ID2209 – Distributed Artificial Intelligence and Intelligent Agents

Final Project – Behavior of different agents

Group 20

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1 Minimal requirements

1.1 Structure

The final project is based on the three previous assignments. Below is the relationship between different species.

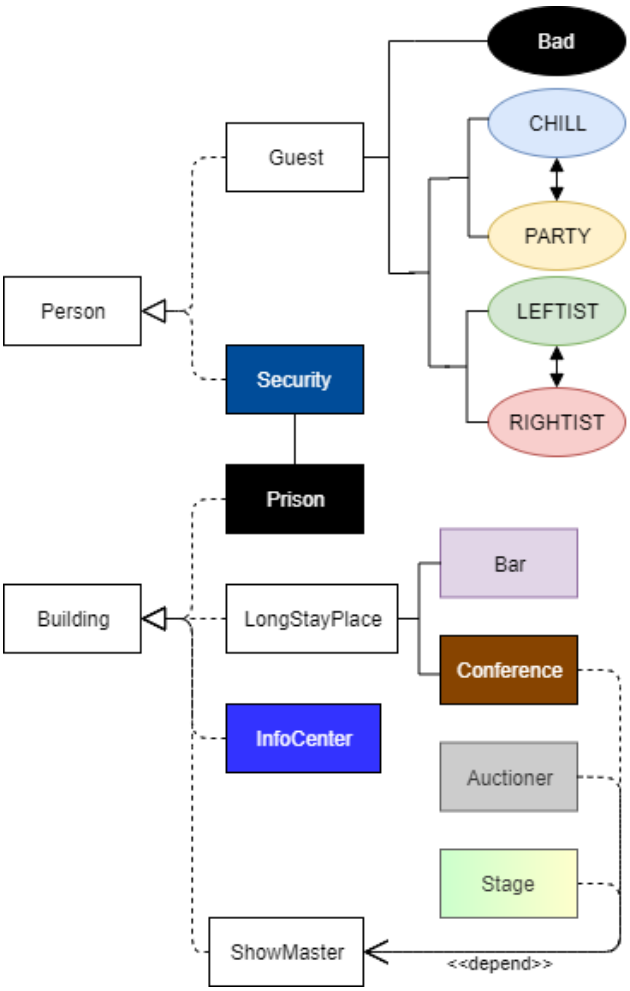

Fig 1.1 Relationship map of species

As shown in figure 1.1, the white rectangle represents abstract species that will not appear in the experiment directly but plays an important part to make the program work. While the colored patterns are the same with their identity in experiment.

Table 1.1 Amount of different species

Person		**Building**	
Guest	[20, 30]	InfoCenter	1
Security	1	Prison	1
		ShowMaster	1
		Auctioneer	4
		Stage	4
		Conference	+1
		Bar	[3, 4]

1.2 Long Stay Place

Compare with the previous experiments, our final project will continously running under the rules below.

- The definition of one day is **2400** cycles.
- Long-Stay-Place species can exist even the day ends.
- If the maximum capacity of a conference is too small, the interaction between politicians may not be seen.

1.3 Guest

Guest plays the most important role in this experiment. Following are the basic rules.

- There are 4 kinds of personality and randomly generated.
- CHILL and PARTY people will interact with each other in the bar, LEFTIST and RIGHTIST will interact with each other in the conference. In other cases, they won't affect each other.
- Every guest has a 20% possibility to be bad. Bad guests are the target of Security and not allowed to join the Auction.

1.3.1 CHILL vs. PARTY

When CHILL people meet PARTY people in the bar, they will be disturbed because PARTY people is making a lot of noises. If the happiness value of CHILL people is lower than *feeling-fine-value*, CHILL people get annoyed and leave this bar; or they're disturbed but still in good mood, it's not worth giving up the drink.

