JUSTUS-LIEBIG-UNIVERSITÄT GIESSEN

Does individual gaze lead to individual visual representations?

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Methods

Observers watched the movie, *Shaun, The Sheep* (60 min) in an 3T fMRI scanner (n=12) and in a separate session while their eyes were tracked with Eyelink 1000 (n=21)

- We used two conditions: participants either fixated centrally, and thus experienced (nearly) identical retinal input or freely viewed the movie, allowing their gaze to diverge. The movie was divided in blocks of 5 min, alternating between **fixation** and **freeview** condition (n=12 blocks).

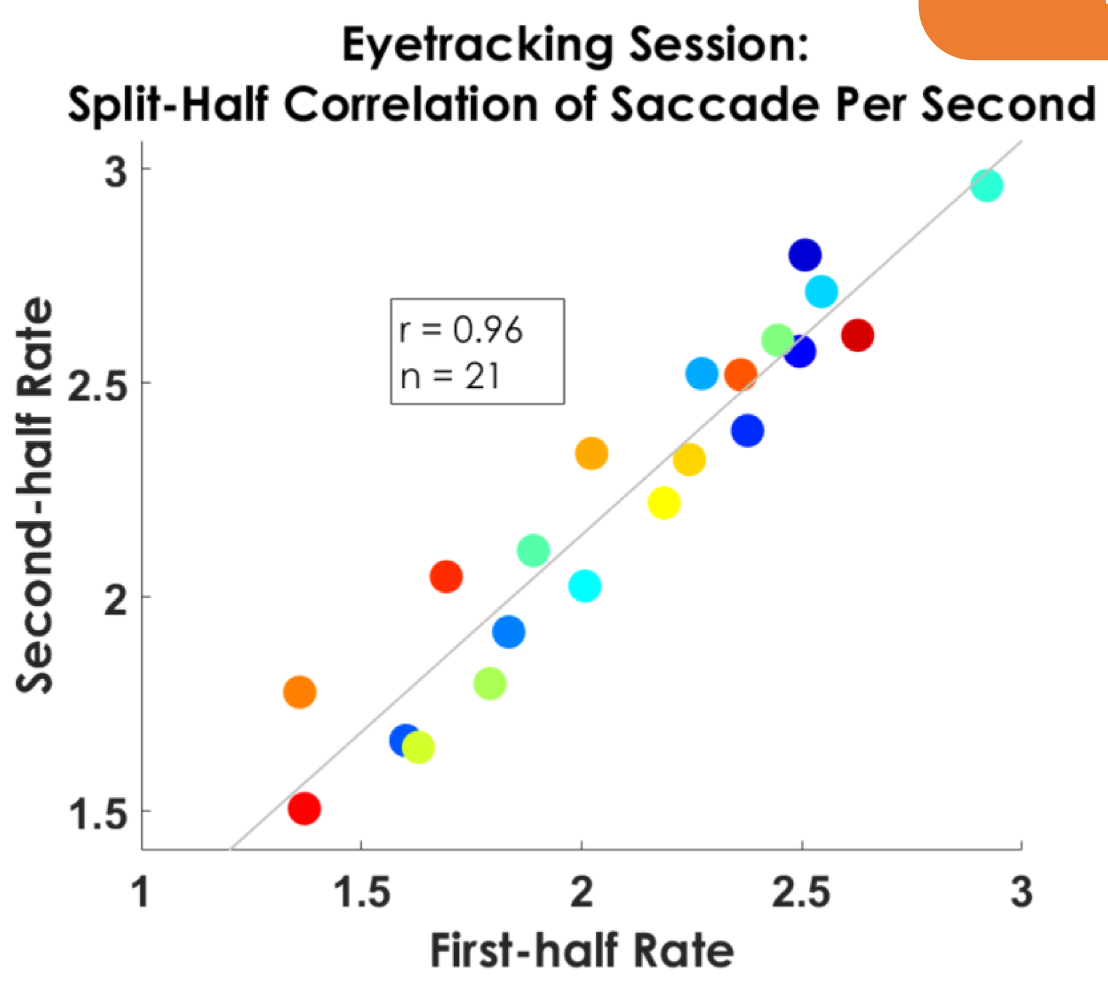
Introduction

- Individual differences in gaze behavior occur systematically and reliably for static (Bargary et al., 2017, de Haas et al., 2019) and dynamic scenes (Constantino et al., 2017, Broda & de Haas, 2022).
- It is unclear, however, what are the **consequences** of **individual oculomotor behavior** in higher visual areas (inferior temporal cortex, IT). Are you *representing* the same scene differently from me?

