Working Memory synchronizes oscillations within and across cortical areas

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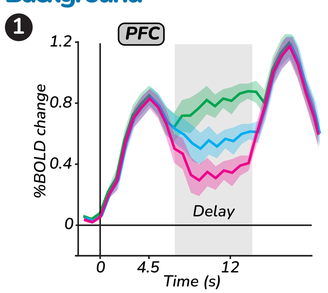
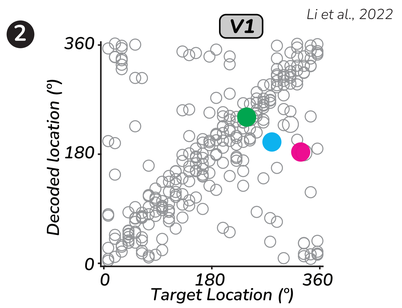
#MM2

Let's connect!

Background



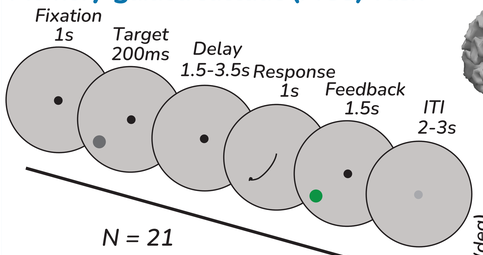


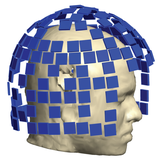
1. BOLD activity in PFC persists during WM delay
2. WM targets can precisely be decoded from activity patterns in V1
3. Amplitude of persistent activity in PFC predicts accuracy of WM decoding from V1

RESEARCH QUESTION

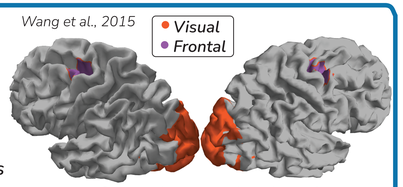
By what mechanisms does PFC modulate V1 to help maintain precise stimulus-specfic information in WM?

Memory-guided saccade (MGS) Task

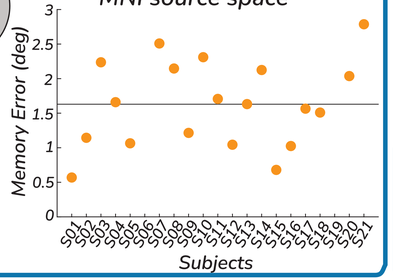




MEG 157 channels



8mm Isotropic Voxels
MNI source space

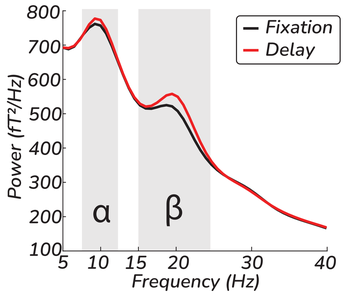


Highlights

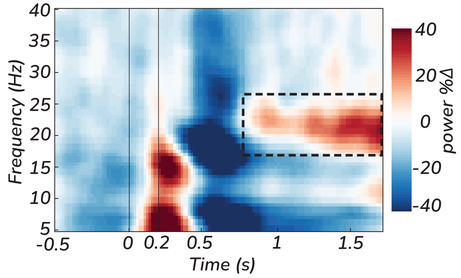
Oscillations in beta (β) band over visual cortex (VC):

1. Change in topographic patterns of power during WM delay
2. Contain item-level specific information about memoranda
3. Predict trial-wise memory behavior
4. Act as communication channel betwen PFC and VC

β power increases during WM delay



Visual sources ipsilateral to target exhibit selective increase in β power during WM delay period

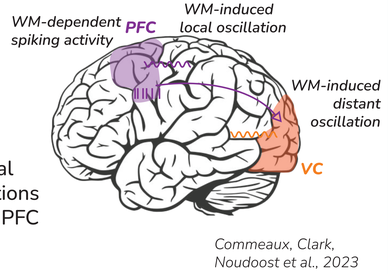


This increase in β power also persists during the delay

Summary and Conclusion

β-activity demonstrated several key hallmarks of WM (i.e, persistent enhancement, encoded stimulus information, predicted behavior)

Consistent with recent empirical and theoretical work, feedback signals in the form of β oscillations may coordinate WM representations between PFC and visual cortex



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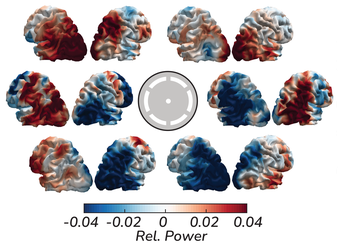
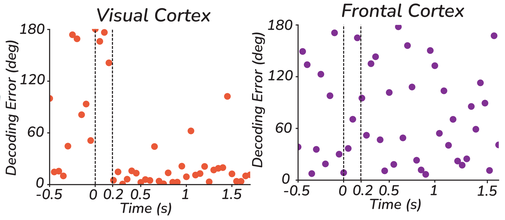
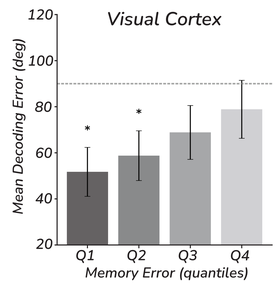
WM information encoded in Beta topography



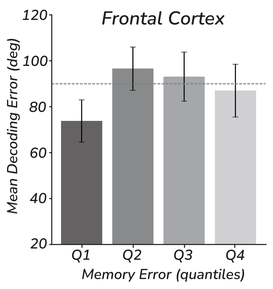
The topography of β power tracks target locations



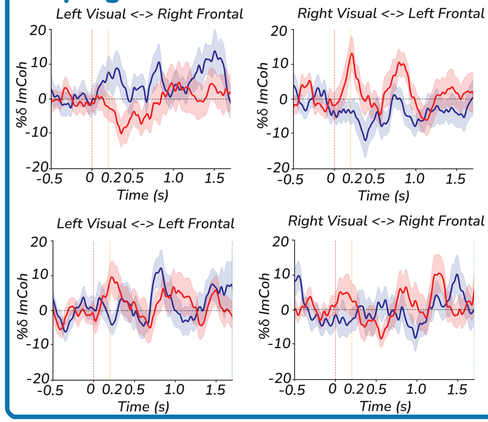
Memorized target locations can be decoded from β power in visual but not frontal sources



On trials when subjects made smaller memory errors, target locations could be decoded more precisely from the β power during WM delay from visual sources



Coupling between V1 & PFC in beta band



$$\mathrm{ImC}_{xy}(f) = \frac{\mathrm{Im}[G_{xy}(f)]}{\sqrt{G_{xx}(f)\ G_{yy}(f)}}$$

where, x(t) & y(t) are activity btwn sources
G_{xy} is cross-spectral density &
G_{xx} and G_{xy} are auto-sepctral densities

- Frontal and visual areas exhibit cross-hemispheric coupling in β band
- Coupling is stronger for ipsilateral targets wrt Visual hemisphere