
The Effect of Affective Iconic Realism on Anonymous Interactants' Self-Disclosure

Sin-Hwa Kang

Institute for Creative Technologies
University of Southern California
13274 Fiji Way
Marina del Rey, CA 90405
kang@ict.usc.edu

Jonathan Gratch

Institute for Creative Technologies
University of Southern California
13274 Fiji Way
Marina del Rey, CA 90405
gratch@ict.usc.edu

James H. Watt

Social and Behavioral Research Lab
Rensselaer Polytechnic Institute
110 8th street
Troy, NY 12180
wattj@rpi.edu

Abstract

In this paper, we describe progress in research designed to explore the effect of the combination of avatars' visual fidelity and users' anticipated future interaction on self-disclosure in emotionally engaged and synchronous communication. We particularly aim at exploring ways to allow users' self-disclosure while securing their anonymity, even with minimal cues of a virtual human, when users anticipate future interaction. The research investigates users' self-disclosure through measuring their behaviors and feelings of social presence in several dimensions. Design and implementation of the stimulus materials and equipments are complete and data collection has begun.

Keywords

avatar realism, anonymity, affective behavior, social presence, rapport, self-disclosure, anticipated future interaction, virtual humans, embodied virtual agents, contingency, nonverbal feedback, evaluation

ACM Classification Keywords

I.2.11 Artificial Intelligence: Distributed Artificial Intelligence---Intelligent agents; J.4 Computer Applications: Social and Behavioral Sciences---Psychology.

Introduction

It has been found that self-disclosure is crucial in shaping social bonds and is a pre-requisite for verbal psychotherapy [1,3]. Previous studies indicate that people are more engaged in mediated environments when their interaction partners are represented by visuals, as visuals increase the sense of colocation of communicators and allow people to get more immersed in the situation [12]. Recent studies have shown that virtual humans can facilitate social interactions among people who have difficulty in forming social bonds or help develop their social skills by interaction with virtual practice [7]. In mediated communications, the use of virtual humans is suggested to secure this purpose; further, the nonverbal behavior of virtual humans is considered a crucial factor in complementing the verbal conversation [4,5]. Therefore, it is suggested to examine what combination of interactional fidelity of virtual humans would contribute to the most effective communication on revealing users' personal information while shaping social presence in their anonymous interactions.

Virtual Humans in Mediated Interactions

Earlier studies [1,4,5,8,9,12,13] have shown that the use of avatars (controlled by a real human) augments social presence among users in some mediated interactions. Bailenson and his colleagues [1] describe avatars as "digital models of people that either look or behave like the people they represent." This includes a videoconference image (raw video) which is described as the most effectual way to create high realism in a mediated interaction. Avatar realism is defined as presentation of either visual appearance or behavioral attributes of a human [8,9,12,13].

Other work has confirmed that the role of the proper timing of feedback, the contingency of feedback, of an agent (controlled by a computer) is critical to shape emotional bonding such as rapport. Recent research suggests that virtual humans can create something similar to rapport with people by producing rapid nonverbal feedback that is obtained by (i.e., contingent on) behaviors (e.g., head nods and postural mirroring) generated by a human interaction partner [4,5].

Anonymity, Anticipated Future Interaction (AFI), and Self-Disclosure

It has been reported that anonymity has a critical role in shaping social ties via feeling social presence [1,8,9], as securing anonymity entails greater self-disclosure [1,2]. Shaffer and Ogden [14] propose that users' AFI is also crucial in determining the amount of personal information that users reveal. Walther [16] further states visual anonymity provides users with a way to create a positive impression of their interaction partners, and elicits greater affection with their communication partners even with minimal cues under no time limitation if they are informed of future interactions with their interaction partners.

In this study, we examine the impact of different visual realism of avatars on users' self-disclosure for establishing social ties, when their anonymity is secured and future interaction may be anticipated.

Research Problem and Hypotheses

Based on literature review, behaviorally correct anonymous (animated drawing or degraded video) avatars should exchange a greater emotion with users when they have AFI than in a face-to-face condition, although they convey fewer cues compared to non-

anonymous (raw video) avatars. No studies of virtual humans have investigated the impact of the combination of avatars' visual realism and users' AFI on their social responses, specifically self-disclosure, in terms of facial expressions. This lack of research is likely due to the technical limitations of employing behaviors of virtual humans.

