

# A Constructive Approach for Studying Human-Robot Communication

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Intelligence is a subjective phenomenon that emerges during interaction or communication; a human feels an intelligence of others through a communication. It is, therefore, indispensable to reveal a principle of human-system and human-human communication in order to investigate the intelligence of a human and an artificial system. A constructive approach reveals the factor that influences human-robot communication.

We have tackled the problem to reveal components of humanoid robot behavior that influence communication. There is, however, a possibility that robotic appearance disturbs the influence. The appearance of a robot is essentially one of its functions; therefore, the effect of appearance must be investigated independently.

There is a bottom-up approach to cope with the “behavior vs. appearance problem”, in which we evaluate communication while adding a behavior or appearance component one by one to the robot. On the other hand, there is also top-down approach, in which we initially build a robot which can behave same as humans and has the same appearance and evaluate communication while removing behavior or appearance component one by one from the robot. To employ the later approach, we have developed a prototype of an android robot.

In this research, we propose a fundamental hypothesis about the effects of behavior and appearance on communications. We call this “a hypothesis about synergistic effect of behavior and appearance,” which is described below.

Mori [1] mentioned familiarity of a robot increases with its similarity of appearance and motion until a certain point, when a subtle imperfection becomes repulsive. This is called “uncanny valley.” Our hypothesis about appearance mentions behavior effect independently. Namely,

The evaluation of communication increases with similarity. However, at the point of closely resemblance to humans, there is a valley like “uncanny valley.” The depth decreases with complexity of robot behavior (Fig. 1(a)).

On the other hand, our hypothesis about behavior is;

The evaluation of communication increases with complexity of behavior, while there is a peak that shows synergy of appearance and behavior. The behavior which brings the synergy changes according to appearance (Fig. 1(b)).

The complexity of behavior changes mainly whether the behavior expresses emotion. The fundamental hypothesis is shown in Fig. 1(c), where the synergy inhibits the uncanny valley.

We form additional hypotheses based on the fundamental one and examine them using the android. Currently, an experiment to investigate whether people look at the android in a different way from when they look at a human is underway.

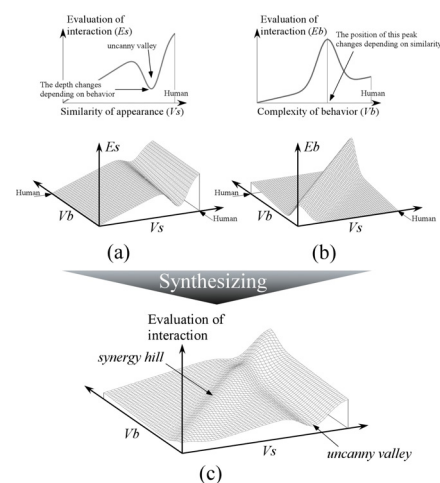


Fig.1 Our hypothesis

[1] Mori. The Buddha in the Robot. Charles E. Tuttle Co., Japan, 1982.