

Stereomotion processing in the non-human primate brain

Yseult Héjja-Briard^{1,2}, Samy Rima^{1,2}, Jean-Baptiste Durand^{1,2}, Benoit R. Cottereau^{1,2}

¹ Université de Toulouse, Centre de Recherche Cerveau et Cognition, Toulouse, France

² Centre National de la Recherche Scientifique, Toulouse, France

Contact: yseult.hejja@cnrs.fr

Overview

Motion perception is a fundamental property of the visual system in most animal species. Although numerous studies examined how the primate brain processes 2D motion, much less is known about how it encodes 3D motion.

A few neuroimaging investigations in human found that stereomotion is processed within the hMT+ complex and/or its neighbourhood (Rockers, Cormack & Huk, 2007; Likova & Tyler, 2007).

Here, we extend this work to non-human primate, using fMRI.

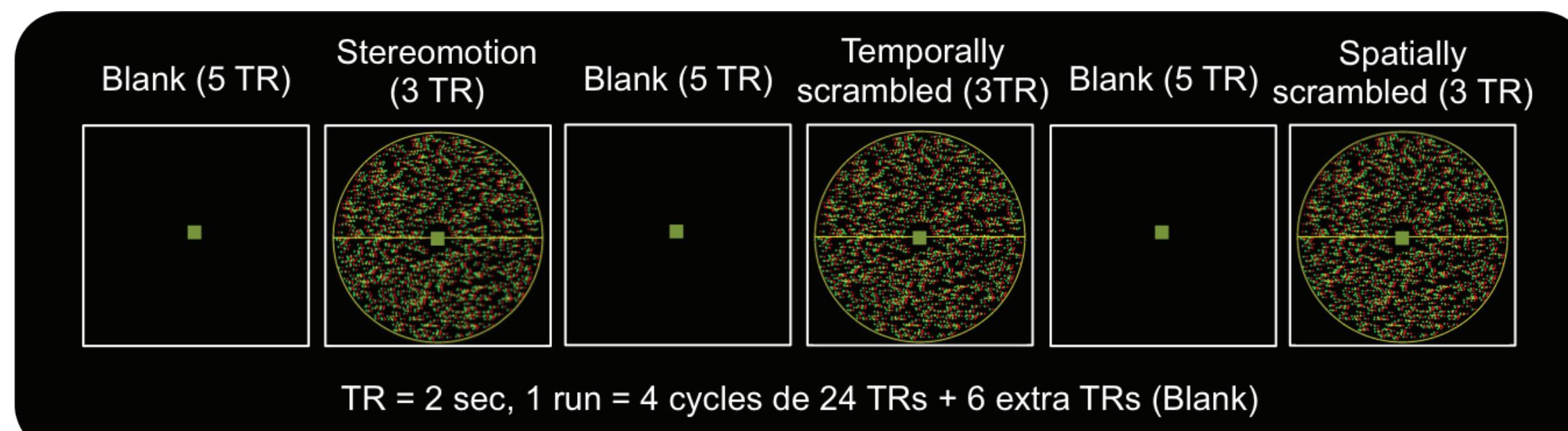
Methods

fMRI recording (3T) in 2 behaving monkeys

Fixation task: only runs with >80% fixation were further analysed (46 and 47 runs in total for M01 and M02, resp.)

