



# Decode the Unseen: Classifying Action Representations During the Anticipatory Interval in the Action Observation Network (AON).



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## Introduction

Action observation is proposed to be a problem of prediction, in which observers construct a mental model of anticipated action outcomes by which sensory evidence is compared (Bach & Schenke, 2017; Kilner, 2007).

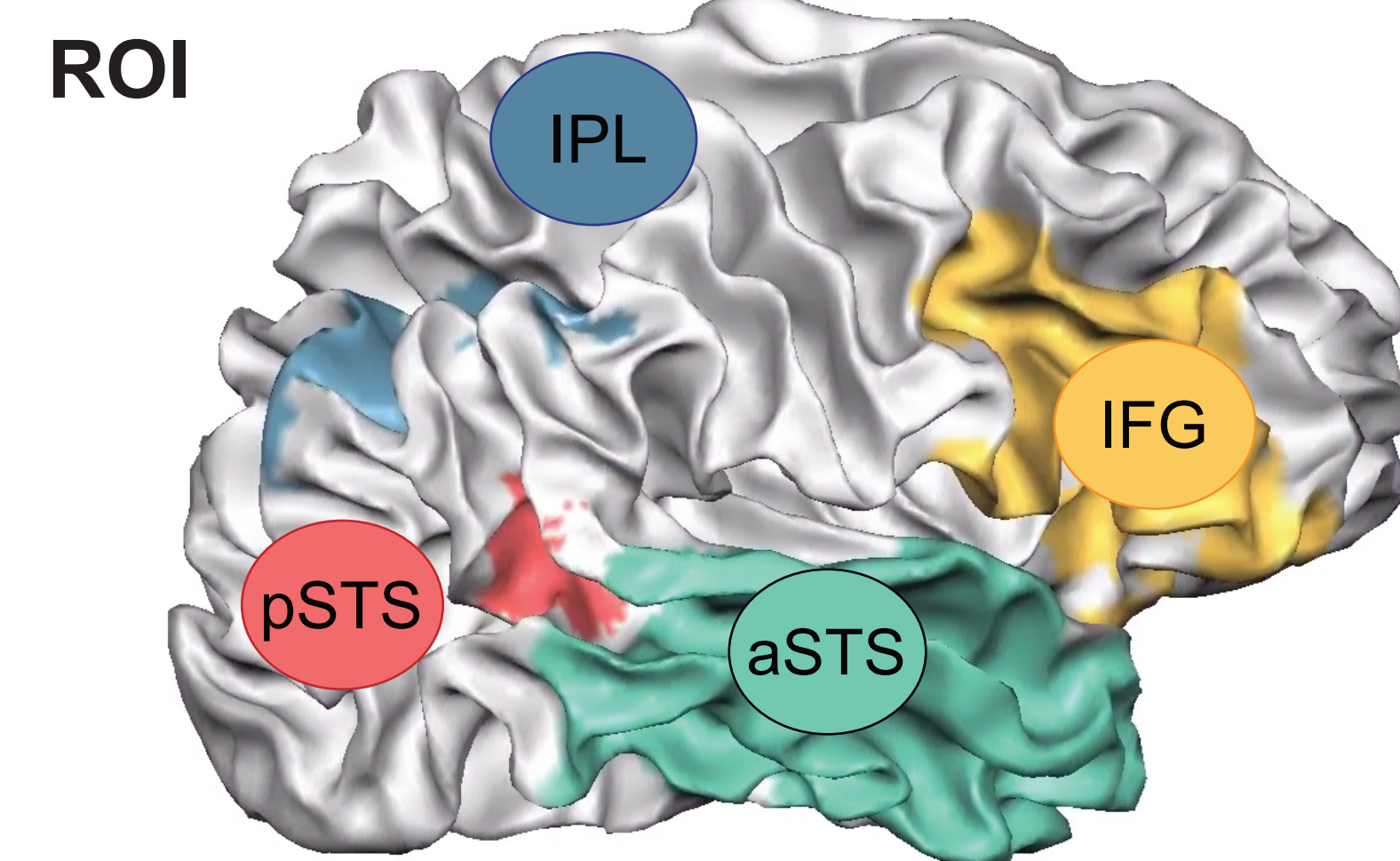
In the brain, action observation is linked to an online, motor-driven dorsal frontoparietal system and a more ventral, semantic and knowledge based frontotemporal system (Binkofski & Buxbaum, xx). The pSTS, with neural tuned to action kinematics, is proposed to be an input system to both.