Results

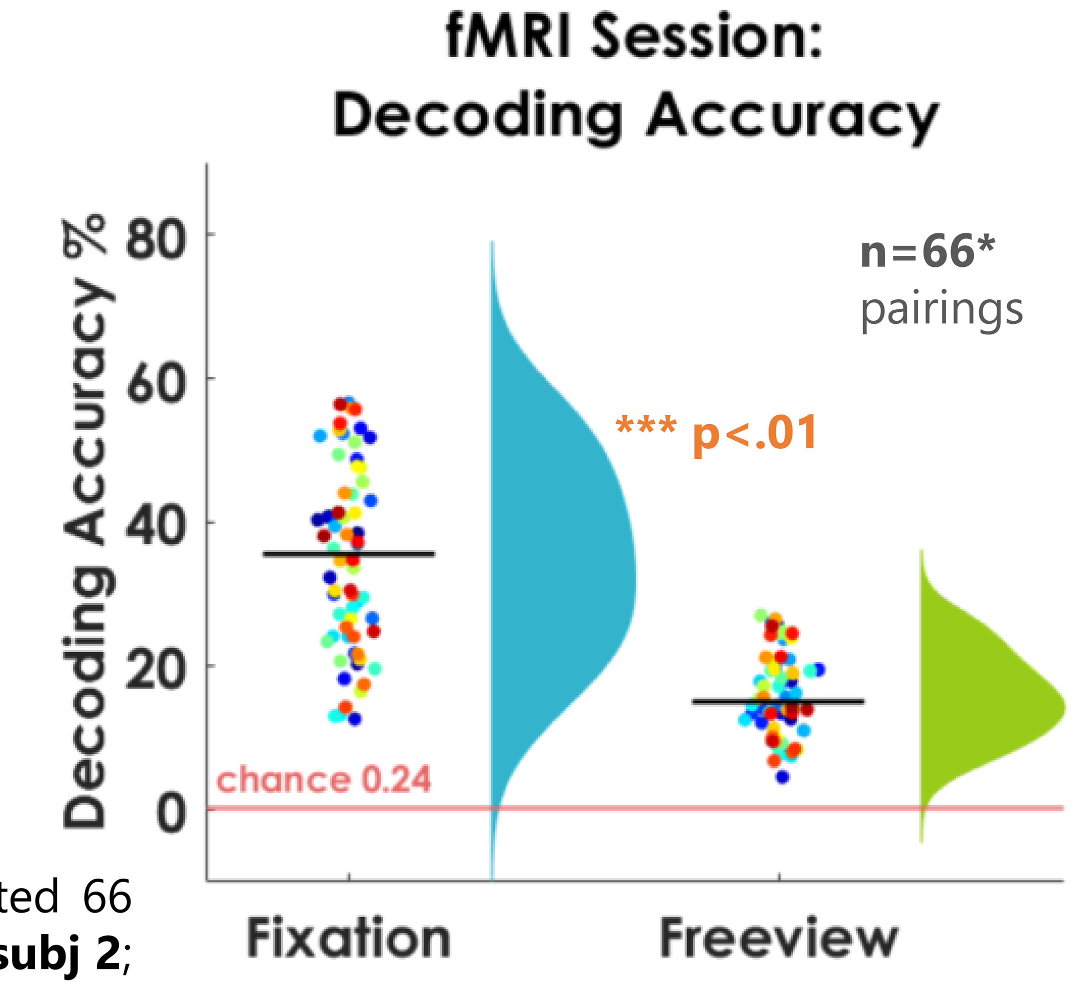
Observers varied consistently up to factor 3 regarding saccadic **rates** and amplitudes.

Here presented only rates



- Decoding accuracy is significantly **higher** for **fixation** than for **freeview** condition ($t = 11.12$, $p < .01$) and both are significantly higher than chance level (0.24 %).

* In total n=12 subjects created 66 unique pairings, e.g. **subj 1 – subj 2**; **subj 1 – subj 3**, etc.



