the Pub. If he meets the Thief he could ask him what he is doing in a rather rude way. Also, the Police could be asked how it is going to catch the thieves. The Journalist is asked for information about taking photographs. There are also rules about how the RockFan should answer other people that initiates contact with him . Traits that could affect these rules are generous, acceptdrink, wantstodance, or takepic but also where they meet in some cases. If he lost money because of Thief he could also go to the PoliceStation to get them back or to PhotoArea to collect Photos.

*RockFan13 receives phone call from:RockFan5: Would you meet me atPub*

*RockFan5 receives a answer from RockFan13 with content Yes, I would love to meet you. I'm going*

Interaction between RockFan and RockFan

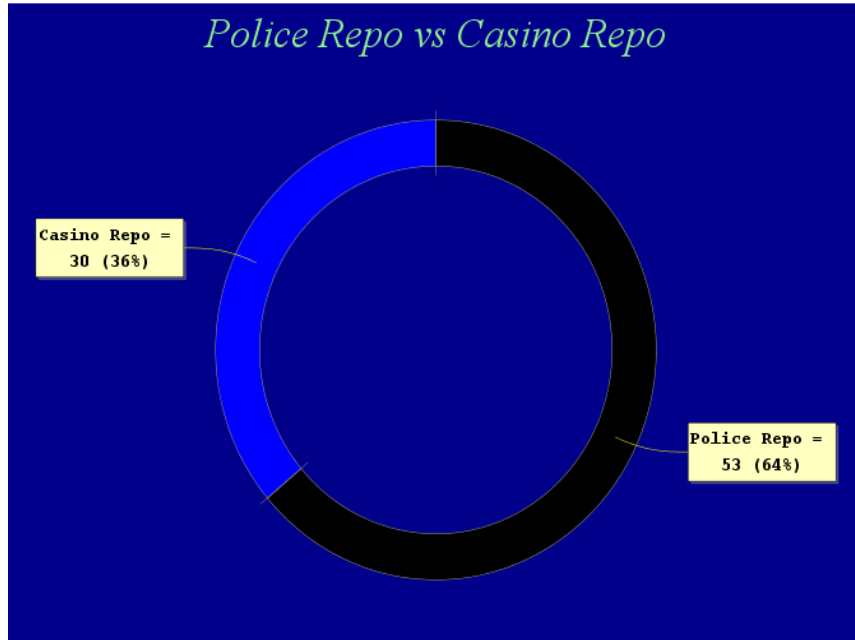
Thief - The thief can go everywhere except the Police Station to rob and will go to the police station only when he gets caught. The thief finds a chill guy or a rock guy who is busy talking and robs them. We can see the below info when robbing:

```
Thief0*****Letmerob!!!*****
Thief1*****Letmerob!!!*****
Thief2*****Letmerob!!!*****
Thief3*****Letmerob!!!*****
Thief4*****Letmerob!!!*****
```

The thief will rob if the chill/rock guy has money with him. If he find that they are carrying less/no money we can observe the below text:

```
ChillGuy14*****arghhhh!! poor fella!*****
```

Post robbing the thief's pockets will be full and he goes to Casino to pay some games and spend the money he has. Post spending it the thief comes out of casino and starts robbing again. When the thief is spending money in casino, we can observe that the casino's repository is filling up with money. Below figure shows casino filling up with money from thieves:



To know what “53” in the above image is, look into the description from police. Now, If the thief accidentally gets near the police you can see the message below:

Thief1\*\*\*\*\*Ohh shit!! police!!!!!!\*\*\*\*\*

when the thief gets caught with heavy money in his pocket, he will be taken to the police station by the police. Below image describes the scenario where thieves(Red) caught by police:



However, when the thief gets caught with less amount of money, he claims that it was his money and won't be going to jail. Police spares him for that moment but will have an eye on him.