Table 1.1 When CHILL meets PARTY in the bar

Personality	Situation	Mood	Happiness
	Being at bar		+10
	No other personality	-	+5
Chill	Meet PARTY people	Good	-10
		Bad	-20
Party	Give Chill a free drink	Good && Generous	+10

1.3.2 LEFTIST vs. RIGHTIST

When LEFTIST and RIGHTIST meets each other in the conference, both their energy and happiness is taken into consideration

Table 1.2 When LEFTIST meets RIGHTIST in the bar

Personality	Situation	Mood	Politician's happiness
Leftist	No RIGHTIST here		+10
	Meet RIGHTIST	Good	-10
		Bad	-20
Rightist	No LEFTIST here		+10
	Meet LEFTIST	Good	-10
		Bad	-20

Apart from personality, individual happiness is also affected by other events.

Table 1.3 Other events that affect happiness

Situation	Individual Happiness
Won an auction	+10
Caught by Security	Cleared
Join a Stage	+3

2 Hard

For the second part, we implemented the concepts of Belief-Desire-Intention on our festival stimulation and created a new model for guests to select the stage.

2.1 Predicates

- **want_music**: represents the guest wants to find a stage and some music.
- **stage_location**: represents the location information of a stage.
- **check_show**: represents the location information of a stage.
- **choose_stage**: represents the guest wants to choose an unwatched music stage
- **watch_show**: represents the guest is staying in a certain stage.
- **cool_down**: represents the guest finished the stage and want to go to the bar and have a drink.
- **share_lager:** represents the guest is on good mood and give the closet guest a free beer.
- **want_exit:** represents the guest wants to exit this festival.

In addition to the basic BDI elements, we also introduced emotion “generous” and “hate” to control guests’ behaviors.

1. If this round ends with 6, all guests are in bad emotion. Vice versa.
2. If the balance of guest is larger than 80, this guest will be generous. Vice versa.

As show in figure 2.1, the purple ovals represent BELIEF, gray rectangles represent REACTION, and gold rounded rectangles DESIRE.