Eye-tracker recordings

Block-design paradigm

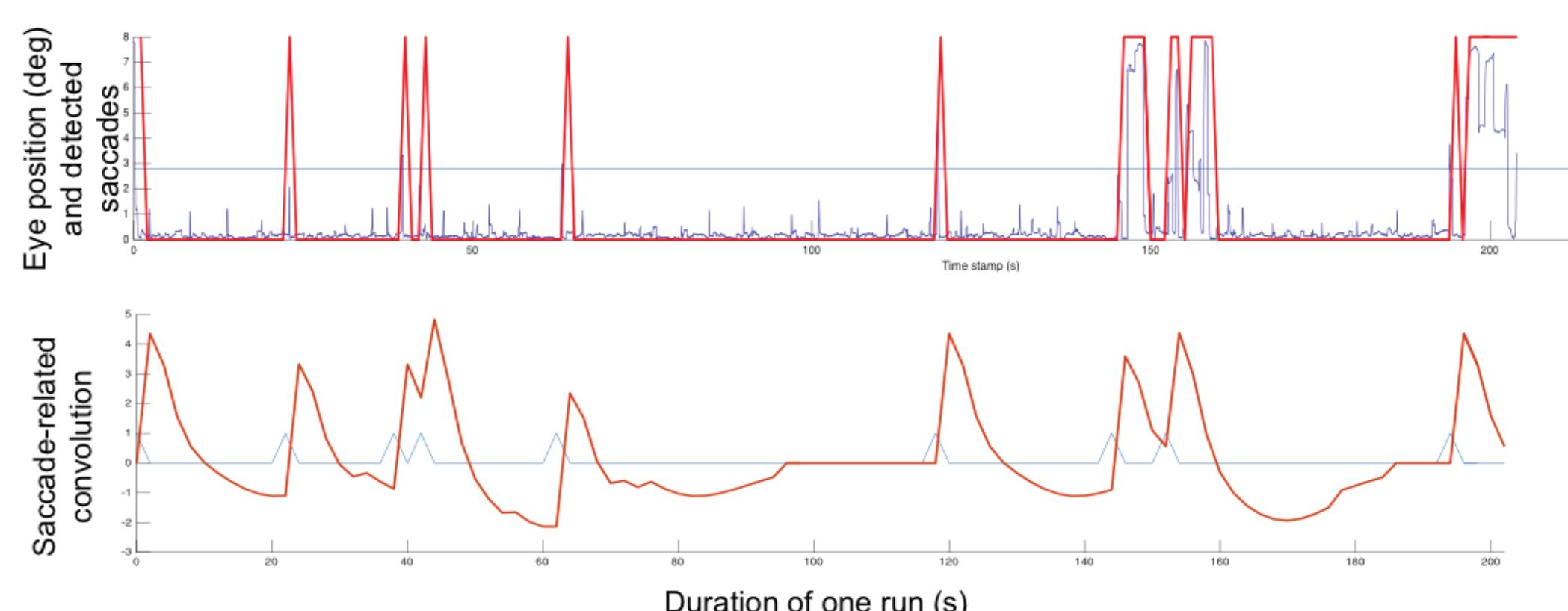


Preprocessing of the data

- slice-timing correction
- mean EPI template coregistration
- normalisation
- smoothing

GLM analysis

- regressors of non-interest based on saccade detection and a PCA performed outside the brain



Bibliography

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- Taira, M., Tsutsui, K. I., Jiang, M., Yara, K., & Sakata, H. (2000). Parietal neurons represent surface orientation from the gradient of binocular disparity. *Journal of Neurophysiology*, 83(5), 3140-3146.

