

# The central neural mechanisms of afterimage perception

A whole brain and cortical  
layer fMRI study

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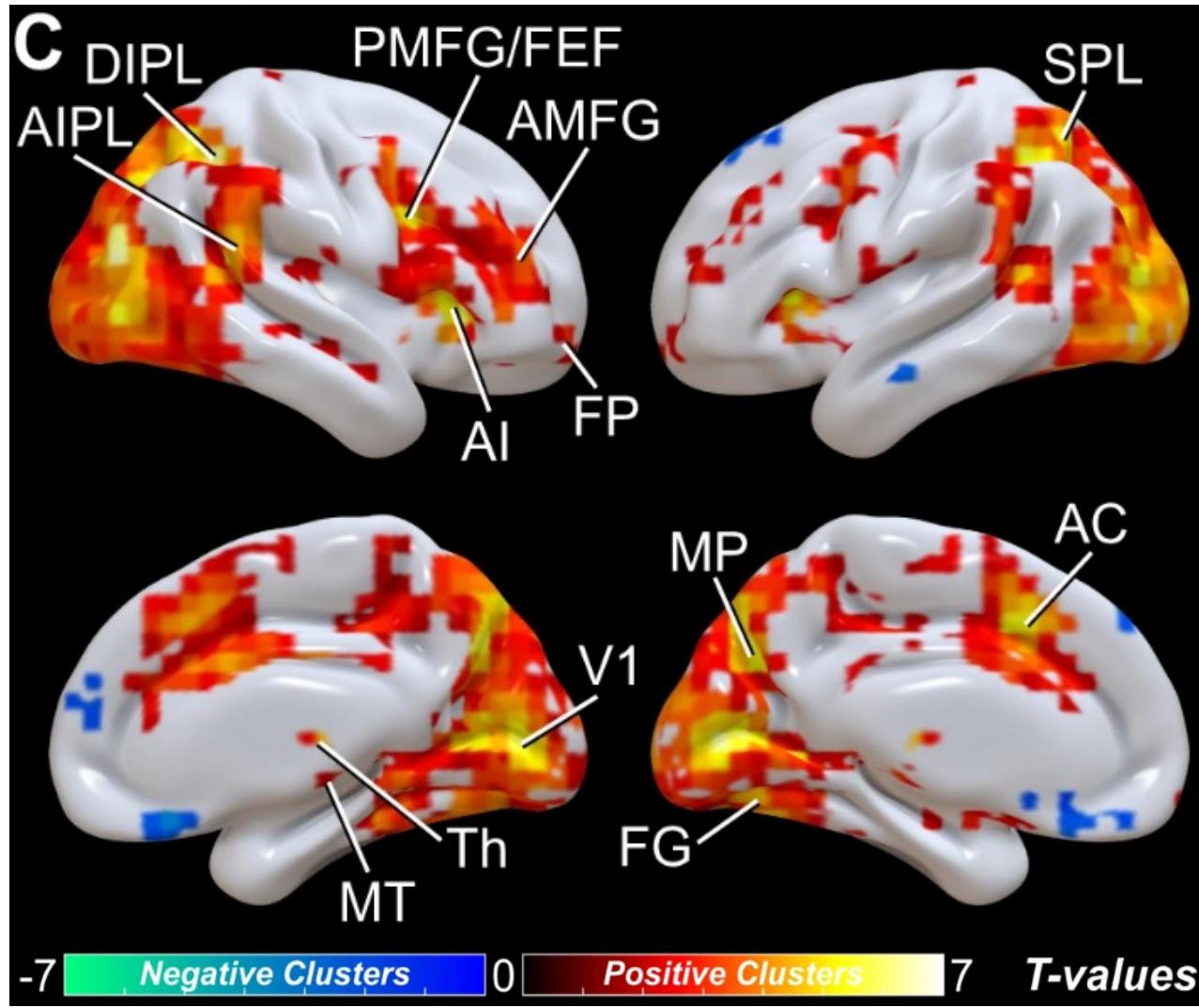
ASSC 27

July 3, 2024



# Sensory Perception

(e.g., vision, audition, etc.)

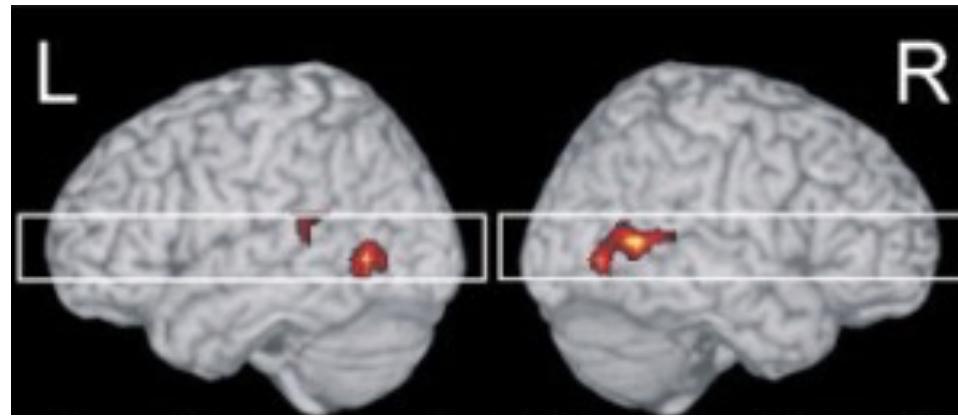


Kronemer et al., Nature Communications, 2022

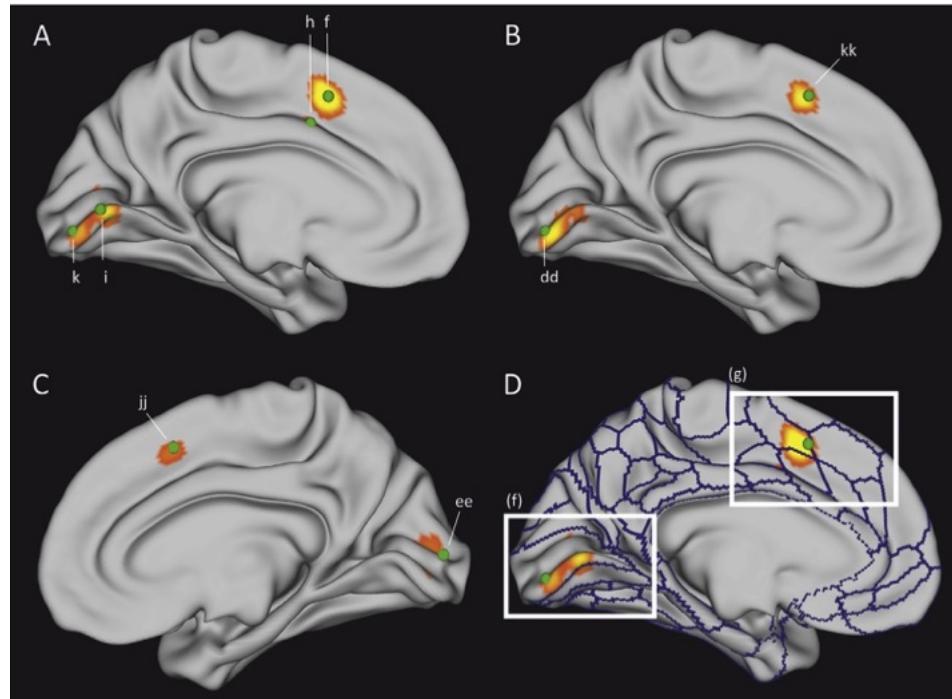


# Sensory-Independent Perception

(e.g., *imagination, hallucination, etc.*)