Police- Police patrols all the festival areas continuously and will always be hunting for thieves. Note that police always know the thieves in festival. Also, he makes sure that all the festival guests are in god discipline. When he catches a thief, he will ask him to

show his pockets. If he finds out that he is carrying heavy money he will take him to the jail. If he finds a thief with less money, he will spy on him.

```
||||Show me your pockets|||||
|||||Remember, I have my eyes on you|||||
```

If he gets caught again with heavy money Police will take him to jail.

```
||||Show me your pockets|||||
|||||I'll take you to jail|||||
```

Now, If the police gets into contact with an overly reacting or underly reacting guests, he will question them about their behaviour. Below images show the conversation:

```
Police2 says Why are you so quiet?
```

```
Police2 says Why are you so loud?
```

When a police gets into contact with other police, he will greet them.

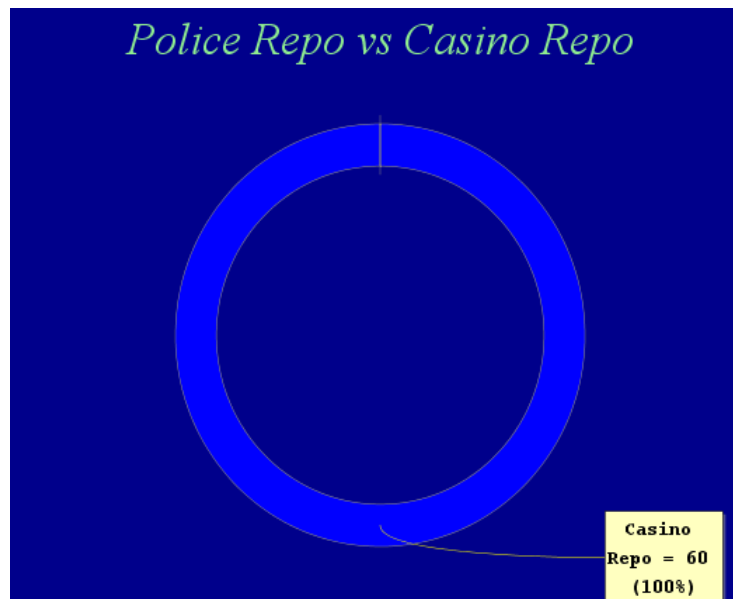
```
<<<<<Good Day Gentlemen!>>>>>
```

When a police gets into contact with a Journalist, he will be asked if he wants a photo. It depends on his mood to accept the request or not.

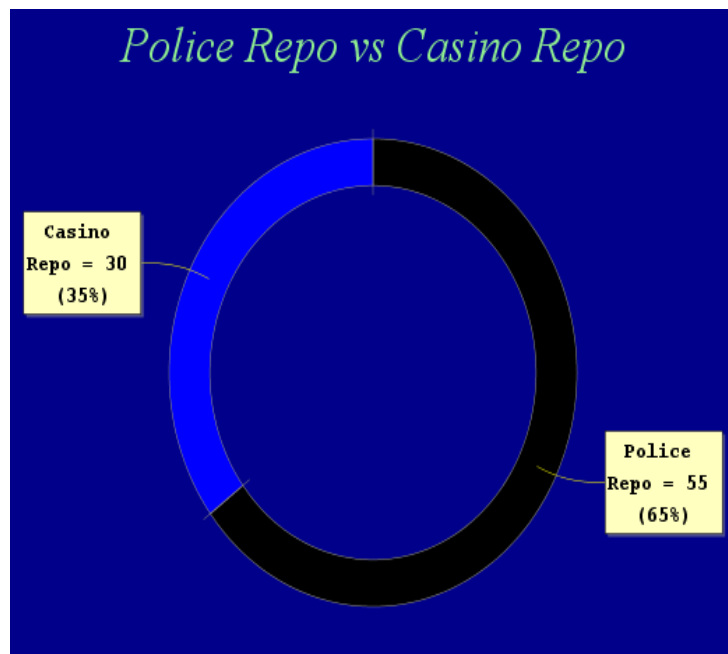
```
<<<<<<<Sure why not!>>>>>>>
```

```
<<<<<<<I'm a little busy right now! Sorry!>>>>>>>
```

