Introduction

While often thought to require specialized cortical systems, particularly those in prefrontal cortex (PFC), recent research has shown working memory may arise through the coordinated recruitment of brain systems involved in sensory, representational, and action-related functions (Postle 2006).

Recent monkey work using a delayed-recognition task for motion direction suggests such a cortical network, with low-level sensory information represented in the middle temporal visual area (MT) and task-related representations appearing in PFC during the memory delay (Pasternak and Zaksas 2003, Zaksas and Pasternak 2006).

Behavioral Experiment

Delayed-recognition for visual motion task with mid-delay cue (n=20)
- Fully crossed design, with factors of cue (direction, speed), mask (congruent, incongruent), mask timing (pre-cue, post-cue) and probe validity (valid, invalid)
- Adaptive staircase adjusted threshold to achieve 75% performance

Timeseries Classification

Train for low-level sensory-based representation on patterns for sample stimuli (Test forward)

Train for high-level task-relevant representation on patterns just prior to test stimuli (Test bi-directionally)

Sensory-based representation decoding (n=3)

Task-relevant representation decoding (n=3)

ROI Timeseries

Motion Direction Decoded Timeseries (n=3)

Classifying Motion Direction

Classifying Motion Speed

Feedback

Sensory-based representation decoding (n=3)

Task-relevant representation decoding (n=3)

Summary

- We find evidence for the storage of visual motion information in PFC and posterior visual areas during long delay periods
- We can successfully decode the remembered direction, but not the speed, of visual motion
- These data suggest low-level visual features may be stored in early visual areas, with the representations being recoded into task-relevant representations in PFC in preparation for response