The pSTS has neural signals modulated the the attentional state of observers during action recognition (Tavares et al., 2008; Stehr et al, 2021). Effective connectivity during action recognition indicates top-down feedback from the IFG (Sokolov et al., 2018).

In this study we seek to evaluate whether information about anticipated actions is apparent in the neural signal prior to observation, as a potential source action prediction.

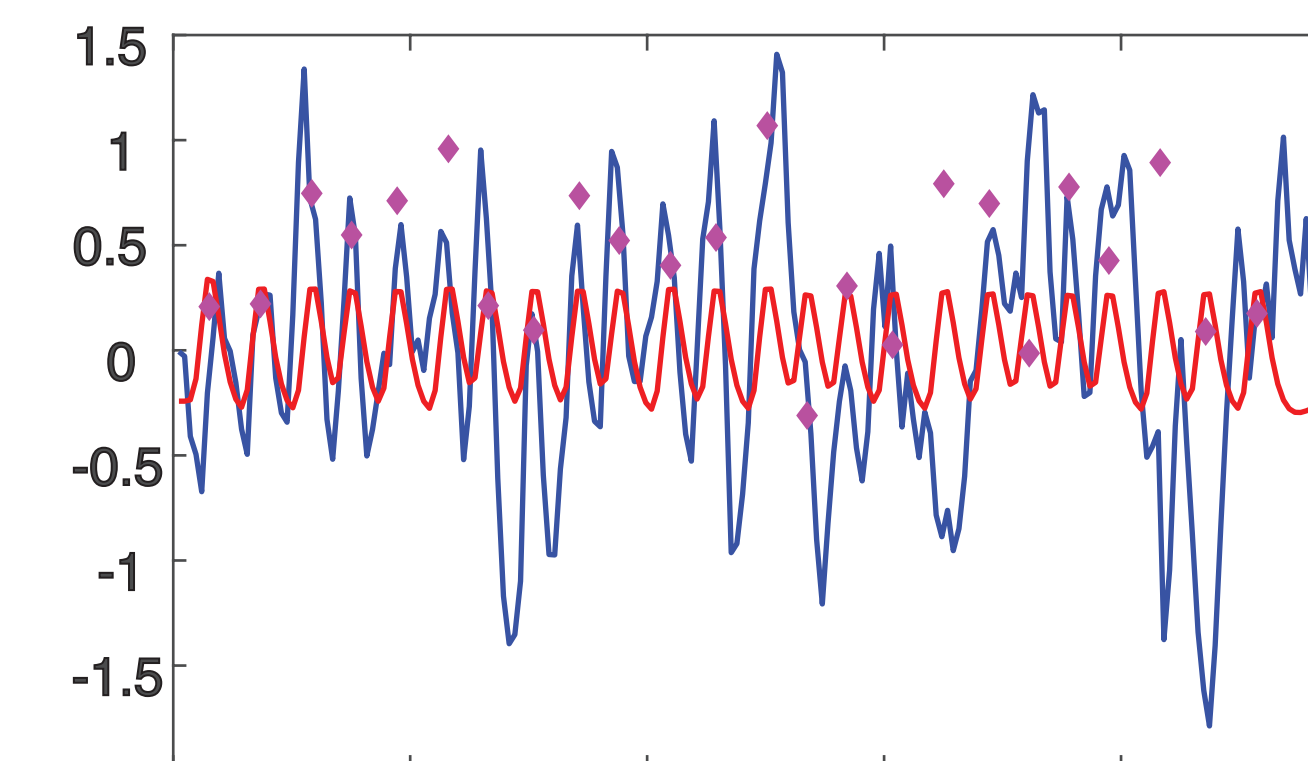
To achieve this, we implement a cueing paradigm, coupled with an extended anticipatory interval. We decode information in the fMRI BOLD response using machine learning classifiers.