When a police officer gets to know that the Police station is out of money, he will go to the casino to collect the tax and deposits the money to police station. Below image indicates that the police station is empty:



The below images shows the status of police repo after the money was deposited by police:



Journalist- The Journalist goes everywhere except the casino. He will decide to take a photo of chill/rockguy depending on the state they are in. A guest can reject the request made by the journalist depending on his interest.



Journalist2 found RockFan  
Journalist2 I don't want to take photo of you. You are too Rocky

```
Journalist2 found RockFan
No thanks
```

When the Journalist meets a police, he will ask him for a free photo. The police can decide if he wants a photo or not. Note that the festival guests should collect the photos for photo studio while the photo is available on spot for police.

FLASH FLASH.....Special free photo for police. You want one?

When a Journalist meets another journalist. They will engage into a conversation as mentioned below:

```
YOO.....Hows your day mate?  
<<<<<<<<Good my friend!>>>>>>>>>>  
MMM!! looks like your pockets are full! good business  
<<<<<<<<<Yeah! pretty good business! Good guests as well>>>>>>>>>>>>>>
```

After taking some pictures of the police and guests, the batteries of a journalist camera goes low and he goes to the Photo Area for recharge.

??????? Recharge please ??????????

The Journalist is responsible to take pictures of thieves and notify all the guests at the festival that the thief who stole the money from guests was caught.

```
Journalist8 please notify all festival guests to be careful!
Journalist9 please notify all festival guests to be careful!
Journalist8 please notify all festival guests to be careful!
Journalist9 please notify all festival guests to be careful!
Journalist8 please notify all festival guests to be careful!
Journalist9 please notify all festival guests to be careful!
```

## Minimal requirements

<b>Species</b>	<b>Goes to Location (at least 2)</b>	<b>Traits (at least 3)</b>	<b>Initiates Interaction with (at least 5)</b>	<b>Rules (some affected by traits and location)</b>
Green - ChillGuy	Pub	generous	ChillGuy/Badguy	Fights or small talk
	Stage	acceptdrink	RockFan	Maybe drink or dance, Pub or stage
	PhotoArea	wantstodance	Thief	Asks what Thief is doing or not
	PoliceStation	startafight	Police	Question about catching Thief
		fightwinorlose	Journalist	Information about photo or not
		takeapic		
Black - RockFan	Pub	generous	ChillGuy	Maybe drink or dance, Pub or stage
	Stage	acceptdrink	RockFan (by Phone)	Decide to meet somewhere
	PhotoArea	wantstodance	Thief	Asks what Thief is doing or not
	PoliceStation	takepic	Police	Question about catching Thief
			Journalist	Information about photo or not
Red - Thief	Everywhere (to rob)	money	ChillGuy	Rob or not
	PoliceStation	willsucceerob	RockFan	Rob or not
	Casino	caughtchance	Police	Inform of location or not
			Journalist	If caught by police inform or not
			Thief	Share money or not
Blue - Police	Everywhere (to patrol)	money	Thief	Catch or not
	Casino	catchThiefSucess	ChillGuy	Ask why so quiet
	PoliceStation	patrol	RockFan	Ask why so loud
			Journalist	Says if he wants a photo or not
			Police	wishes pleasant morning or could wish good job

## Extra Assignment - Belief Desire Intention Behaviour in agents

The requirements for passing the challenge of this assignment was to clearly demonstrate (in presentation and paper) BDI behaviour in agents. In our solution we used the Gold Miner implementation as a base ([https://gama-platform.github.io/wiki/BDIAgents\\_step2](https://gama-platform.github.io/wiki/BDIAgents_step2)). The BDI procedure could be shortly described as an agent has the belief of something, this could lead to getting a desire which leads to that the agent needs to fulfill the intention of achieving this desire. In this assignment we decided to implement BDI behaviour in the guests of ChillGuy and RockFan when they decide to do something or interact with each other. This is done by beliefs, rules and perceive and is described in the following simplified log:

