

Understanding the Nonverbal Behavior of Socially Anxious People during Intimate Self-disclosure

Sin-Hwa Kang, Albert (Skip) Rizzo, and Jonathan Gratch

Institute for Creative Technologies, University of Southern California,
12015 Waterfront Drive, Playa Vista, CA 90094 USA
{kang,rizzo,gratch}@ict.usc.edu

Abstract. This study explores the types of nonverbal behavior exhibited by socially anxious users over the course of an interview with virtual agent counselors that talked about themselves. The counselors provided self-disclosure using human back stories or computer back stories. The video data was collected from a previous study. We defined nine types of nonverbal behavior to investigate the associations between the types of nonverbal behavior and users' anxiety levels. The results of preliminary data analysis show that five features out of the nine features are positively correlated with different levels of users' anxiety in the "computer back stories" condition. These five types of nonverbal behavior are gaze aversion, moving arms and hands, constant rocking, shaking a head, and fidgeting arms and hands. There are no significant relationships between the kinds of nonverbal behavior and users' anxiety levels in the "human back stories" condition.

Keywords: nonverbal behavior, embodied virtual agents, social anxiety, affective behavior, self-disclosure, virtual humans, evaluation.

1 Introduction

This study is part of a larger program to demonstrate the suitability of virtual agents that sense client nonverbal cues in therapeutic interactions where human clients need to be encouraged to disclose sensitive information. In clinical interactions, nonverbal behavior is widely considered a crucial indicator of a client's mental state [14]. Likewise, nonverbal behavior can help build intimacy between a client and a clinician [1,4] as nonverbal cues serve to communicate inner feelings and intentions [2,14,17]. In fact, some evidence suggests that nonverbal cues may serve as more credible indicators of clinical states than the verbal information communicated by clients [11]. For example, research in clinical psychology has found that the nonverbal behavior of human clients unintentionally revealed intimate information that is not disclosed in their verbal behavior [5,17]. More broadly, nonverbal behavior plays a vital role in the creation and maintenance of a therapeutic relationship by constructing rapport between counselors and clients in psychotherapeutic interactions [17].

Human clinicians invest considerable time and effort into carefully observing the nonverbal behavior of clients and adjusting their own nonverbal behavior to respond

appropriately and build intimacy. If virtual agents were capable of detecting and interpreting both verbal and nonverbal signals from human clients, such agents could obtain a better understanding of the clients' intention and, thus, respond in a more appropriate manner. For instance, a virtual counselor must be able to understand the psychological states of human clients to approach the level of rapport and diagnostic efficacy of human clinicians in psychotherapeutic interactions. Thus, giving virtual agents the ability to recognize and understand these indicators would greatly enhance their relevance in clinical settings. This may lead to the creation of a virtual clinical setting run more similarly to the way that human counselors interact with their clients in the real world.

Social anxiety is the most common clinical condition faced by clinicians, occurring in 18% of the general population [15]. Therefore, recognizing nonverbal indicators of social anxiety is a priority for our research in clinical virtual agents. In this study, we aim to identify the kinds of nonverbal behavior displayed by human clients with varying anxiety levels during their interaction with a virtual counselor. We introduce the preliminary results of our study in this paper.

We investigated the types of nonverbal behavior displayed by socially anxious users over the course of an interview with a virtual counselor that self-disclosed personal information. The video data analyzed in this paper was recorded during a previous study [10] described in detail in the following section.

2 Experimental Design

In a previous study [10], we investigated whether the different types of virtual agent counselors' self-disclosure affected real human clients' social responses in psychotherapeutic interactions. We designed a between-subjects experiment involving two different kinds of self-disclosure from virtual counselors in an interview setting: i) human back stories, e.g. "I was born and raised in LA"; ii) computer back stories, e.g. "I was designed and built in LA." Each experimental condition was presented to same gender combinations of dyadic partners.

