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Aligned motion-direction information for touch and vision in the human brain

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Aligned visual and tactile motion directions in the human brain

IMRF 2023, Brussels

By Iqra Shahzad

Promoters:

Prof. Olivier Collignon

Prof. André Mouraux

29th June 2023

How to swat a fly? A multisensory task!

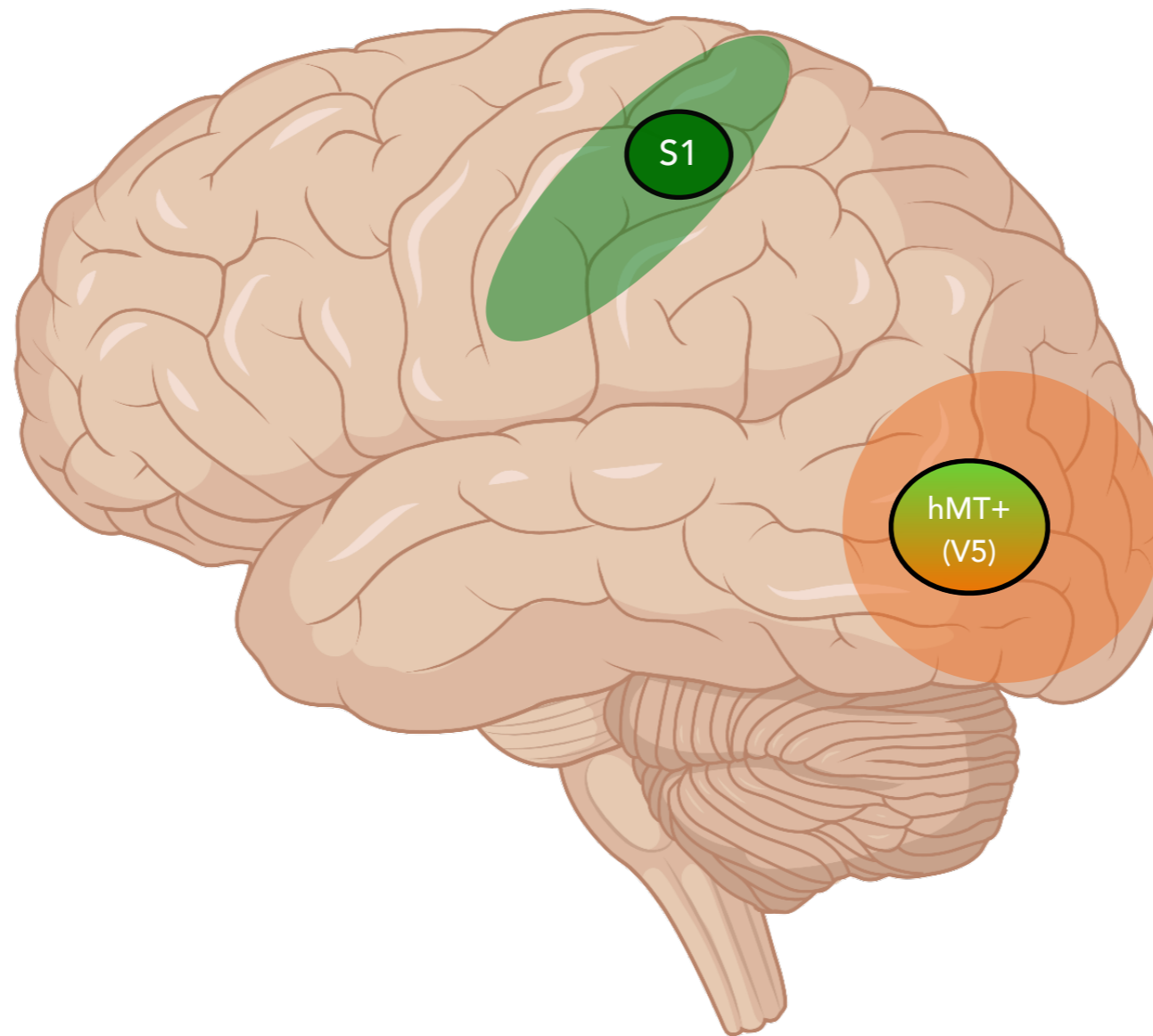
- TOUCH
- VISION
- PROPRIOCEPTION
- And **SWAT!**



How does the brain compute the position Of a MOVING stimuli?

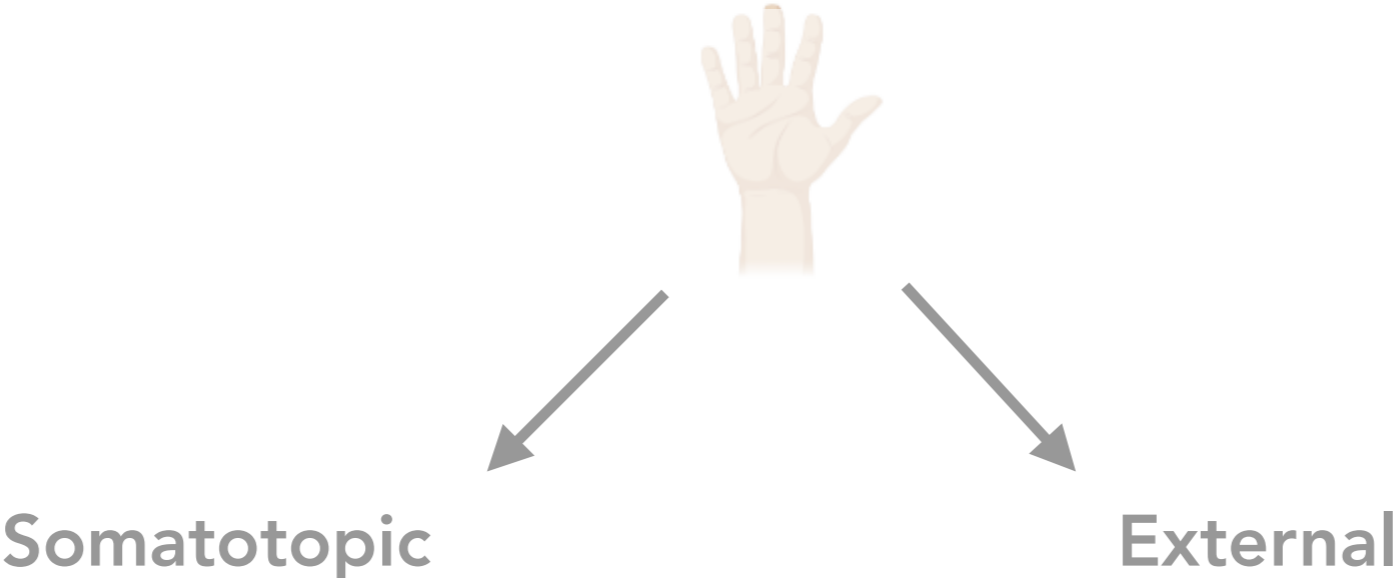
↙
Map
=Frame of Reference
(FoR)

