The LISSA Virtual Human and ASD Teens: An Overview of Initial Experiments

Seyedeh Zahra Razavi[1], Mohammad Rafayet Ali[1], Tristram H. Smith[2], Lenhart K. Schubert[1], and Mohammed (Ehsan) Hoque[1]

[1]Department of Computer Science, University of Rochester, NY, USA
{srazavi, mali7, mehoque, schubert}@cs.rochester.edu
[2]School of Medicine, University of Rochester, NY, USA
Tristram_Smith@urmc.rochester.edu

Abstract. We summarize an exploratory investigation into using an autonomous conversational agent for improving the communication skills of teenagers with autism. The system conducts a natural conversation with the user and gives real-time and post-session feedback on the user's nonverbal behavior. We obtained promising results and ideas for improvements in preliminary experiments with five autism spectrum disorder teens.

Keywords: Autism spectrum disorder, conversational virtual agent, communication skills training

1 Introduction

Understanding and exhibiting appropriate social behavior is difficult for individuals diagnosed with autism spectrum disorder (ASD). Many people with ASD are in the average range of intelligence (that is, high-functioning) and often want help in improving their conversation skills. In this paper, we provide the results from an exploratory experiment, undertaken to determine the feasibility of using an autonomous conversational agent to help teenagers with ASD to practice and eventually, to improve their conversational skills. The fully automated conversational agent that we employ is a version of LISSA [1], adapted to help those with ASD. Using the automated version of the system, we ran a pilot study with five teenagers with ASD. Our study shows that a virtual agent can appear human-like and engaging in its dialogue behavior, from the perspective of teenagers with ASD.

Our system conducts a natural conversation with the teenagers, while at the same time providing both continuous feedback about the appropriateness of the user's prosodic and nonverbal behavior and post-session feedback in a simple, easy-to-interpret format. Based on the information collected from the users through interviews and a questionnaire about the system, we gained some initial insights into the strengths and weaknesses of our approach for the target population as well as some sense of the variation in user reactions to a system of this type.

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2 Related Work

In recent years, various virtual agent systems have been developed for skills training in common social scenarios—job interviews or public speaking, for instance. Examples include My Automated Conversation coacH (MACH) [2], Cicero [3], and the TARDIS simulation platform [4]. These systems provided feedback on prosody and nonverbal aspects of users' behavior, but made few, if any, attempts to make sense of user inputs. Other conversational agents were intended to combine meaningful conversations with nonverbal feedback. HWYD [5] and SimSensei [6] are some recent ones. Other computer systems aimed specifically at children with ASD include ECHOES [7], designed to improve collaboration skills, and RACHEL [8], which leads both a storytelling and a problem-solving task. Instead of using storytelling or tutoring tasks, we equip our system with the ability to lead a natural conversation, while at the same time presenting feedback to the users to improve their nonverbal behavior.

3 Feedback System and Dialogue Management

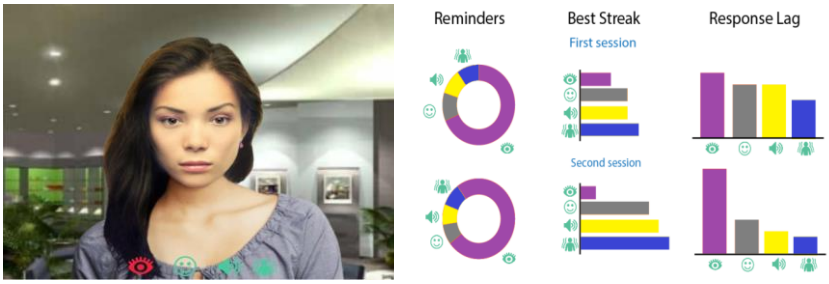

Fig. 1. Real-time feedback interface (left) and post-session feedback interface (right)

Our system had two major responsibilities: providing live and post-session feedback, and hosting a dialogue manager that allows users to have an open-ended conversation. The real-time feedback (Fig. 1) uses flashing icons to suggest changes in the user's eye contact, speaking volume, smile, and body movement. Fig. 1 also shows the charts displayed in post-session feedback, revealing the number of reminders (red flashes) the user received during the conversation, how long the user kept the icons green, and the time taken to adjust their behavior. The real-time feedback system uses a Hidden Markov Model (HMM) to predict the point at which an icon needs to turn red and green afterwards. The HMM was trained using data collected from a previous study [1], and details about its algorithm will appear in a future publication.

