

Effects of a Communication with Make-Believe Play in a Real-Space Sharing Edutainment System

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Abstract. Recently, e-learning has become widely used. We have already developed an edutainment system named GOSAL (GOkko-asobi Supporting system for Active Learning) in which we introduce distinctive CG characters and communication support functions to enhance user communication for group work. We also confirmed that an element of make-believe play promotes the utterance of users. In this study, we evaluated the effectiveness of the system through an experiment in comparison with real group work, and confirmed the effectiveness for creative and laugh-filled learning.

Keywords: Embodied communication, embodied interaction and edutainment.

1 Introduction

In recent years, information technology has been used to develop various e-learning systems that enable users to study anywhere and at any time. However, with such systems, it is difficult to check the process and the depth of understanding achieved because the communication between the teacher and the students is not adequately smooth or intuitive. To solve this problem, the authors developed a speech-driven CG-embodied character called InterActor [1], which performs the functions of both speaker and listener by generating expressive actions and movements in accordance with the speech input. In addition, the authors developed a speech-driven embodied group-entrained communication system called SAKURA, which introduces multiple InterActors [2]. Furthermore, InterActors can be employed for various purposes, such as education and entertainment. For example, the authors have developed an edutainment system called LEAP (Learning with Embodied entrainment Animal Partners) that uses teacher and student InterActors, in which the user plays a double role, acting as both the teacher and student, and have demonstrated the effectiveness of this system [3].

The authors then expanded these systems to group learning, and developed an edutainment system called GOSAL (GOkko-asobi Supporting system for Active Learning), in which the user's learning is facilitated by engaging in make-believe play with CG characters [4]. In addition, they confirmed that the make-believe play of GOSAL

encourages users to speak more freely during group learning [5]. In the present study, we performed an experiment to confirm the effects of communication using GOSAL, by comparing group learning that takes place in a meeting room both with and without GOSAL.

2 GOSAL

2.1 Concept

We learn many important things when playing, in the process of growing up [6]. GOSAL is a system in which students can enjoy their learning process by engaging in make-believe play in a group learning setting. Students communicate by playing a learning role as a distinctive character in real space, via a sharing edutainment system in which they enjoy shared make-believe play (Fig. 1). Teachers can also play the role of a character and enjoy learning along with their students. In this way, users can exchange knowledge or information more freely, thus enhancing the group's education process.

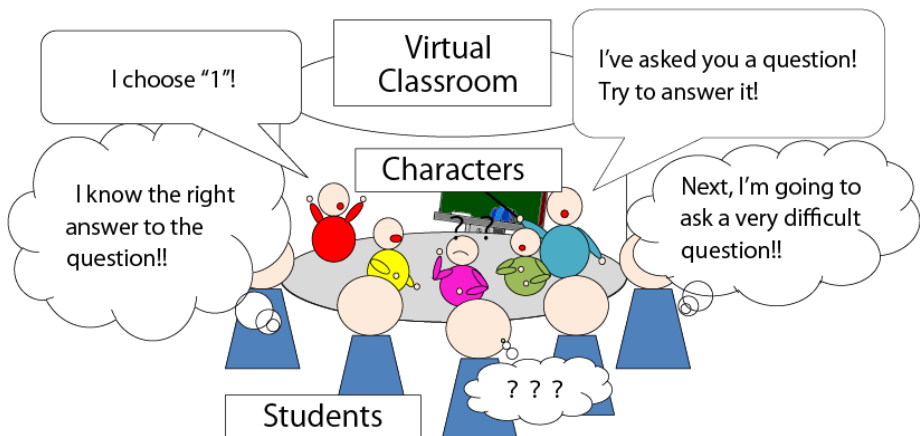


Fig. 1. Concept

2.2 System Configuration

When using GOSAL, all the students sit around a table, each with their own PC and microphone. Students play a character role using InterActor [1], which generates communicative motions and actions based upon the student's speech from the microphone while immersed in the virtual space. The students share real space in the same room at the same time, as well as enjoy face-to-face learning with their teacher and fellow students (Fig. 2). Here, we used five microphones (audio-technica AT810F), five PCs (HP Elite-Book 8730w) equipped with Windows 7, an Ethernet, and an LCD TV (SHARP LC-52RX5) or a 100-inch screen and a projector (EPSON LC-52RX5).

