

Transsaccadic object updating depends on visual working memory: An fNIRS study

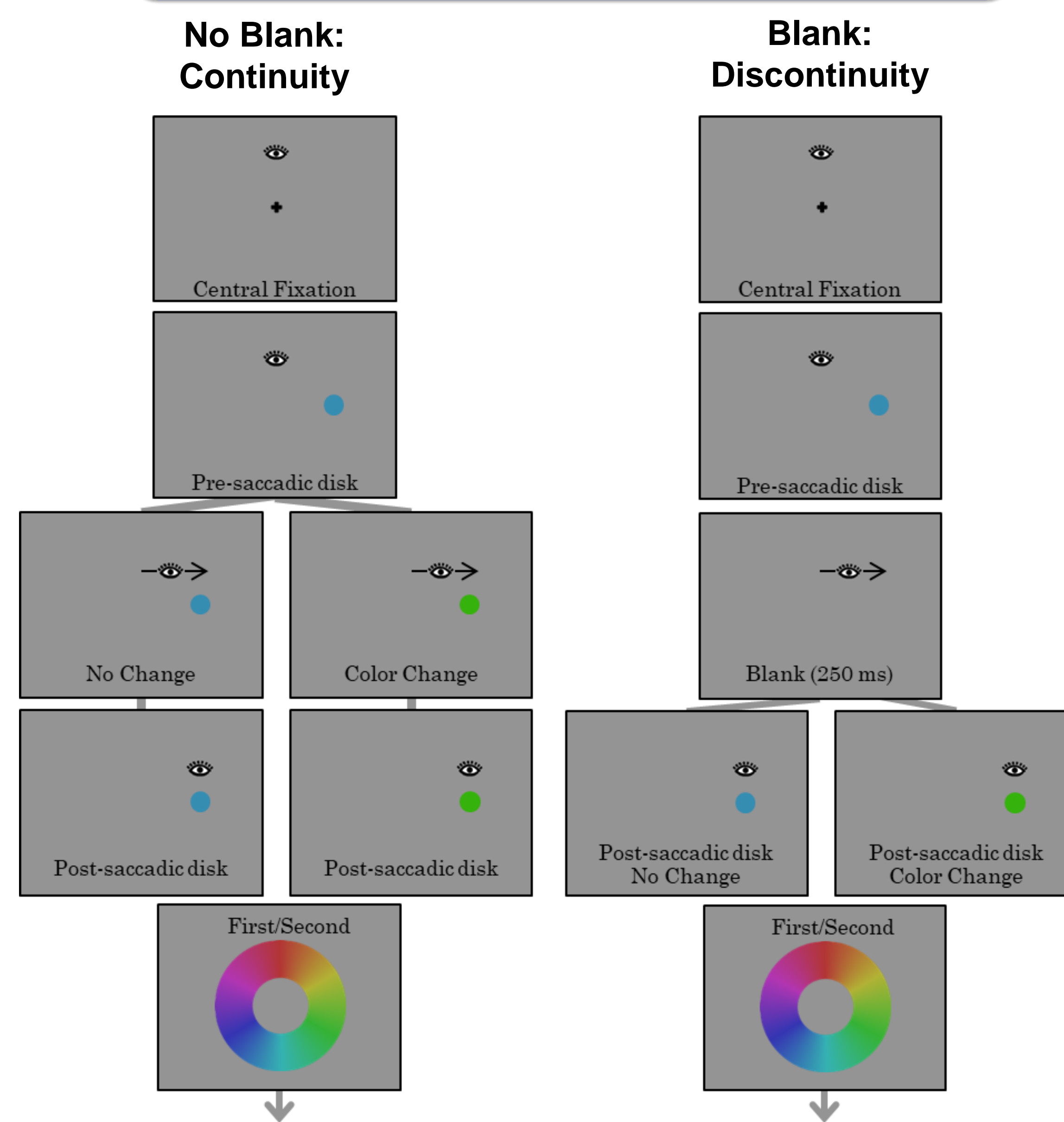
Research Question

Does transsaccadic perception engage visual working memory processes?

