

Shyness Level and Sensitivity to Gaze from Agents -Are Shy People Sensitive to Agent's Gaze?

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Abstract. This paper reports how shy people perceive different amount of gaze from a virtual agent and how their perception of the gaze affects comfortableness of the interaction. Our preliminary results indicate shy people are sensitive to even a very low amounts of gaze from the agent. However, contrary to our expectations, as the amounts of gaze from the agent increases, shy people had more favorable impression toward the agent, and they did not perceive the adequate amount of gaze as most comfortable.

Keywords: gaze, shyness, intelligent virtual agents, non-verbal behavior, evaluation

1 Introduction

Gaze plays an important role in our social interactions such as controlling the flow of a conversation, indicating interest and intentions, and improving listener's attention and comprehension [1, 2]. As in humans, virtual agent's gaze behavior is also important to provide natural interaction. Previous research on modeling gaze behavior of virtual agents were conducted to make appropriate turn management [3], to figure out where to look at [4], how to make idle gaze movements [5], to express social dominance by gaze [6], and what the adequate amount of gaze is to facilitate interaction [7], all of which report modeling realistic human gaze behavior to an agent resulted in more natural and smooth interaction.

However, being gazed at can lead to discomfort from feeling observed, especially for shy people. Shyness is defined as "discomfort and inhibition in the presences of others, where these reactions derive directly from the social nature of the situation" [8]. Shy people tend to avert gaze and engage in more self-manipulations [9, 10]. Thus, shy people might not prefer to interact with a virtual agent that exhibit a social, realistic human gaze behavior that facilitates smooth interaction.

This research aims to investigate adequate gaze behavior of a virtual agent for shy people to interact comfortably, and seek for answers for the following hypotheses: 1) Shy people are more sensitive to gaze from a virtual agent than those are not shy. 2) Shy people prefer lower amounts of gaze from the virtual agent, thus they perceive more friendliness from an agent that does not gaze at them.

2 Experimental Procedure

We designed a conversational virtual agent with four types of gaze behaviors based on [6] that proposed a gaze behavior model controlled by a probabilistic state transition. Firstly, the agent gazes toward a participant all the time (Full gaze condition); secondly, the agent gazes toward the participant 67% of the time, which is defined as the adequate gaze pattern to facilitate smooth interaction (adequate gaze condition); thirdly, the agent gazes toward the user 33% of the time (low gaze condition); and lastly, the agent gaze away from the user all the time (no gaze condition). The gaze transition was controlled at random in order to control the amount of gaze only. The agent's gaze state and averted gaze state are shown in Fig. 1.

25 university students participated in the Woz experiment and had pseudo conversations with the all four agents. Topics include favorite food, route to school. Each conversation lasted for a couple of minutes. They answered the Shyness scale questionnaire [11]. We divided the participants into two groups based on their shyness level score. 12 participants were categorized as high shyness group (shyness score >48 , HS hereafter), 7 participants as low shyness group (shyness score <41 , LS hereafter). Answers from other participants' were not used for the latter analysis to eliminate results from those with mid shyness level. Another questionnaire, about the perceived gaze amount from the agent, perceived friendliness of the agent, and perceived smoothness of the interaction, was administered after the experiment. The experimental conditions were participants' shyness (low or high, between-subjects design), and gaze patterns (4 patterns, within-subjects design).



Fig. 1. Agent's Gaze state (left) and Gaze-away states (middle and right)

3 Results and Discussion

The results of 2-way ANOVA repeated measures showed a significant main effect of gaze condition in "perceived amount of gaze from the agent" ($F=32.95$, $p<0.01$). Fig. 2 shows the results of perceived amount of gaze from each condition shown by the participants' shyness level. The more gaze the agent gives toward the participants, the higher they felt the agent was looking at them. This result can be used as a manipulation check of the gaze amount of each condition, which indicates the gaze amount were successfully manipulated in each condition. HS was more sensitive to change of gaze

amount between no gaze and low gaze condition (score=1.83, 3.42; $F=11.46$, $p<0.01$), while LS was more sensitive to the one between low gaze and adequate gaze condition (score=2.00, 4.14; $F=10.81$, $p<0.01$). Thus, hypothesis 1 is supported.

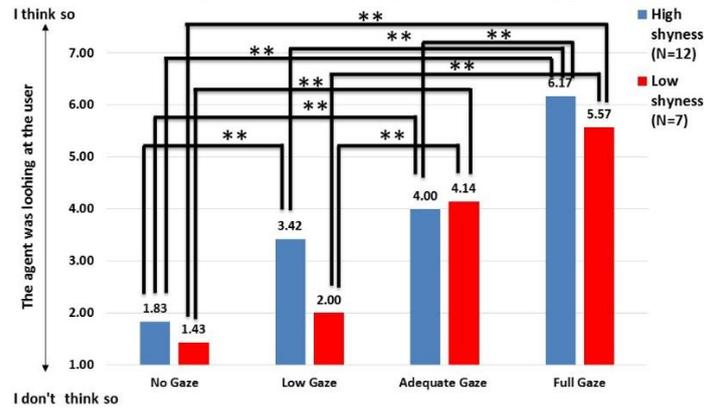


Fig. 2. Perceived Gaze Level from the Agent

In terms of perceived friendliness toward the agent shown in Fig. 3, HS liked the agent less than LS in general. There were significant interactions between the gaze condition and the shyness condition ($F=41.36$, $p<0.01$). LS rated the adequate gaze condition as most friendly (score=4.73, $p<0.05$), while HS did not perceive the difference in friendliness between adequate and full gaze, although they are aware of the differences in the amount of gaze between the two conditions. The results did not support the hypothesis 2. Friendly impression would lead to smooth interaction. In terms of the perceived smoothness of the interaction with the agent, similar tendency was found as the perceived friendliness. LS rated the adequate gaze condition as most smooth, while HS rated the full gaze condition as such.