2.1 Participants and Procedure

Forty people (50% women, 50% men; average 31 years old) from the general Los Angeles area were recruited using Craigslist.com and compensated for seventy five minutes of their participation. The participants were randomly assigned to one of the two experimental conditions. Participants were given instruction describing the counseling interview interaction. The interview questions were modified from ones used in a previous study [9]. The virtual counselors preceded each interview question with some information about themselves before asking each counseling question to participants. Participants in all conditions viewed the virtual agents on a 30-inch screen display that approximated the size of a real human sitting 4 feet away. They wore a lightweight close-talking microphone and spoke into a microphone headset. The monitor was fitted with a camcorder and a webcam. To control for gender effects, two types of gender dyads were used in equal numbers in each experimental condition: male-male and female-female. The typical interaction was allowed to last about thirty minutes.

2.2 Stimulus Materials

The Rapport Agents [8] were used as virtual counselors (see the image (a) in Figure 1) that presented timely positive feedback, such as smile and head nods, by recognizing and responding to the audiovisual features of a participant (human client) (see the image (b) in Figure 1).

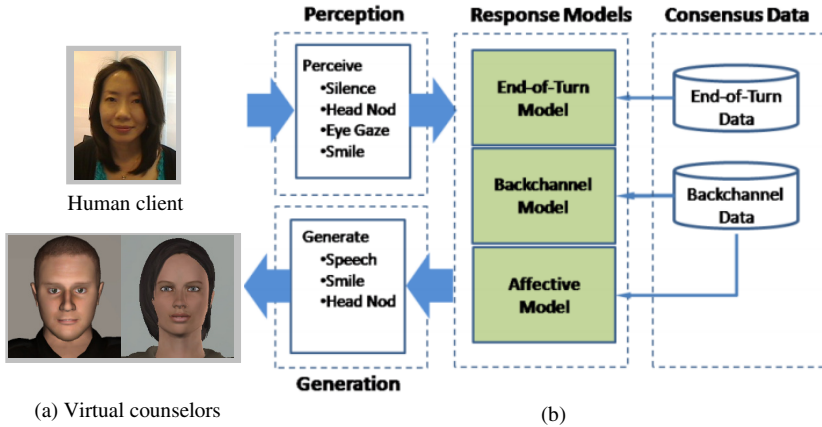


Fig. 1. (a) Rapport Agents (male & female); (b) System architecture of the Rapport Agent

To generate the virtual counselor's behaviors, the Rapport Agent first collected and analyzed the attributes from the voice, smile, head nods, eye-gaze, and upper-body movements of a human client. To detect the client's behaviors, a webcam was placed in front of the client. An audio cue detector extracted data such as the intensity of the client's voice from the raw signal using the signal processing package, Praat. A visual cue detector tracked the direction of eye-gaze, head nods, smile levels, and body movements. The backchannel, end-of-turn and affective models of the Rapport Agent were unique in their ability to make real-time decisions and generate the most appropriate responses to client statements using perceived audiovisual features. For example, the virtual counselor may provide back-channeling in the form of a smile if the human client smiles. To generate speaking behaviors of the virtual counselor to provide self-disclosure, an experimenter controlled the buttons that retrieved pre-recorded voice messages. The same male and female virtual agents were used in all conditions (see the images in Figure 1 (a)).

2.3 Measurements

Social anxiety. The pre-questionnaire packet included questions about one's social anxiety as a dispositional personality trait. We utilized the modified Cheek & Buss shyness scale [3] to measure users' anxiety levels. Scales ranged from 1 (disagree strongly) to 5 (agree strongly). Sample items include: 'I feel tense when I'm with people I don't know well' and 'I feel inhibited in social situations.'

Nonverbal behavior. We defined nine nonverbal features to explore the types of nonverbal behavior exhibited by socially anxious users: gaze aversion, frowning eyebrows, leaning, moving arms and hands, constant rocking, touching on body, shaking a head, fidgeting arms and hands, and fidgeting feet and legs. These nonverbal behaviors were extracted from an extensive literature review and previously observed features of social anxiety in previous work [13]. A coder annotated the frequency of nonverbal cues present by tallying the occurrences of behavior displayed by participants.

