



# Distinct patterns of hippocampal activity are associated with spatial memory and color memory



MAP Lab

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## Introduction

- Activity in the hippocampus has been associated with source memory across a wide variety of stimulus and source types. As such, hippocampal involvement during source memory is thought to be domain-general (Davachi, 2006; Duarte et al., 2011; Staresina et al., 2011; Kafkas et al., 2017)
- However, it is unknown whether different types of source information are differentially processed in the hippocampus
- The current fMRI study utilized two different source memory tasks to determine if retrieval activity in the hippocampus differed for two types of visual source information: spatial location and background color

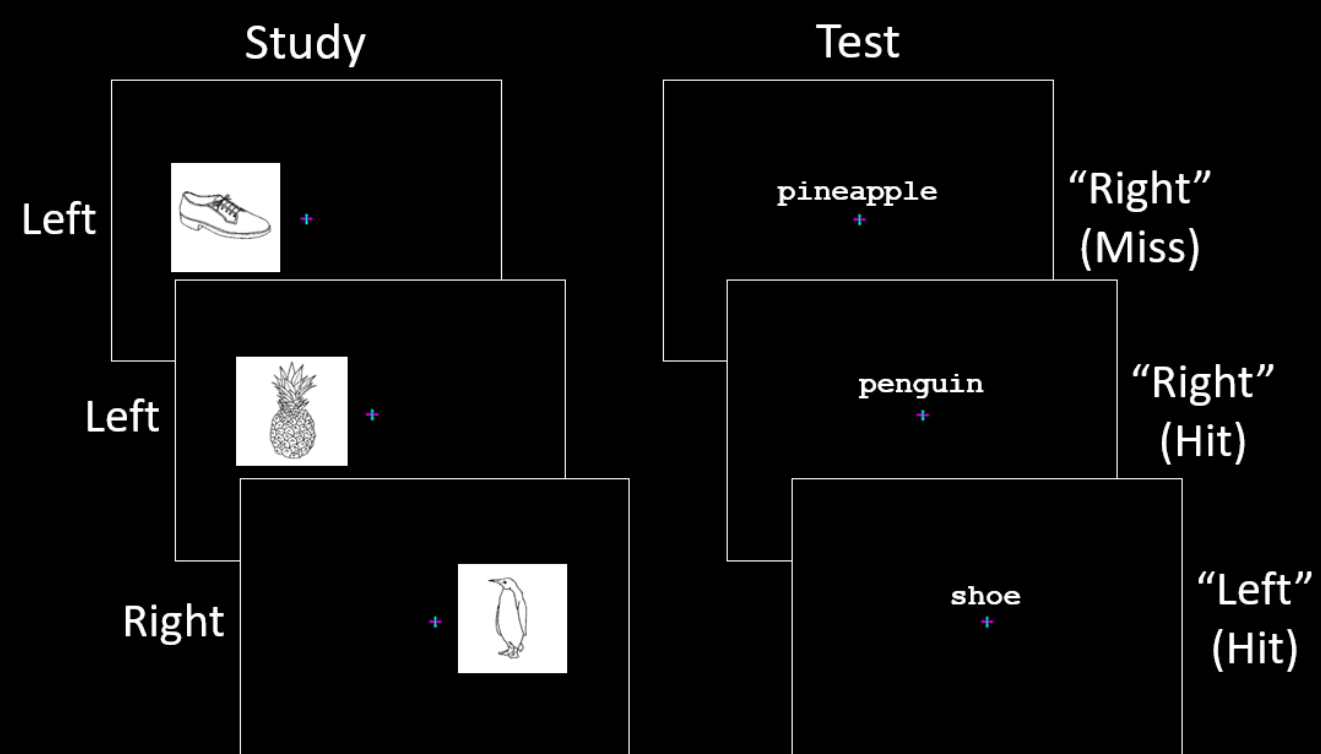
## Methods

- Participants (n = 17) completed three runs of a color memory task and three runs of a spatial memory task

