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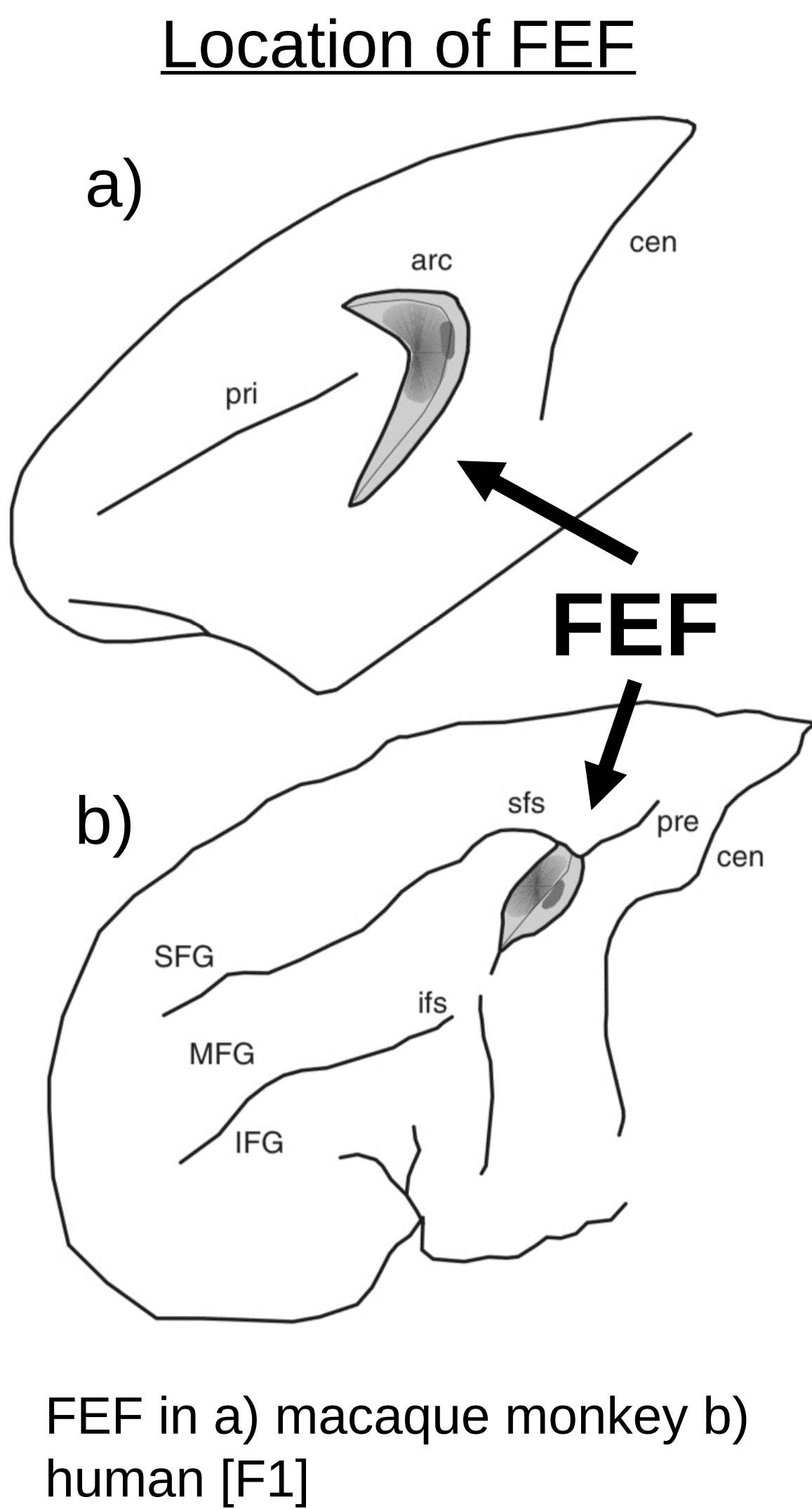
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## Background

Saccades enable us to quickly direct our gaze towards objects of interest in daily life.<sup>1</sup>

The brain area FEF plays a key role in the initiation and execution of saccadic eye movements, and the integration of predictive and anticipatory mechanisms during eye movements.<sup>2</sup>

There is limited and controversial data whether tDCS over the frontal eye field (FEF) can modulate the (anti-) saccadic performance.<sup>3</sup>