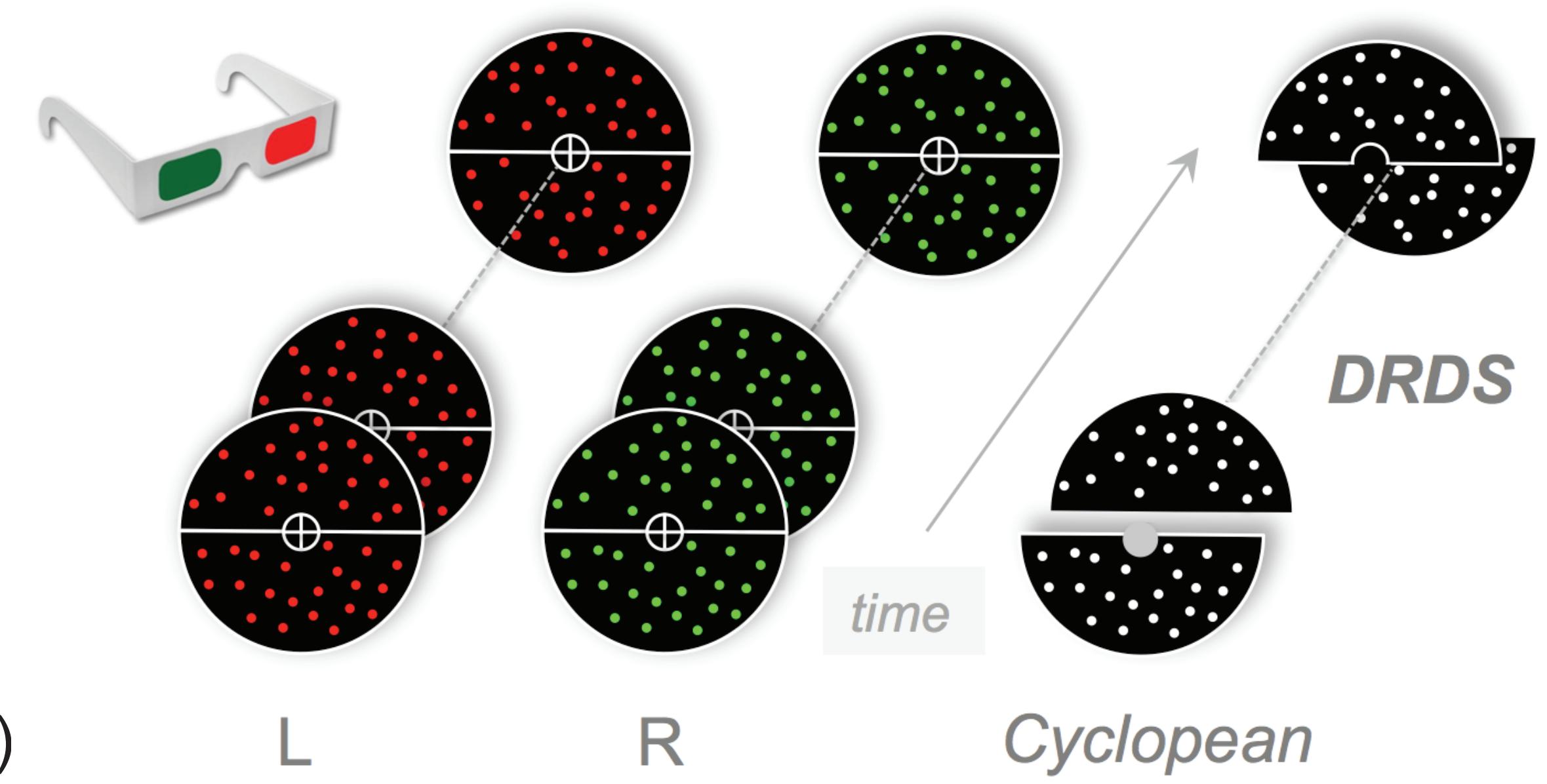
Stimuli

Dynamic random dot stereograms (DRDS)
Refresh rate: 30 Hz

Main condition:

Stereomotion (StM)
(triangular function
between +/- 23 arcmin)

