

# Gaze-communicative Stuffed-toy Robot with Joint Attention and Eye Contact based on Remote Gaze-tracking \*

Tomoko Yonezawa  
ATR IRC Lab.  
2-2-2 Hikaridai  
Seika-cho, Soraku-gun,  
Kyoto 619-0288, Japan  
yone@atr.jp

Hirotake Yamazoe  
ATR IRC Lab.  
2-2-2 Hikaridai  
Seika-cho, Soraku-gun,  
Kyoto 619-0288, Japan  
yamazoe@atr.jp

Akira Utsumi  
ATR IRC Lab.  
2-2-2 Hikaridai  
Seika-cho, Soraku-gun,  
Kyoto 619-0288, Japan  
utsumi@atr.jp

Shinji Abe  
ATR IRC Lab.  
2-2-2 Hikaridai  
Seika-cho, Soraku-gun,  
Kyoto 619-0288, Japan  
sabe@atr.jp

## ABSTRACT

We demonstrate a gaze-communicative stuffed-toy robot system with joint attention and eye-contact reactions based on ambient gaze-tracking as a method for natural interaction between human and robot. The stuffed-toy robot reacts to the user based on a “communication level” determined by the user’s gaze direction. These reactions include 1) joint attention behavior and 2) reactions to eye contact.

## 1. SYSTEM STRUCTURE

Our proposed gaze-communicative system aims to evoke a desire for communication via communication-level-aware interaction using unconscious to conscious communicative methods (Figure 1). The passive and indirect communicative evocation (*joint attention*) enables the stuffed-toy robot to draw the user’s interest by engaging in turn-taking of the initiative in the communication, which creates an atmosphere of communication. The active and direct evocation (*robot’s reactions to eye contact*) evokes favorable feelings from the user based on the user’s existing interest in the stuffed-toy robot. By communicating in multiple steps with several different ways, the robot is capable of natural interaction (Figure 2).

Image-based gaze tracking is performed by a gaze-tracking data server as shown in Figure 3, and multimodal and gaze-communicative reactions are produced by a reaction processing server as in Figure 4.

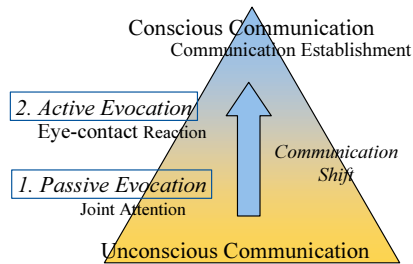


Figure 1: Aim of the System



Figure 2: Communication Levels

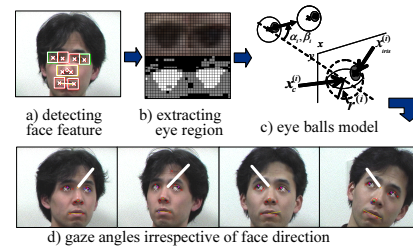


Figure 3: Gaze-tracking Process

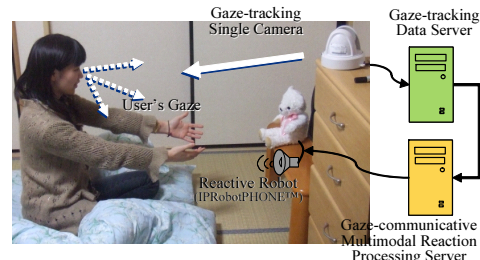


Figure 4: System Implementation

## 2. EXAMPLES OF BEHAVIORS

The stuffed-toy robot reacts corresponding to the state of the user’s gaze. Figure 5 shows examples of passive/indirect and active/direct communicative behaviors. When the user looks at near the robot, the robot looks at the same position as the user without any utterances (passive evocation). When the user looks at the robot, it reacts with the movement of its arms and the utterance to show that eye contact has been established. Thus the user can feel that she/he and the robot are sharing interest and communicating in a natural and spontaneous way. Detailed explanations and discussions are shown in the paper [1].

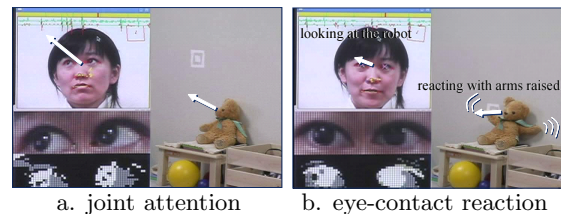


Figure 5: Examples of Robot’s Gaze Behaviors

## Acknowledgements

This research was supported in part by the National Institute of Information and Communications Technology of Japan.

## Reference

[1] T. Yonezawa, H. Yamazoe, A. Utsumi, and S. Abe, “Gaze-communicative Behavior of Stuffed-toy Robot with Joint Attention and Eye Contact based on Ambient Gaze-tracking,” ICMIO7, to appear.

\* A detailed version of this demonstration is available in the papers’ section in ICMIO7.