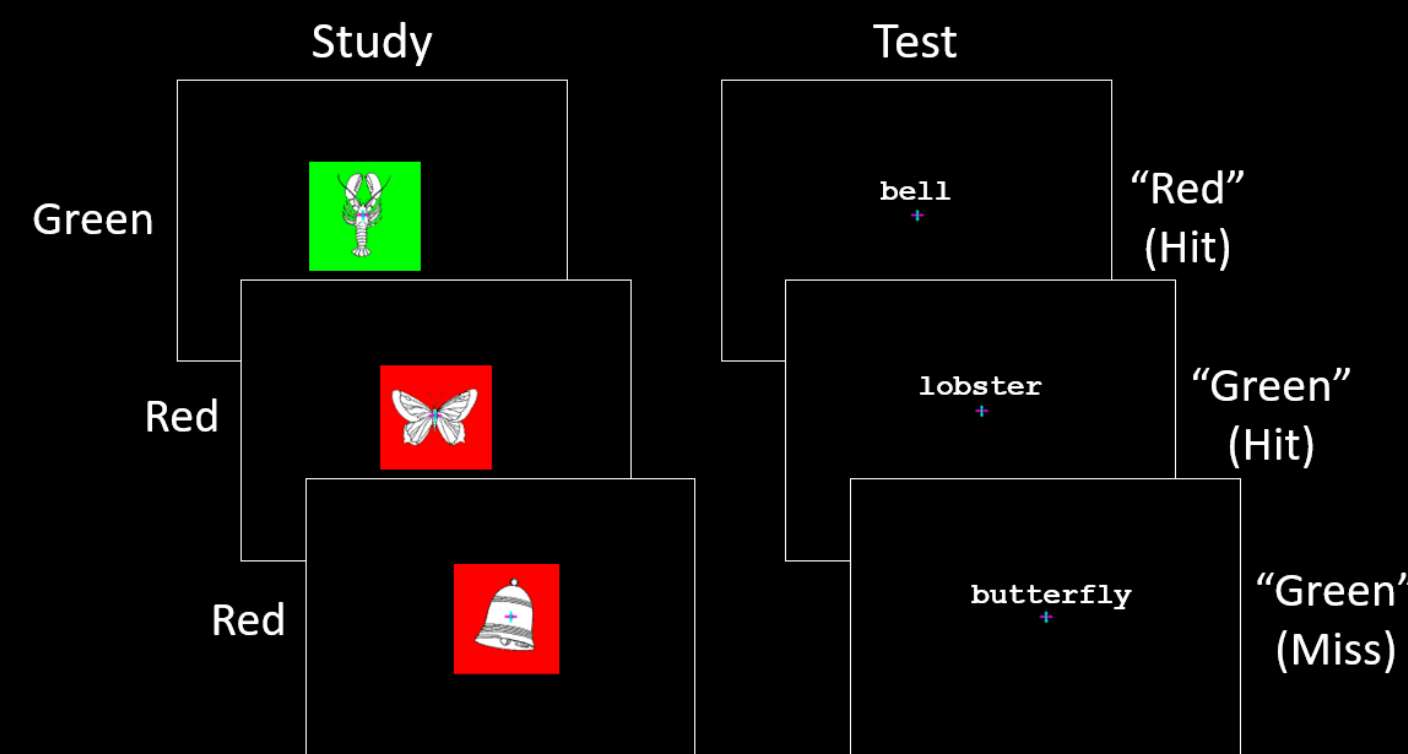
### Memory Paradigm

- Study phase: 32 line drawings were presented to either the left or right of fixation during the spatial memory task, or on either a red or green background during the color memory task
- Test phase: 48 nouns were presented in the center of the screen and participants classified each item as old and previously on the “left”/on a “green” background, old and previously on the “right”/on a “red” background, or “new”