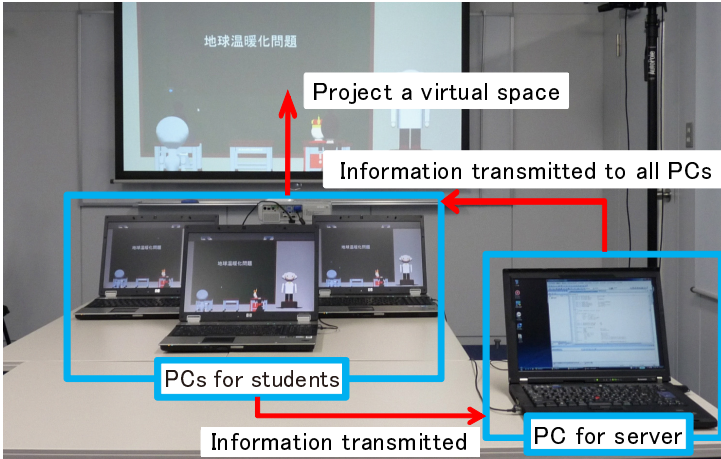


Fig. 2. System configuration

2.3 Virtual Classroom and Characters

We prepared a virtual classroom and eight characters whom students can enjoy in their make-believe play (Fig. 3, Fig. 4). Each student determines the character that he will play. For each character, a distinctive expression was prepared so that the character can be easily identified. For example, when a user chooses the “Samurai” character, the user speaks like “— de gozaru,” and enjoys this mode of communication. In this way, we support each student’s make-believe play by keeping everybody informed of the appearance and expression of the characters. This approach promotes the speaking of all participants since they can feel a sense of unity, based on the communication used by these characters in the virtual space.



Fig. 3. Virtual classroom

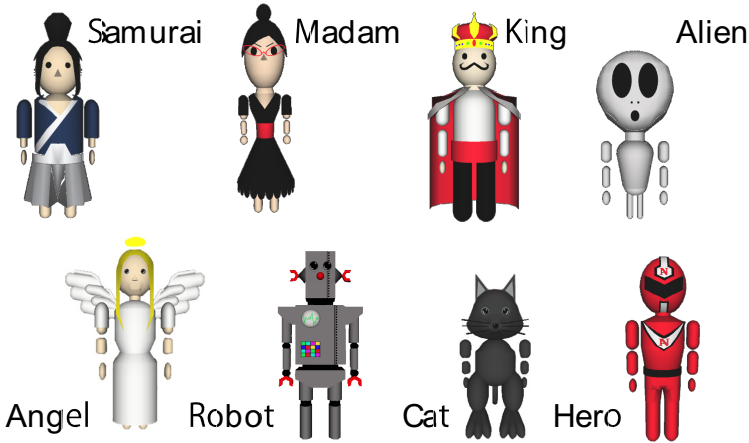


Fig. 4. The eight characters

3 Communication Experiment

3.1 Experimental Setup

In our experiment, considering group learning both with GOSAL (w/ G) and without GOSAL (w/o G), we compared four subjects acting as students and one subject acting as a teacher (Fig. 5, Fig. 6). We made slides showing educational materials that were configured as an explanation section, a discussion section, and a debate section (Fig. 7). We prepared two kinds of content—“Japanese and Western food” and “Chinese and French food”—to make the students to discuss familiar meals in various ways.



Fig. 5. Experiment scenery (w/ G)



Fig. 6. Experiment scenery (w/o G)

