EmotiRob : an expressive compagnion robot for disabled children

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Abstract. We will discuss the research in the field emotional interaction, for the EmotiRob project, to maintain an interaction with children from 4 to 8 years. EmotiRob is a component of the MAPH project. The objective of which is to give comfort to vulnerable children and/or those undergoing long-term hospitalisation through the help of an emotional robot companion. The studies carried out on perception and emotional synthesis have allowed us to develop an experiment stufffed robot, Emi, using an emotional model, iGrace, allowing an emotional reaction based on the speech of the user. This short paper presents briefly MAPH and EmotiRob project, how we used emotion for Emi and experimentations with children.

Keywords: Interaction model, emotion, companion robot

1 Introduction

The design of a companion robot is justify by the fact that robots, wich was mostly used in industrial context, is using in domestic context today. Domestics robots allows to provide services for everyday life. The issue with accepting this type of robot is very important for a long-term interaction, the robot is present everyday in the home. To make the robot acceptable, it doesn't only have to be "perfect" in its tasks, it must also be able to communication with men in a "human" way. To do this "natural" communication, we must use capacity of communicating using for our traditional means: gestures, speaking, writing, touch, etc. In back, the robot must be able, beyond carrying out the functions for which it was programmed, to express emotions to show: feeling safe, calm, normal, warm, etc. The objective of the Emotirob project is to begin a study on companions robots using a stuffed robot that a child could hold in his/her arms and with which he/she could interact by talking to it, and then the robot would express itself through bodies postures or facials expressions.

2 MAPH and EmotiRob project

MAPH project objective is to design an autonomous stuffed robot, which may bring some comfort to vulnerable children (eg, children in long hospital stay).

However, a too complex and too voluminous robot is to be avoided. EmotiRob project, which is a subproject of MAPH aims to equip the robot from perception and understanding capabilities of natural language so that it can react to the emotional state of the speaker. EmotiRob also includes conception of a model for emotional states of the robot and its evolution.

Before beginning our project, we did two experimental studies. The first experiment [3] was carried out using the Paro robot to verify if reaction/interaction with robots depended on cultural context. This experiment pointed out that there could be mechanical problems linked to weight and autonomy, as well as interaction problems linked to the robot due to lack of emotions.

The second experiment [4] was to help us reconcile the restriction of a light, autonomous robot with understanding expression capacities. Evaluators had to select the faces that seemed to best express primary emotions of Ekman [2] among a list of 16 faces. It was one of the simplest faces that obtained the best results. With only 6 degrees of freedom [5], it was possible to obtain a very satisfying primary emotion recognition rate.

3 Modelisation and expression of emotions in a stuff robot

(a) Joy (b) Surprise (c) Sadness

(d) Anger (e) Fear (f) Disgust

Fig. 1. Example of facial expression for the last version of Emi

What is an emotion for a human and how can a computer have this kind of emotion. The subject more complex than emotions in humans is not unanimous. For example: are you first afraid when you see an animal and see it is a bear

after; or do you see that it is a bear first and then become scared because it is a dangerous animal? The Emotirob project has thus proposed an emotion model, GRACE [1], and a calculation method for emotions, iGrace [6], and has implemented them into our robot Emi which is specifically make to express simples emotions through facials expressions (Fig. 1) and the posture of its head in response to what it said to it.

The experiments conducted allow hypothesis validation of the model that is integrated in Emi. To avoid a phenomenon of repetition, a study on behaviour dynamic and it evaluation had been undertaken. EmI, under construction during this study, a virtual avatar: Arte, was created to represent EmI conscience. Art-e had to display the same facials expressions as the robot, so they both had not exactly the same constraints. Art-e allows work and tests on emotional dynamics, whose good results must be used by the robot. Art-e has five expressive components : eyebrows and mouth - which are the same as the robot - and eyes, head and trunk. Each component has a role when an emotive experience is displayed. It is based on the six primary emotions and neutral.

4 Major results for EmotiRob project with Emi

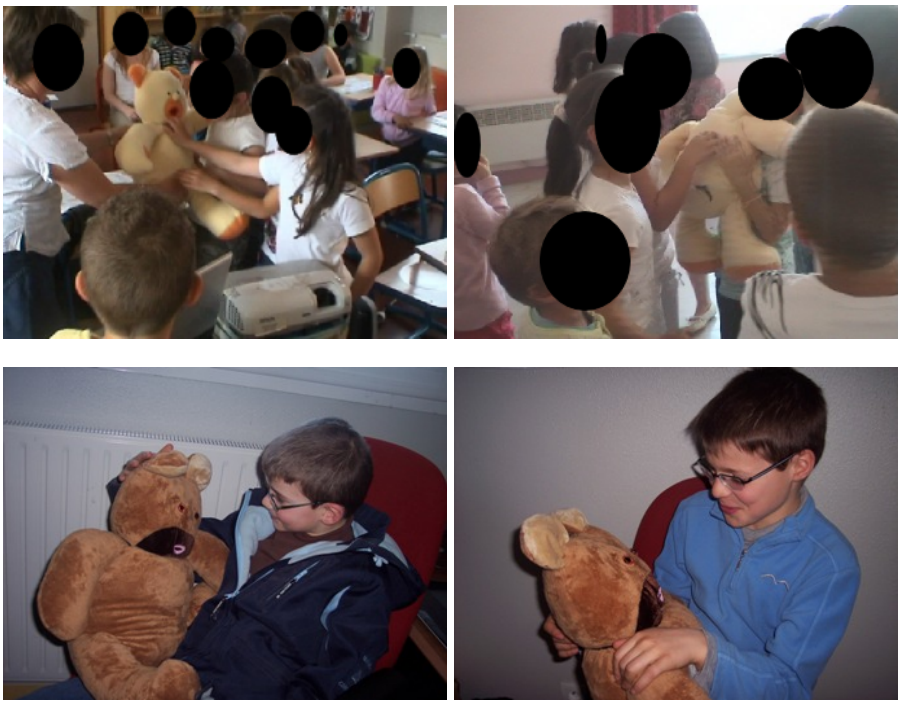

Fig. 2. Evaluation of second and third version of Emi with children

Several sets of experiments have shown the "credibility" of the robot's reaction to the text that a child said to it. For example, the recognition rate of the emotions expressed by the robot is satisfactory in relation to the quality of the robot prototype. Moreover, touching or caressing the robot also increases the quality of the interaction, which is due to the stuffed robot's texture as compared to traditional metal or plastic robots that feel "cold".

5 Conclusion

This article has presented the research we have done for the EmotiRob project. We have briefly described some of the hypotheses and models we have used for interaction between chidren and the Emi companion robot. Each previously presented models and Emi robot have already been evaluated separately. The results, which are not presented in this article, are very promising.

We have now began the integration of all the modules (understanding, interaction, and dynamics) for future experimentation of interaction between Emi and children. This experimentation will allow us to validate all choices we made for this project.

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