To perceive the world as stable, the visual system must integrate two representations of the saccade target (pre- and post-saccadic). We tested whether transsaccadic updating relies on visual working memory (VWM) processes.^{1,2}

Hypothesis: Transsaccadic updating will be associated with activation in posterior parietal cortex.³

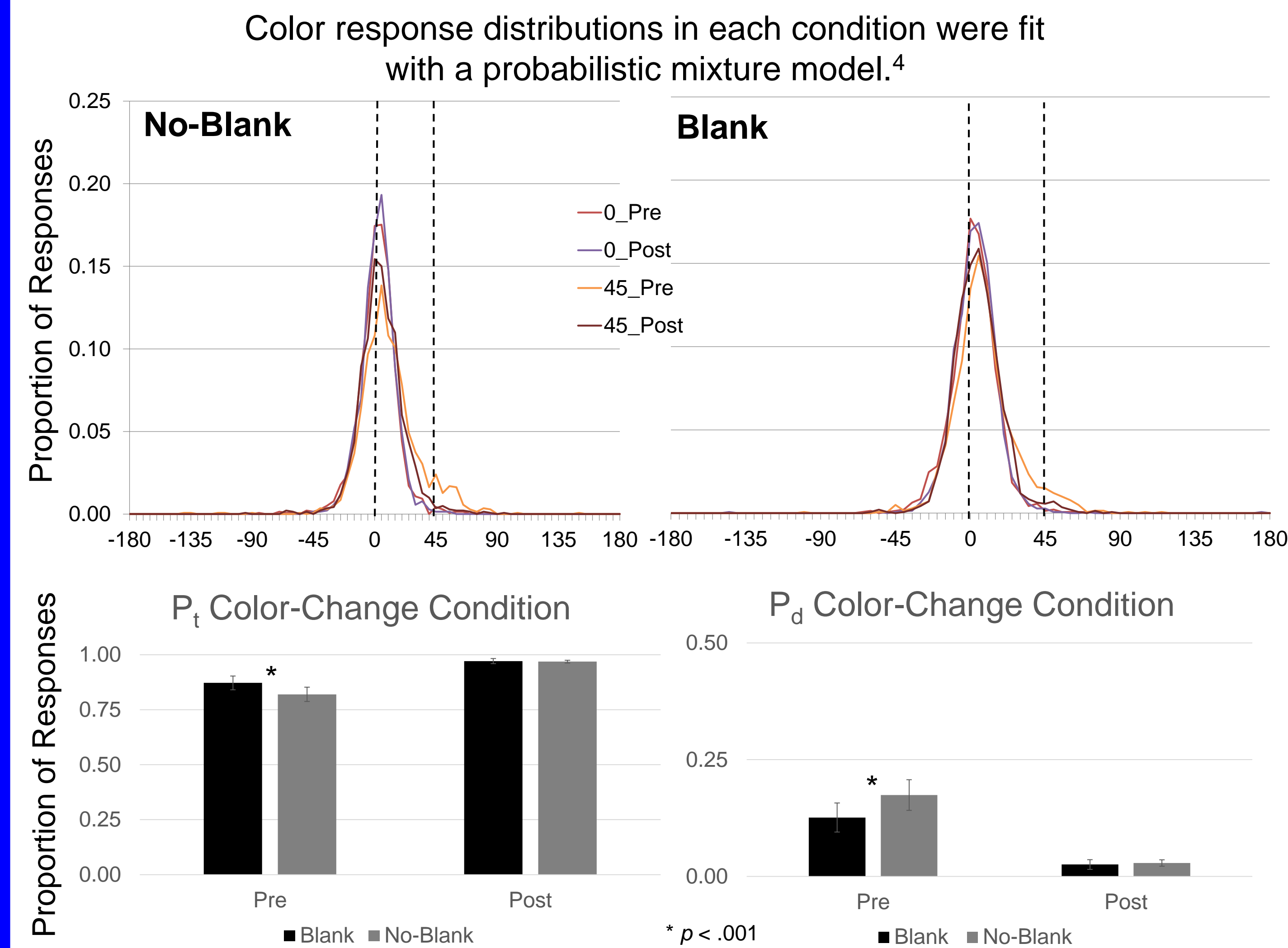
Method



fNIRS Method and Pre-processing

1. Probe digitization
2. Raw data converted to optical density and motion correction
3. GLM used to estimate beta coefficients
4. Generated brain surface model
5. Created group mask
6. Projected beta coefficients into group mask and ran group analyses with AFNI's 3dMVM

