Whole brain and primary visual cortex layer fMRI signatures of afterimage perception

National Institute of Mental Health #2540

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Primary Aim: Map the whole brain and V1 layer fMRI responses for image and afterimage conscious perception.

1. Motivation and Background

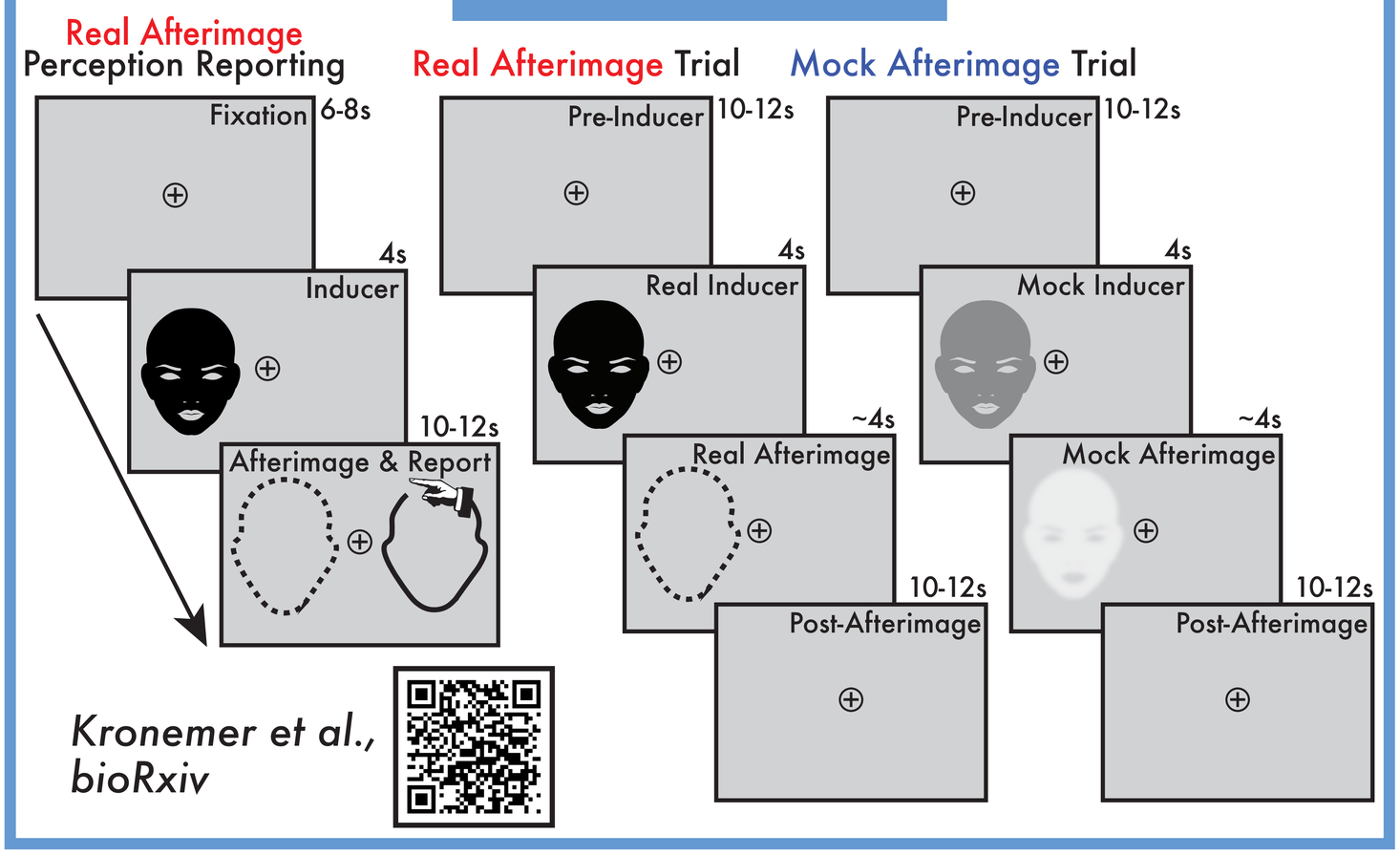
- Afterimages are illusory, conscious visual perceptions commonly induced by a preceding image (i.e., an inducer stimulus; e.g., bright light). [1]
- The precise neural mechanisms of afterimages is unknown. Previous studies suggest both retinal and cortical contributions. [2,3]
- A challenge of contrasting sensory vs sensory-independent perception (e.g., vision vs imagery) is matching perceptual experience and task demands.
- Afterimages may be used as a perceptual model of sensory independent conscious perception.

