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DOI
10.1007/978-3-319-67401-8_14

Publication date
2017

Document Version
Final published version

Published in
Intelligent Virtual Agents

Citation (APA)
Ding, D., Burger, F., Brinkman, W.-P., & Neerincx, M. A. (2017). Virtual Reality Negotiation Training System with Virtual Cognitions. In J. Beskow, C. Peters, G. Castellano, C. O'Sullivan, I. Leite, & S. Kopp (Eds.), *Intelligent Virtual Agents: 17th International Conference, IVA 2017, Proceedings* (pp. 119-128). (Lecture Notes in Computer Science; Vol. 10498 LNAI). Springer. https://doi.org/10.1007/978-3-319-67401-8_14

Virtual reality negotiation training system with virtual cognitions

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Abstract. A number of negotiation training systems have been developed to improve people's performance in negotiation. They mainly focus on the skills development, and less on negotiation understanding and improving self-efficacy. We propose a virtual reality negotiation training system that exposes users to virtual cognitions during negotiation with virtual characters with the aim of improving people's negotiation knowledge and self-efficacy. The virtual cognitions, delivered as a personalized voice-over, provide users with a stream of thoughts that reflects on the negotiation and people's performance. To study the effectiveness of the system, a pilot study with eight participants was conducted. The results suggest that the system significantly enhanced people's knowledge about negotiation and increased their self-efficacy.

Keywords: Virtual reality, Negotiation training system, Virtual cognitions

1 Introduction

Negotiations are very commonplace in many kinds of interpersonal relationships and being able to negotiate successfully is hence a crucial social skill. Despite this, people may choose to avoid negotiations because of a lack of skills or motivation. While many self-help books have been published on the topic, electronic solutions, so-called negotiation skills training systems, are becoming a viable alternative due to their accessibility and low cost. Existing training systems seem, however, to focus exclusively on skill development. Learners are typically taught what to do or how to behave in a negotiation situation in a learning-by-doing manner. Although feedback is provided, to the best of our knowledge, no system exists that informs learners about the reasons as to why they should behave in a certain prescribed way. The latter would be beneficial for learners as thoughtful and timely guidance is vital for the effectiveness of the learning experience [8]. Besides understanding, little attention has also been paid to people's self-efficacy, which affects their motivation to engage in negotiation. People's beliefs about their capabilities, e.g. their self-efficacy, determine how they feel, think, behave, and motivate themselves to participate in social interactions [4].

To enhance people's knowledge and self-efficacy, we put forward a virtual reality training system that allows people to passively experience a one-on-one

J. Beskow et al. (Eds.): IVA 2017, LNAI 10498, pp. 119-128, 2017.
DOI 10.1007/978-3-319-67401-8_14

negotiation while being exposed to a stream of thoughts of one of the virtual negotiators. These simulated thoughts, i.e. virtual cognitions, are a set of pre-recorded voice-overs that provide understandable guided learning and motivating statements. Users perceive the negotiation from a first-person perspective, hearing themselves talk and think during the negotiation.

2 Related work

Compared to human-human training or traditional therapy, using a computer-based system for negotiation training is more cost-effective and controllable. There are many examples of negotiation training systems that have the potential to address the limitations of traditional negotiation training (see [13] for a game-based example and [22] for an agent-based example).

These systems aim at skill development by giving users hands-on negotiation experience. In this paper, however, we examine a training phase prior to this, focusing on building negotiation understanding and self-efficacy by using virtual cognitions.

2.1 Self-efficacy

Self-efficacy is one's perceived capability to execute a certain task or reach goals [6]. Multiple sources influence self-efficacy. The primary source is *enactive mastery experience*. If individuals have completed a task in the past, they are more confident in their ability to do it again in the future. Instead of obtaining such mastery experiences in the real world, individuals can also gain experiences by actively performing specific tasks in virtual environments [7,1]. These experiences in virtual environments can affect people's self-efficacy belief in the same way that experiences in the real world do [29].

