Cognitive Science
UC San Diego

Laura Shelley's Dissertation Defense

Parietal and Hippocampal Representations of Complex Spatial Paradigms

Monday, November 28th
2:00pm – 4:00pm
Cognitive Science Building, Room 003

Abstract

In the following experiments, we sought to examine posterior parietal and hippocampal mapping of complex environments and spatial tasks. Experiment 1 found PPC population activity represented location, locomotor action, and progress through a trajectory, and that PPC and HPC's scale of representation followed the action being performed during traversal of a three-dimensional squared spiral track with stairs, ramps, and corners.

Experiment 2 found that animals could learn to apply a behavioral rule where the correct choice varies depending on which half of the room the choice point is located. All animals could perform at well-above chance levels, and their performance transferred to novel locations. Although overall significantly above chance, accuracy was somewhat decreased on the first trial of a block, possibly due to increased difficulty of the task on each trial 1 where the track was placed in a new location for a set of trials.

Using the paradigm from Experiment 2, Experiment 3 found that PPC and HPC firing patterns remained anchored with the maze itself across environmental locations, as opposed to differentiating the different room locations in their firing. Furthermore, HPC and PPC firing patterns did not discriminate the upcoming turn choice beyond what could be attributed to differences in the animal's speed and orientation. We propose a model for how the task can be solved at different track locations via a conjunction of HPC-on-track mapping and the differing visual cues at each track location. Lastly, Experiment 3 found that HPC firing differentiated the first trial of a block compared to subsequent trials at a particular location, characterized by overall increased rates and a backward-shift in field location. Such differentiation was consistent with the decreased behavioral accuracy on first trials.

Such studies investigating HPC and PPC representation in complex, abstract paradigms reveal the noteworthy forms by which these two networks work in conjunction to map position and action within allocentric and egocentric frameworks. Such dynamic mapping by these and other related structures can give rise to complex and abstract cognitive phenomena bridging behavior and neural activity into a cohesive experience of an event.

Committee members:

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