Analysis of the Continuous Effects of Assertive Feedback from a Job Interview Training Agent

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Abstract: In this study, we developed an interview training agent system that identifies areas for improvement in interviewees' nonverbal behaviours (eye gaze, facial expression, and posture) and verified its effectiveness in providing feedback using assertive communication in a series of experiments. Assertive communication is a method of conveying one's opinions and sentiments while respecting another person's position and opinions. The effectiveness of the feedback was verified in two conditions: the assertive feedback condition, in which the agent provided feedback while expressing its sentiments, in addition to identifying areas for improvement and offering suggestions for improvement; and the control condition, in which the agent solely identified areas for improvement. The preliminal results showed that assertive feedback was effective in improving the acceptability and usefulness of the feedback and agents' interpersonal impressions. In addition, as a continuous effect of the three interview practices, the agent's interpersonal impression improved as the number of times the participants received assertive feedback increased.

1 INTRODUCTION

Interview training is useful for acquiring skills through exposure to the content and flow of job interviews, and can increase interviewees' confidence. In recent years, social signal processing techniques employing multimodal information have been used for dialog analysis (Vinciarelli,2009; Burgoon, 2017; Okada, 2016) and have been applied to AI-based interview systems (MIDAS [1] ; ZENKIGEN[2]; Naim, 2015; Rao, 2017) and interview training systems (Goda, 2017; Barur, 2013; Smith, 2015; Tanaka, 2015). Some systems visualise the nonverbal behaviour of the interviewee and provide feedback on the interview (Anderson, 2013; Damian, 2015; Hoque, 2013; Langer, 2016), whereas others provide feedback through a virtual agent (Barur, 2013; Callejas, 2014; Gebhard, 2014).

Several studies have shown that practising interviews with a virtual agent as an interviewer is more effective in improving interviewee performance than with human interviewers (Damian, 2015; Lucas, 2014; Lucas, 2017) and reduces interview anxiety (Langer, 2016). However, these studies focused on the effects of using virtual agents, and not on the communication methods agents use during the interviews. Our previous study showed that a virtual agent providing rational feedback with numerical evidence is rated as more reliable but less friendly than non-rationalised feedback (Takeuchi, 2021).

In this study, we focused on assertive communication and implemented it as a communication method for virtual agents. Assertive

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communication is a method of expressing one's opinions and sentiments in a way that the self-esteem and the feelings of others are not affected, and has been used in corporate training (Hotta, 2013; Niiya, 2015; Ilie, 2015). Therefore, we believe that assertive communication is suitable for interview training, in which negative opinions must be conveyed, as it allows advisors to make their points respectfully.

In a series of experiments, we examined the continuous effectiveness of feedback incorporating assertive communication from a virtual agent in terms of the acceptability and usefulness of the feedback and interpersonal impressions of the feedback agent.

2 JOB INTERVIEW TRAINING SYSTEM

Our job interview training system (Takeuchi, 2021a; Takeuchi, 2021b; Takeuchi, 2021c; Koda, 2023) has been developed using Unity, Python, OpenFace[3] and OpenPose[4]. The training procedure consisted of interview, analysis, and feedback phases, as shown in Figure 1. In the interview phase, participants underwent a mock interview by providing a one-minute self-presentation while sitting in front of a 40-inch display. Three webcams were used to capture the front, side, and face of the participants' bodies. During the analysis phase, the videos were analysed using OpenPose and OpenFace, and the analysed data were used to detect inappropriate nonverbal behaviours. Inappropriate nonverbal behaviours were detected by comparing the interviewees' postures and facial expressions with those of a professional interview counsellor. In the feedback phase, the CG agent (Figure 2) appeared on the display and provided feedback on selected inappropriate behaviours while playing and pausing the video. Figure 3 shows an actual image of a participant taking part in the experiment and being given a feedback from the CG agent while watching his video playback.

