Appendix B - Simulation Results

1. LEADSTO Simulation Results

Using the LEADSTO simulation tool, the Altruism simulation model has been used to generate a number of simulation traces. An example of such a trace is shown in Figure 1 to 4. In these figures, time is on the horizontal axis, the state properties are on the vertical axis. A dark box on top of a line indicates that a state property is true, a light box below the line indicates that a state property is false.

Figure 1 and 2 show the cooperation behaviour of one agent without decision function and one agent with decision function, respectively. Initially, all six agents request each other for help. However, only the agents with the inter-temporal decision function (i.e. agent 4-6) are willing to cooperate; they accept all requests (see Figure 2, first three cooperation rounds), thereby showing some kind of altruistic behaviour. The other agents (1-3) show egoistic behaviour: they refuse all requests (see Figure 1). As a result, the trust in the cooperating agents increases, whilst the trust in the non-cooperating agents decreases. This development continues for a while, until the trust in the non-cooperating agents is so low that even the agents with the inter-temporal decision function (the cooperating agents) are not willing to help them anymore (see Figure 2, next cooperation rounds). However, they still continue helping the other cooperating agents. Thus, a group emerges of three agents that are helping each other, whilst the other three agents get isolated: they do not interact with any agent anymore.

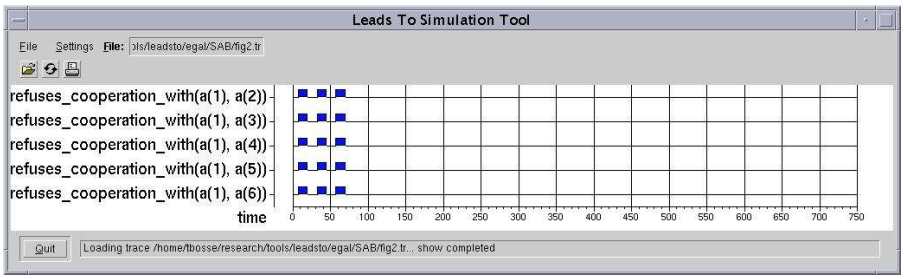


Fig. 1. LEADSTO simulation trace.

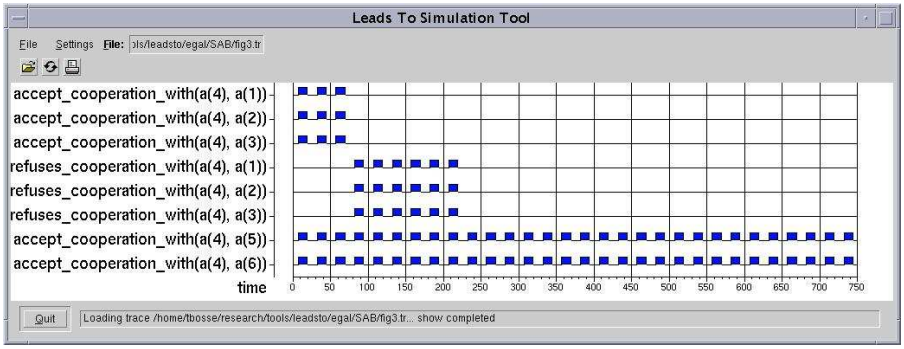


Fig. 2. LEADSTO simulation trace.

As a consequence, the fitness of the agents with the decision function (which was first rather low, since these agents were initially exploited by the other agents) recovers, and the fitness of the agents without decision function gets lower and lower. The fitness of one agent without decision function and one agent with decision function is shown, respectively, in Figure 3 and 4. These results confirm the hypothesis that agents that have the ability for inter-temporal decision making will show altruistic behaviour, which leads to a bigger social network, and eventually to a higher fitness.

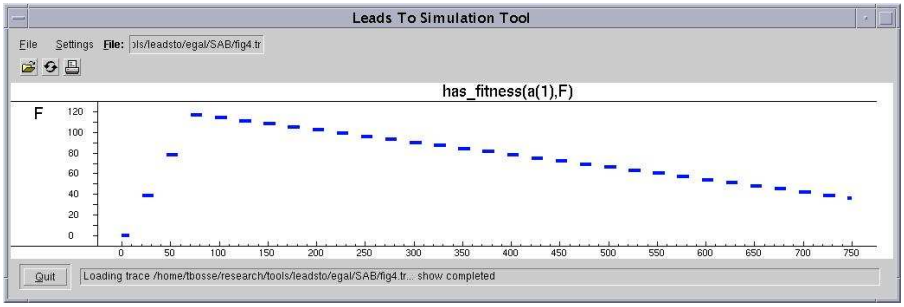


Fig. 3. LEADSTO simulation trace.

