

Inducement of Attention to Agent through Averting Gaze from the Other

M. Suzuki and Y. Takeuchi

*Graduate School of Informatics, Shizuoka University
3-5-1 Hamamatsu, Shizuoka 432-8011, Japan
(Tel: 81-53-478-14551; Fax: 81-53-478-1455)
(gs10029@s.inf.shizuoka.ac.jp / takeuchi@inf.shizuoka.ac.jp)*

Abstract: In the study of social relationship established through mutual gaze, averting one's gaze from another's, which is treated as an act of refusing social relationship, has not been discussed as an act that intends to engage social relationship. Our study treats averting one's gaze from another's as a cue to engage social relationship, and deals with the ambiguity of this act and its effects on social affiliation. In particular, the effects on social affiliation are caused by the difference of contexts in which the act is performed.

Keywords: Eye contact, Gaze, Averting the eyes, Social relationship

I. INTRODUCTION

Intelligent agents such as humanoid/android robots, virtual embodied agents, and conversational systems are becoming more common in daily life, increasing the chances for people to socially interact with them.

Human social interaction centers on concern for other people. In the beginning of the interaction, people perceive another's existence; then, they observe his/her personality or mental state through behavior and/or appearance. Accordingly, the social interaction between human and agent also requires mutual awareness of the other's existence. In general, intelligent agents have an original "body" and appearance different from humans. Therefore, it is sometimes difficult for people to observe and perceive the agent's characteristics or inner condition. This is why the early stage of human-agent interaction is initiated by verbal communication or social roles previously defined by the developer of the agent. These interactions, however, are generally not natural because people do not spontaneously interact with the agent. People merely interact with the agent following given information concerning the agent or a defined social role that people have to play. In short, the human-agent interaction obviously differs from natural human interaction.

The concern for other people is the most important issue between humans in the beginning stage of interaction. Thus, how can we make others perceive our attention to them, and how can we perceive others' attention? The answer to these questions may be that

people gaze at other people to get their attention. In other words, a person who perceives another's gaze can expect that that person is trying to get his/her attention.

Although this human cognition of gaze perception could be a useful and effective means of initiating a social relationship between human and agent, it is difficult to achieve such an interaction. Some reasons for this result from the characteristics of an agent's gaze. In the case of a human gaze, the eyes adjust each angle of vergence to see the object in 3D vision. Accordingly, people can easily perceive another's attention to themselves. In the case of an agent, however, most visual systems do not apply such means to synthesize 3D vision. Therefore, humans cannot perceive an agent's attention even though the agent is focusing on him/her. The second reason is the Mona Lisa effect, which is the visual illusion that the eyes of the portrait follow the viewer from any vantage. The third reason involves characteristic human non-verbal expression. Human mental conditions such as emotion, will, determination, or intention are naturally expressed through facial features or the appearance of the eyes, but these expressions are vague and hard to formulate. Thus, it is difficult to make an agent express its inner conditions by eye movement.

For these reasons, we have to consider how to make people perceive an agent's attention by simple means. An agent's gaze toward a subject does not always succeed in getting its attention, which differs from the case of a human's gaze. People do not perceive attention or concern from the agent even if the agent looks at and

focuses on them. However, a human easily supposes that an agent has something of an embarrassed attitude toward him/her if the agent averts its gaze immediately after making eye contact.

In this paper, we examine whether people perceive attention or concern from an agent when they are refused eye contact. We also discuss natural means of social engagement between human and agent based on the result of a psychological experiment.

II. AVERTING ONE'S GAZE FROM ANOTHER'S

Once two persons look at each other and make eye contact, averting ones' gaze from the other's generally indicates a twinge of self-consciousness or embarrassment. Therefore, the person who is refused eye contact normally wonders why the other person averted his/her gaze. In other words, it can be said that this gaze interaction induces one's attention to the other.

Such gaze interaction does not necessarily give an agreeable impression to the person who is refused eye contact by the other. Thus, how do people feel in the case of human-agent interaction? As described in the introduction, an agent gazing toward a subject does not always succeed in getting attention, which differs from the case of a human's gaze. People do not perceive attention or concern from the agent even though the agent looks at and focuses on them. On the other hand, we do not have any idea whether a human perceives attention or concern from an agent when the agent refuses to make eye contact. Also, we have not explored how people feel given such seemingly unsociable interaction.

III. EXPERIMENT

1. Experiment

A. Overview

In this section, the question of whether a human perceives attention or concern from an agent averting eye contact with him/her is explored through a psychological experiment. We aim to demonstrate that a human strongly presumes the agent's intentionality in such an interaction.

