Appendix C

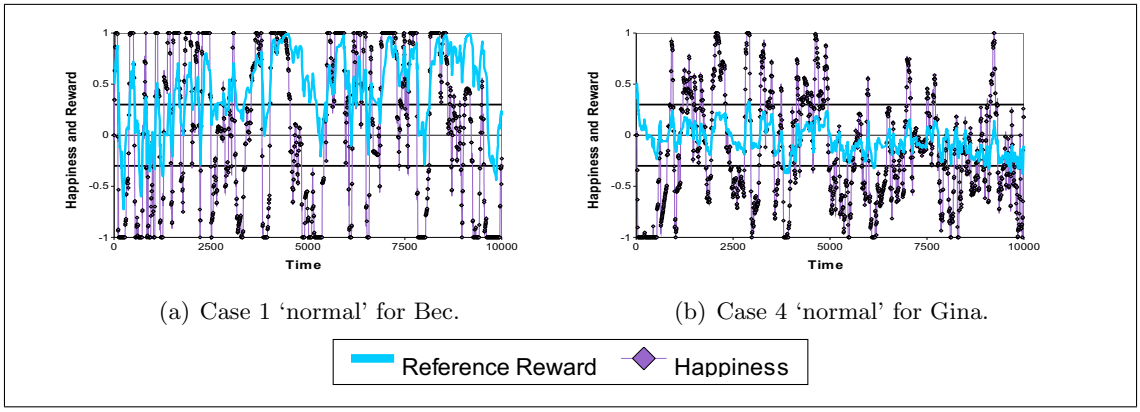
Domain-dependent Results

In the domain used for implementation, characters used two main opinions as part of their domain-dependent knowledge, attraction towards others and happiness. Based on *attraction towards others*, characters were able to build friendships that were relatively stable. Although how friendships are developed is based on domain-dependent equations, whether they wanted to make friends was part of their soft goals and therefore somewhat dependent on the stability of the model. The characters also had a *happiness* value that represented how close they were to achieving all of their soft goals.

In this appendix, we begin by examining happiness and then friendships as generated in the 'normal' mode when characters were able to adapt and use contexts. We finish by discussing the implications of these domain-dependent results.

C.1 Happiness

Happiness is closely related to reward values, since happiness is updated every time the character calculates a personal reward value (see evaluation process Section 3.2.2, page 90). By looking at the happiness graphs, we can also consider how personal reward fluctuated over time during the simulation. We consider two representative Cases as shown in Figure C.1 (page 206). These graphs show happiness intensity as a dot at each time tick. The reference reward is shown as the line, where reference reward is a reflection of all past rewards. Happiness fluctuates from high to low levels often and very quickly over time. The reference reward is also fluctuating, but not as severely.



(a) Case 1 'normal' for Bec.

(b) Case 4 'normal' for Gina.

Figure C.1: Happiness and reference reward for two example runs for two example characters. Horizontal lines are cutoffs for being "happy" and "sad".

In Case 1 (Figure C.1(a)), the average reference reward is higher than Case 4 (Figure C.1(b)). This was discussed in the results presented in Section 5.2 (page 160).

These results indicate that the personal reward and happiness fluctuate a lot, which is perhaps why the characters found it so difficult to learn. Even when the simulation was run for longer periods of time, the reward does not stabilise. We tried changing parameters within the learning function to improve stability but this seemed to have little effect. At the start of the simulation, the characters seemed to "learn" quickly since time steps allowed the character to complete each activity multiple times. These results show that the learning function needs significant work if it is considered desirable for reward and happiness to be more stable. However, how happy someone is can change throughout the day and so perhaps an unstable happiness value could be more realistic than a stable fixed happiness, depending on the domain and the intended use.