*ChillGuy1 adds desire wants to do something*  
*ChillGuy1 tries to achieve desire wants\_to\_do\_something*  
*ChillGuy1 goes to pub*  
*ChillGuy1 add belief has\_decided\_where\_to\_go*  
*ChillGuy1 At destination*  
*ChillGuy1 remove intention wants\_to\_go\_somewhere and belief has\_decided\_where\_to\_go*

*(ChillGuy 3 has PERCEIVED another agent and added who\_to\_talk\_to)*  
*ChillGuy3 rule of sub-belief who\_to\_talk and talk\_to\_someone is evaluated*  
*ChillGuy3 wants to achieve desire stop\_and\_have\_a\_conversation*  
*ChillGuy3 the list: [ChillGuy(1)]*  
*ChillGuy3 says Hello, good day to you sir*  
*ChillGuy1 says Hi! Thanks, it's a nice day today.*  
*ChillGuy3 remove intention stop\_and\_have\_a\_conversation and subbelief who\_to\_talk\_to*  
*ChillGuy1 tries to achive desire wants\_to\_do\_something*

## Creative Idea 1 - Disease measurement between agents

In this assignment we decided that a creative idea could be implementing disease spreading and measurement of multiple diseases between the agents. They can only be infected by one disease to see which one could be the most spread one in the Festival. When they interact by asking each other there is a random probability they will be

infected by ut the other agent. This is considered creative because it adds another scientific dimension to the project. Now this could be used in evaluating risks of infections at festivals by the number of guests, and maybe further used to plan healthcare at festivals.

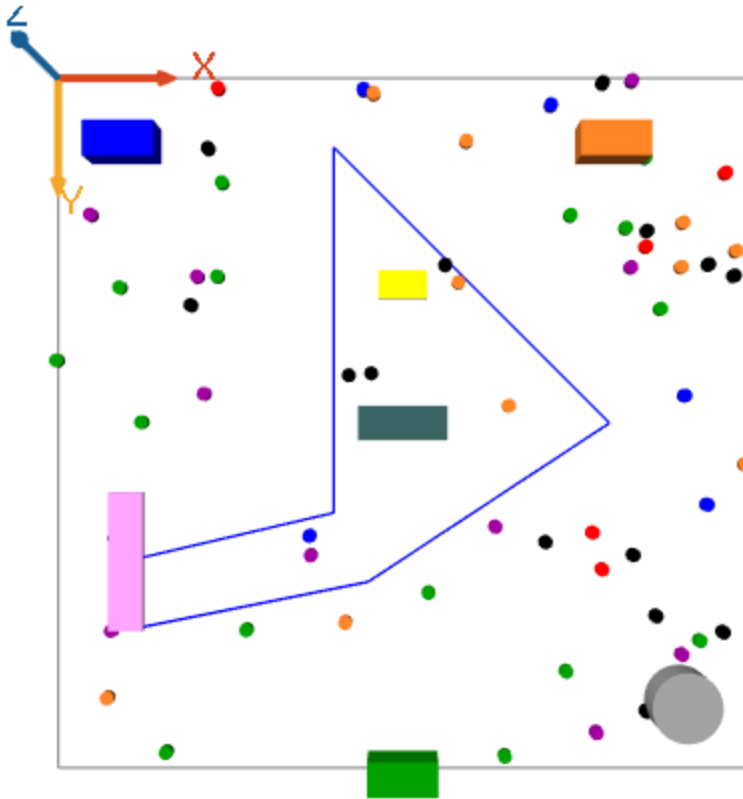
<b>Qualitative/Quantitative questions</b>	<b>Answer</b>
Time spent on finding and developing the creative part	4
In what area is your idea mostly related to...	Utility and coordination
On the scale of 1-5, how much did the extra feature add to the assignment?	3
On the scale of 1-5, how much did you learn from implementing your feature?	3

