

The central neural mechanisms of afterimage perception

A whole brain and cortical layer fMRI study

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SFIM, NIMH

ASSC 27

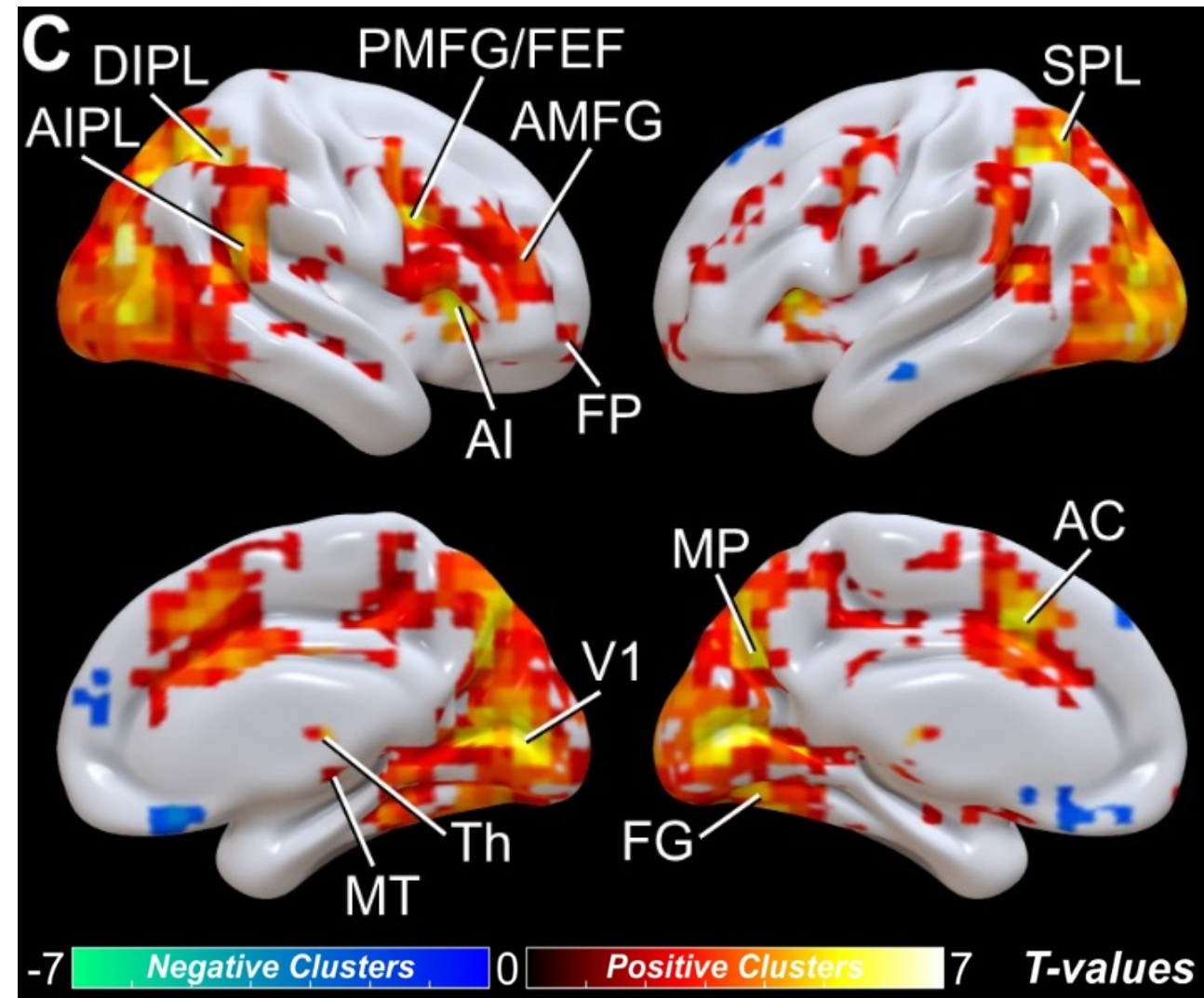
July 3, 2024



Vanessa Pantoja

Sensory Perception

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



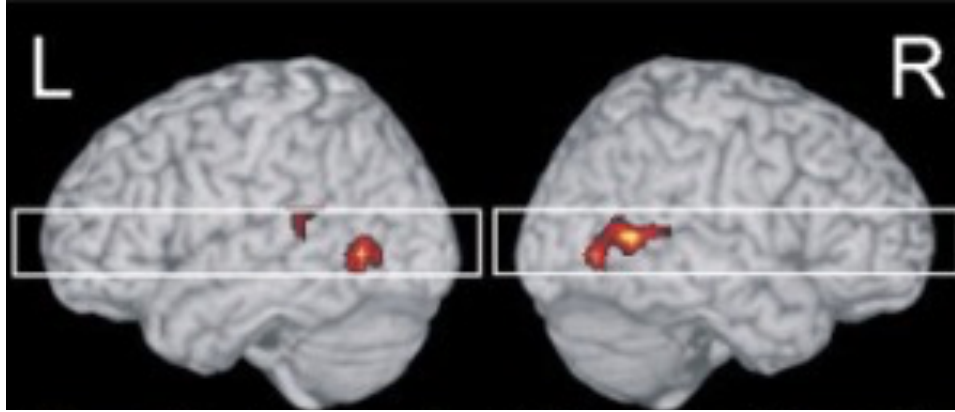
Kronemer et al., *Nature Communications*, 2022