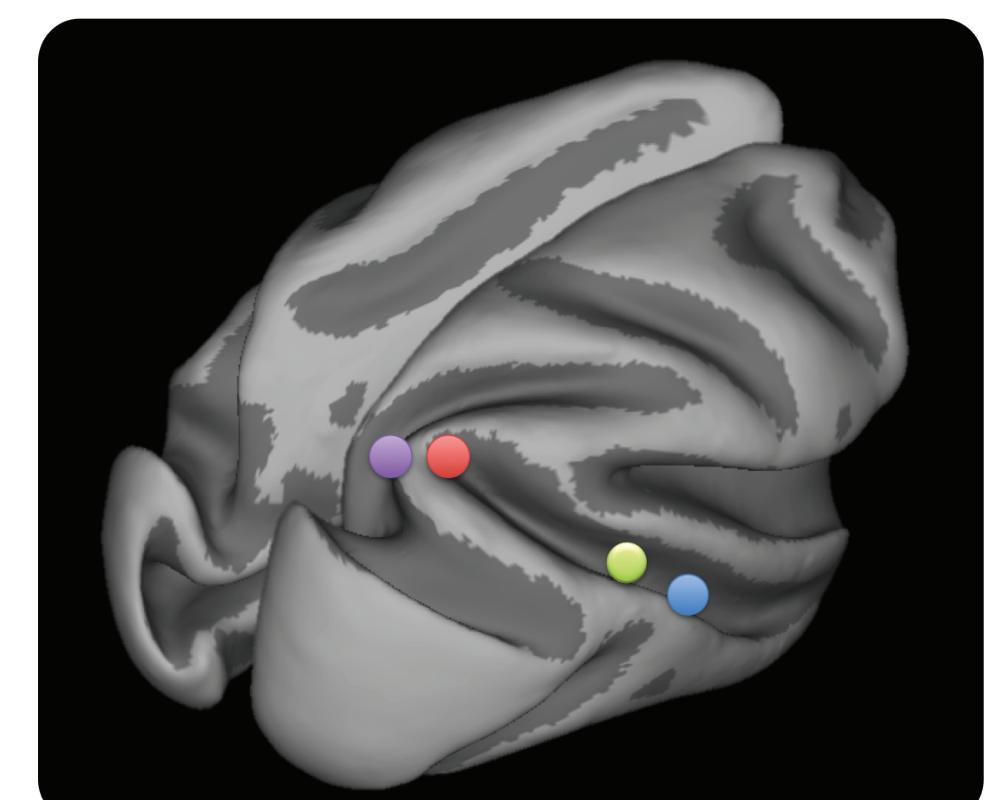
Two **monocularly identical** control conditions:
temporally scrambled (TS) and spatially scrambled (SS)



Results

Significant activations in the parietal cortex:

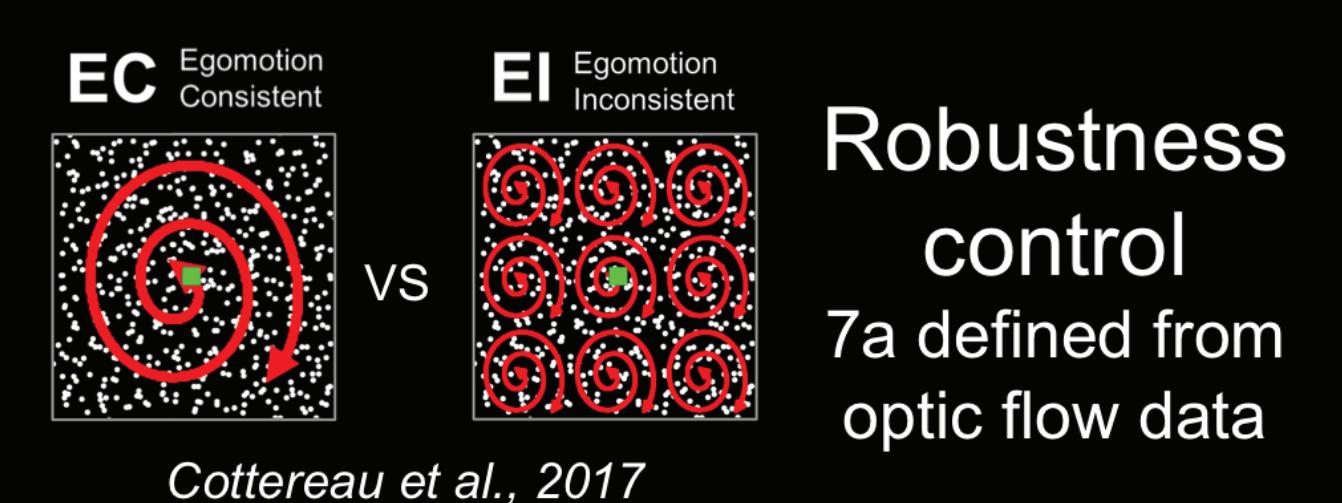
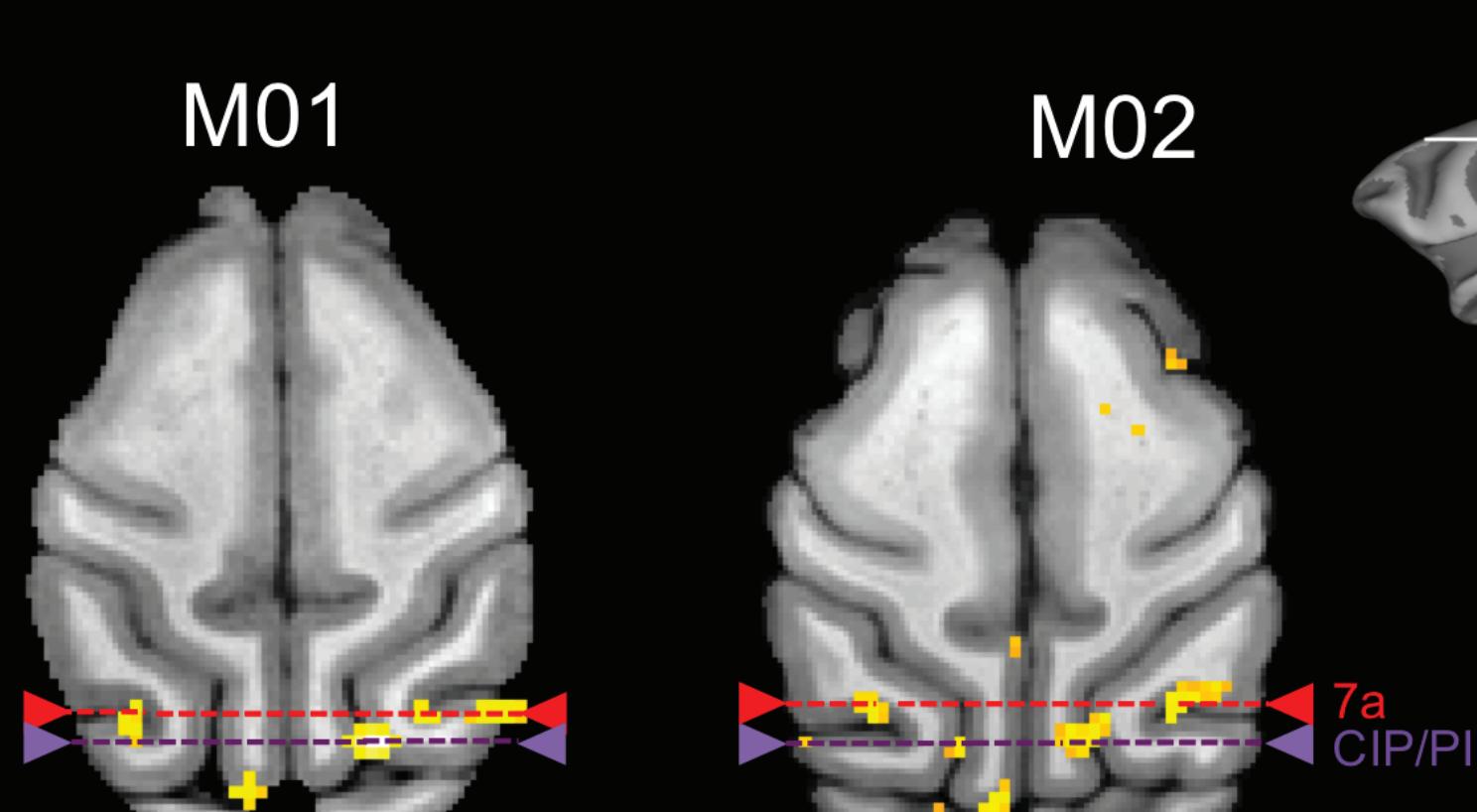
7a, CIP/PIP