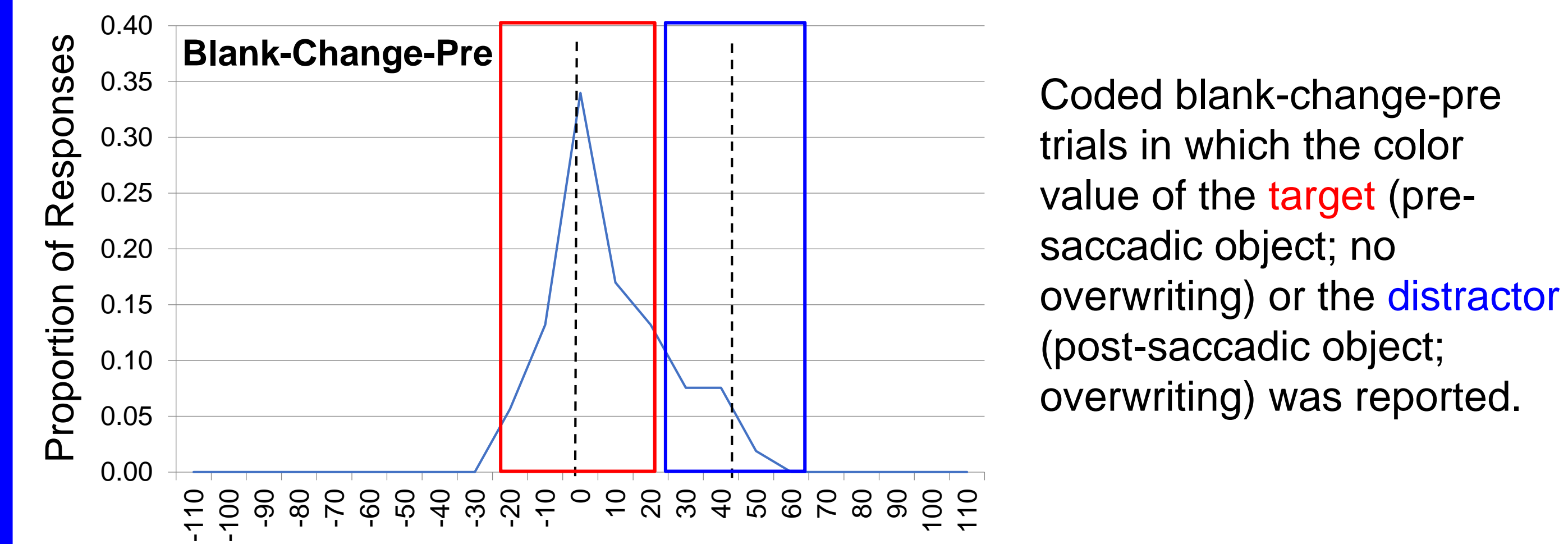
Behavioral Results



fNIRS Results

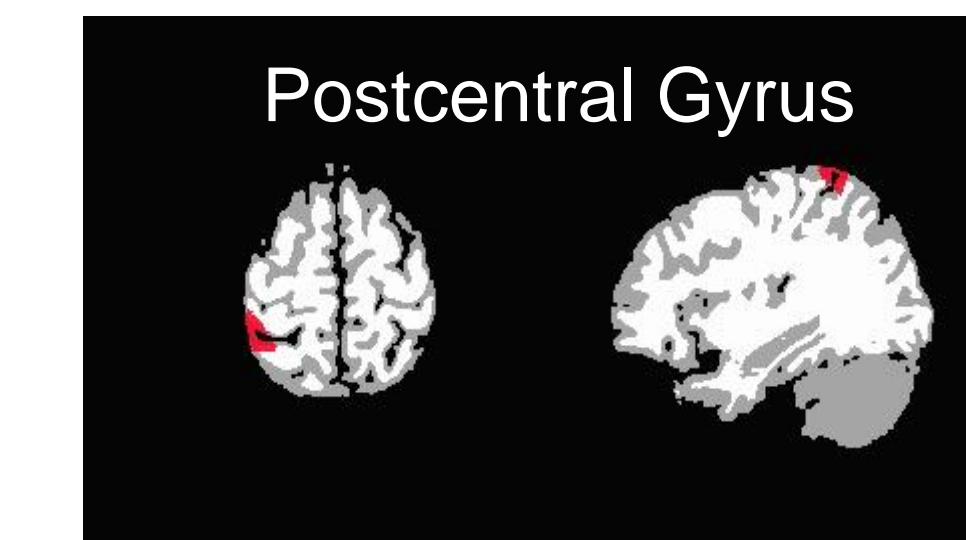
Effect	Region	Hemisphere	MNI			Volume (mL)
			X	Y	Z	
Oxy x Report	Postcentral Gyrus	L	-37	-44	66	3400
	Angular Gyrus	R	38	-65	54	2936
Oxy x Blank x Report	Angular Gyrus	R	40	-64	53	3616
Oxy x Blank x Change x Report	Superior Parietal Lobule	R	39	-62	54	1560