## **Creative Idea 2 - The RollerCoaster**

Here we have implemented a rollercoaster in the festival for kids. The also have created 2 additional areas. One being a candy store and the other being a Rollercoaster with a small circuit around the festival. The kid initially chooses either to go to the candy store to get some candy or to the rollercoaster itself directly. He believes that coaster is good initially and develops and intention to try it. However, the coaster will start only when there are 10 kids onboard since we cannot run the coaster for each kid. The kids will start the ride around the circuit and randomly starts falling off the coaster because of its poor infrastructure. The kid that was fallen goes to the candy store and develops an intention that Coaster is not safe. The kids that complete the ride goes to the candy store again and and mollifies the injured that the coaster is not harmful.

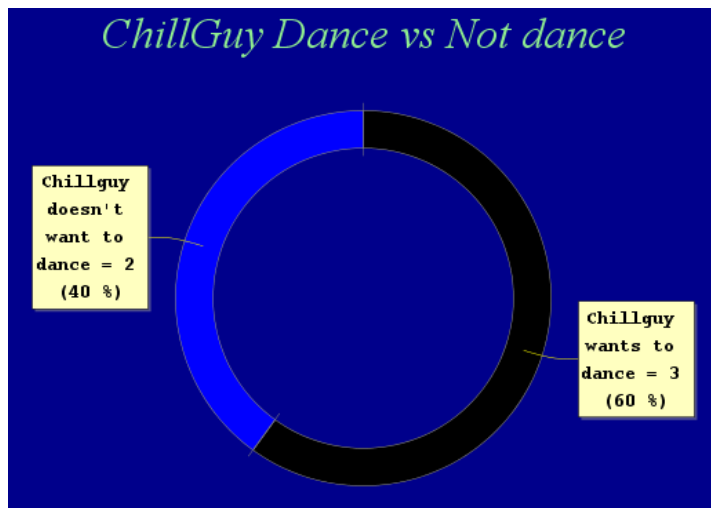
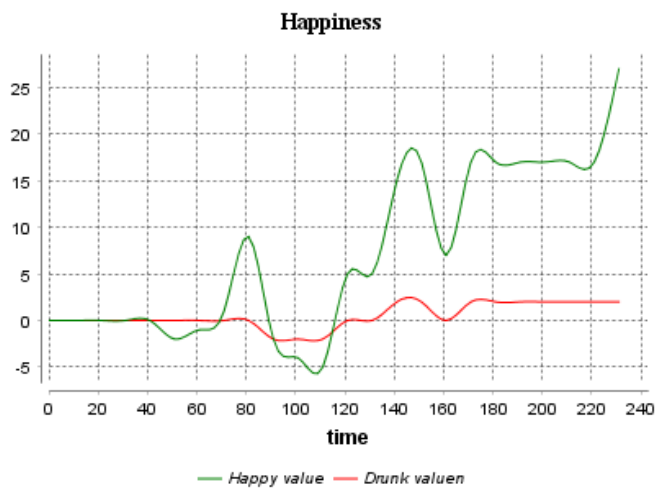
<b>Qualitative/Quantitative questions</b>	<b>Answer</b>
Time spent on finding and developing the creative part	6
In what area is your idea mostly related to...	Utility and BDI
On the scale of 1-5, how much did the extra feature add to the assignment?	3

