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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!

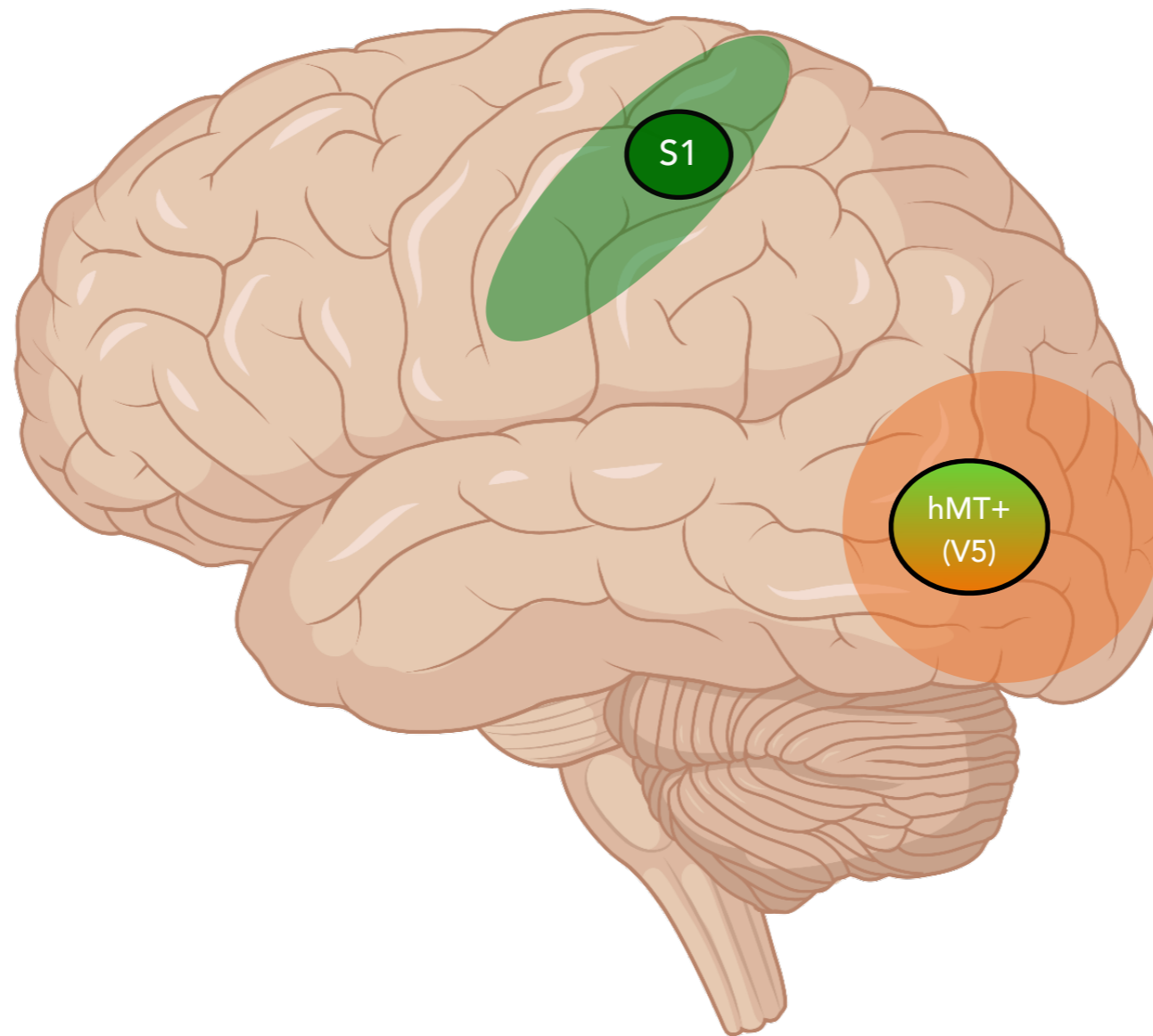
- TOUCH
- VISION
- PROPRIOCEPTION
- And **SWAT!**



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

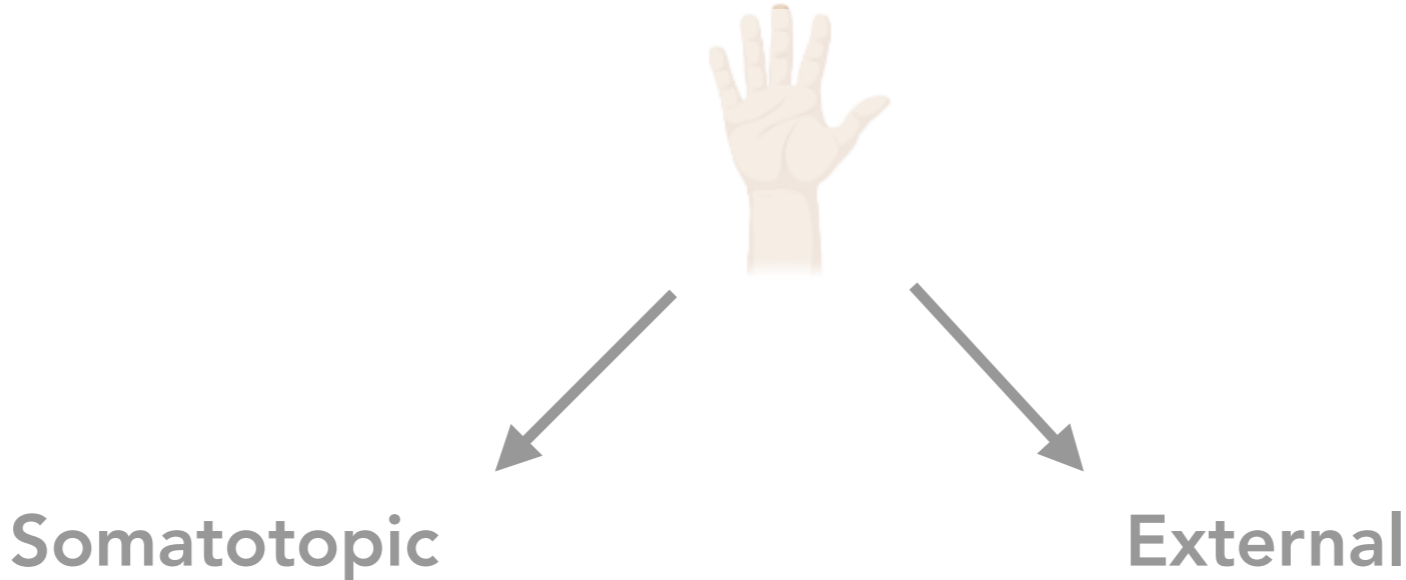
↙  
Map  
=Frame of Reference  
(FoR)

