

# **Dissociating Proactive and Reactive Conflict in the Subthalamic Nucleus**

### Abstract

- The subthalamic nucleus (STN) contributes to adaptive control by temporarily preventing response execution, buying time for the best response to be selected.<sup>1</sup>
- This suggests two separable functions of the STN: increased activity to cues signaling potentially conflicting outcomes, and increased activity during motor response conflict.
- It was predicted that these specific functions would be revealed when: 1) a cue indicates slowing or inhibition is needed and 2) when actions compete for execution.
- Greater STN activity to both 1) proactive signals of upcoming conflict and 2) reactive signals of stimulus-response conflict was observed.
- These findings implicate the role of the STN in both cognitive and motor conflict, and identify a potential mechanism for conflictinstantiated cognitive control.



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Delta/theta increases for informative and imperative cues and responses at depth electrodes and Cz, replicating previous findings.<sup>1</sup>

Beta suppression found throughout.



### **Condition Differences in Time-Frequency Power**

Informative Cues (Proactive signals) : Delta/theta increases in dorsal and middle electrode and high frequency (alpha/beta) increases in all depth electrodes; delta/theta increases at Cz.

Imperative Cues (Reactive signals): Theta increases at middle and dorsal electrodes, delta increases at ventral electrodes. Response (Reactive signals): Delta/theta increases at middle electrode; alpha

increases at ventral electrode.



The mPFC is thought to facilitate deliberate control over behavior, in part via a "hyperdirect" pathway with the STN. <sup>2,3</sup>

Differential activity in the STN was observed for proactive conflict and reactive conflict.

> An increase in low frequency activity in the STN was observed when a cue indicated inhibition or slowing was needed. This provides evidence for a proactive role for the STN in behavioral control.

Increased activity in the theta range for imperative cues, and in the low frequency during responses, replicated previous findings of <u>reactive control</u> due to response conflict in the STN.<sup>4</sup>

This finding provides evidence for a neural network by which mPFCregistered conflict can implement cognitive control by raising the response threshold for basal ganglia output via the STN.

These findings support the notion that the mPFC-STN conflict-control system may be instantiated via communication in low frequency bands.<sup>4</sup>

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### Discussion

### <u>References</u>