Priming Anthropomorphism

Can the credibility of humanlike robots be transferred to non-humanlike robots?

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***Abstract*— We investigated the perceived credibility of statements made by robots, hypothesising that people are more likely to believe robots with humanlike characteristics than those that are less anthropomorphic. We also examined whether prior experience with a humanlike robot would lead people to extend this advantage to the less-anthropomorphic robot. A measure of credibility was provided by agreement on the pricing of objects, where participants negotiated with either a more (iCub) or less-anthropomorphic robot (Scitos G5) that was engaged in more (using social gaze) or less-humanlike (fixed gaze) social behaviour. In the first experiment participants only interacted with Scitos G5, in the second they interacted with Scitos G5 only after having first interacted iCub. Results showed that iCub was more credible than Scitos G5, and was the only robot to benefit from the use of social gaze. It was also found that the credibility of the Scitos G5 was higher after participants were 'primed' by prior exposure to the iCub.**

Keywords— HRI; anthropomorphism; priming; eye-gaze

I. Introduction

If an object is deemed to be anthropomorphic then we tend to respond or interact with it by through the automatic application of normal social stereotypes [1]. In robotics this naturalistic social connection provides a useful scaffold on which we can learn how to interact with the robot, and has been found to improve both our acceptance [2] and perceptions of the usefulness of those interactions [3] [4]. One of the main aims of this study is to examine whether socially beneficial effect of anthropomorphism could be extended to less-humanlike robots, simply through prior exposure to their anthropomorphic relations. Uninitiated, it is unlikely we would assign anthropomorphic status to robots that do not fit with stereotype. However, if we are first exposed to a humanlike robot and assign it anthropomorphic status, then it is possible that we may also extend this status to the wider category of robots, including less-anthropomorphic exemplars. This could be viewed as a type of 'anthropomorphic priming', similar to other established priming effects, where the perception of others can activate a set of automatic processes, both perceptual and motivational, that guide behaviour [5] [6]. To test this hypothesis we compared robot interactions between the anthropomorphic iCub and less-humanlike Scitos G5 (Figure 1) when engaged in a price judgement game used by Rau et al. [7]. Participants were asked to accept price valuations on common objects provided by the robot. Their willingness to change their own price judgments to that provided by the robot was taken as providing a primary measure of the robot's credibility. In the first experiment participants were only asked to interact with the less-anthropomorphic Scitos G5 robot, to be referred to as the 'nonprimed Scitos G5'. In the second experiment participants first interacted with the anthropomorphic iCub robot, before repeating the task with the Scitos G5, to be referred to as the 'primed Scitos G5'. In addition, to increase the scope of anthropomorphism beyond the physical form of the robot a behavioural condition was included in the experiment, in which robots could engage with participants during the game with either a social or fixed gaze. To summarize our hypotheses, we expect that measures of credibility would be higher in the anthropomorphic than less-anthropomorphic robot. We would also expect that interactions using a social gaze should be more credible than those with a nonsocial fixed gaze. However, if we only apply our normal social stereotypes to anthropomorphic robots, then it might be surmised that the benefits of social gaze would only be seen in humanlike robots. Most importantly, we also hypothesise that the credibility of the less-anthropomorphic robot would be significantly greater when interactions with this robot are preceded, or 'primed' by interactions with an anthropomorphic robot.

II. Methods

In the first experiment 15 participants between 18 and 30 years interacted only with Scitos G5. The robot initially described the object on the table and gave two price options to the participants. Participants selected their choice. The robot commented the initial selection, either positively or negatively. In case of negative feedback the participants had the opportunity to change their decision and make a final selection. During the experiment the robot could perform two different gaze behaviours (social and nonsocial). In the social gaze behaviour the robot looked first at the object on the table and then moved its gaze to the participant before starting describing the object. In the nonsocial gaze behaviour the robot looked constantly at the stimulus. The robot answer to each stimulus was provided from a randomized script, with the same pattern of responses provided to each participant, irrespective of their choices. In the second experiment 15 participants between 18 and 30 years interacted first with iCub and then immediately repeated the game with Scitos G5. All participants were psychology students with no reported direct experience of robots.