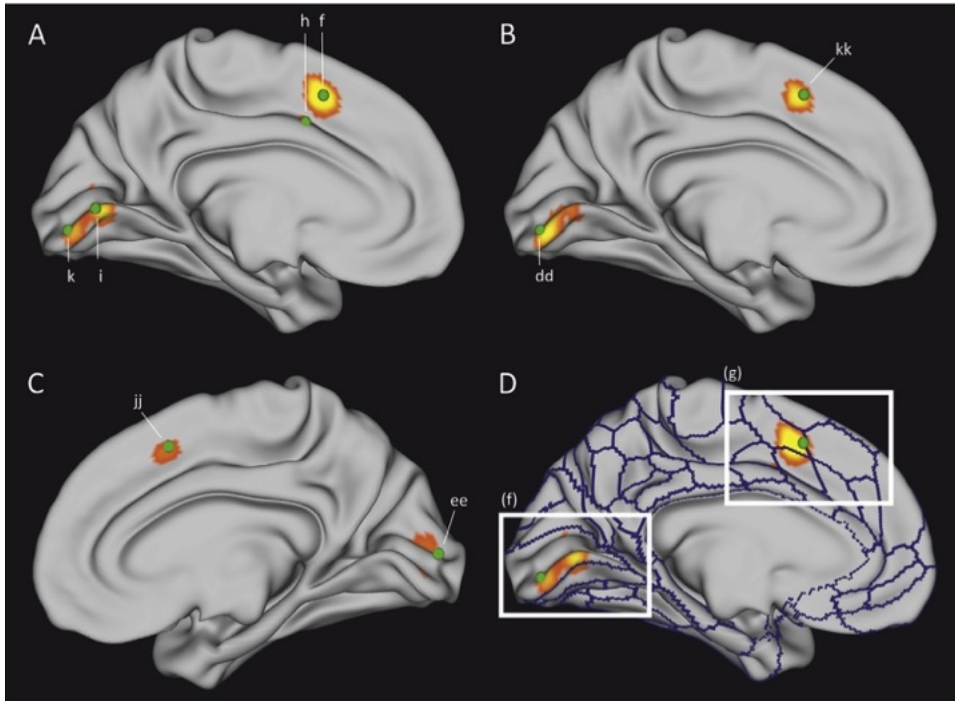
Sensory-Independent Perception

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

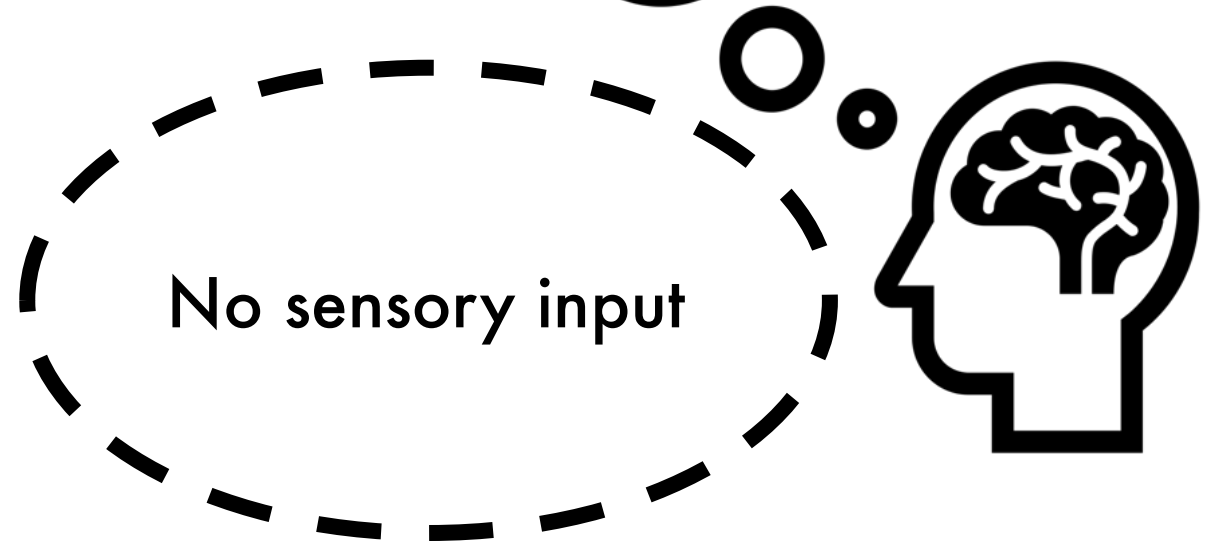
Afterimages?

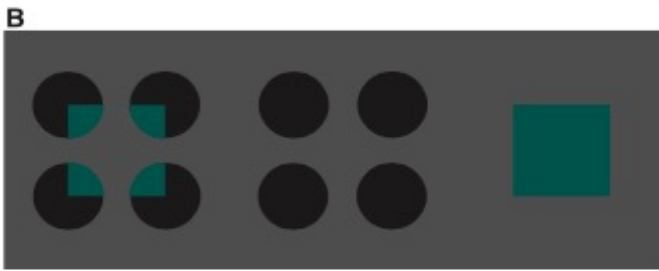
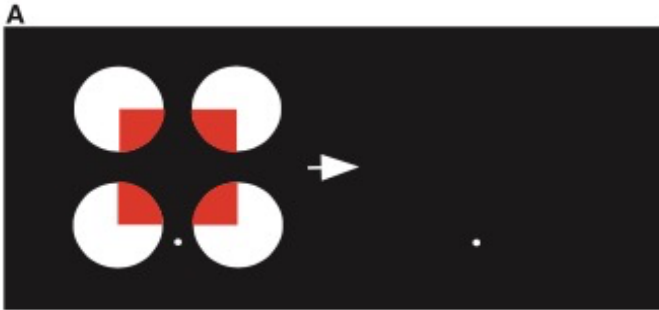


Bunzeck et al., *NeuroImage*, 2005

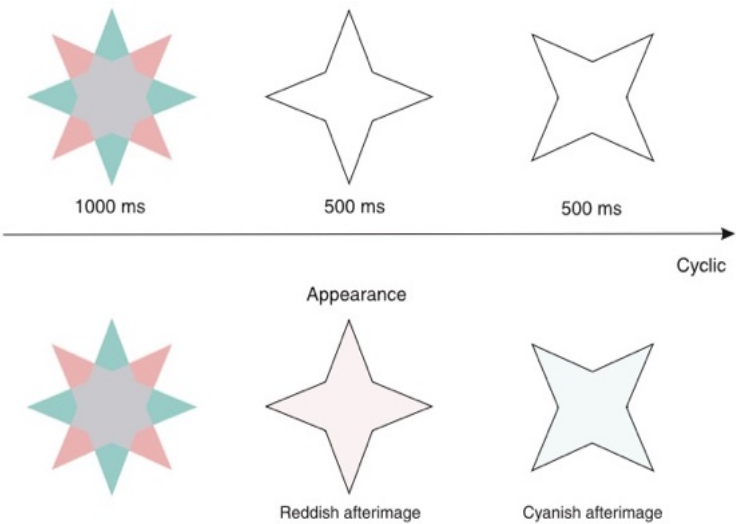


Winlove et al., *Cortex*, 2018





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)