3 Preliminary Findings

We ran a Pearson Correlation for users' anxiety levels ($M = 2$; $SD = .65$) and frequency of nonverbal behaviors present in each experimental condition. The results show that five features are positively correlated with users' anxiety levels in the "computer back stories" condition (see Figure 2). These five features are gaze aversion ($r = .5$), moving arms and hands ($r = .5$), constant rocking ($r = .55$), shaking a head ($r = .53$), and fidgeting arms and hands ($r = .61$). There is a general trend of positive associations between the users' anxiety levels and the rest of the behaviors in the condition. It is also worth noting that there is no significant difference in the length of conversations as a function of anxiety level. Thus, these correlations indicate that these nonverbal behaviors are derived from the quality rather than the quantity of their speech. It seems that the users' existing views toward programmed characters' own stories might have, in turn, prompted a more awkward interaction that contributed to showing nonverbal behaviors associated to higher anxiety when speaking to the counselor using computer back stories. There are no significant associations between these two variables in the "human back stories" condition.

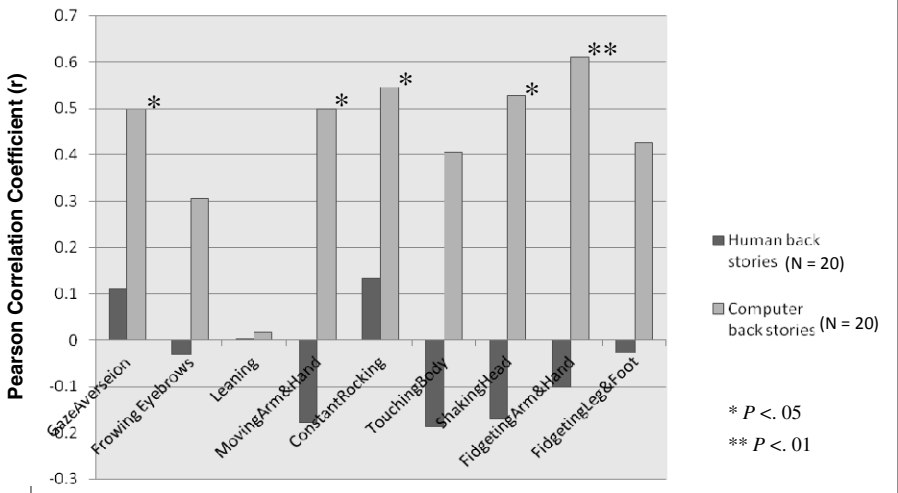


Fig. 2. Correlations between users' Social Anxiety Levels and frequency of Nonverbal Behaviors in two experimental conditions

4 Discussion and Future Work

Previous studies indicate that the nonverbal signs of social anxiety include gaze aversion, facial expressions, and body movements which relay discomfort, such as extremity movements [13]. The output of our study is in line with and reinforces these prior findings. Our examination of the nonverbal behaviors associated with social anxiety levels in users interacting with virtual counselors supports a movement in the direction of developing more effective virtual agents in the future.

Detecting the nonverbal signals of users could complement comprehension of their verbal content and result in a virtual agent that employs this crucial information to assess the user's emotional state. The virtual agent could then utilize this information to create a higher fidelity model of the user's state that would enhance the quality of the agent's feedback. Potentially, such nonverbally-aware agents would result in more robust communication between the agent and humans and facilitate establishment of rapport [6,7].

In our future work, we plan to extend this analysis to other clinically-relevant client states, such as depression and post-traumatic stress disorder, building on a larger recently-collected dataset of clinical interviews with clients with such conditions. By validating the presence of nonverbal cues that correlate with clinical states, this research informs the design of automatic techniques that aspire to recognize such cues in real-time, within the context of clinical interactions [16]. Although considerable technical and ethical hurdles must be overcome as this research proceeds, ultimately this research is advancing the potential of virtual human agents that can assist in clinical contexts.

Acknowledgements. This work was sponsored in part by the DARPA Detection and Computational Analysis of Psychological Signals (DCAPS) program and 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.

