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Distinct patterns of proactive and reactive inhibition in the human motor system

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Abstract

Response inhibition—our ability to suppress actions—is achieved through coordinated reactive and proactive processes that may recruit different neurophysiological mechanisms. Here we adapted a two-step continuous performance task in which the decision to respond depends on a combination of an initial context cue and a subsequent target probe. Using transcranial magnetic stimulation (TMS), we mapped changes in corticospinal excitability and inhibition, providing indices of reactive and proactive processes that influence the state of the motor system in the lead-up to initiating or suppressing a response. We found distinct changes in corticospinal excitability at critical timepoints when participants were preparing in advance to inhibit a response (during the cue) and while inhibiting a response (during the probe). Motor system activity during early timepoints correlated with behavioural indices of proactive capacity and predicted whether participants would later successfully inhibit their response. Implications for theories of inhibitory control will be discussed.