Tactile



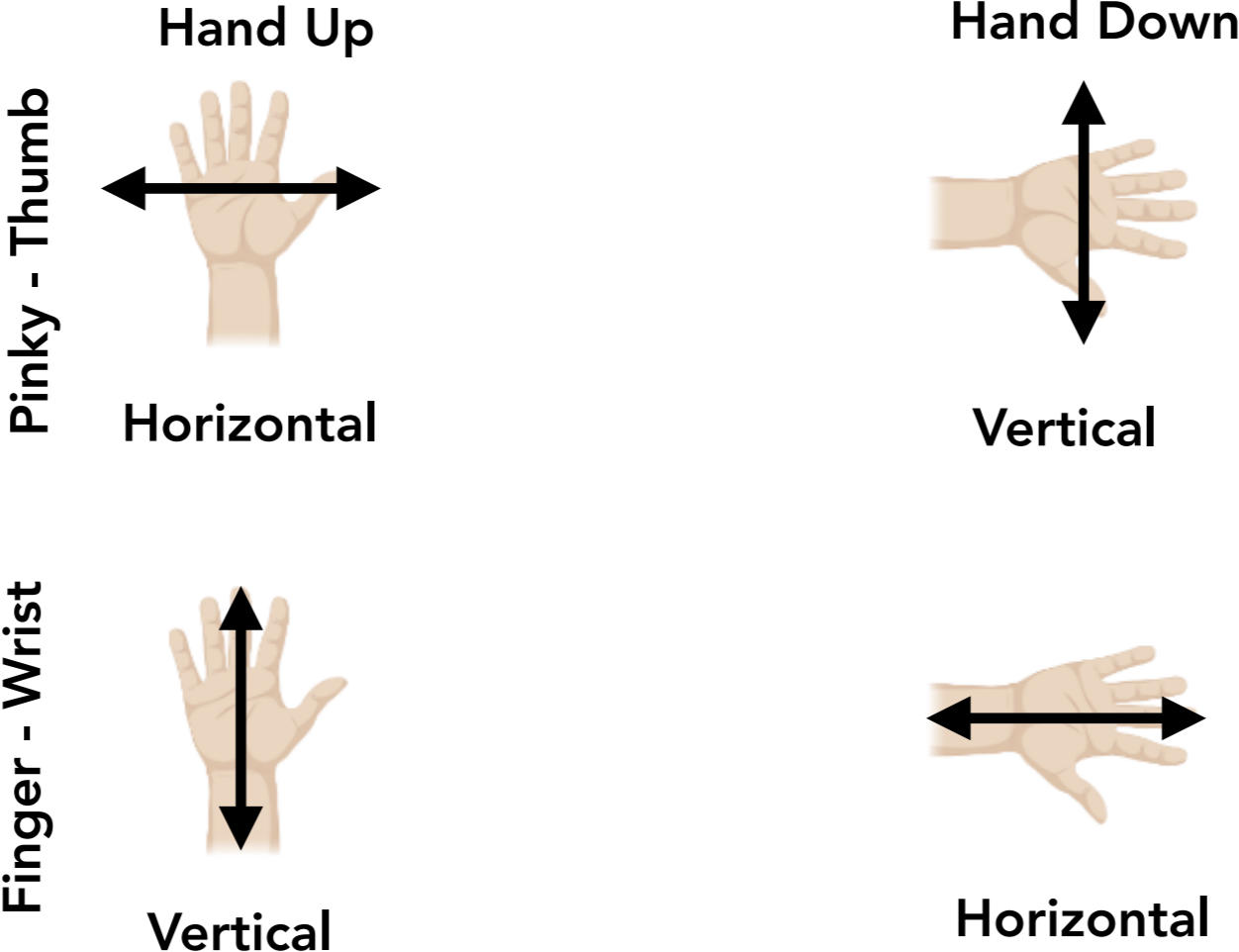
Visual

Frame of Reference (FoR)



Hand Positions

Somatotopic Directions

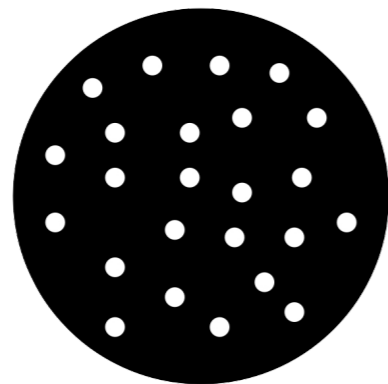
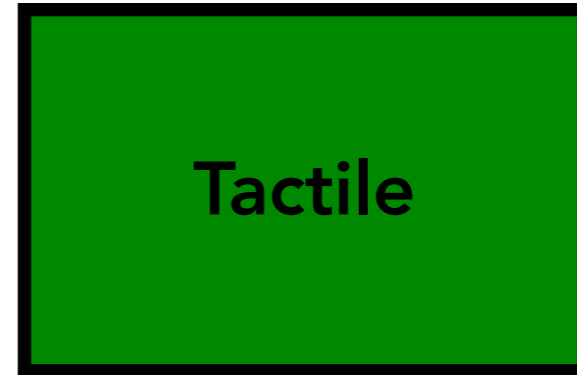
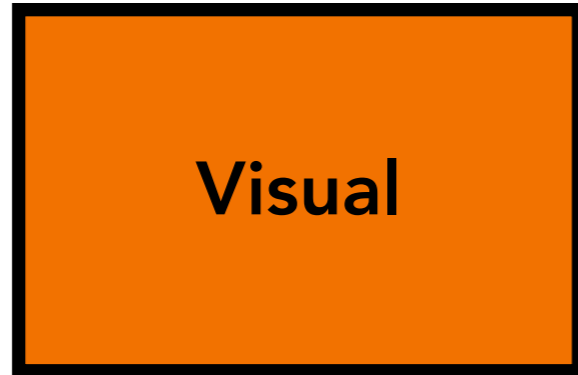


Aim of the project

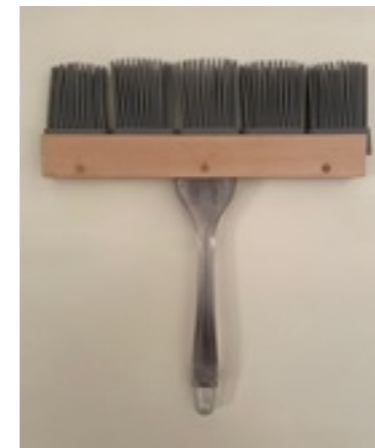
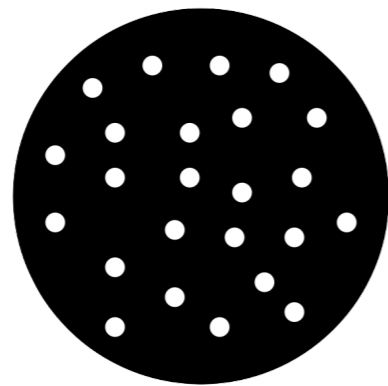
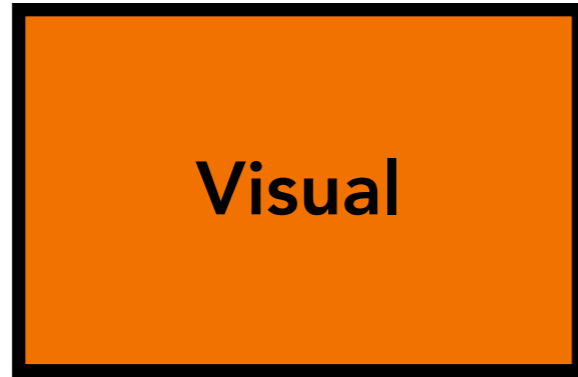
- Q1. Which regions in the brain are motion-selective in vision and touch?
- Q2. Which FoR is used to decode tactile directions?
- Q3. Where are the motion-directions aligned across the senses ?



Stimuli



Stimuli





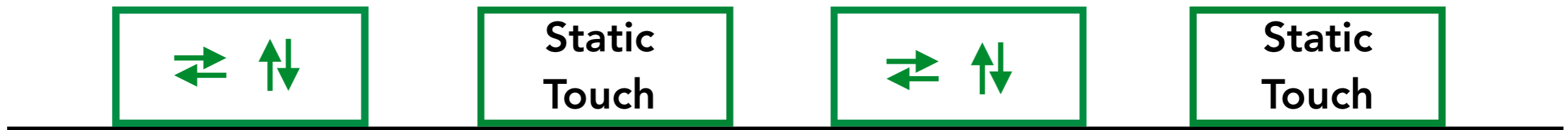
Experiment I: Motion localizers

(n= 18 subjects)