C.2 Friendships

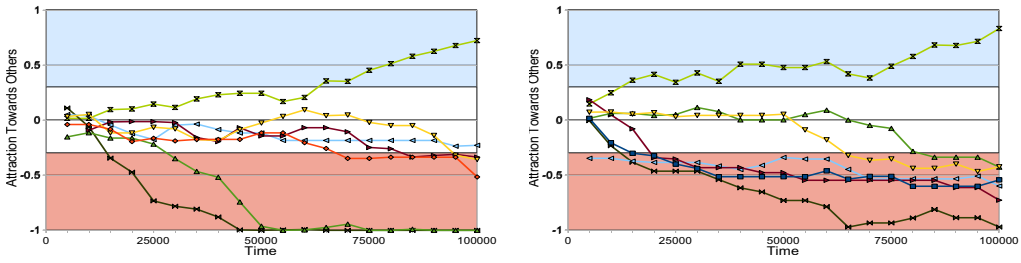
In this section, we examine the results based on opinions the character stored relating to each other character, *attraction towards others*. In our domain, friendships were formed based on insults given and received. The equations that generate attraction towards others are given earlier (see Section 4.1.2.2, page 111). The key ways that characters changed opinions of others was based on not liking people who insult you, liking people who agree with you, liking people talking to you, and liking people who insult people

you do not like. In an effort to simplify the complexity of these relationships, all characters used the same methods to determine how to update opinions.

Attraction towards others allowed characters to classify the other characters as 'friends', 'enemies' or 'neutral'. These values were used when the characters decided who they wanted to move towards (or away from), who they wanted to talk to and who they wanted to insult. We will look at five sample runs for each of the five Cases for the 'normal' mode (i.e. using our full model with adaptation and contexts). By examining *attraction towards others*, we can consider how stable the friendships were between characters. We examine graphs of the attraction values held by each individual character towards the others, and also the friendship networks. We begin by explaining how to read the figures.

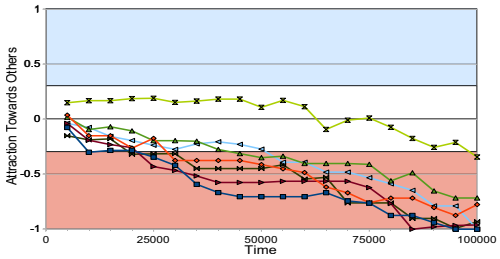
In this section, we show a graph for each of the eight characters of attraction towards others for each of the five Cases, taken from a single, sample run . For example, Bec's attraction towards others over time is shown in Figure C.2(b). Each of the seven lines represents a different character, for example, Heidi. The attraction towards that character is on a scale of $[-1, +1]$, with -1 being the worst value, and $+1$ the highest. If the attraction towards others goes over the threshold of $+0.3$ (as set by the domain-dependent threshold from emotionality, Section 4.2.2, page 122), then Heidi will be considered a 'friend' by Bec. If the attraction value goes below -0.3, then Heidi will be considered an 'enemy'.

We also show a friendship network representing a snapshot in time of how the characters feel towards each other. In particular, we show the friendship network as it stands at the end of the simulation. In these diagrams, (such as in Figure C.2(k)) an arrow from one character to another indicates that the originating character considers the other to be a 'friend'.