In this experiment, the agent, whose eyes move side-to-side in order to express eye contact and averting its gaze from a human subject, appears as a Head-Display (HD); the agent's face and eye movement are projected

onto a dummy head (Fig. 1). The agent's expression and eye movement are designed and controlled through Adobe Flash animation, which the experimenter remotely controls according to the participant's actions.



Fig. 1. Head Display

B. Settings

Three visual stimuli (agent behaviors) are displayed to the participants.

Type 1: Averting. At the start of the experiment the eyes of the agent stare into the participant's eyes, but controlled by the experimenter immediately avert the gaze upon eye contact.

Type 2: Scanning. The agent scans the scene, rather like a searchlight. Eye contact can not be established and the agent does not meet the eyes of the participant.

Type 3: Staring. The eyes of the agent look into the participant's eyes throughout the experiment.

Eighteen university students who major in informatics participated in this psychological experiment. The participants sat in front of three agents whose eye movement corresponded to each of the above types.

C. Indicators of Observation

The experimenter counts the frequency with which the participant looks at each type of agent as an indicator of behavioral response. Moreover, the participants' perceptions and impressions with regard to the agents' motions and intentionalities are investigated by a questionnaire after the experimental task.

Questions about the participants' perceptions and impressions were:

- Which agent were you most concerned with in the experiment?
- Where/What did each agent observe?
- Which agent's attention did you want to get?
- Which agent did you perceive had intentionality toward you?

D. Procedure

The procedure of this experiment is as follows.

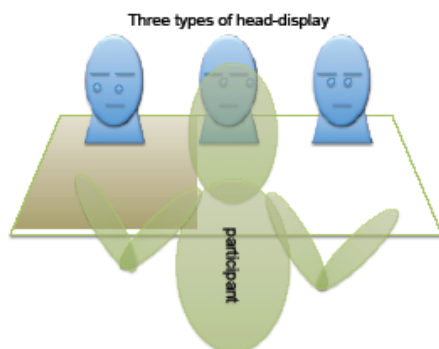


Fig. 2. Experimental settings

1. A blindfolded participant is guided to the experimental room (Fig. 2), and seated in a chair in front of the three agents.
2. The participant is given instructions by the experimenter.
3. The experimenter removes the blindfold. The experimenter keeps the participant sitting for five minutes, which is the main task of this experiment.
4. The participant answers the questionnaire.

E. Hypothesis and Predictions

To explore the following research issues, we carried out a psychological experiment:

- Does the agent averting its gaze from the human's make the human perceive the agent's attention and concern toward him/her?
- How does a human assume the intentionalities of the agent with each type of agent behavior?

In this experiment, we hypothesize that the agent's unsocial behavior of averting its gaze from the human induces attention to the agent more than the case in which the agent looks around or stares at the human.

This hypothesis will be supported by the following participant responses:

- The frequency of looking back at the agent that refuses eye contact with the participant (Type 1) is higher than the other two types of agent.
- The participants perceive more attention from the agent that refuses eye contact (Type 1) than the other two types of agent.

F. Results

Behavior and Perception

Figure 3 shows the average frequency of looking back at each type of agent. A statistical analysis indicated the main effect in the difference of agent behavior ($F(2,17)=22.32$, $p<.01$). There were also significant differences between Type 1 and 2, Type 1 and 3, and Type 2 and 3.

Figure 4 shows the participants' guess of each agent's intention of looking at them. The question was asked, "Which agent did you think would look at you?" The participants were permitted to give multiple answers. When the participant selected one of the agents, it was given a score of one. Accordingly, the participants answered most for the Type-1 agent that averts its eyes from those of the human. A statistical analysis indicates the main effect ($(F(3,17)=14.62$, $p<.01$).

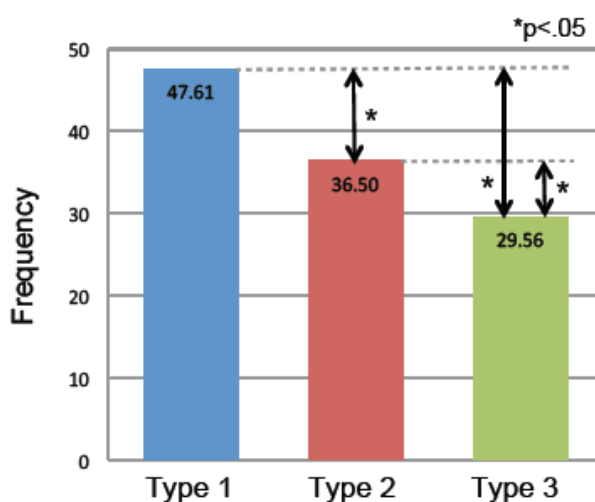


Fig.3. Average frequency of looking back at each type of agent.