**Tactile**



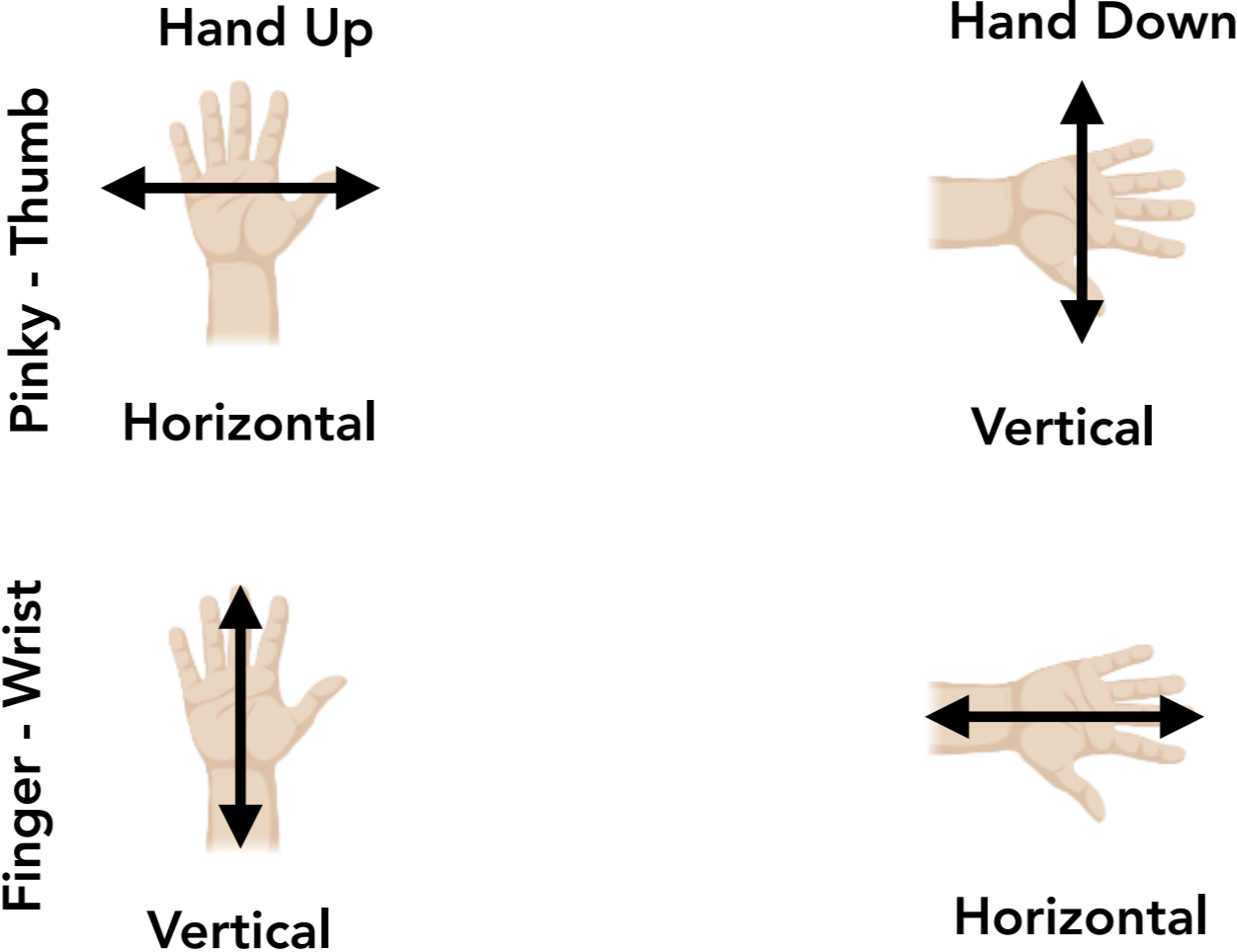
**Visual**

# Frame of Reference (FoR)



## Hand Positions

### Somatotopic Directions

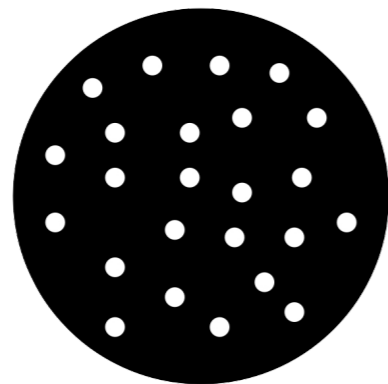
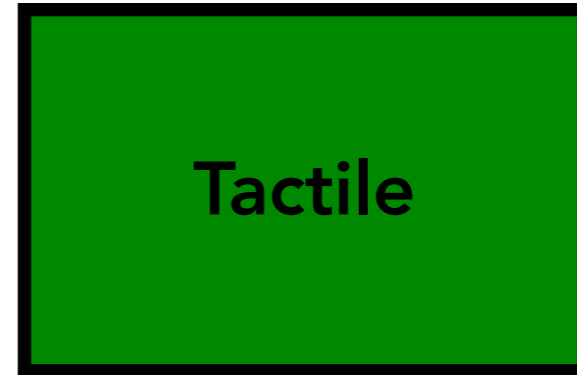
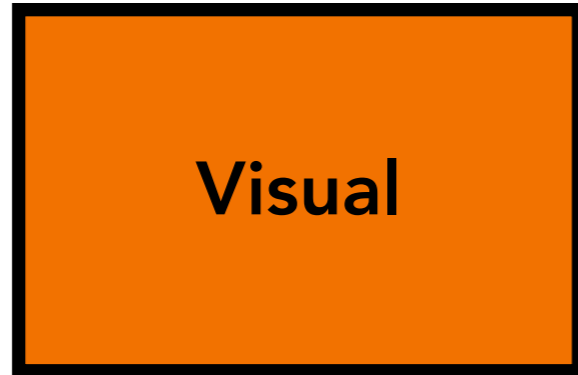


# Aim of the project

- 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

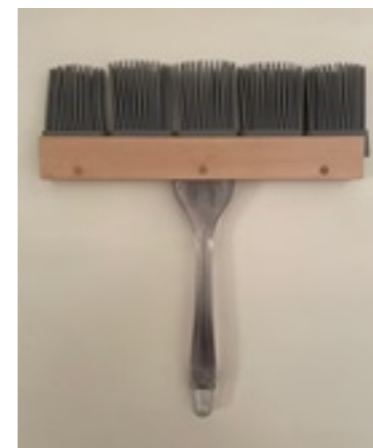
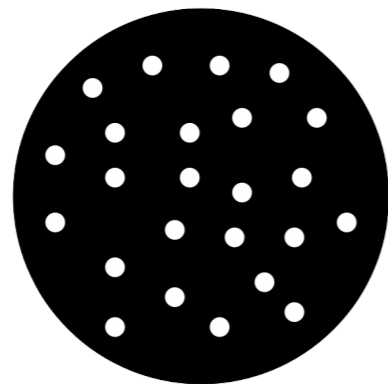
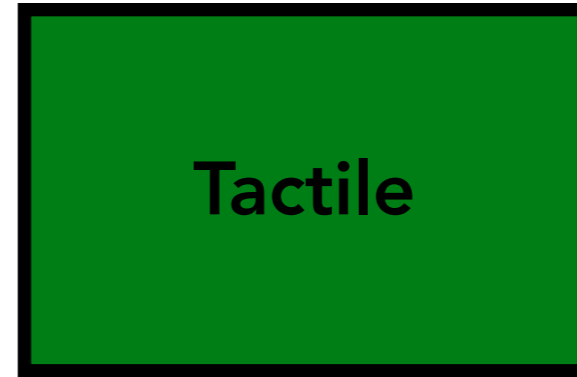
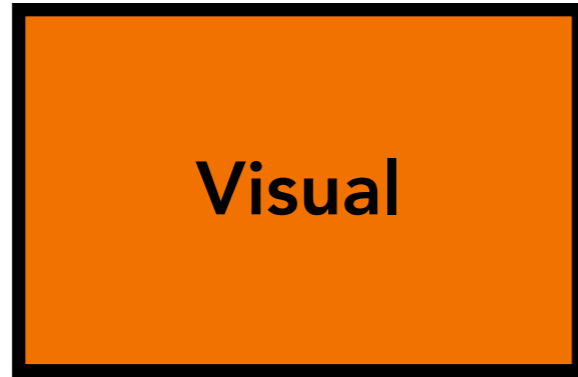








# Stimuli





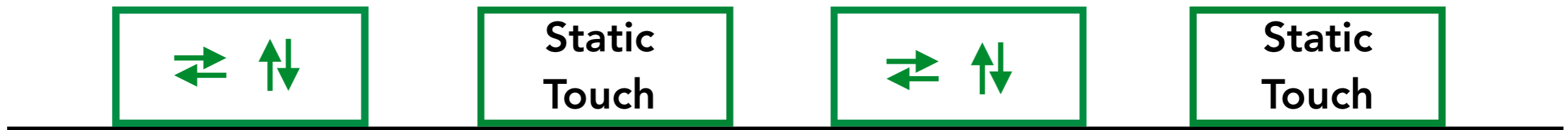
# Experiment I: Motion localizers

(n= 18 subjects)