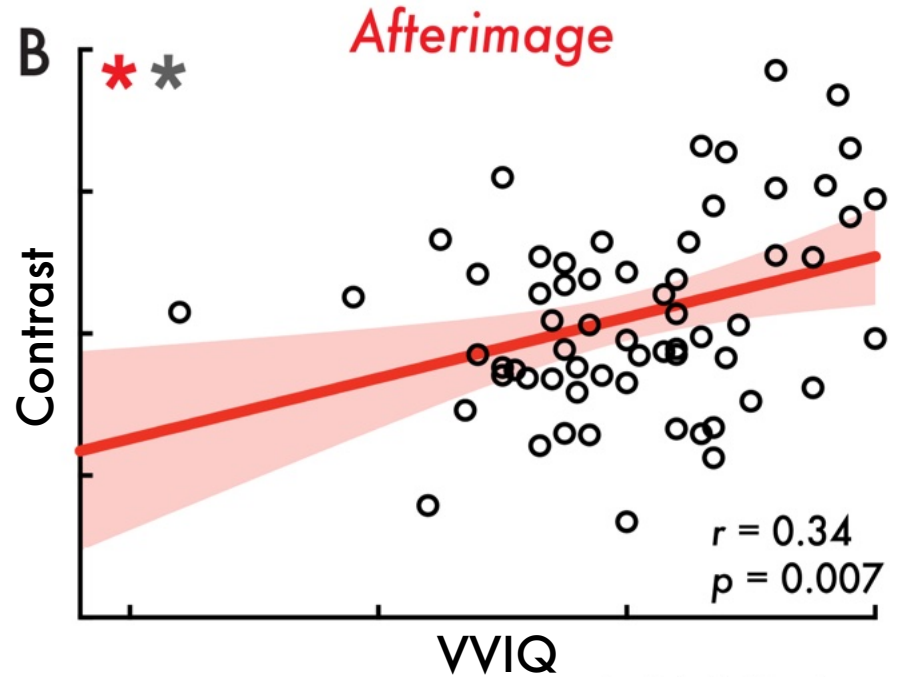
| Subject | Colors <i>S</i> Was Asked to “Imagine” | Afterimage Reported by <i>S</i> |
|---------|--|---------------------------------|
| GB | Blue | Yellow |
| JB | | Yellow |
| PM | | Butter yellow |
| SS | | Gold |
| GB | Red | Greenish violet |
| JB | | Traffic light green |
| PM | | Bluish |
| SS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

Downey, *Psych Review*, 1901

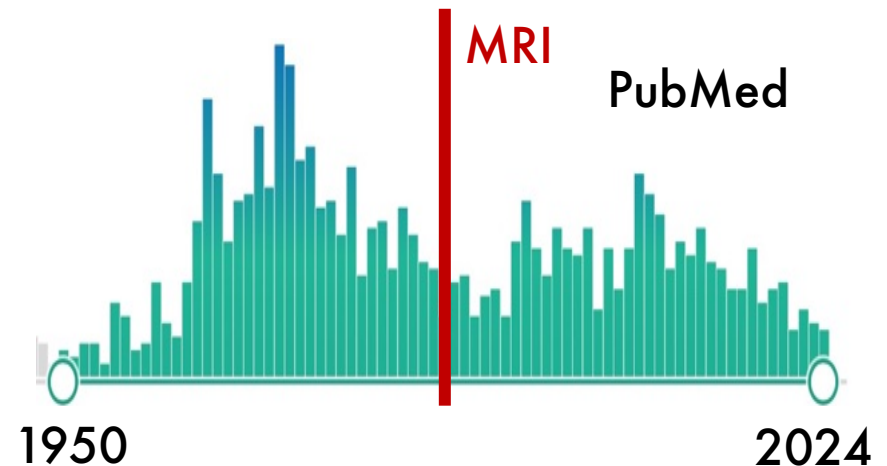
Weiskrantz, *J Exp Psych*, 1950

Oswald, *J Exp Psych*, 1957

Barber, *J Ab Psych*, 1959



Kronemer, et al.,
NoC, accepted



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 1.2mm³)

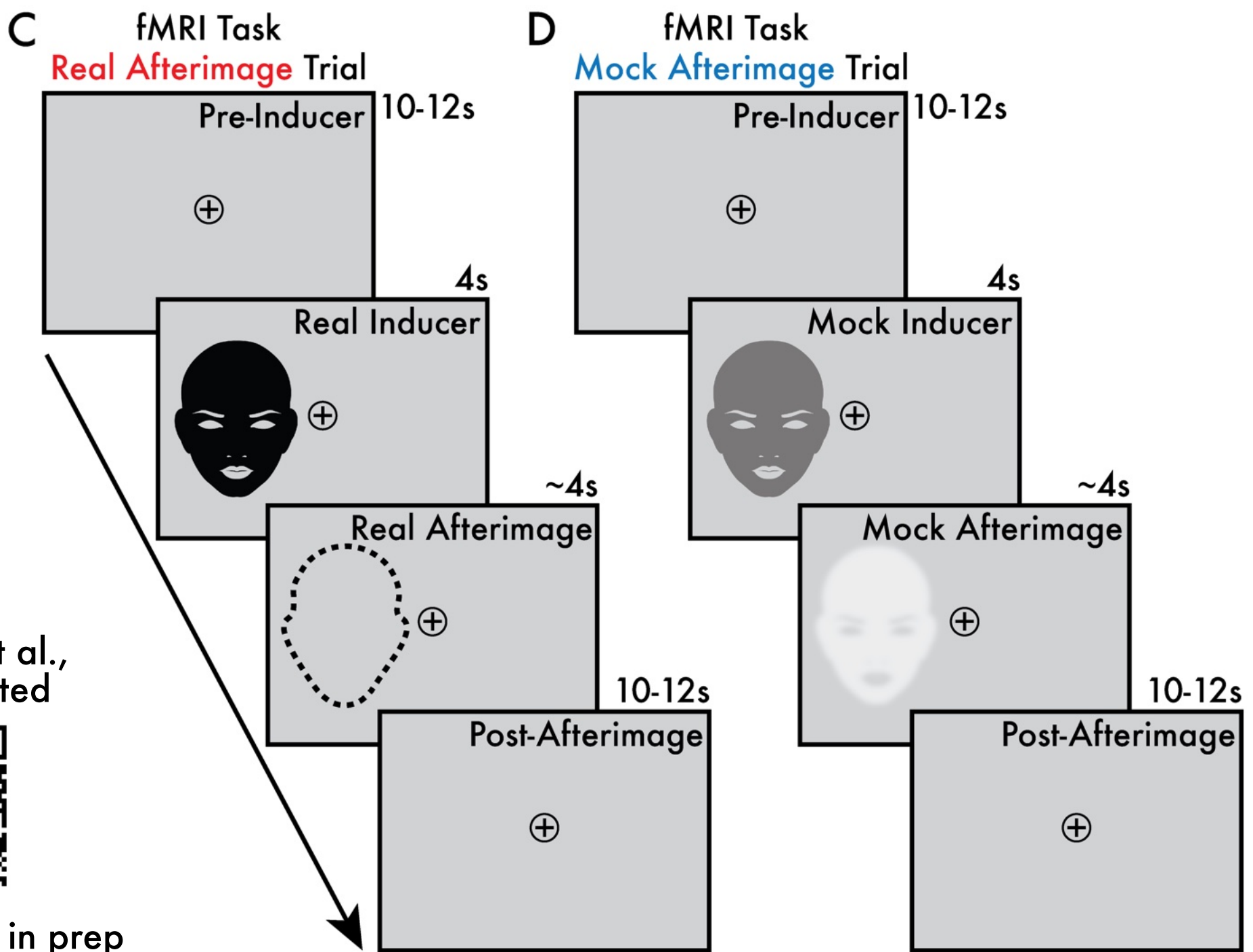
+

Eye-tracking & pupillometry

(1000Hz; right eye)

