

# Challenges in child-robot interaction: The cases of two research projects

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**Abstract.** Evaluating Child-Robot Interaction (cHRI) constitutes one of the main challenges among the Human-Robot Interaction (HRI) community. This paper presents the challenges faced by two projects: the EMOTE and the CoWriter projects, aimed at having a robot interacting with children in learning contexts. Moreover, the paper presents the metrics used, addresses their challenges and contributes with some solutions for the evaluation of cHRI.

**Keywords:** Child-robot interaction; Metrics; Challenges

## 1 Context

Social robots are becoming widespread as useful tools in a variety of context, such as entertainment [8], assistance [5] and tutoring [2]. As such, HRI is not only reserved for adults, but for children as well. Moreover, for the interaction to be successful, robots must be designed, developed and evaluated in their real context of use with real end-users. This paper addresses the challenges of measuring and evaluating the performance of a robot that is being developed across two different projects: the EMOTE project<sup>1</sup> and the CoWriter project<sup>2</sup> with children as end-users (see Fig. 1). Moreover, this paper presents how we have dealt with the same challenges and proposes some possible solutions.



**Fig. 1.** From left to right: Children in EMOTE; Children in CoWriter.

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<sup>1</sup> EMOTE project: <http://www.emote-project.eu/>

<sup>2</sup> CoWriter project: <http://chili.epfl.ch/cowriter>

## 2 The cases of two research projects

**EMOTE Project:** EMOTE is an EU FP7 project aimed at designing, developing and evaluating a new generation of artificial embodied tutors that have perceptive capabilities to engage in empathic interactions with learners in a shared physical space [2]. The target users of this project are early-secondary students with age ranging 11 and 15 years old. To measure children's perception on the robot's performance, quantitative measures were applied during studies. Therefore, we have used the **God-speed series** to measure the perception of *anthropomorphism*, *animacy*, *likeability*, *perceived intelligence* and *perceived security* [1]; moreover, we have used an adapted version for HRI of the **Interpersonal Reactivity Index** to measure empathy, specifically *empathic concern* and *perspective taking* dimensions [4]; also, we have measured children's attitudes using the **Negative Attitudes Towards Robots Scale** [9]; and finally we have applied a **Technology Acceptance Scale** [6]. Mostly, our results did not yielded differences across study conditions, revealing almost always positive results towards the evaluation of the robotic tutor by children. After the study, children were also interviewed and expressed their excitement for the interaction with a social robot. Therefore, the novelty effect of interacting with a sci-fi character seemed to have influenced the overall results of a study when the measures rely on quantitative metrics for children.

**CoWriter Project:** The CoWriter is a project aimed at exploring how a robot can help children with the acquisition of handwriting, wherein children are the teachers who help the robot to better write [7], or help correcting other children in their writing [3] (see Fig. 1). The target group are children between 6-7 years old that already learned how to write, but need to master their handwriting skills. To gain insights about how children perceived the robot during the interaction, studies were performed and validated quantitative metrics developed for younger children were used. Therefore, the **Smileyometer** aimed at measuring how children liked the activity with the robot, wherein the **Again-Again Table** aimed at measuring how much children 1) would like to perform the activity again only with the robot; 2) only with the iPad; 3) and with both the robot and the iPad [10]. Despite having used metrics specially developed for younger children, results revealed to be extremely positive in all study conditions, with no significant differences, revealing that children are extremely positive assessing a novel type of interactive technology such as a robot.

## 3 Solutions

Studies conducted in the scope of EMOTE and CoWriter projects translate some of the challenges in using quantitative metrics in cHRI. To better understand how children perceive the interaction with the robot, behavioural analysis were conducted, revealing different reactions of children to the interaction. Moreover, interviews in the EMOTE project also

lead to important insights about their perception of the robot. In addition, longitudinal studies will be considered. In sum, qualitative measures seem to better translate cHRI in comparison with quantitative metrics. However, there is a need to understand behavioural commonalities to enable comparison across studies. To achieve such a high goal, the community of HRI focused on cHRI needs to work together on the creation of such metrics.

**Acknowledgments.** This work was partially supported by the European Commission and was funded by the EU FP7 ICT-317923 project EMOTE and partially supported by national funds through FCT - Fundação para a Ciência e a Tecnologia, under the project UID/CEC/50021/2013. The authors are solely responsible for the content of this publication. It does not represent the opinion of the EC, and the EC is not responsible for any use that might be made of data appearing therein. The authors thank Escola Quinta do Marquês and Escola 31 de Janeiro for their involvement in the projects.

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