On the scale of 1-5, how much did you learn from implementing your feature?	3
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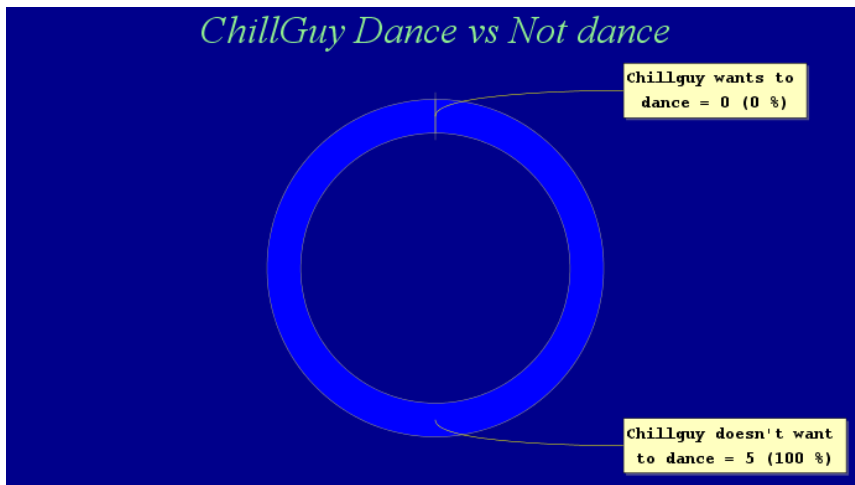
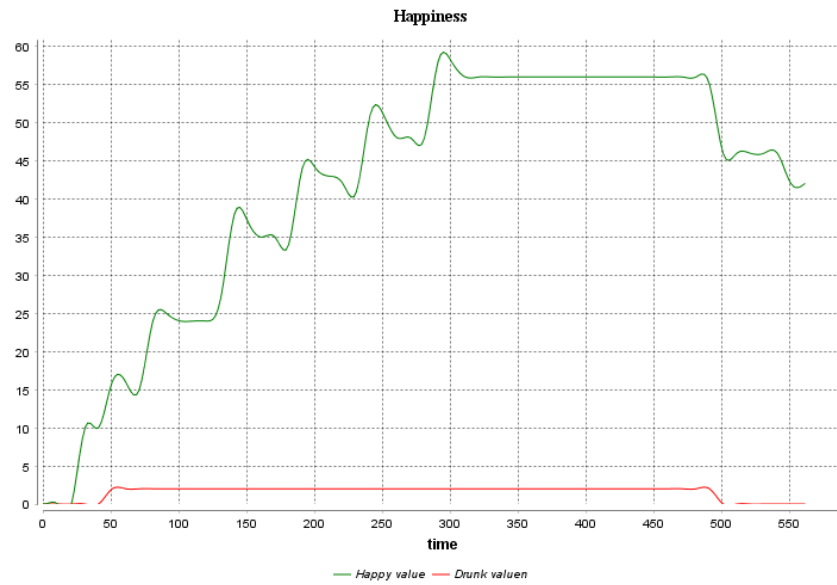