The second source of influence is a *vicarious experience* provided by social models. Observing people similar to oneself succeed raises observers' beliefs that they can master comparable activities. This effect has also been shown to hold when observing virtual agents perform in a virtual environment [12]. Also, enactive mastery and vicarious experience can be mixed in virtual reality by experiencing a virtual doppelganger from a first-person perspective [16].

Verbal persuasion in the form of encouragement and discouragement about individual's performance or capability to perform [21] is another powerful source to develop self-efficacy. Similar to the real world, when individuals receive encouragement in a virtual environment by listening to a virtual coach or hearing a conversation between virtual avatars, people's beliefs can change [20].

Wood, et al. [28] point out that positive self-statements can backfire if they do not match the person's current belief or need. This can be explained by social judgment theory [23] as it provides a framework for the design of strong persuasive messages. Based on a person's beliefs, messages are classified into latitudes of acceptance, non-commitment, and rejection. Messages that target the latitude of non-commitment can establish the largest belief change, as messages falling into

the latitude of acceptance are already close to people's beliefs, and messages falling into the latitude of rejection are likely to be rejected or even strength current beliefs. Therefore, to establish persuasive messages, a system needs to take into account a person's current self-efficacy level and the categorization of potential persuasive messages.

2.2 Stream of consciousness

Psychologist William James [14] coined the term stream of consciousness in 1890, to describe that thoughts can be regarded as a continuous stream and "part of a personal consciousness" (p. 225). In literature, the stream of consciousness is a narrative technique that reproduces people's internal psychological world, presenting mental observations and commentary (e.g. [15]).

Human behavior, attitudes, and cognitions are extensively influenced by people's conscious thoughts. Much research work asserts that inner voice, also known as internal monologue, plays various important roles in cognitive function, such as self-regulation [27], self-reflection [19] and, importantly, learning [25]. Helping learners to use inner voice during learning can contribute to reducing anxiety and increasing both confidence and communicative competence [26].

Based on these considerations, we propose the use of virtual cognitions to work as a kind of inner voice or personalized voice-over to present conscious thought to the user during the negotiation training.

3 System

Table 1 is an excerpt from the scripts of our negotiation dialogs and virtual cognitions that users heard when they were immersed in our VR negotiation training system. The conversations were set between the user, in the role of an employer (ER), and a virtual employee (EE), sitting across from the user. Users heard the external dialog as shown in Lines 1-3. Lines 4-6 show the virtual cognitions that users heard as part of an internal monologue. They introduce the relevant negotiation knowledge, describe the current situation, and reflect what users heard and what they should do and why. Line 5 illustrates a self-motivating statement, which users also heard during the training as one key factor of virtual cognitions. Although users played the role of the employer negotiating with an employee, they did not actively contribute to the negotiation. Instead, they heard pre-recorded audio while seeing a virtual self. For this, they wore a head mounted display. Their body movement was captured to synchronize it with their virtual body which they could see in a virtual mirror to enhance the body ownership illusion and sense of agency over the virtual body [2,24].

The system delivered three training sessions, each addressing different negotiation topics and each set in a specific workplace scenario: (1) stages in negotiations (scenario: continuously being late for work); (2) best alternative to a negotiated agreement (scenario: requesting an immediate holiday); and (3) separate the people from the issue (scenario: quitting one's job). During the training,

Table 1. Excerpt from negotiation scripts between employer (ER) Leon (the user's perspective) and virtual employee (EE) Tom.