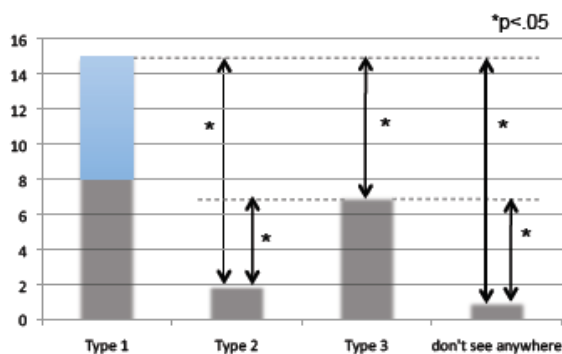


Fig.4. Participants' presumption of each agent's intention of looking them.

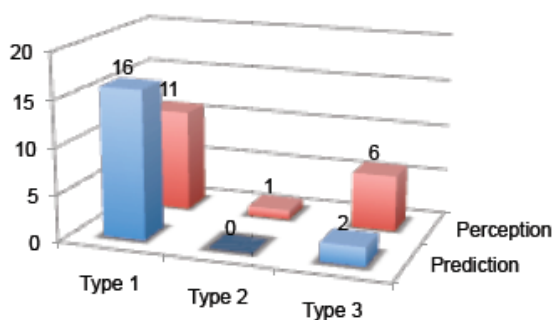


Fig. 5. Participants' perception of agent's consciousness of them.

Figure 5 shows the participants' perception of the agent's consciousness of them. The front side of the figure shows the participants' of which agent would be most concerned with them. The rear of the figure shows the participants' perception of the agent most concerned with them. It was obviously demonstrated that Type 1 was the most concerned.

Impressions

The questionnaire asked participants for their impressions based on two perspectives. One perspective was impressions of themselves from the agent's viewpoint, and the other was impressions of the agent from their original viewpoint. These are demonstrated in Figs. 6 and 7, respectively. The scores for these results are shown on a seven-degree Likert scale, which corresponded to the magnitude of agreeability for each question.

IV. CONCLUSION

The results supported the hypothesis that the agent's unsocial behavior of averting its gaze from a human

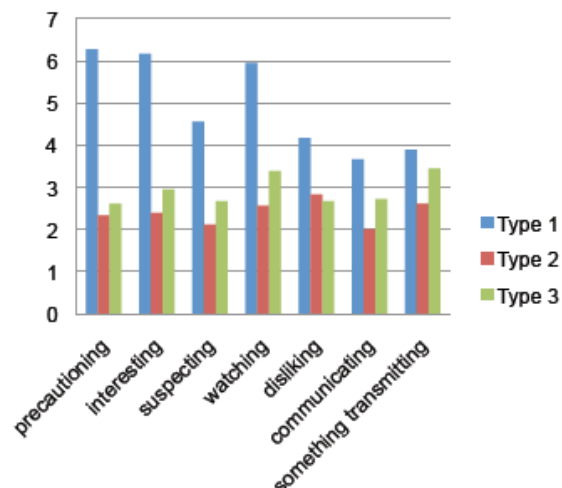


Fig. 6. Participants' impressions of themselves from the agent's viewpoint.

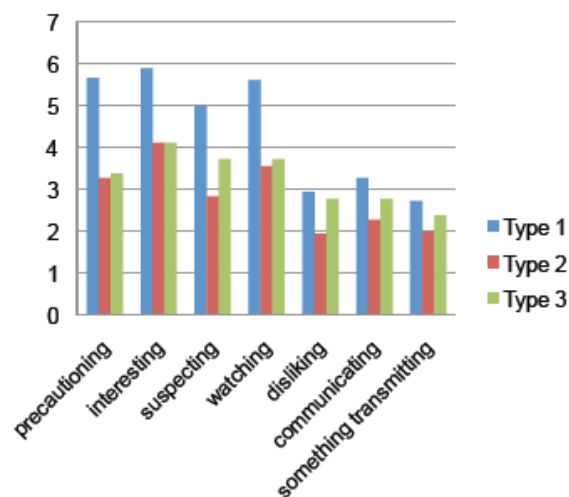


Fig.7. Impressions toward the agent from participants' original viewpoint.

induced attention to the agent more than the cases in which the agent looked around or stared at the human. These human impressions were not always positive. That the humans behavior and attitude was strongly affected by the averting of the agent's eyes provides a clue to natural human-agent interaction.

REFERENCES

- [1] Gibson, J. J. (1963), Perception of another person's looking behavior. *American Journal of Psychology* 76:386-394
- [2] Mukawa, N. (2002), Survey of Roles of Gaze in Communication: How are Intentions and Feelings Conveyed by Gaze? (in Japanese). *IEICE* 85(10):756-760