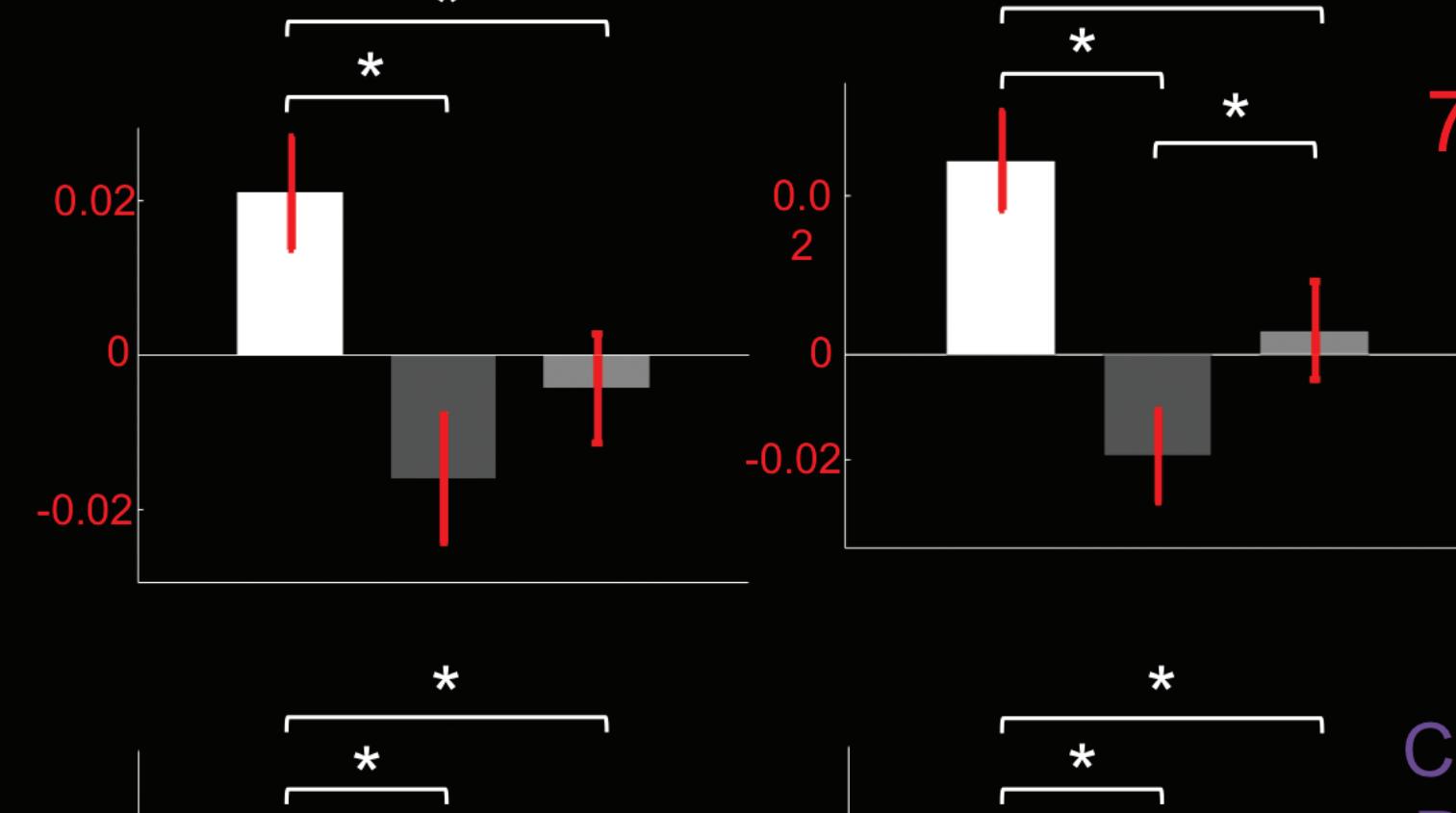
Tendencies along the superior temporal sulcus (STS):