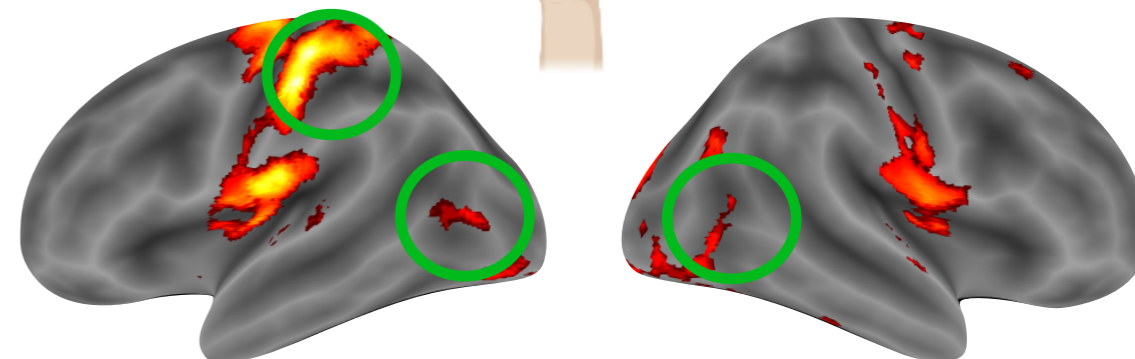
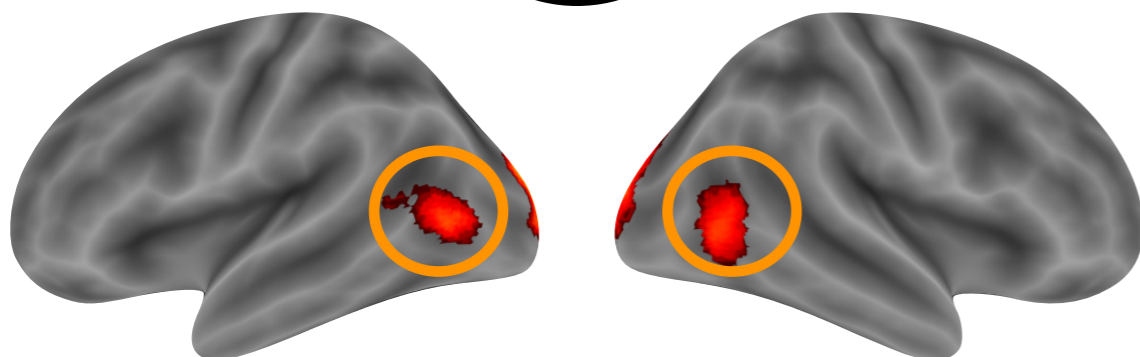
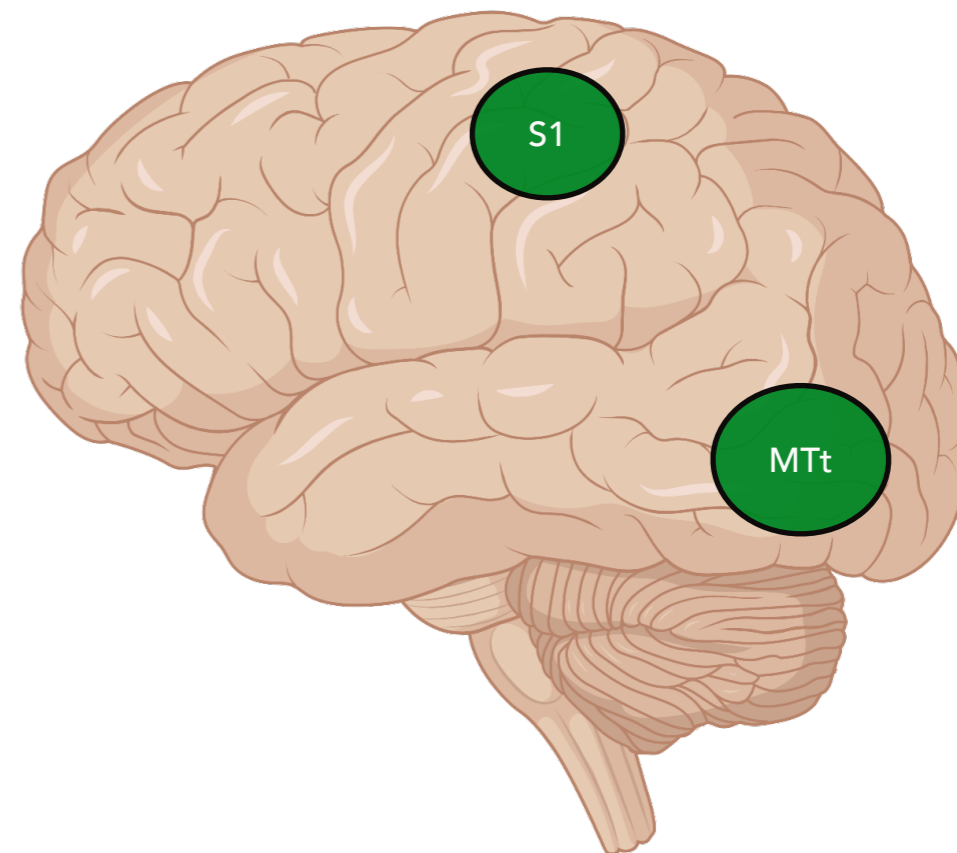
Visual motion localizer



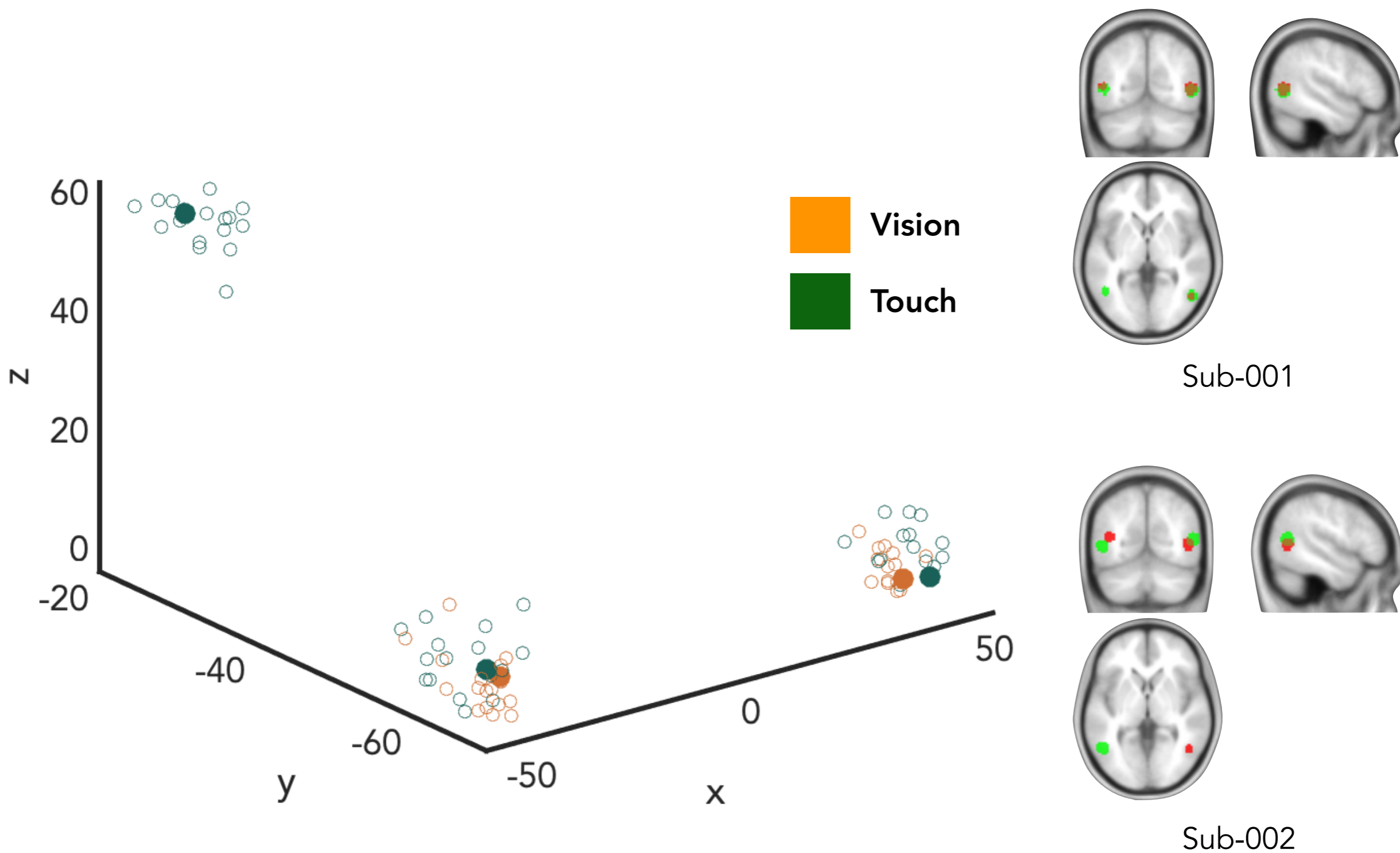
Tactile motion localizer



Regions of Interest (ROIs)