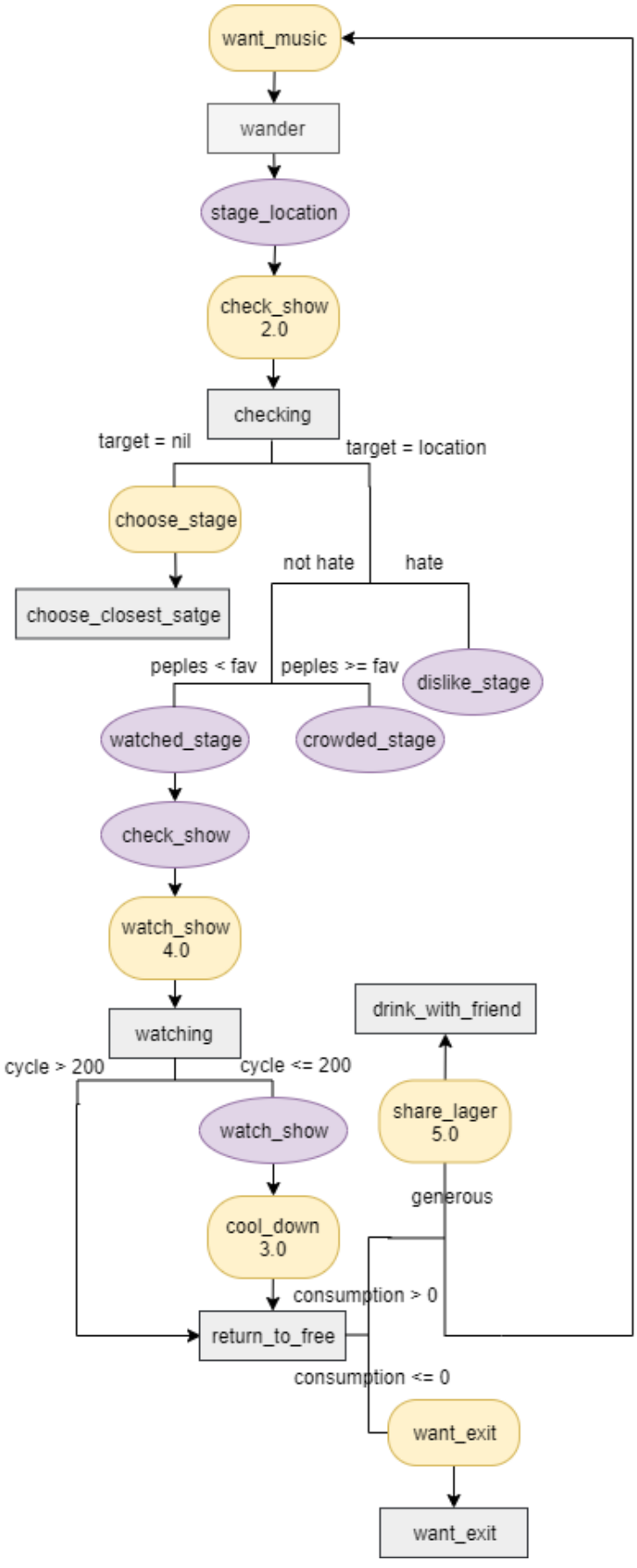

Figure 2.1 BDI tree

2.2 Implementation

At first, we set an initial desire **want_music** to every guest.

Guests kept wandering until they detected a stage nearby and took **stage_location** as their new belief. According to the first rule, the belief **stage_location** would produce a new desire, **check_show**, whose strength equals **2.0**.

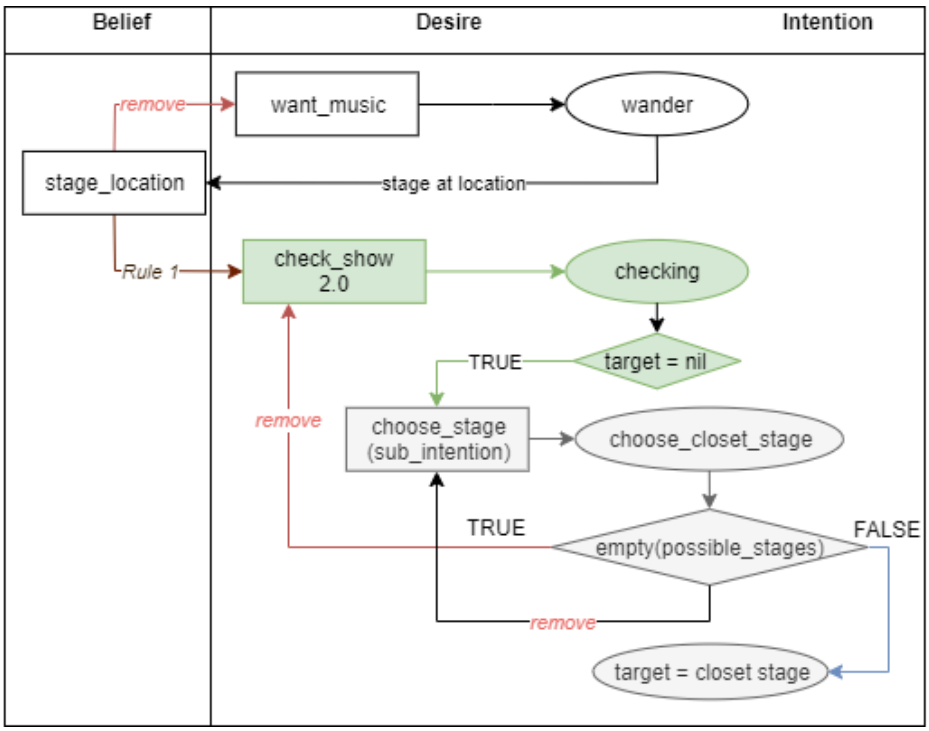

Figure 2.2 when guest did not have a target

Figure 2.1 illustrates when the guests did not have a target, we gave him a sub-intention **choose_stage** for choosing an available stage.

- If the list of possible stages was not null, chose the closest stage as target.
- If the list was empty, remove the intention **check_stage** and its sub-child.

