A Case Study on Social Network in a Computer Game

Yang Cao, Golha Sharifi, Yamini Upadrashta, Julita Vassileva
Computer Science Department
University of Saskatchewan
Saskatoon, SK, S7N 5A9 Canada
Phone: 1-306-966-2073
{yac614, gos787, ysu156, jiv}@cs.usask.ca

ABSTRACT

This paper argues for the importance of considering interpersonal relationships emerging among the users of multi-user applications, and demonstrates the usefulness of a multi-agent system underlying a specially designed multi-player games to investigate emerging user attitudes towards each other.

Categories and Subject Descriptors

H.1.2. **[User-Machine Systems]**: Human factors
H.5.3 **[Group and Organization Interfaces]**: Web-based interaction
I.2.11 [**Distributed Artificial Intelligence**]: Distributed Artificial Intelligence – multi-agent systems, cooperation.
J.4 **[Social and Behavioral Sciences]**: Sociology

General Terms

Design, Experimentation, Human Factors.

Keywords

Cooperation, Social Networks, User Attitude, Multi-Payer Games.

1. INTRODUCTION

With the recent developments in the fields of distributed artificial intelligence, game theory and multi-agent systems (MAS), there has been a continuously growing interest in the study of social issues and cooperative behavior. One reason for this interest is technical - a system consisting of many autonomous interacting entities is hard to predict and manage [2, 3, 6]. Researchers studying social issues in MAS for this reason are mostly interested in the mechanisms for emerging cooperation and apply techniques from the areas of game and economic theory. Another reason for studying social issues in MAS is related to the successful deployment of multi-agent systems with human users in the real world [5,7], which requires taking into account the social dynamics of the environment. Researchers motivated by this reason are more interested in sociological aspects, i.e. discovering and describing existing relationships among people and organizational structures [1]. While there is a lot of research of user cooperation in organizations [8], there is not much research on emerging cooperation among users within MAS applications, where users do not know each other from the beginning, have no existing organization to define roles and processes and yet the users need to cooperate in order to exchange services and resources. Examples of such multi-agent, multi-user environments are multi-player games, newsgroups and discussion forums, peer-to-peer file sharing or computation resource sharing applications, e-learning environments.

User attitudes play an important role in such cooperation. We are interested specifically to find out how people develop attitude of liking or disliking other people and how one changes his/her attitude towards other people to reciprocate their perceived attitudes towards him/her. For this purpose we designed a game that allows players to manipulate their attitude (level of liking or disliking) to the other players. The user attitudes have impact on the success of each player, since only through cooperation all players can maximize their scores.

2. GAME DESIGN

We want to study the evolution of personal relationships among a group of people using a multi-player web-based game. This game is implemented using Apache Tomcat server and is built on FIPA-OS [4], a multi-agent platform. The idea of the game is as follows:

The game requires at least three players. The game starts by player A signing in the system. Player A will be provided with the list of names of the current players in the system and will be required to enter his/her attitude (how much he/she likes each other player) as a integer from 5 (strong like) to 1 (strong dislike). A round of the game starts by player A choosing one of the other players, say player Z, as a final destination for a packet of 100 units. The rules of the game do not allow A to send the packet directly to Z. Player A needs to send it to another player, who he/she likes most. Each intermediate player, upon receiving A's package takes away a number of parts proportional to the level of dislike it holds towards A and passes the package to another player, which it likes most. The round finishes when the packet reaches the destination player or is destroyed. The score for A of this round is a function of the percentage of the packet that has arrived at the destination and the length of the path it traveled. One can see that if everyone likes everyone, everyone will be able to maximize his/her scores. The game becomes interesting when players have different attitudes to each other. To ensure that this

AAMAS'03, July 14–18, 2003, Melbourne, Australia.
ACM 1-58113-683-8/03/0007

is the case, a tit-for-tat behavior is stimulated by allowing player A at the end of the round to get feedback about the attitudes of the other players towards him/her. The actual attitudes of the players are not revealed; they are kept private. However, the server observes how much each player subtracts from the package and classifies the attitude of each to user A in one of two types: likes (levels 3, 4, 5) or dislikes (levels 1, 2). In response, the player A can change his/her attitudes towards any of the other players before playing another round of the game.

A personal agent represents each player, thus saving the player's effort needed to consider each passing packet and ensuring consistency in the forwarding of packages according to the attitudes of the player towards the other players. The personal agent maintains a list of attitudes $\{a_1, \ldots, a_k\}$ of the player towards the other k players. A number $a_i \in \{1,2,3,4,5\}$ represents each attitude, where 1 means "dislikes" and 5 "likes". During the course of the game, the agent decides to whom to pass each packet and how much to take away. The following are some of the rules that agents use during the game. The packet is sent to the agent of the most liked player $M \mid a_M = \max_i \{a_1, \ldots, a_k\}$. An agent of player A will not send a package to the agent of a player B that A dislikes (i.e. $a_B = 1$ in A's attitude model). Assume that a_R is the value of the attitude of the player to the originator R of the package, if the player completely dislikes R (i.e. $a_R = 1$) the agent will destroy the packet, i.e. it will not pass it further. Otherwise, the agent takes away n parts of the package where $n = 5 - a_R$ and forwards the package. The agent does not reveal the attitudes of its player to either other agents or to the system.

