The engagement of adaptive control is reflected in oscillatory neural dynamics in mediofrontal cortex

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Abstract

The mediofrontal cortex (MFC) is key to adaptive behavior. Across a variety of situations and paradigms, ranging from reinforcement learning to response conflict and post-error adjustment, the MFC recruits other brain regions to implement and fine-tune such adaptive behavior. Physiologically, these interactions may occur through local and long-range synchronized oscillation dynamics, particularly in the theta range (4-8 Hz). Here we report on time/frequency analysis of EEG data from a handful of studies in humans to demonstrate that the MFC-theta signature of such adjustments 1) differs between impulsive errors and attentional lapses, 2) differs between response conflict and stimulus conflict, 3) accurately reflects the temporal dynamics of response conflict, 4) accurately predicts successful learning from negative feedback, and 5) shows qualitative change with age. These patterns highlight the central role of MFC-theta oscillations in the neurobiological mechanisms underlying the engagement of adaptive control in response to endogenous and exogenous demands.

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