+

N = 35 healthy participants



Kronemer et al.,
NoC, accepted



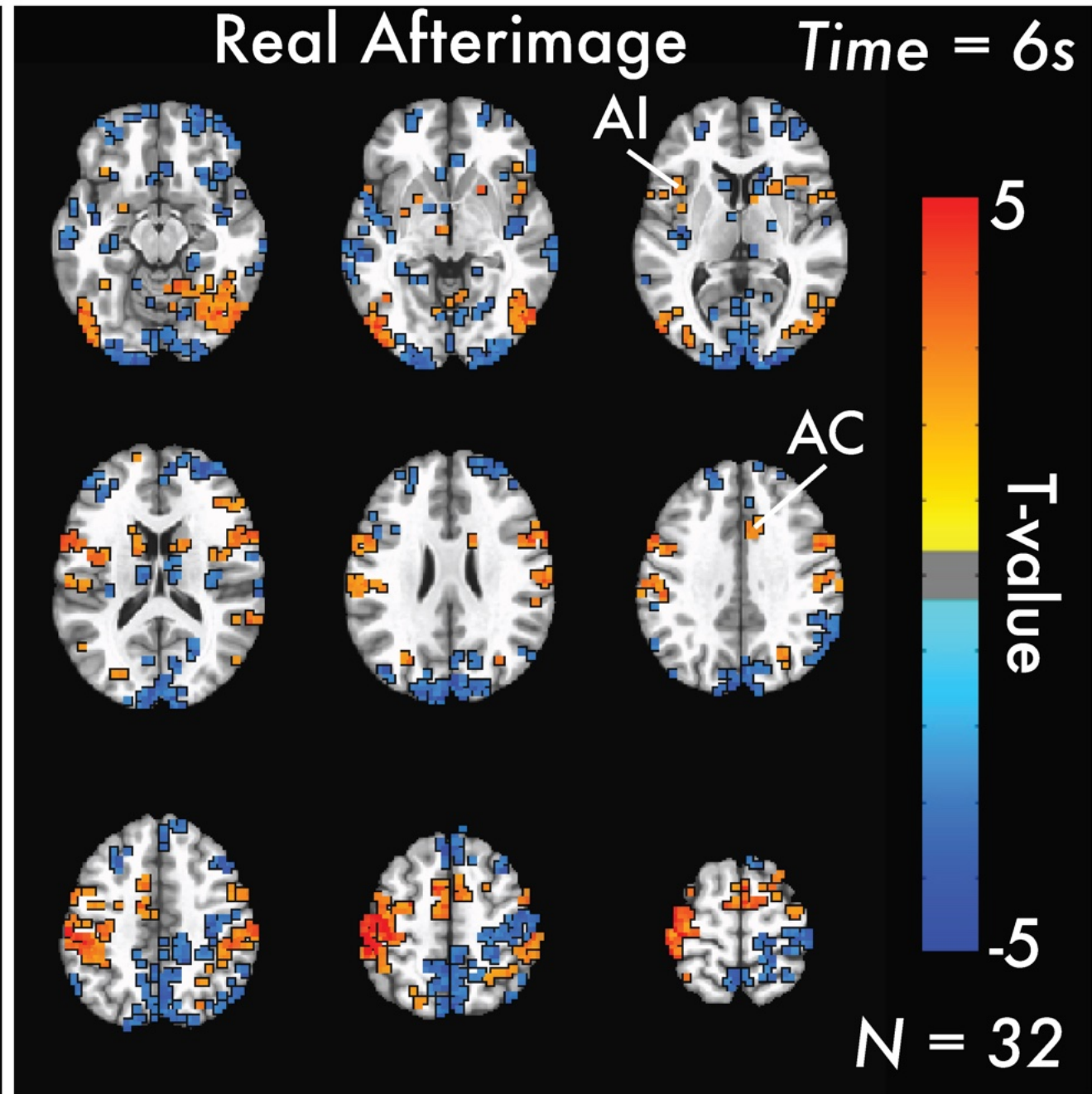
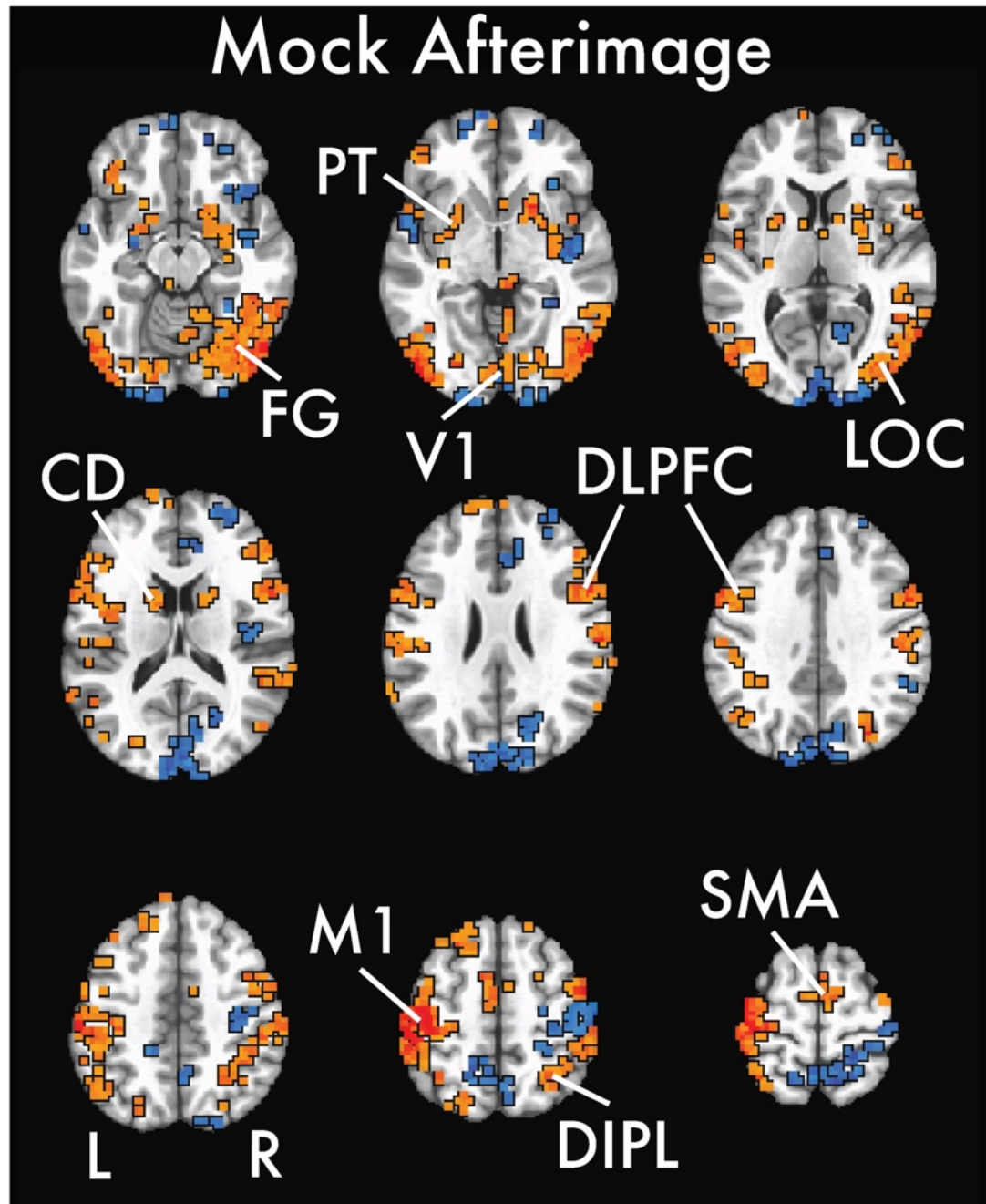
Kronemer et al., in prep

