Pilot Study with RALL-E: Robot-Assisted Language Learning in Education

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1 Introduction

Social robots, designed to engage in face-to-face communication, have great potential in language training, because spoken language is a face-to-face communication skill. Early experiences with robotics for language learning have demonstrated the potential of robot-assisted approaches [1]. Social robots have shown promise in research laboratory settings for language education, but historically, they have been too expensive to consider as a relevant educational technology. In this paper, we describe RALL-E (Robot-Assisted Language Learning in Education), a low-cost autonomous social humanoid robot designed to engage learners in complex task-based conversational interactions in a foreign language. The hardware of the RALL-E robot is the Hanson Robokind R25 model. The RALL-E robot's conversational capability is developed based on the Virtual Role-Player (VRP) architecture [2], [3]. This architecture has been applied in many foreign-language training technologies that can engage in multimodal communication with trainees in a foreign language. The topics RALL-E covers include basic greetings and introductions in Chinese. A learner interacts with RALL-E through natural language in Chinese.

2 Pilot Study

To study how learner skills impact the use of RALL-E, we placed the robot in both an introductory Chinese class (Chinese I) of 10 students and an advanced Chinese class (Chinese III) of 47 students in a United States high school. The study was carried out in three 1-hour long class periods (one 1-hour Chinese I and two 1-hour Chinese III). Students interacted with RALL-E in groups of 3–5. The interaction lasted between 5–20 minutes. One teacher who teaches the Chinese classes participated in the study.

Overall, RALL-E was somewhat successful in engaging students in basic conversational dialogue in Chinese. RALL-E received 3219 voice inputs and was able to recognize 60% of them. From the recognized input, RALL-E successfully responded to 65% of them. The other 35% of the recognized input was considered out of context. For example, if the student and the robot are discussing music, an utterance about sports is considered out of context. This means that RALL-E was able to provide responses to 39% of the input (60% times 65%). From the 7-point Likert scale usability ratings collected after the study, students considered RALL-E somewhat useful (M=4.12, std=0.98), easy to use

(M=4.59, std=0.97), easy to learn (M=5.72, std=1.14) and were somewhat satisfied with practicing Chinese with RALL-E (M=4.54, std=1.15). When asked whether they were interested in using the RALL-E in the classroom when a new version was released, 55% of the students responded "Yes". Student t-tests showed that the ratings on how easy it was to learn to interact with RALL-E ($M_{ChineseI}$=6.28, $M_{ChineseIII}$=5.60, p=0.0024) and overall satisfaction with RALL-E ($M_{ChineseI}$=5.06, $M_{ChineseIII}$=4.43, p=0.0185) from Chinese I students were higher than those from Chinese III students. There was no significant difference in ratings of usefulness and ease of use of RALL-E. Fisher's exact tests showed that, compared to Chinese III students, a higher percentage of Chinese I students signed up to use the next version of RALL-E inside the classroom ($PCT_{ChineseI}$=90%, $PCT_{ChineseIII}$=48%, p=0.0314). The teacher who participated in the study rated RALL-E's usefulness as 3.57, ease of use as 4.78, ease of learning as 5.0 and overall satisfaction as 4.29.

3 Discussion

In the pilot study, the voice-recognition rate was decent, considering the noisy classroom environment RALL-E operated in. Students were quite impressed with RALL-E's ability to understand them. The main criticism was that RALL-E did not respond the way students expected it to. This points to the need for improvement in RALL-E's speech recognition and dialogue management — problems facing both conversational virtual agents and humanoids.

Results also indicated that RALL-E was much better received by beginners (e.g., Chinese I students) than advanced learners (e.g., Chinese III students). Interviews carried out after the study also indicated that different user populations had different needs for RALL-E. For example, Chinese III students requested features to allow them to converse with RALL-E on topics they are interested in, and to have RALL-E adapt to the students' language proficiency. Students from the Chinese I class, who had a large vocabulary but poor pronunciation, requested that RALL-E provide feedback on their pronunciation.

A possible extension of RALL-E is to further integrate its humanoid features with language learning. Another possible direction is to further enrich the dialogue with RALL-E. Students suggested many topics to converse with RALL-E, and expressed strong desire to go "deeper" into the discussion of a particular topic, and to have RALL-E take more initiative in the conversation. This suggests that students were not only open to conversing and practicing Chinese with RALL-E, but were also looking forward to more of it.

References

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