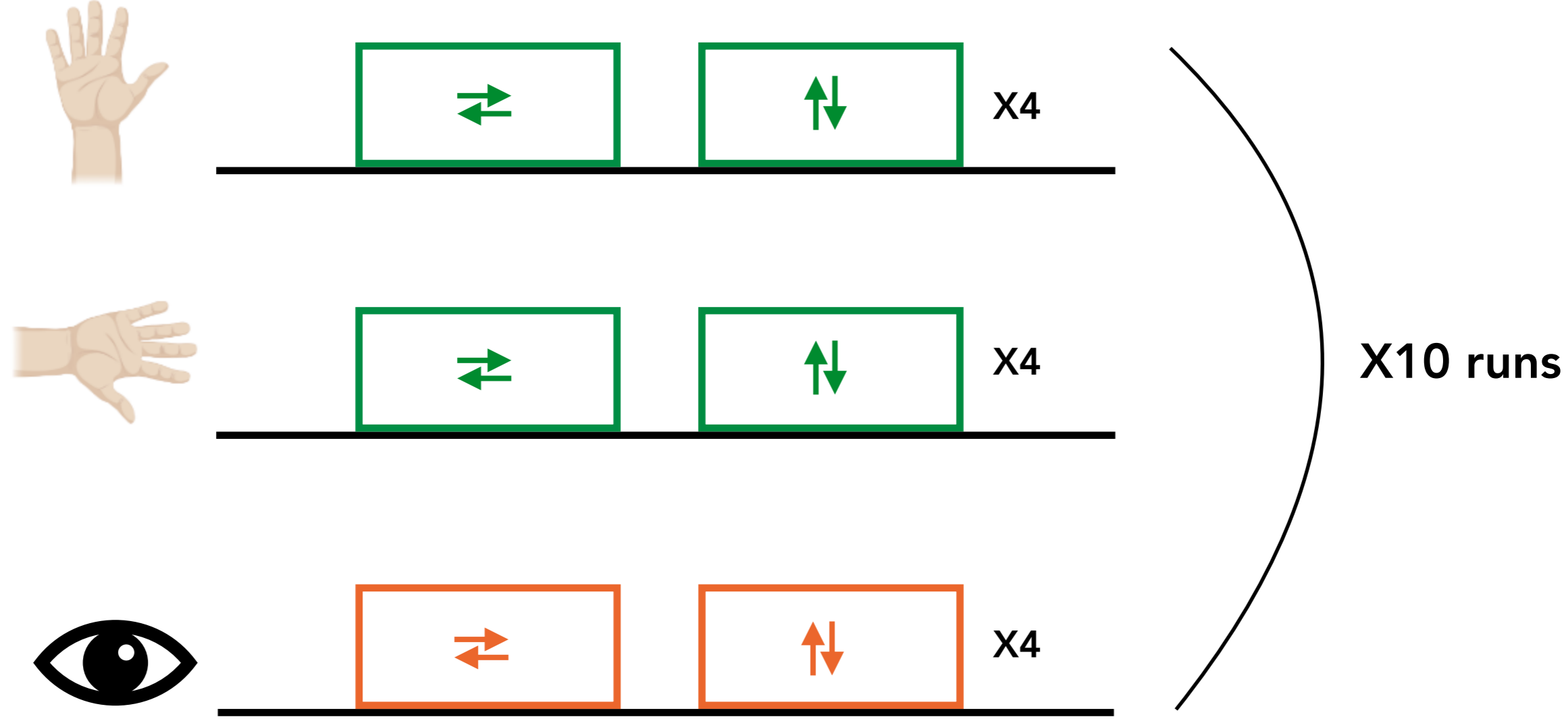


Regions of Interest (ROIs)

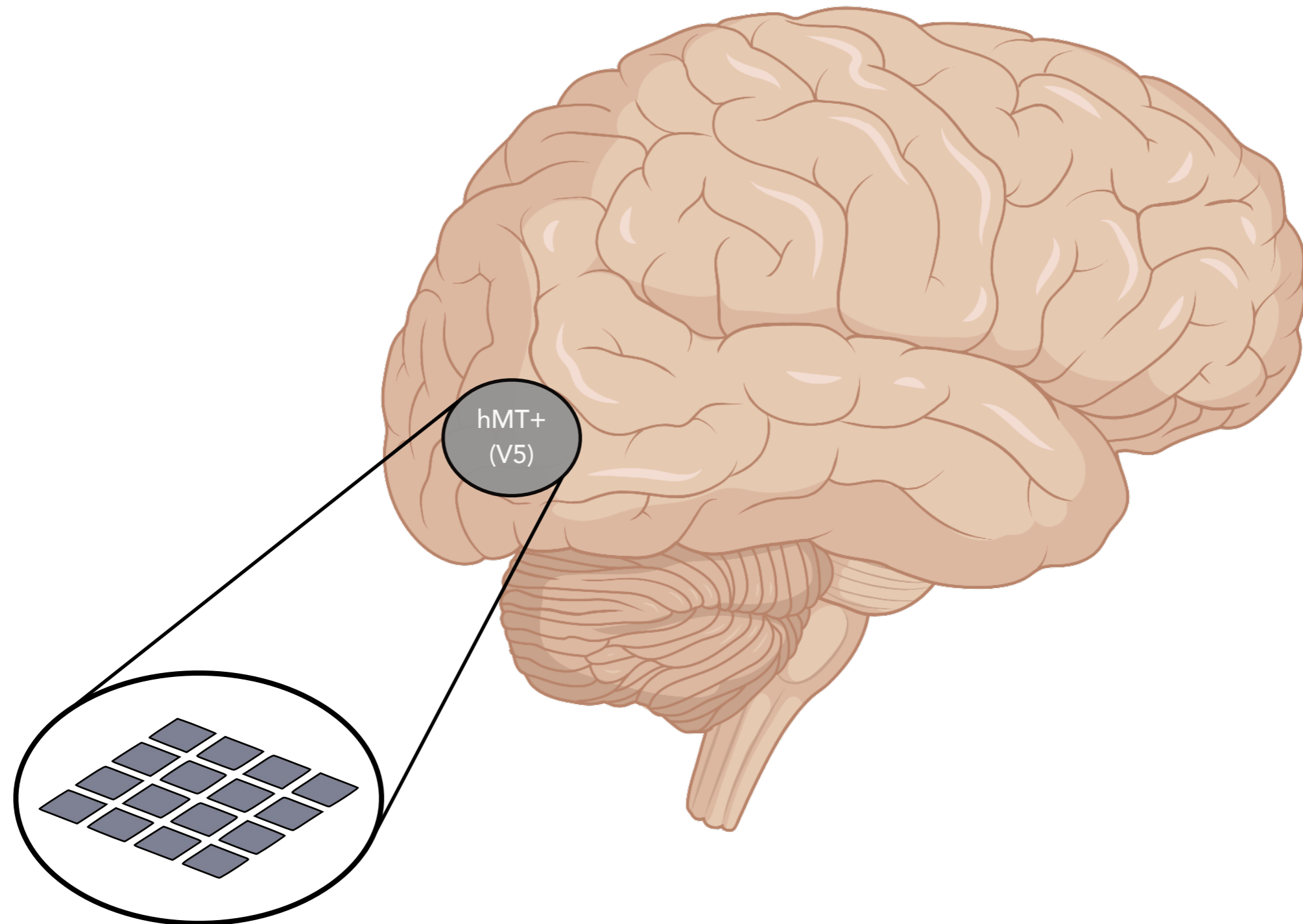


Experiment II: Directional motion decoding experiment

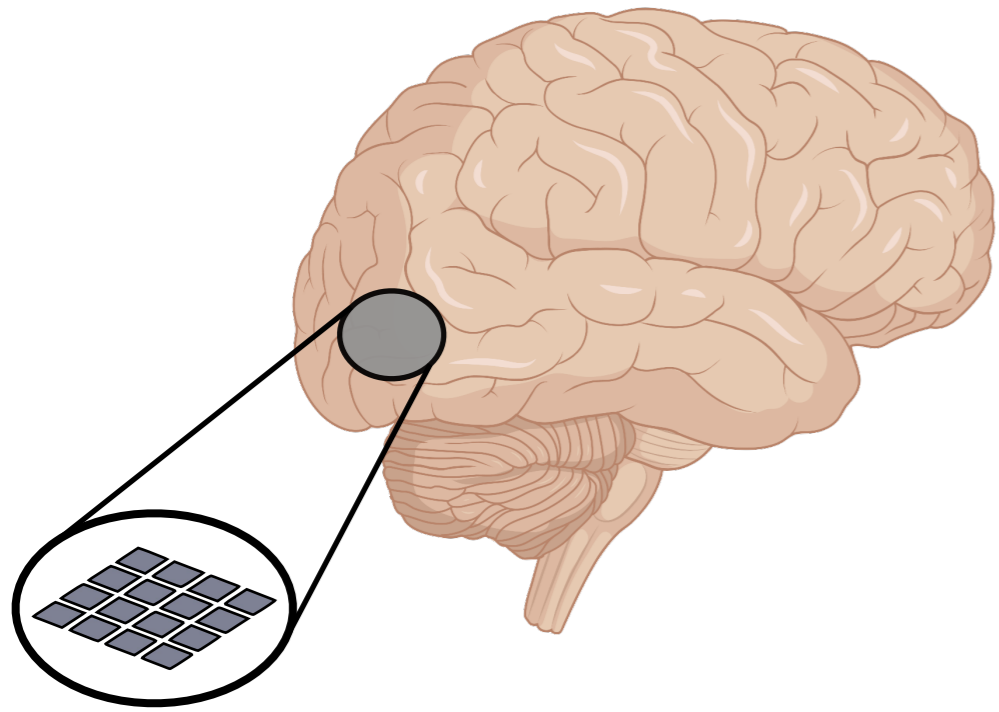
(n= 20 subjects)



