Session 081 - Neural Networks for Executive Functioning

Add To Itinerary

81.03 / DDD8 - Cortico-hippocampal contribution to the generation of contextual information

November 12, 2016, 1:00 - 5:00 PM

Halls B-H

Presenter at Poster

Sat, Nov. 12, 2016, 3:00 PM - 4:00 PM

Authors

***S. BERNARDI**[1,3], J. MUNUERA[2], M. RIGOTTI[4], S. FUSI[2], D. SALZMAN[2,2,3];
[1]Psychiatry, [2]Neurosci., Columbia Univ., New York, NY; [3]Psychiatry, New York State Psychiatric Inst., New York, NY; [4]IBM T.J. Watson Res. Ctr., Yorktown Heights, NY

Disclosures

S. Bernardi: A. Employment/Salary (full or part-time):; NIMH T32. B. Contracted Research/Research Grant (principal investigator for a drug study, collaborator or consultant and pending and current grants). If you are a PI for a drug study, report that research relationship even if those funds come to an institution.; American Psychiatric Association. **J. Munuera:** None. **M. Rigotti:** None. **S. Fusi:** None. **D. Salzman:** B. Contracted Research/Research Grant (principal investigator for a drug study, collaborator or consultant and pending and current grants). If you are a PI for a drug study, report that research relationship even if those funds come to an institution.; NIMH R01-MH082017, Gatsby Foundation, Swartz Foundation, Fyssen Foundation.

Abstract

Identical stimuli often produce different outcomes (and thereby different emotional responses) depending upon the context in which they are encountered. One mechanism the brain employs to infer chances of reward or punishment and to regulate emotional responses is to abstract 'cognitive contextual structures'. These contexts can be described as the set of circumstances that help us derive situationally informed meaning from the world. Previous studies have established the importance of the prefrontal cortex (PFC) in rule-guided behavior, and recent studies have shown that the amygdala, a brain structure long thought of as a key mediator of emotion, along with the PFC, also represents abstract contextual information. In particular, Saez et al. (2015) showed that the amygdala, ACC and OFC all represent abstract contexts defined by task sets; a task set is the set of CS-US contingencies in effect within a block of trials. The formation of a neural representation of task set may be created if neural signals providing a memory of a previous trial converge with neural signals representing the current trial. Thus neural signals providing information about the previous trial may be conceptualized as a providing a vital input to the formation of a representation of task set. We sought to determine whether the hippocampus (HPC) or dorsolateral prefrontal cortex (DLPFC) might provide this input by encoding the episodic memory of the previous trial. Alternatively, HPC and DLPFC might explicitly already represent task sets. We have been obtaining simultaneous electrophysiological recording from neurons in the HPC, the ACC and the DLPFC while two rhesus monkeys utilize knowledge of task sets to select an action that maximizes reward rate upon viewing an image. Using a linear decoder, we have observed that all task-relevant variables, including stimulus identity, context, planned operant action, and expected reinforcement may be decoded in each area. However, context could in principle be decoded if neural signals merely reflect a memory trace of the previous trial, since each trial type appears in only one context. We are therefore determining whether the decoding of context derives from signals that represent memory traces, a function long associated with the HPC. Alternatively, neural representations in

these areas could reflect the linked trials within a task set. Assuming that neural representations of context truly reflect task sets, and not merely memory traces, a critical question concerns the extent to which these representations are created in a parallel or serial manner across brain structures that include HPC, DLPFC, ACC, OFC, and the amygdala.