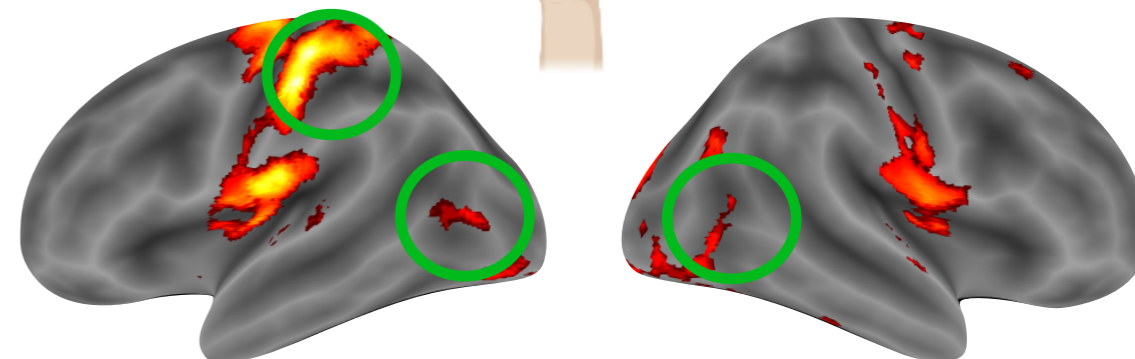
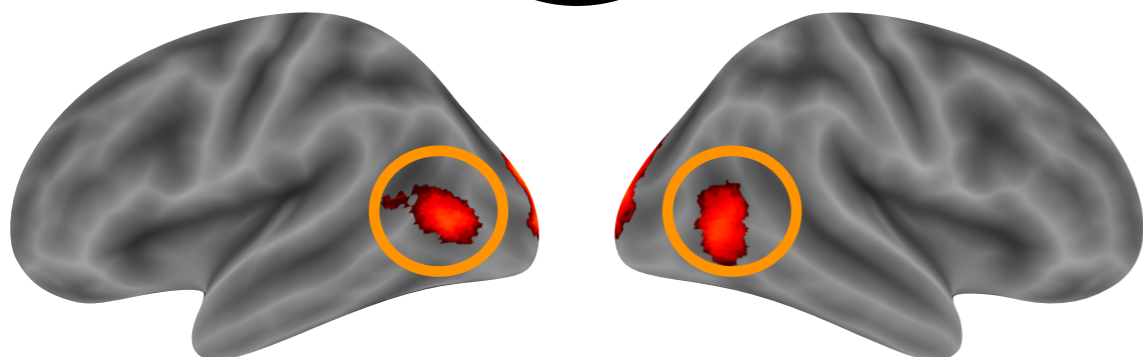
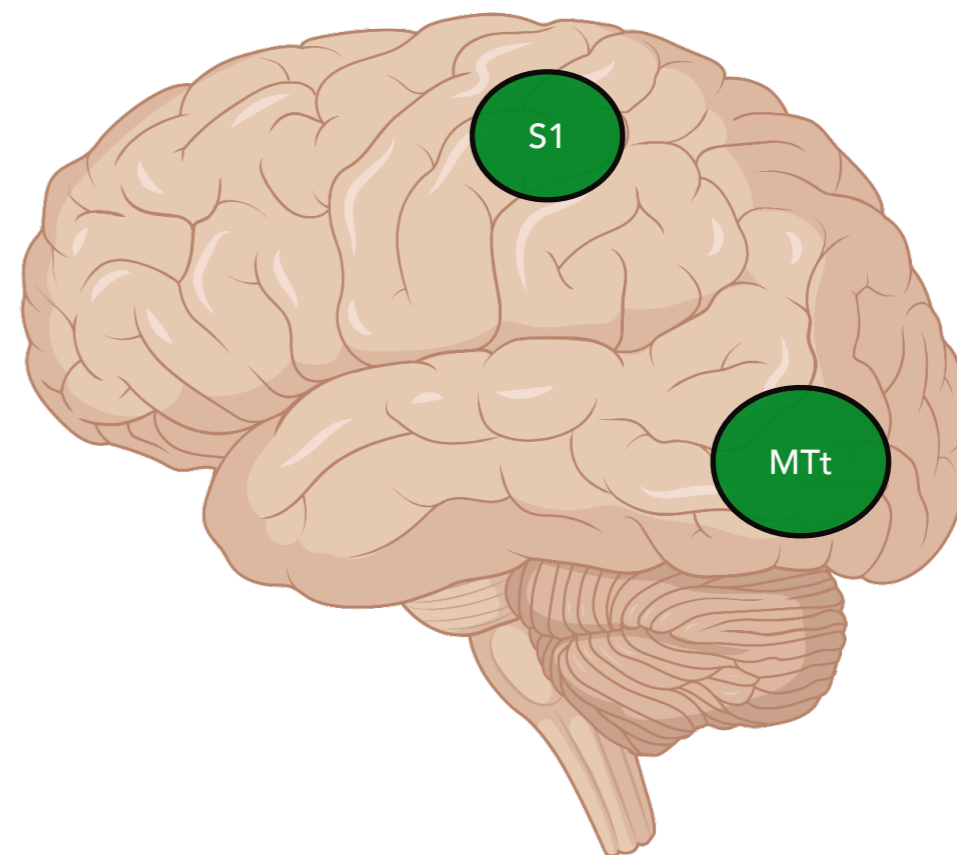
## Visual motion localizer