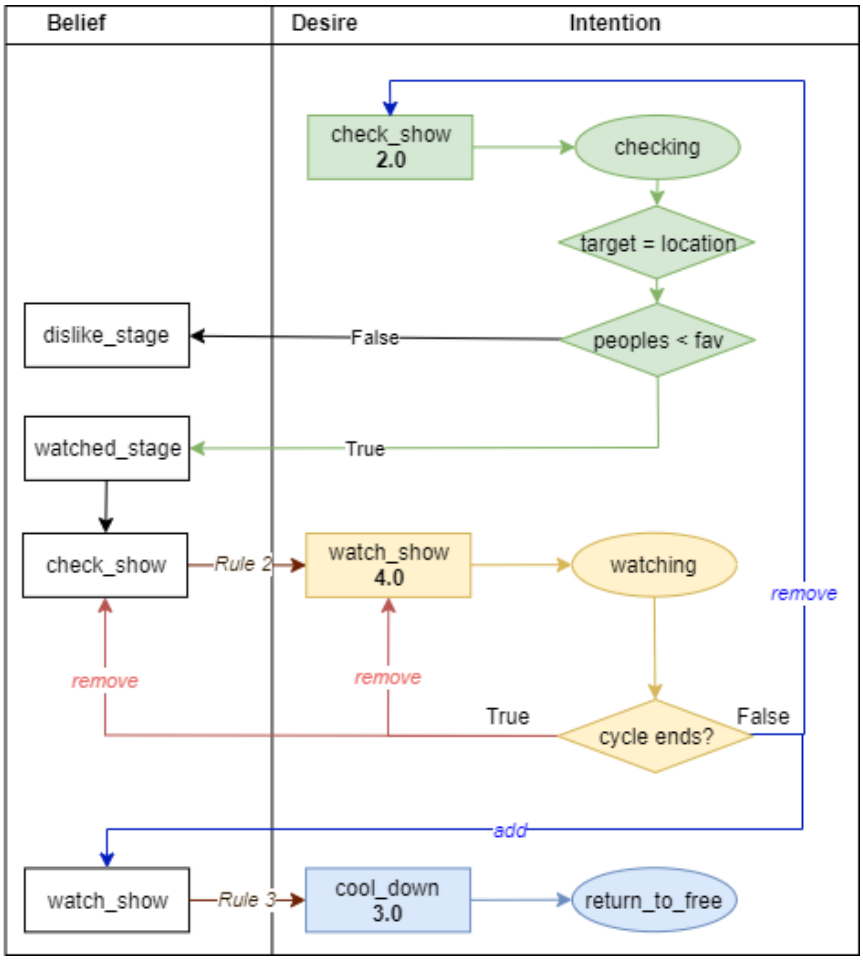

Figure 2.3 when guest had a target

As shown from figure 2.2, when guest had a target, he would check whether this stage met his preference.

- If the stage was crowded, marked this stage as **dislike_stage**.
- If the stage was corona-friendly, staying in this stage for 200 cycles, and marked this stage as **watched_stage**.

It worth pointing out that during the guest's stay, the model had already put a new belief **watch_show** into the guest's brain, which correspondingly produced a new desire **cool_down**. However, the reason why guest still stayed in the stage was because the weight of **cool_down** was lower than **watch_show** (4.0 > 3.0), and humans always follow the strongest desire.

3 Results

3.1 Minimum Requirements

The preconditions for the following simulation results are:

- Initial number of guests is 30.
- The energy consumption rate is 0.05, the happiness consume rate is 0.05.
- The maximum capacity of a conference is 8.

