Goal-Directed Temporal Modulation of Probabilistic Decision-Making: The Roles of the VMPFC and Hippocampus

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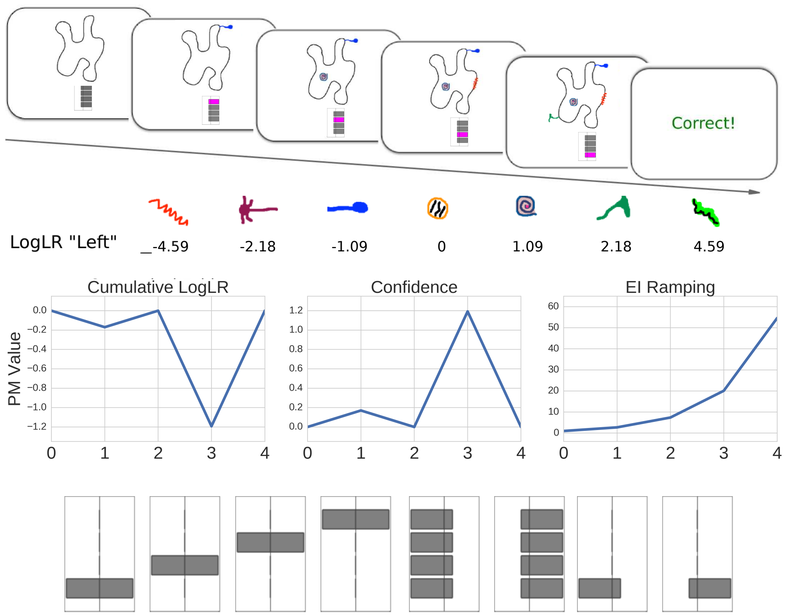
Introduction

- In real-world environments, decision-makers must often integrate behaviorally-relevant sensory information over time and across information sources of varying reliability.
- To capitalize on transient opportunities for reward, they must also use this information in ways that are contextually-appropriate.