Real Afterimage Trial

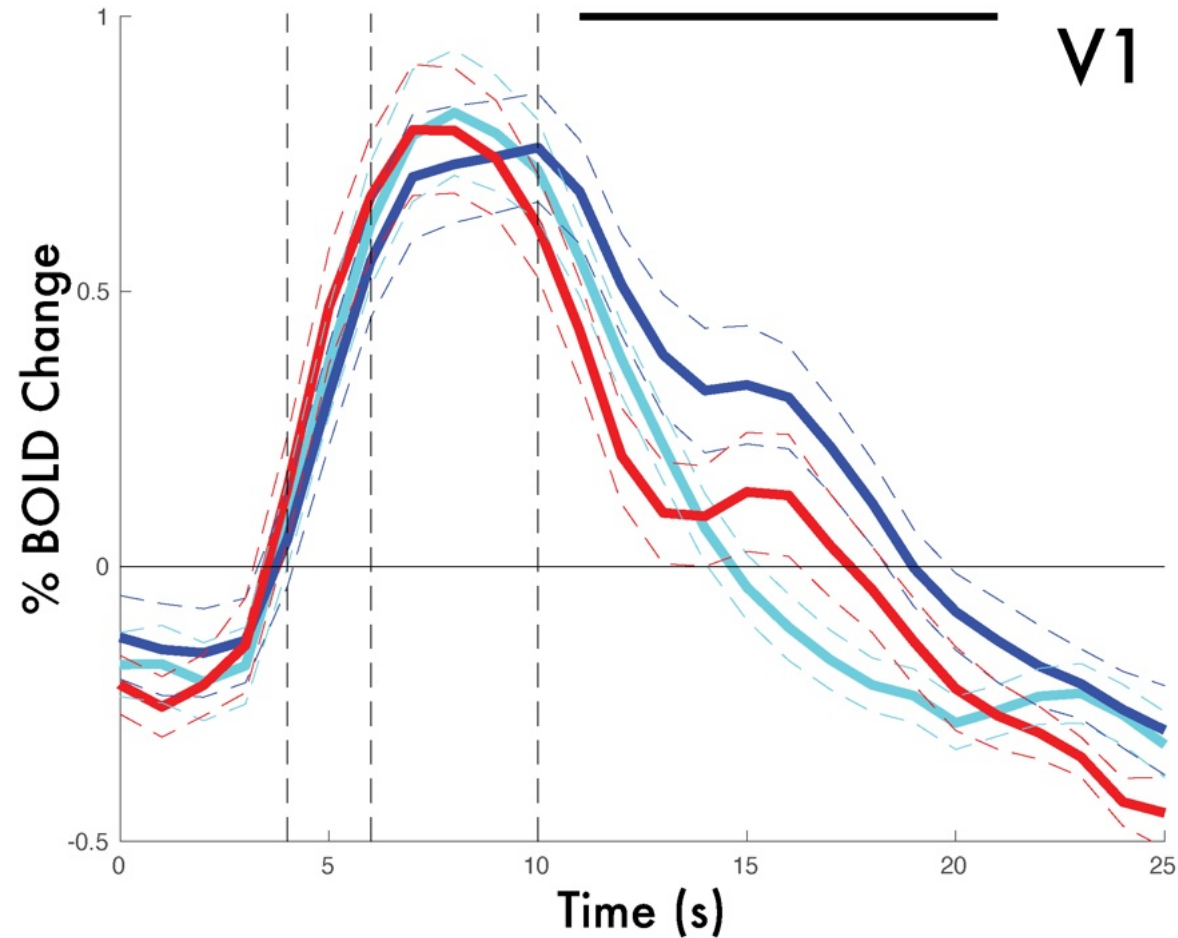
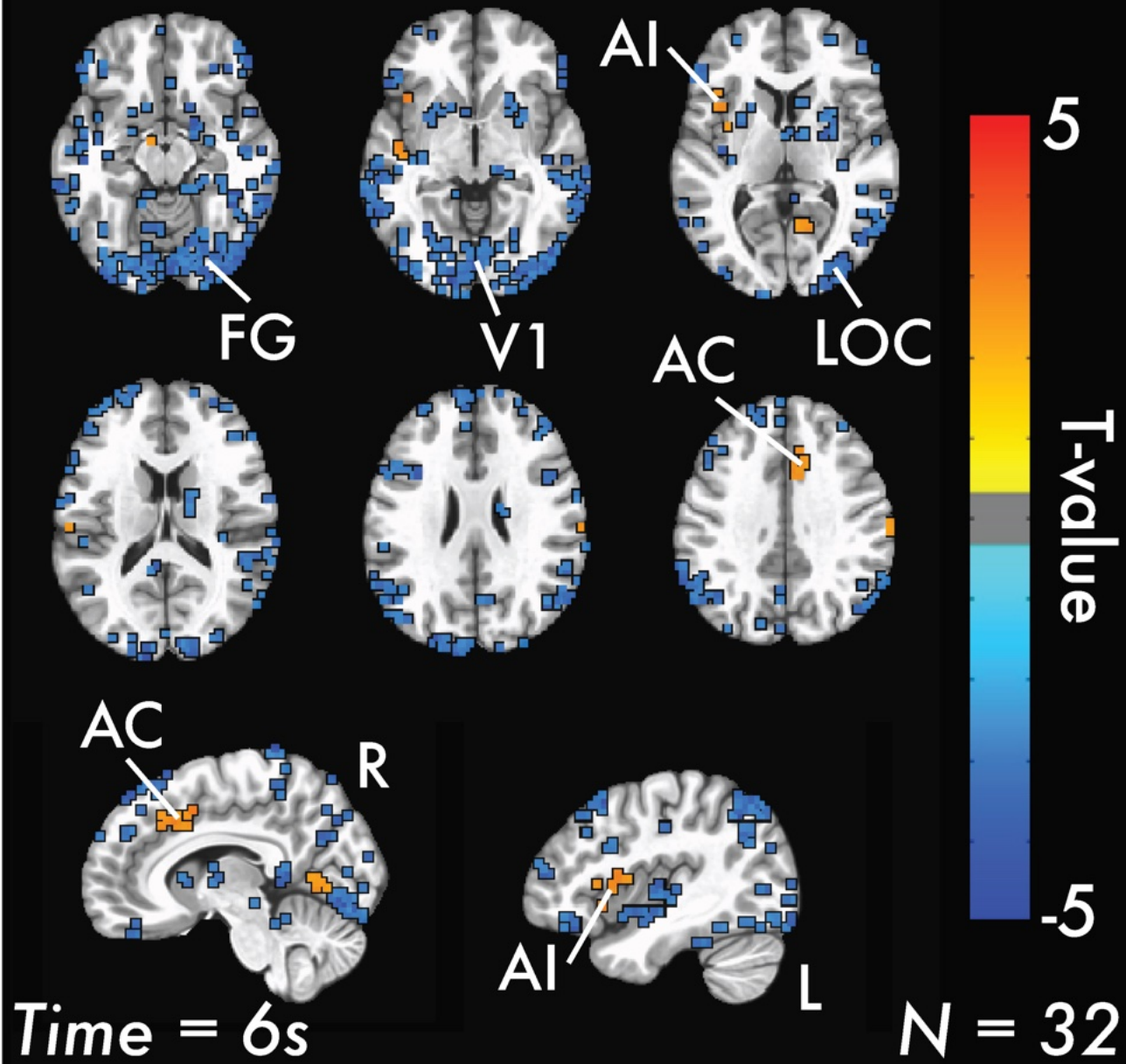


