Discerning proactive and reactive mechanisms of inhibitory cognitive control: a combined EEG-fMRI study

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Abstract

Some authors claim inhibitory processes are not purely reactive, but contain both reactive and proactive mechanisms. Recent literature has highlighted this importance and has stated that discerning neural substrates of both proactive and reactive mechanisms of inhibition would provide a richer model for understanding inhibitory control. In this study, concurrent measurements of EEG and fMRI were used to simultaneously explore spatial and temporal characteristics of reactive inhibition and proactive control. We employed a modified stop-signal task consisting of frequently presented go-trials (61%) and two different stop-signals (13% and 26%). Subjects were cued in three conditions, providing information on with-holding their response to (i) both stop signals, (ii) only the first stop signal (13%) and (iii) only to the second stop signal (26%). This design allowed us to discern effects of cueing on task performance, as well as exploring cognitive processes, such as proactive control, reactive inhibition and conflict monitoring.

Go-response times and stop signal reaction times differed significantly between conditions of reactive inhibition and proactive control. Manipulations of conflict possessing demonstrated larger effects in theta than in other EEG frequency bands. Prediction of BOLD-responses from power fluctuations of EEG frequency bands on a trial-by-trial basis revealed a differential association of delta, theta and beta activity with functional networks known to be associated with conflict processing.

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