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How facial expression may influence the trust in a robot?

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Abstract— **Trust, is supposed as one of the important aspects in Social Robotics which targets the quality of interaction between humans and robots. In this study, we address the level of trust which a human being makes facing a robot under different circumstances. The influencing factors are considered as the facial expression of a robot during the interaction as well as the influence of making small talks. In this paper, we are going to present a framework to investigate the effect of these two factors on trust in depth.**

I. Introduction

The emergence of social robots in our everyday life is increasing rapidly day in day out. This fact highlights the important role of Social Robotics which targets the integration of robots in our daily lives. For instance, assistive robots which aid people to perform predetermined actions. It is almost obvious that the robot's actions may cause serious consequences to the people surrounding them [1]. In this case, the concept of trust in robots becomes a central issue in this field.

On the other hand, it is not surprising that the feeling of confidence felt by human subjects can turn robots to a more collaborative partners [2]. This fact has motivated several studies in the field of social robotics to investigate factors influencing on trust. Another motivating factor might be the fact that trust is strongly linked to persuasiveness in social and collaborative contexts. Hence, trust may directly affect people's inclination to cooperate with the robot, for instance by accepting given information or following its suggestions [3].

The preceding factors motivated us to investigate a system that aims at evaluating the trust felt by a human subject in a robot. In this framework, we have designed different scenarios, described in the following sections in details, to compare and evaluate the level of trust under different circumstances. We argue that using a robot telling a story to a human subjects, may reveal the influence of such factors. With this aim, the robot will be programmed to tell the story expressing either happy or sad facial expressions. Besides, the robot will be able to get confidence of a subject, by making small talk before starting the story telling phase. We expect to reach higher level of trust in case of a storytelling robot expressing sad facial expressions while starting his conversation by small talk.

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II. Methodology

As mentioned earlier, in this paper two hypotheses are suggested:

1. Facial Expression (FE): expressing sad facial, while telling a sad story would enhance the level of trust in a robot.
2. Small Talk (ST): starting a conversation with small talk would enhance the level of trust in a robot.

As follows, we define the two hypotheses as bipolar variables. In other words, each variable can take two different values. For instance, the first hypothesis is a variable with two possible values: making small talk (ST) or not (NST). Similarly, the second hypothesis could be expressing either happy or sad Facial Expression (FE). In this way, four different scenarios will be assumable: (a) starting the conversion *with* ST – while expressing *sad* face [ST_SAD], (b) starting the conversation *without* ST while expressing *sad* face [NST_SAD], (c) starting conversation *with* ST – while expressing *joyful* face [ST_JOY] and (d) starting conversation *without* ST while expressing *joyful* face [NST_JOY].

III. Implementation

To test the two suggested hypotheses, we propose to design an experiment using a story telling robot. In this experiment, the participants are asked to sign a consent form and then fill in a trust questionnaire published recently in [4]. Afterward, participants will start interacting with the robot regarding the four possible scenarios described in the previous section.

In the intended implementation, the robot is supposed to tell a sad story and ask the participant to help him in form of a donation. As discussed earlier, the robot is configured to perform or not to perform small talk before starting the interaction, as well as expressing sad or joyful facial expressions. In the scenario starting with small talk, the participants are able to interrupt the robot conversation; and the robot is able to comprehend the interruptions using an embedded microphone. In this way, the interaction would be more real and pleasant.

At the end of the storytelling phase, regarding the donated amount considering a threshold (for example 20 Euros), the robot will express a happy or sad face. Then, the post-questionnaire is applied to measure the trust in the robot. Figure 1, depicts the implementation flow in detail.