STPm, TEO

Activations in the parietal cortex



Robustness control
7a defined from
optic flow data



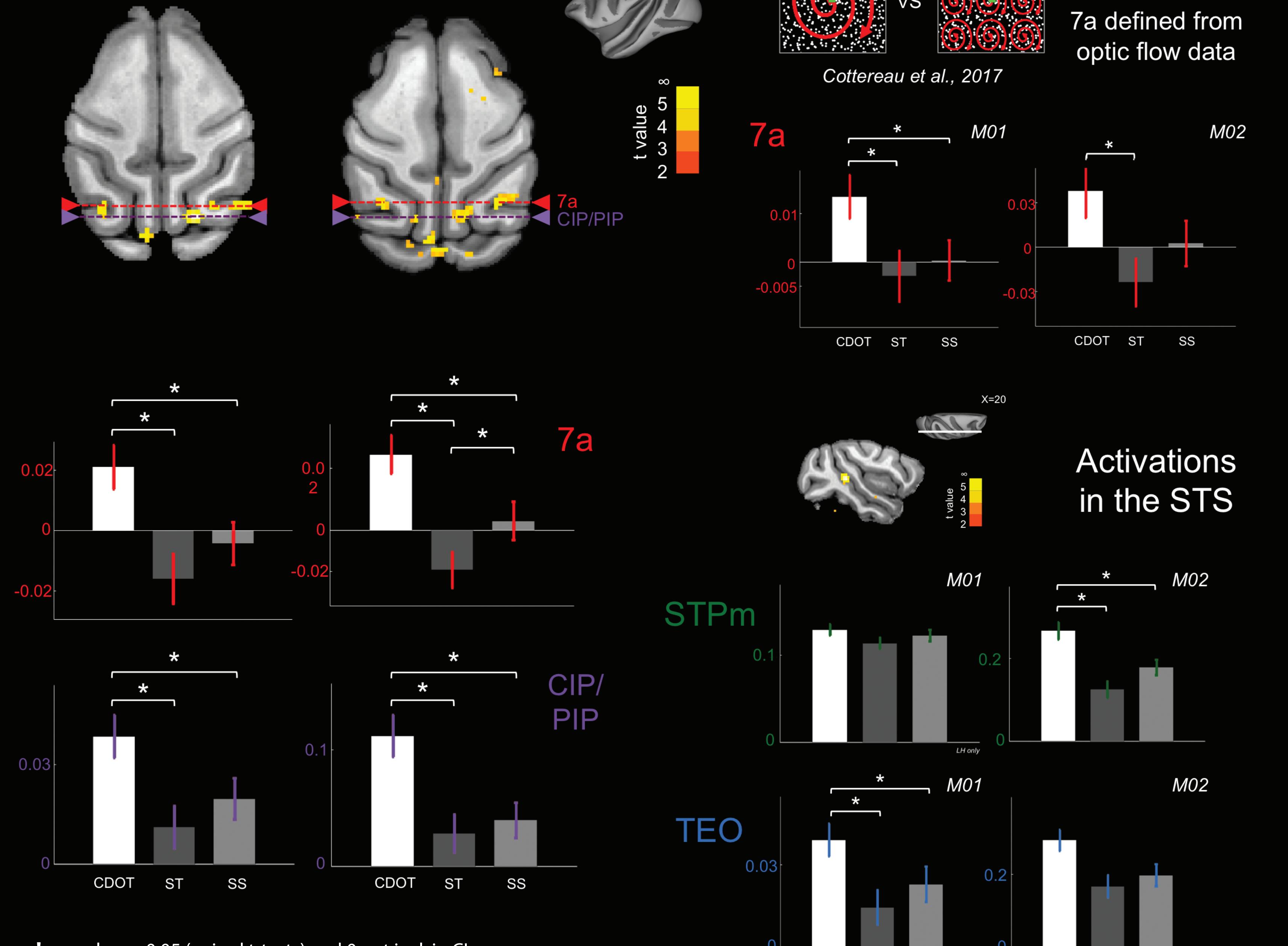
Conclusion

In macaque, stereomotion is mostly processed in the parietal cortex, where both areas 7a and CIP/PIP were significantly more activated by motion-in-depth.

Area 7a was recently found to respond to egomotion-consistent optic flow (Cottereau et al., 2017), implying that 7a processes different types of complex motion.

Neurons in area CIP/PIP were previously found to be selective to disparity-defined slants (Taira et al., 2000). CIP/PIP might, therefore, process both temporal and spatial disparity gradients.

Activations were also found along the superior temporal sulcus but they were not as consistent and robust.



*: p-values <0.05 (paired t-tests) and 0 not incl. in CIs.