ABSTRACT
In this paper, we present a user-study designed to examine the effect of reward/coercion persuasive strategies inspired by social power. We ran the study with 90 participants in a persuasion scenario in which they were asked to make a real choice to select a less-desirable option. The preliminary results indicated that the robot succeeded in persuading the users to select a less desirable choice compared to a better one. However, no difference was found in the perception of the robot regarding the persuasion strategies.

KEYWORDS
HRI, Social Robots, Persuasion, Reward, Coercion

1 INTRODUCTION
The technology of the future will bring an increasing number of robots into our daily life. Also, people apply human-like social rules to technology in the same manner they respond to other people [6]. This has motivated many researchers to explore diverse factors to promote social interaction with robots. To date, several studies have explored different social factors in Human-Robot Interaction (HRI) to achieve social-emotional goals in diverse applications [1].

In specific applications, robots are supposed to promote and/or encourage particular behaviors, or persuade a person to comply with a request to change (and/or) maintain a particular attitude [8]. In this paper, we investigate the effect that different persuasive strategies have on persuasion, considering these hypotheses:

(1) H1. Using persuasive strategies increases the likelihood of selecting a less-desirable option.
(2) H2. Higher probability of receiving a worse option, decreases the success persuasion.
(3) H3. A coercive persuasive strategy is more effective than reward in persuading people.
(4) H4. Different strategies will affect the participants differently, hence causing a different perception of the robot.

2 METHOD
To investigate these hypotheses, we designed an experiment to examine how social robots can influence participants and persuade them to make specific decisions using different strategies inspired from the bases of social power [3, 5]. More specifically, in one scenario, the robot attempts to persuade the user, by giving her/him a reward. And in another one, the robot tries to influence the user by punishing her/him if s/he does not comply with the request. Inspired from social power theory, we call the first strategy as "Reward" and the second one as "Coercion" strategy respectively.

2.1 Participants and Materials
In this study, we use an Emys robot (Figure 1), that has the ability to display social cues (human-like face with speech output, gaze and blinking eyes, head movements and facial expressions) to maintain human-like interaction leading to stronger effects [4]. During the interaction, Emys talks to the user and explains the study procedure. The speech is similar in the three scenarios and the only difference is the strategy sentence (Reward/Coercion/No strategy for control). 90 people (38 or 42.2% females) participated in the experiment voluntarily. The population age ranges from 18 to 47 (M=24.59, S.E.=6.28), from 10 different ethnicity. Among all the participants, 30 people (33%) had interacted with robots and 11 people had interacted with Emys prior to this study. We randomly assigned these subjects to one of the three scenarios. Since most of the participants were non-native English speakers, we asked the participants to rate their English proficiency on a 5-point Likert scale. The results indicate that there is no significant difference between the three scenarios regarding their English proficiency, age, gender and race.

Measure. In our study, from the participant’s side (the persuasion target) we measured demographics, Personal Sense of Power (PSP), Susceptibility to Persuasion, and personality. From the robot’s side (the persuasion actor) we focus on its verbal cues and its effect on the user. We measure the robot perception using the RoSAS questionnaire [2]. Also, we apply the Social Power scale [7], to check if the negative strategy induced exerting coercive social power and rewarding caused any sort of reward social power. Also, we investigate the persuasiveness of the robot using a couple of task-specific questions on a 5-point Likert scale.
2.2 Design and Procedure

We designed a between-subject study and ran over three weeks in single sessions which took around 20 minutes. Each participant entered the room individually and after signing the consent form, filled out the pre-questionnaire. Then, the subject seated at the table in front of the robot. Afterward, the researcher turned on two cameras (in front and on the left of the subject) and started the task.

2.2.1 Task. We designed a task in which the robot promotes two coffee brands (hidden in two boxes) that are ranked hypothetically in a prior study. Based on this ranking, one of the coffees has a higher rank comparing to the other one. In the first scenario (reward or R), the robot rewards the participant a pen, in case s/he opts for the lower-ranked coffee. In the second scenario (coercion or C), the robot gives a gift (a pen) to the participants initially, and ask the participant to return it in case s/he opted for the better coffee. And finally, in the last scenario (control or ctrl), the robot lets the participant select the coffee freely without exerting any persuasion.