Response Type Analyses



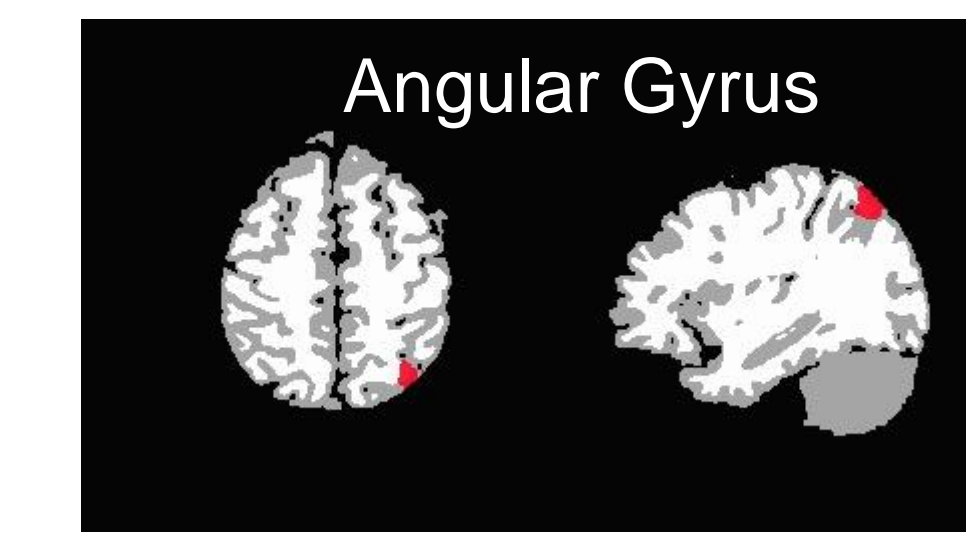
Effect	Region	Hemisphere	MNI			Volume (mL)
			X	Y	Z	
Oxy x Response Type	Inferior Parietal Lobule	L	-45	-58	49	3288

