
Mu rhythm modulation during intentional and unintentional human and robot actions

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Abstract

Previous studies have found that electroencephalogram (EEG) oscillations in the mu frequency band (8-13 Hz) are suppressed during the performance and observation of human actions. Mirror neurons, originally discovered in the macaque premotor cortex, are characterized by their activity in response to both self-performed and observed actions. Based on this functional correlation, mu wave suppression is believed to be an index of activity of the human mirror neuron system. Accumulating evidence suggests that the mirror neuron system serves to create an internal simulation of actions that are perceived as either biological or intentional. The present study seeks to investigate the flexibility of the mirror neuron system by exploring its response to both intentional and unintentional biological and non-biological movement. Fourteen adult participants viewed a series of videos including 1) Visual white noise (baseline condition) 2) Balls bouncing (non-biological unintentional movement), 3) A human hand opening and closing (biological intentional movement), and 4) A human hand being pulled by a string (biological unintentional movement). Power in the mu frequency was significantly suppressed during both biological movement conditions. This finding suggests that biological movement is sufficient to suppress the mu wave independent of intentionality. Thus we conclude that the human mirror neuron system is responsive to both intentional and unintentional biological movement. To further explore this question, we are currently collecting data on intentional non-biological (i.e., robot) movement. Based on preliminary data from on-going fMRI mirror neuron studies, we hypothesize that non-biological intentional movements will also be sufficient to suppress the mu wave.