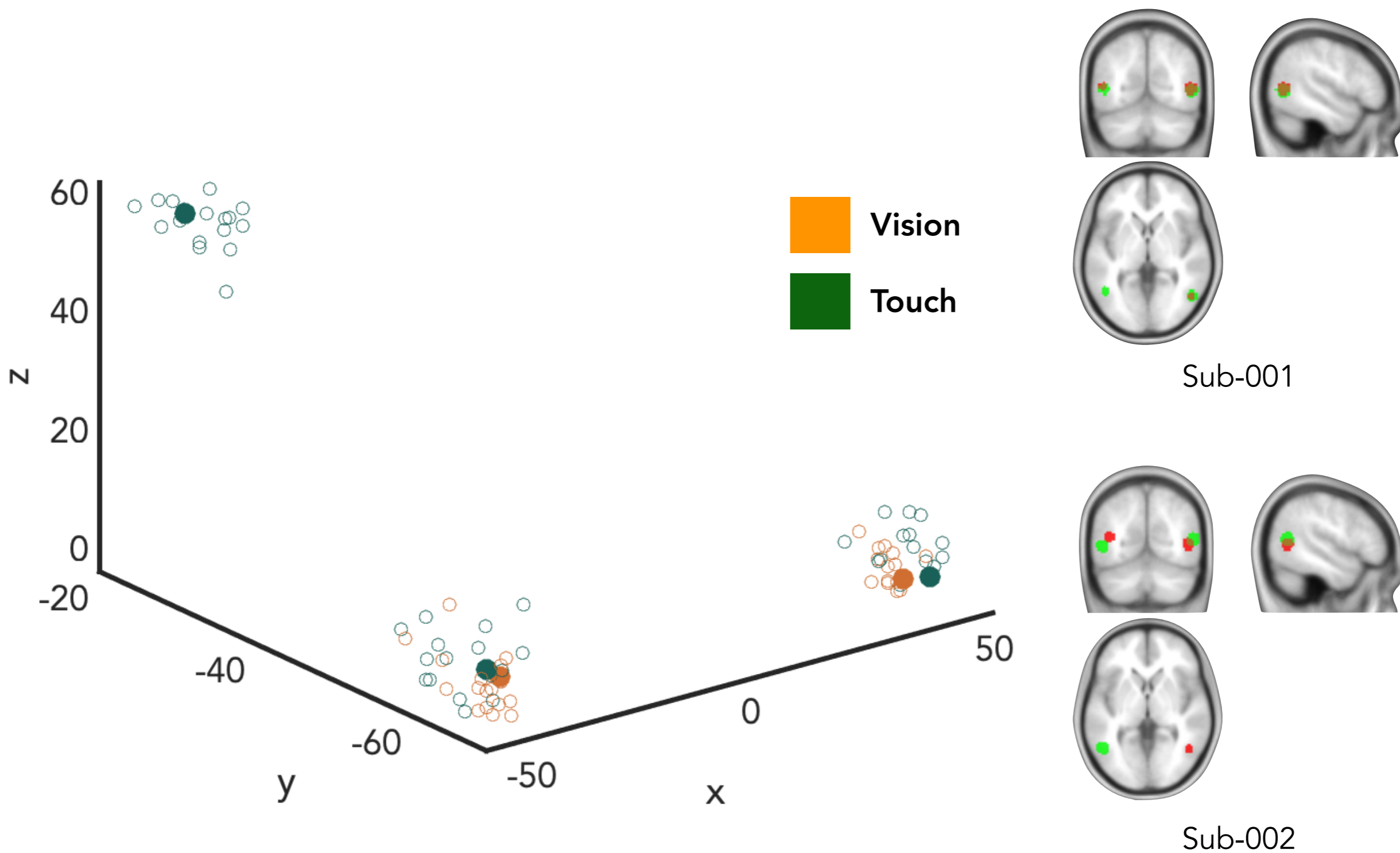
## Tactile motion localizer



# Regions of Interest (ROIs)

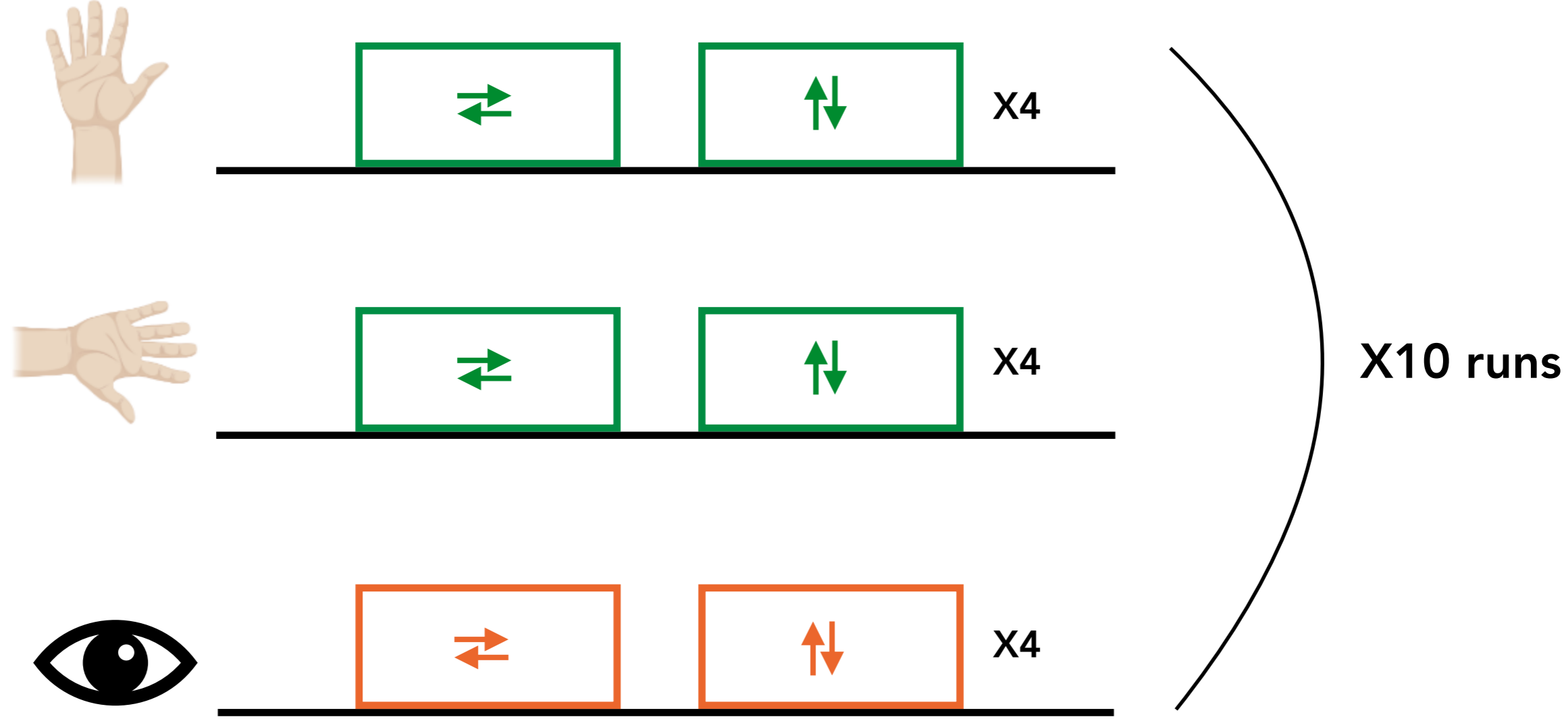


# Regions of Interest (ROIs)

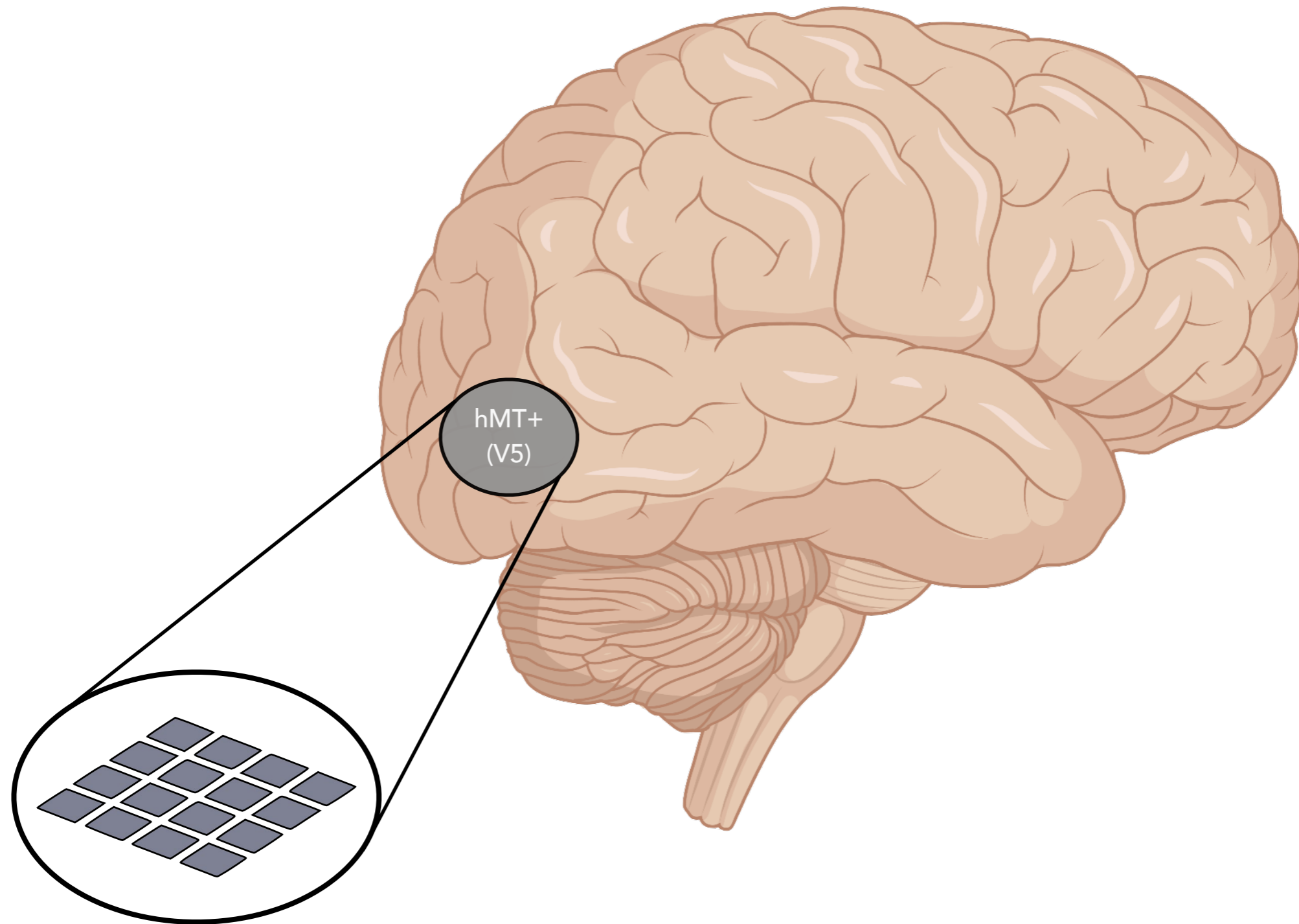


# Experiment II: Directional motion decoding experiment

(n= 20 subjects)

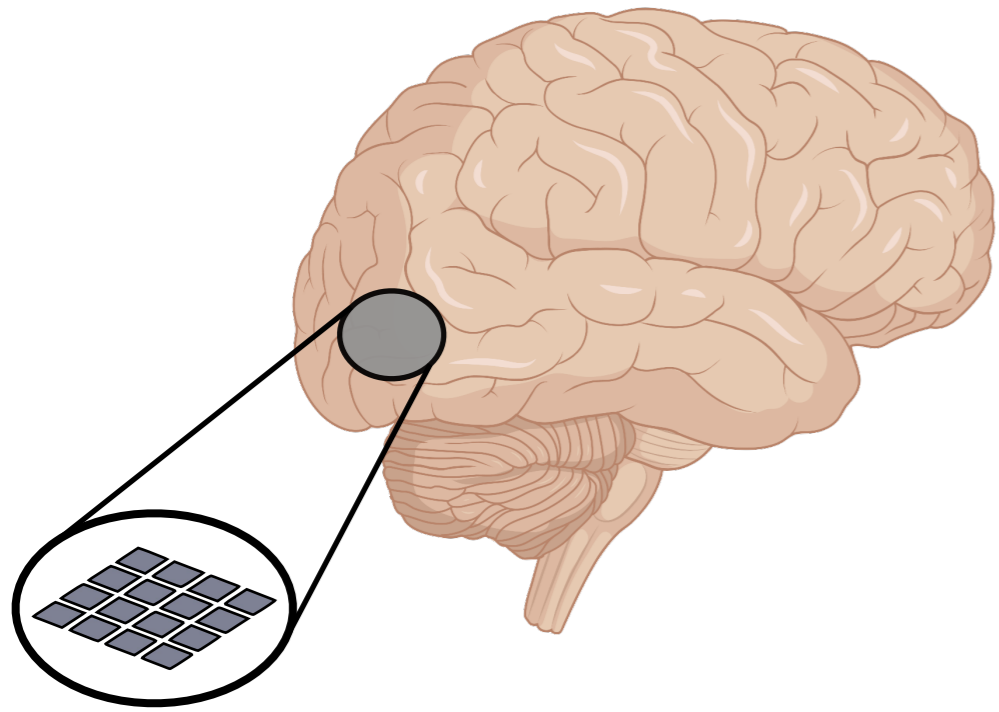


# Multivariate Pattern Analysis (MVPA)

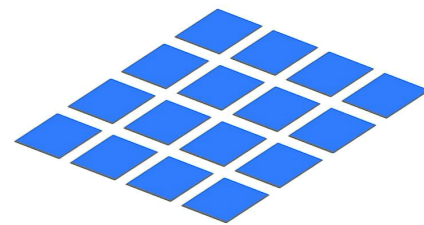
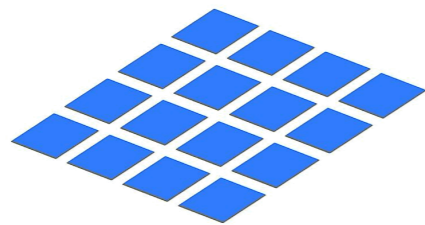