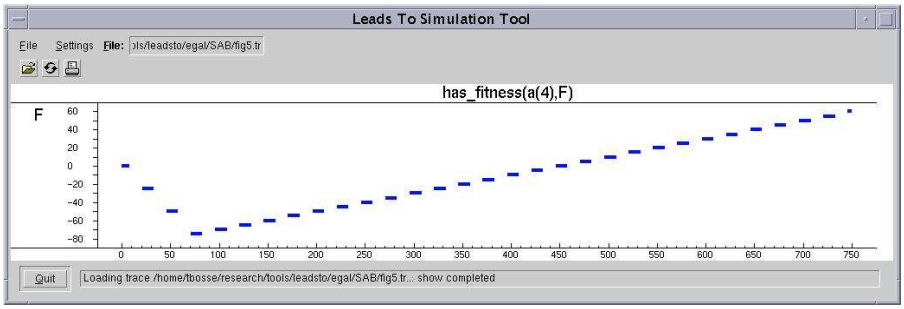
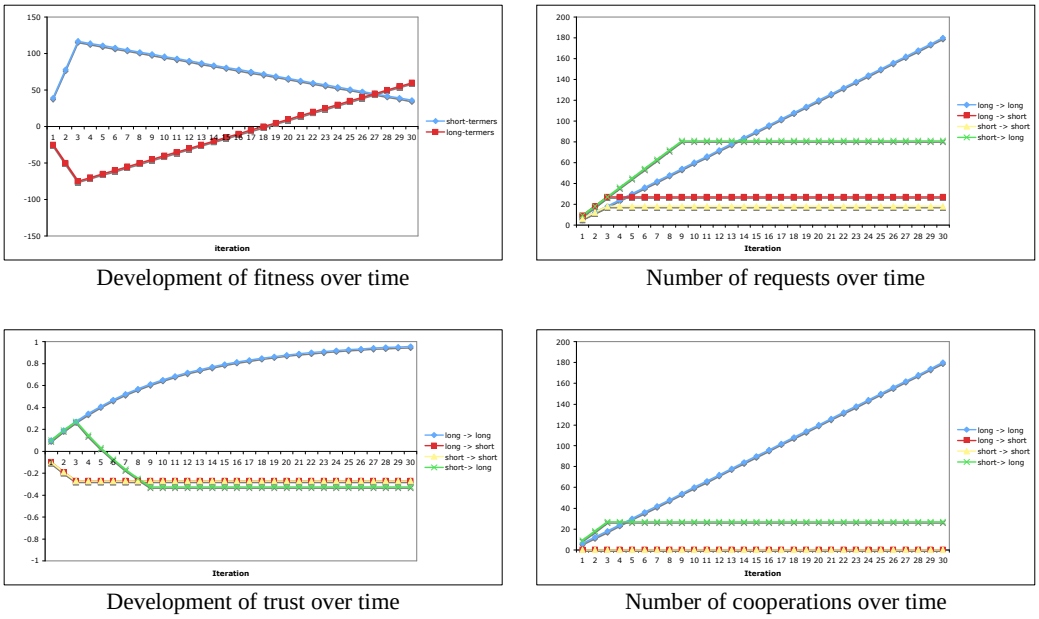


Fig. 4. LEADSTO simulation trace.

2. NetLogo Simulation Results

The results for the NetLogo simulation of the model involving 6 agents are shown in Figure 5.

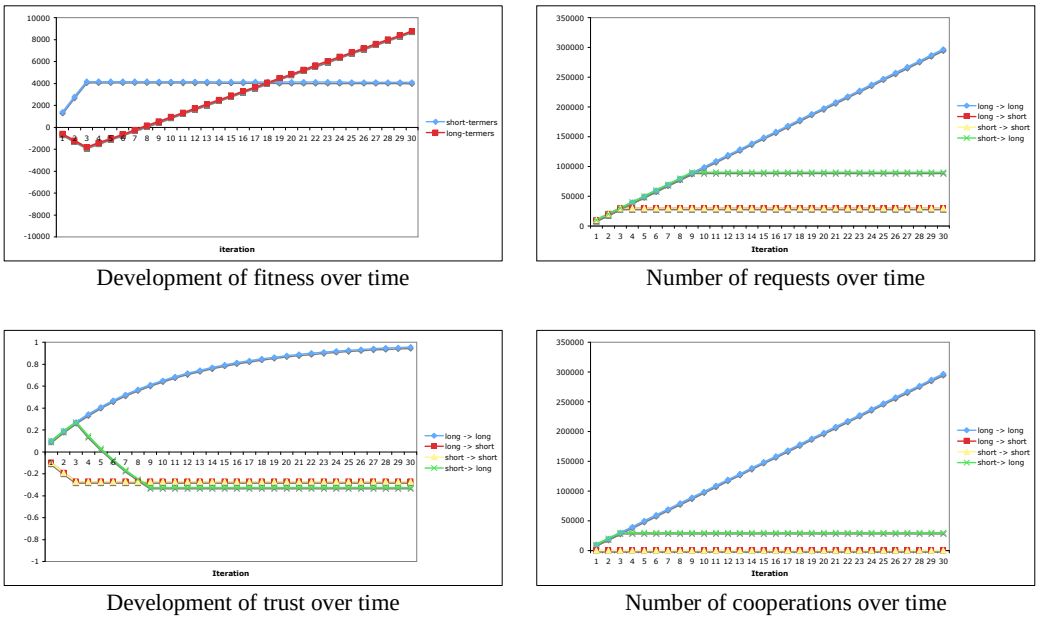


Development of fitness over time | Number of requests over time

Development of trust over time | Number of cooperations over time

Fig. 5. NetLogo results for simulation with 6 agents.

The results for the NetLogo simulation of the model involving 200 agents are shown in Figure 5.



Development of fitness over time | Number of requests over time

Development of trust over time | Number of cooperations over time

Fig. 6. NetLogo results for simulation with 200 agents.