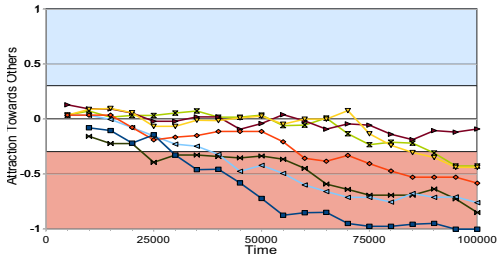


(a) Anna's attraction towards others

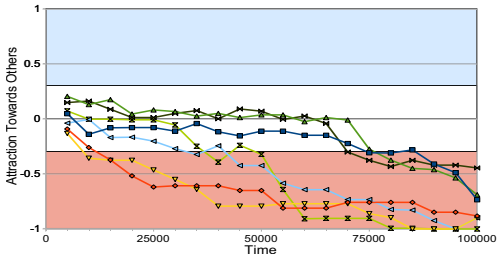
(b) Bec's attraction towards others



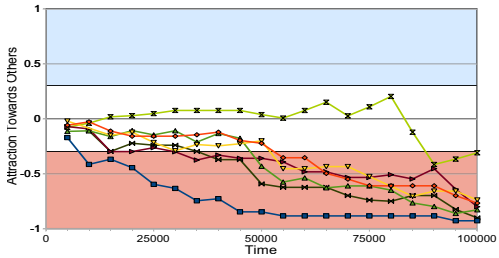
(c) Chloe's attraction towards others



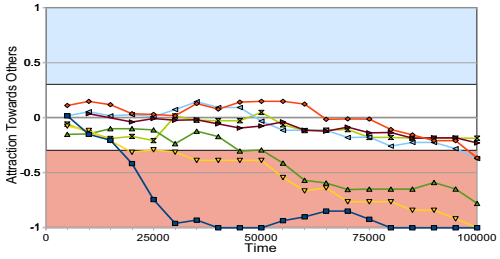
(d) Deb's attraction towards others



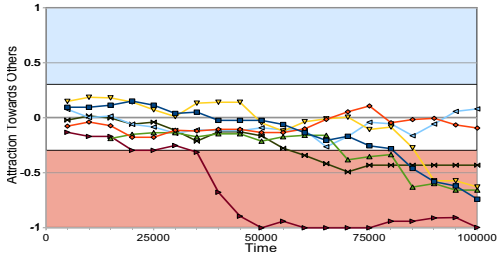
(e) Elle's attraction towards others



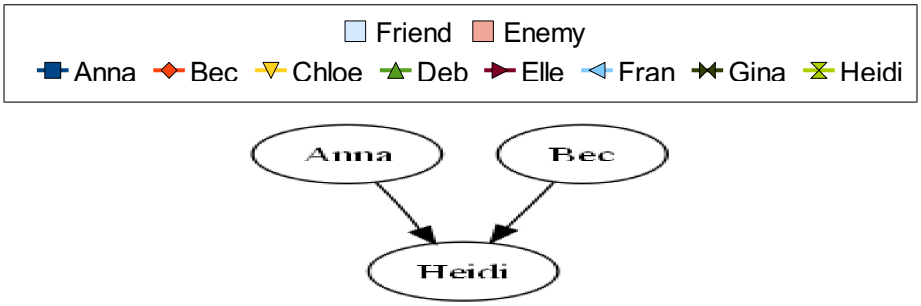
(f) Fran's attraction towards others



(g) Gina's attraction towards others



(h) Heidi's attraction towards others

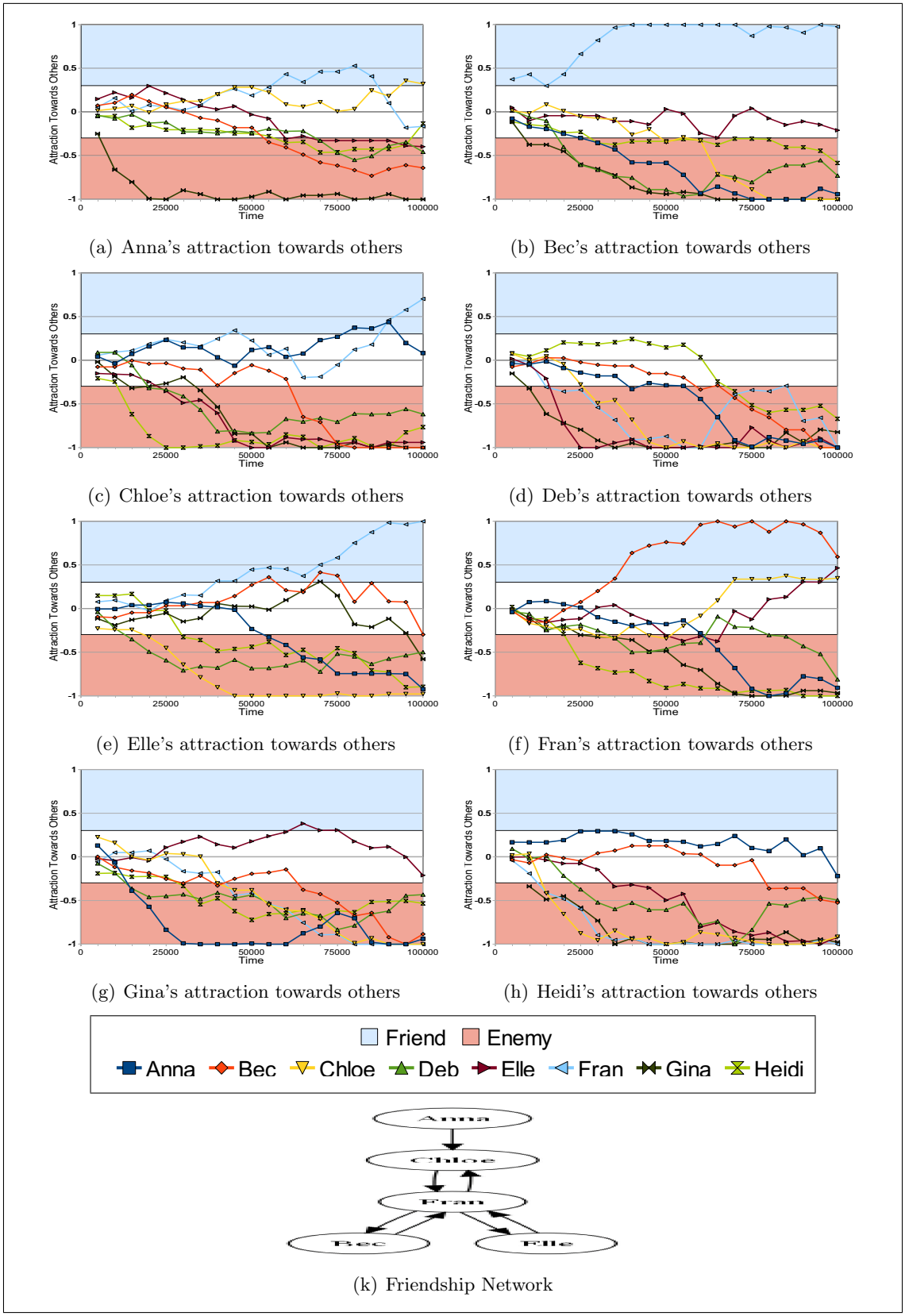


(k) Friendship Network

Figure C.2: Friendship network and attraction levels for Case 1 'normal'.

C.2.1 Case 1: Clear Preference Against One Activity

We start by considering the Case where there was a clear preference against one activity, insults. Our domain was set up so that it would be difficult to make friends directly. Therefore, in our domain, generating or listening to insults were the only ways that characters could make friends, since these plans are the only ones that update the attraction