Detectable nonverbal behaviours include postures (i.e., hunched, leaning back, upright), feet positions (i.e., forward, backward, dangling, vertical), neck (i.e., upward, downward, straight), crossed legs, leg spread (i.e., wider than shoulder width, gradually opening), elbow extension, hands (position, movement), facial expressions (i.e., tight lip corners), and gaze orientations (upward, downward, left/right).

The assertive feedback used in this study was based on the elements of assertive communication (Hotta, 2013) and has the following structure: First, "facts/problems (issues to be corrected)" are communicated, then "sentiments" of the CG agent toward the facts/problems are expressed, and finally "suggestions" on how to improve the issues are given. A concrete example is: "At this moment, you were hunched over (fact/problem). I think it is a pity because it makes you look unconfident, no matter how good your speech is (sentiment). Therefore, you should try to straighten your back with your chin pulled back and put some strength in your lower abdomen. Good posture improves your impression,

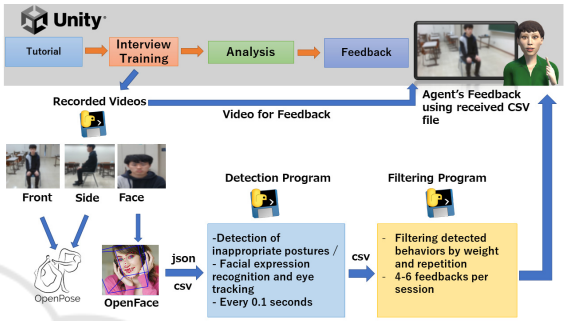

Figure 1: Interview and feedback procedure.

Figure 2: Examples of facial expressions of the CG agent (left: neutral, right: smile).

Figure 3: Experiment scene.

[3] OpenFace, https://github.com/TadasBaltrusaitis/OpenFace (6, January, 2025)

[4] OpenPose, https://github.com/CMU-Perceptual-Computing-Lab/openpose (6, January, 2025)

and makes you look confident and persuasive (suggestion).” In addition, we implemented eye and face directions, facial expressions, and gestures as nonverbal behaviours during agent feedback, as shown in Figure 2.

3 EVALUATION EXPERIMENT

The purpose of the experiment was to verify the effectiveness of assertive feedback in terms of “the usefulness of feedback (acceptability and usefulness)” and “the interpersonal impression of the feedback agent (perceived friendliness and aggressiveness)”. We compared the effectiveness of two conditions: the assertive feedback condition (AF condition), in which the CG agent gave feedback on facts/problems and suggestions while expressing their sentiments, and the control condition (CF condition), in which the agent gave feedback on facts/problems only.

The evaluation experiments were conducted using a within-subject design, in which each participant was interviewed three times for each condition. The participants were given two mock interviews and feedbacks on both conditions (order is randomly assigned) per day. The experiment was conducted three times on separate days. Twenty-three university students (male: 23, female: 3; age range: 21–24 years old) participated in the experiment and completed a questionnaire after each experiment. The questions were on the acceptability of the feedback (i.e., “I felt I could accept the agent's feedback.”), usefulness of the feedback (i.e., “I would like to continue practising interviews with the agent in this system.”), perceived friendliness of the agent (i.e., “I had a favourable impression of the agent.”), and perceived aggressiveness of the agent (i.e., “I perceived criticism from the agent.”).

The following four hypotheses were formulated for this experiment:

H1: Assertive feedback improves feedback usefulness (higher acceptability and usefulness compared to the CF condition).

H2: Assertive feedback improves a feedback agent's interpersonal impression (higher friendliness and lower aggressiveness compared to the CF condition).

H3: Continuous assertive feedback does not decrease its usefulness (maintains a certain level of acceptability and usefulness).

H4: Continuous assertive feedback improves the feedback agent's interpersonal impressions (increased friendliness and decreased aggressiveness).