2. Participants

Whole Brain fMRI (7T; TR 1s; 1.5mm^3) N = 35

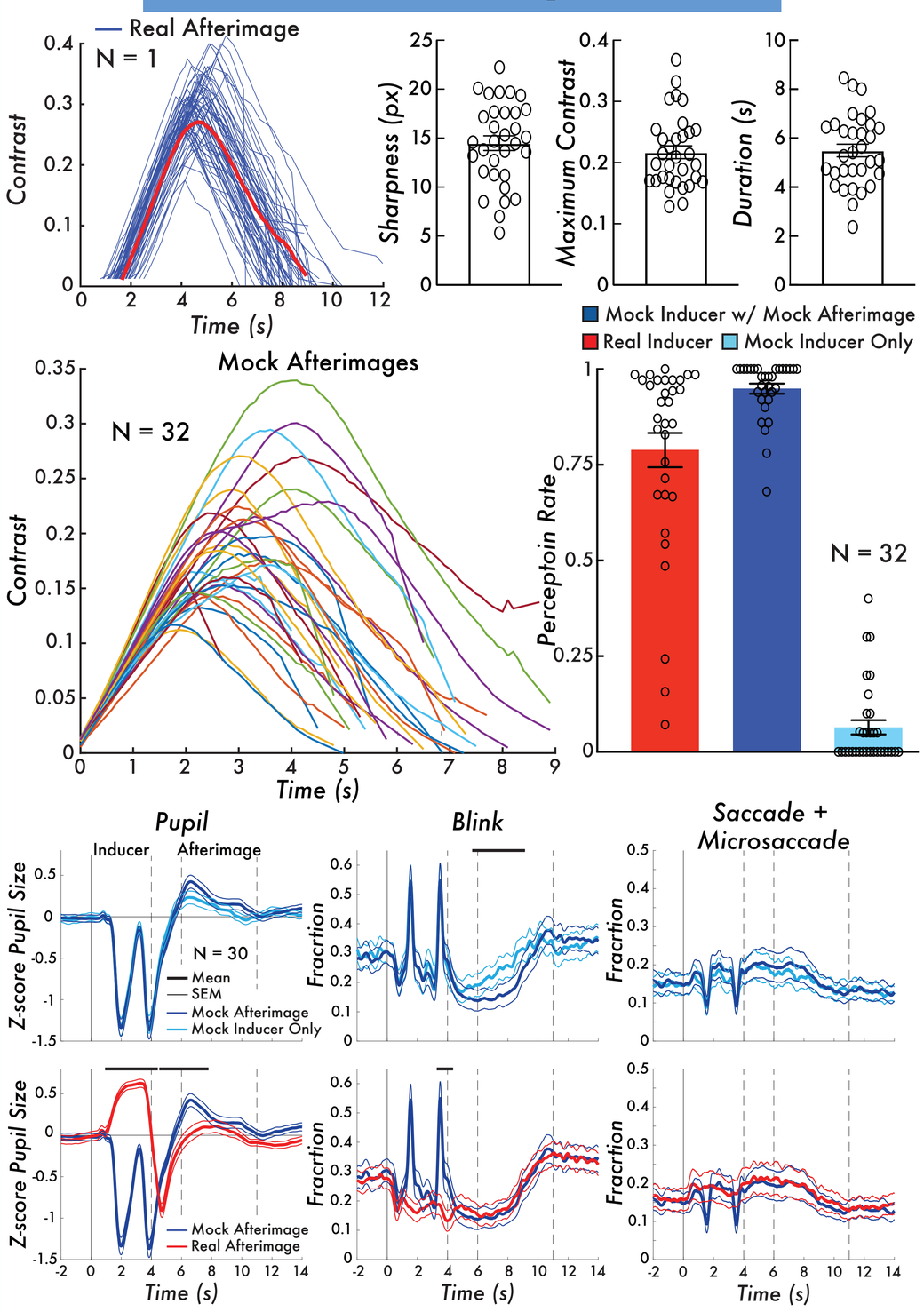
V1 Layer fMRI (7T; TR 3.1s; 0.88mm^3) N = 12