towards others value (see Section 4.1.2.2, page 111). In Figure C.2, we see the graphs from one example run (the friendship networks generated were fairly similar in all ten runs). The characters did not make very many 'friends' and, in almost all runs, there were no mutual friendships generated (where both characters consider the other to be a 'friend'). For example, the network in this single run (Figure C.2(k)), shows arrows (i.e. friendships) in only one direction. Only Anna and Bec consider someone to be their friend. The low number of friendships in Case 1 is likely due to the clear preference against insults, and consequently against making friends.



(a) Anna's attraction towards others

(b) Bec's attraction towards others

(c) Chloe's attraction towards others

(d) Deb's attraction towards others

(e) Elle's attraction towards others

(f) Fran's attraction towards others

(g) Gina's attraction towards others

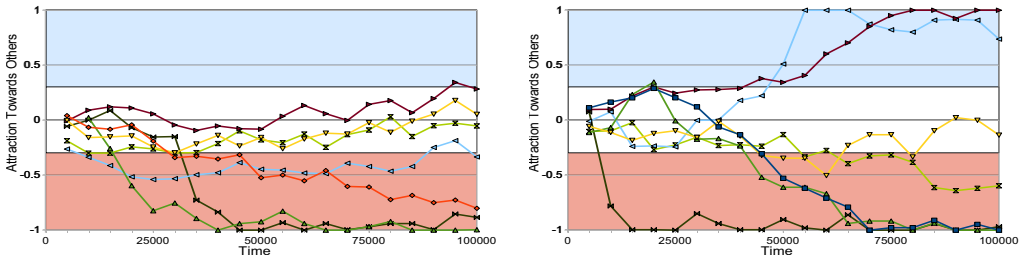
(h) Heidi's attraction towards others

(k) Friendship Network

Figure C.3: Friendship network and attraction levels for Case 2 'normal'.