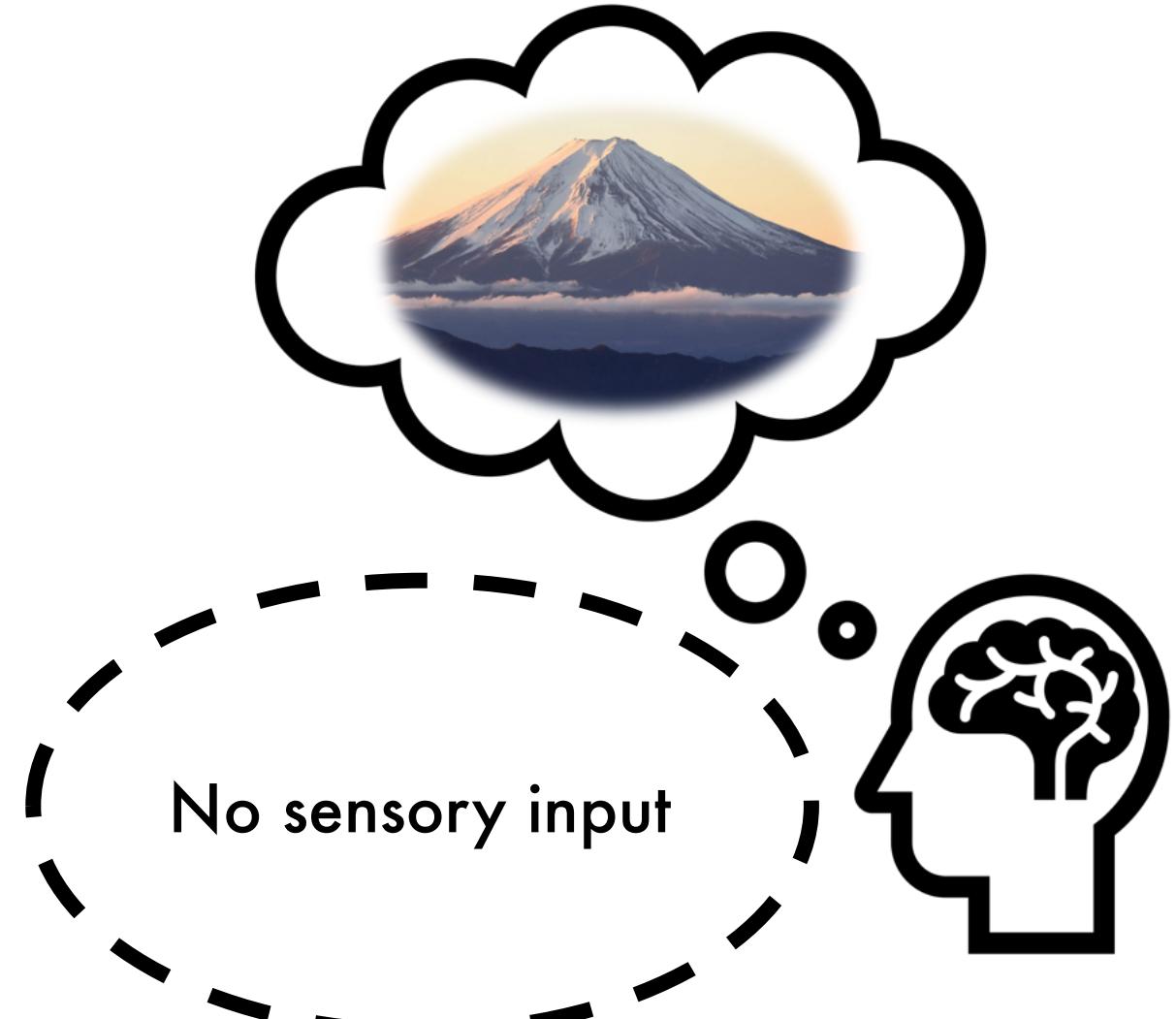


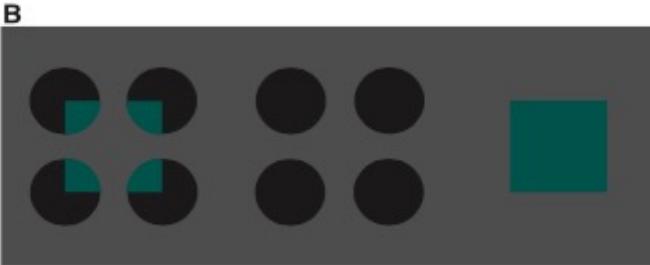
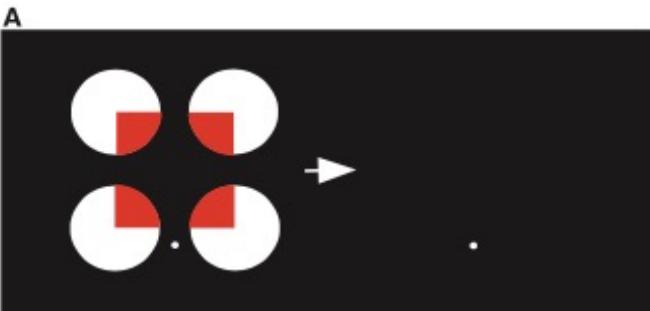
Bunzeck et al., *NeuroImage*, 2005



