Let's Be Friends: Perception of a Social Robotic Companion for children with T1DM

Ivana Kruijff-Korbayová[a], Elettra Oleari[b], Clara Pozzi[b], Francesca Sacchitelli[b], Anahita Bagherzadhalimi[b], Sara Bellini[b], Bernd Kiefer[a], Stefania Racioppa[a], Alexandre Coninx[c], Paul Baxter[d], Bert Bierman[e], Olivier Blanson Henkemans[e], Mark Neerincx[e], Rosemarijn Loije[e], Yiannis Demiris[c], Raquel Ros Espinoza[c], Marco Mosconi[b], Piero Cosi[f], Rémi Humbert[g], Lola Cañamero[h], Hichem Sahli[i], Joachim de Greeff[d], James Kennedy[d], Robin Read[d], Matthew Lewis[h], Antoine Hiolle[h], Giulio Paci[f], Giacomo Sommavilla[f], Fabio Tesser[f], Georgios Athanasopoulos[i], Georgios Patsis[i], Werner Verhelst[i], Alberto Sanna[b], Tony Belpaeme[d]

[a]*DFKI, Language Technology Lab (Saarbruecken, Germany)*
[b]*Fondazione Centro San Raffaele, eServices for Life and Health (Milano, Italy)*
[c]*Imperial College London (London, United Kingdom)*
[d]*The Cognition Institute, Plymouth University (Plymouth, United Kingdom)*
[e]*Organization for Applied Scientific Research (Soesterbergs, The Netherland)*
[f]*National Research Council – ISTC (Padova, Italy)*
[g]*Aldebaran Robotics (Paris, France)*
[h]*University of Hertfordshire (Hatfield, United Kingdom)*
[i]*Vrije Universiteit, Electronics & Informatics Dept. (Brussel, Belgium)*

Abstract. We describe the social characteristics of a robot developed to support children with Type 1 Diabetes Mellitus (T1DM) in the process of education and care. We evaluated the perception of the robot at a summer camp where diabetic children aged 10-14 experienced the robot in group interactions. Children in the intervention condition additionally interacted with it also individually, in one-to-one sessions featuring several game-like activities. These children perceived the robot significantly more as a friend than those in the control group. They also readily engaged with it in dialogues about their habits related to healthy lifestyle as well as personal experiences concerning diabetes. This indicates that the one-on-one interactions added a special quality to the relationship of the children with the robot.

Keywords: Social robots, Child-Robot Interaction, diabetes, Off-Activity Talk, self-disclosure, social skills, social robot perception.

INTRODUCTION

Type 1 Diabetes Mellitus (T1DM) is a chronic disease that affects a shocking 17,000 new children, mostly under 14 years old, per year in Europe [1]. T1DM is an overwhelming pathology that can cause life-threatening complications. It requires children of all ages to learn to constantly manage their condition in terms of glycaemia monitoring and insulin injection. This necessitates a major change in their lifestyle [2].

The present work stems from the Aliz-E project [3], in which we investigated the use of a humanoid social robot to support children with T1DM on their way to self-management. A social robot system was developed and instantiated in a Robot Theatre to facilitate child-robot interaction [4]. It was deployed in real-life settings during two editions of a Diabetes Summer Camp in 2013 and 2014, organized by the Italian families association "Sostegno70 – insieme ai ragazzi diabetici ONLUS" and the team of the Pediatric unit of Ospedale San Raffaele (Milan, Italy).

During the 2013 summer camp we experimented with introducing so-called *Off-Activity Talk* (OAT) to engage children in conversations about topics related to diabetes and healthy lifestyle as part of one-on-one interactions around gaming touchpoints with the robot. Details about the experiment design and a comparison of the effects of individual interactions with and without OAT were presented in [5]. We also observed that children who participated in the individual interactions exhibited a significantly stronger adherence in following the medical advice to fill in a nutritional diary than children who only participated in group interactions with the robot.

We hypothesized that this might be due to a different quality of the child-robot relationship established through the individual interaction. This inspired us to further investigate the effect(s) of individual interactions on children's perception of the robot during the 2014 edition of the camp. This paper presents the method and the results of the 2014 experiment.

EXPERIMENT GOALS AND METHODOLOGY

Goals

The aim of the 2014 summer camp experiment was to further investigate the children's (i) perception of the social robotic companion; (ii) expectations about having a robotic companion in their daily life; (iii) willingness and spontaneity to talk freely about their diabetes condition.

Design

The experiment was held in August 2014 during a ten-day-long Diabetes Summer Camp for T1DM

children. All the children at the camp had the opportunity to experience the robot in scripted "theater" performances during collective evening recreational activities. Out of the 41 children attending the camp, 28 volunteered to participate in the study.

