Does Small Talk Enhance Robot-Assisted Learning?

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ABSTRACT

Small talk is considered an important aspect of social bonding, which has been shown to aid the learning process. However, it is challenging to implement the natural language generation (NLG) processes needed to enable a robot to engage in small talk. Therefore, we propose to start by investigating 1) whether a robot that performs small talk provides benefits to the learning process, e.g. in terms of increased learning performance or engagement, and 2) what kind of topics come up during small talk, in other words how extensive the robot's knowledge base should be in order to autonomously be able to engage in small talk.

KEYWORDS

small talk, natural language generation, robot-assisted learning

1 INTRODUCTION

Small talk, also known as chatting, off-task talk, social talk, or phatic communion, is a crucial element of establishing and maintaining bonds with others, creating a friendly and relaxed atmosphere, and building trust [6]. Examples of small talk include discussing the weather, interests or hobbies, and gossip. Specifically in educational settings small talk can be used to introduce and maintain a positive classroom atmosphere, for example by making the learner feel more relaxed [17]. This sets the scene for a productive learning process [16].

In addition, the fact that small talk is generally not related to the task at hand does not mean that it cannot serve a task-related purpose as well. As a teacher, we could start by discovering the learner's interests through small talk and then tailor the educational, task-related content to make it feel more relevant and appealing. For example, if the learner has an interest in cars we could draw examples from this domain to explain basic concepts of physics. Or, as we have recently done in a study with a robot tutor, we could personalize the context in which education takes place by changing the background on a tablet device to match the learner's favourite color with the aim to further support the learner's need for relatedness [21].

However, most of our studies in education thus far have included a robot that behaved in a structured and repetitive fashion, without adapting the interaction or responding to input from the learner in any way. We consider this a *knowledge transfer* robot, one that engages almost exclusively in task-related talk and thus invests little effort into forming a social relationship with the learner. Because we tend to anthropomorphise these human-like robots [2, 9], this can result in a mismatch between the robot's actual behaviour and our expectations of the robot as being a sort of companion [3] with whom we can build relationships and communicate in ways similar to how we communicate with each other, which generally includes a strong social and off-task component. However, at the moment even knowledge transfer robots appear to be accepted by those that interact with them. We expect that this is because robots are currently still considered a novelty and most interactions consist of a single event, usually with a researcher present [20]. The next step is to put robots in the wild, where they will have to be able to maintain interactions by themselves over longer periods of time in order to avoid losing people's interest. Therefore, we believe that a robot's ability to become a relational agent [5] by building rapport through social behaviour will be a crucial element for sustaining long-term interactions in the future, especially after the novelty wears off [15].

The reason why most robots currently do not have the ability to engage in small talk is because it is challenging to implement the natural language generation (NLG) technologies needed to support this behaviour. Most current NLG systems focus on generating language to support a particular task, or to maintain a dialogue in a specific domain or context. In the case of small talk, the range of topics that could be discussed increases drastically. This includes references to things that are present in the interlocutors' physical environment, which calls for situated language generation [10] — one of the potential growth areas for the NLG field [11]. Small talk could also extend towards past experiences, interests, and preferences [4]. This would require a knowledge of social practices [1], general world knowledge, theory of mind [18], and an extensive and organized memory of the robot's previous interactions with the interlocutor and with others. The robot might also need to have extensive self-knowledge regarding its appearance, character, origin, and abilities, since we feel this is likely to come up as a topic of conversation as well. Because of their physical and social presence, even more so than with virtual agents that 'live inside a computer' and smart assistants that usually have fewer visible sensors and actuators than robots, we might find it more believable for robots to have experienced things and to have been to different places. For example, while it may break immersion if Amazon Echo told you she had been to Paris and met up with friends, this would not be so hard to believe (and, in fact, has happened) with our Nao robot.

The addition of small talk also has an influence on the discourse planning part of an NLG system, as found by Bickmore and Cassell while developing a virtual real estate sales agent [4]: it will have to balance the task-related and interpersonal goals, and it should support the non-discrete nature of these goals — a bond is not something that is either there or not there, it develops and can also fade through time. Finally, in order to come up with relevant replies the robot should be able to understand the off-task utterances by others, which may include frequent and sudden topic changes.