Oxy x Report

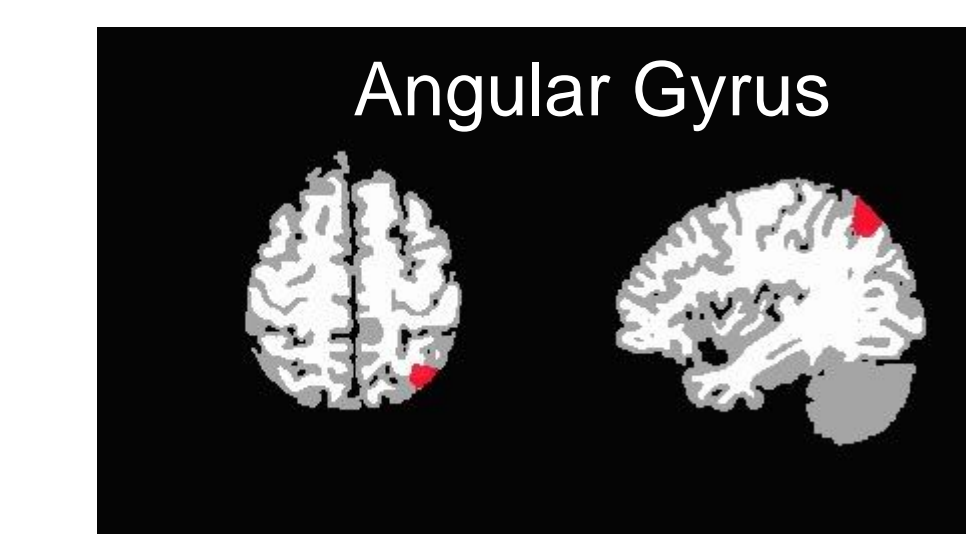


* $p < .01$
** $p < .005$

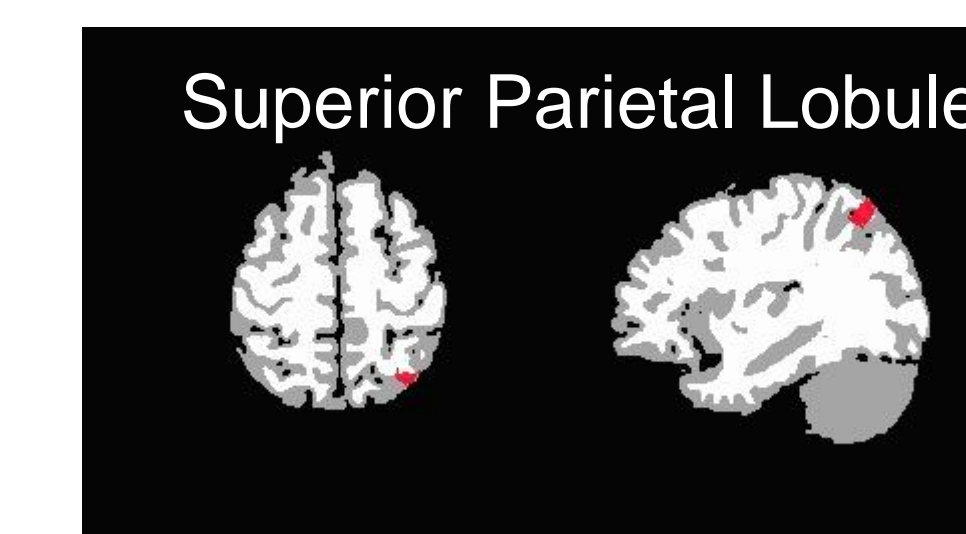
Oxy x Report



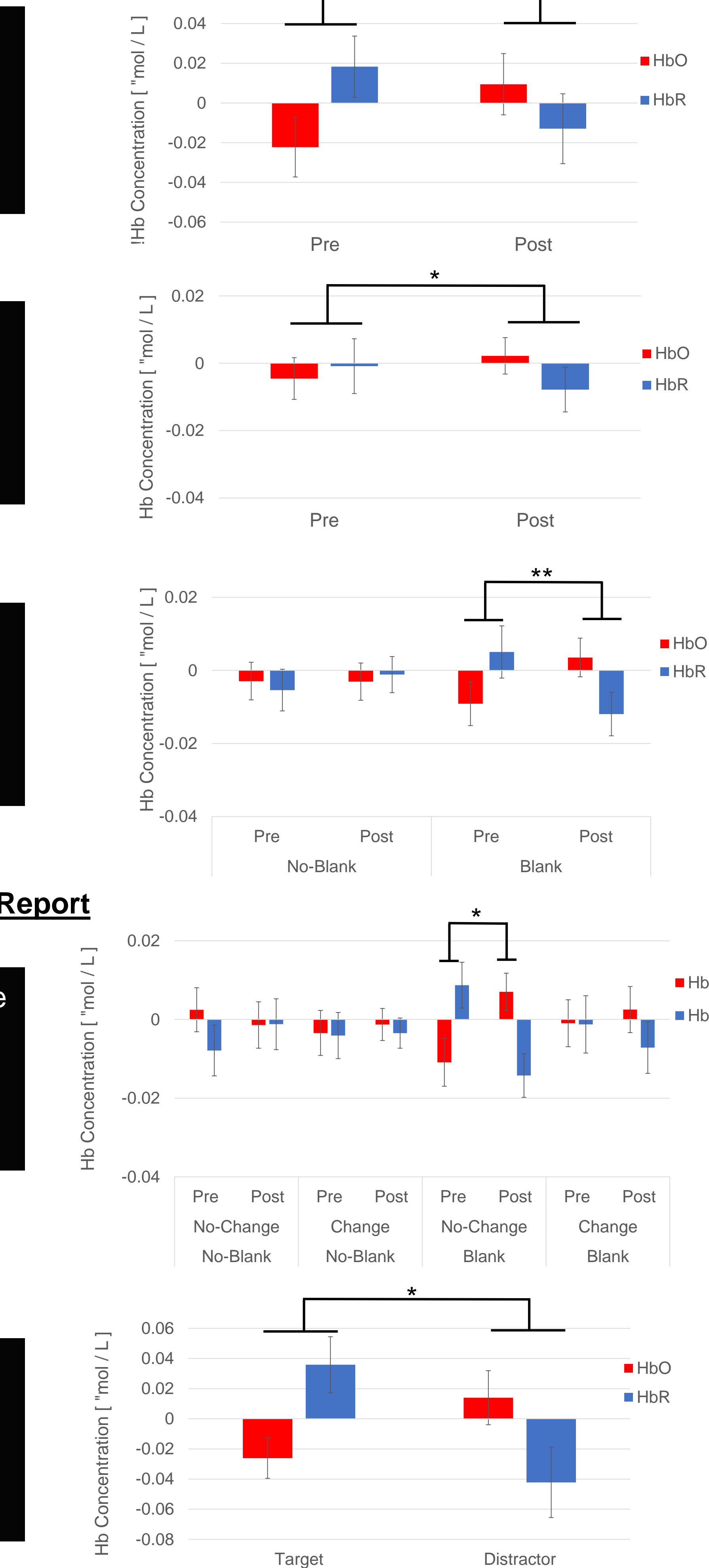
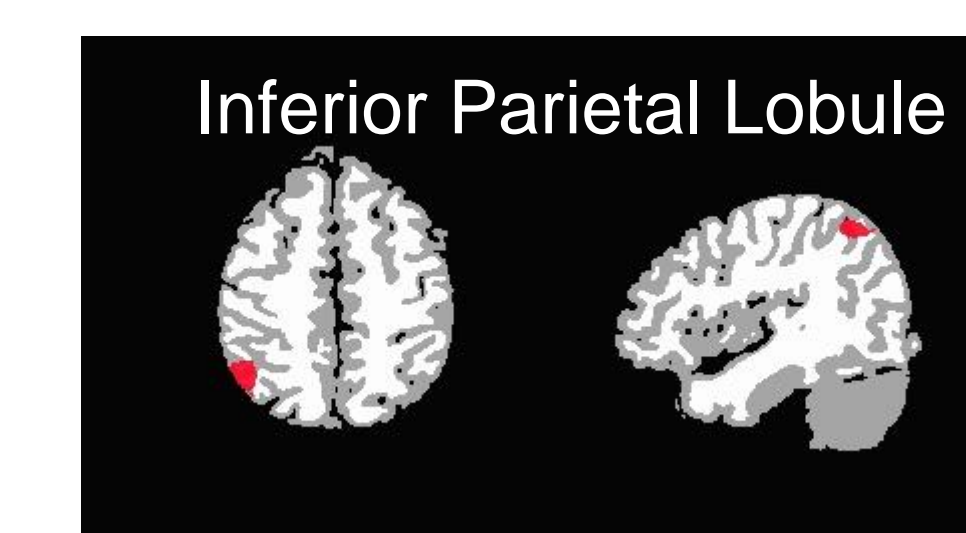
Oxy x Blank x Report



Oxy x Blank x Change x Report



Oxy x Response Type



Summary

- Activation was observed to increase:
 - when participants were instructed to report the post-saccadic object, possibly because this object was foveated and represented more strongly.
 - on blank trials when instructed to report the post-saccadic object, suggesting that breaking object continuity also increases activation.
 - when the pre-saccadic object representation was updated by incorrectly reporting the post-saccadic object.
- We suggest that the process of overwriting in transsaccadic perception may depend on the relative weights of pre- and post-saccadic object representations in VWM.

References

1. Currie, C. B., McConkie, G. W., Carlson-Radvansky, L. A., & Irwin, D. E. (2000). The role of saccade target object in the perception of a visually stable world. *Perception & Psychophysics*, 62(4), 673-683.
2. Van der Stigchel, S., & Hollingworth, A. (2018). Visuospatial working memory as a fundamental component of the eye movement system. *Current Directions in Psychological Science*, 27(2), 136-143.
3. Todd, J. J., & Marois, R. (2004). Capacity limit of visual short-term memory in human posterior parietal cortex. *Nature*, 428(6984), 751-754.
4. Bays, P. M., Catalao, R. F. G., & Husain, M. (2009). The precision of visual working memory is set by allocation of a shared resource. *Journal of Vision* 9(10): 7, 1-11.

Support

This project was supported by NIH R01HD092485