The dialogue manager is designed to lead a human-like, responsive, autonomous conversation with the user. Fig. 2 provides some idea of this interaction. To lead a dialogue, LISSA follows plans and subplans that are dynamically customized and modified. Throughout the dialogue, user inputs are mapped to explicit, context-

independent “gist-clauses”, where the mapping uses the gist-clause representation of the preceding LISSA output as context. The user’s gist-clauses are then used to generate an appropriate reaction to the user's input in the context of the preceding LISSA output. Both mappings (user inputs to gist-clauses, and gist-clauses to responses) use a flexible, robust hierarchical pattern transduction method.

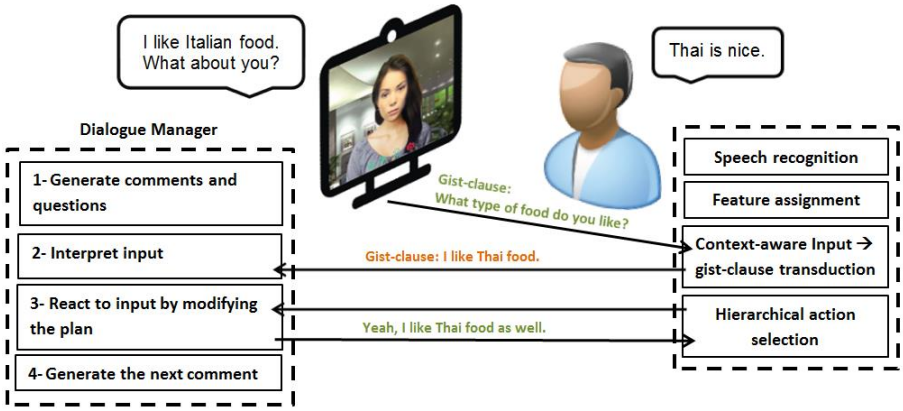

Fig. 2. Dialogue management outline.

4 Experimental Study

We ran a preliminary study with five teenagers (one girl and four boys) ranging in age from 15 to 17 years, all diagnosed with ASD based on expert evaluation and standardized diagnostic testing. After a five-minute explanation of the system, they had two rounds of conversation with LISSA, each taking five to 10 minutes. After the second round, the participants filled out a questionnaire in which we asked the participants to indicate their level of agreement with various statements. Responses were given on a five-point scale ranging from “strongly disagree” (1) to “strongly agree” (5). Experimenters had a five- to 10-minute chat with the teenagers about the users’ perceptions of the experiment.

Among the five participants, one was uncomfortable with the system. He was rather anxious before and during the conversation. He found talking to a computer relatively unnatural. Other participants generally handled the interaction well. They felt that LISSA understood what they said (*avg.* = 3.8, *sd* = 0.74). Four of them mentioned this as a feature they liked. They found the feedback from LISSA useful (*avg.* = 4, *sd* = 0.6). They also tended to agree that they could easily interpret the icons (*avg.* = 3.6, *sd* = 1.5), although two participants were disconcerted by any unexpected issues with the system, such as the screen “freezing” or a seemingly out-of-place question or feedback icon. Such glitches adversely affected the subjects’ assessments of the system and tended to become the focus of the post-session chat. Four of the five subjects were interested in more experiences with our system, indicating they would use it for training if its feedback became more precise and its responses more prompt. On average, they neither agreed nor disagreed that the

experience with LISSA was almost as real as talking to a human (*avg.* = 3, *sd* = 1.09), although two of them said they might prefer it over talking to a human.
Significantly, two of the subjects were particularly averse to any implied deficits in their social skills, making them uncomfortable with the system-provided feedback. Being gentle and respectful in explaining the system—as well as in the automated feedback it provides—are important.

5 Conclusion

We proposed a conversational agent designed to help teenagers with ASD improve their conversational skills. We ran an exploratory study with five teenagers, analyzed their behavior during a series of conversations, and asked them about their experiences with the system. According to the results, the LISSA conversational agent can potentially benefit many teenagers as a social communication skills training tool. The negative feedback, however, should be addressed, and the system should avoid hypothetical questions.

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