Title of Project : Cognitive Interaction Design: A Model-Based Understanding of Communication and its Application to Artifact Design

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【Purpose of the Research Project】

The mental model of others, which is used for understanding and predicting partners' actions under certain situations, plays an important role in human communication. In fact, we sometimes feel a gap in the conversation with a stranger, since we do not have such a mental model of others at first. This kind of phenomenon, namely the communication facilitation by the mental model of others, is expected to find in the interactions between humans and companion animals/artifacts as well as in human-human communication.

This research project is aiming at establishing a new academic field which we call "Cognitive Interaction Design (CID)". We strongly believe that the cognitive construction of "mental model of others" is a key to establish the design and implementation of artifacts that can adapt themselves to human users naturally and persistently. To this end, we focus especially on the common cognitive process among human-human communication as well as the interactions between humans and animals/artificial agents. Then we implement the mental model of others at an algorithmic level and utilize it for the design of artifacts.

【Content of the Research Project】
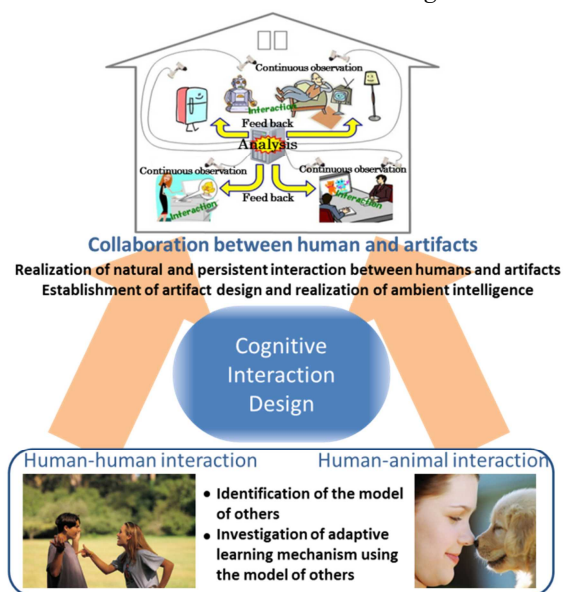
We have three main challenges in this

Fig.1 Overview of Cognitive Interaction Design

research project:

(1) Human-human interactions are cognitively analyzed to reveal 1) the mechanism of the metal model of others, 2) the way of interaction using the model, and 3) adaptation of the model in the course of interaction. We focus not only on the verbal communication but also on the nonverbal one. Both of adult-adult and child-adult interactions are analyzed.

(2) Human-animal interactions are analyzed to elucidate how companion animals such as dog or horse can learn the meaning of instructions through food (primary reinforcer) or prosodic features (secondary reinforcer). Moreover, we examine how animals estimate the internal states of their human partners using the acquired instructions, and how human change their interactions according to the internal states of the animals. These analyses lead to a cognitive model of mutual adaptation process, which includes the internal-model of others, in the human-animal interactions.

(3) Based on the above analyses, a methodology of designing artifacts that can adapt to users naturally and persistently is established. A novel design policy in terms of the adaptive and persistent interaction with human users will be provided. Furthermore, ambient intelligent systems including a user adaptable electric wheelchair, a concierge for online shopping, and so forth, will be developed.

【Expected Research Achievements and Scientific Significance】

Expected research achievements are 1) the establishment of CID at an algorithmic level, which is beyond the current interaction design framework, 2) the establishment of cognitive science of the interaction between humans and companion animals, which is not established yet, and 3) the application of these achievements to the design of artifacts that can adapt to users naturally and persistently.

【Key Words】 Human-Agent Interaction: a research field that aims to analyze and design interactions between humans and agents

【Term of Project】　　FY2014-2018

【Budget Allocation】　 668, 400 Thousand Yen

【Homepage Address and Other Contact Information】

http://www.cognitive-interaction-design.org