

The CoWriter Project: Teaching a Robot how to Write

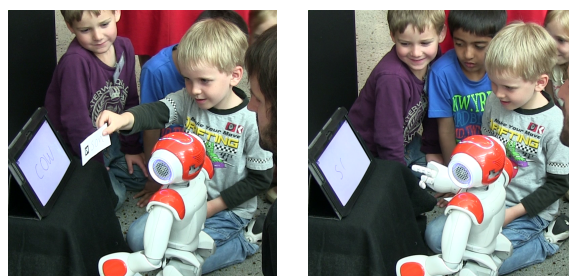
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This video (that accompanies the paper “When Children Teach a Robot to Write: An Autonomous Teachable Humanoid Which Uses Simulated Handwriting” by the same authors, and presented as well during this conference) presents the first results of the EPFL CoWriter project. The project aims at building a robotic partner which children can teach handwriting (Figure 1). The system allows for the *learning by teaching* paradigm to be employed in the interaction, so as to stimulate meta-cognition, empathy and increased self-esteem in the child user. It is hypothesised that use of a humanoid robot in such a system could not just engage an unmotivated student, but could also present the opportunity for children to experience physically-induced benefits encountered during human-led handwriting interventions, such as motor mimicry.

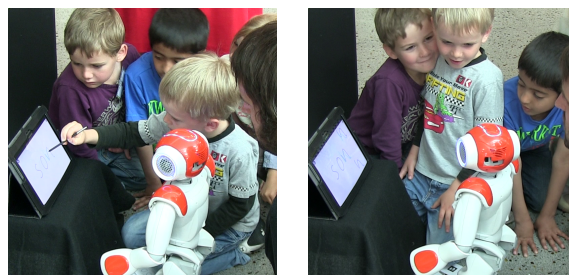
By leveraging simulated handwriting on a synchronised tablet display, a NAO humanoid robot with limited fine motor capabilities has been configured as a suitably embodied handwriting partner. Statistical shape models derived from principal component analysis of a dataset of adult-written letter trajectories allow the robot to draw purposefully deformed letters. By incorporating feedback from user demonstrations, the system is then able to learn the optimal parameters for the appropriate shape models. The video illustrates these techniques and successively presents how the robot is made to simulate handwriting, how bad letters are generated and how the user can provide demonstrations to improve them.

Preliminary in situ studies have been conducted with primary school classes in Geneva area to obtain insight into children’s use of the novel system. About 50 children aged 6-8 were successfully able to engage with the robot and to improve its writing to a level which they were satisfied with. The validation of the interaction represents a significant step towards an innovative use for robotics which addresses a widespread and socially meaningful challenge in education, and provides context for robotics in education beyond the well-explored use of teaching coding and robotics-related subjects.

The full source code for the teachable robotic handwriting partner relies on a set of ROS nodes and has been made available at https://github.com/chili-epfl/cowriter_letter_learning.



(a) The child shows a card to the robot with a word to write. (b) The robot writes the word seen on the card and asks for feedback.



(c) The child provides feedback on the letters written via demonstration. (d) The robot responds to the feedback, until the user is satisfied.

Figure 1: A child engaging with the robot in the *learning by teaching* interaction, using demonstrations as feedback.

Acknowledgments

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