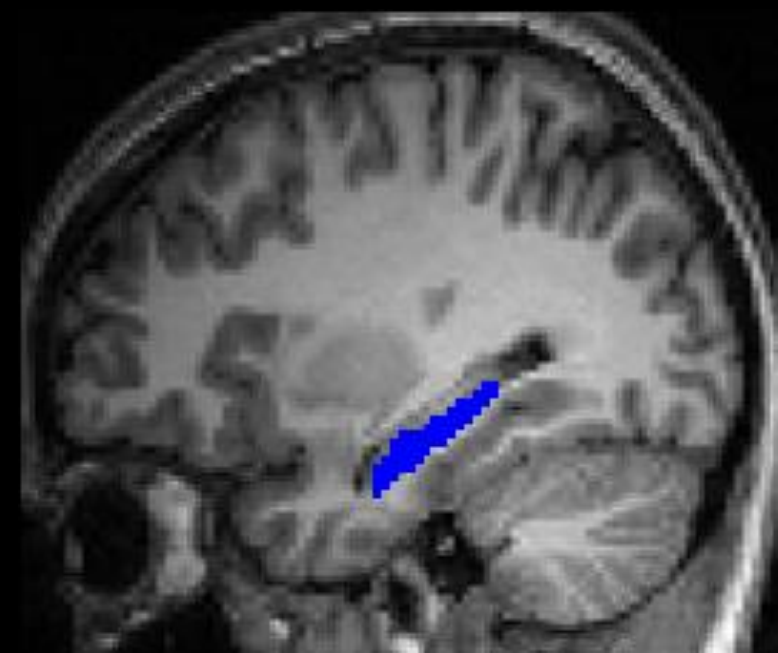
#### Spatial Memory Runs



#### Color Memory Runs



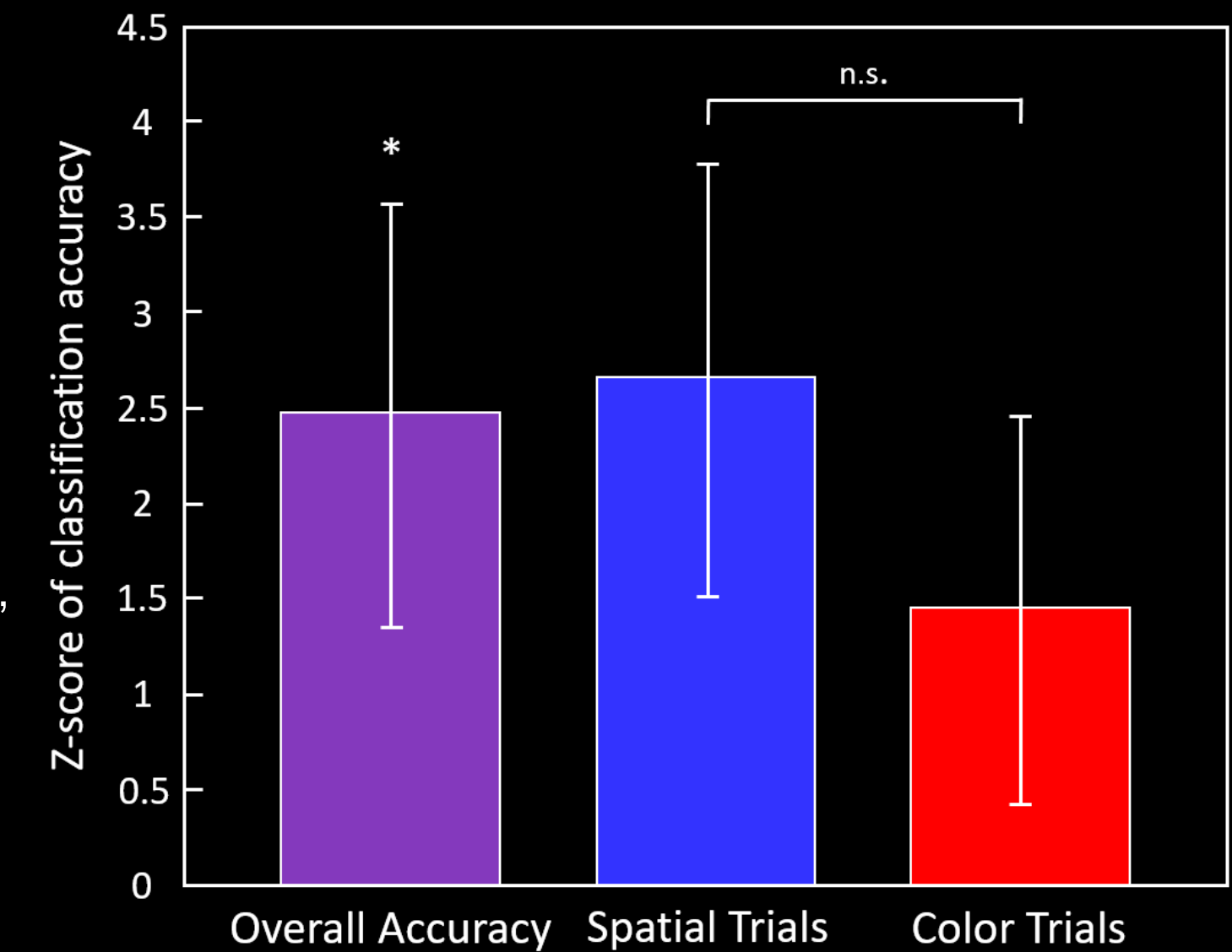
### Multi-Voxel Pattern Analysis



- Classification was implemented using a logistic regression classifier from the Princeton MVPA toolbox and individual trial retrieval activity in the hippocampus
- The hippocampal region of interest (shown to the right in blue at x = 32) was defined anatomically for each participant
- The memory task with the larger number of hit trials was randomly subsampled 100 times to ensure both memory tasks had an equal number of trials during cross-validation. Participants’ average accuracies were then z-scored by subtracting 50% (chance accuracy) and dividing by the standard deviation of accuracy across the 100 iterations

## Results

- Classification accuracy was significantly greater than chance (54.7%, z-scored accuracy = 2.46, chance = 50%,  $t(16) = 2.20$ ,  $p < .05$ )
- There was no significant difference between the average classification accuracies of color trials and spatial trials ( $t(16) = 1.05$ ,  $p = .31$ ), indicating that both trial types could be similarly classified
- To ensure that the classifier was not biased and 50% was an accurate estimate of chance accuracy, 10,000 iterations of a null classification simulation were conducted by scrambling the trial labels before cross-validation, which produced an average classification accuracy of 50.02% (standard deviation = 0.09%)



## Discussion

- Above-chance classification accuracy indicates that different types of source information are represented by distinct patterns of activity in the hippocampus
- A general linear model analysis did not reveal any hippocampal activity that differed between accurate spatial memory and accurate color memory. These null results, in contrast to the current MVPA results, indicate that different types of source information may be differentially represented in distributed patterns of hippocampal activity rather than preferentially processed by distinct regions of the hippocampus
- These results are in line with two previous studies that found both distinct and overlapping hippocampal activity associated with spatial and temporal source information (Ekstrom et al., 2011; Deuker et al., 2016). Whether differential hippocampal activity would be found for different types of nonspatial source memory is a topic of future research

## References

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