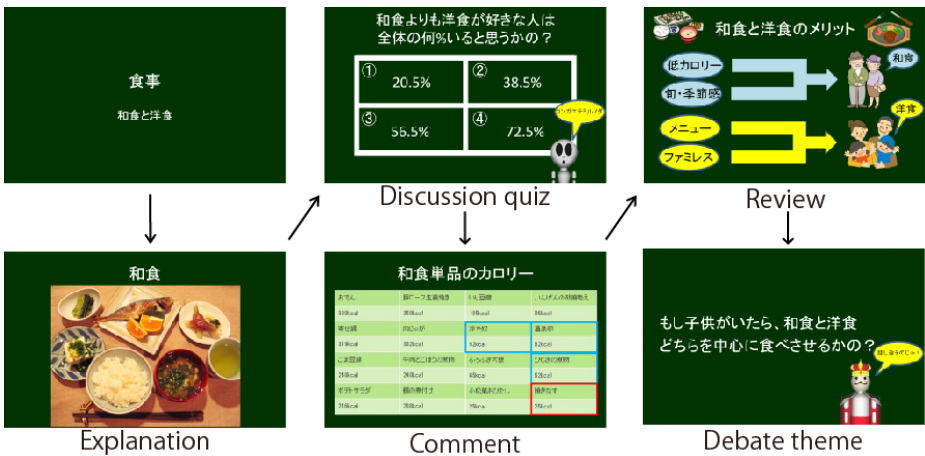


Fig. 7. Examples of contents

The procedure of the experiment is shown in Fig. 8. First, the teacher explained the experiment. Then, we had the users initiate the group learning by introducing themselves, which they did via the characters in the w/ G mode. After these introductions, the teacher gave a lecture to the students using the slides. During the lecture, students discussed their answers to a discussion quiz for 3 min, which they repeated a second time. They also each debated the theme of the debate for 6 min. Finally, the students answered a questionnaire that included a seven-point bipolar rating scale and a free description. These flows constituted one set for one mode, after which we went through the same set of flows in the w/o G mode. In the experiment, we assigned the w/ G and the w/o G modes and the lecture contents randomly. Before beginning the experiment, we explained the system and the educational materials to the teacher, and

prescribed the lectures that would be given in the same way in both modes. The role of the teacher was to give a lecture in the same way using slides, and to ask one of the students to make a comment. All the participants wore a microphone during the experiment, and we recorded their conversation during the group learning process. We used a portable multi-track recorder (TASCAM DR-680) to record the conversation. The experiment was performed by one 23-year-old Japanese student who acted as the teacher, and 8 pairs drawn from 32 Japanese students, 19–23 years old, who acted as students (16 men, 16 women, with each group composed of the same gender).

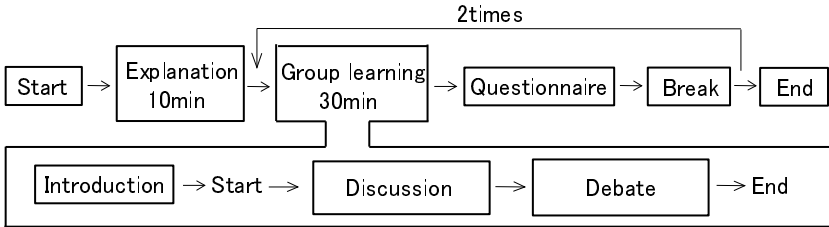


Fig. 8. Procedure of the experiment

3.2 Results

Fig. 9 shows the results of the seven-point bipolar ratings. As shown by the results of a Wilcoxon signed-rank test, there were no significant differences in any of the items. We then divided the results of the seven-point bipolar ratings by gender, and performed a Wilcoxon signed-rank test and a Mann-Whitney U-test. Fig. 10 shows the results. In terms of “easy communication,” there was a significant difference, at a significance level of 1%, and the w/o G mode was rated higher by the men. In addition, in terms of “enjoyment,” “active participation,” “easy communication,” the women rated the system higher than the men in the w/ G mode. At a significance level of 5%, for “active participation,” “lively conversation,” the women rated the system higher than the men in the w/ G mode, at a significance level of 1%.