Hypotheses

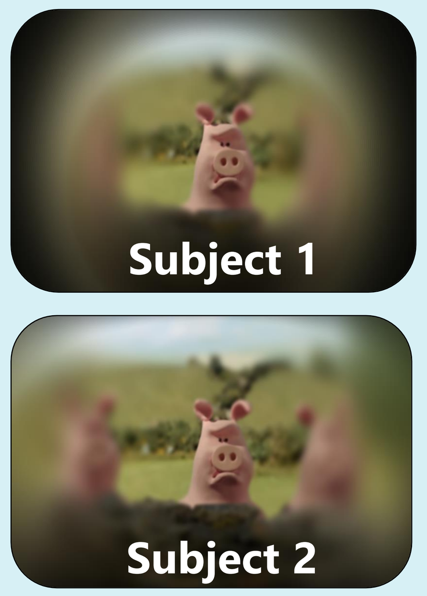
H1 **Individual gaze leads to more different neural representation in ventral stream.**

Proposition: Neural representations reflect selection differences (de Haas et al., 2019)

H2 **Individual gaze leads to more similar neural representation in ventral stream.**

Proposition: Eye movements are **compensating** for individual architecture of visual system (Moutsiana et al. 2016)

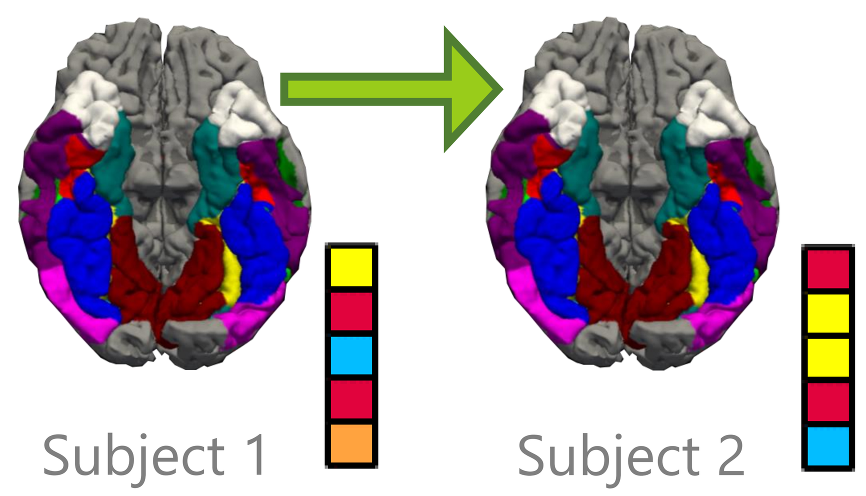
Simulation of (para)foveal drop-off driven by differences in sizes of population receptive fields. In this example more frequent saccades by Subject 1 may lead to a more similar representation.



Analysis

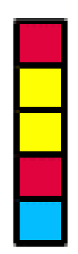
Hyperalignment (Haxby et al., 2011)

Learning **linear transformation** that projects neural activity pattern for the same input from subject 1 to subject 2



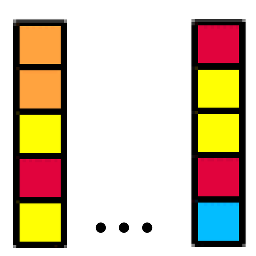
Predicted pattern

Forming prediction of activity pattern for **hold out** data (different portion of the movie)



Actual response

Decoding actual activity pattern of subject 2 from predicted transformed activity pattern of subject 1 (correlation based nearest neighbor classifier)

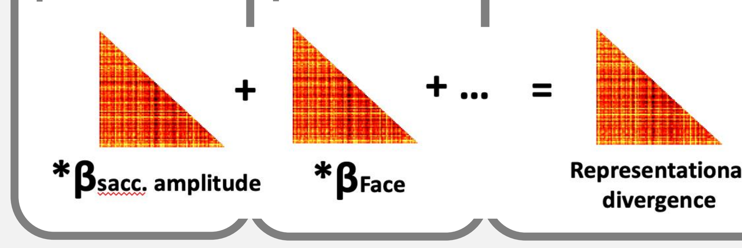


This procedure was repeated separately for **fixation** and **freeview** conditions for each pair of observers resulting in two estimates of **decoding accuracy**

Conclusion & follow-up

Individual gaze lead to individually different ventral representation of the same external stimuli → your representation of the world is different from mine

Follow-up: How much of the differences can be explained by **low-level** characteristics (saccade amplitude or rate) and how much is explained by **high-level** features (e.g. tendency to fixate faces)



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References

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