Proposal Research Traineeships 2016

1. Title of the Project
A robot tutor for academic language learning of preschool children

2. Coordinators
Make sure to mention your respective departments.

Dr. Paul Vogt (DCI)

Dr. Rian Aarts (DCU)

3. Project Summary
Short summary in which you give a clear and concise outline of your project, including the research question, the intended methods of data gathering, the collaborative aspect of the project, as well as the objective you would like to achieve with the help of a research trainee. Max. 1000 words.

Due to recent advancements of robot technology and potential of robots to educate people, there has been an increased effort in developing robot tutors to educate both children and adults (Castellano et al., 2013). One application domain for robot tutors is second language tutoring to preschool children (Belpaeme et al., 2015; Fridin, 2014). This could be either tutoring a popular second language such as English to native speakers of, for instance, Dutch or tutoring the official school language to children from immigrant families. This project focuses on robot tutoring aspects of academic language of Dutch to preschool children with Turkish as their mother tongue.

Schools' subjects are taught through academic language, a specific language register used in cognitively demanding and decontextualized situations which has specific features on the lexical, grammatical and textual level (Schleppegrell, 2004; Aarts, Demir & Vallen, 2011). Proficiency in this language register is important for achieving school success (Leseman, Scheele, Mayo & Messer, 2007). However, there are large differences in the extent in which home environments stimulate the emergence of academic language (Demir-Vegter, Aarts & Kurvers, 2014). Moreover, there are also considerable differences in the extent in which teachers stimulate students' academic language development. Teachers in multilingual classrooms may even simplify their language input in such a way that they provide impoverished input to children learning Dutch as a second language (Aarts, Demir-Vegter, Kurvers & Henrichs, 2016).

Academic language stimulating behavior of teachers can be divided in three components: providing academic input (e.g. using diverse lexicon, complex sentences, specific references, high abstraction level), stimulating understanding (e.g. modeling, giving meaning, repeating, visualizing) and stimulating the production (e.g. asking to be precise, giving directions, reformulating, recasting) of academic language by students (Dokter & Aarts, 2015).

Robot tutors may provide an additional source of academic language stimulating behavior for preschool children learning Dutch as a second language. The advantages of using robots in addition to teachers are that robots are able to provide one-to-one tutoring, consistent behavior and a good model of the target language. Moreover, children tend to consider interacting with robots being less stressful (Alemi, Meghdari & Ghazisaedy, 2015), as a result of which children engage more readily with robots about things they think is boring when interacting with humans (Leyzberg, Spaulding &

Scassellati, 2014). In comparison to other digital learning environments, such as avatar or tablet-based applications, robots provide embodiment, which increases learning gains (Kennedy, Baxter & Belpaeme, 2015; Leyzberg, Spaulding, Toneva & Scassellati, 2012). However, the development of tutor robots is still in its early stage, so experimental studies investigating what kind of robot behavior works well are crucial.

Research questions

1. What kinds of academic language stimulating behavior can be incorporated in a robot tutor?
2. What are the effects of a robot tutor on the proficiency of academic language?

Methods

The project is divided in two parts, each relating to one of the two research questions. The project will be carried out in close collaboration with *Kinderopvanggroep*, a Tilburg-based organization that manages a large number of preschools in Tilburg and surroundings, and who have agreed to facilitate this research.

In the first part, relating to research question 1, we will start with exploring the academic language stimulating behavior of teachers in preschool. Next, the study will focus on finding out which academic language stimulating behaviors can be incorporated in a robot tutor. The focus will be on teaching academic language about numbers and basic arithmetic. The robot behavior will be programmed in parallel, starting with implementing basic perception and acting, followed by implementing the language stimulating behaviors. The robot we will use is the Aisoy1 V5 (www.aisoy.com) that has been recently ordered by DCI and which can be straightforwardly programmed using the Scratch programming language.

The second part, relating to research question 2, consists of carrying out experiments and analyzing these. The main aim of the experiments is to investigate whether or not the implemented language stimulating behaviors do give rise to an increased proficiency in the target academic language. In addition, we are interested in analyzing how the children interact with the robot. The experiments will be carried out at preschools in Tilburg with 4 year-old children who have Turkish as their first language and are learning Dutch as their second language. Two analyses will be carried out to measure the effects of the robot tutor on 1) academic language proficiency and 2) the interaction with children. To measure the effect on language proficiency, a pre-test and a post-test will be designed. A qualitative analysis of the recorded behavior will provide insights on the child-robot interaction.

Collaboration and project results

The research trainees will closely collaborate in data collection and analysis, but each with their own focus. One trainee will focus more on the academic language stimulation and help design the robot behavior, while the other will focus more on the technical aspects of this project. This collaboration also nicely integrates research approaches from the two departments involved. The project incorporates language acquisition research of both departments: educational aspects and academic language from DCU, and the recently European funded L2TOR project on second language learning using social robots from DCI.

The project will result in an initial draft for a publication to be submitted to a journal on child language development or educational robotics. In addition, the project will yield experimental

findings that can be incorporated in the L2TOR project, which aims to develop a robot tutor that be valorized in commercial applications in the years to come.

4. Project timeline
List of planned activities (possibly with milestones and intermediary results).

Part	Month	Trainee DCU	Trainee DCI	Milestone
1	1	Literature study		
	2-5	Analysis of academic language stimulating behavior, prepare experiments	Design and implementation of robot tutor	Overview academic language stimulating behavior, and robot tutor.
2	6-7	Experiment		Experimental data collected.
	8-9	Data coding		
	10	Data analysis		Experimental findings.
	11-12	Writing report		

5. Research Trainee Profile
Describe the general tasks of the research trainees, whether they need any preliminary knowledge (regarding the topic and/or research methods) and which skills the research trainees should have. Also specify which type of students are eligible to apply (Ba, Ma, ReMa).

At the end of your proposal, provide some information on how to apply e.g. required documents for application (resume, motivation letter etc.) and an email address where applications should be sent to.

Both trainees will be involved in the literature study, data collection and analysis. One trainee will focus primarily on the academic language stimulating behavior, while the other is more concerned with the task of incorporating this into the robot tutor (programming).

We are seeking enthusiastic students, preferably at the Master's or Research Master's levels (though Bachelor students with good programming skills are also considered), who have excellent communication skills and preferably some background in language acquisition. For one of the trainees, basic programming skills are required.

Applications, including a motivation letter and a resume, should be sent to both Rian Aarts (A.M.L.Aarts@uvt.nl) and Paul Vogt (P.A.Vogt@uvt.nl).

References

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