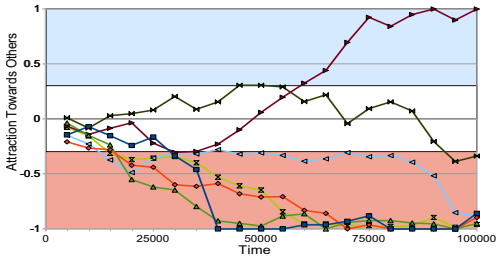
C.2.2 Case 2: Multiple Ways to Achieve Goals

The sample graphs for Case 2 are shown in Figure C.3. Here, the friendship network generated at the end of the simulation (Figure C.3(k)) is more complex than in Case 1. Three mutual friendships are formed and overall more characters have "friends". For example, as seen in Figure C.3(b), Bec considers Fran to be a 'friend' beginning near the start of the simulation and does not change her opinions very much. In Figure C.3(f) Fran also becomes friends with Bec early in the simulation and this opinion remains fairly stable. However, Fran also changes her attraction to Chloe and Elle as the simulation continues, so that she becomes friends with both of them by the end.

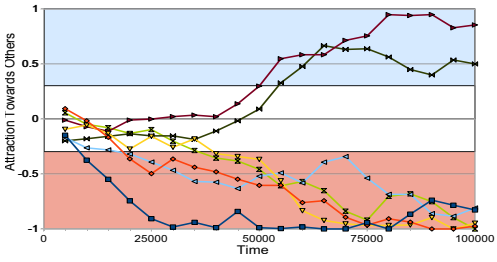


(a) Anna's attraction towards others

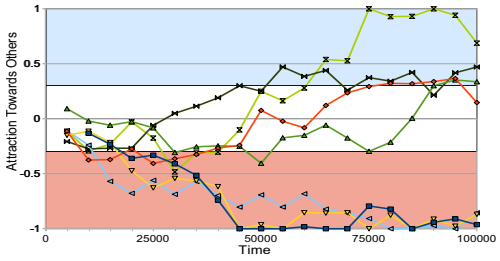
(b) Bec's attraction towards others



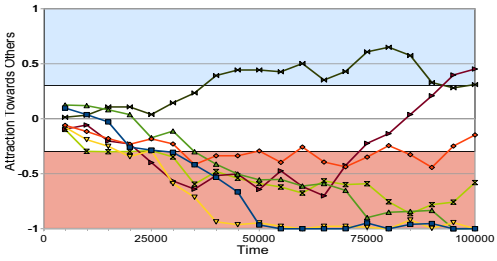
(c) Chloe's attraction towards others



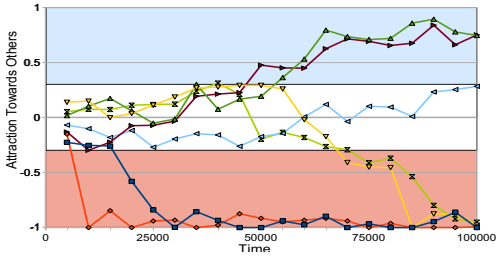
(d) Deb's attraction towards others



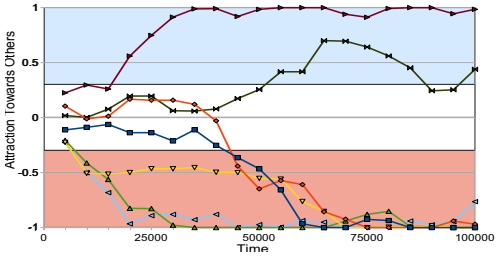
(e) Elle's attraction towards others



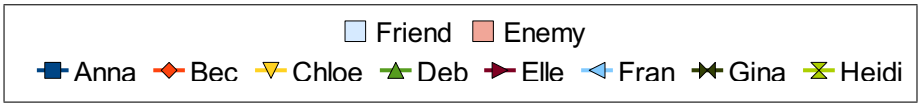
(f) Fran's attraction towards others

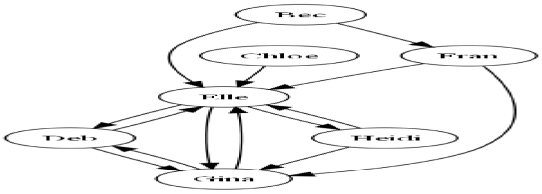


(g) Gina's attraction towards others