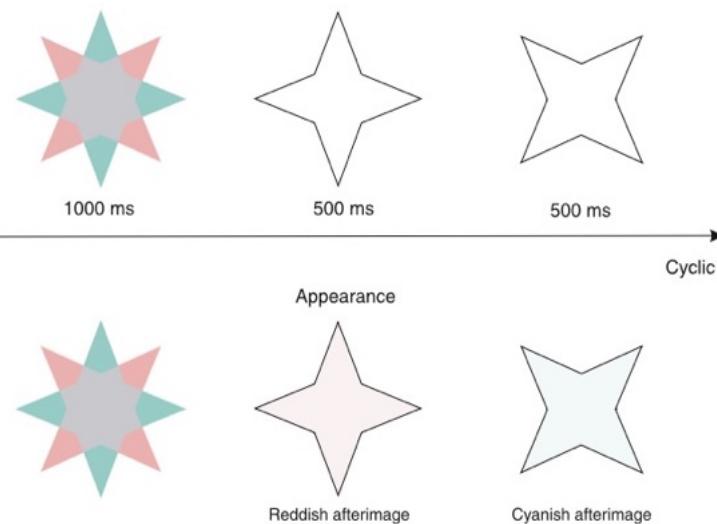
Winlove et al., *Cortex*, 2018

**Afterimages?**





Shimojo et al., *Science*, 2001

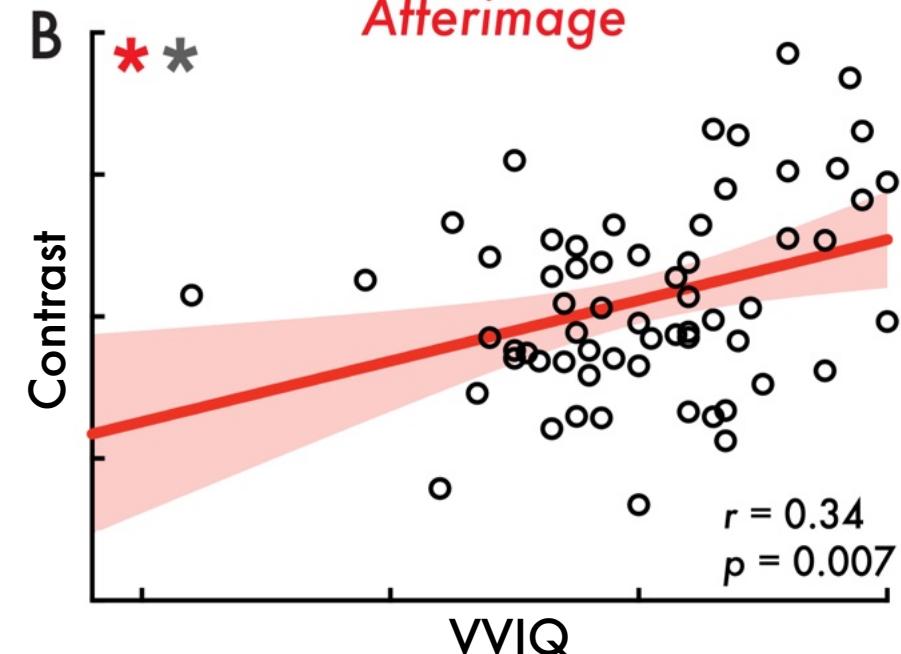


Van Lier et al., *Curr Biol*, 2009

**TABLE 2**  
AFTERIMAGES OF “IMAGINED” COLORS DURING  
“WAKING”  
(GB and JB participated in Experiment 2; PM and  
SS participated in Experiment 3)

Subject	Colors <i>S</i> Was Asked to “Imagine”	Afterimage Reported by <i>S</i>
GB		Yellow
JB	Blue	Yellow
PM		Butter yellow
SS		Gold
GB		Greenish violet
JB	Red	Traffic light green
PM		Bluish
SS		Green
GB		Bluish green
JB	Yellow	Blue grey
PM		Greenish-blue
SS		Greeny-blue
GB		Pinkish
JB	Green	Pink
PM		Nut brown
SS		Red
GB		Blue
JB	Orange	Greenish blue
PM		Pale blue
SS		Purple

Downey, *Psych Review*, 1901  
Weiskrantz, *J Exp Psych*, 1950  
Oswald, *J Exp Psych*, 1957  
Barber, *J Ab Psych*, 1959

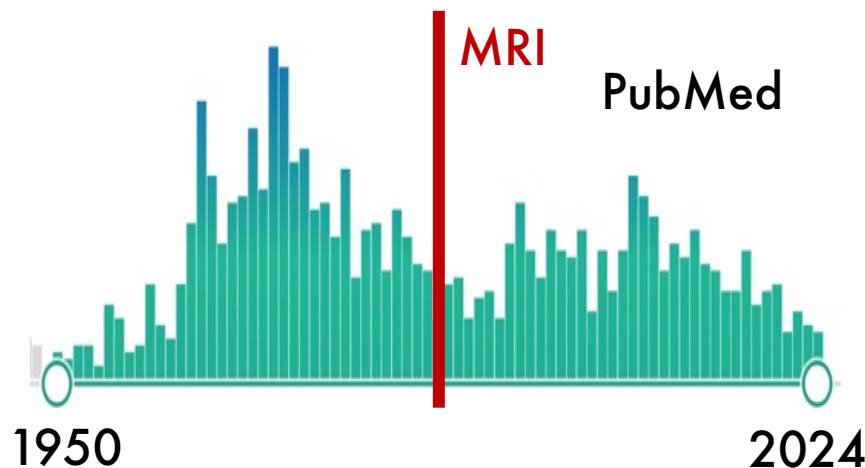


Kronemer, et al.,  
NoC, accepted



MRI

PubMed



# **What are the neural mechanisms of afterimage perception?**

## **Aim 1**

Map the whole brain contributions for afterimage conscious perception with fMRI.

## **Aim 2**

Measure the V1 cortical layer contributions for afterimage conscious perception with fMRI.

