Perceptions of ASIMO: An Exploration on Co-operation and Competition with Humans and Humanoid Robots

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ABSTRACT

Recent developments in humanoid robotics have made possible a vision of robots in everyday use in the home and workplace. However, little is known about how we should design social interactions with humanoid robots. We explored how co-operation versus competition in a game shaped people's perceptions of ASIMO. We found that in the co-operative interaction, people found the robot more sociable and more intellectual than in the competitive interaction while people felt more positive and were more involved in the task in the competitive condition than in the co-operative condition. Our poster presents these findings with the supporting theoretical background.

Categories and Subject Descriptors

H.1.2 [**Models and Principles**]: User/Machine Systems – *Human factors.* H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *Evaluation/methodology, User-Centered Design.*

General Terms

Design, Experimentation, Human Factors, Theory

Keywords

Human-robot interaction, humanoid robots, ASIMO, social robots, social perception, co-operation vs. competition

1. INTRODUCTION

Honda's ASIMO (Figure 1) robot is intended by its designers to be a first step toward a vision of an intelligent system that would "duplicate the complexities of human motion and actually help people" [3]. ASIMO's successors might help with household chores such as doing laundry or dishes, assisting in the care of the elderly, ensuring that children arrive at school safely, or acting as a caretaker for individuals within a home or institution. Many of these tasks would involve co-operation between robots and the people they assist. Our research explores how co-operation and competition shape people's perception of a humanoid robot as well as their experiences with the robot.

Nass and his associates showed that social responses to interactive computers are similar to responses to other people [5]. We extend their findings to humanoid robots and use the social science literature to examine how these responses take place. Research on conflict in small groups show that members of co-operative groups approach their group members more positively than members of competitive groups do [2,4]. Moreover, co-operative situations are friendly, intimate, and involving, whereas competitive ones tend to feel unfriendly, nonintimate, and uninvolving [4]. Based on these results, we hypothesized that people who interact with a robot in a co-operative task will perceive the robot more positively and feel more positively than people who interact with the robot in a competitive task.

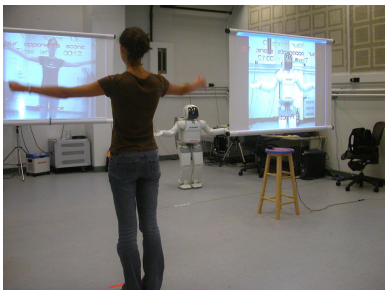

Figure 1. Participant with ASIMO.

2. EXPERIMENT

We tested our hypothesis in a laboratory experiment where people interacted with ASIMO in different experimental conditions. We designed an interactive experience, a videogame, for a person and ASIMO that served as an experimental task (Figure 1). The interactive experience was a two-player videogame and was selected with the goal of having ASIMO and the participant act as peers. Both players had identical game screens while interacting along a diagonal line of sight. The screen that the participant saw showed a video (mirror) image of himself/herself as well as four targets colored red or green. The goal of the game was for the participant or ASIMO to swipe a hand over the green targets while avoiding the red targets.

Design: We manipulated the video game to be either competitive or co-operative. In the competitive game, participants competed against their partner to maximize individual success and both their scores were shown on the screen. The co-operative game asked participants to work with their partner towards a given goal and the group score as well as the goal were shown on the screen. The task and the experimental procedure were identical across the competitive and the co-operative manipulation except for the instructions and the presentation of the score.

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Measurement: We recruited 26 (16 females, 10 males; average age 21) CMU undergraduate students, diverse in undergraduate major. In both conditions, participants were asked to answer a pre-experiment and post-experiment questionnaire to capture the affect of the experiment on their ratings. The dependent variables that we measured were participants' own affective state [9], their perception of their partner's affective state [7,8], how connected they felt to their partner [1], their perceptions of their partner's physical, social, and intellectual characteristics including social desirability, intellect, humanlikeness, attractiveness, mutual liking, and trustworthiness [6], and participant demographics.

3. RESULTS

Our data analysis used three methods; repeated measures analysis of variance (MANOVA), regression (Least Squares Estimation), and multivariate correlations.

Perception of the Robot: Our analyses showed that people perceived the robot as significantly more desirable in the co-operative condition than in the competitive condition ($F[1:22]=4.75$, $p=0.04$). However, when gender is included in the analysis, this effect is significant only for male participants ($F[1:22]=5.57$, $p=0.02$). A similar but marginal tendency was observed in participants' perceptions of the robot's intelligence ($F[1:22]=3.45$, $p=0.07$). This effect is also significant only for male participants ($F[1:22]=4.65$, $p=0.04$). Partner's friendliness, dominance, pleasure, and arousal did not show significant differences across experiments and task structures.

Self Affective State: Participants' ratings of their affective state showed a trend opposite to our prediction. The impact of the interaction on participants' positive affect was higher in the co-operative condition than in the competitive condition ($F[1:22]=4.32$, $p = 0.05$). This effect is also only significant for male ratings ($F[1:22]=7.73$, $p=0.01$). This implies that men who competed with the robot felt more positively than those who co-operated with the robot did, while women did not show significant difference in their feelings across conditions. An analysis of participants' involvement in the task provides an explanation of this result. We found that men's involvement in the interaction was higher in the competitive task than in the co-operative task ($F[1:22]=9.80$, $p<0.01$), while women's involvement did not differ across conditions.

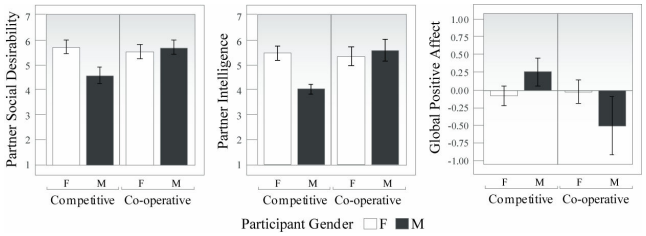

Figure 2. Social desirability, intelligence, positive affect ratings

Our results showed that people do differ in their perceptions of the robot and in their affective state based on whether they co-operate or compete with a robot. However, this result holds only for men. Men perceive a robot partner as more socially desirable and intelligent in a co-operative task than in a competitive task. On the other hand, they feel more positively and are more involved in the interaction in a competitive task than in a co-operative task. Women, on the other hand, do not differ in their perceptions of the robot as well as their positive feelings and involvement across the two tasks.

4. DISCUSSION

Although this is only an initial study our experimental results point to a few principles for designing interaction techniques for humanoid robots. We found evidence that the level of co-operation involved in the task affected participant's social experience with a robot. The results suggest that designers of interactive experiences should ascertain in advance that the interaction style of the robot fits the structure of the task as well as individual attributes of the users (i.e. their gender). For example, men found ASIMO less desirable in the competitive task than in the co-operative task implying that ASIMO should act co-operatively with men when social desirability or acceptance is required. On the contrary, when involvement in the task is a priority, such as helping the elderly maintain an exercise regimen, better involvement would be achieved if ASIMO acted competitively.

This study is an early exploration in a fairly new research domain and our study explored only a single dimension in the factors of a social interaction. Additional experiments are required to understand more fully how these factors shape social interaction with humanoid robots.

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