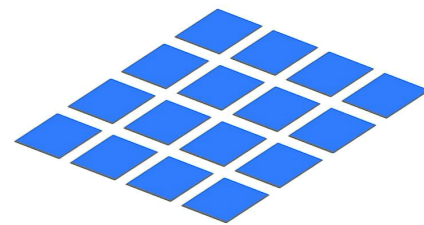
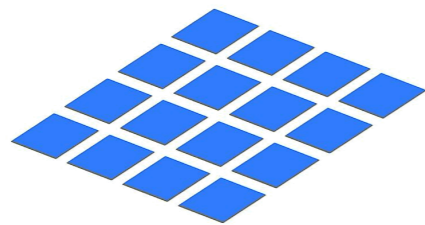
Multivariate Pattern Analysis (MVPA)



hMT+/V5 voxels

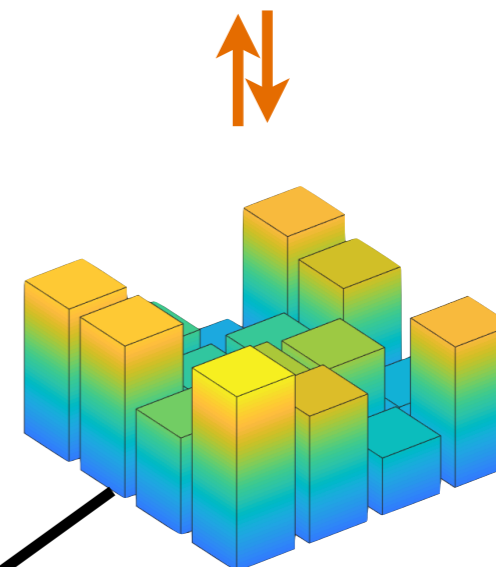
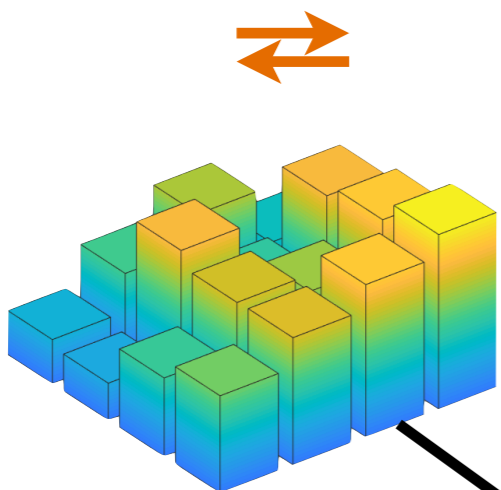
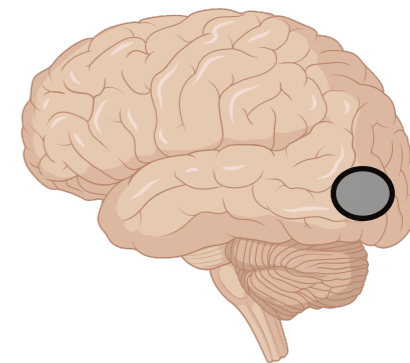


hMT+/V5 voxels





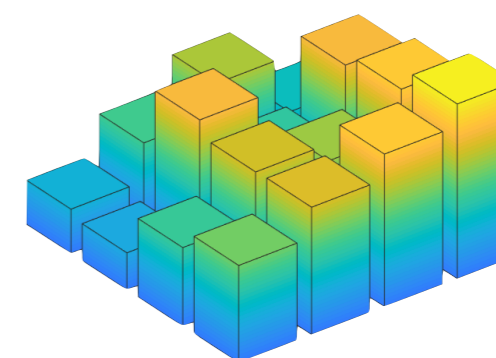
Visual Motion

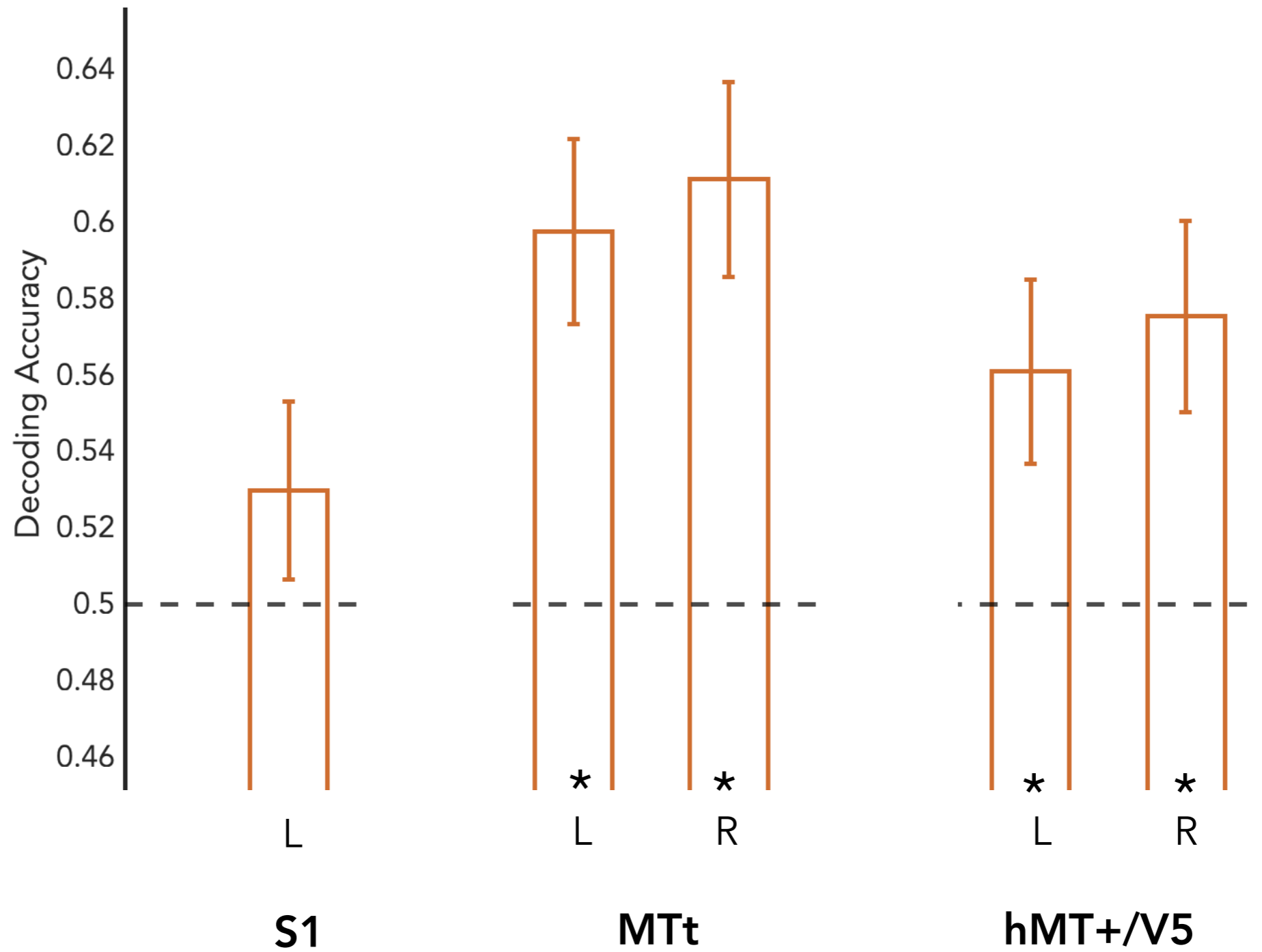
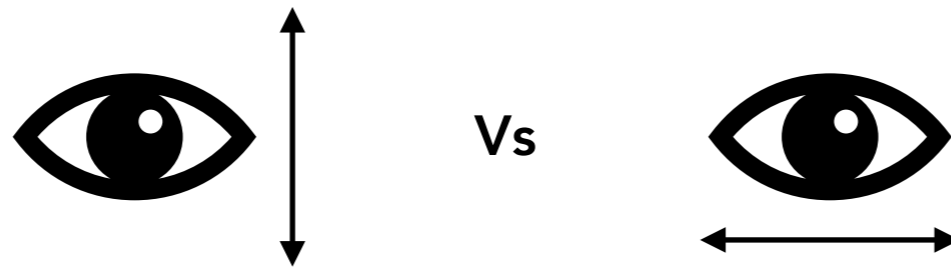