# Aim 1

**Whole Brain, 7T fMRI**

**(TR = 1000ms; Voxel Size 1.2mm<sup>3</sup>)**

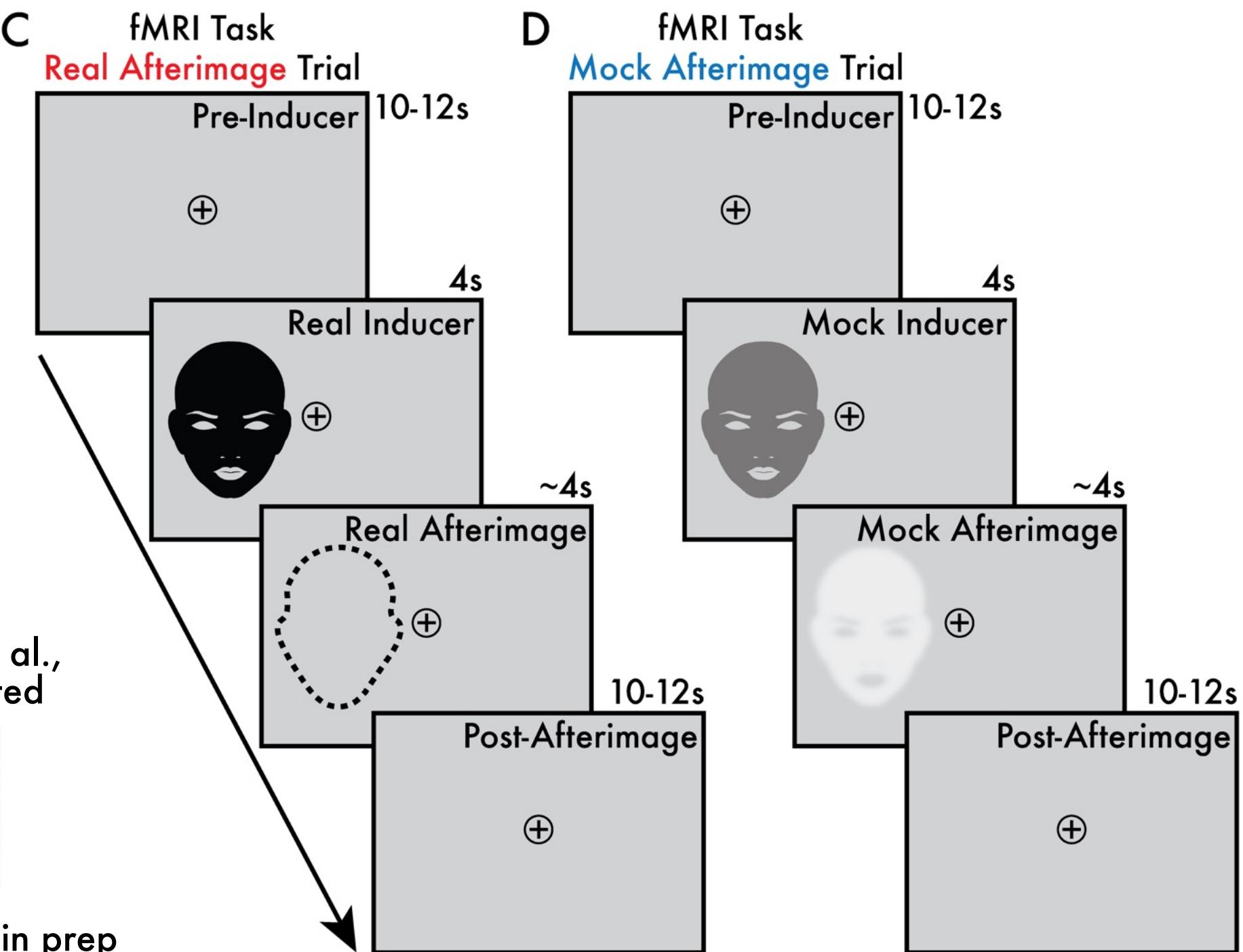
+

**Eye-tracking & pupillometry**

**(1000Hz; right eye)**

+

**N = 35 healthy participants**



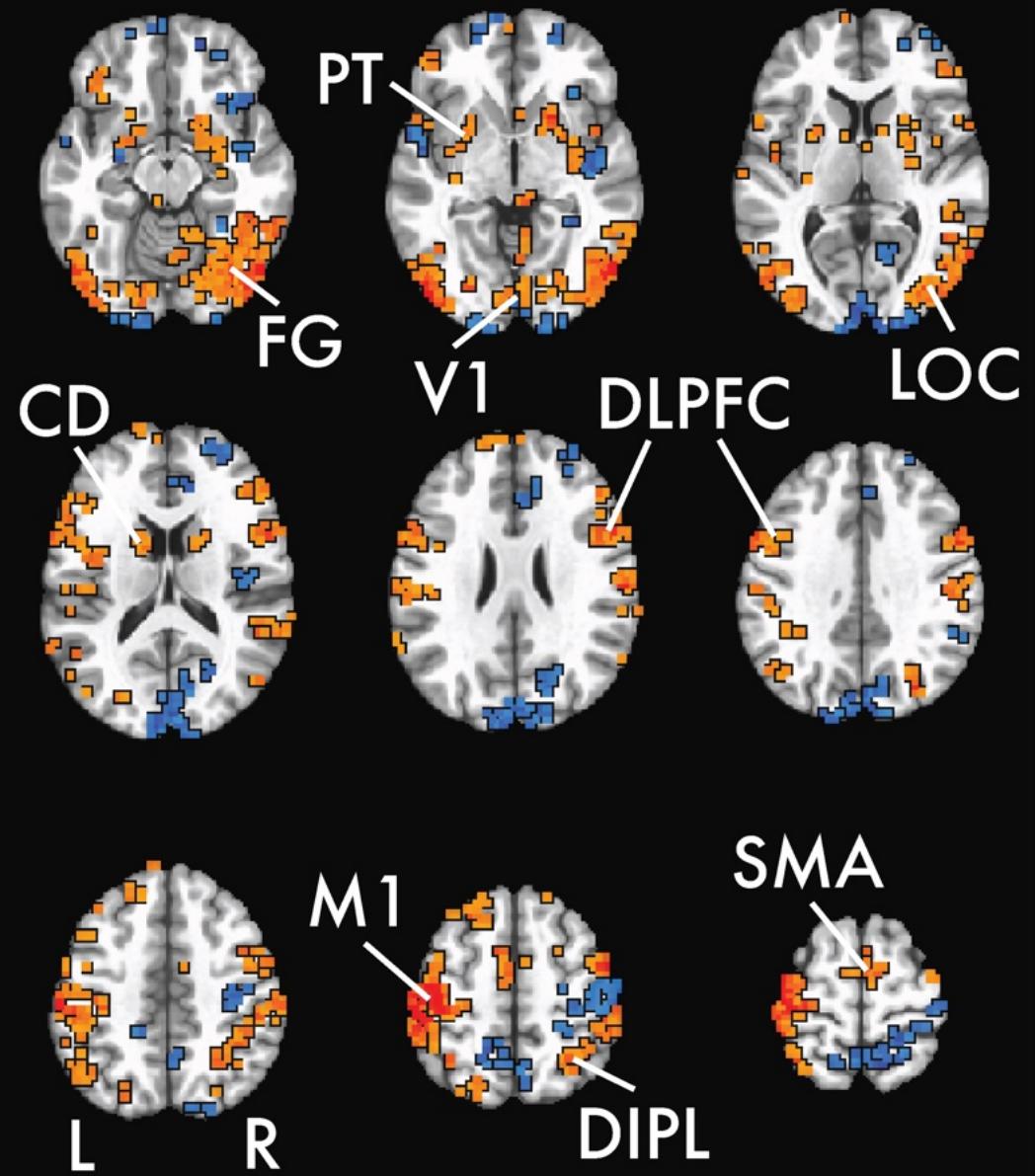