Mock Afterimage Trial





Real vs Mock Afterimage



Aim 3

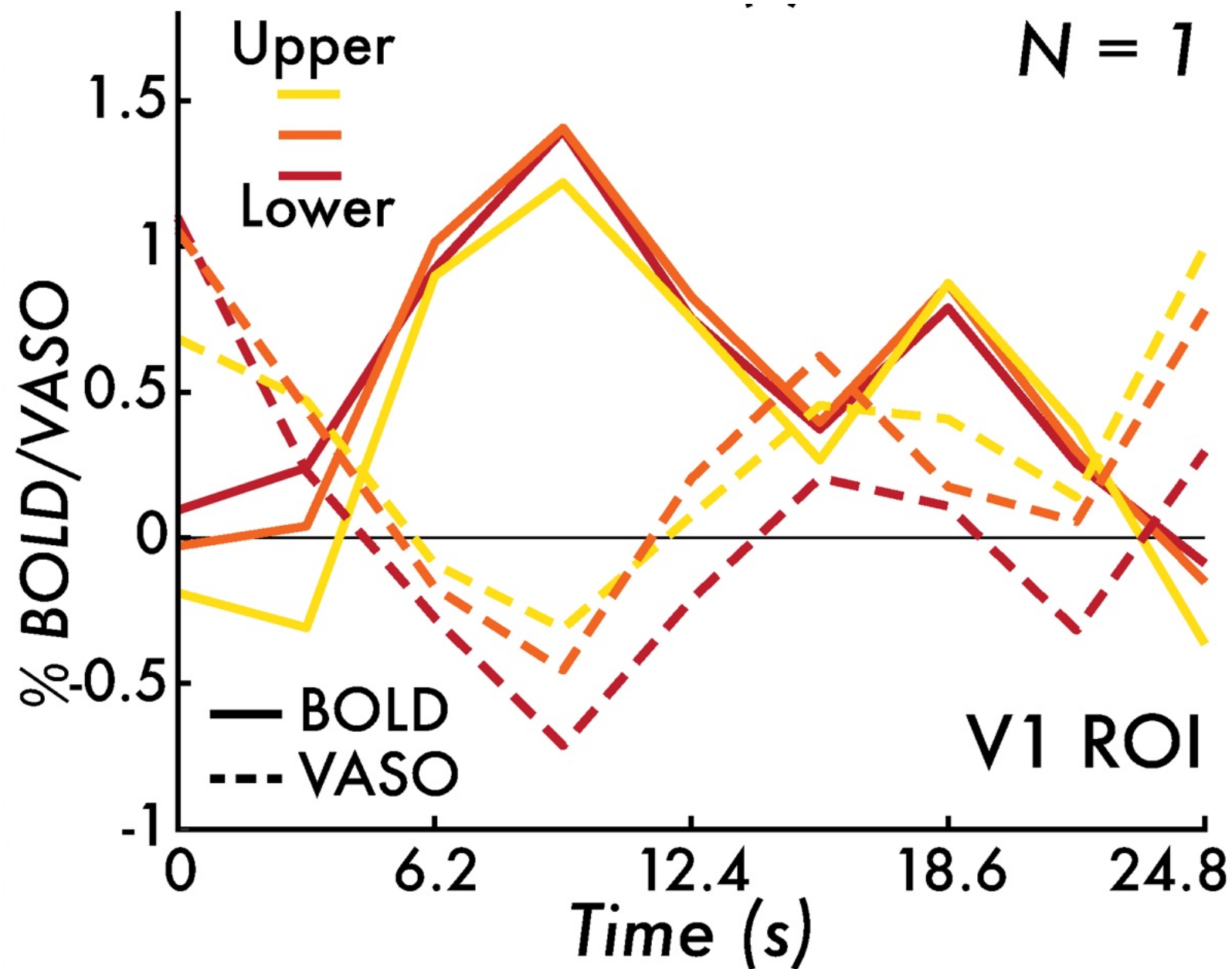
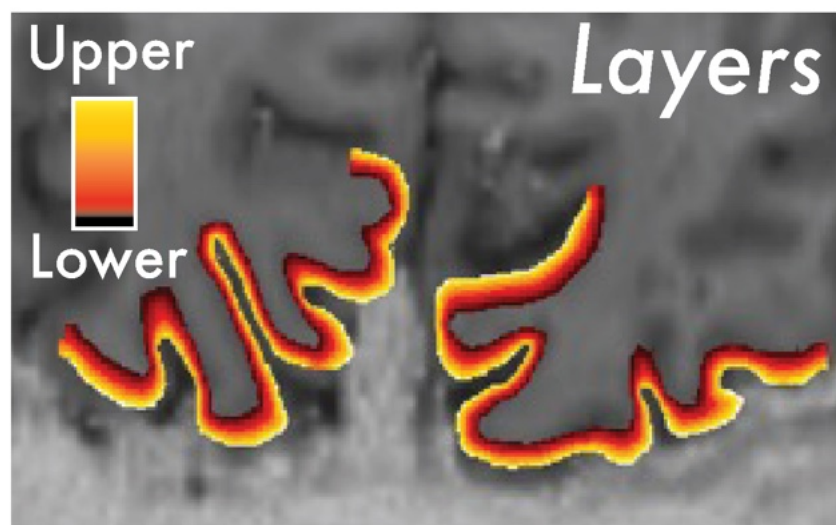
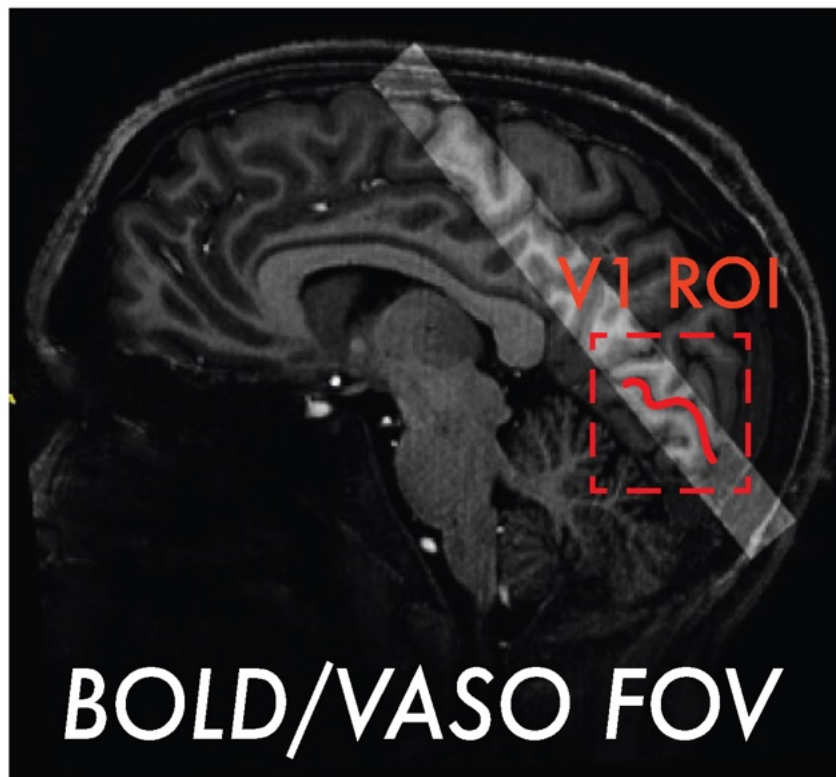
V1 Layer, 7T fMRI VASO/BOLD
(TR = 3100ms; Voxel Size 0.8mm³)