(h) Heidi's attraction towards others



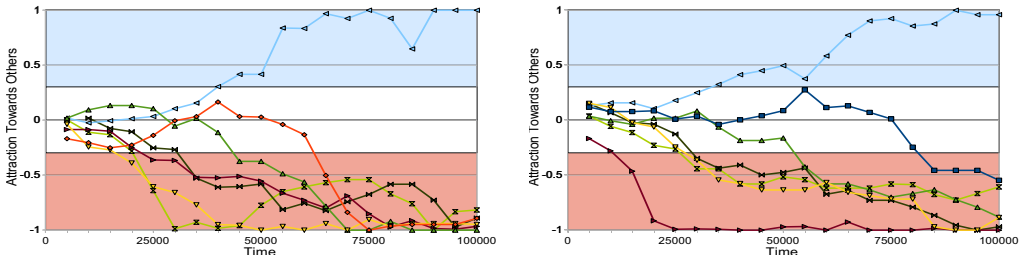


(k) Friendship Network

Figure C.4: Friendship network and attraction levels for Case 3 'normal'.

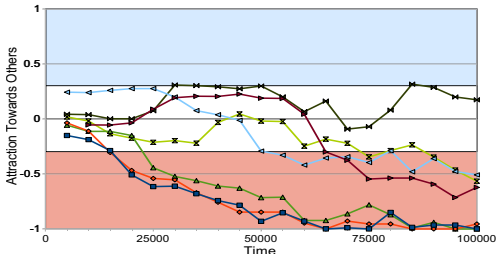
C.2.3 Case 3: Conflicting Goals

The attraction values and friendship networks for Case 3 are shown in Figure C.4. The final network shows four characters (Deb, Elle, Gina and Heidi) as a core group who mostly like each other and who are liked by other characters. Bec, Chloe and Fran are outsiders who like other individual characters, but whom no one likes. Anna considers no one her friend, neither does anyone consider her their friend. When we examine what activities the characters preferred to do (Figure 5.3, page 149), there does not appear to be a correlation meaning that, characters who always prefer to insult others are sometimes popular, like Gina, and sometimes unpopular, like Anna. If we examine the actual fluctuations of their attraction levels over time (for example, Figures C.4(e) and C.4(h)), we see that the levels are fairly constant. Once one character "likes" another character, they continue to do so and do not change their mind often. However, this is not as true for Elle and Fran who change their opinions slightly throughout the scenario.

