# How distributed are short-term memory representations of visual motion?

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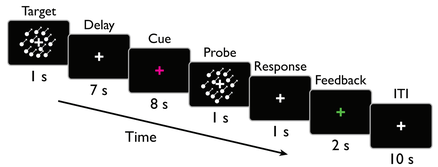
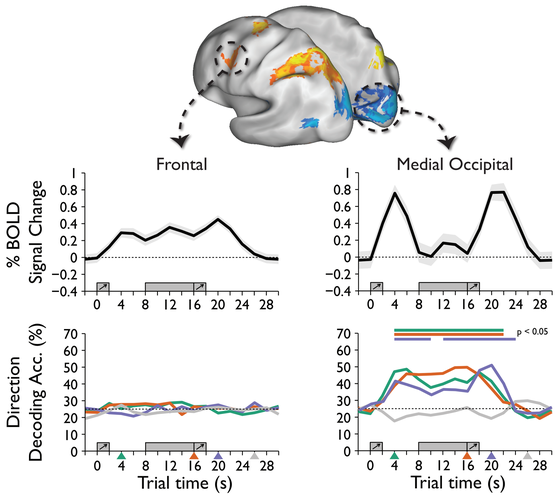
## Introduction

We have recently demonstrated successful decoding of stimulus-specific patterns of BOLD activity throughout the delay period of a delayed-recognition task for visual motion (Riggall & Postle, 2012).



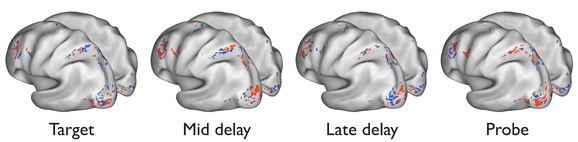

Stimulus-specific information was decodable only from posterior visual regions and NOT from frontal and parietal areas that showed sustained, elevated BOLD activity during the delay-period.




Inspection of the "importance maps" from feature-selected whole-brain decoding revealed two results that appear at odds with these findings:

"Important" voxels appear in frontoparietal regions

"Important" voxels change timepoint to timepoint.




The current work sought to resolve these paradoxical results and answer two questions about the nature of visual STM representations:

**Q1: How spatially distributed are these representations?**

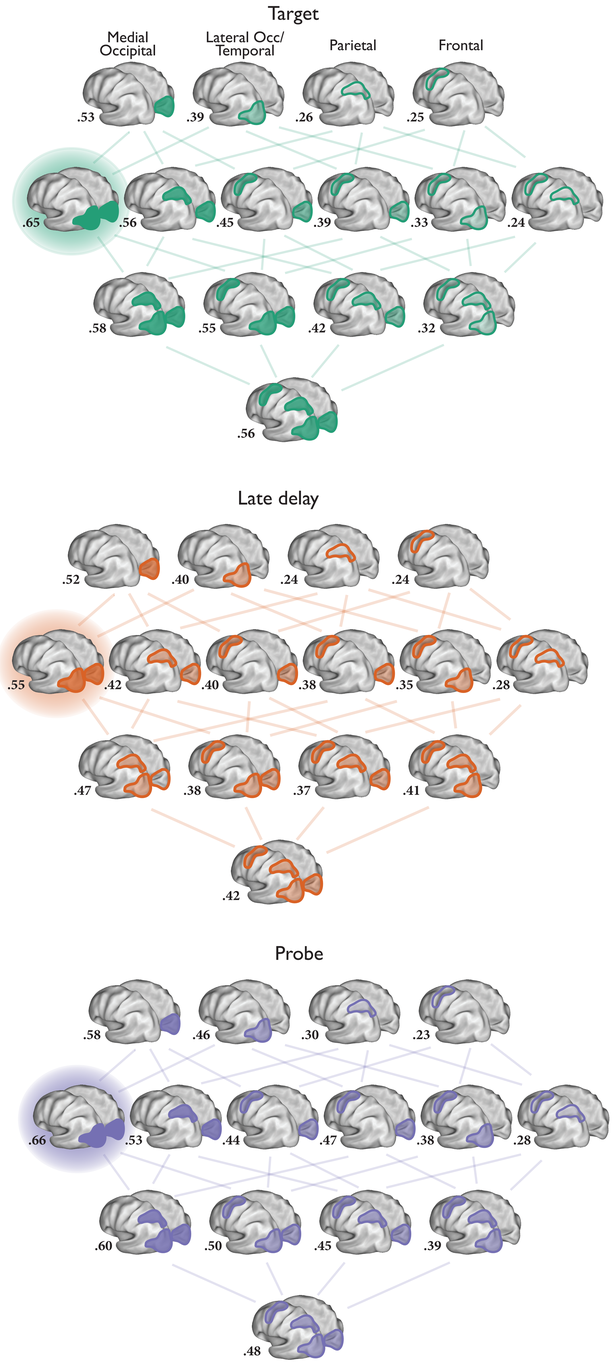
**Q2: How temporally stable are these representations?**