4 RESULTS AND DISCUSSION

A one-factor analysis of variance was conducted for the questionnaire answers with two levels of agent factors (AF and CF conditions, repeated measures). A two-factor analysis of variance was conducted on the two levels of the agent factor and three levels of the number of experimental factors (#1, #2, and #3).

The usefulness of the feedback was evaluated by comparing the acceptability and usefulness of each condition. In the acceptability evaluation, the AF condition was found to be significantly higher than the CF condition (Figure 4, AF=5.8, CF=4.9, F=43.177, p=0.000). The AF condition was evaluated as significantly higher than the CF condition for usefulness (Figure 5, AF=5.7, CF=4.9, F=43.240, p=0.000). Thus, H1 is supported. This result suggests that assertive feedback improves the usefulness of feedback because feedback in the AF condition was more specific than in the CF condition, conveying specific points for improvement along with sentiments.

In both the AF and CF conditions, there were no significant differences in the acceptability ratings based on the number of experimental factors. Therefore, H3 is supported; although the usefulness ratings in the AF condition were higher than those in the CF condition, we believe that receiving feedback had a continuous effect on usefulness ratings in both conditions.

Next, we compared the interpersonal impression ratings of the friendliness and aggressiveness of the agent between the two conditions. The results showed that the AF condition was rated significantly higher than the CF condition in terms of friendliness (Figure 6, AF=5.5, CF=4.5, F=122.550, p=0.000). The CF condition was rated significantly higher for aggressiveness than the AF condition (Figure 7, AF=1.5, CF=1.8, F=17.436, p=0.000). Thus, H2 is supported. The reason the AF condition was rated significantly higher than the CF condition on friendliness and the AF condition was rated significantly lower than the CF condition on aggressiveness was thought to be due to the presence of sentiments. These results suggest that assertive feedback effectively improves the agents' interpersonal impressions of friendliness and aggressiveness.

Regarding friendliness, the second and third experiments were rated significantly higher than the first in terms of the number of experimental factors (#1=4.8, #2=5.1, #3=5.0, F=9.205, p=0.000, p=0.004). Furthermore, an interaction between the agent factor and the number of experimental factors

was observed, indicating that the agent's friendliness in the second and third experiments was rated significantly higher than that in the first experiment in the AF condition. However, the friendliness ratings in the CF condition did not change during the three experiments (Figure 8, F=7.907, p=0.000, p=0.000). Aggressiveness ratings did not differ significantly with the number of experiments. Thus, H4 is partially supported in terms of friendliness. This indicates that the continued effect of assertive feedback is likely to manifest as an improvement in an agent's friendliness.

Although the preliminal results suggest positive effects on the assertive feedback, this study is limited in that it compared the condition in which the agent solely identified areas for improvement with the assertive condition. It is necessary to dissect the elements of assertive communication (facts/problems, suggestions, sentiments) to identify their individual contributions on the evaluation of usefulness and interpersonal impressions. Specifically, four conditions should be prepared: one in which only facts/problems are fed back, one in which facts/problems and suggestions are fed back, one in which facts/problems and sentiments are fed back, and one in which facts/problems, suggestions, and sentiments are fed back.

In addition to the subjective evaluations conducted in this study, an objective evaluation of assertive feedback by comparing the number of detected nonverbal behaviours for improvement over time is necessary. Furthermore, based on the comments from the participants in the experiment (i.e., "It's okay to start with the AF condition, but I'd prefer to move on to the CF condition as I practice interviews" and "I want to use the CF condition during the period of repeated practice and the AF condition when there is a sense of urgency, such as right before a real job interview"), we need to develop a job interview training agent that changes the feedback method according to the context of job search activities.

