

論文の内容の要旨

Information Theoretical Approaches to Dyadic Human Interactions

(情報理論的アプローチによるヒトの二者間相互作用の解析)

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It is not yet well understood how we become aware of the presence of other people as being other subjects. In this thesis, we focused on the dyadic interaction between two subjects and aimed to characterize the dynamics which account for the feeling of the other's presence. For this purpose, we adopted two experimental settings, Perceptual Crossing Experiment, and TypeTrace Messenger.

Perceptual crossing experiment was designed as the minimal experimental setup to investigate the dyadic interaction between two subjects. In this experiment, two subjects were asked to identify the other in the 1D virtual space. The dynamics of each trial was fully captured by 4 time series data, which were each agent's movement trajectory, and the time course of the sensory feedback by vibrating device. We characterized these time series data quantitatively using several different measures and compared these values with the perceptual awareness scale to investigate the feature of dynamics that was related to the feeling of other's presence. First, we measured the movement synchronization between two subjects and found that these were related to the perceptual awareness scale, and the trial with the larger movement synchronization was associated with the stronger feeling of other's presence. Next, we used local transfer entropy to quantify directions of influence in the dyadic interaction, and compared this value before and after the click, at which subjects were convinced that they found the other subject. Before the click, we found the significant increase of passive reception of the stimulation from the other subject, which was characterized by the local transfer entropy from the other subject's movement to the stimulation. After the click, this was gradually switched to the active touching, which was characterized by the local transfer entropy from the subject's own

movement to the stimulation. This transition from passive to active was evident in the trial with the high perceptual awareness scale.

The experiment of TypeTrace Messengers is designed to investigate the effect of medium during dyadic interactions. Social presence, or the subjective experience of being present with another existing person, varies with the medium used for the interaction. Early theories argued that social presence depends on the richness of information mediated through communication system. Later, counters to this idea argued that even computer-mediated communication systems, however, deprived of social cues compared to face-to-face conversation, can generate as much social presence. Until now, social presence researches in general have mainly focused on uni-directional aspects of each exchanged message. On the other hand, researches in social cognition have studied the importance of bi-directional interaction in understanding dyadic interactions. Our primary purpose is to quantify the degree of social presence among the participants of a realtime online chat system with a few statistical measures. To this end, we developed a software called "TypeTrace" that records all keystrokes of online chat interactants and reenacts their typing actions. Our results show that when we just increase the richness of information by presenting the typing process during the chat, the cognition of the presence of others does not significantly increase. When the information concurrency of the chat is augmented, we found that transfer entropy between the interactants becomes higher, and the social presence, as well as, emotional arousal, intimacy increased. This result shows that the mere augmentation of information richness does not necessarily lead to an increase in the social presence, and concurrent communication is another important factor for fostering vivid conversation in virtual communication.