## Analysis

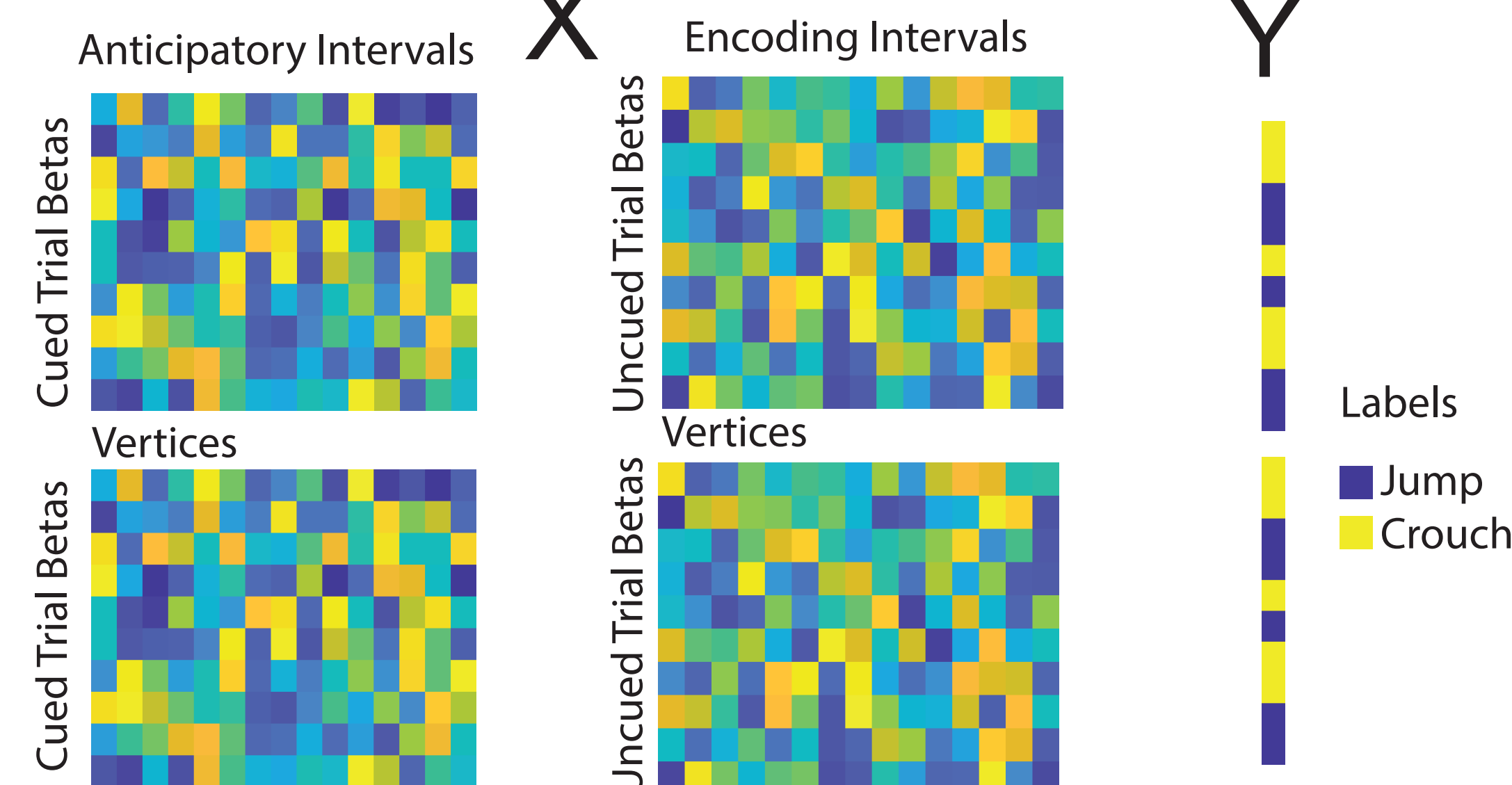


### Calculate Betas - LSS approach

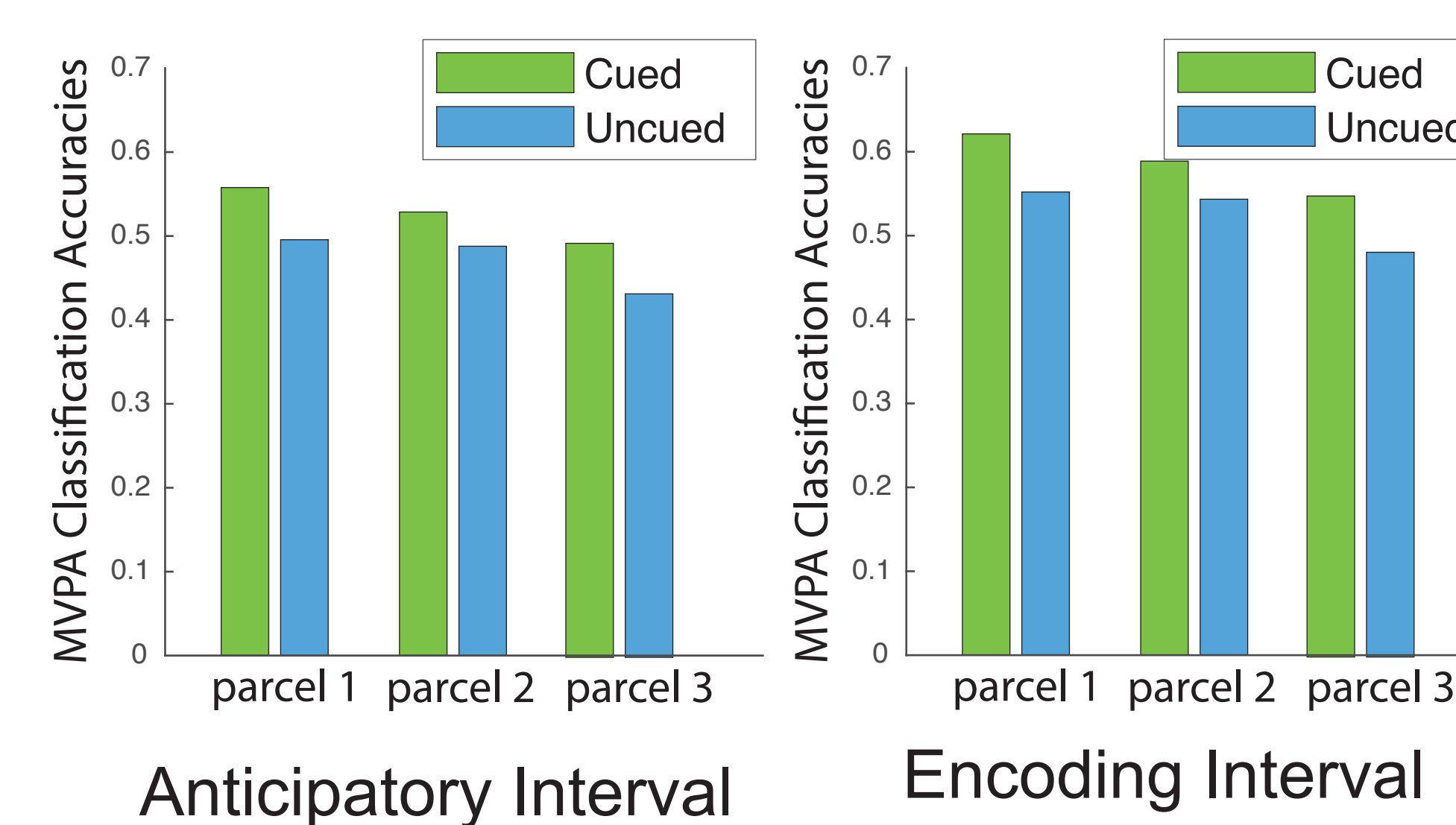
ROI Time Series  
Model  
Beta



### MVPA Methods



## Proposed hypothesis



## Conclusion

- Classification results revealed that the presence of action cues significantly influenced leave-one-run-out MVPA classification accuracies of actions.

- During the movie interval, this effect was observed in the right posterior superior temporal sulcus (pSTS) and right inferior frontal gyrus (IFG) ( $p < 0.05$ ).