References

1. Argyle, M., Dean, J.: Eye-contact, distance, and affiliation. *Sociometry* 28, 289–304 (1965)
2. Cacioppo, J.T., Petty, R.E., Losch, M.E., Kim, H.S.: Electromyographic activity over facial muscle regions can differentiate the valence and intensity of affective reactions. *Journal of Personality and Social Psychology* 50, 260–268 (1986)
3. Cheek, J.M.: *The Revised Cheek and Buss Shyness Scale (RCBS)*. Wellesley College, Wellesley (1983)
4. Edinger, J., Patterson, M.: Nonverbal Involvement and Social Control. *Psychological Bulletin* 93(1), 30–56 (1983)
5. Farber, B.: *Self-Disclosure in Psychotherapy*. Guilford, New York (2006)

6. Gratch, J., Okhmatovskaia, A., Lamothe, F., Marsella, S., Morales, M., van der Werf, R.J., Morency, L.-P.: Virtual Rapport. In: Gratch, J., Young, M., Aylett, R.S., Ballin, D., Oliver, P. (eds.) IVA 2006. LNCS (LNAI), vol. 4133, pp. 14–27. Springer, Heidelberg (2006)
7. Gratch, J., Wang, N., Gerten, J., Fast, E., Duffy, R.: Creating Rapport with Virtual Agents. In: Pelachaud, C., Martin, J.-C., André, E., Chollet, G., Karpouzis, K., Pelé, D. (eds.) IVA 2007. LNCS (LNAI), vol. 4722, pp. 125–138. Springer, Heidelberg (2007)
8. Huang, L., Morency, L.-P., Gratch, J.: Virtual Rapport 2.0. In: Vilhjálmsón, H.H., Kopp, S., Marsella, S., Thórisson, K.R. (eds.) IVA 2011. LNCS, vol. 6895, pp. 68–79. Springer, Heidelberg (2011)
9. Kang, S., Gratch, J.: People like virtual counselors that highly-disclose about themselves. *The Annual Review of CyberTherapy and Telemedicine* 167, 143–148 (2011)
10. Kang, S., Gratch, J.: Socially Anxious People Reveal More Personal Information with Virtual Counselors That Talk about Themselves using Intimate Human Back Stories. In: Proceedings of the 17th Annual CyberPsychology & CyberTherapy Conference (2012)
11. Knapp, M., Hall, J.: *Nonverbal Communication in Human Interaction*. Wadsworth | Cengage Learning, Boston (2010)
12. Morency, L.-P., Sidner, C., Lee, C., Darrell, T.: Contextual Recognition of Head Gestures. In: Proceedings of the 7th International Conference on Multimodal Interactions, Toronto, Italy (2005)
13. Perez, J., Riggio, R.: Nonverbal social skills and psychopathology. In: Philippot, P., Feldman, R., Coats, E. (eds.) *Nonverbal Behavior in Clinical Settings*. Oxford University Press, New York (2003)
14. Philippot, P., Feldman, R., Coats, E.: The Role of Nonverbal Behavior in Clinical Settings. In: Philippot, P., Feldman, R., Coats, E. (eds.) *Nonverbal Behavior in Clinical Settings*. Oxford University Press, New York (2003)
15. Raj, B., Sheehan, D.: Social Anxiety Disorder. *Medical Clinics of North America* 85(3), 711–733 (2001)
16. Scherer, S., Marsella, S., Stratou, G., Xu, Y., Morbini, F., Egan, A., Rizzo, A., Morency, L.-P.: Perception Markup Language: Towards a Standardized Representation of Perceived Nonverbal Behaviors. In: Nakano, Y., et al. (eds.) IVA 2012. LNCS (LNAI), vol. 7502, pp. 455–463. Springer, Heidelberg (2012)
17. Tickle-Degnen, L., Gavett, E.: Changes in nonverbal behavior during the development of therapeutic relationships. In: Philippot, P., Feldman, R., Coats, E. (eds.) *Nonverbal Behavior in Clinical Settings*. Oxford University Press, New York (2003)