hMT+/V5 voxels



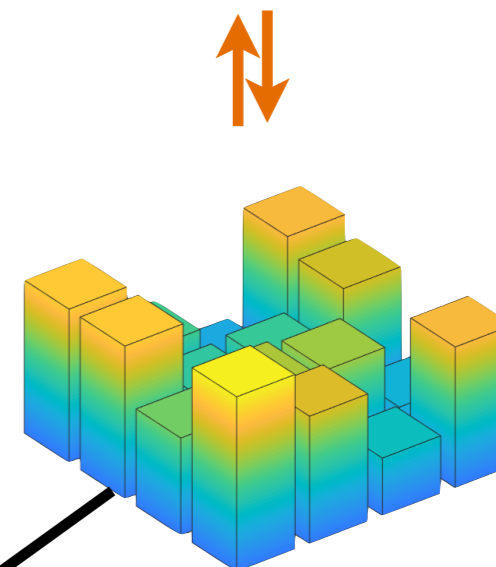
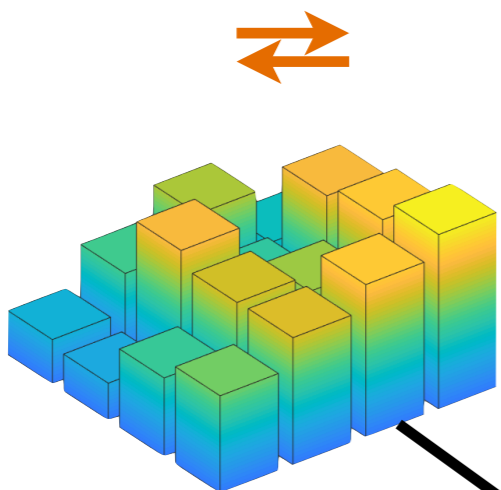
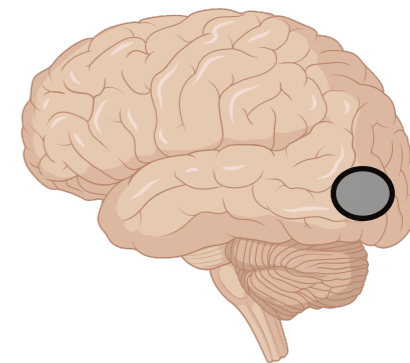


hMT+/V5 voxels





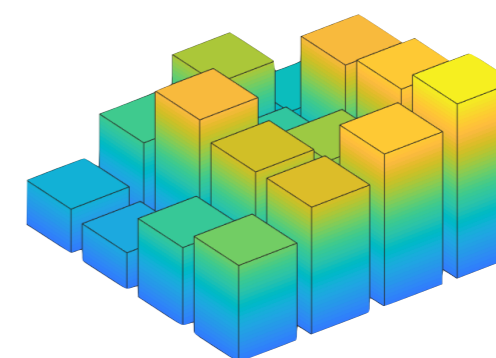
# Visual Motion

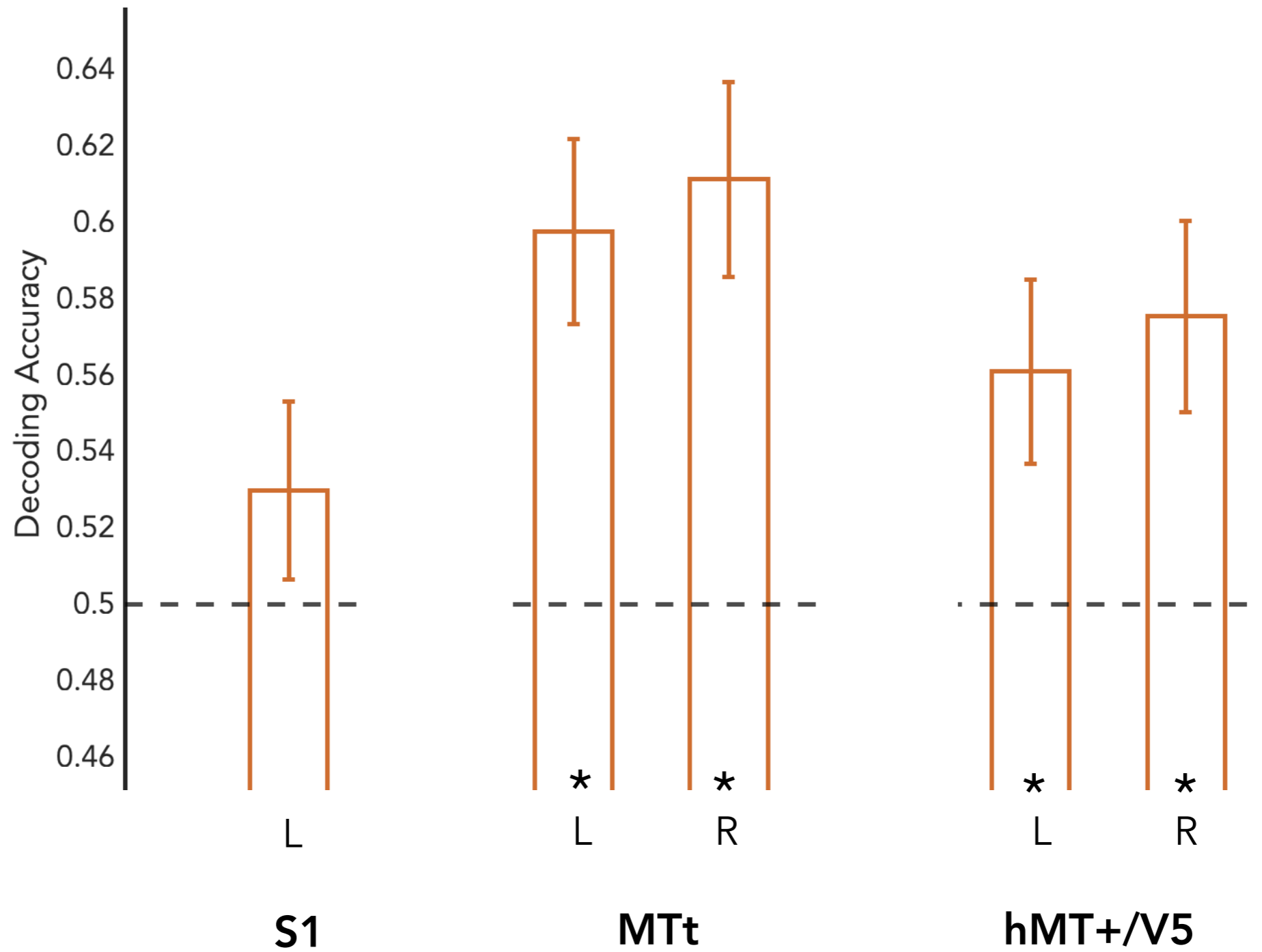
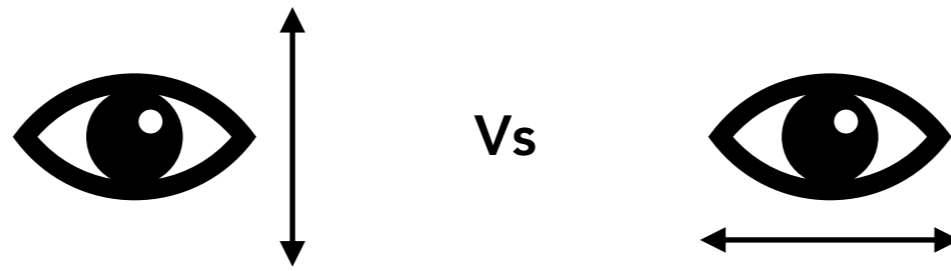