To examine the influencing factors, based on the four designed scenario, we assume 6 different comparisons listed in Table 1. Regarding the first hypothesis, we expect to reach a significant difference between the two groups with different facial expression, i.e. ST_JOY vs. ST_SAD (Comparison 1);

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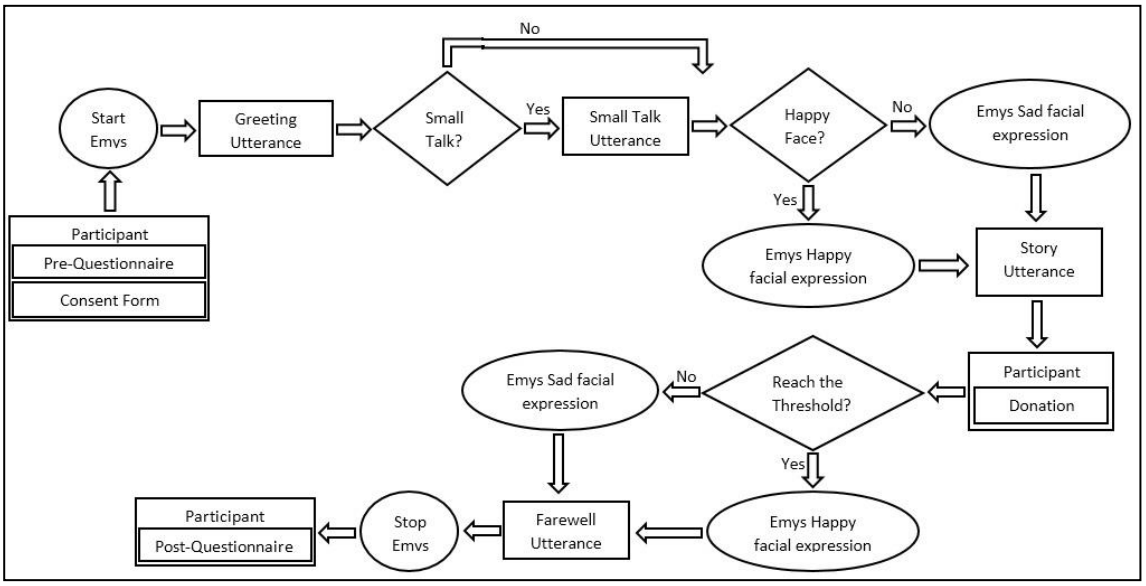

Fig. 1. Methodology Flow

as well as NST_JOY vs. NST_SAD (Comparison 2). Moreover, we expect to reach significant difference between the reported trust regardless of making small talk (Comparison 3).

Similarly, we expect the second hypothesis, i.e. the role of ST, follow a similar pattern. To be more specific, in comparison 4 we expect to reach a significant difference comparing the group of participant interacting a robot expressing sad facial expression but started the conversation with/without small talk. In a similar vein, we expect to reach a statistically significant difference in comparison 5, as well as the level of reported trust in case of starting the conversation with small talk regardless of the facial expression (Comparison 6).

TABLE 1. ASSUMED COMPARISONS

Comparision Label	Groups
Comparison 1	ST_JOY vs. ST_SAD
Comparison 2	NST_JOY vs. NST_SAD
Comparison 3	ST/NST_JOY vs. ST/NST_SAD
Comparison 4	ST_SAD vs. NST_SAD
Comparison 5	ST_JOY vs. NST_JOY
Comparison 6	ST_JOY/SAD vs. NST_JOY/SAD

Finally, taking into account the two hypotheses, we expect to reach higher level of reported trust in case of sad face together with small talk. In other words, we expect to reach the highest level of difference in comparison 1 comparing to the others. The justification behind this is that the two influencing factors, i.e. ST and FE, are assigned the ideal variable. It means that, when the robot expresses sad facial expression it is able to gain the trust of its partner more by starting his conversation with a small talk.

Another factor that might be a discriminant feature distinguishing between each groups, is the amount of donation. To be more specific, we expect to reach a significant difference between the amount of donation.

In sum, the purpose of the current study is to determine a framework considering two factors influencing the trust a human being makes in a robot. In our future direction, we are going to implement the four scenarios to examine the suggested hypotheses.

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