Train

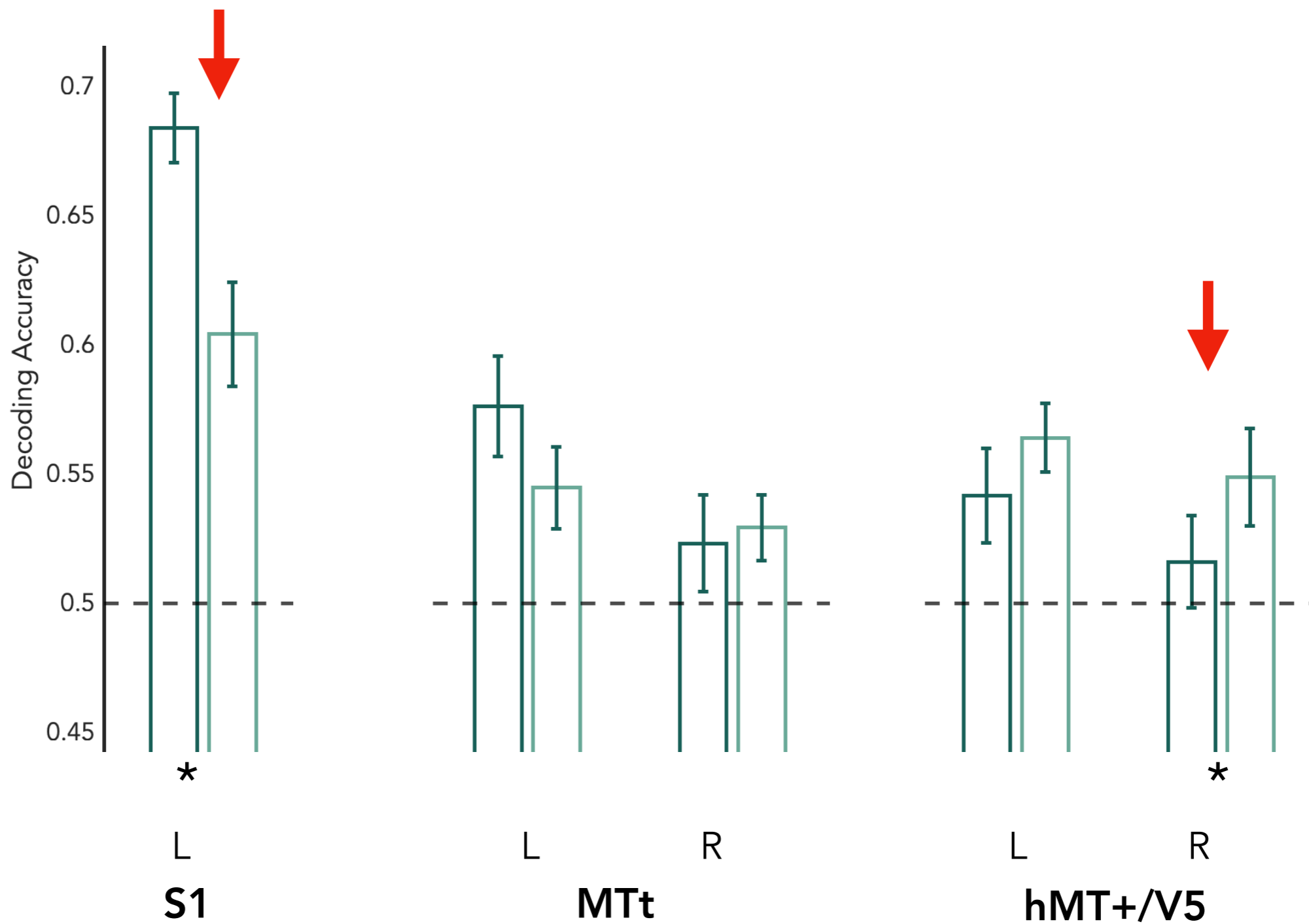
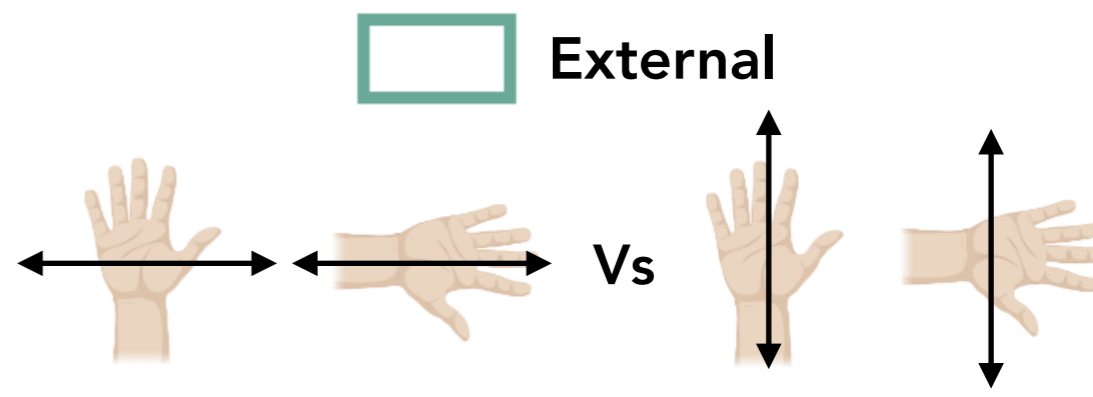
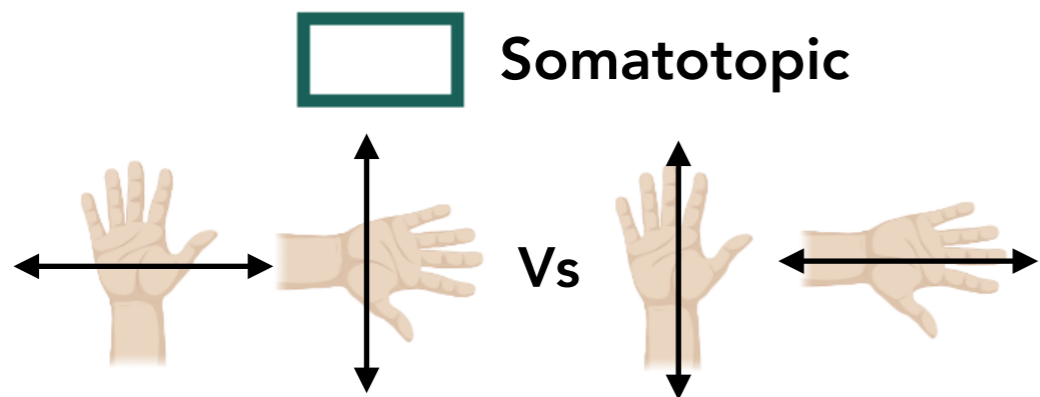
Test