These results indicate the answer to the questions in the following; 1) HS are sensitive to gaze even in the low gaze condition, where the agent gaze at the participant only 33% of the interaction duration. 2) However, HS perceived lowest friendliness toward the agent that does not gaze at them at all. On the contrary, they perceived the highest friendliness toward the agent that give them full gaze, while the low shyness group rated the friendliness of the agent highest when its amount of gaze was adequate. This suggests that HS were sensitive to little amounts of gaze but not sensitive to / aware of "adequate level of gaze" (66 % of the interaction duration), which is recognized and attributed to agent's friendliness by the low shyness group.

One of the reason our hypothesis 2 was not supported is that HS regarded the gaze aversion from the agent as a sign of rejection, and the agent's full-gaze was regarded was a sign of interest toward them. Also, we cannot deny the effect that the interaction partner was a virtual agent, not human. Further study should compare perception of gaze behavior from human and agents, with wide variety of agent designs, with more realism, with both gender and by more participants. Also we should analyze other amounts of gaze, the ideal amount of gaze for a shy person might be lower than 67%, while for an extrovert it is higher than 67%. Moreover, quantitative analysis of eye

tracking data of participants' gaze, especially whether they look at the agent's face or eyes is needed. We believe this research would lead to investigating comfortable gaze behavior of agents for shy people, and such agents could be applicable to train adequate gaze behavior to shy people.

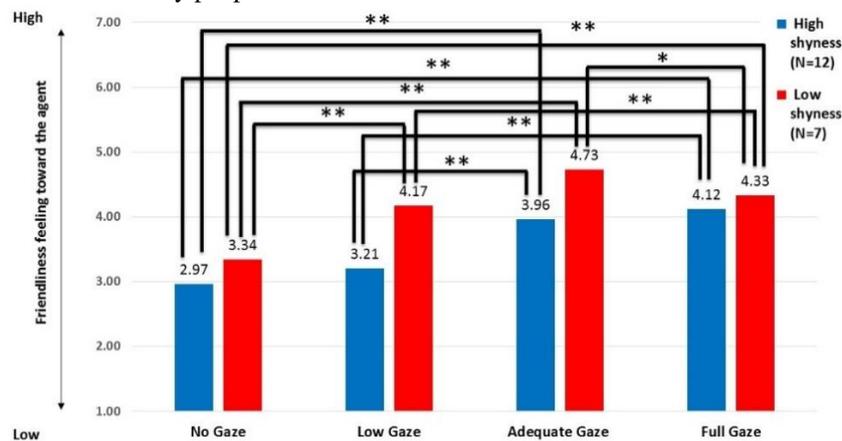


Fig. 3. Perceived Friendliness toward the Agent

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References

1. Argyle, M., Cook, M. Gaze and mutual gaze. Cambridge University Press Cambridge, 1976.
2. Bayliss, A., Paul, M., Cannon, P., and Tipper, S. Gaze cuing and affective judgments of objects: I like what you look at. *Psychonomic bulletin & review* 13, 6 (2006), pp. 1061-1066.
3. Pelachaud, C., and Bilvi, M. Modelling gaze behavior for conversational agents. In *IVA2003*, Springer, pp. 93-100, 2003.
4. Lee, J., Marsella, S., Traum, D., Gratch, J., and Lance, B. The rickel gaze model: A window on the mind of a virtual human. In *IVA2007*, Springer, pp. 296-303, 2007.
5. Cafaro, A., Gaito, R., and Vilhjrilmsson, H. Animating idle gaze in public places. In *IVA2009*, Springer, pp. 250-256, 2009.
6. Bee, N., Pollock, C., André, E., Walker, M. Bossy or Wimpy: Expressing Social Dominance by Combining Gaze and Linguistic Behaviors. In *IVA2010*, Springer, pp 265-271, 2010.
7. Ishii, R, et al. Avatar's Gaze Control to Facilitate Conversation in Virtual-Space Multi-User Voice Chat System, in *J. of Human Interface*, 10 (1), pp. 87-94, 2008. (in Japanese)
8. Jones, Warren H., and Dan Russell. "The social reticence scale: An objective instrument to measure shyness." *Journal of personality assessment* 46.6 (1982): 629-631.
9. Cheek, J. M., & Buss, A. H. 1981 Shyness and sociability. *Journal of Personality and Social Psychology*, 41, 330-339.
10. Daly, S. 1978 Behavioral correlates of social anxiety. *British Journal of Social and Clinical Psychology*, 17, 117-120.
11. Aikawa, A. A study on the reliability and validity of a scale to measure shyness as a trait. *The Japanese Journal of Psychology*, 62(3), pp.149-155, 1991. (in Japanese)