Train

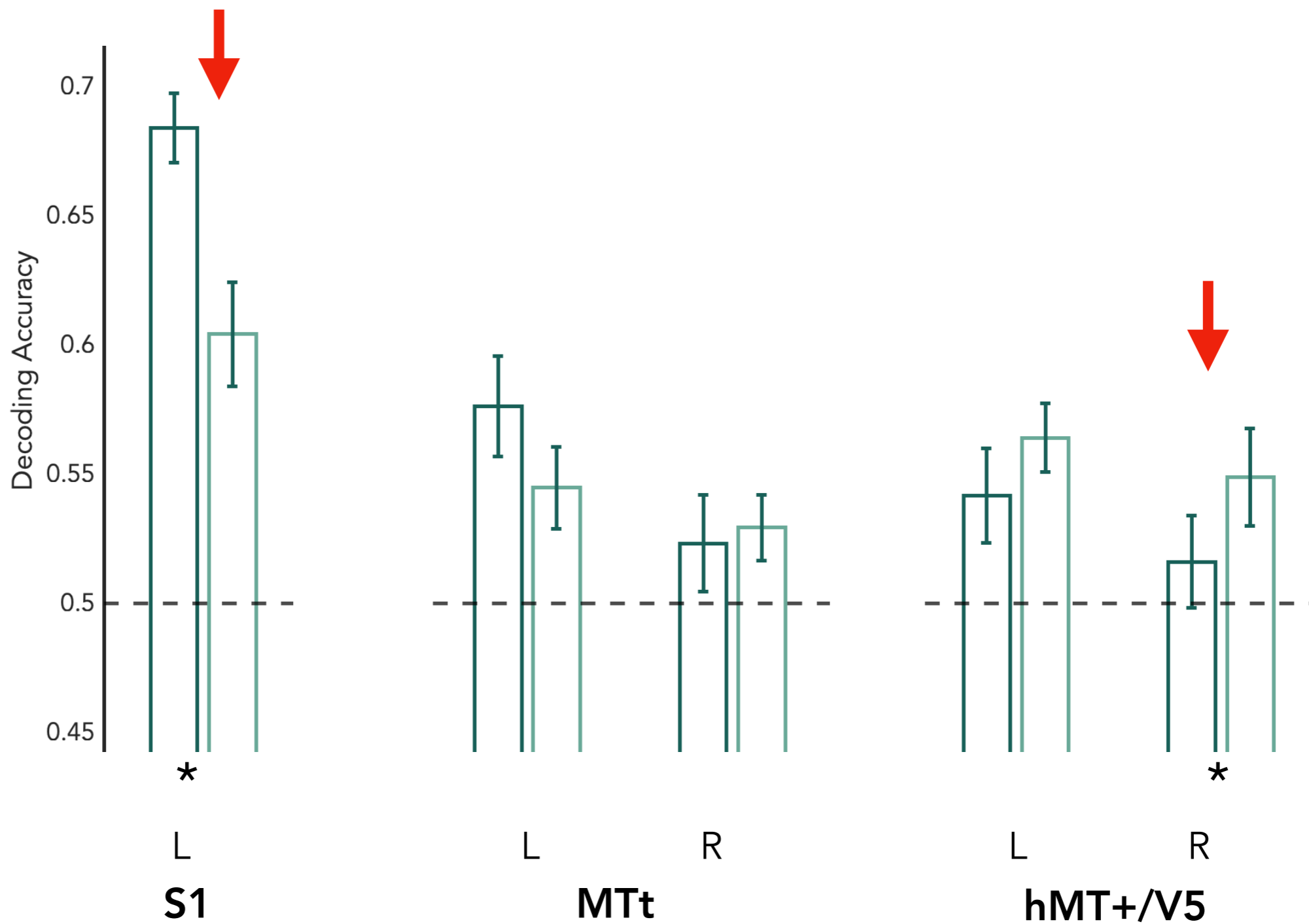
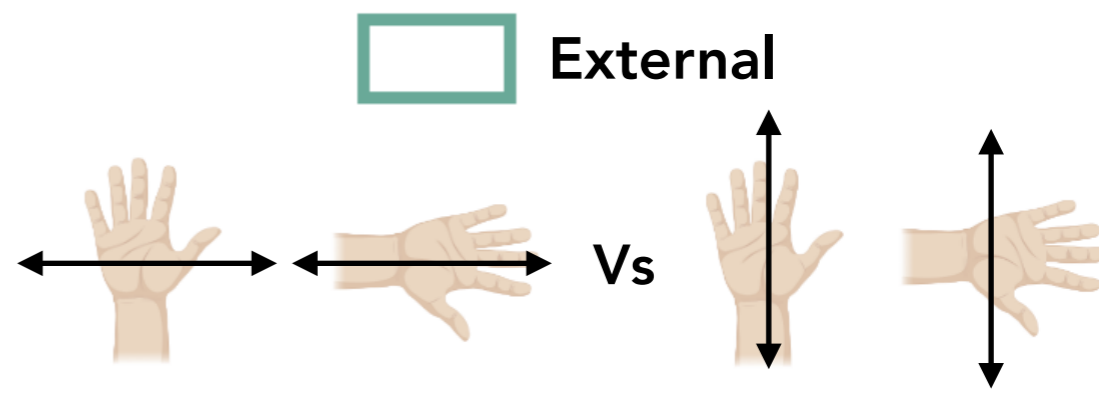
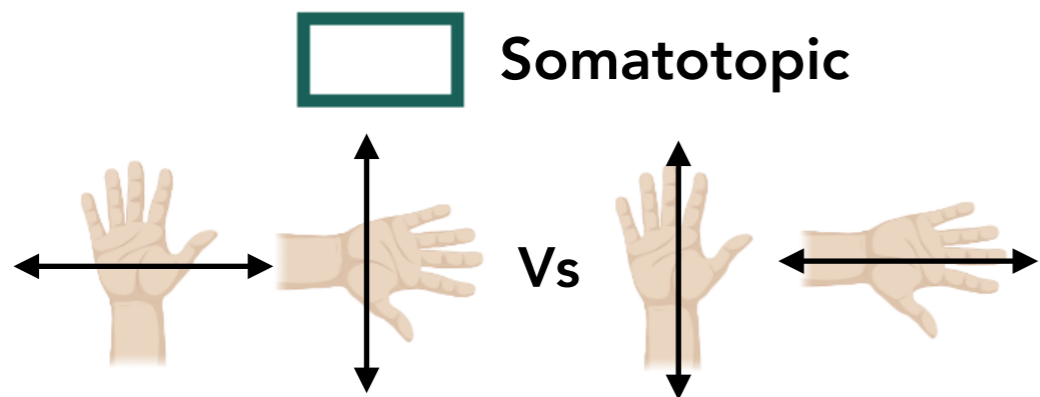
Test

