Ventral hippocampus inactivation impairs goal-directed spatial navigation in obstacle-laden environments


1. Department of Psychology, University of Arizona 2. Department of Computer Science and Engineering, University of South Florida

**Introduction**

It is generally believed that dorsal, but not ventral hippocampus supports spatial learning and that ventral, but not dorsal hippocampus is involved in emotional and motivational processes (1).

- Spatial scale representation increases along the dorso-ventral axis of the hippocampus (2).
- Modeling studies have suggested ways in which information can be processed along the dorso-ventral axis and used for spatial navigation (2,8,24).
- We hypothesized that the dorsal and ventral levels of the hippocampus are differentially involved in trajectory planning and memory-guided decision-making in complex spatial tasks.
- We used a learning task in which animals memorize the location of a set of rewarded heaters, and recall these locations in the presence of small or large obstacles.

**2. Methods**

**Animals**
- Male rats, 7 for each condition.
- Male and female in dorsal or ventral hippocampus.

**Behavioral Apparatus**
- Each trial took place in a circular arena containing two walls.
- A large obstacle, whose dimensions were limited to the area.
- Obstacles, Large Blocks.

**Hippocampus Inactivation**
- Hippocampus inactivation was achieved by injecting 1,700-1,500 microliter of the solution to the contralateral hippocampus.

**Daily Experimental Protocol**
- Rat 1
- Rat 2
- Saline injection
- Rat 1
- Rat 2

**Computational Modeling**

**Actor Critic**
- DH
- VH
- NA

**3. Behavioral performance (recall without obstacles)**

**4. HP inactivation did not produce any motor impairment**

**5. Dorsal and Ventral Hippocampal inactivation impaired spatial performance in complex environments**

**6. Computational model**

**7. Conclusions**

- Our reinforcement learning model of navigation showed that the inactivation of both ventral and dorsal hippocampus can impair navigation in the presence of small obstacles while select conditions suggest that ventral hippocampus interferes with navigational performance while the effect is only modestly involved in navigation with large obstacles.
- Future work will involve electrical/behavioural recording in VH and DH under the conditions of the recall as a matter of fact presented with realistic and noisy navigational challenges.

**References**


**Supported by NSF Grants 1117303 and 1117302**

**Acknowledgements**

Image credit: The authors.