+

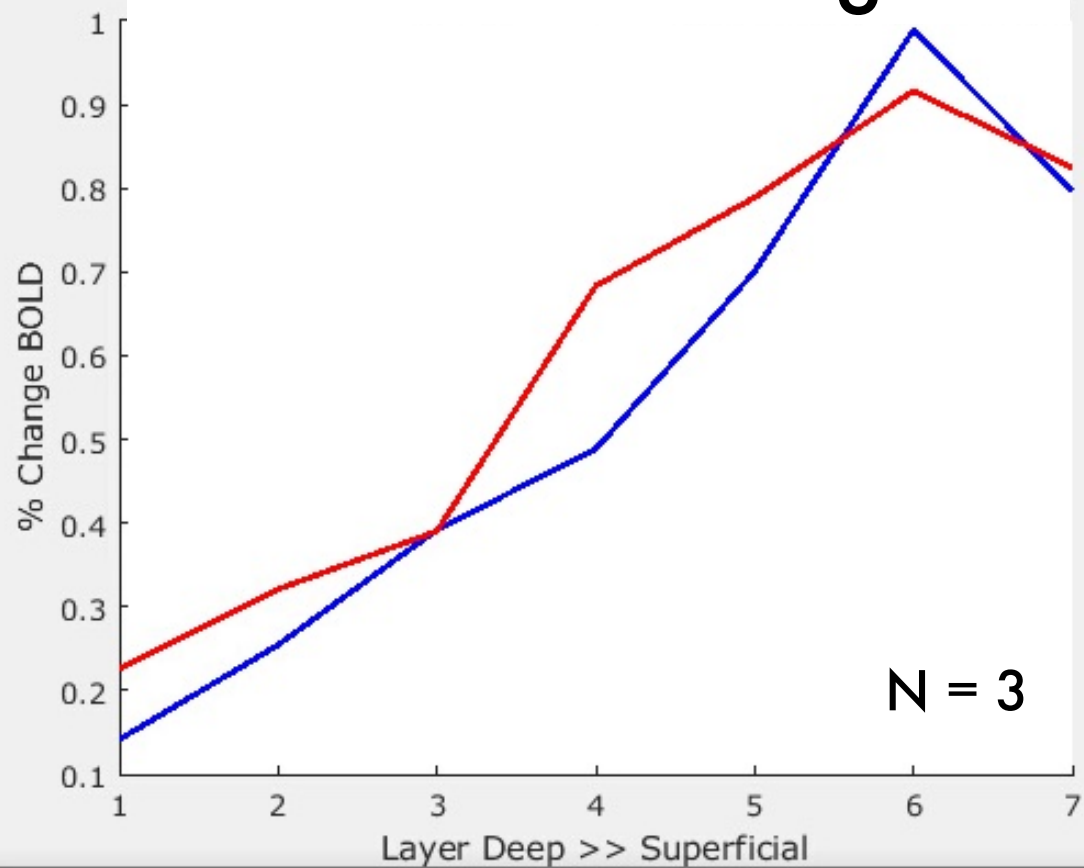
Eye-tracking & pupillometry
(1000Hz; right eye)