# Real Afterimage Trial



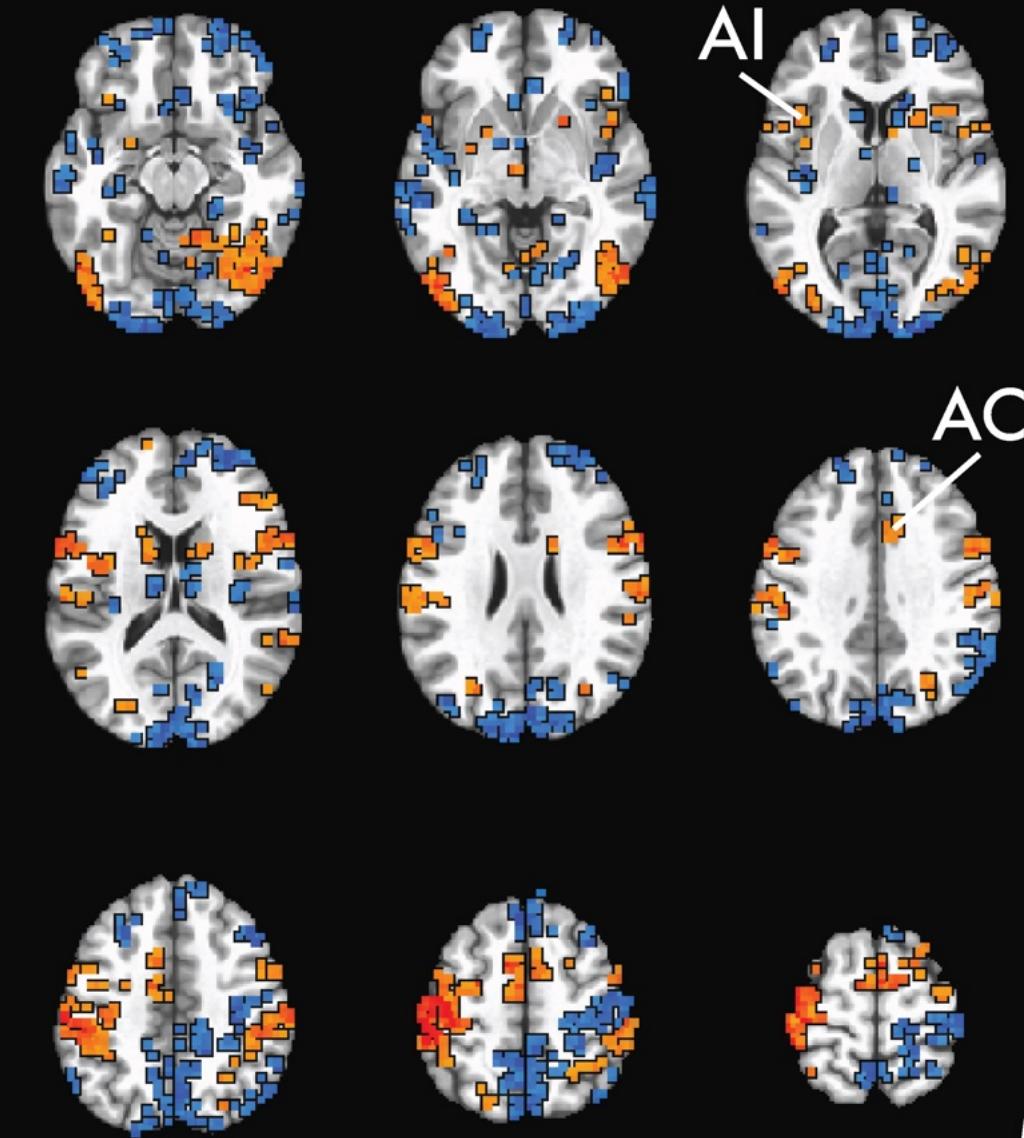
# Mock Afterimage Trial



## Mock Afterimage



## Real Afterimage



Time = 6s

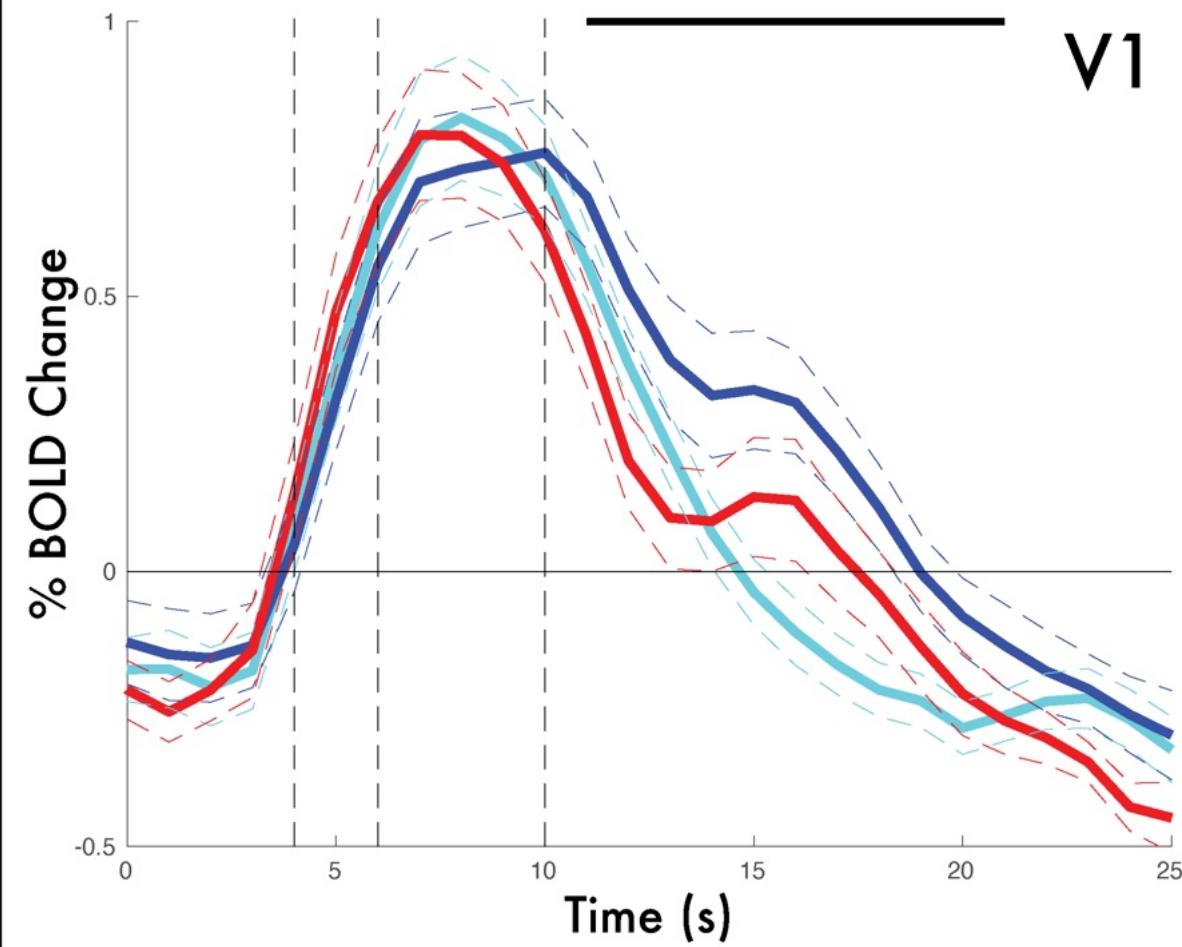
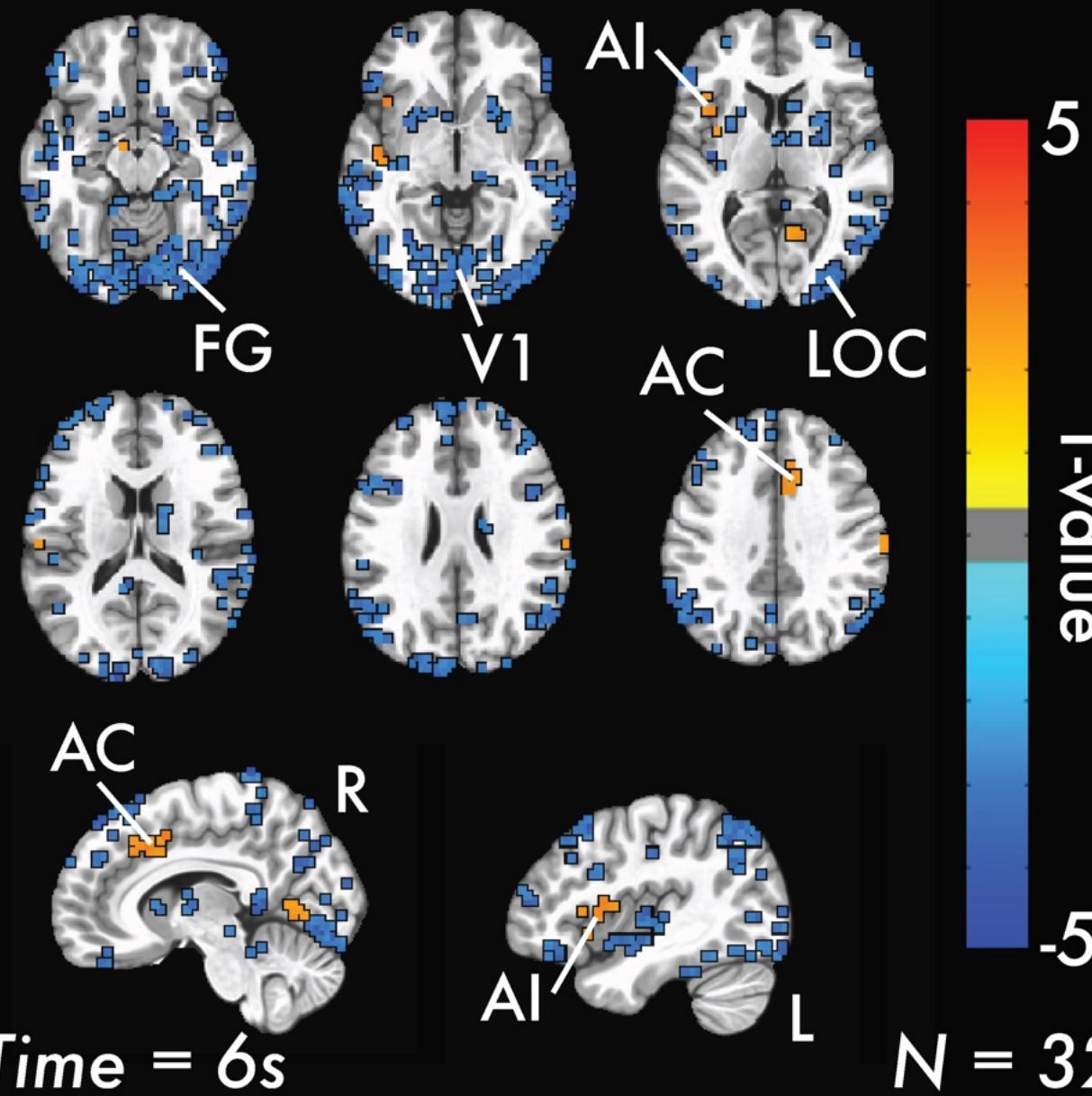
N = 32

