

Engaging Children as a Storyteller: Backchanneling Models for Social Robots

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ABSTRACT

In this video, we provide an overview of the analyses, design, and evaluation of a backchannel opportunity prediction (BOP) model for a social robot listener.

1. AN ATTENTIVE ROBOT LISTENER

Our aim is to develop a robot companion that can assess children’s language skills and storytelling ability and present a personalized context to effectively improve their syntactic and lexical skills. In the process, it is important for a robot listener to convey its attention to the child storyteller through listener responses, i.e., backchanneling. Here, we provide an analysis of young children’s nonverbal behavior with respect to how they encode and decode listener responses and speaker cues. Based on our findings, we developed a BOP model that detects four main speaker-cue events based on prosodic features in speech. We evaluated this model in a human-subjects study where children told stories to an audience of two robots, one demonstrating a contingent backchannel behavior and the other providing non-contingent responses. A full description of this work is presented in [1].

We still have very little knowledge regarding young children’s speaking and listening dynamics and how a robot companion should decode these behaviors and encode its own in a way children can understand. From a video corpus of preschool-aged child dyads taking turns telling stories to each other, we identified backchannel behaviors – partner gazes, leaning toward, smiles, utterances, brow raises, and nods – that indicate a positive engagement state of the listener. We also identified speaker cues—gaze, pitch, word, energy, pauses taken singly and in combinations—that children listeners acknowledge and respond to. From a within subject study, we characterized the bidirectionality of nonverbal behaviors in that children understand the function of nonverbal behaviors both in the role of the communica-

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Figure 1: Tega detects prosodic cues from the storyteller’s speech to provide backchannel feedback.

tor and recipient. Children can decode nonverbal behaviors they encode.

Based on our findings, we developed a rule-based BOP models based on wordiness, long pause, and combinations of pitch & pause, and energy & pause events. Twenty-three children were recruited to tell stories to two “twin” Tegas (Figure 1), contingent and non-contingent backchanneling robots. We hypothesize that children will identify the robot with contingent backchannel behavior more attentive, shown both in children’s behavioral and subjective measures. The results of this study show that our BOP model produces contingent backchanneling responses that convey more attentive listening behavior, and children prefer telling stories to the BOP model robot. More specifically, we found that: 1) Children direct their storytelling more toward the contingent BOP robot, 2) children express more positive affect toward the BOP contingent robot, and 3) children perceive the BOP contingent robot as more attentive and interested in their story.

Our aim was to evaluate two crucial questions that motivate the design and development of social robot learning companions that can successfully foster early language skills of preschoolers. Can a social robot generate backchannel behaviors that are perceived as attentiveness by preschool children? Is contingency (as opposed to frequency) of agent feedback crucial toward creating these perceptions? Our study suggests that contingency matters as it leads children to appropriately direct their storytelling to their audience, conveys more attentive listening and gazing behavior, and gains children’s preference.

2. REFERENCES

- [1] H. W. Park, M. Gelsomini, J. J. Lee, and C. Breazeal. Telling stories to robots: The effect of backchanneling on a child’s storytelling. In *Proceedings of the 12th ACM/IEEE international conference on Human robot interaction*. ACM, 2017.