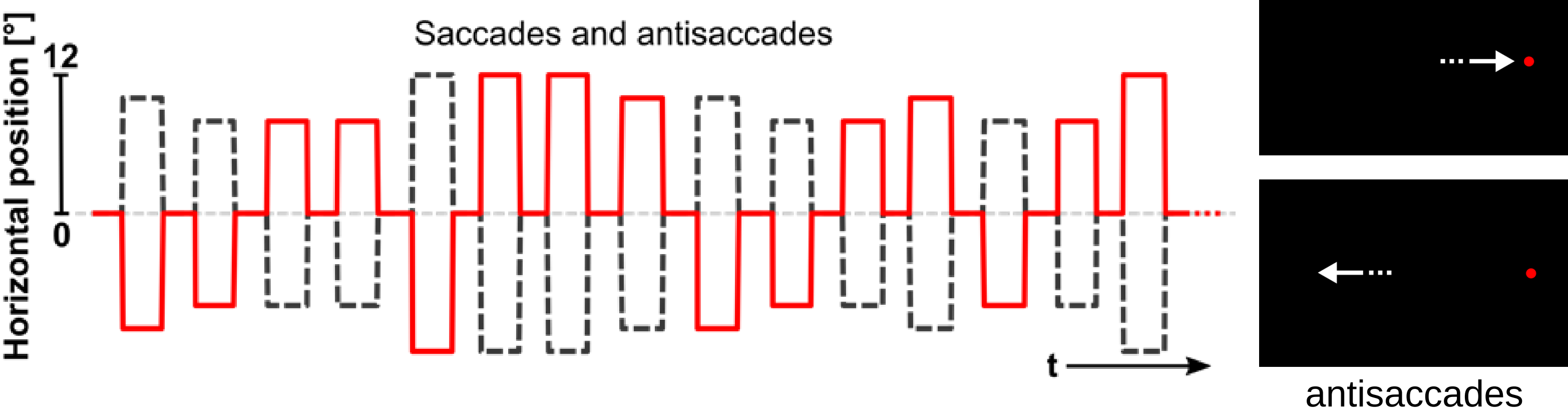
FEF in a) macaque monkey b) human [F1]

## Research question

Does unilateral tDCS over the FEF (=frontal eye field) modulate error rates and latencies of the pro- and antisaccade task in healthy individuals?

## Methods

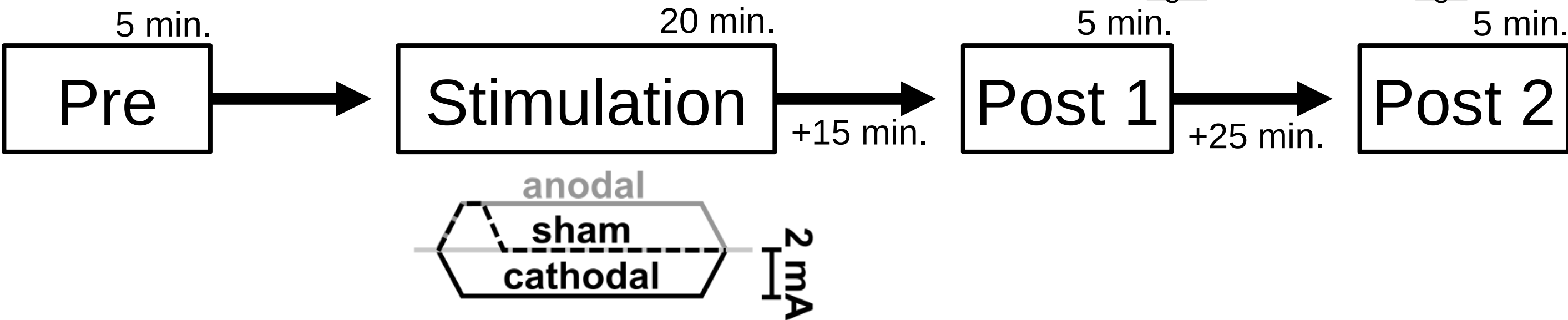
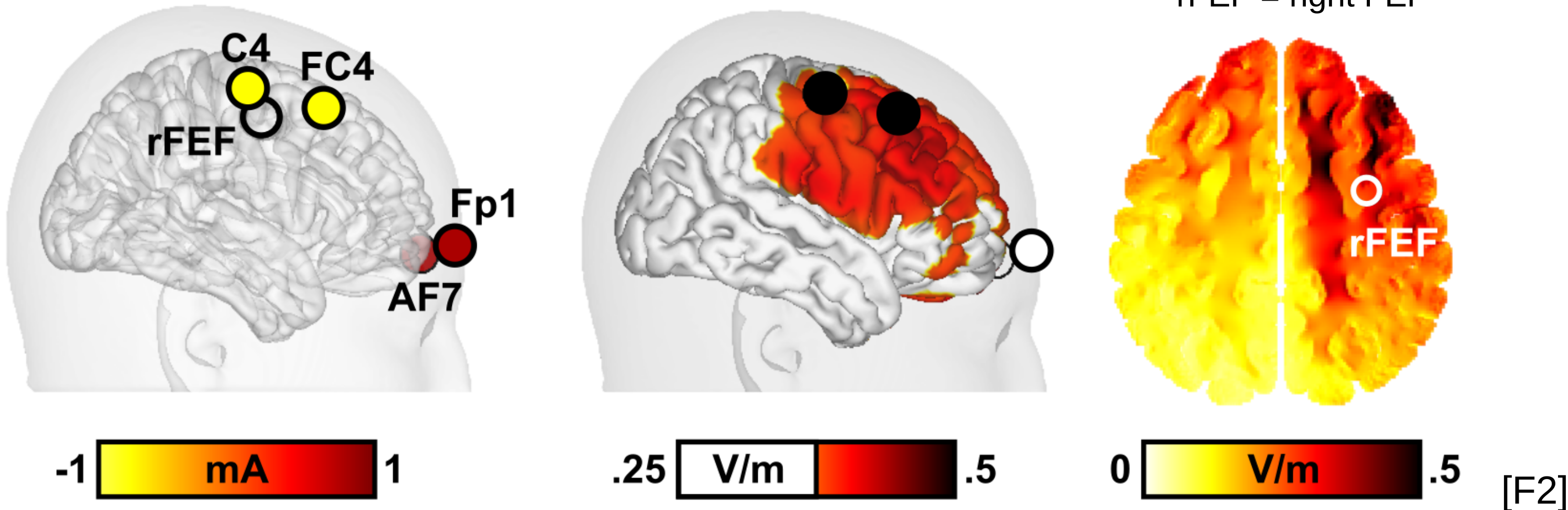
### Stimulus design