5

T-value

-5

# Real vs Mock Afterimage



# Aim 3

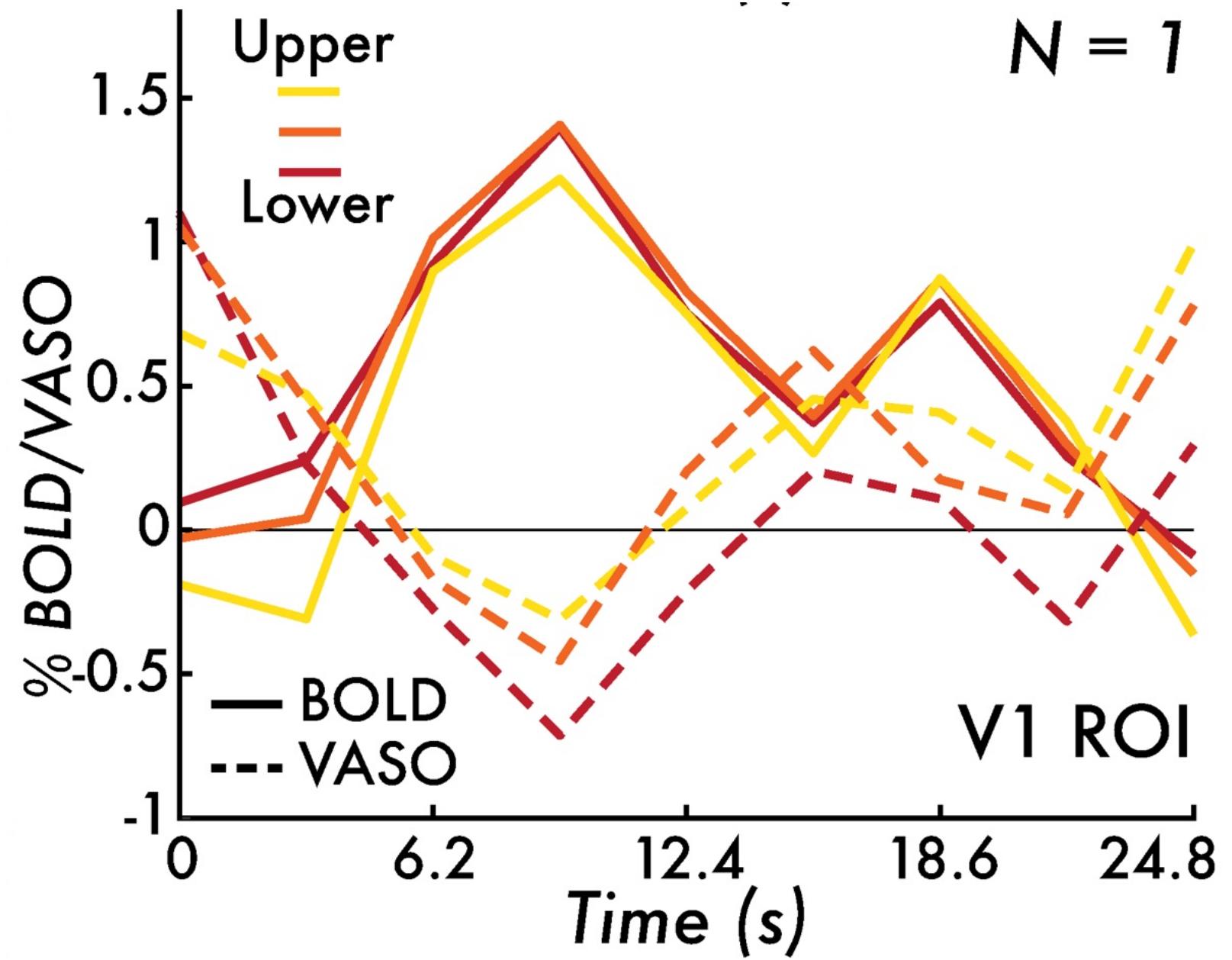
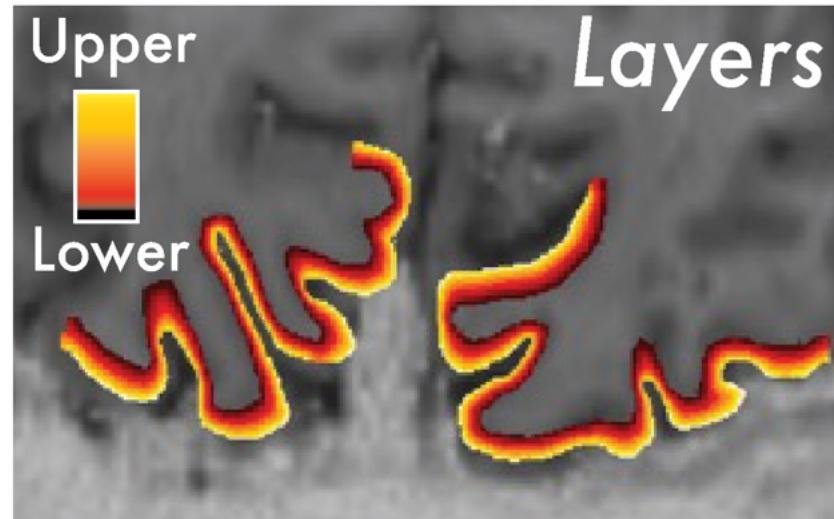
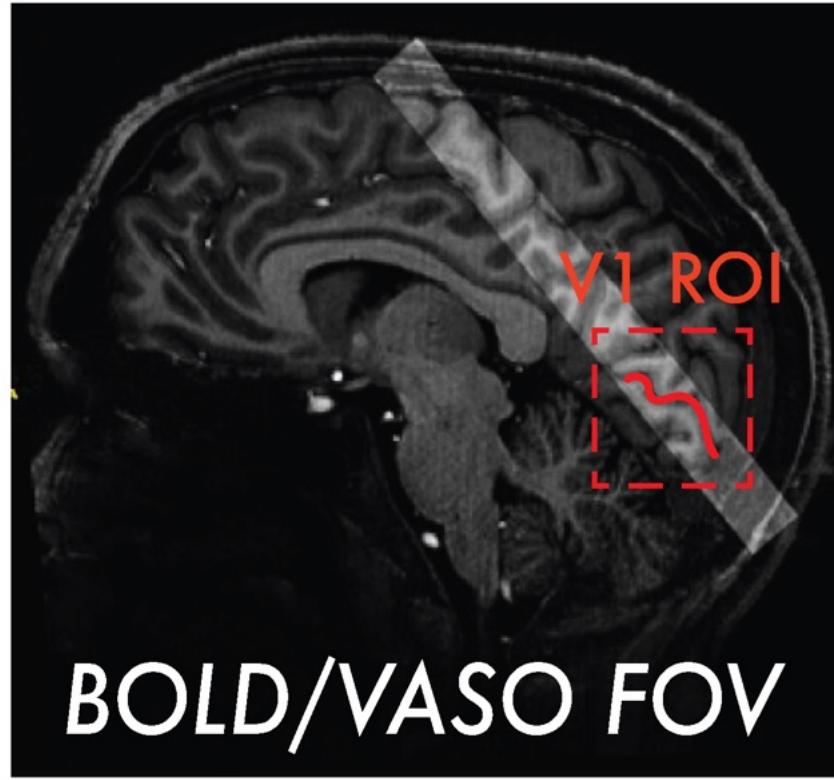
**V1 Layer, 7T fMRI VASO/BOLD**  
**(TR = 3100ms; Voxel Size 0.8mm<sup>3</sup>)**

