Evaluating Child-Robot Interaction via Body Pose Features

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Abstract. In our work the aim is to evaluate the influence of a robot's behaviour on the child's attitude, in terms of liking, relaxation, dominance and engagement. We ran an experiment in which a child would interact with a robot having either a *permissive* or *authoritative* behavioural style. The set-up of the experiment was within subjects where each subject would see a robot permissive and an authoritative in a random order. Each interaction was about 20 minutes long. We used interviews and questionnaires. We also recorded with a Kinect sensor[1] the body poses of the child. We computed various static features on each frame of captured data. Where we found no significant impact of the behavioural styles in the data collected via questionnaires and interviews. The subtle differences in the behaviour of the robot were not explicitly perceived by the children. However the data analysis run on the body communication of the children showed significant differences according to the styles. Further analysis on these data should enable us to propose new dimensions for evaluation of body attitudes in child-robot interaction.

1 Introduction

Works in Child Robot Interaction (CRI), have covered various contexts from educational to entertaining uses, and children seems to be keen to accept robots as companions.

Our research project, the MoCA project[2], deals with children from 7 to 12 alone at home after school. We were interested in the value that a companion robot could bring to the child in this context. In our project, we aimed to make the behaviour of the robot *plastic* in a way that it would be adaptable to the user's social expectation. To this end, we used two behavioural styles namely `permissive` and `authoritative`, to modify neutral motion and to propose variation of behaviours of the robot in a same role. In order to evaluate the impact of our system, we used several techniques of measures as suggested by [2].

2 Experimental Setup and Evaluation Methods

The experiment took place in an ecological environment at Domus, an experimental platform of the LIG Laboratory. We used the Nao robot for this experiment, wildly used in HRI. Many studies have been conducted in child-robot interaction with Nao, and hence, the biases can be easier to avoid and the repeatability of the experiment easier to ensure.

[1] Microsoft Kinect 2 https://www.microsoft.com/en-us/kinectforwindows/develop/
[2] MoCA is a French ANR Project http://moca.imag.fr/

The experimental design was within subject; each participant seeing 2 conditions in a random order during 2 sessions of 3 interactions. Each session was about 20 minutes long and organized by the succession of 3 interactions. First the child would take a mathematical evaluation (*Math Quiz*),after the robot would *dance* for the child and finally the child would take a second *Math Quiz*. In order to test the *impact* of behavioural styles, we generated authoritative and permissive behaviours for the Nao robot from neutral behaviours on the fly during the *Math Quiz*. We tested our styles only during the *Math Quiz* interaction. The scenario was developed so as to be autonomous during the Math Quiz. An experimenter was however sending signals to the robots to change activities or in case of a problem (for example, the robot falling).

In order to collect the children's opinions on the interaction, we conducted interviews and questionnaires after each session. These interviews aimed to collect the children's perception of the robot's attitude. The first part of the interview was composed of very generic questions about the experiment. Then more specific questions were asked about the robot's attitudes and the activities. The questionnaire used after each session was based on the Godspeed[1] items about Credibility, Likability and Complicity. We also used the COIRS [4] questionnaire at the end of the experiment to collect general opinions about robots. After each session, the children would reply to the interview; and after the second a final interview would deal with explicit comparison of the two sessions. We used the data to measure variation on the child's attitude between the sessions. Several features form the literature on body communication have been implemented and applied on the Body Kinect data.

3 Discussion and Conclusion

The challenge in this experiment was to measure the impact of the behavioural style of the robot on the children. First by making sure they would perceive it and then by evaluating the child's preferences in term of styles. The behavioural style changes are however very subtle and touching only non-verbal communications signs.

We first ran interviews of the children. We adapted some items of the Godspeed questionnaire [1]. We also used a SAM iconic representation [3]. At the end of the experiment, we used the COIRS questionnaire[4]. These subjective data did not show any difference in the two conditions proposed to the children. However, the bodily attitude of the children did changed significantly between the condition. Data on this bodily attitude captured via the Kinect sensor are under analysis but seems to be promising for the evaluation of CRI experiments.

Following our experiment, we aim to provide a set of meaningful features and a toolkit in order to analyses bodily signals in CRI. New test would need to be performed latter on to filter the features that are relevant for psychologist in human-human interaction but might be irrelevant for child-robot interaction.

References

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