1. EE: (Talking) Next week is the last week that it is still warm in Spain. After that it will be too cold to enjoy the beach this year. My wife likes the beach very much, and she has already been asking me to take her to a beach for over a year. Next week is the last chance for us to go.
2. ER: (Talking) Ok, I see. So you want to have a holiday immediately next week mainly because you worry that you can't take your wife to the beach later?
3. EE: (Talking) Yes, you can say that.
4. ER: (Thinking-reflection) I gathered a large amount of information about Tom's plan for a holiday and finally figured out the underlying and real reason why Tom wanted to take a vacation immediately. It was not just what he said at the very beginning about being very tried, but instead he wants to take his wife to the beach otherwise the weather could turn cold.
5. ER: (Thinking-self motivation) Leon, the negotiation is going quite well, you are doing a great job in the joint exploration stage.
6. ER: (Thinking-knowledge) Now, the negotiation will come to the next stage: bidding. The teacher emphasized that BATNA should always be kept in mind. I should share more information about my interests with Tom and develop multiple options for him to choose from.
7. ER: (Talking) Fine. I understand. How about you finish your project first, then I arrange for you to go to Egypt for a new project. You can take your wife with you, so during the weekends you can relax and enjoy the sunshine and the beach all the time.
8. EE: (Talking) Um, it sounds great, but I don't have enough money to take my wife to Egypt.

Table 2. Three types of virtual cognitions we used in the system.

Type	Function	Example
Knowledge and principles	Introduce the targeted knowledge and principles	"A successful negotiation usually consists of four major stages: private preparation, joint exploration, bidding, and closing."
Reflection	Describe the current situation, analyze the thoughts, feelings, and behaviors of the other parties and explain what to do and why the user should behave in the proposed manner	"Until now, Mike seems getting into a better mood. I should continue making him feel relaxed and let him know he can talk about everything he wants with me."
Self-motivation	Persuade people of their capability to perform social behaviors and encourage themselves to engage in social interactions	"Yes, great! The negotiation went well. Mike was totally calmed down. I did a great job. [User's name], you are quite good at negotiating."

session users were exposed to three types of virtual cognitions (Table 2) as taken from the idea of social stories theory [18]: knowledge and principles, reflection, and self-motivation.

The knowledge and principles introduced in previous training sessions were reviewed to strengthen users' understanding and recollection. The reflective virtual cognitions in the first training session only focused on observations of the situation at hand. In the second and third sessions, these reflections also included thoughts about the previous negotiation. A similar strategy was followed for the self-motivation cognitions, evaluating the user's performance in current or previous negotiation, stressing feelings of mastery of experience. To target users' latitude of non-commitment towards a higher level of self-efficacy, users' self-efficacy level was measured before each training session, and matching self-reflective cognitions were selected from a validated ranked list of cognitions [10]. These self-motivation cognitions were written in the third-person perspective, which has been shown to be more effective in regulating people's thoughts, feelings and behavior compared to first-person language use [17].

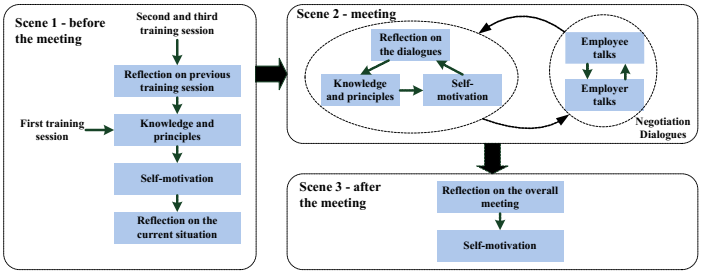

Fig. 1. The flow of virtual cognitions and dialogues in a training session.

Each training session consisted of three scenes (Fig. 1). The first scene was set before the meeting. Here users heard virtual cognitions reflecting on a fictional negotiation course or previous negotiations. These experiences were linked to self-motivation cognitions. The scene ends with reflections on the upcoming negotiation meeting, applying the negotiation knowledge and principle to the situation at hand. In the second scene, users started to experience the virtual negotiation in action, facing a virtual employee, which was gender-matched to the user. When the employee talked, users saw the mouth movement of the employee. When users heard their own external voice, they saw the movement of their virtual mouths in the virtual mirror. When they heard the virtual cognitions, their virtual mouth did not move. To create a natural pause in the dialog, the employee drank from his or her mug when users were hearing an internal monologue. In the closing scene, the users were again alone in the virtual meeting room. Here they heard virtual cognitions that reviewed the process of the past negotiation, their performance and also motivated them affirmatively.