Experimental Paradigm



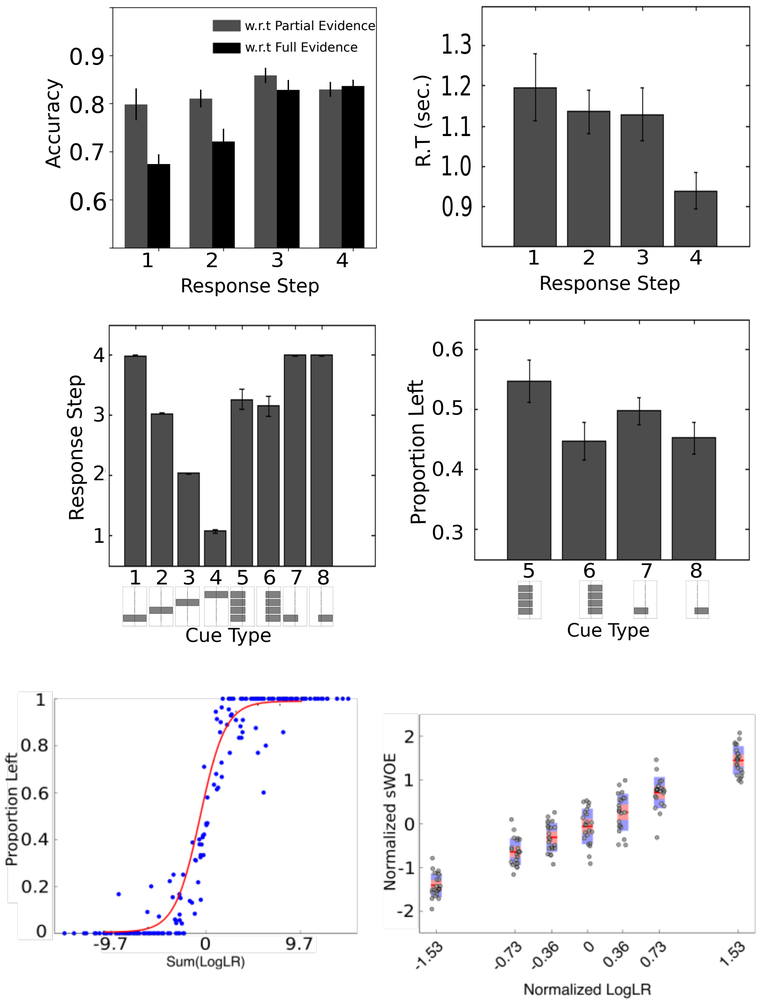
Decision Evidence

$$CmLogLR_{(step4)} = log\frac{P(Left|F_1,F_2,F_3,F_4)}{P(Right|F_1,F_2,F_3,F_4)} = \sum_{i=1}^{4} w_i$$

Probabilistic Reward

$$P(Left|F_1,F_2,F_3,F_4) = \frac{e^{\sum_{i=1}^{4} w_i}}{1+e^{\sum_{i=1}^{4} w_i}}$$

Behavioral Results

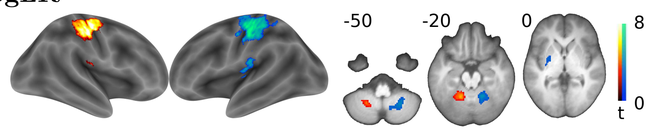


Behavioral Results Summary

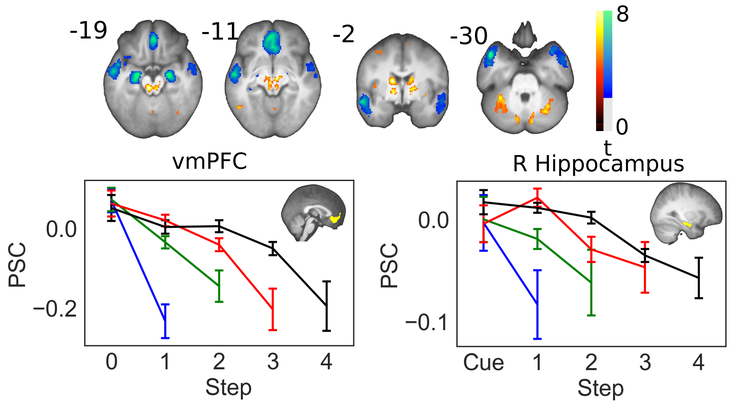
- Reward availability strongly influenced decisions about *when* to decide
- Attentional weights closely matched those of the probabilistic environment
- Both **Confidence** and **Steps-Until-Reward** influenced reaction time

Neuroimaging Results

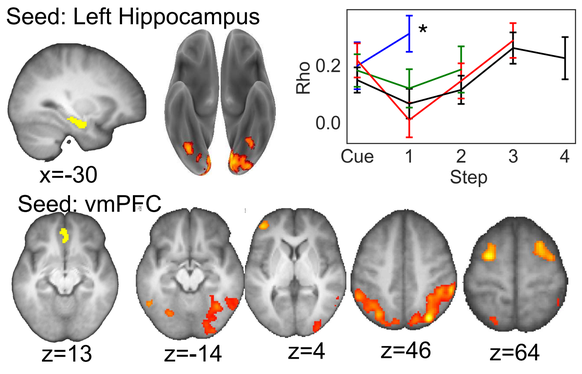
CmLogLR



Evidence-Independent Signals



Beta-Series Correlation



Summary

- The vmPFC, aHPC, dopaminergic midbrain and SMA (not shown) were strongly sensitive to Steps-Until-Response rather than Step.
- The vmPFC and aHPC increased connectivity with occipitotemporal cortex during deliberation. VMPFC additionally increased connectivity with IPS and MFG.
- MVPA: vmPFC represents CmLogLR