# Functional neuroimaging of embodied social cognition

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Recently, a growing number of studies have employed hyperscanning technique, with which two or more individual's brain activities were simultaneously measured, and reported that the inter-brain synchronization is enhanced during a cooperative action. In this talk, I will present two hyperscanning studies conducted in our lab: cheering and joint agency.

Cheering a favorite player in a sports game is one of the most pervasive entertainment. It is likely that cheering facilitates the observer's subjective unity with the player and hence the synchronized activity between the two brains. In this study, we measured brain activities of the player and the observer simultaneously by using functional near-infrared spectroscopy (fNIRS). The player performed the Rock-Paper-Scissors (RPS) game against an experimenter while the observer cheered for that player. The result showed that the observer's brain activity was enhanced by the player's positive outcome and was functionally connected with the player's motor area activity. These results suggest that cheering enhances the synchronization of the player's and the observer's internal states, establishing a sense of unity.

In another study, we investigated the inter-brain synchronization during a mutually cooperative joint action. We measured two individuals' electroencephalography (EEG) simultaneously during a cooperative task, in which they coordinated their tapping rhythm. People would feel the sense of 'joint agency', which is the sense that 'we' did it, during a mutually cooperative action. The results showed that the participants felt strong sense of joint agency in the cooperative actions, but not in the non-cooperative actions. Furthermore, the degree of inter-brain synchronization was significantly correlated with the sense of joint agency, as well as the temporal accuracy of the tapping actions of the pair. These results indicate that the sense of joint agency strongly reflects the inter-brain synchronization, which depends on the quality of mutual cooperation during a joint action.