Parameters of interest: saccade gain\*, latency, error rate

\*gain= accuracy of performed saccades

### tDCS montage



## Results

Descriptive data	task	parameter	Mean +/- SD
prosaccades	gain	latency	0,97 ± 0,06
		error rate	135 ± 14,3 ms
		error rate	2,3 ± 2,4 %
antisaccades	latency	latency	217 ± 38,9 ms
		error rate	19,0 ± 11,3 %
		error rate	

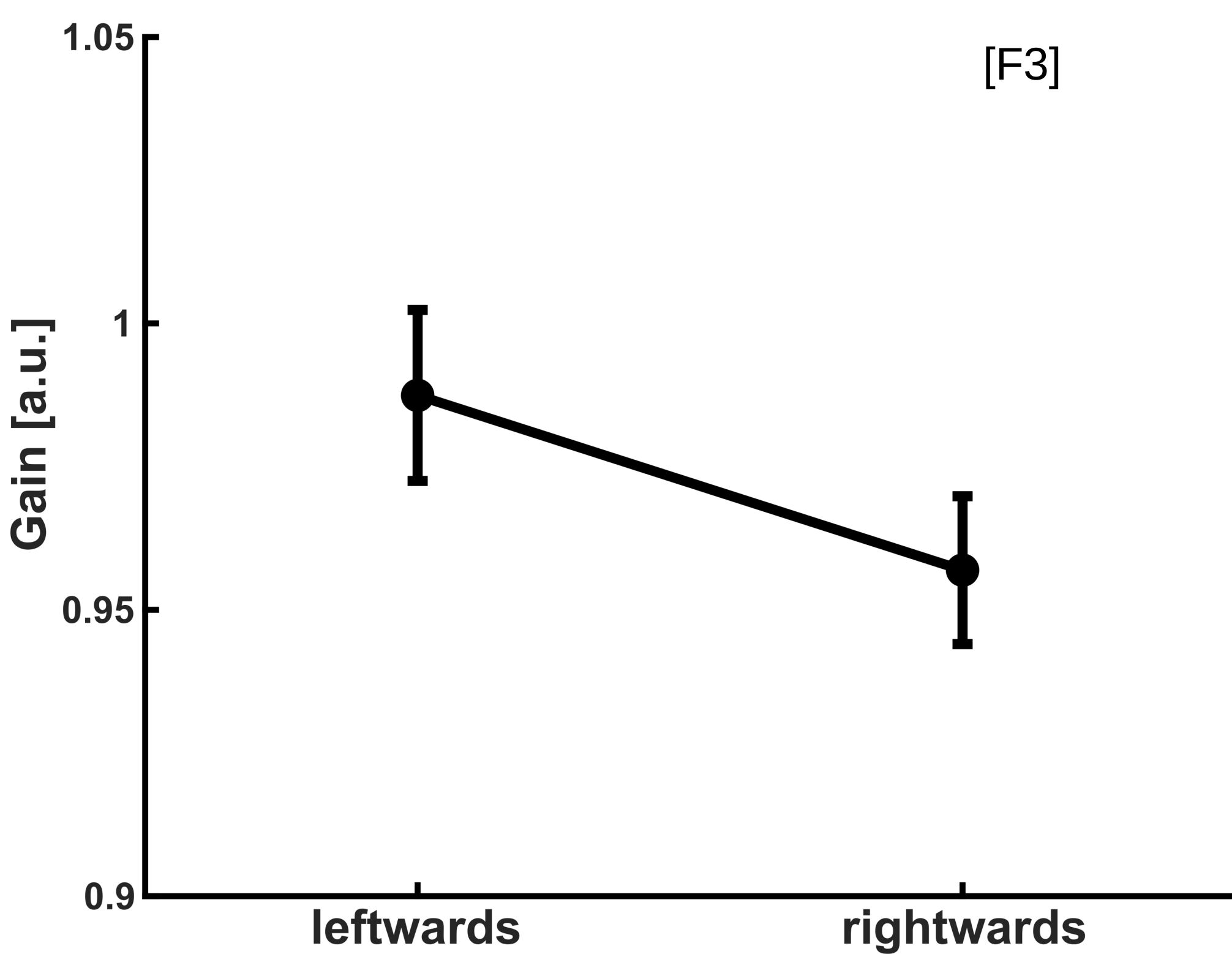
### Antisaccades

- no significant main effect or interaction ( $p \geq .082$ ) was revealed for latency or error rate
- No modulation by normative tDCS was observed

### Pro- versus antisaccades

- Shorter latencies ( $p < .001$ ) and reduced error rates ( $p < .001$ ) of prosaccades, compared to antisaccades
- As previously reported<sup>4</sup>

### Prosaccade gain depends on direction



### Prosaccades

- significant main effect of saccade direction for gain ( $p = .02$ ; all other main or interaction effects:  $p \geq .08$ )
- increased gain for saccades directed to the left, compared to the right
- No modulation by normative tDCS was observed

## Conclusions

- No tDCS-specific effects were observed using normative tDCS montages.
- Limited tDCS efficacy may be explained by the high saccade performance of our healthy test subjects. Personalized tDCS montages considering individual anatomy and functional localization of FEF might be able to increase tDCS efficacy.
- Prosaccade gain depended on saccade direction. This effect might be attributable to the dominance of reflexive shifts of attention maintained by the right brain hemisphere resulting in more accurate prosaccades directed to the left.<sup>5</sup>