III. Results

Social interaction with the robot was quantified through analysis of trials in which the robot disagreed with the price choice of the participant. A 'change rate' was calculated as the proportion of these trials where the participants changed their selection to agree with the robot, compared to those in which they stuck with their original decision. Change rates for iCub

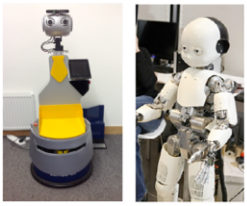

Figure 1: Scitos G5 robot (left) and iCub robot (right)

and the primed and nonprimed presentations of G5 are shown in Figure 2, presented for both the social and nonsocial gaze conditions. Three separate pairwise ANOVA analyses of 'change rate' were conducted between each of the three robot conditions, each with factors of 'robot' and 'gaze'. The comparison between iCub and the nonprimed Scitos G5 revealed a significant effect of 'robot', (iCub=0.198 vs nonprimed Scitos G5=0.112; $F_{(1,28)}$=6.71, p=.008), with participants changing their decisions more often with iCub than with nonprimed Scitos G5. A significant interaction between 'robot' and 'gaze' was also found ($F_{(2,28)}$=8.13, p=.015). Posthoc testing revealed that 'change rate' was significantly higher (p<.05) for the social than for the nonsocial gaze condition in the iCub, but not the nonprimed Scitos G5 (p=.775). Comparisons between iCub and primed Scitos G5 did not reveal a significant difference in change rate between the two robots (p=.48), but did show a significant interaction between 'gaze behaviour' and 'robot' ($F_{(1,14)}$=22.35, p=.000). Posthoc testing revealed that change rate was significantly higher (p<.05) for the social than for the nonsocial gaze condition in the iCub, but not in the primed Scitos G5 (p = .086). There was no significant main effect of 'robot' (p=.48). The final comparison between nonprimed and primed Scitos G5 showed a significant main effect of 'robot' (nonprimed Scitos G5=0.111 vs primed Scitos G5=0.221; $F_{(1,28)}$=8.99, p=.007), where participants changed idea more often when Scitos G5 was primed by iCub than when it was presented in isolation. The main effect of 'gaze' (p=.068), and interaction (p=.14) were both non-significant.

IV. Conclusion

The results of our study indicate that people are more socially engaged with robots when they are more-humanlike, similar to the findings of other studies [3]. We found that participants were more likely to change their valuation of an object to agree with the humanlike iCub robot than with the less-anthropomorphic Scitos G5, when that robot was presented in isolation. Moreover, it was found that this 'change rate' increased when the iCub engaged in a more-humanlike social gaze behaviour, compared to use of a fixed gaze. Conversely, this social gaze behaviour had no effect on interactions with the Scitos G5, where the 'change rate' was not significantly different from the use of a fixed gaze. This suggests that the credibility of anthropomorphic robots benefits from the automatic activation of social stereotypes that are normally absent during interactions with less-anthropomorphic variants. However, it would appear that once participants had experience of an anthropomorphic robot they were willing to extend this classification, and the associated social benefits, to subsequent interactions with a less-humanlike robot. We found that participant's 'change rate' with the Scitos G5 was significantly higher if participants had first interacted with the iCub robot. Also, once the less-humanlike Scitos G5 had been 'primed' by the anthropomorphic iCub there was no longer any significant difference in 'change rate' between these two robots. It should be noted however that even this 'anthropomorphically primed' Scitos G5 did not benefit from the use of social gaze, probably due to the lack of congruence between this behaviour the robot's physical form. This finding has important consequences for the credibility of robots and our acceptance of them, e.g. in the increasing need and advocacy for the use of robots to assist the elderly in their homes [8]. However, the functionality required in this environment often precludes the use of anthropomorphic physical forms, which hinders acceptance [9]. Our study suggests that if users were first primed with anthropomorphic robots they would be more accepting of their less-humanlike, but more functional, robotic relations.

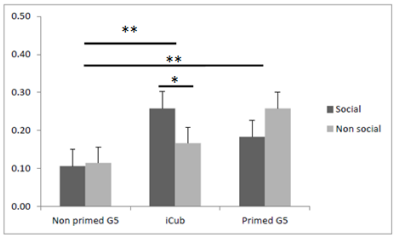

Figure 2. Change rate for nonprimed Scitos G5, iCub and primed Scitos G5

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