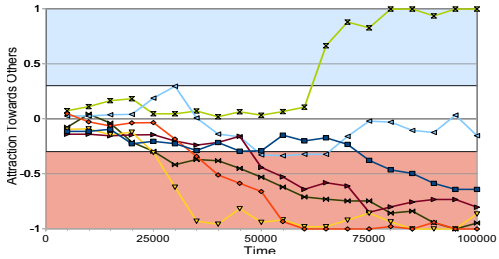


(a) Anna's attraction towards others

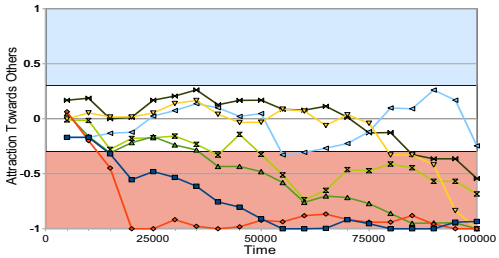
(b) Bec's attraction towards others



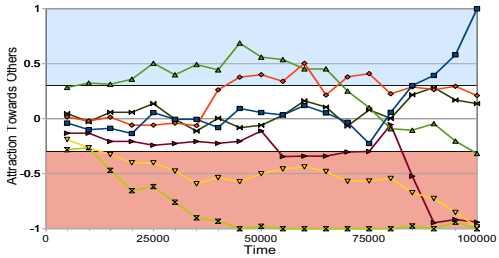
(c) Chloe's attraction towards others



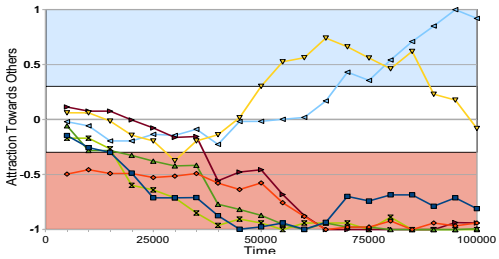
(d) Deb's attraction towards others



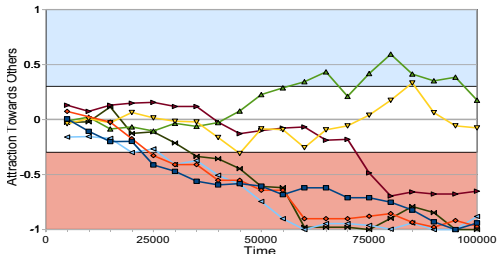
(e) Elle's attraction towards others



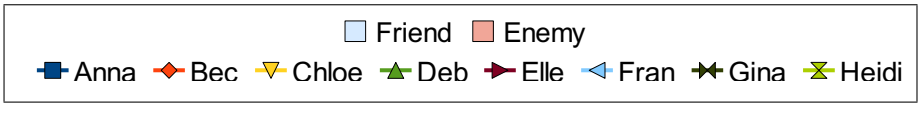
(f) Fran's attraction towards others

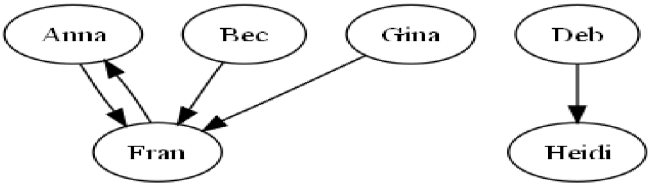


(g) Gina's attraction towards others



(h) Heidi's attraction towards others



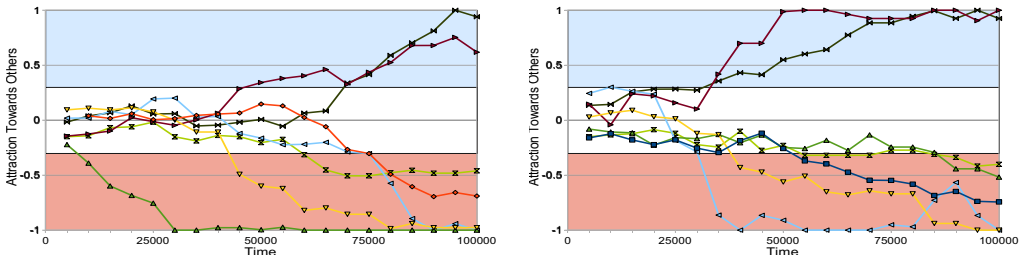


(k) Friendship Network

Figure C.5: Friendship network and attraction levels for Case 4 'normal'.

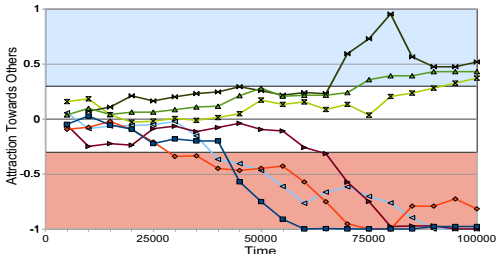
C.2.4 Case 4: Complex Soft Goal Personality

The graphs from Case 4, where characters are pursuing many soft goals, are shown in Figure C.5. The characters are trying to achieve "make friends" and "don't make enemies" as well as four other soft goals. The friendship network (as shown in Figure C.5(k)) and the individual character graphs show that, although some friendships were formed, the characters were not very successful at their goals. That is, in most Cases, the characters had more 'enemies' than friends. It is interesting that, according to the friendship network, two groups of friends were formed. Also, Fran appears to be the most popular girl, since three other characters like her, and yet she only likes Anna. These apparent abnormalities happen in the real world as well.