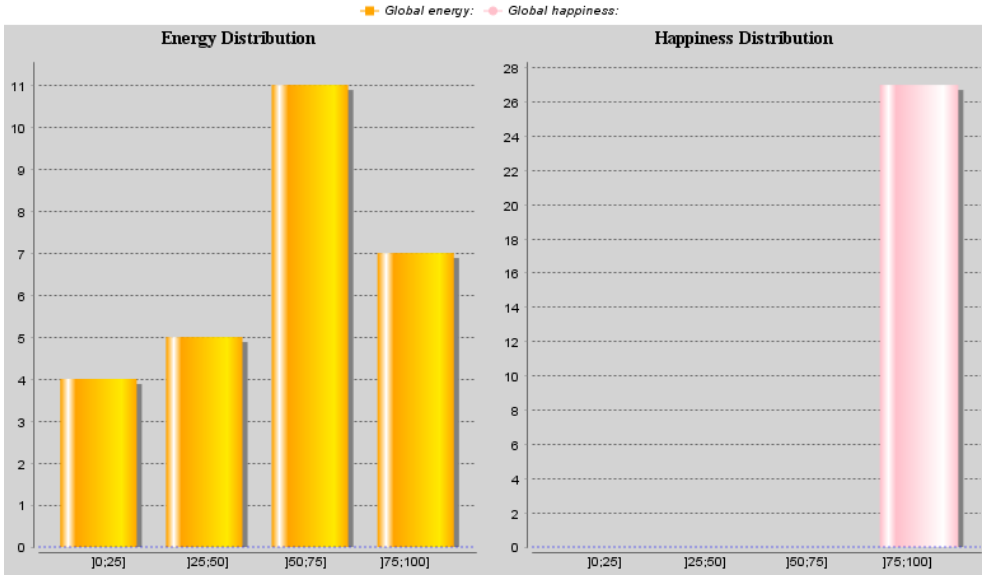

Fig 3.1 Histogram diagram of initial global energy and happiness

Figure 3.1 below illustrates the initial state of global-Energy, which followed the random distribution, while every individual's happiness was set to full.

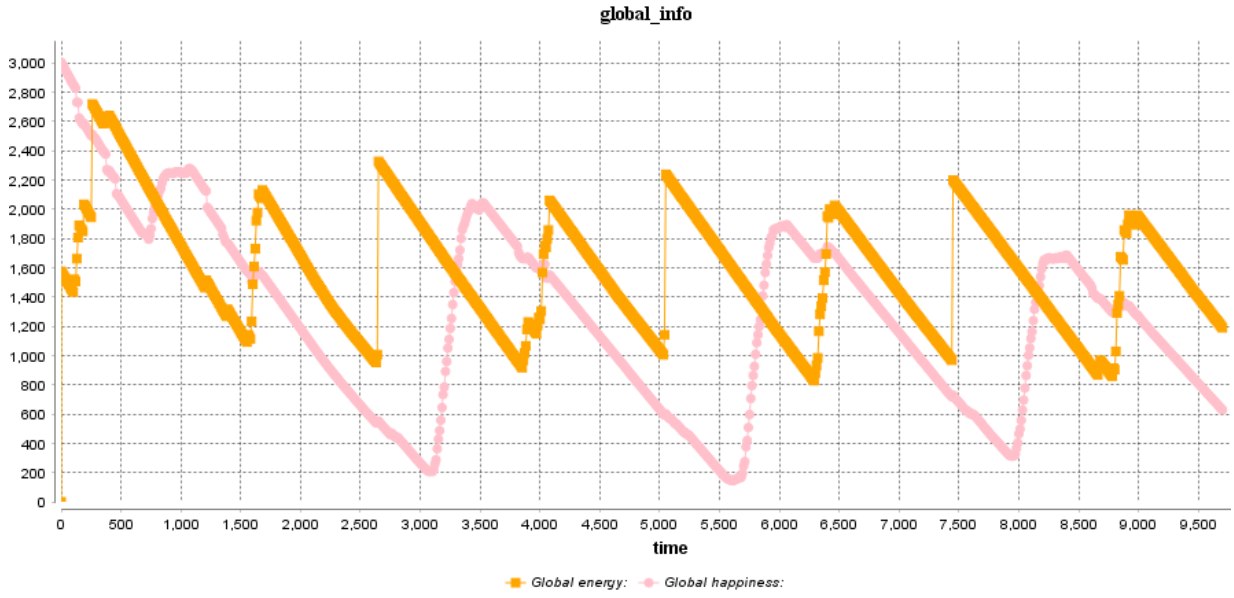

Fig 3.2 Series diagram of global energy and happiness period change

In figure 3.2, the orange line represents the change of *global-Energy*, it is clear that there are two significant fluctuations in one day which shows guests staying in the auction and stage for a long time. While the orange line jumped to a peak, when the activities ended and guests stopped wandering and went to bar.