4 Method

To obtain a first evaluation of the system, we conducted a pilot study. To this end, we followed a pretest-posttest design with all participants completing the training and consequently no comparison group. The study was approved by Delft University of Technology Human Research Ethics Committee (ID: 60).

4.1 Participants

Eight participants (1 female) were recruited via e-mail or approached personally throughout the university campus. Their ages ranged from 22 to 29 ($M = 25.5$, $SD = 2$). Participants received a small gift in appreciation of their efforts.

4.2 Materials and Measures

Materials. The system captured the body movements of users with a Kinect, which returned real world distance in meters. For the HMD, an Oculus Rift DevKit 2 with a resolution of 1920*1080 pixels was used, while the virtual environment was created in Unity3D. To strengthen similarity and therefore the effect of this vicarious experience, we gave the virtual employer character the voice of the participants. We recorded all external dialogs and the virtual cognitions, resembling participant's inner voice, by asking participants to read the sentences of the negotiation out loud prior to the training. This was done with a pair of binaural microphones (Roland CS-10EM) worn by the participant.

Self-efficacy. Following Bandura's approach [5], a one-item self-efficacy assessment was conducted. The question was formulated as: "Supposing that now you, as an employer, need to negotiate with your employee about a topic at the workplace, please rate how certain you are that you can successfully negotiate with him/her." The item was rated on an 11-point Likert scale from -5 (highly certain cannot do) to 5 (highly certain can do).

Negotiation knowledge. A validated negotiation knowledge video test [9] was used. This consists of eight negotiation scenarios (female version and male version) each including six video scenes portraying negotiation situations. After each scene, participants are asked: "What is your advice for the employer?". Written answers are scored on the participant's ability to identify key negotiation concepts. The video test has been validated in a study with 128 participants. Mean and standard deviation for each negotiation scenario were hence available to standardize test scores.

Perceived Utility. To investigate how satisfying and useful people found the training, a 7-item utility questionnaire was used, which included three items on the satisfaction of the training process and four items on the effectiveness in improving negotiation performance. This questionnaire was adapted from the one used in a study by Kang [16]. All the items were rated on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree).

4.3 Procedure

On their first visit, participants were informed of the nature of the experiment and signed their consent to participate. The pilot study consisted of three phases: pre-training, training, and post-training. In the first phase, recordings were made of each participant reading out all sentences of the three negotiation training sessions (dialogs and virtual cognitions). The order of sentences was randomized to limit participant understanding and memorization of actual scenarios. After the recording, participants were asked to listen to a part of their recordings and set sound parameters with the instructions to make their recordings sound as they hear their own external voice or as their inner-voice. Participants were also asked to record their names, which were later incorporated into the negotiation dialogs and self-motivation cognitions. After at least one week, we invited participants to complete an online questionnaire collecting demographic information and the pretest measures (self-efficacy question, negotiation knowledge test).

Once the questionnaire was completed, participants started with the training phase. In this phase, they were invited into the lab to receive the negotiation training consisting of three consecutive sessions; each administrated on a separate day. Each training session lasted around 30 minutes, which started with five minutes of immersion into the virtual room, allowing participants to familiarize themselves with the virtual world and their virtual body before the actual scenario started. After each session, participants were asked to finish an online questionnaire to measure their self-efficacy and negotiation confidence. The latter was used to select the self-motivation cognitions in the next training session. Two weeks after entering the second phase, all participants were sent a link for the posttest measurement.

5 Result

5.1 Self-efficacy

Taking participants as a random intercept effect, two multilevel models were fitted to the self-efficacy data: a fixed intercept effect model (baseline model) and extended model that included the moment of data collection as a fixed effect. The analysis revealed a significant model fit improvement for the extended model ($\chi^2(1) = 9.65$, $p = 0.002$), suggesting that, as shown in Fig. 2, over time, self-efficacy increased.