Classifier





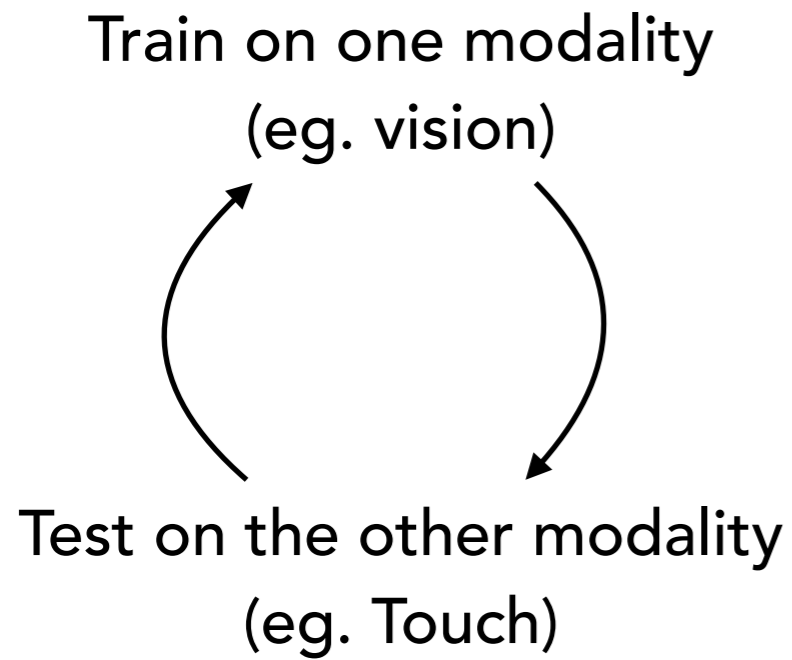
* $p < 0.05$



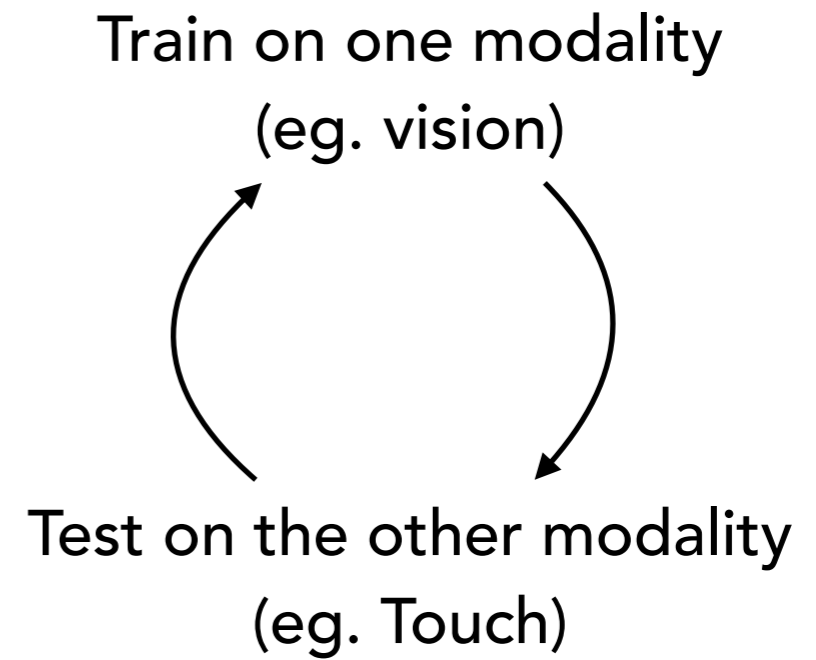
* $p < 0.05$

CrossModal Decoding

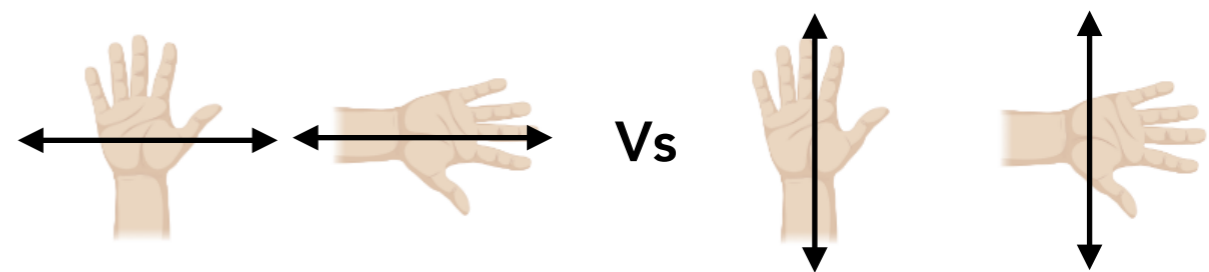
A



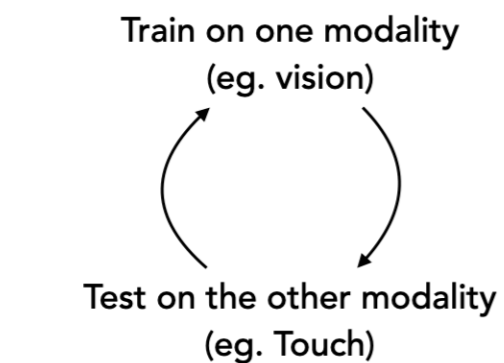
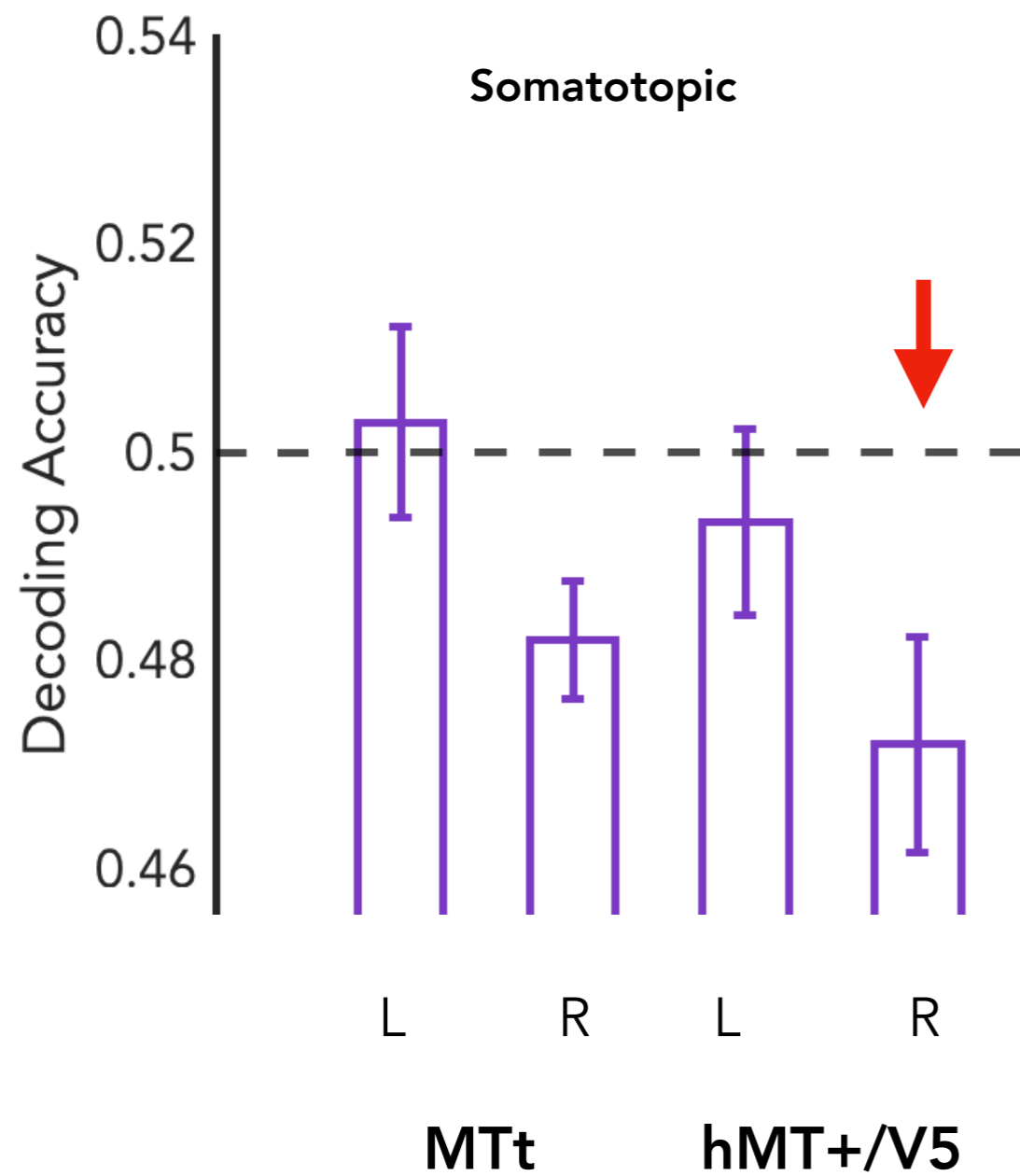
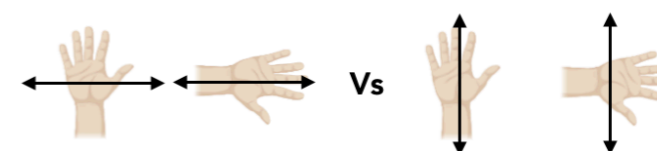
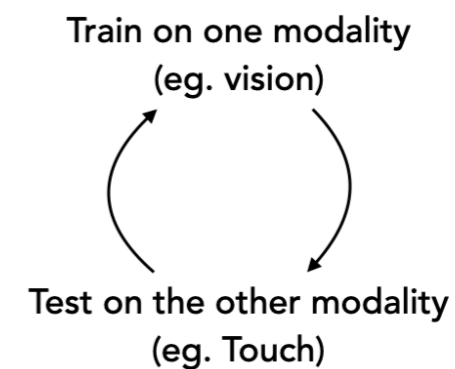
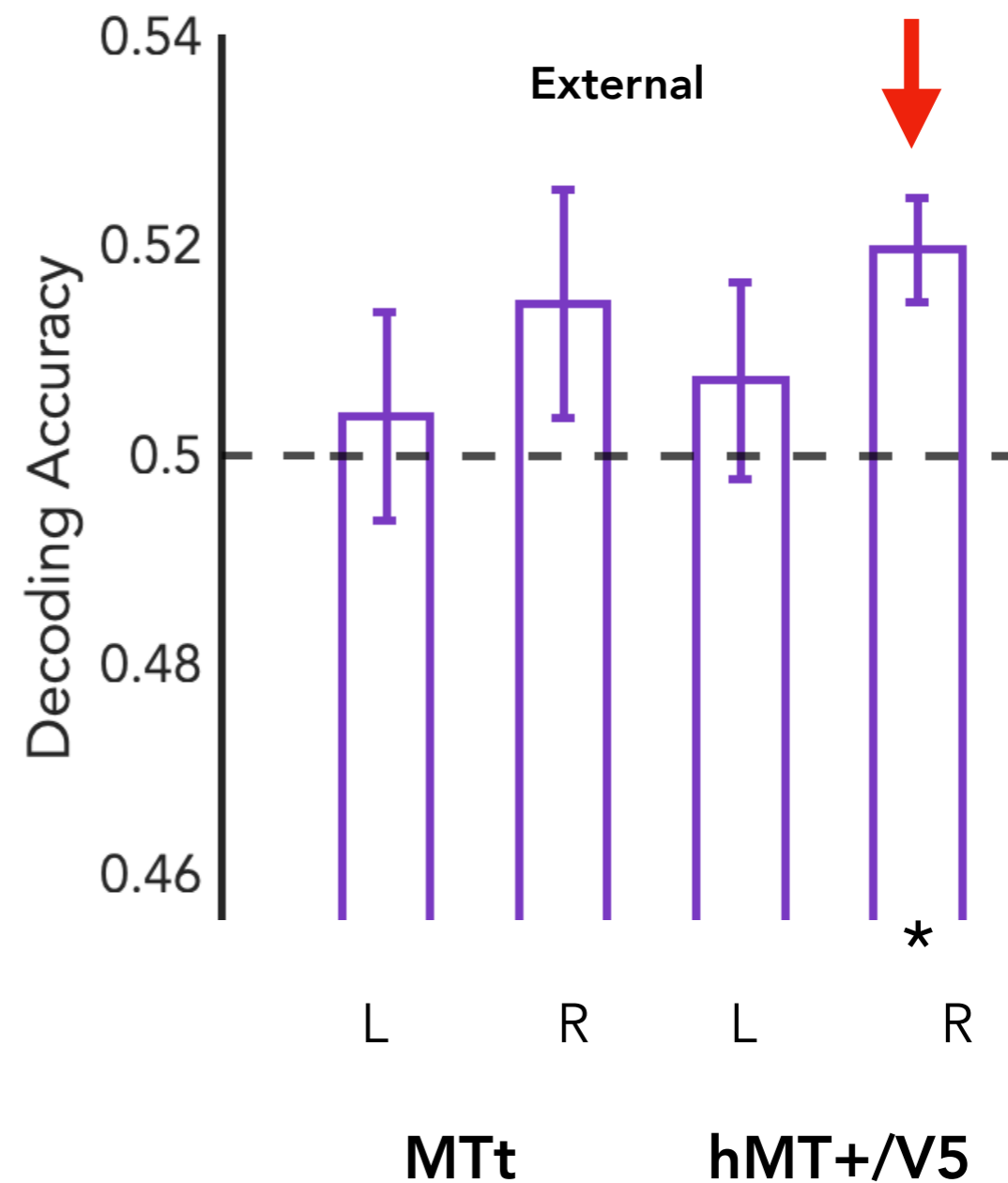
B