Classifier





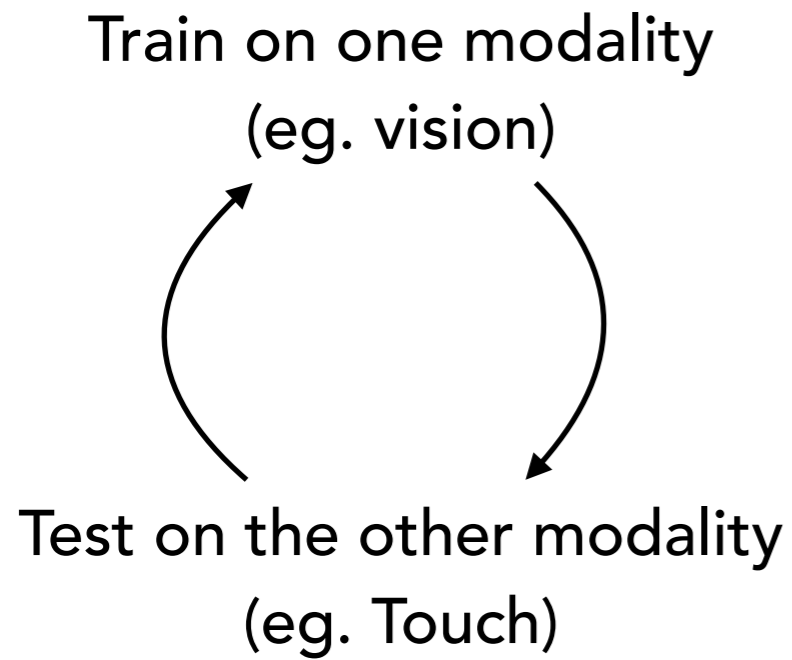
\*  $p < 0.05$



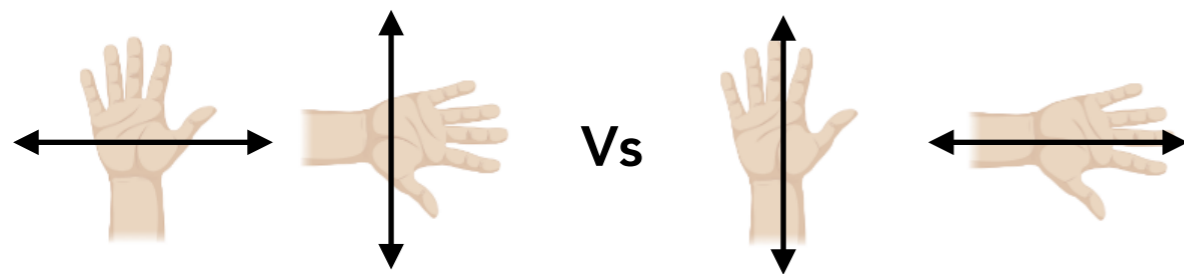
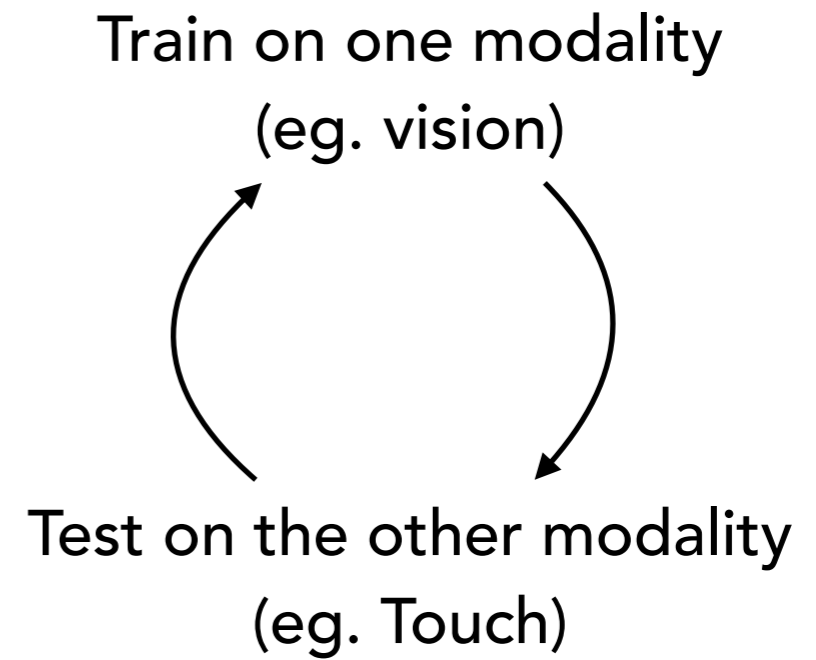
\*  $p < 0.05$