On the other hand, the global-Happiness value increased slightly when the auction ended, followed by an obvious growth when the stage began.

```
Party, Guest18: Give the Chill a free drink. (at: Bar(1))
Chill, Guest22: Disturbed, but too lazy to move. (at: Bar(2))
Chill, Guest8: Disturbed, I hate PARTY people! (at: Bar(2))
Party, Guest7: Give the Chill a free drink. (at: Bar(2))
```

Fig 3.3 Console output between Chill and Party

It's important to point that there is nothing wrong if politicians did not speak anything in the console, which means no or only one politician joined the conference.

```
Leftist, Guest5: Disturbed, but in a good mood. (at: Conference(1))
Rightist,  Guest9: Disturbed, but in a good mood.  (at: Conference(1))
Leftist, Guest10: Disturbed, but in a good mood. (at: Conference(1))
Rightist,  Guest6: Disturbed, but in a good mood.  (at: Conference(1))
```

Fig 3.4 Console output between Leftist and Rightist

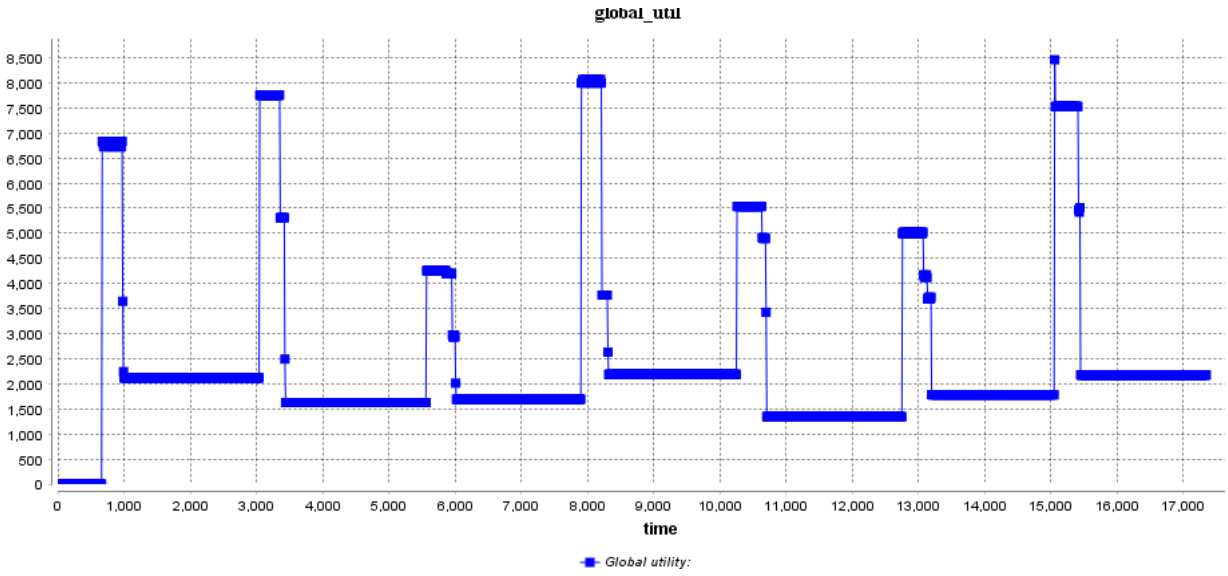

Fig 3.5 Series of global utility

The line roared suddenly was because we set a condition that only when the stage appeared, the calculation of global utility would start. And when one stage exited, the guests would move to a less satisfying stage, so their personal utility went down too.