+

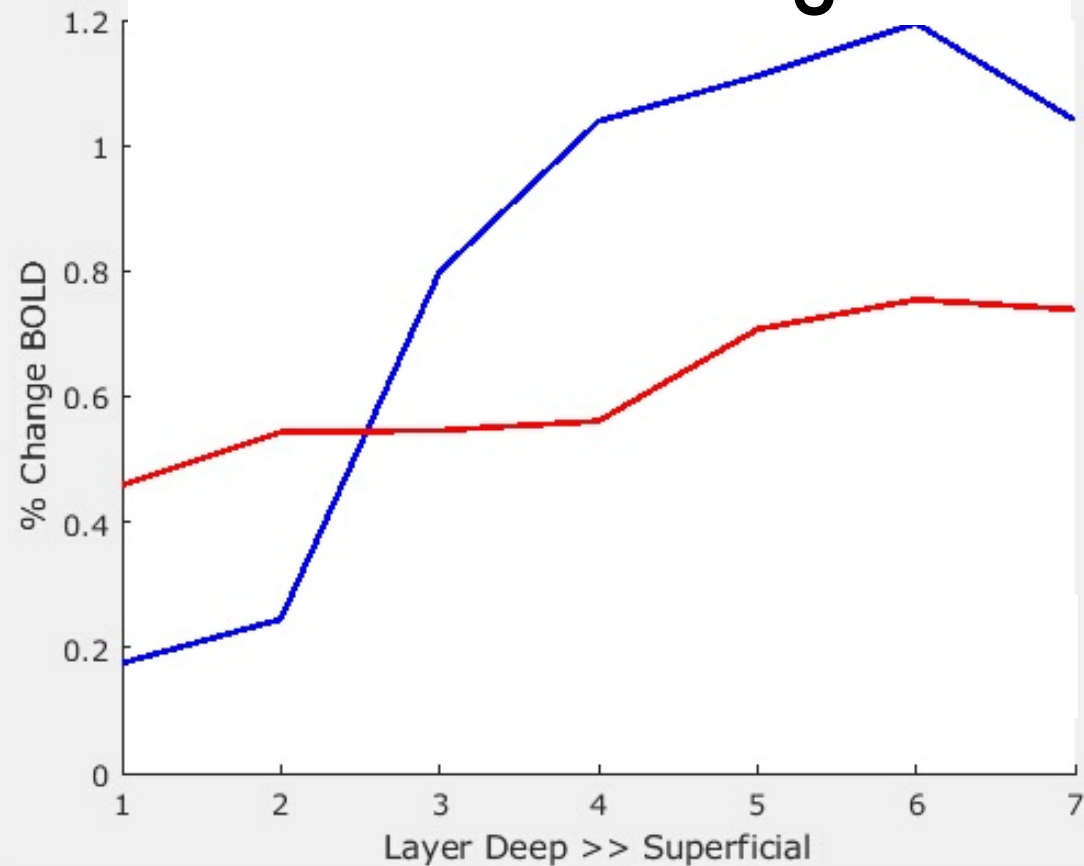
N = 12 healthy participants



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

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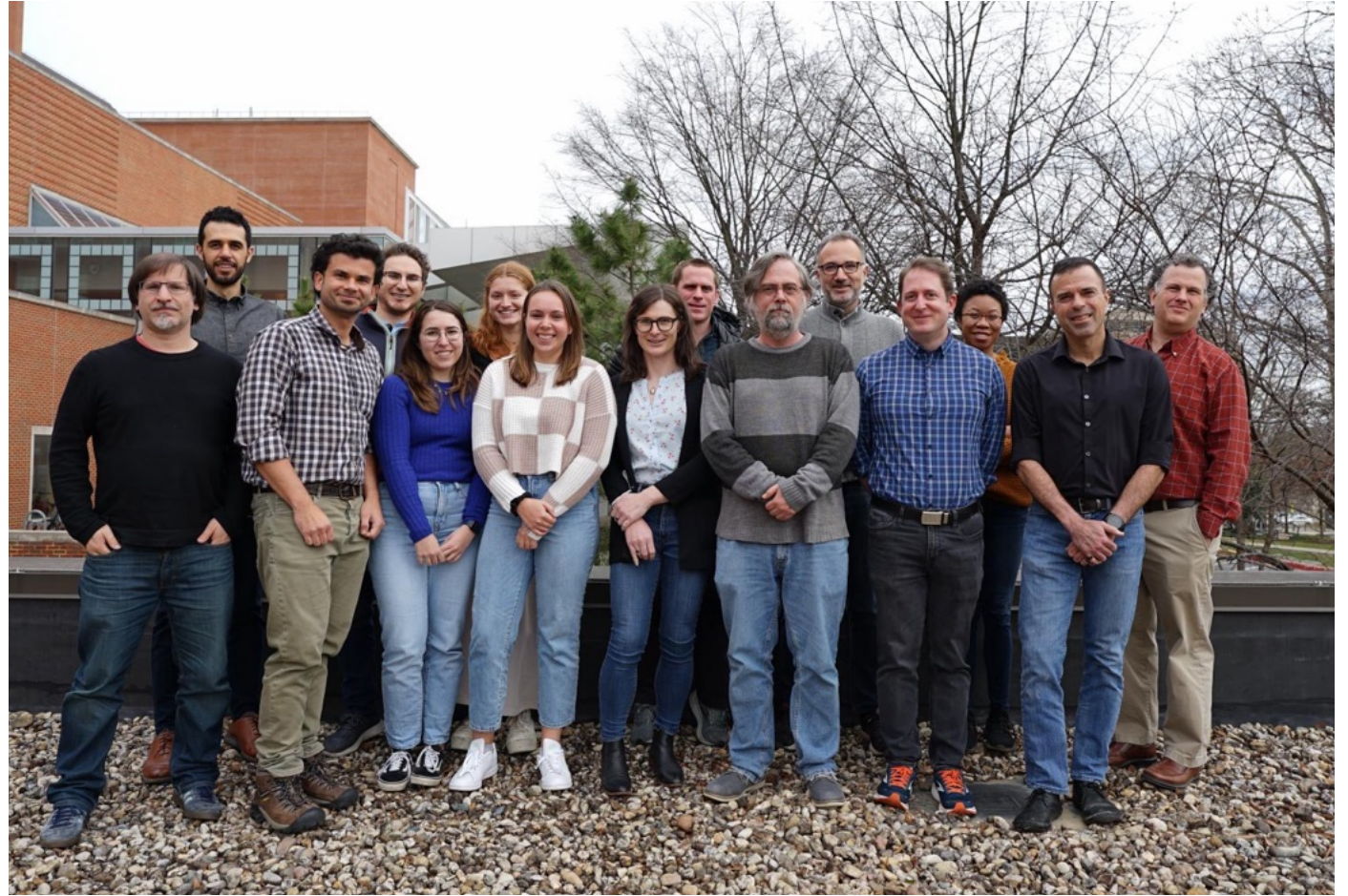
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Catherine Walsh



Thank you to the volunteers!



National Institute
of Mental Health