Previous studies showed that users revealed more of their "self" when they interacted with the others via "text-only" than via face-to-face [6] or via "voice-only" than via a videoconference [1] perhaps because "text-only" and "voice-only" secure interactants' anonymity. These findings lead to the hypothesis:

H1: People will be more likely to reveal intimate information about themselves when they interact with partners represented by anonymous avatars.

Shaffer and Ogden [14] assert that interactants' AFI entails more self-disclosure. Walther [16] also argues that peoples' AFI enhances more self-disclosure in initial computer-mediated communication (CMC) interactions than in initial face-to-face interactions and it also affects the level of intimacy. This outcome leads to the hypothesis:

H2: People will be more likely to reveal intimate information about themselves when they are informed of the possibility of future interactions.

The "hyperpersonal communication" perspective [16] supports the idea that people feel more affection and emotion with their interactants when they have fewer cues, while predicting that people's AFI enhances more

self-disclosure in initial CMC interactions. This argument leads to the hypothesis:

H3: People will be more likely to reveal intimate information about themselves when they interact with partners via media with "fewer cues" if they anticipate future interactions with partners.

Experimental Design and Preliminary Work

The basic experimental design is a 3 (visual realism) x 2 (AFI versus No AFI) factorial between-subjects experiment involving two factors: i) three levels of visual realism of avatars – a raw video, a degraded video, and an animated drawing (Rapport Agent); ii) two conditions of future interaction – anticipation of future interaction and no anticipation of future interaction. In the AFI conditions, subjects will be informed that they would have a second interaction session with their partner after a first session. In the no AFI conditions, subjects will not be informed of another session and will not expect to interact further with their partner. The rationales for the choices of the visual appearance conditions are outlined below. Each experimental condition is presented to same gender combinations of dyadic partners: male-male and female-female. The dependent measures are composed of two measurements: i) dimensions of behavioral measures, such as the length of the responses and the number of discrete disclosures [10,15]; ii) dimensions of social presence [8], such as social attraction, emotional credibility, and social richness of medium using validated Likert-type scales. In the analysis portion of this study, gender combinations of interactants will be considered a measured control variable.

About one hundred and eight participants will participate in the experiment. Each participant is paired with someone whom they have never met beforehand. The paired participants are randomly assigned to one of six experimental conditions in the 3 x 2 design. The interaction takes place in two separate rooms where the paired participants are placed at different times, to avoid any initial face-to-face contact. Participants are given a hypothetical conversational scenario where each assumes the role of a person (interviewee) who seeks to find out if the other person is a suitable match with whom an apartment can be shared, and who might possibly become a friend. The other person is a confederate (interviewer) who asks ten questions requiring self-disclosure of the participant [10,15]. We propose that this communication situation and the questions motivate emotional interaction where people need to disclose personal information about themselves to get to know each other. Anonymity and AFI in this kind of self-revealing interaction is important. The typical conversation is allowed to last about thirty minutes, but subjects are not informed of any specific time limitation.

Avatar Design

Avatars include a unmodified videoconference image [1,8,9] and its alterations with special video effects in the types of avatars. In terms of visual realism, three types of iconic images (raw videos: non-anonymous & highest-iconic images; degraded videos: anonymous & high-iconic images; and animated drawings: anonymous & low iconic images) are provided to represent visual identity.

For the degraded videos, we utilize the findings of Zhao and Stasko [8,9]. They examined four types of video-

filtering techniques to express participants' identity masking and reported an edge-detected image (see the image (b) in Figure 1) provided lower actor identification than a pixelized one frequently used for identity hiding. This technique was used to provide anonymity in previous studies [8,9]. To generate the avatar movement of this degraded video, a web-cam (Logitech QuickCam Orbit MP) captures participants' facial expressions and visual effect software (WebcamMax) degrades video using an edge-detector filter. To allow video chat conversation, video conference software (Skype) is used. A hands-free headset connected to the computer is provided to participants for the audio communication.