3. Behavioral Task

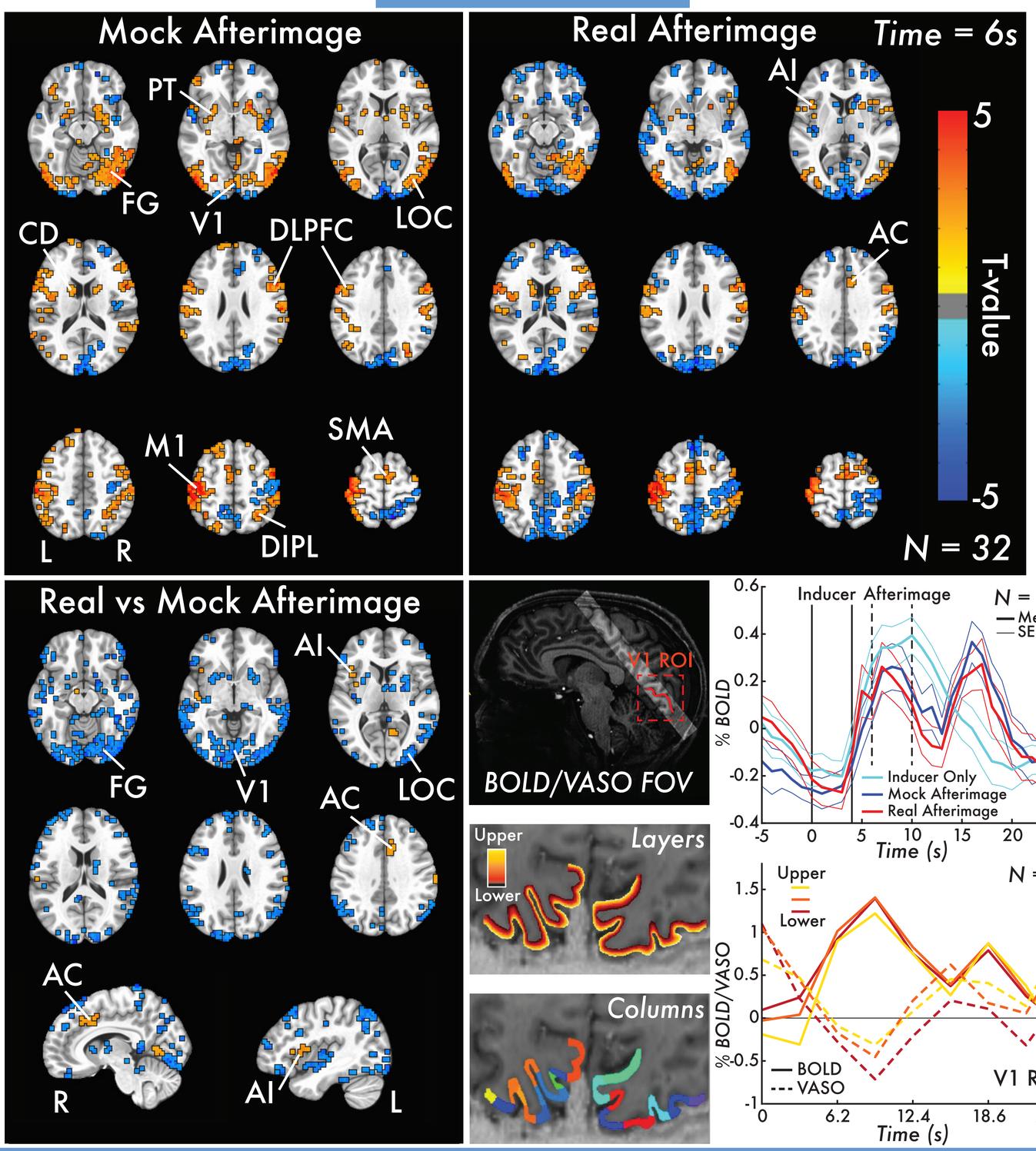


Kronemer et al., bioRxiv

4. Behavioral & Eye Results



5. fMRI Results



6. Conclusions

- Afterimages are reliably induced and perceptually-matched by participant self-reporting (mock afterimage).
- Blink and saccades (but not pupil size) show similar responses during mock and real afterimage conscious perception.
- Mock and real afterimages share widespread cortical and subcortical BOLD, including FG, LOC, DLPFC, and SMA/M1.
- BOLD is greater in sensory regions for mock afterimages (e.g., FG/V1); greater in AI and AC for real afterimages.
- Layer resolution BOLD replicate whole brain findings in V1.

7. Future Directions

- Study the feedforward and feedback contributions for mock and real afterimage conscious perception.
- Study networks discriminating real vs illusory perception.

References

1. Shimojo et al., Science, 2001
2. Dong et al., Scientific Reports, 2017
3. Sperandio et al., Nature Neuroscience., 2012