Somatotopic



External

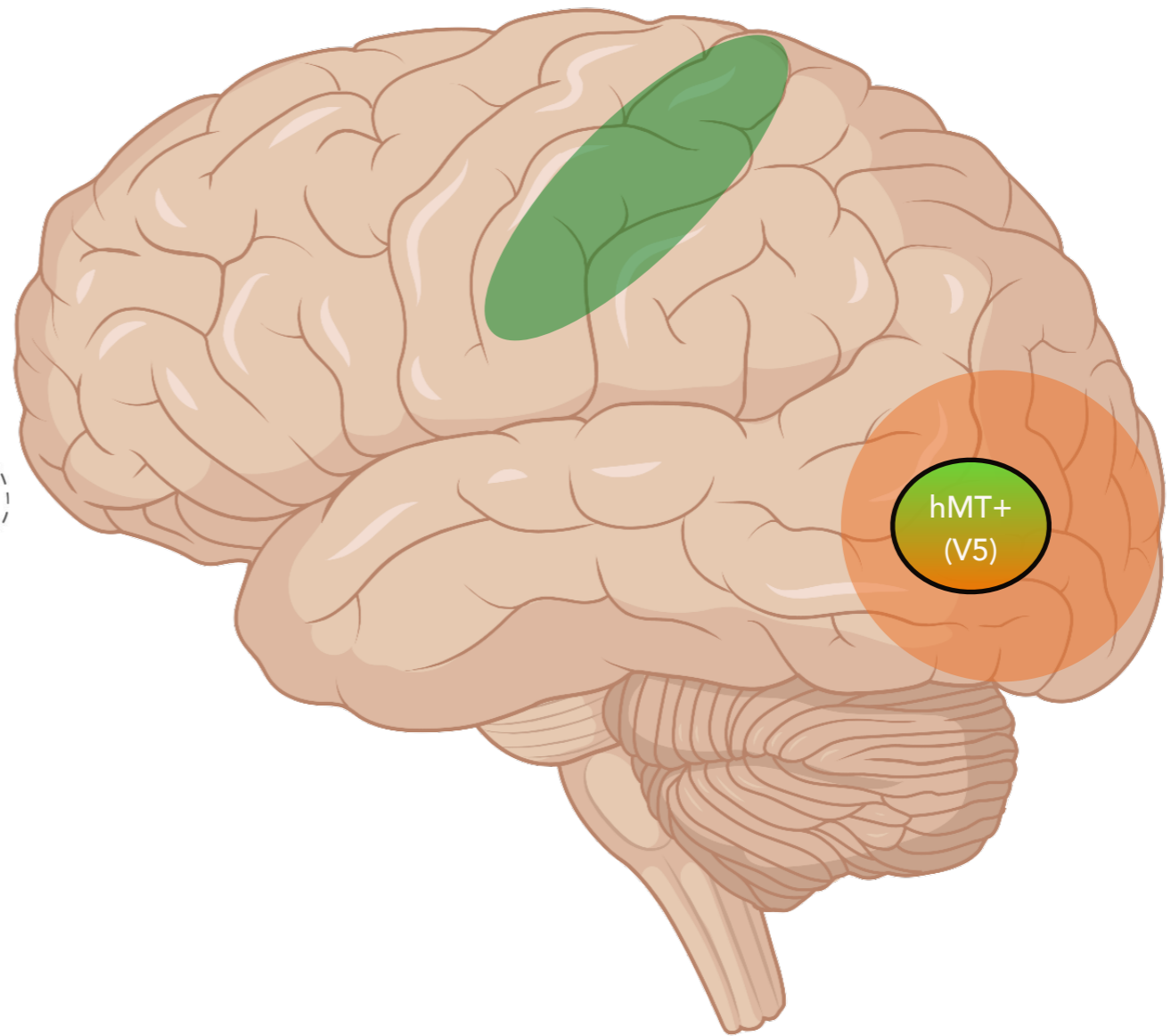
A**Somatotopic****B****External*** $p < 0.05$

Conclusions

- Visual and tactile motion engage part of hMT+/V5
- Visual and tactile motion directions can be decoded in hMT+/V5
- Visual and tactile directions align using an external FoR in hMT+/V5



Tactile



Visual

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THANK YOU

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