3.2 Hard

- Initialize 20 customers, each with 100 cash at the beginning.
- 5 stages are randomly distributed.
- Guests will consume [30, 50] each time they get into the bar, and when they spend all money, they will leave the festival.

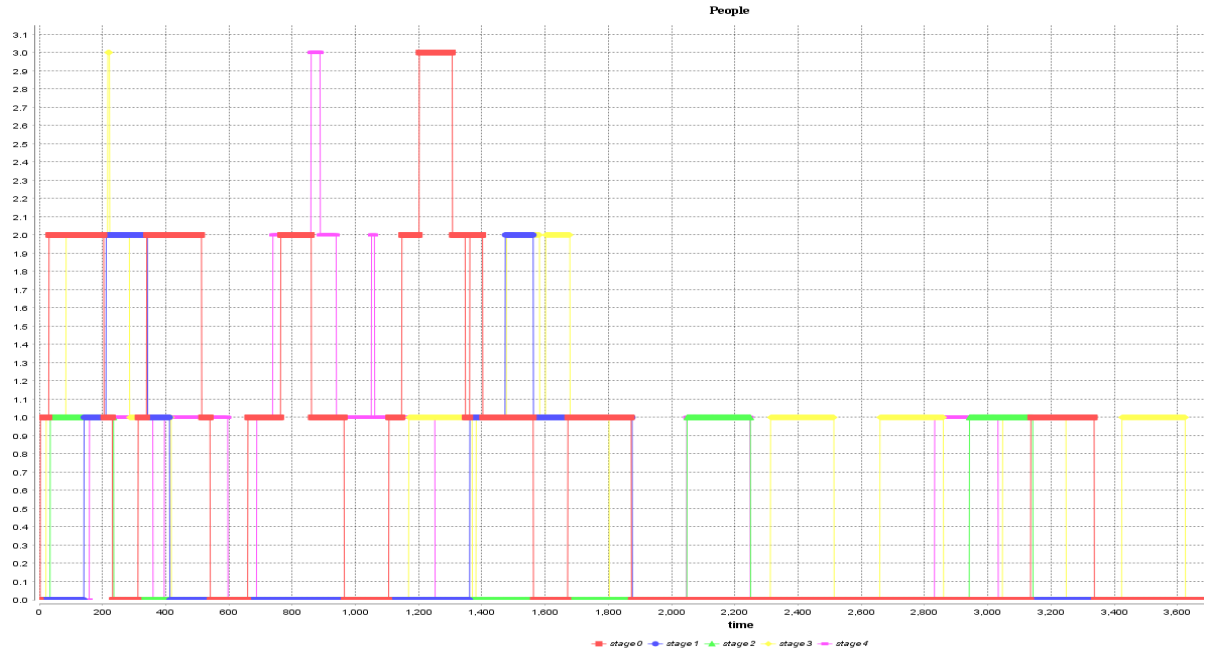

Fig 3.6 Changes of the number of guests on stage

In figure 3.6, we unexpectedly found that the max number of people on each stage will not exceed **the average of total people on each stage**.

