A Gamified Go/No-Go Paradigm Replicates Behavioral and Neural Signatures of Inhibitory Control in Neurosurgical Patients

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The go/no-go (GNG) task is a well-known paradigm for studying reactive inhibition. While traditional GNG tasks use repetitive presentations of letters or other visual stimuli, there is an inherent disconnect between standard laboratory assessments and the application of inhibitory control in naturalistic, real-life scenarios. In this study, a gamified GNG was developed to bridge the gap. Ten neurosurgical patients undergoing intracranial sEEG monitoring were recruited (3 males, 20 to 68 years old). Single-unit neural activity was obtained through Behnke-Fried probes. Behavioral results demonstrated that the task successfully replicated key behavioral patterns seen in traditional paradigms, including faster reaction times for false alarms than for go-correct trials ($p = .001$), post-error slowing ($p = .03$), and slowing responses with increasing difficulty ($p < .001$). Single-unit recordings revealed diverse firing patterns, with neurons showing selectivity for trial type and temporal dynamics. Neuronal state-space analysis of orbitofrontal cortex (OFC) units (93 units across 7 patients) showed condition-dependent trajectories that diverged between go and no-go trials ($p < .05$), aligning with existing evidence that OFC represents task states relevant for inhibitory demands. These findings validate the use of this novel task to investigate inhibitory control more naturalistically across difficulty levels and in association with different action values. Future work includes (1) extending the preliminary findings by analyzing data from a larger cohort of patients and across multiple brain regions; (2) testing for the effect of other task variables (difficulty, lives remaining, etc.); (3) performing within-participants comparisons of gamified and traditional GNG signatures.

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