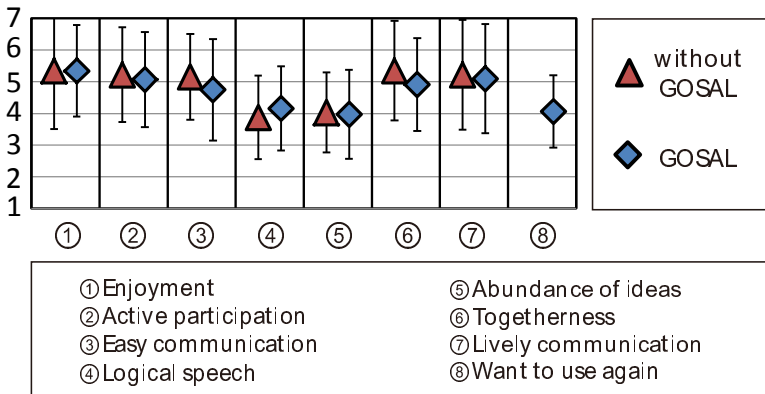


Fig. 9. Seven-point bipolar rating

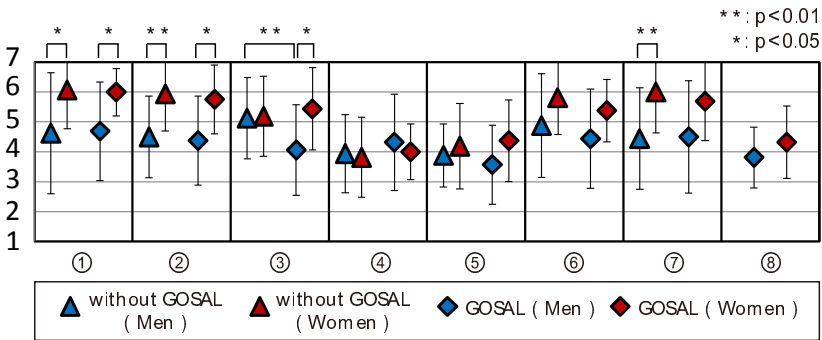


Fig. 10. Seven-point bipolar rating, by gender

Next, we analyzed the voice and speech in the group-learning event that we recorded using ELAN [7]. We divided the voices into utterances and laughter, and analyzed these in terms of time of occurrence and number of times. Fig. 11(a) shows the results. The result of the t-test for the time of utterances and laughter revealed that there was a significant difference at a significance level of 5%. In addition, for the number of times of utterances and laughter, there was a significant difference at a significance level of 1%. To analyze the speech, we investigated the degree of creativity expressed using the S-A creativity test by G. P. Guilford. Using this test, we could categorize the words spoken in the group learning event, and could calculate the scores for creativity in terms of the frequency of the appearance of the words used. First, we noted the words that appeared for the first time in conversation, and the person who had uttered these words. The number of the words was 1,176 of 755 kinds. Next, two experimenters categorized these words and determined a total of 18 categories. Next, we constructed a table to calculate the scores for the words according to the frequency of their occurrence. Using this table, we were able to calculate the scores for fluency, flexibility, originality, and creativity, which was the sum of the first three scores. Fig. 11(b) shows the results. As shown by the results of the t-test, there was no significant difference in the scores for creativity. However, for the original scores, there was a significant difference at a significance level of 1%.

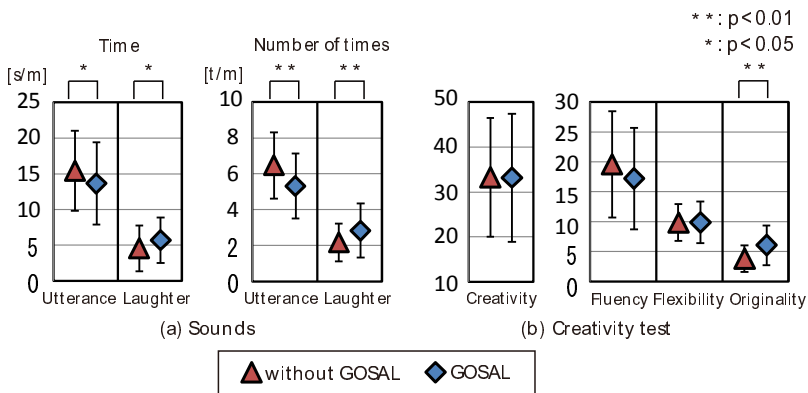


Fig. 11. Results of conversation analysis

In addition, we divided the results of the creativity test by gender. Fig. 12 shows the results. As shown by the results of the t-test, there was a significant difference at a significance level of 5% for time of men’s laughter in the w/o G mode, and at a significance level of 5% for the number of times of men’s utterances. Moreover, in terms of men’s fluency scores, the w/o G mode was rated higher than the w/ G mode at a significance level of 5%. In terms of the fluency scores, in the w/ G mode, the women rated higher than the men, at a significance level of 5%. Furthermore, in terms of men’s and women’s scores for originality, the w/ G mode was rated higher than the w/o G mode, at a significance level of 1%.