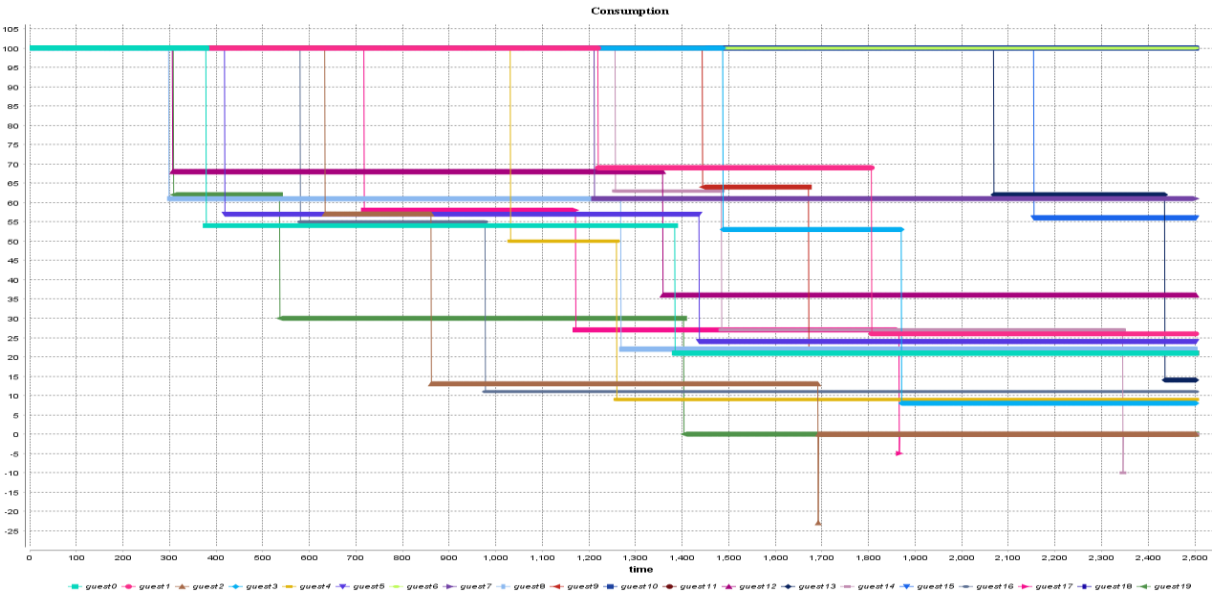

Fig 3.7 The remaining amount of each guest

On the other hand, figure 3.7 proved that different individuals can make intelligent decisions. The hard part was successful.

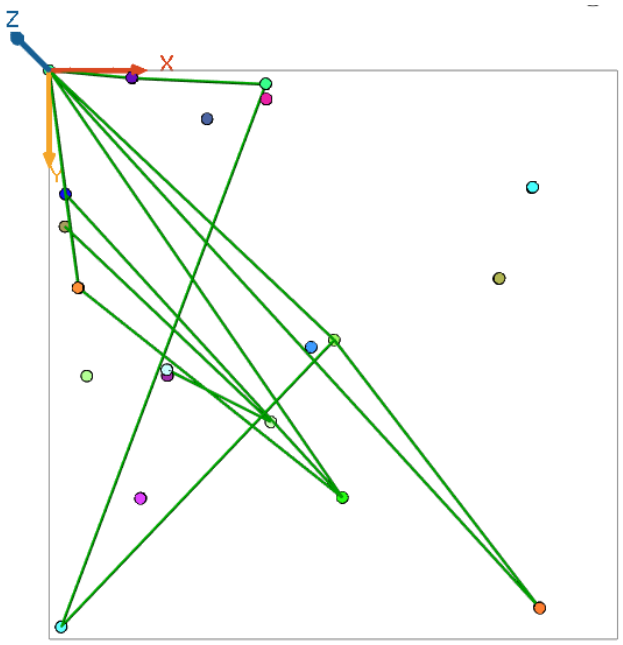

Fig 3.8 The remaining amount of each guest

What's more, figure3.8 shows guests would build a relationship when they were close enough and their favorite stage are the same. Then when guest were "generous", they would produce the desire **share_lager** and head to one of their closest friend.

```
guest2 dislike stage0
guest11 and guest2 are friends now
guest15 dislike stage2
guest2 and guest11 are friends now
guest17 want to share a lager with his new friend!
guest18 feel stage0 is a good show
guest16 feel stage3 is a good show
```

Fig 3.8 The remaining amount of each guest

It is worth noting that the generosity of guests mainly appears in the early stage. When they spended all money, they would stay in the exit. We didn't kill this poor guest because we want to save their data.

4 Questions

Through the study of this course, it's very exciting to learn to solve individual intelligence problems. By stimulation.

Based on a more cautious academic attitude, we still have a question about the relationship between Desire and Intention. From our study of the BDI sample code, we simply infer that **Desire** and **Intention** equal in some way.