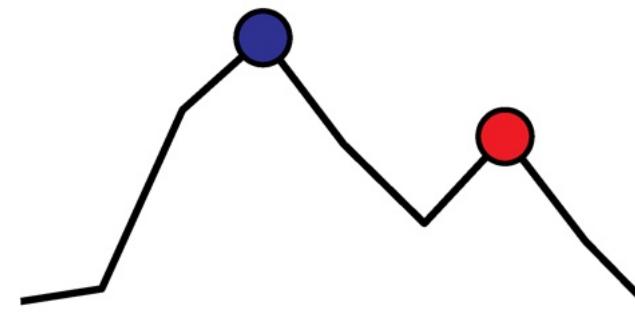
+

**Eye-tracking & pupillometry**  
**(1000Hz; right eye)**

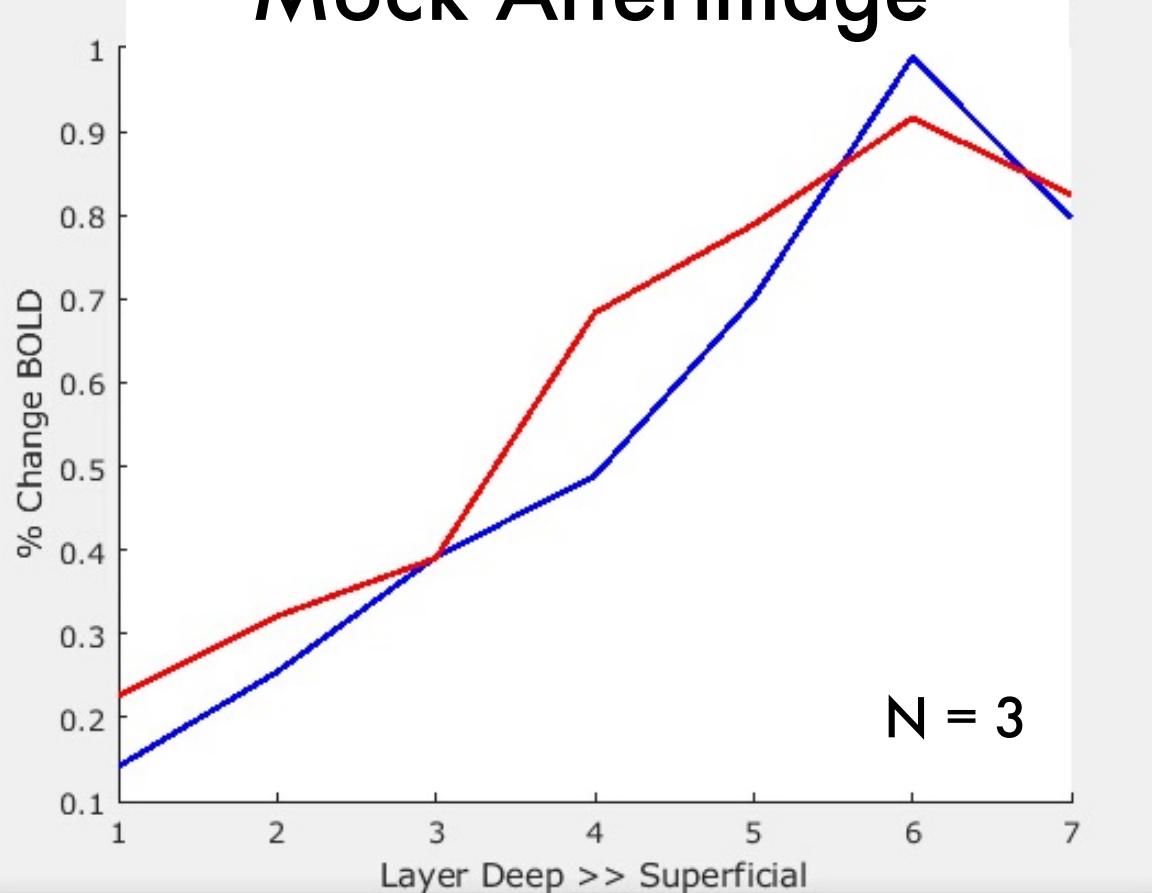
+

**N = 12 healthy participants**

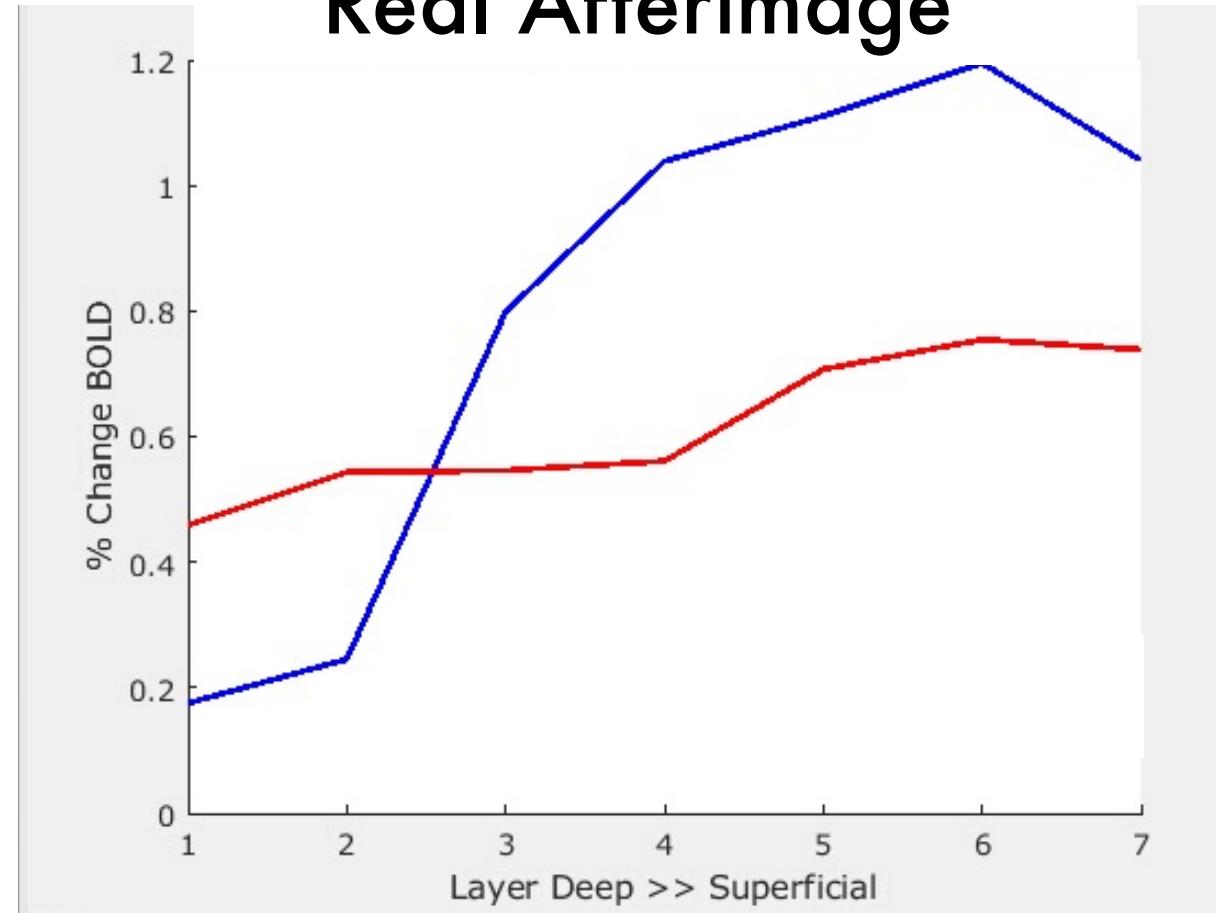




Mock Afterimage



Real Afterimage



# Summary

- **Aim 1** Afterimage conscious perception involves widespread cortical/subcortical fMRI responses.
- **Aim 1** Relative to image conscious perception, afterimages reveal reduced sensory and frontal activity and increased AI and AC fMRI activity.
