Social Theatre: Showcasing Social Power Aware Agents (Demonstration)

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ABSTRACT

In recent years there has been an increasing interest in social concepts that might contribute to new advances on social intelligence and believability in agents. A key social concept in social interactions is social power. To explore the potential of social power in human-agent interactions we created an interactive virtual environment depicting a theatre company where the user plays the director role and the actor roles are played by agents with behaviors guided by social power decision mechanisms.

Categories and Subject Descriptors

I.2.0 [**Artificial Intelligence**]: General—*Cognitive simulation*; H.1.2 [**Models and Principles**]: User/Machine Systems—*Human Factors*

General Terms

Algorithms, Design, Human Factors

Keywords

social power, cognitive architecture, social intelligence

1. INTRODUCTION

In recent years there has been an increasing interest in social concepts that contribute to new advances on social intelligence and believability in agents [3]. Social power, regardless of its pervasiveness and acknowledged impact in a multitude of human social processes remains little explored in agents [2]. One application of social power is in social intelligent agents for interactive systems. These are created so that users can interact with agents that usually embody human like qualities. Since social power plays a key role in the cognitive processes that mediate behavior then it is also a fundamental factor for the believability and effectiveness of developed interactive agent systems

To address this gap in social intelligence we developed the SAPIENT[1] - SociAl Power Intelligent agENTs - agent framework operationalizing different bases of social power

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[1] http://gaips.inesc-id.pt/sapient

[4] in a cognitive agent architecture. We then implemented an interactive virtual environment where a user can explore social power dynamics emerging form interactions with the agents. In the Social Theatre environment demonstration[2] the user's actions and modality of interactions affect the agents' mental model of the user which consequently affects their behaviors through social power decision mechanisms.

2. SOCIAL THEATRE ENVIRONMENT

Social Theatre is a virtual environment in which a user plays the director of a theatre company (see Figure 1). The company has four actors agents that were created with the SAPIENT framework in order to integrate social power cognitive processes in agents' decisions. Besides conceptualizing and maintaining a social relation with the user, each actor agent has a specific preference for the role it wants to perform in a given play. In this prototype we created a human-agent interaction setting in which agents are affected by the social power associated with user's influence interactions.

Figure 1: Social Theater screenshot depicting a reaction of an agent to a role assignment performed by the user.[3]

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[2] Video at: http://gaips.inesc-id.pt/~gpereira/st/
[3] Virtual environment originally developed by Serious Games Interactive: http://www.seriousgames.net/

The prototype takes the user through sequences of rehearsal/performance cycles each representing a different play. A play is characterized by a specific set of available roles that parameterize the difficulty of the assignments to be made by the user. In an easy situation the available roles perfectly match the actors' preferences. In a more difficult situation only one actor preference can be satisfied by the available roles. Notice that each different role has an associated "time on stage" which, additionally to an actor's specific role preferences, the greater its value the more valuable the role.

In each rehearsal the user must direct the agents by assigning them roles from the set of available roles for the current play and at the same time try to influence the agents to accept these roles. If an agent does not accept the assigned role it leaves the rehearsal and will not participate in the play thus diminishing its quality for the audience. To influence an agent, the user can simply rely on the social power it has acquired or use a social power strategy to emphasize one of their social power bases. An interaction is realized through a specific sentence that the user may choose from.

After the assignment and strategy choice, agents receive the role assignments and reply based on their social power assessment of the interaction. Agents decide to either accept or refuse to participate in the play and generate an appropriate reply depending on the match between their desired roles, the strength of the activated social powers and also possible promises or threats done by the user in previous rounds. Simultaneously, and according to the assignment interaction and reply, the agents derive the social power effects which result in updates to their social power related beliefs. Finally, after the performance is presented (if at least two out of the four initial actors accepted their roles) an agent is chosen as the audience's favorite actor. The agents update their beliefs of favorite actor status for the elected agent and increase their acting skills, according to the importance of the played role, due to their participation in the play. If there are less than two actors, the play is cancelled.

The scenario was designed to initially present the user with simple assignment choices which increase in difficulty with each game cycle progress. The difficulty is increased by varying the available roles so that the amount of actor preferences that can be satisfied decreases with each cycle. According to the "time on stage" characteristic of an actor's played role, it is affected in earned skill for performing and in the probability of being selected as the audience favorite.

3. SOCIAL POWER AWARE AGENTS

The agents playing the actor role in Social Theatre were implemented in the SAPIENT framework. It was specifically developed to create social intelligent agents capable of being aware and manipulating social power. To do so created a computational model of social power [5] and integrated it into a cognitive agent architecture [6] based on social psychology theoretical background research [4, 7]. Based on this SAPIENT agents are social power aware to the five fundamental bases of social power introduced by French & Raven [4] : reward, coercive, legitimate, referent and expert.

To operationalize the different social powers for agent simulations and interactive environments we developed a cognitive architecture according to the Power Interaction Model [7]. In doing so three core social power processes were identified as essential: Power Situational Analysis, Power Interaction Planner and Power Effects Assessment. By implementing the processes associated with these components the agents are able to reason and decide based on the social powers between them and any other agent/user. Furthermore, by having an effects assessment an ecological social power dynamics is supported by taking into account the consequences of different interactions and their modalities.

The agents in the Social Theatre environment use their social power awareness to maintain a model of the user and keep track of the social power relations maintained. Depending on the interaction history, the agent preferences and the modality of the user interactions with the agent decisions are made based on social power assessments. The modality of the interactions are defined by the way the user tries to influence an agent to accept a given role in the play. He/she can do so by simply asking an agent or by using a social power strategy that emphasizes some social power resource in the agent's reasoning process.

4. TECHNOLOGY

The SAPIENT framework was developed as a generic C# library targeting .NET 3.5 to maximize compatibility with Unity^{TM}, frequently used to build virtual environments. The system can be configured through a XML file or by an authoring tool created to facilitate the parameterizing. The Social Theatre environment was adapted from the My Dream Theatre virtual environment [1] Unity^{TM} application.

REFERENCES

[1] J. Campos, C. Martinho, G. Ingram, A. Vasalou, and A. Paiva. My dream theatre: Putting conflict on center stage. In *8th International Conference on the Foundations of Digital Games*, pages 283–290, 2013.

[2] C. Castelfranchi. The micro-macro constitution of power. *Protosociology*, 18-19:208–268, 2003.

[3] F. Dignum, R. Prada, and G. J. Hofstede. From autistic to social agents. In *Proceedings of the 2014 International Conference on Autonomous Agents and Multi-agent Systems*, AAMAS '14, pages 1161–1164, Richland, SC, 2014. International Foundation for Autonomous Agents and Multiagent Systems.

[4] J. French Jr and B. Raven. The bases of social power. In *Studies in social power*, pages 150–167. Univer. Michigan, Oxford, England, 1959.

[5] G. Pereira, R. Prada, and P. A. Santos. Exploring social power intelligent behavior. In *To appear in the proceedings of the 2015 International Conference on Autonomous Agents and Multi-agent Systems*, AAMAS '15, 2015.

[6] G. Pereira, R. Prada, and P. A. Santos. Towards social power intelligent agents. In *To appear in the proceedings of the 2015 International Conference on Autonomous Agents and Multi-agent Systems*, AAMAS '15, 2015.

[7] B. Raven. A power/interaction model of interpersonal influence: French and raven thirty years later. *Journal of Social Behavior & Personality*, 7(2):217–244, 1992.