MINI SYMPOSIUM

4th mini-symposium on Cognition, Decision-making and Social function

October 25 (Tuesday), 2016
13:30 – 16:40
1F Seminar Room, BSI Central Building

13:30-13:35 Opening

13:35-14:25
Optimal decision rules in repeated games where players infer an opponent's mind via simplified belief calculation (in collaboration with Mitsuhiro Nakamura)
Dr. Hisashi Ohtsuki
SOKENDAI (The Graduate University for Advanced Studies)

14:25-14:40 Break

14:40-15:30
Understanding neuropsychiatric disorders: focus on obsessive-compulsive disorder
Dr. Yuki Sakai
Advanced Telecommunications Research Institute International / Kyoto Prefectural University of Medicine

15:30-15:50 Break

15:50-16:40
Neural mechanisms underlying sense of agency
Dr. Hiroshi Imamizu
The University of Tokyo / Advanced Telecommunications Research Institute International

16:45-18:00 Informal discussion (at Nakahara Lab/N201)

Host:
Hiro Nakahara Lab for Integrated Theoretical Neuroscience

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Optimal decision rules in repeated games where players infer an opponent's mind via simplified belief calculation (in collaboration with Mitsuhiro Nakamura)

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In strategic situations, humans infer the state of mind of others, e.g., emotions or intentions, adapting their behavior appropriately. Nonetheless, evolutionary studies of cooperation typically focus only on reaction norms, e.g., tit for tat, whereby individuals make their next decisions by only considering the observed outcome rather than focusing on their opponent's state of mind. In this paper, we analyze repeated two-player games in which players explicitly infer their opponent's unobservable state of mind. Using Markov decision processes, we investigate optimal decision rules and their performance in cooperation. The state-of-mind inference requires Bayesian belief calculations, which is computationally intensive. We therefore study two models in which players simplify these belief calculations. In Model 1, players adopt a heuristic to approximately infer their opponent's state of mind, whereas in Model 2, players use information regarding their opponent's previous state of mind, obtained from external evidence, e.g., emotional signals.

We show that players in both models reach almost optimal behavior through commitment-like decision rules by which players are committed to selecting the same action regardless of their opponent's behavior. These commitment-like decision rules can enhance or reduce cooperation depending on the opponent's strategy.

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Understanding neuropsychiatric disorders: focus on obsessive-compulsive disorder

Dr. Yuki Sakai

Advanced Telecommunications Research Institute International / Kyoto Prefectural University of Medicine

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Neuropsychiatric disorders have a large impact on individuals, families and communities. Individuals suffer the distressing symptoms of disorders. They also suffer because they are unable to participate in work and leisure activities. The burden of disability associated with a disorder can be measured in units called disability-adjusted life years (DALYs) which represent the total number of years lost to illness or disability within a given population. Neuropsychiatric disorders are the leading cause of disability in the U.S and account for 13.6 percent of total U.S. DALYs (WHO). One of its reason, those disorders are difficult to understand and to be treated.

As the first step to understand neuropsychiatric disorders, we have focused on obsessive-compulsive disorder (OCD). OCD is a common neuropsychiatric disorder with a lifetime prevalence of 2–3% (Ruscio et al., 2010), which is characterized by persistent intrusive thoughts (obsessions), repetitive actions (compulsions), and excessive anxiety. A prevalent pathophysiological model suggests that OCD is associated with dysfunction of ventral striatal circuitry (Sakai et al., 2011; Abe and Sakai et al., 2015) and serotonergic system (Aouizerate et al., 2005). I will introduce our approach to elucidate the mechanism of OCD using behavioral task, computational model, and fMRI.

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Neural mechanisms underlying sense of agency

Dr. Hiroshi Imamizu
The University of Tokyo / Advanced Telecommunications Research Institute International

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Sense of agency (SoA) is subjective awareness that one is initiating, executing, and controlling one's own actions. I'll introduce our two studies on neural mechanisms underlying SoA. In the first study, we investigated temporal changes in MEG brain activities caused by a repeated exposure to a delay (150 ms) inserted between a button-press and a flash as visual outcome under voluntary movement. We found that readiness potentials shift later in fronto-parietal regions while visually evoked potentials shift earlier in occipital regions in the delay condition compared to a no-delay condition. This result may correspond to an "intentional binding" of subjective timings of action and its consequence, which is often used as an implicit measure of SoA. In the second study, we investigated how the brain constructs representations of movements attributed to self and other. Our multi-voxel pattern analysis of fMRI data found difference in activity patterns between self and other appears first in the sensorimotor regions and then in the parietal lobe as movements proceeds. This illustrates that the accumulation of sensorimotor information leads to an explicit judgments of self-agency. Our studies are paving the way for an objective estimation of SoA, which has been mainly investigated by subjective reports.

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