## Decoding Approach

Classification with *L2*-regularized logistic regression (λ = 25)
Leave-one-trial-out cross-validation (91 trials)
Train on single trial timepoint, test on all trial timepoints

## Q1 Results: Spatial distribution of representations

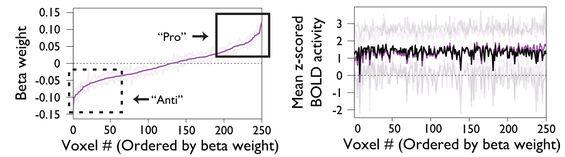
Approach: Compute decoding performance for all possible combinations of ROIs, isolate best performing combination



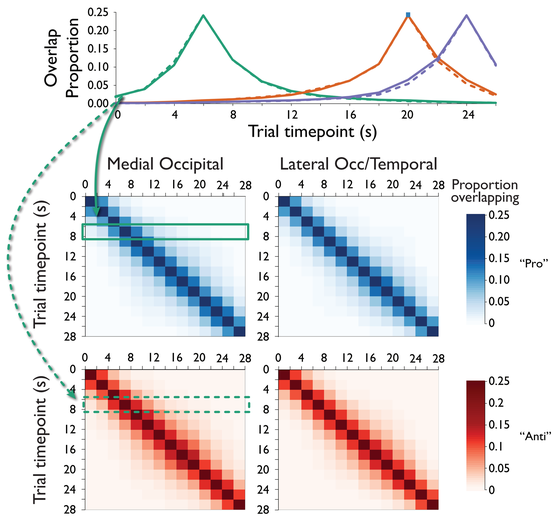

## Q2 Results: Temporal stability of representations

Approach: Extract "important" voxels and compare how much they overlap with the "important" voxels from other timepoints

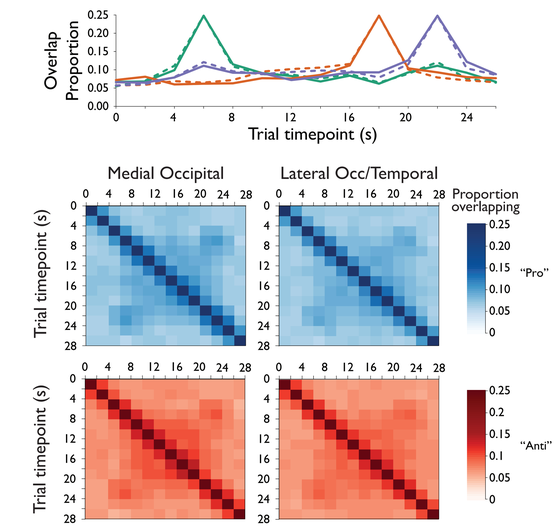
1. Extract top 25% most "important" voxels




2. Compute continuous overlap of "important" voxels

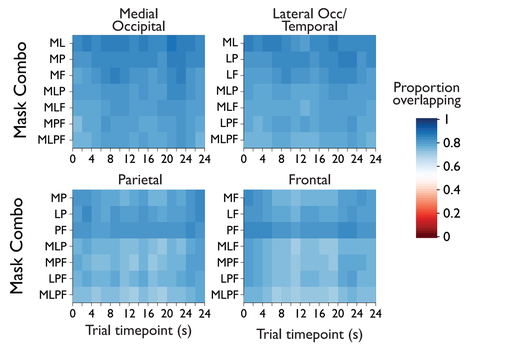



3. Compute any overlap of "important" voxels

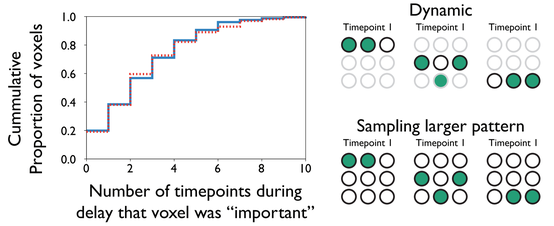



## Results: Stability of patterns when combining ROIs

Approach: Compare the overlap of the important voxels in an individual ROI with the important voxels in that same ROI when it is combined with other ROIs




## Future: Dynamic pattern or sampling larger stable pattern?




## Conclusions

The patterns that support decoding of visual motion memory representations are spatially confined to posterior visual regions

These patterns appear to be temporally dynamic, but future work will be required to further determine the details of these dynamics

Distributed decoding approaches provide valuable insight into the neural representations used for short-term storage

## References

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Emrich, S. M., Riggall, A. C., LaRocque, J. J., & Postle, B. R. (2013). Distributed patterns of activity in sensory cortex reflect the precision of multiple items maintained in visual short-term memory. The Journal of Neuroscience, 33, 6516-6523.

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