3. EXPERIMENT

This section describes some preliminary results generated by a 45-minutes experiment with the game. Six participants played a total of fifty rounds of the game (i.e. packages sent by different players) and answered survey forms in the end. The participants had different gender, age, and background (nationality, education, and research interests). In each set of experiments the participants did not know each other (aliases were used by all but one of them). The players were given a general introduction about the game and the basic rules. Some of the questions we wanted to answer with the experiment and the observations follow:

Can cooperative groups be identified by a certain pattern in the individual players' attitude changes? The evolution of the group average level of attitude fluctuated in a small interval above the neutral, reflecting the generally cooperative spirit in the group of players.

How players choose initial attitudes to a player they didn't know? 4.3% of the players chose "strong like (5)", 30.4% chose "like (4)", 60.9% chose "neutral (3)", 4.4% chose "slight dislike (2)", and none of the players chose "strong dislike (1)".

How players change their attitude to another player when they know the other player's general attitude toward themselves (only like/dislike)? 17.4% of the players never changed their attitude to others. If the players find out that another player does not like them, 4.3% of the players changed their attitude to the player to "strong dislike (1)", 52.2% decreased their attitude level gradually, and 26.1% did not change their attitude. But if the players find out that the other player likes them, 82.6% of the players increment their attitude level gradually. From these numbers it seems that the players had neutral to positive attitude disposition at start and were fairly conservative in changing their attitudes.

Does individuality play a role in changing attitudes towards other players in response to failure or success? The individual players displayed different evolution in their attitudes, corresponding to the reactions described above. One of the players reacted strongly to the fact that his package was destroyed, so he changed his attitude to all other players to "strong dislike" towards the end of the game. After realizing that he won't be able to play anymore, he changed his attitude by assigning random values. This radical change of attitude shows that individuality plays an important role in peoples' attitudes. Such individual differences need to be considered when designing motivation mechanisms in multi-user systems. A classification of users with respect to the most typical reaction they chose may help to select appropriate adaptation of the system for the individual user to encourage cooperation among users. Users can be then identified as belonging to particular classes using several rounds of game playing as a diagnostic tool before starting their actual usage of the P2P environment.

Even though the results of this very preliminary experiment are not conclusive, they demonstrate the wealth of data that can be retrieved from the game that we described. It would be useful to analyze the data available to each player at each point when they decided to change attitude and to use think aloud protocols to find out the reasons for the change. This will throw light into how people develop attitudes towards each other in response to events and information about other peoples' attitude towards them.

4. CONCLUSIONS AND FUTURE WORK

Interpersonal relationships influence the level of cooperativeness and motivation of the participants to share resources and services. There are not enough studies of how people actually develop attitudes to each other in the context of a computer supported interaction environments and how these attitudes evolve in time in response to events and realizing others' attitude towards oneself. We use a specifically designed MAS-based computer game as a tool to investigate the dynamics of such attitudes and we show some preliminary results. As our next step we will develop emotional and motivational interface to attempt to steer different types of users towards a more cooperative behavior.

5. REFERENCES

[1] Artikis, A., Pitt, J., and Sergot, M. Animated Specification of Computational Societies, Proc. AAMAS'2002, ACM Press, 2002, 1053-1061.

[2] Axelrod, R. The evolution of cooperation. New York: Basic Books, 1984.

[3] Axtell, R. Non-cooperative Formation of Multi-Agent Teams, Proc. AAMAS2002, ACM Press, 2002, 1082-1089.

[4] FIPA-OS: http://fipa-os.sourceforge.net/

[5] Greer, J., McCalla, G., Vassileva, J., Deters, R., Bull, S., and Kettel, L. Lessons Learned in Deploying a Multi-Agent Learning Support System: The I-Help Experience, Proc. AIED'2001, IOS Press: Amsterdam, 2001, 410-421.

[6] Hales, D. Group Reputation Supports Beneficent Norms, Journal of Artificial Societies and Social Simulation, 5, 4, 2002, http://jasss.soc.surrey.ac.uk/5/4/4.html

[7] Jennings, N., Sycara, K., and Wooldridge, M. A Roadmap of Agent Research and Development, Int. J. of Autonomous Agents and Multi-Agent Systems, 1, 1, 1998, 7-38.

[8] Malone T., Crowston K., Lee J., Pentland B., Dellarocas C., Wyner G., Quimby J., Osborn Ch., Bernstein A., Herman G., Klein M., and E. O'Donnell (1999) Toward a handbook of organizational processes, Management Science 45(3) pp 425-443, March, 1999.