Social Power in Human-Robot Interaction: Towards more Persuasive Robots

Extended Abstract

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ABSTRACT

Social power is defined as one's ability to influence another to do something which s/he would not do without the presence of such power. Different theories classify alternative ways to achieve social power, such as providing a reward, using coercion, or acting as an expert. In this work, we explored two types of persuasive strategies that are based on social power (specifically Reward and Expertise) and created two social robots that would employ such strategies. To examine the effectiveness of these strategies we performed a user study with 51 participants using two social robots in an adversarial setting in which both robots try to persuade the user on a concrete choice. The results show that even though each of the strategies caused the robots to be perceived differently in terms of their competence and warmth, both were similarly persuasive.

KEYWORDS

Persuasion; Social Power; Social Reward; Human-Robot Interaction; HRI; Persuasive Robot; Social Robots

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1 INTRODUCTION

The future will bring robots into many aspects of our personal and work lives. This gave a rise to the emergence of Social Robotics, which aims to develop robots capable of communicating and interacting with human users in a socio-emotional way [2]. Recent studies revealed the importance of robots with social skills in our daily life [5].

On the other hand, the academic literature on Human-Robot Interactions (HRI) indicates that people are as sensitive to the social dynamics of power between people and robots as they are to the dynamics between people [11]. Social power is an important attribute of the influencing agent in an interpersonal influence situation [10] as it generates psychological states which influences how we feel, think and act [13]. Recent studies revealed that the higher is the sense of power, the greater is people's action orientation, level of abstract thinking and higher optimism in perceiving risk [13]. Thus, as robots are treated as social agents that can engage in social interactions with their users [16], they can benefit from being able to use social power in their interactions.

One recent trend in the field of Social Robotics is the rise of "Persuasive Robotics" which refers to the study of persuasion that applies to HRI [17]. Persuasion also plays a critical role in human interaction and exchanges [14]. To date, a number of persuasive technologies using social robots has been developed. For instance, persuasive robots have been applied to health-systems, learning and training, marketing, or in behavior change support systems leading to higher sustainability, healthy living, etc. [1, 6, 12].

An important question regarding these technologies is how should robots behave in an interaction setting whose goal is to persuade? What strategies should they choose? Do such strategies work equally for everyone? We believe that unravelling these issues is central to HRI, leading to more persuasive robots. For instance if specific personality traits favor specific persuasion strategies, personalized persuasive technologies would have higher performance. Hence, we aim to address these questions by conducting a user study in a setting where two robots, making use of different social power strategies, try to persuade the user to choose one of three alternatives. As social power is recognized to be a motivating force that is central to human interactions [7, 18] and given that recent studies acknowledge its relationship with persuasion [3], we aim to explore its effectiveness in social robots.

2 STUDY DESIGN AND PROCEDURE

We designed a persuasion task in which two robots try to convince participants to select a particular coffee using different strategies. Our control variables are as follows: personality, Coffee Drinking Habit or CDH (How much do you (a) like/(b) drink coffee?), and

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power strategy (rewarding or giving information). Further, we measure the following dependent variables: coffee selection (which coffee they select), robot preference (which robot they prefer to interact with), perceived persuasiveness (how persuasive they find each robot), robot perception (how they perceive each robots in terms of warmth, competence, and discomfort), and future compliance towards robot (likelihood of following robots suggestions in future).

To include a control condition, we added a third coffee to make sure the participants do not select randomly and the made decision is due to the influence of the two persuasive strategies. In this experiment, Social power is present as the robots are trying to shift the decisions from a natural 1/3 random choice to one of the supported by a robot. We expect that option 3 would be much less common, and the robots would be able to perform some persuasion. We argue that, as people have different orientations toward being persuaded, using different strategies would lead to higher performance. In this designed experiment, we aim at examining two strategies inspired by Raven and French theory of social power.

In this task, the participant should listen to arguments of the two robots and then make a choice. After making decision, participants had to fill out a questionnaire. The questionnaire is divided in 4 parts:

(1) Demographic data (gender, age, occupation, prior interaction with robots, CDH);
(2) TIPI personality Questionnaire [9],
(3) RObotic Social Attribute Scale (RoSaS) [4],
(4) A number of questions to measure task-specific factors such as the perceived persuasiveness of the two strategies.

We equipped an isolated room with the two robots, mounted on a table. Also, we put three equally appearing boxes containing coffee capsules, two in front of each robot and one in the middle between the two robots (control condition). To avoid confusion we put the name of each robot on the corresponding box, but we did not add any further information on the box in the middle. We emphasize that participants were unaware of contents of boxes.

During the interaction, the robots explained to the participants that they are promoting two different coffee capsules. One of the robots interacted in a more funny way by telling jokes, whereas the other robot was more serious and interacted based on facts and information. The funny robot (*Joker* from now on), works to persuade users by giving them a social reward, as telling a joke. On the contrary, *Expert* robot tries to influence participants by highlighting impressive characteristics of his coffee.

Thereby, one robot acts to persuade the user by giving information about the quality of his capsule (Expert Power Strategy). The other robot uses a reward to influence the user (Reward Power Strategy). As the reward, we programmed the robot to give the user "Social Rewards", by telling a joke. We programmed the robots in a scripted scenario with the two persuasion strategies. So we constructed the following hypotheses:

- *H1*: Power Strategy × Coffee Selection: We hypothesize that people are persuaded differently facing different power strategies.
- *H2*: Power Strategy × Perceived Persuasiveness of robots: We assume that different power strategies lead to different persuasiveness perceived by participants.
- *H3*: Power Strategy × Robot Preference: We expect people to have different preferences toward interacting with robots with different persuasive strategies.
- *H4*: Power Strategy × Future Compliance: We hypothesize that using different power strategies affect the likelihood of following future suggestions of the robots.
- *H5*: Power Strategy × Robot Perception: We expect that different power strategies cause the two robots to be perceived differently.
- *H6*: Personality × Perceived persuasiveness: We postulate that people perceive the persuasiveness of robots differently based on their personality.

In this study, we used two Emys robots appearing equally, however, differing in their voices and names. To overcome potential biases towards the voice, we randomly assigned Expert/Joker role to the robots and counterbalanced the data to have an equal number of participants in each assignment. The two robots represented the same instances of social cues (human-like face with speech output, gaze and blinking eyes, head movements and facial expressions) to maintain more human-like interaction leading to stronger effects on the user [8].

Each participant entered the room individually and seated at the table with the two robots. Participants were given the consent form and were briefly introduced to the task. We did not inform the participants about the goal of the study and curious participants were told that their questions could be addressed after the experiment. After signing the consent form the researcher turned on the two cameras and started the task.

3 CONCLUSION AND FUTURE WORK

In a nutshell, based on French and Raven theory, power arises from different sources [15]. In this study, we equipped robots with two different sources (reward and expertise) and designed them in such a way to generate persuasive strategies based on their power sources. We tested the robot's persuasiveness in a scenario where participants have to make a real choice, rather than an imaginary one. Overall, this study shows that using different sources of power, and hence power strategies, appear to be equally viable solution to design social robots capable of persuading people. Also, the result of this study shows that Social Rewards can be effective at persuading users and, unlike material rewards, they are unlimited and always available. A further study could investigate social power considering 'reactance' [8] toward the persuasion attempt.

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