The study had a between-subject design with two conditions: (1) the *control* condition, constituted by children who only experienced the social robot as a theater-performance character, but did not interact individually with it; (2) the *intervention* condition, where children had the additional possibility to interact individually with the social robot.

The individual interactions for the *intervention* condition were carried out using the Robot Theatre described in [4] in a partially Wizard-of-Oz setup and were centered around three activities, among which the children could freely choose and switch: a quiz game, a sorting game and a creative dance activity (see Figure 1). More details about the activities can be found in [4] and [5].

During these interactions the robot elicited off-activity-talk as described in [5] and exhibited the following social behavior characteristics discussed in [6]: the ability to express recognition and familiarity (e.g., using the child's name, referring to previous joint experiences); non-verbal bodily cues [7]; turn taking during game playing [8][9]; allowing children to touch it and responding to touch; and occasionally making mistakes, which helps children to feel at ease.

Measures

Children's perception of the robot and their expectations about the possibility to have a robotic companion were measured by questionnaires. Children's willingness and spontaneity to talk about diabetes was evaluated by 3 raters who independently assessed every OAT sub-dialogue regarding diabetes.

Figure 1: Left-to-right:
the quiz game, the sorting game, the creative dance activity

RESULTS

The robot was described as a friend (as opposed to pet, toy, adult, computer) significantly more often by the intervention group than the control (χ^2=20.09 with probability 1%, two-tailed p=0.0001). Instead, there was a tendency in the control group to ascribe machine-like characteristics to the robot, unlike in the intervention group. The children's willingness and spontaneity to talk about diabetes was mostly high. Qualitatively, all coders noticed a common positive attitude in sharing practical notions about diabetes and often also their personal experiences with the robot. Majority of children in the intervention group would like to meet the social robotic companion again (more preferred at home rather than school, hospital, or summer camp) or own one. The reason was the playful character or the relational aspect in majority of cases. This unique relationship also had a positive impact on the educational aspects of the interaction.

CONCLUSIONS

The individual interactions lead the children to perceive the robot as a peer. They do not feel judged, but rather encouraged to learn and exchange knowledge. This finding underlines the potential of such a robotic companion. It shows that children are willing to let a robot enter such a delicate and personal dimension. This is extremely important for fostering companionship to support children with diabetes.

REFERENCES

[1] http://www.idf.org/diabetesatlas/europe

[2] Freeborn D., Dyches T., Roper S.O., Mandleco B. (2103) Identifying challenges of living with type 1 diabetes: child and youth perspectives. *Journal of Clinical Nursing*. 22/13-14. 1890–1898.

[3] http://www.aliz-e.org

[4] Coninx, A., Baxter, P., Oleari, E., Bellini, S., Bierman, B., Blanson Henkemans, O., Cañamero, L., Cosi, P., Enescu, V., Ros Espinoza, R., Hiolle, A., Humbert, R., Kiefer, B., Kruijff-Korbayová, I., Looije, R., Mosconi, M., Neerincx, M., Paci, G., Patsis, G., Pozzi, C., Sacchitelli, F., Sahli, H. et al. (in press). Towards Long-Term Social Child-Robot Interaction: Using Multi-Activity Switching to Engage Young Users. To appear in *Journal of Human-Robot Interaction*. http://www.coninx.org/work/ALIZE-JHRI-preprint.pdf

[5] Kruijff-Korbayová, I., Oleari, E., Baroni, I., Kiefer, B., Zelati, M. C., Pozzi, C. et al (2014). Effects of Off-Activity Talk in Human-Robot Interaction with Diabetic Children. In *Proceedings of the 23rd IEEE International Symposium on Robot and Human Interactive Communication. (RoMan 2014)*, 649-654.

[6] Nalin, M., Baroni, I., Sanna, A. & Pozzi, C (2012). Robotic Companion for Diabetic Children. In *Proceedings of the 11th International Conference on Interaction Design and Children*. 260-263.

[7] Brooks A. G., Arkin R. C. (2007) Behavioural overlays for non-verbal communication expression on a humanoid robot. *Autonomous robots*. 22/1 55-74.

[8] Nalin, M., Baroni, I., Kruijff-Korbayová, I., Cañamero, L., Lewis, M., Beck, A. et al (2012). Children's adaptation in multi-session interaction. In *Proceedings of the 21st IEEE International Symposium on Robot and Human Interactive Communication* (RoMan 2012).

[9] Baxter, P., Wood, R., Baroni, I., Kennedy, J., Nalin, M. & Belpaeme, T (2013). Emergence of Turn-taking in Unstructured Child-Robot Interactions. In the *Proceedings of the 8th ACM/IEEE International Conference on Human Robot Interaction (HRI)*. 77-78.