

Towards Social Power Intelligent Agents

(Extended Abstract)

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ABSTRACT

Social power, regardless of its pervasiveness and acknowledged impact in a multitude of human social processes remains little explored in virtual agents. To address this gap in social intelligence and consequently virtual agent believability, we introduce the cognitive processes that underlie social power intelligence. In conceptualizing these we identify three core social power components required for operationalizing social power in agents. Our design process is inspired by theoretical background research in social psychology that have long studied social power.

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, autonomous agents, cognitive architecture, social intelligence

1. INTRODUCTION AND MOTIVATION

Social synthetic characters are intelligent virtual agents (IVAs) to which the capacity to interact in a believable way is essential. One of the efforts involved in their development is the modeling of cognitive structures in the agents' minds that can support their sociality in interactions with other agents or users.

Social power is one of the most pervasive concepts in human societies due to its function as a *social heuristic* for decision making. It combines diverse (and in themselves) complex decision influencing social concepts such as formal/informal norms, resource/action dependencies or social status [1]. The impact of social power may be observed in a multitude of social processes such as coordination, delegation, cooperation, hierarchy formation, alliance formation, resources allocation and negotiation [1].

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Even though power has been previously explored as a social heuristic for agent behavior [1] there are still significant research gaps regarding social intelligence for intelligent virtual agent believability in both inter-agent and human-agent interactions. Following our motivation to develop agent social believability we address this gap by introducing key cognitive processes, inspired in theoretical background research, required to endow agents with social power intelligence and describe the core social power components underlying them.

2. TOWARDS A COGNITIVE ARCHITECTURE FOR SOCIAL POWER

To create an agent architecture that can endow agents with power awareness and the ability to generate behaviors based on plans including power strategies our main inspiration was the Power Interaction Model [3]. It defines the main stages underlying the cognitive process of a social power interaction episode associated with an influence interaction. Moreover, this model connects the conceptualization of the interaction cognitive process with several bases of social power [2]. In a social power interaction there are two main interaction perspectives, each requiring a specific cognitive process. One is the perspective of an influencing agent (see Figure 1) another is the perspective of an agent being influenced (see Figure 2). To operationalize these processes we developed an agent architecture for a social power intelligent agents and in this section we describe the associated core social power components identified.

2.1 Power Situational Analysis

The main purpose of this component is to identify and quantify the social power forces relevant to a given (possible or anticipated) influence interaction. A social power force can either oppose or actually reinforce the value assessment of the action underlying an influence interaction. To do so the agent must not only detect powers directly mapped from the social power underlying factors, but also their interdependencies. The quantification of social powers is thus a function of all these factors. The resulting social power force realizes our social power conceptualization as an integrative concept of diverse social forces affecting agents' actions.

2.2 Power Effects Assessment

In this component the effects (or outcomes) of a social power interaction are identified. Some inspiration to model these effects come from French and Raven [2]. In their presentation of the bases of social power, they discuss the effect

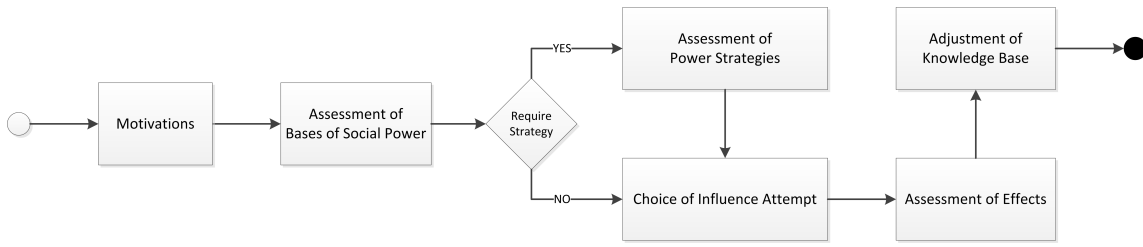


Figure 1: Influencing agent’s cognitive process in a social power interaction episode.

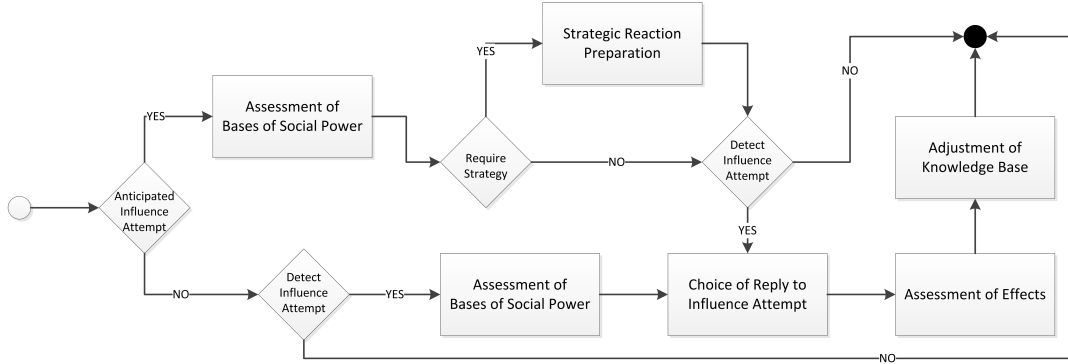


Figure 2: Influenced agent’s cognitive process in a social power interaction episode.

of increasing referent power when reward power is used as well as its decrease when coercions are used. Interestingly, this change can be altered when these powers are used in combination with legitimate power. This component identifies the social power related belief changes that result from a given interaction.

2.3 Power Interaction Planner

The main purpose of this component is to perform planning for social power-based interactions. It enables the agent to reason about possible influence situations and choose its best option to influence other agents by integrating all its knowledge about social powers, their effects and its own power utilization preferences. The basic information for planning an interaction is the “Power Situational Analysis” which provides an assessment of the social power forces in a given context. Additionally, central to the planning is the “Power Effects Assessment” identification of anticipated social power related belief changes and the analysis of their value for the agent. Once the social power forces and anticipated effects are identified, the agent still has to compare and choose from the different interaction possibilities. In a social power based interaction the agent can influence others in two different manners. One by simply asking and another by using a power strategy that emphasizes a base of social power. It is at this stage of planning that the agents’ preferences attribute biases the agent’s strategy choice.

3. CONCLUSIONS AND FUTURE WORK

By identifying the presented cognitive processes and associated core social power components we established the core elements for a functioning social power intelligent agent architecture¹. To guide our design we studied several theoret-

ical background research in social psychology to incorporate valuable insights from a field that has long studied social power. Some of the most widely acknowledged were used to inspire the identification not only of the core social power processes, but also of their relations with other components.

Based on the presented conceptualizations we developed an agent architecture and the implemented it in an agent framework for social power intelligent agents. Using it we created a virtual environment exploring a human-agent setting that enabled us to perform a user study to assess the users’ perceptions regarding the agents’ social power awareness. As a result we found encouraging evidence supporting the correct modeling of social power intelligence capabilities in the agents implementing our model. In the future, our goal is to use the developed framework to improve training applications (e.g. serious game in leadership) and enhance social simulations in games (e.g. role playing or simulation games with more dynamic character social interactions).

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REFERENCES

- [1] C. Castelfranchi. The micro-macro constitution of power. *Protosociology*, 18-19:208–268, 2003.
- [2] J. French Jr and B. Raven. The bases of social power. In *Studies in social power*, pages 150–167. Univer. Michigan, Oxford, England, 1959.
- [3] 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.

¹<http://gאים.inesc-id.pt/sapient>