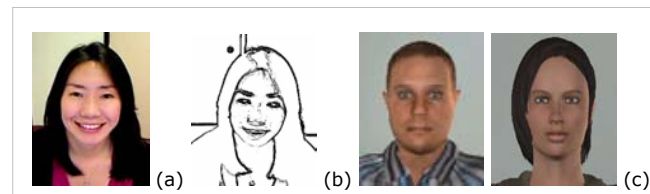


Figure 1. (a) a raw video; (b) a degraded (edge-detector filtered) video; (c) animated drawings (Rapport Agents: male & female)

For the animated avatars, we utilize the Rapport Agent, created by Gratch and his colleagues [4,5], whose system architecture is described in the next section (see the images (c) in Figure 1), as it has been found that the contingent feedback of an agent elicits greater social bond of interactants in human-computer interaction between a real human and an agent than in real humans' face-to-face situation [4,5,7]. The participants will be informed that the Rapport Agent is an avatar controlled by another participant [4,5,7].

Rapport Agent Design

To generate listening behaviors of an interviewer (confederate) used in the animated avatar condition, the Rapport Agent first collects and analyzes the attributes from the interviewee (subject)'s voice and upper-body movements (see Figure 2). Two Videre Design Small Vision System stereo cameras are placed in front of the interviewee. The interviewee's head orientation and position are tracked by the Watson image-based tracking library using a stereo camera [11]. Watson also incorporates learned motion classifiers that detect head nods and shakes from a vector of head velocities. Acoustic features are derived from properties of the pitch and intensity of the speech signal using a signal processing package, LAUN [4].

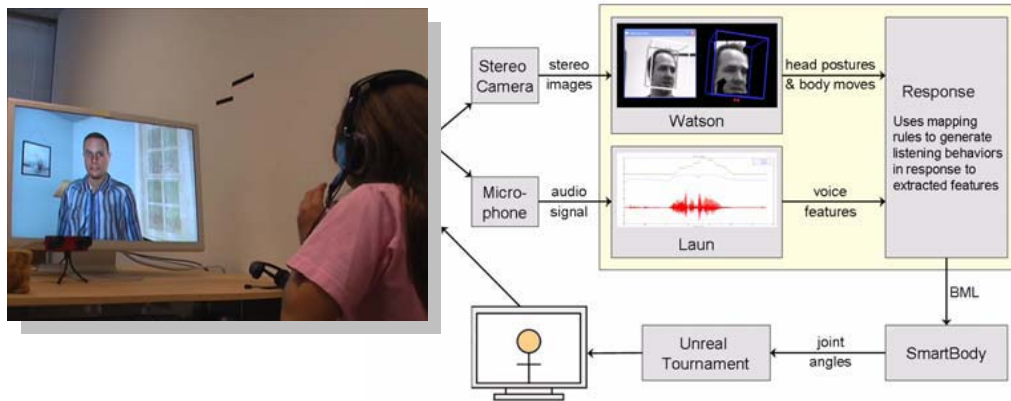


Figure 2. The system architecture of the Rapport Agent

To generate speaking behaviors of the interviewer in the animated avatar condition, the experimenter controls the buttons that retrieve pre-recorded voice messages. Four desktop computers are used in the

experiment: two DELL Precision 670 computers to run Watson and record stereo camera images, one for an interviewee and one for an interviewer; one DELL Precision 690 to run the experiment system; and one DELL Precision 530 to store logs. The video avatars and Rapport Agent are displayed on a 30-inch Apple display to approximate the size of a real human sitting 8 feet away. The Rapport Agent conditions use the same male and female virtual characters (see the images (c) in Figure 1).

Manipulation of AFI

In a pilot test conducted as a preliminary to this research, we investigated whether the manipulation of AFI worked well. We had six persons to interact with the Rapport Agent which asked ten questions in a first session and informed the participants of a second session in which they would ask the same questions to their partner after the first session. The results showed all of them believed that they would have future interactions.

Potential Implications and Future Work

The results of this study should contribute to identifying the most effective combination of different aspects of avatar realism that produces maximum emotional engagement that would allow users to reveal personal information which may in turn lead to enhancing their social ties.

The findings have implications for determining the most efficient combination of interactivity of an agent. Therefore, this research adds to the growing body of knowledge about the design of embodied virtual agents that might be used for social skills training and therapy. Important in the design is

enhancing the interactional fidelity of those agents in mediated communication.

