

Bachelor Projects in Social Robotics and Child Development

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I am happy to supervise several bachelor projects on social robotics and on analysing children's multimodal interactions automatically. The following topics are examples in which projects can be done:

- **Modelling confusion detection in multimodal data** When communication is disrupted when interacting with a social robot, people may get confused. Last year, we collected data from elderly persons interacting with a social robot [1]. During the interaction, communication disruptions were induced by the robot yielding participants showing signs of confusion. In this project, the aim is to train a machine learning model that can reliably recognise confusion from both audio and visual cues.
Main method: Machine Learning
- **Gesture use in HRI** When communicating among humans, people tend to use a large variety of hand gestures, facial expressions, and bodily motions to add meaning to what they say. However, to what extent do people also use such non-verbal cues when interacting with a social robot? In this study, the aim is to setup, carry out and analyse an experiment to investigate how much people use gestures, different facial expressions and body postures when interacting with a social robot. The study includes exploring recently developed AI techniques to analyse multimodal communication, see, e.g., the <https://EnvisionBox.org>. **Main method: Human-Robot Interaction; Behaviour Understanding**
- **AI techniques to analyse children's multimodal communication** Communication between humans is essentially multimodal, involving not only speech, but also hand and body movements, facial expressions and more. It is widely believed that the non-verbal aspects of communication aid in meaning formation, allowing –among others– children to learn language. Around 15 years ago, I collected a large video corpus of children interacting with their social environment (parents, siblings and other family members) in different cultures [2]. These data have been manually annotated, but to what extent can we use modern AI techniques to carry out similar –or even more sophisticated– analyses to study how children's

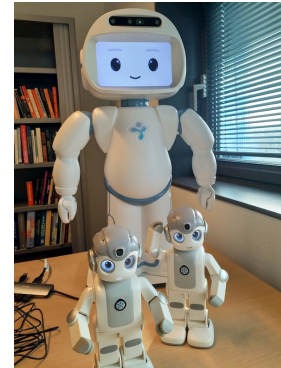
multimodal behaviour supports language learning. The study includes exploring recently developed AI techniques to analyse multimodal communication, see, e.g., the [EnvisionBox.org](https://envisionbox.org). **Main method: Behaviour Understanding; Machine Learning**

- **Second language tutoring with social robots** [With Dr Suzan Schef-fer] Generative AI offers many new opportunities to investigate how social robots can contribute to children’s language learning. Last academic year, we explored how AI-generated music can be used to teach children new vocabulary using a social robot. In this project, the aim is to replicate this study in a larger experiment. **Main method: Child-Robot Interaction Experiments**

Work expected from student

For the HRI studies, students are expected to work with either the Alpha Mini robot or the QT robot. For more information on the robots and links, see the UG Social Robotics Lab webpage. For all projects, the following activities are expected from the student:

- Read the relevant literature.
- Design and program a solution to the posed research question.
- Test and evaluate the implemented solution, either with human participants or as a more classical ML evaluation.



Note that the Alpha Mini robot can be programmed in Python, Javascript or Android. Some programming skills in ROS with Python or C++ are required for working with the QT robot.

If you are interested and want to know more about a project, you can contact me through email (p.a.vogt@rug.nl).

References

- [1] Paul Vogt and Yara Bikowski. Towards grounding conversations between social robots and elderly persons. In *ASIMOV-2024: Workshop on Adaptive Social Interaction based on user’s Mental models and behavior in HRI*, 2024.
- [2] Paul Vogt and J. Douglas Mastin. Anchoring social symbol grounding in children’s interactions. *Künstliche Intelligenz*, 27:145–151, 2013.