5.2 Negotiation knowledge

Two coders scored the answers obtained from the negotiation knowledge test. With acceptable correlation ($r = 0.95$) between scores of the coders, the average score was taken, which was normalized using the scenario mean, and standard deviation available for each negotiation scenario [9]. A paired-sample t-test, revealed that participants had a significantly higher ($t(7) = 3.19$, $p = 0.015$, $d = 1.13$) negotiation knowledge score after the negotiation training ($M = 1.5$, $SD = 0.94$) than before the training ($M = 0.1$, $SD = 0.90$).

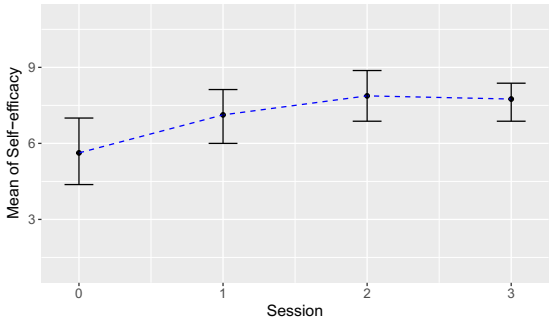

Fig. 2. Mean (error bar 95% CI) self-efficacy score obtained before the training (0) and in the different sessions (1-3).

5.3 Perceived Utility

Cronbach's alpha was calculated for the two subscales of the utility questionnaire, satisfaction of the system ($\alpha = 0.57$) and usefulness of the system ($\alpha = 0.74$), respectively. The mean value of the items within each questionnaire was taken as a single measure of that concept. To investigate if users hold a positive attitude about our training system, one-sample t-tests were conducted comparing scores with a value 4, the neutral position on the scale. Tests did not find significant deviations from the neutral rating, for either the satisfaction-related utility ($M = 4.17$, $SD = 0.99$) or the effectiveness-related utility ($M = 4.66$, $SD = 1.04$).

6 Discussion

We developed a virtual reality negotiation training system that exposes users to an unfolding negotiation, thereby witnessing both the dialog and the thought process of a negotiator. The main findings of the pilot study suggest that the training system can enhance people's negotiation knowledge and their self-efficacy, two key factors influencing a successful negotiation. The results of our pilot study thus encourage further confirmation studies with a control group to control for confounding variables or comparison with groups using other training systems or instruction delivery methods. Although the passive nature of our training might cause less anxiety to enroll, it might also make the experience less engaging and enjoyable, as the perceived utility data of the pilot study indicates. Interesting would, therefore, be to examine the effect of combining this training with existing unguided negotiation training systems where people actively negotiate with a virtual opponent.

Several design choices limit the scope of the results and should be noted to appreciate the findings. First, the format and articulation of the inner voice are very personal, as it has been found to resemble people's voice and regional accent [11]. This might have affected the pilot study as it included non-native English participants, whose everyday inner monologue might not be in English as the

virtual cognitions were in the study. Similarly, the sense of agency in the virtual environment might be improved by administering vibrotactile stimulation on the thyroid cartilage when the participants hear the pre-recorded stimulus voice [3]. In our current system, users only passively experience the negotiation. Using eye-tracking in virtual reality offers the possibility to tailor virtual cognitions to people's focus of attention in the virtual environment. It could thus provide more timely guided-learning and more thoughtful motivation. Finally, we received some negative feedback on the audio quality from the participants. The audio of the employee avatar was recorded at close range. This did not match with the spatial distance that participants had to the avatar in the virtual environment.

In conclusion, a system that provides guided learning with the combination of virtual self-experience and virtual cognitions can potentially affect people's knowledge of negotiation and self-efficacy. Further research might investigate the extent to which the system has the potential to change individual's beliefs and behavior in the long run.

Acknowledgements

This research was supported by the China Scholarship Council (CSC), grant number 201506090167. We thank colleagues from Interactive Intelligence Group, TU Delft who carefully prepared the stimuli voice for the virtual employee.

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