Child's Culture-related Experiences with a Social Robot at Diabetes Camps

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***Abstract*—This paper investigates the experiences of Italian and Dutch children while interacting with a social robot that is designed to support their diabetes self-management. Observations of children's behaviors and analyses of questionnaires at diabetes camps, showed positive experiences with variation (e.g., Italian children seemed to be more open and expressive, and more close to the robot compared to the Dutch children). A culture-aware robot should be sensitive to such differences.**

I. Introduction

Type 1 Diabetes Mellitus (T1DM) is a chronic disease that sets high demands on self-management of lifestyle affecting a 140,000 children under 14 years old in Europe [1]. The PAL project[1] develops a social robot (using the Nao[2]), an avatar (on a mobile device) and child-robot/avatar activities (e.g., time-line and quiz) that help these children to improve their self-management. They can participate in different activities with the robot in diabetes related environments (hospitals and diabetes camps) in a North European (Germanic) country: The Netherlands, and in a (Latin) South European country: Italy. Understanding the cross-cultural differences on how the children experience the robot, and how these experiences are being expressed, will help to better harmonize robot's bodily and textual expressions to the way the children interact and express themselves.

The cultural differences that are likely to relate to specific situated behavioral and cognitive components (cf., [2], [3]) are studied in the social environment in which the robot acts. We distinguish two research questions:

1) Can we identify words written by the children that indicate the sentiment of the child, and what are the differences between Italian and Dutch children on the sentiment expressions in text?
2) Can we identify the emotions that are being expressed by the child when they interact with the robot, and are there differences between Italian and Dutch children (i.e, based on observations of gestures, posture, and speech)?

[1]Personal Assistant for healthy Lifestyle; http://www.pal4u.eu/
[2]Aldebaran Robotics (https://www.aldebaran.com)

II. Experiments

A. Experimental method. Although the Dutch and Italian camps had somewhat different objectives and schedules, the same child-robot activities, observation methods and text analyses were performed.

There were two *activities*, taking about 15-30 minutes in total. The *quiz* was played on a hinging tablet between the robot and the child, pointing either to the child or to the robot. In turn, the robot and child asked each other a question and the other gave the answer. The *sorting game* was played on a touch table between the robot and the child. Both the child and robot could drag icons to a specific side of the screen (e.g., icons of high-carbohydrates food to the left and low-carbohydrates food to the right).

All the interactions were video scored. After the interaction, the children were asked to write down how they felt while interacting with the robot and why, and to write a letter to the robot to tell him in what way he could help them dealing with diabetes in daily life.

In the *Italian camp*, 34 children participated, aged between 10 and 14. The camp provided informational moments, practical training and structured lessons about T1DM and related topics (e.g.: nutrition, physical activity, etc.) supervised by an expert medical staff (doctors, nurses, psychologists and nutritionists). During afternoons and evenings it was possible for children to engage in collective recreational activities organized by the animation staff, or the child-robot activities.

In the *Dutch* camp, 21 children participated, aged between 8 and 11. The children were divided in groups of 4 or 5, with two mentors for each group, a volunteer and a nurse or doctor. This camp focused on sharing experiences with 'diabetic peers' in a kind of vacation setting instead of an educational setting.

At the beginning and at the end of the camps, children filled in a robot-related questionnaire in which they had to answer, in plain words: 1. Would you like to play with the robot again; why? 2. How would you build a robot?