Although some groups have started working on adding small talk capabilities to agents [12], and coming up with models for off-task dialogue sequences [14, 19], a lot of research still uses canned

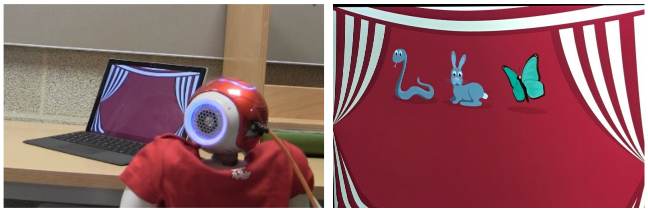

Figure 1: Example of the set-up (left) and a task on the tablet (right) during *I spy with my little eye.*

phrases rather than a full-fledged NLG system to generate small talk, which is then mostly used to break the ice at the start of an interaction rather than establishing a long-term social bond. Since NLG for small talk seems to be a challenging endeavour at this point in time, we propose to start with a Wizard of Oz approach to study more deeply the usefulness of small talk in human-robot interaction, and to explore if it is really as unconstrained as it appears, or whether we can identify certain topics or dialogue sequences that make it easier to capture small talk in NLG systems. Concretely, we designed a first exploratory study in which we will attempt to answer the following three main questions:

(1) Does small talk affect the interaction between robot and human, particularly in an educational context, in the form of learning outcomes, engagement with the robot, or likeability of the robot?
(2) How often do children initiate small talk during an educational interaction, and how is this affected by children's expectations of the robot's abilities?
(3) What is the nature of the small talk that happens between children and robots: what kind of topics are discussed, and how deep do these discussions go (e.g. in the number of turns taken)?

2 THE STUDY

In order to answer these three questions, we have conducted a within-subjects study with two experimental conditions: (1) knowledge transfer robot, in which the robot completed its lesson without responding to any input from the learner and (2) social robot in which the robot would initiate small talk and respond to input from the learner. We are currently analyzing our results, which we intend to present at the workshop.

2.1 Participants

A total of 22 children participated in the study (M_{age} = 11 years, 2 months; SD = 5 months), 7 boys and 15 girls, all native speakers of Dutch. The conditions were randomized, so that 14 participants interacted with the knowledge transfer robot first and then the social robot, while 8 participants first met the social robot followed by the knowledge transfer robot.

2.2 Materials

As a platform for this study, we used a similar system to the one we have used in previous work [7, 8], which takes the form of a simplified game of *I spy with my little eye* with a SoftBank Robotics Nao robot. In this game, the robot calls out an animal name in a second language (L2), in this case German, after which the learner has to select the corresponding image from three different images displayed on the screen (see Figure 1). This process is repeated for 24 rounds. In the knowledge transfer condition, which is how the robot behaved in our previous work, the robot would not respond to any attempts from the child to engage in off-task talk. Note that this is not an antisocial robot: it still welcomes the child and explains the game. In the social condition, the researcher used a Wizard of Oz setup to control the robot's text-to-speech engine. A pause was implemented after every round, leaving room for the child to initiate small talk and for the researcher to respond. In addition, at four points in time the social robot was programmed to initiate small talk with a predefined set of questions. To make a clear distinction and to provide an explanation of why the robot would behave differently between conditions we gave the robot a different shirt with a different name for each of the two sessions.

2.3 Measurements

Learning gain was measured by means of a pre-test, taken several days before the first session, and a post-test that was included as part of the training session with the robot. For engagement, we look at the amount of gaze from the child towards the robot, the tablet, and the researcher. We also examine the frequency and average duration of small talk during the sessions, the topics that are discussed, and whether it was the robot or the participant who initiated the small talk. Finally, we measured children's perception of the robot using a questionnaire [13], and asked them whether they were aware of any differences between the two robots and if they preferred one robot over the other.

3 CONCLUSION

The proposed study forms our first exploration of the potential role and nature of small talk in an educational human-robot interaction. Our first, informal impressions suggest that small talk had no effect on learning outcomes, but that children strongly preferred working with the social robot. We aim to present our findings at the workshop, and hope that this inspires discussion on the role of small talk in human-robot interaction, and the challenges we face when developing suitable NLG systems.

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