- During the anticipatory interval, this effect was observed in the left dorsal IFG and left anterior superior temporal sulcus (aSTS) ( $p < 0.05$ ). These findings suggest that the presence of action cues has a significant impact on neural activity patterns in multiple regions of interest, both during the observation of actions in the movie and during the anticipation of upcoming actions.

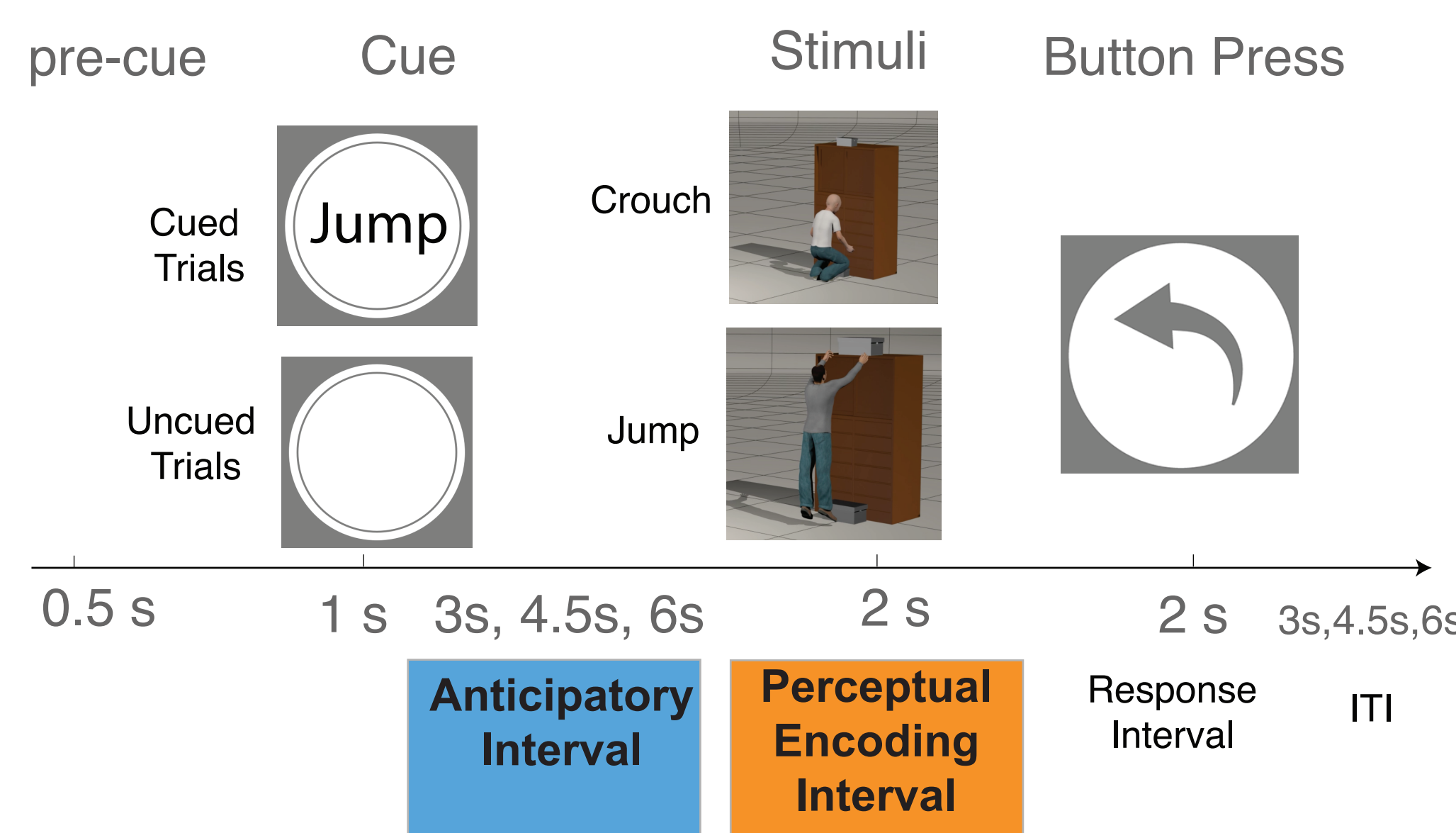
## Method

### Stimuli and Experiment Design

Subjects : n =29

Event-related design

- Participants viewed 2 sec animations of an avatar jumping or crouching
- Cue trials: 8x% valid cue specifying upcoming action
- Uncued trials: No cue as to upcoming action
- 3-6 sec anticipatory interval between cue and action encoding

