Frontoparietal contributions to visual working memory precision

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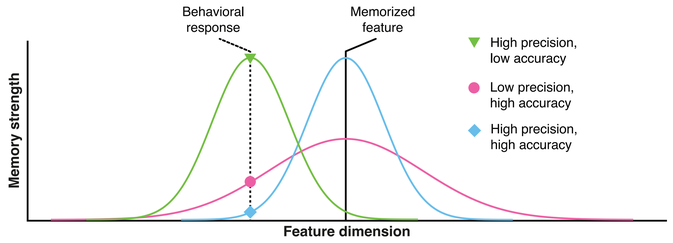
Background

- Constraints on visual working memory (VWM) limit not only the quantity, but the quality (i.e., precision) of items held in memory[1].
- VWM is thought to rely on top-down signals from frontoparietal cortex[2].

Does activity in frontoparietal regions modulate the precision of VWM representations?

- A challenge to answering this question is that traditional VWM tasks conflate precision and accuracy.



Approach: Use a novel task[3] that allows us to estimate trial-wise VWM precision and examine how frontoparietal activity varies with VWM precision.

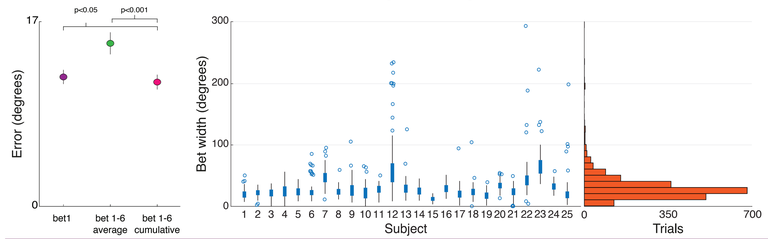
Highlights

Persistent delay period activity was primarily observed in frontoparietal regions, while evidence for VWM storage was evident mainly in visual cortex.

Activation in regions exhibiting delay period activity predicted trial-wise behavioral measures of VWM precision.

These result indicate that activity in frontoparietal cortex is related to the precision of VWM representations.

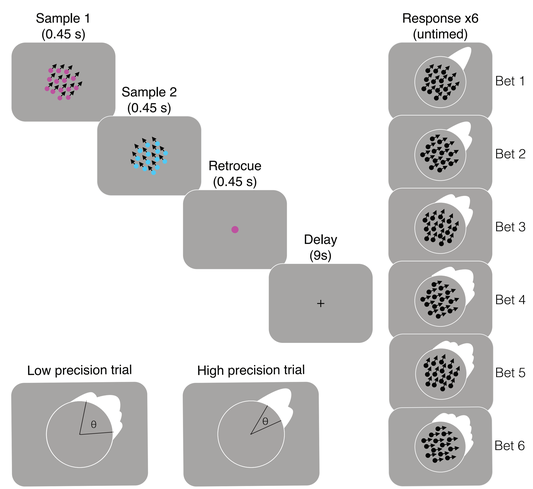
More information in multiple reports?



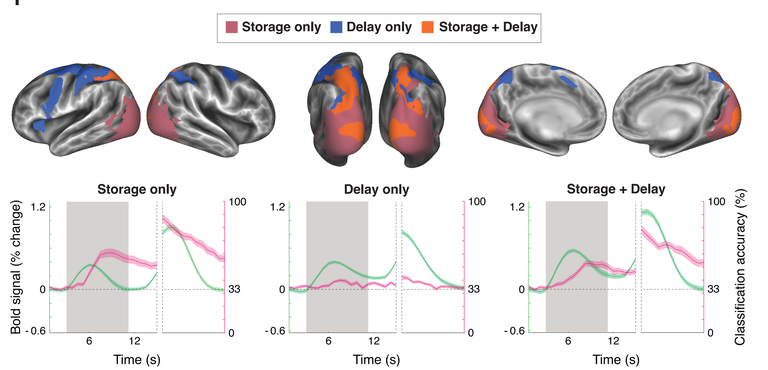
The average of 6 bets was more accurate (lower error) than the 1st bet or the average of the 6 bets' errors. Bet width varied within and across participants.

Trial-wise estimation of VWM precision

- 25 subjects
- BOLD signal measured during delay period
- Rather than 1 report per trial, subjects made 6 reports or *"bets"* on the target direction on a given trial
- Spread of bets (bet width) used as a proxy for trial-wise VWM precision



Overlap of storage- and delay-related activity in parietal cortex

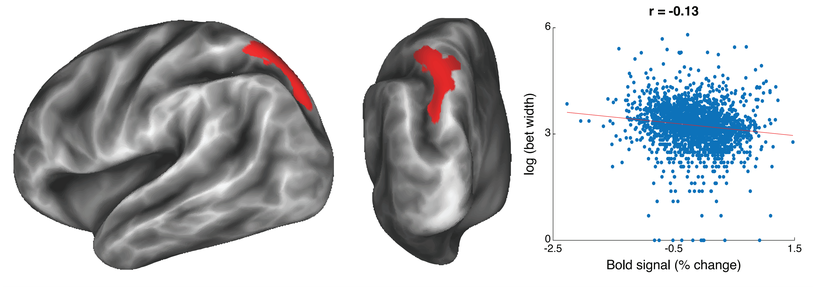


Consistent with previous results[4,5], frontoparietal areas exhibited delay activity, while parietal and visual regions showed evidence of VWM storage.

Which regions modulate VWM precision?

1. Wholebrain approach

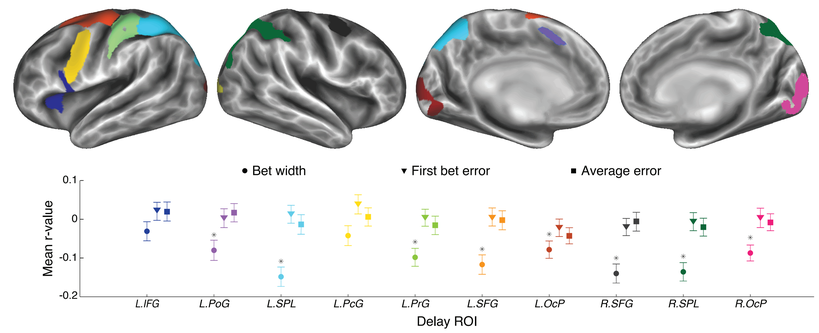
Trial-wise behavioral estimates of precision (bet width) were correlated with trial-wise estimates of delay magnitude in a whole brain across-subject correlation analysis[6].



A region in left posterior parietal cortex demonstrated a significant negative relationship between bet width and delay period activity.

2. Region-of-interest approach

We examined the relationship between bet width and delay magnitude in ROIs that exhibited significant delay activity.



The majority of ROIs that had significant delay period activity exhibited activity that was negatively correlated with bet width.

References

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[6] Zhou, Li, Zhou, Li & Cui (2018). Item-Wise Interindividual Brain-Behavior Correlation in Task Neuroimaging Analysis. Frontiers in Neuroscience, 12, 817.