- **Aim 2** Unique cortical layer fMRI activity for image versus afterimage conscious perception – suggestive of feedback

**Future Directions:** Reality monitoring - image vs afterimage

# Acknowledgements

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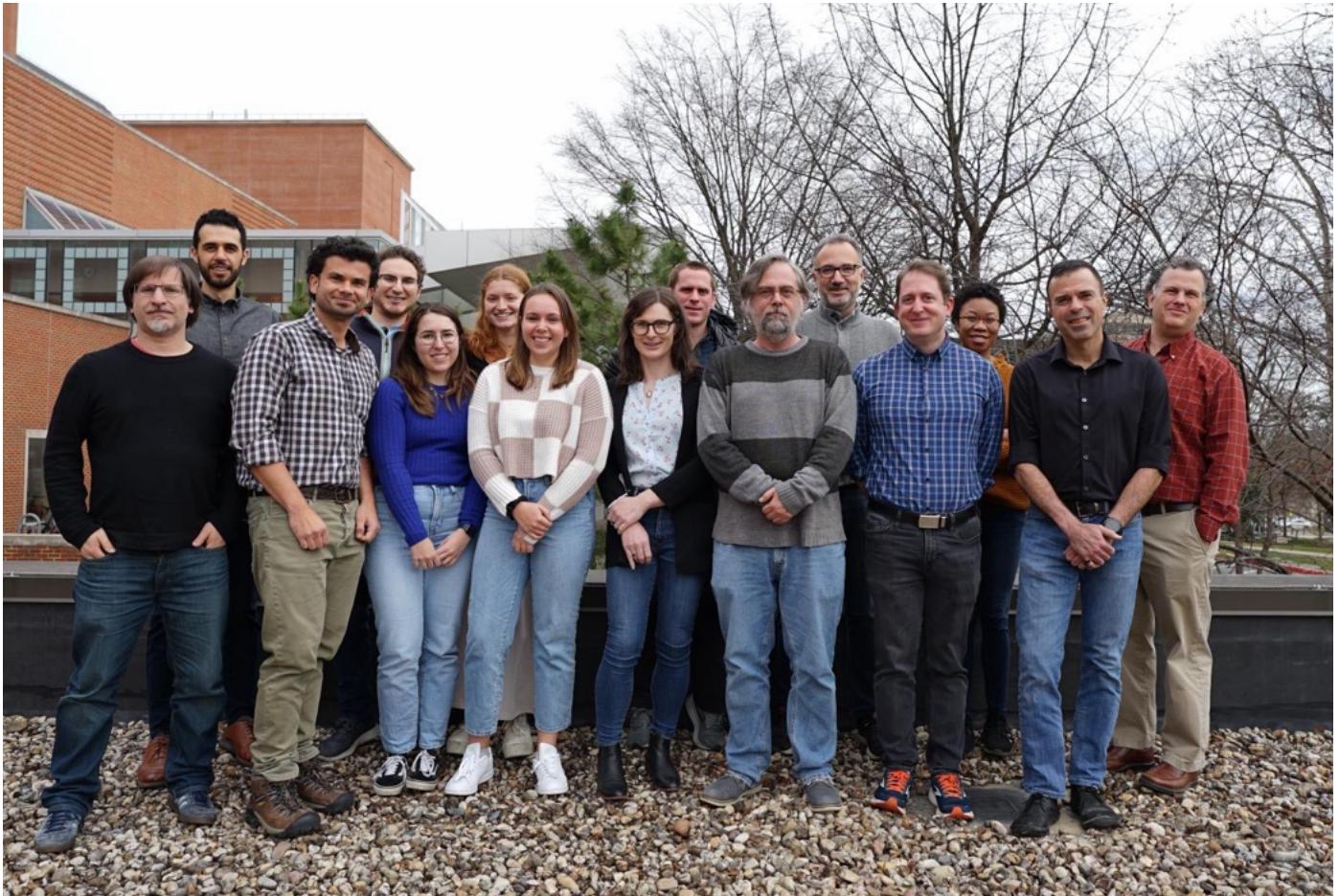
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**Thank you to the volunteers!**



National Institute  
of Mental Health

