

Exploring Social Power Intelligent Behavior

(Extended Abstract)

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ABSTRACT

The connection of human beings with their social environment is indeed strong. One of the domains explored to create agents with social intelligent behavior is social power. It can be defined as the potential for direct or indirect influence of a person over another. In this work we identify and discuss the key concepts to operationalize different types of 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, behavior expressiveness, social intelligence

1. INTRODUCTION

Research on intelligent autonomous agents has long focused on developing mechanisms that improve the way agents sense, keep record of and interact with their environment. As part of this progress in recent years there has been an increasing interest in social concepts that might contribute to the improvement of social intelligence in agents [1].

The social reality in which we live in is in fact deeply intertwined with the way we perceive our environment and the way we act on it [2]. One such concept that pervades our social reality and strongly affects the way we behave in our environment is social power. The study of social power enables us to understand the fundamental social influence resources that each person can have and what are the mechanisms that operate them.

In this work we address an existing research gap in understanding of the link between different types of social power and their underlying factors. To achieve this we present clear definitions for several types of social power based on

Appears in: *Proceedings of the 14th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2015)*, Bordini, Elkind, Weiss, Yolum (eds.), May 4–8, 2015, Istanbul, Turkey.
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identified underlying factors and discuss the behavioral implications that these factors and their relation. The presented level of detail is essential in order to link high level conceptualizations of the social power concept to actual implementations of these models in agent frameworks.

2. MODELING SOCIAL POWER FACTORS

In [4] we introduced a general mechanism integrating social power forces with a value force which also has a strong impact in an agent’s decision process. This value force conceptualizes the agent’s assessment of the value corresponding to the action for which it is being influenced to perform.

Our main goal in this research is to model and explore the behavioral expressiveness of the different components that integrate each social power force derived from the different bases of social power according to theoretical background research. For the following discussion, we will describe each social power according to French and Raven’s taxonomy of social powers [3]. Additionally, notice that the descriptions are made from the perspective of the target of the power (agent influenced to perform some action), i.e. based on its perceptions and beliefs. In this context the agent that is (consciously or unconsciously) influencing the target is the actor agent.

2.1 Reward

A reward social power that an actor exerts over a target and influences the latter to perform an action (C) is a function of the value that the target assigns to another action (rew) that the actor can perform (Val_{rew}), the target’s achievement bias ($AchB$) and the recognized rewarding tendency of the actor ($RewardingT_{T,A,rew}$). This description is succinctly modeled in function (1). A reward social power is therefore directly proportional to the value of the rewarding action, to the achievement bias from the target and also to the perceived rewarding tendency of the actor for that reward action.

$$Reward_{A,T,C} = Val_{rew} * AchB * RewardingT_{T,A,rew} \quad (1)$$

2.2 Coercive

A coercive social power that an actor exerts over a target and influences the latter to perform an action is a function of the value that the target assigns to another action (coe) that the actor can perform (Val_{coe}), the target’s achievement tendency ($AchB$) and the recognized coercing tendency of the actor ($CoercingT_{T,A,coe}$). This description is succinctly modeled in function (2). A coercive social power is therefore inversely proportional to the value of the coercive action

and directly proportional to the achievement bias from the target and the perceived coercive tendency of the actor for that coercive action.

$$Coercion_{A,T,C} = -Val_{coe} * AchB * Coercing_{T,A,coe} \quad (2)$$

2.3 Legitimate

A legitimate social power that an actor exerts over a target and influences the latter to perform an action is a function of the importance of the social group (g) for the target (I_g), the intrinsic dutifulness that the target has towards the social group (Dut_B), the perceived difference of social norm conformity between the actor and the target ($RelNC_{A,T}$) and a norm (n) bias ($NormB_n$) derived from the agent's association and experience with the social group. This description is succinctly modeled in function (3). The strength of a legitimate social power is therefore directly proportional to all its components: the importance of the social group, the dutifulness felt by the target, the relative norm conformity between the actor and the target and also the norm bias.

$$Legitimate_{A,T,C} = I_g * (DutB + RelNC_{A,T}) * NormB_n \quad (3)$$

2.4 Referent

The referent social power modeled in this work can be of two types: liking or status. A referent liking social power that an actor exerts over a target and influences the latter to perform an action is a function of the strength of the liking relation ($Liking_{T,A}$) that the target holds for the actor and the target's personal affiliative tendency ($AffiliativeB$). This description is succinctly modeled in function (4). A referent liking social power is therefore directly proportional to the strength of the liking relation held by the target agent and also its affiliative tendency.

$$ReferentL_{A,T,C} = Liking_{T,A} * AffiliativeB \quad (4)$$

Another type of referent power is the referent status social power that an actor exerts over a target and influences the latter to perform an action is a function of the actor's status ($Status_{T,A,ca}$) recognized by the target for the actor regarding a given status category (ca , e.g. popularity in a group of friends), the target's personal status tendency ($StatusB$) and also the agent's personal preference for the specific category of status ($PrefB$). This description is succinctly modeled in function (5). A referent status social power is therefore directly proportional to the amount of status ascribed to the actor agent by the target agent, the target's status tendency and also its preference for the associated status category.

$$ReferentS_{A,T,C} = Status_{T,A,ca} * StatusB * PrefB_{ca} \quad (5)$$

2.5 Expert

An expert social power that an actor exerts over a target and influences the latter to perform an action is a function of the importance of the skill associated with that action ($Importance_s$), the trust that the target agent has for the actor (Tru_A) and the target's perceived skill difference between the actor and the target ($SkillD_{A,T}$) regarding the skill associated with the action. This description is modeled in function (6). The strength of an expert social power is therefore directly proportional to the importance of the associated skill, the magnitude of the target's trust relation

with the actor and the recognized skill difference between the actor and the target.

$$ExpB = \begin{cases} Tru_{T,A} * SkillD_{A,T,s}, & \text{if } Tru_{T,A} \neq 0 \wedge SkillD > 0 \\ 0, & \text{otherwise} \end{cases}$$

$$Expert_{A,T,C} = Importance_s * ExpB \quad (6)$$

3. CONCLUSIONS

In this work we present mechanisms to improve agents' social intelligence through a social power mechanism. To achieve this we address a gap in understanding the link between different types of social power and their underlying factors. For each type of social power we identify its characteristics and the relation between each of them and the associated social power.

The presented mechanisms can be used to improve agents' intelligence in a variety of contexts and applications. One possible application is on multi agent simulations for studying social power dynamics according to variations in the agent's personal motivations and the structure of the social environment in which they interact. Another is interactive virtual agent applications in order to improve non player characters' intelligence. Such applications can be used in both entertainment (e.g. role playing games) and serious game scenarios (e.g. leadership training).

This work has already been integrated in a virtual environment to assess its correct operationalization in agents' interactions with human users¹. Results obtained by evaluating the agents in this scenario have already provided support for the presented mechanisms. This shows that our contribution is a valuable mechanism to improve agents' social intelligence by means of social power conceptualizations that may be used to represent many different social situations and enrich agent simulations.

Acknowledgments

Work supported by FCT (INESC-ID multi annual funding) under project UID/CEC/50021/2013 and FCT scholarship SFRH/BD/66663/2009.

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¹<http://gaips.inesc-id.pt/sapient>