# CrossModal Decoding

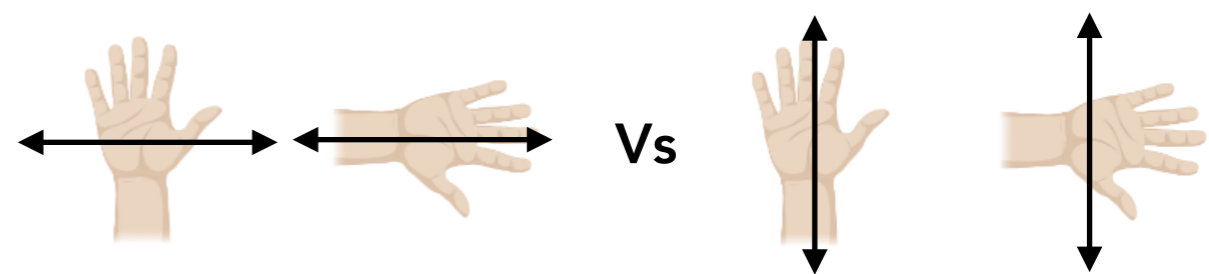
**A**



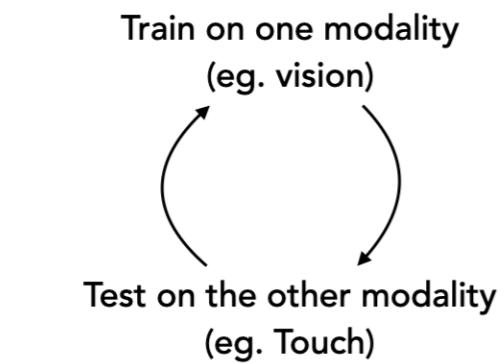
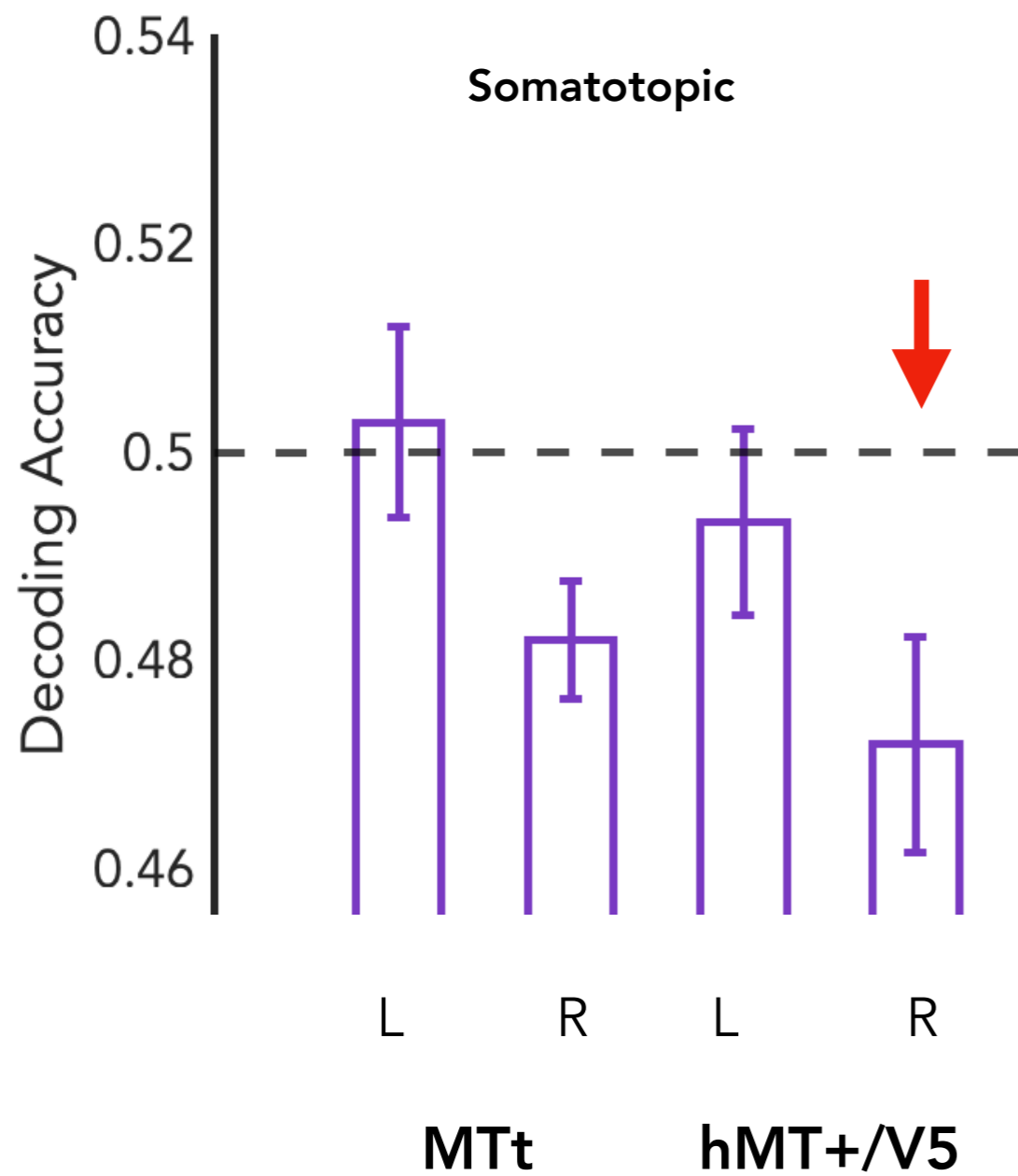
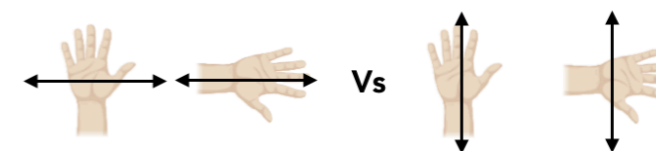
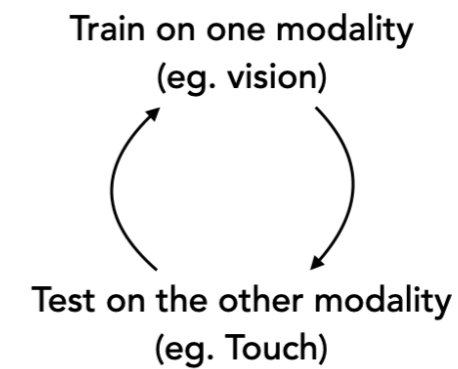
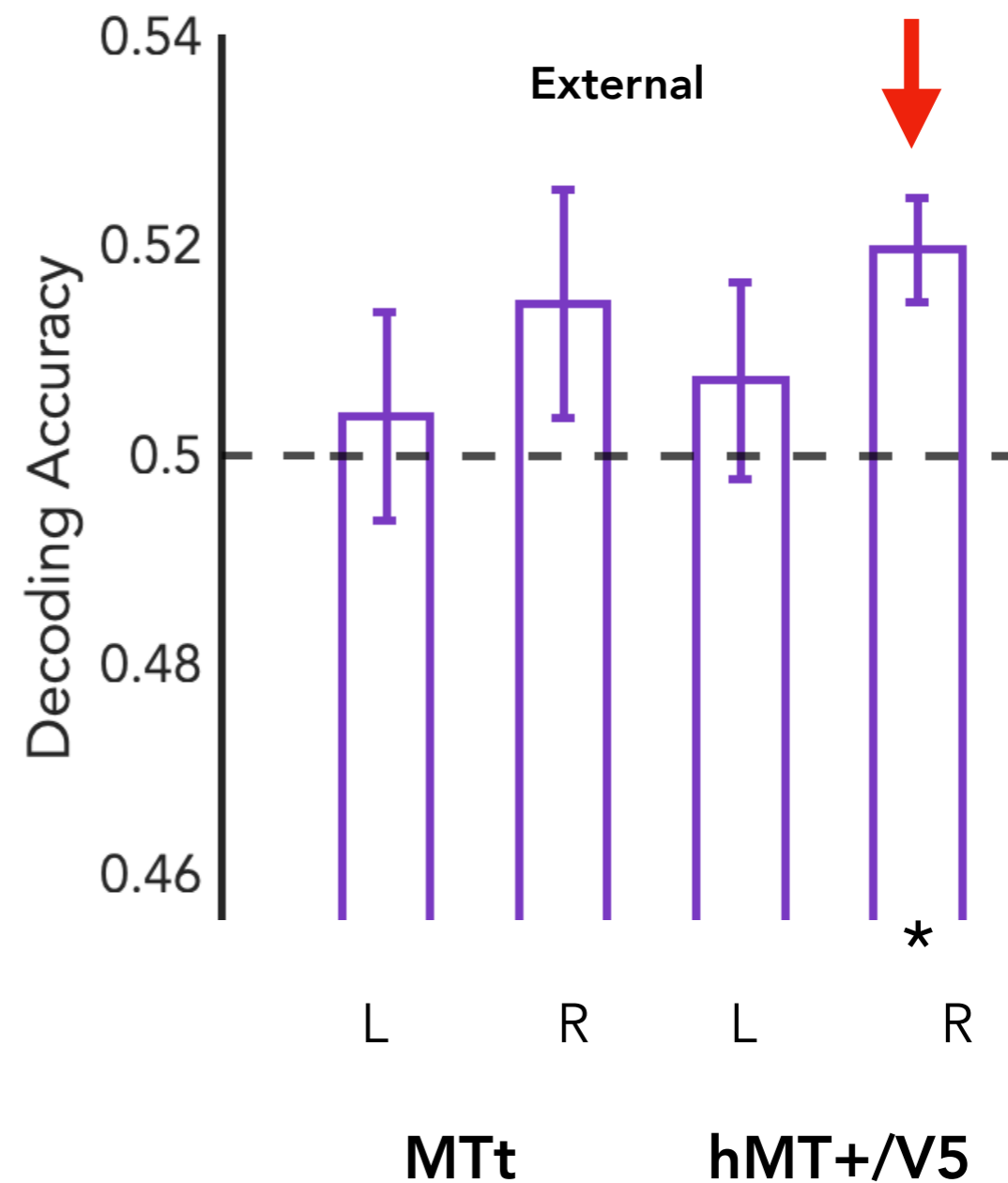
**B**



**Somatotopic**



**External**

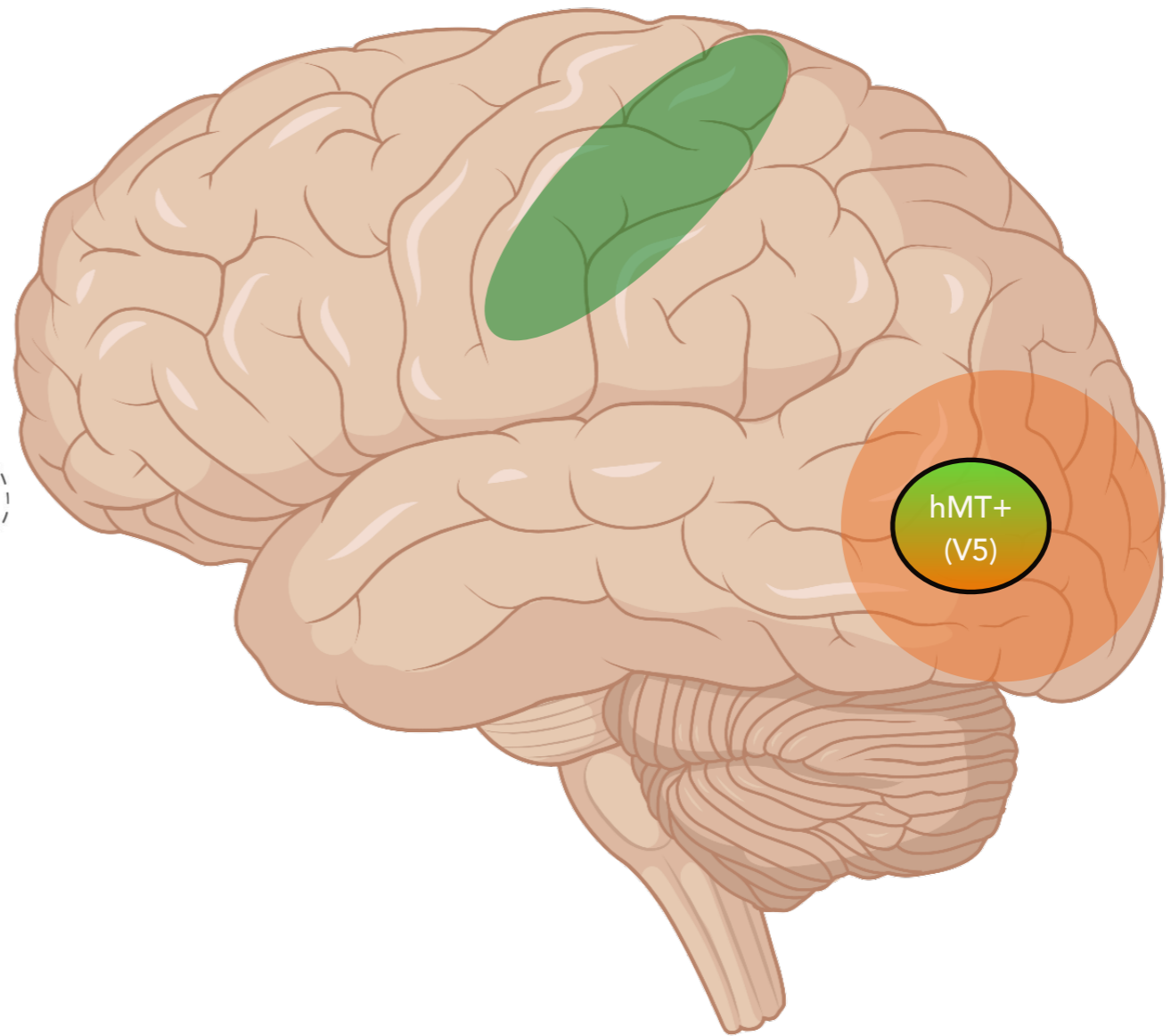
**A****Somatotopic****B****External**\*  $p < 0.05$

# 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



# Acknowledgements



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