In terms of applying our interview training system for practical use, we shoud modify the critaria for detecting the inappropriate behaviors. The detection of the inappropriate posture, eye gaze, and facial expressions in our interview practice system was based on the criteria for judgment during interviews with newly graduated students in Japan. In Japan, there are strict standards for non-verbal behaviours during interviews, particularly with regard to posture: the upper body should be upright and the hands should be on the knees. However, in other countries, a more relaxed posture is considered acceptable. Therefore, if this system is to be applied outside of Japan, the criteria should be modified to match the standards of that country.

It is also necessary to compare usefulness and interpersonal impressions when the same assertive feedback is given by a human interviewer and a CG agent, as the impression between the human and the agent giving the feedback may change. We would like to further verify the effectiveness of the feedback by changing the gender and appearance of the agent and by comparing the effectiveness of assertive feedback across cultures.

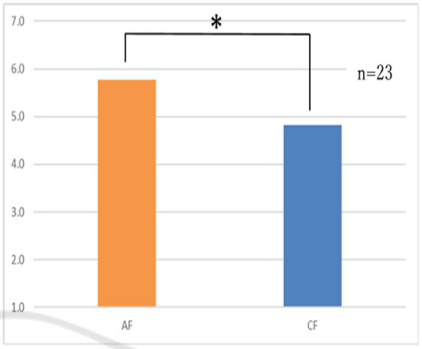

Figure 4: Acceptability of the feedback.

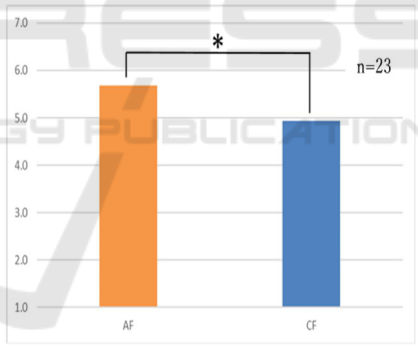

Figure 5: Usefulness of the feedback.

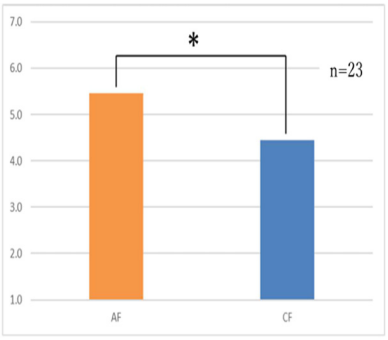

Figure 6: Friendliness of the agent.

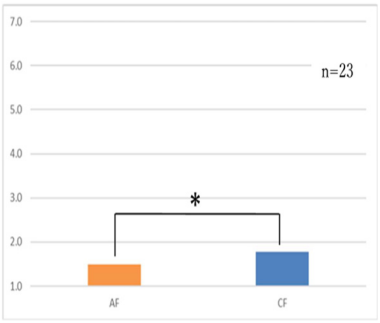

Figure 7: Aggressiveness of the agent.

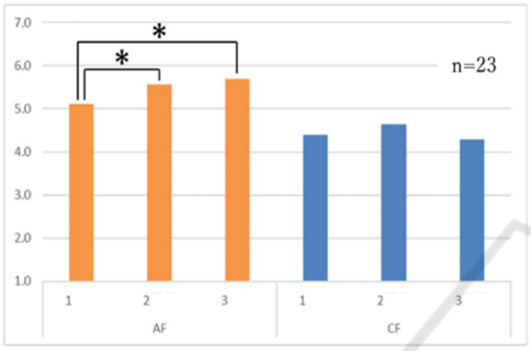

Figure 8: Friendliness of the agent compared by the number of experiments.

5 CONCLUSIONS

In this study, we evaluated the continuous effects of assertive feedback in terms of its usefulness and the interpersonal impression of the feedback agent in a series of interview training experiments. The results showed that assertive feedback was evaluated higher in terms of usefulness and interpersonal impression than the condition in which the agent simply suggested points to be improved, and that the evaluation did not decrease over time; that is, the effect of assertive feedback was sustained. The results also suggest that assertive feedback continuously improves the agents' perceived friendliness.

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