Design and implementation of the virtual humans and presentation software are complete, data collection has begun, and results will be available for presentation at the conference. The results of this study will be extended to diverse communication settings and interaction technologies in future work.

Acknowledgements

This work was sponsored by the U.S. Army Research, Development, and Engineering Command (RDECOM). The content does not necessarily reflect the position or the policy of the Government, and no official endorsement should be inferred. We would like to thank Dr. Nicole Kraemer for her advice on this study. We are grateful to Debbie Rowe and Sasi Kanth Ala for their helpful comments.

References

- [1] Bailenson, J.N., Yee, N., Merget, D., & Schroeder, R. The effect of behavioral realism and form realism of real-time avatar faces on verbal disclosure, nonverbal disclosure, emotion recognition, and copresence in dyadic interaction. *PRESENCE: Teleoperators and Virtual Environments* (2006).
- [2] Bargh, J. A., McKenna, K. Y. A., & Fitzsimons, G. M. Can you see the real me? Activation and expression of the "True Self" on the Internet, *Journal of Social Issues*, Vol. 58, No. 1, 33-48 (2002).
- [3] Digiuseppe, R. & Bernard, M. REBT assessment and treatment with children in *Rational Emotive Behavioral Approaches to Childhood Disorders: Theory, Practice, and Research*, Ellis, A. & Bernard M. E. (Eds.), Springer (2006).
- [4] Gratch, J., Okhmatovskaia, A., Lamothe, F., Marsella, S., Morales, M., van der Werf, R., et al. *Virtual Rapport*. *Proc. 6th International Conference on Intelligent Virtual Agents* (2006).

- [5] Gratch, J., Wang, N., Gerten, J., Fast, E., & Duffy, R. Creating rapport with virtual agents. *Proc. 7th International Conference on Intelligent Virtual Agents* (2007).
- [6] Joinson, A. N. Self-disclosure in computer-mediated communication: The role of self-awareness and visual anonymity. *European Journal of Social Psychology*, Vol. 31, 177-192 (2001).
- [7] Kang, S., Gratch, J., Wang, N., & Watt, J. H. Does the contingency of agent's nonverbal feedback affect users' social anxiety? *Proc. 7th International Conference on Autonomous Agents and Multiagent Systems* (2008).
- [8] Kang, S., Watt, J. H., & Ala, S. K. Social copresence in anonymous social interactions using a mobile video telephone. *Proc. Computer-Human Interaction* (2008).
- [9] Kang, S., Watt, J., & Ala, S. K. Communicators' perceptions of social presence as a function of avatar realism in small display mobile communication device. *Proc. Hawaii International Conference on System Sciences* (2008).
- [10] Moon, Y. Intimate exchanges: Using computers to elicit self-disclosure from consumers. *Journal of Consumer Research*, Vol. 26, No. 4, 323-339 (2000).
- [11] Morency, L.-P., Sidner, C., Lee, C., & Darrell, T. Contextual Recognition of Head Gestures. *Proc. 7th International Conference on Multimodal Interactions* (2005).
- [12] Nowak, K. & Biocca, F. The effect of the agency and anthropomorphism on users' sense of telepresence, copresence, and social presence in virtual environments. *Presence: Teleoperators and Virtual Environments*, Vol. 12, No. 5 (2003).
- [13] Nowak, K. & Rauh, C. The influence of the avatar on online perceptions of anthropomorphism, androgyny, credibility, homophily, and attraction. *Journal of Computer-Mediated Communication*, 11(1), (2005). Available at <http://jcmc.indiana.edu/vol11/issue1/nowak.html>.
- [14] Shaffer, D. R. & Ogden, J. K. On sex differences in self-disclosure during the acquaintance process: The role of anticipated future interaction. *Journal of Personality and Social Psychology*, Vol. 51, No. 1, 92-101 (1986).
- [15] Tidwell, L. C. & Walther, J. B. Computer-mediated communication effects on disclosure, impression, and interpersonal evaluations. *Human Communication Research*, Vol. 28, No. 3, 317-348 (2002).
- [16] Walther, J. B. Computer-mediated communication: Impersonal, interpersonal, and hyperpersonal interaction. *Communication Research*, Vol. 23, 1-43 (1996).