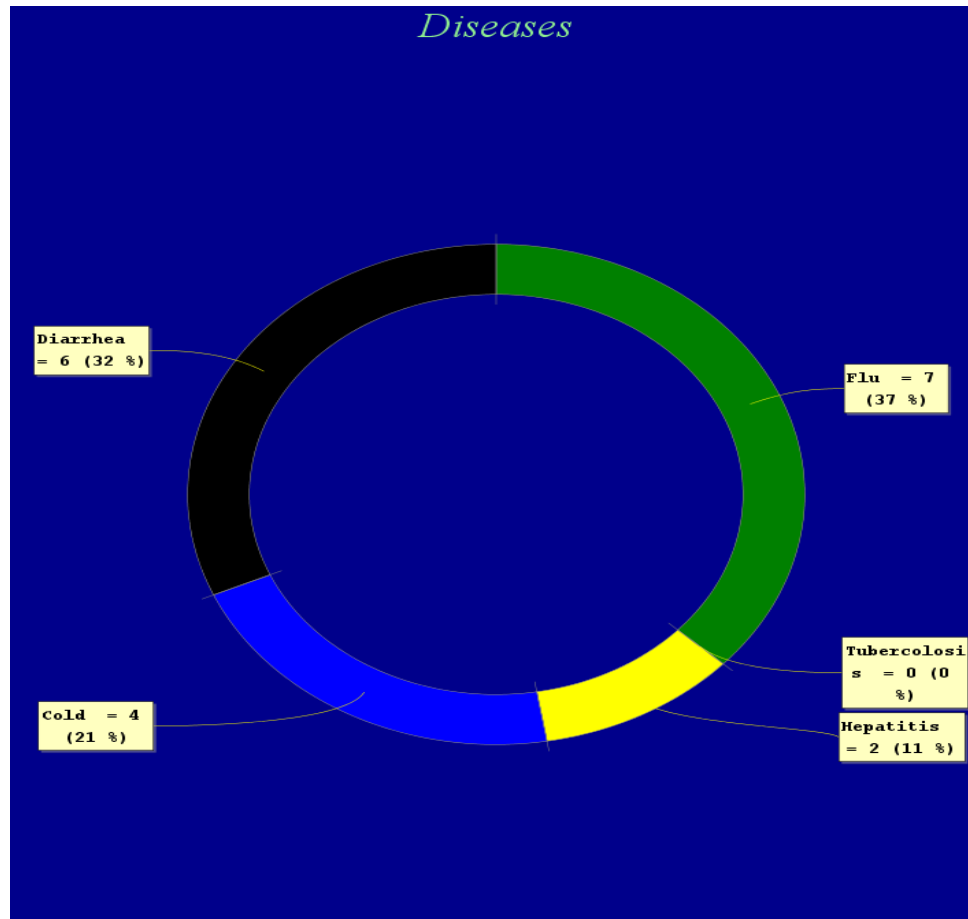
## Experiments and Results

In the Base Assignment there were requirements to show Pie Charts and diagrams of the simulation. From this there should be at least 1 interesting conclusion about the simulation. We decided to collect the happy value and drunk value of ChillGuy if he decides to dance, and drink or not. Also, there was a look at correlation between drunk and happy value. In the chart below we can see that there are no correlation between happy and drunk value, but a correlation between happiness and ChillGuy wants to dance. This is when the WantsToDance and WantsToDrink limit is 50.



When the limit is increased to 99 and 99 at time 300 we can see that the happy value and drunk value starts decreasing after this value has been changed.





When the diseases were tested for a small amount of time we could see that the flu was spreading most followed by diarrhea. This is probably because the flu is originating from the Thief from the beginning. And the Thief has close contact with many of the agents at the festival when Robbing. This is probably because of RockFan is traveling a lot between Stage and Pub, and interacting with other agents. However, the results could have been different depending on the randomness of simulation.

## Discussions and Conclusions

The Assignment was challenging because there were many agents to think of and how they should interact with each other. In previous tasks we have mainly thought of interaction with one place such as Auction house or Stage etc. Now it was problematic to think of implementing an agent that should be able to talk to it's neighbor but also answer a phone call or be robbed by a thief. We had to consider not only ordinary asks



situations but also FIPA messaging and handling of different guests communication in many ways. They should also be able to go to different places that they are not usually going to, like Police station or PhotoArea. The part of Belief Desire and Intention was very interesting and if we had learned this from the beginning, maybe the entire project should have been implemented with it. This because the logic is more clear than having different if statements about the behaviour. It was difficult to directly connect the theory from lectures to BDI behaviour in agents, but the examples provided by Gama Platform where very helpful. Also, it was difficult to figure out all the different behavior and situations that the agents could have. It required a big amount of imagination and maybe it would have been easier if more behaviour were requirements in this assignment. There were sadly no time to finish the final part of Reinforcement learning. Maybe some of the earlier Homeworks could have been replaced with this part so that we could get experience of working with the interesting subject.