B. Results Sentiment Analysis. The sentiment analysis was automatic, but errors of this automatic process were corrected

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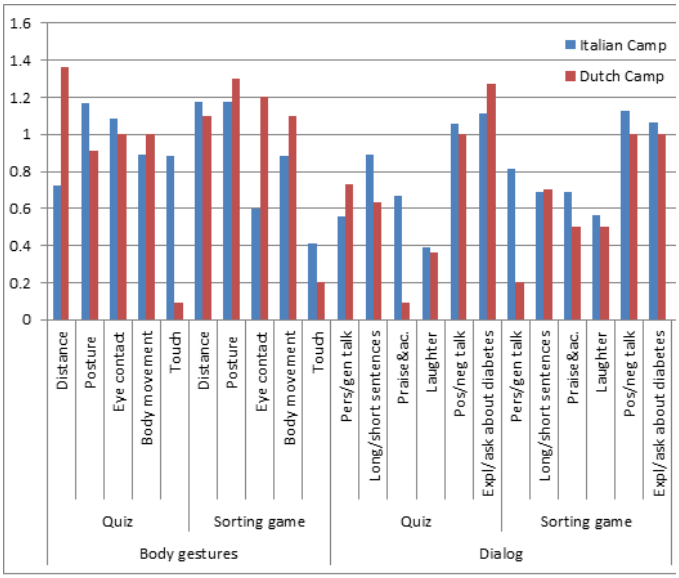

Fig. 1. Mean scores of the observations of child's body gestures and dialog during the quiz and sorting game; scale 0 (low) to 2 (high).

TABLE I
VARIABLES THAT WERE RECORDED DURING THE ACTIVITIES.

Dimension	Speech Dialog	Body Language
Familiarity	Personal talk, length of sentences	Distance
Attitude	Praise & acknowledgement	Eye contact, Posture
Liking	Laughter, Valence of talk	Touch
Benevolence	Diabetes content	Body movement

manually. The texts of the Dutch and Italian children were first corrected for spelling mistakes. Then we parsed the text using Pattern [4] to extract the part-of-speech tags and the lemmas of the terms, and used these to translate them into English. For each term then a sentiment value was looked up in the SentiWordNet dictionary [5].

The number of different sentiment words used by the Dutch children was limited. When asked if the children would like to play with the robot again, two-third of the Dutch children responded using the same term for nice ('leuk'). A total of only 8 words bearing sentiment could be found in their answers. When the Italian children were asked a similar question, their responses contained 24 different sentiment bearing terms.

The sentences written down by the Dutch children were much shorter on average than the sentences of the Italian children, e.g. the length of the answer to the question 'How would you build a robot?' was 9.2 words for the Dutch children, and 19.3 words for the Italian children. The Italian children used a larger variety of words, and used more expressive words. The children all enjoyed the interaction with the robot, hardly any the children wrote anything negative.

Results Observations. Table I shows the variables that were recorded by the observer on childrens speech (dialog) and body language. Observables on 4 dimensions were collected (e.g., [6], [7]). Figure 1 shows that the child's experience, as expressed in speech and body, was quite similar for Italian and Dutch children. For the *body* variables: In the quiz, Italian children proved to be closer to the robot (distance) and touch the robot more often (such effect will not appear in the sorting game, as there is a large table in between). However, Italian children seemed to have less eye contact in the sorting game (here the table attracks attention, in competition with the robot, so that such effects can appear). For the *dialog* variables: In the quiz, the Italian children seemed to express more praises and acknowledgements (the quiz has a more intensive dialog than the sorting game), and in the sorting game more personal talk (here the dialog is more 'free').

III. CONCLUSIONS AND DISCUSSION

This study identified words and behaviors that indicated the sentiment and emotion of Dutch and Italian children while playing a quiz and a sorting game with a social robot at a diabetes camp. In general, all children responded very positive, both in their answers and observed behaviors. Up to a certain level mistakes made by the robot were tolerated, e.g. a child said: 'He was not dumb, he told me that he just needed to learn a little bit.' Corresponding to cultural expectations, Italian children seemed to be more open and expressive, and more close to the robot compared to the Dutch children. Part of these differences could be caused by the fact that the Italian children were slightly older and because the settings of the camps were different. Due to these limitations, the study does not provide definitive conclusions on cultural differences. However, it provides context-rich information on the variety of experiences that the robot has to accommodate, which we will address in the next design and test cycle (e.g., integrating culturally defined verbal and non-verbal communication into the social robot, and providing strategies to persuade less-expressive children to engage more in the recommended activities).

Acknowledgments. PAL is funded by Horizon2020 grant nr. 643783-RIA. We thank all children, and the DVN and Sostegno70 associations for their participation and constant support.

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