## References

- <sup>1</sup>Joos, et. al (2003) Spezielle Verfahren 1: Bewegungen des menschlichen Auges [...]. Psycholinguistik, volume 24, pp. 142-173. <https://doi.org/10.1515/9783110114249>
- <sup>2</sup>Lencer, et. al (2019) Smooth Eye Movements in Humans [...]. Eye Movement Research, pp. 117-163. Cham: Springer International Publishing. [http://link.springer.com/10.1007/978-3-030-20085-5\\_4](http://link.springer.com/10.1007/978-3-030-20085-5_4)
- <sup>3</sup>Vernet et. al, (2014) Frontal eye field, where art thou? [...]. Frontiers in integrative Neuroscience, volume 8 (66), pp. 1-24. <https://doi.org/10.3389/fnint.2014.00066>.
- <sup>4</sup>Olk, B. and Kingstone, A. (2003) Why are antisaccades slower than prosaccades? [...]. Neuro Report, volume 14 (1), pp.151-155. <https://doi.org/10.1097/00001756-200301200-00028>.
- <sup>5</sup>Arshad, Q. et. al (2015) Right hemisphere dominance [...]. Neuroscience, volume 311, pp. 484-489. <https://doi.org/10.1016/j.neuroscience.2015.10.045>

### Register of illustrations:

- [F1]: Adapted from Schall, J. D. (2009). Frontal Eye Fields. In: Encyclopedia of Neuroscience, volume 4, p. 368 (367-374). <https://doi.org/10.1016/B978-008045046-9.01111-6>
- [F2]: Adapted from Radecke, J. O. et al. (2023). Normative tDCS over V5 and FEF reveals practice-induced modulation of extraretinal smooth pursuit mechanisms, but no specific stimulation effect. *In review*.
- [F3] conceived by Radecke, J.O. (2023)



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