Title: Two dissociable processes for detecting gaining and losing control in human brain

Presenting Author: Wen Wen

Author(s): Wen Wen, Department of Precision Engineering, the University of Tokyo, Ryu Ohata, Department of Psychology, the University of Tokyo; Cognitive Mechanisms Laboratories, Advanced Telecommunications Research Institute International, Masaru Tanaka, Department of Psychology, the University of Tokyo; Japan Society for the Promotion of Science, Atushi Yamashita, Department of Precision Engineering, the University of Tokyo; Hajime Asama, Department of Precision Engineering, the University of Tokyo; Masaru Tanaka, Department of Psychology, the University of Tokyo; Cognitive Mechanisms Laboratories, the University of Tokyo; Masaru Tanaka, Department of Psychology, the University of Tokyo; Cognitive Mechanisms Laboratories, Advanced Telecommunications Research Institute International; Research into Artifacts, Center for Engineering, the University of Tokyo; Hiroshi Imamizu, Department of Psychology, the University of Tokyo; Cognitive Mechanisms Laboratories, Advanced Telecommunications Research Institute International; Research into Artifacts, Center for Engineering, the University of Tokyo

Abstract: 2.57

The comparator model suggests that prediction errors modulate the sense of agency. Consistent to this view, previous neuroimaging studies have found that decrease in the sense of agency is associated with brain areas that are considered to be linked to the processing of prediction errors (e.g., the temporoparietal junction). However, it is yet unclear whether the detection of gaining control also shares the same brain mechanism as the former. On one hand, gaining the sense of agency may be due to decrease in prediction errors. In that sense, gaining and losing the sense of agency shares the same mechanism. On the other hand, gaining the sense of agency may rely on the detection of matches between sensory predictions and external events from a null state (i.e., default assumption of not being in control) via exploration actions. If that is the case, brain mechanisms for error detection should not be involved. In the present study, participants performed a visuomotor task inside an MRI scanner. In this task, a dot moved in a hybrid direction mixed by the participants’ motion and pre-recoded motions of other participants. In each trial, the proportion of the participants’ motion varied from 0%-100%. The participants were asked whether they felt a change in the control or not. We found that the activities in the left cerebellum and the right dorsolateral prefrontal cortex positively correlated with the detection of an increase in control. In addition, we also found that the activity in the left anterior insula was negatively correlated with the detection of a decrease in control, while that in the bilateral frontoparietal regions was positively correlated. In short, our results clearly showed that the detection of gaining and losing control is linked to different brain mechanisms.