Alex Johnson's

DISSERTATION DEFENSE

Equivalence in Equivalent Places:
Considering Similar Spaces in Neural Representations and Behavior

Abstract:

Space is ubiquitous in nearly every experience we have. The mammalian nervous system has evolved a network of distributed brain regions important for the perception of space, and for planning navigational behaviors. Many functional cell types have been described throughout this system: 'place cells' discovered in the CA1 subregion of the hippocampus; 'head-direction cells' discovered in the postsubiculum, retrosplenial cortex, thalamus, and elsewhere; boundary vector cells discovered in the subiculum (SUB); and neurons in several cortical regions, including posterior parietal cortex (PPC), that can have their activity described by certain types of movements such turning left or turning right. These findings in rats, have all placed attention on how the nervous system encodes specific features of space. More recent studies have shown structured environments can drastically influence the activity profiles of neurons.

This dissertation involves studies that utilize a triple-T maze, alongside a working memory find-all task, to elicit novel activity from three brain regions and to allow for novel navigational behaviors to be described. Chapter 2 compares both individual and population-level CA1 neuron activity to one of its major efferents, the SUB. Chapter 3 looks at PPC neuron data to assess the effects of self-motion on individual activity profiles recorded across the different spatially defined routes of the maze. Chapter 4 details specific navigational behaviors animals utilize as they navigate the triple-T maze during a working memory task. The results from all of these studies highlight the importance of utilizing sufficiently complex structures when studying spatial navigation. Based on these findings I make recommendations for future research into how different structures influence known activity patterns throughout the spatial navigation system.

ALEX JOHNSON
TO DEFEND

TUESDAY
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AT 9:30 AM

VIA ZOOM

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