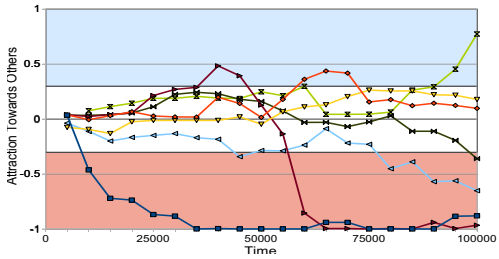


(a) Anna's attraction towards others

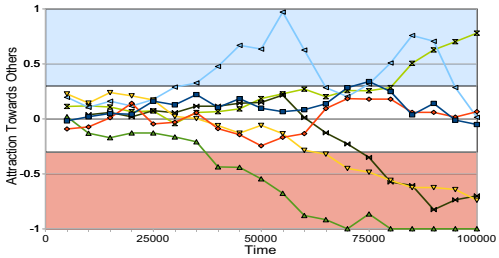
(b) Bec's attraction towards others



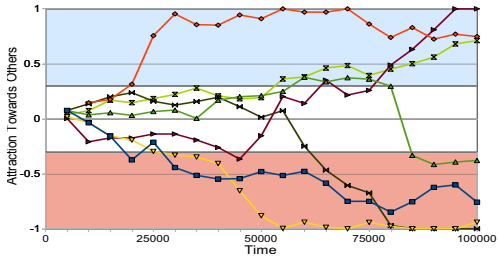
(c) Chloe's attraction towards others



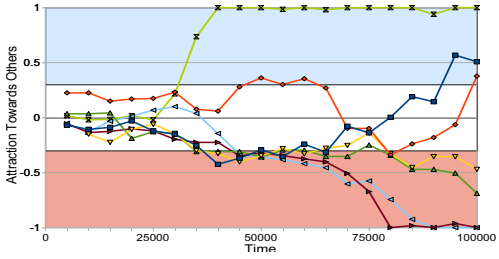
(d) Deb's attraction towards others



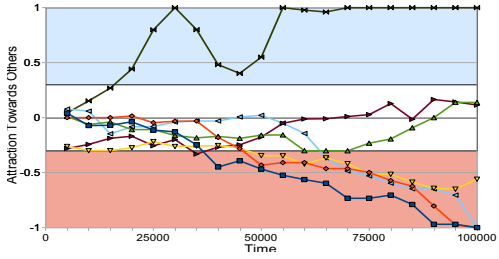
(e) Elle's attraction towards others



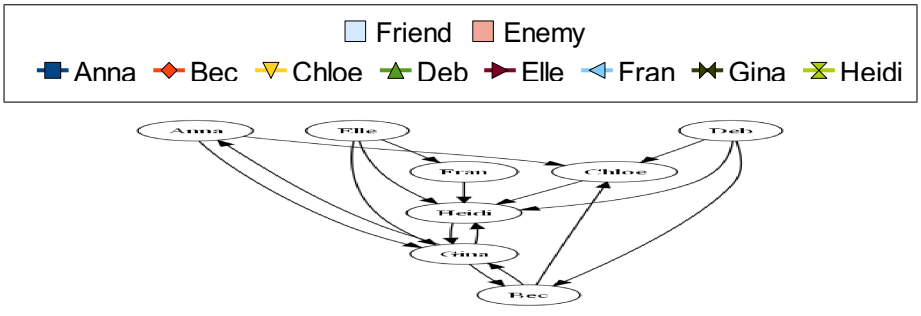
(f) Fran's attraction towards others



(g) Gina's attraction towards others



(h) Heidi's attraction towards others



(k) Friendship Network

Figure C.6: Friendship network and attraction levels for Case 5 'normal'.

C.2.5 Case 5: Different Soft Goal Personalities

In Case 5, characters with different soft goal personalities, a relatively complex friendship network was generated (see Figure C.6(k)). In this network, we see that Gina and Heidi are the two most popular girls. Interestingly, the only soft goal that both Gina and Heidi were attempting to achieve was "make friends". So, according to the friendship network both girls achieved their goal quite well, even though Heidi considered only Gina to be her friend. The friendship network shows that there are some characters, such as Elle and Deb, who like three other characters but are liked by no one. This can happen in the real world, particularly with girls of school age.