During the interaction, the robot explained that two different coffee capsules are hidden in the boxes and the stars signify the rating. Depending on the scenario that the participants were randomly assigned to, the robot would offer a pen at the beginning or the middle of the interaction. The participant listened to the arguments of the robot and then made a choice at the end. Then s/he was requested to fill out the questionnaire. While answering the questionnaire, the experimenter made the coffee using the machine for the ones who opted to drink it there, and the rest took the coffee capsule as their reward of participation. Also, they were all rewarded a pen before leaving the room and after filling the questionnaire, even if they had selected the higher-ranked coffee.

To overcome potential biases towards the position of the coffee boxes, we randomly assigned the higher/lower ranks to the boxes and counterbalanced the data to have an equal number of participants in each assignment. Furthermore, to investigate the effect of loss on the persuasiveness of the robot, we considered two different coffee ratings. In one scenario, we assigned 3.8* vs. 4.8*, and to resemble a higher loss we assigned a 3* rating, versus vs. 4.8*. To be specific, selecting a 3* coffee has a higher probability of receiving a bad coffee, a loss of getting a better coffee. In sum, we have two different ratings in three different scenarios of Reward/Coercion/Control or a 2×3 between-subject study to investigate persuasiveness of a social robot on decision making.

3 PRELIMINARY FINDINGS

Before data analysis, we checked if a prior interaction with social robots affects the decision making of the subjects. The results of a t-test indicated that there is a significant difference in the selection of the users who already interacted with social robots and the ones who had not (t(88)=2.469, p=.015). To overcome this bias, we divided the data into two subgroups: people who are new to robots, vs. people who already interacted with robots.

Based on the collected data, we could only verify H1 and H4 partially. Particularly, H1 was verified only in the case of people who were new to robots. To be more specific, the result of a chi-square test ($X^2(5) = 16.964, p = .005$) indicated that the robot could significantly persuade the people of this group to select the lower-ranked coffee. And regarding H4, surprisingly, the results indicated that people who already interacted with robots, found the coercing robot significantly higher on the warmth dimension of RoSAS questionnaire ($t(14)=2.732, p=.016$). Meaning that they found the coercing robot more friendly. A potential reason for this might be that the participants did not perceive the coercing action (returning the pen) as a punishment, rather they found it funny and even some participants laughed.

We could not verify the other hypotheses in any of the population groups. Specifically, we hypothesized that the difference between the rating of the two coffees would lead to different patterns of decision making. We expected to see less compliance, when the risk of receiving a bad coffee was increased (3* coffee). Also, regarding H3, we expected to gain higher compliance regarding the coercion due to its stronger effect. We hypothesized that people might be more attached to the pen they own (after receiving it as a gift) in the coercion scenario comparing to the reward scenario. However, none of these two hypotheses were met in the collected data.

4 CONCLUSION AND FUTURE WORK

This study aimed to investigate persuasiveness of social robots using reward/coercion strategies inspired by a theory of social power. The results suggest that social robots are capable to persuade the users by using social power, especially the ones who are new to social robots. However, it is not clear how the participants perceived the social power of the robots. The bias in the data regarding the prior interaction with robots lead to small sample size, especially in the group of people who already interacted with robots.

Although the results showed that the robot was successful in persuading people, little is known about the subjects’ perception of the strategies and the robot’s social power. One potential reason might be the way we measured social power. The standard questionnaire we used, was very general and strict. In the future, we would like to measure perceived social power more profoundly by using other questionnaires more in line with our research. We require to measure the perception of the participants about the persuasive strategies thoroughly using more task-specific questions.

ACKNOWLEDGMENTS

This work was funded by AMIGOS project (PTDC/EEISII/7174/2014), and partially supported by national funds through Fundação para a Ciência e a Tecnologia (FCT) with reference UID/CEC/50021/2019.
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