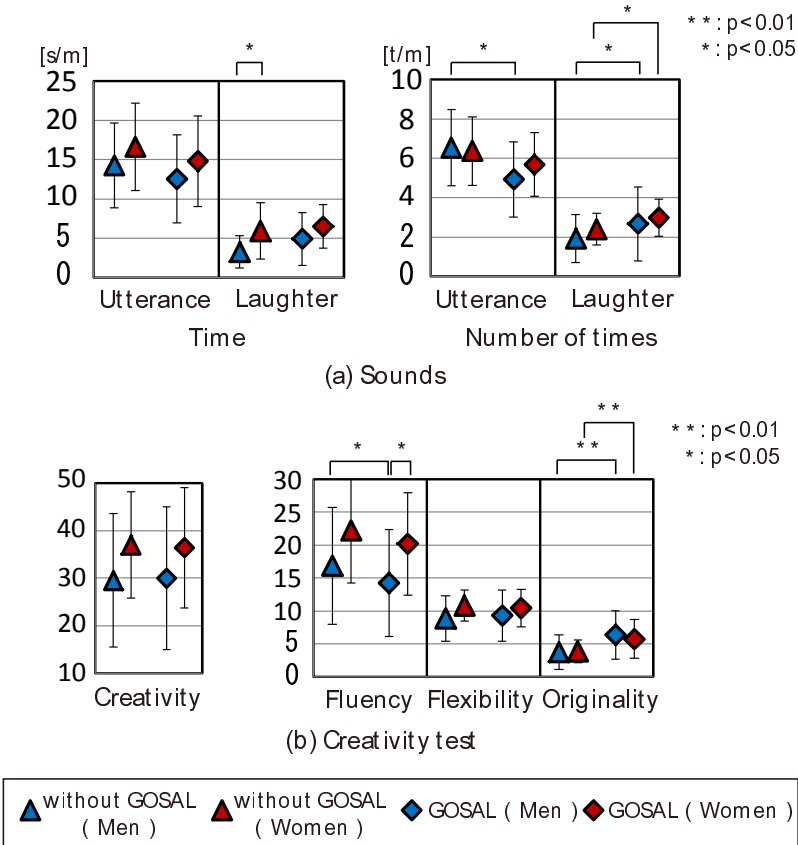


Fig. 12. Results of conversation analysis, by gender

3.3 Discussion

The results of our voice and speech analysis show that GOSAL produces more laughter and creative discussion than ordinary group work. The reason for this is that learners enjoy the group learning process in which they flexibly share ideas utilizing

the different characteristics of the CG characters. For example, one learner said, “You should use the search function of ROBOT,” which showed that this promoted the other learners’ interaction in the quiz mode. This is but one example of how ideas and interactions using GOSAL provoked the learners’ laughter and made their communication more pleasurable.

On the other hand, the learner’s utterances decreased in the w/ G mode. This reflects the decrease in men’s utterances, as their fluency scores were low. This result is also reflected in the seven-point bipolar ratings, in terms of “easy communication” and the other items. These results suggest that the men had a harder time getting used to enjoying role-play talk. On the other hand, there were significant differences in the seven-point bipolar rating in terms of gender, though the women evaluated the w/ G mode and the w/o G mode almost equally. In fact, the women were readily able to get used to role-playing, and gave a high evaluation to the group work. In addition, in terms of laughter time, there were significant differences between men and women in the w/o G mode. In fact, the gender differences displayed in the seven-point bipolar ratings reflect the fact that the women talked and laughed much more than the men. However, the laughter time and the originality scores increased for both men and women. In fact, the results show that the group work in the w/ G mode essentially becomes a more pleasurable and unique experience than it is in the w/o G mode.

4 Summary

In this paper, we first describe the development of GOSAL, which facilitates pleasurable learning for users who share a virtual space in which they engage in make-believe play. Next, we evaluated the effectiveness of GOSAL by means of a communication experiment that used this system. As a result, we demonstrated the effectiveness of GOSAL, which makes group learning a pleasurable and unique experience.

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