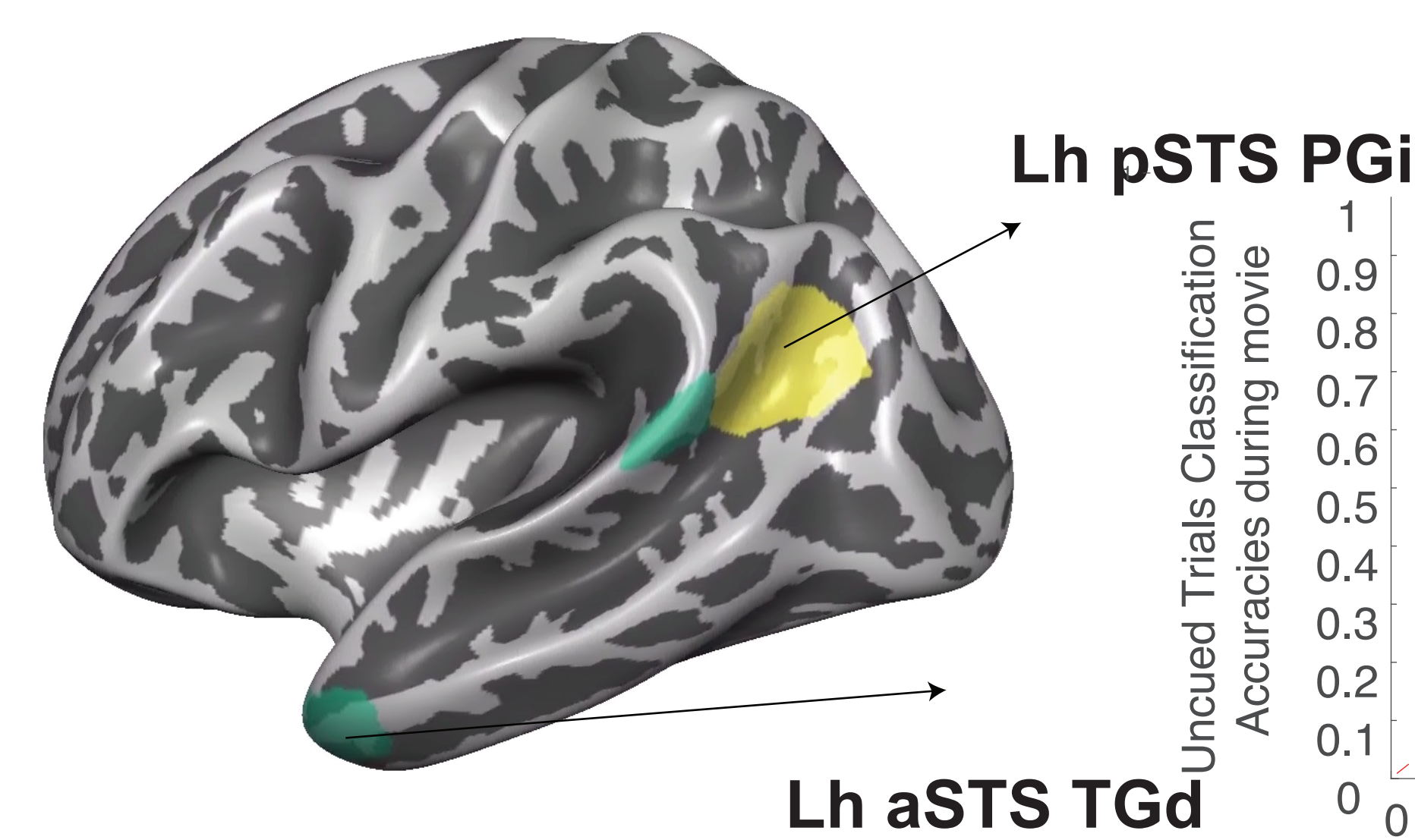


fMRI scanning on 3T at FIBRE (UC Irvine)

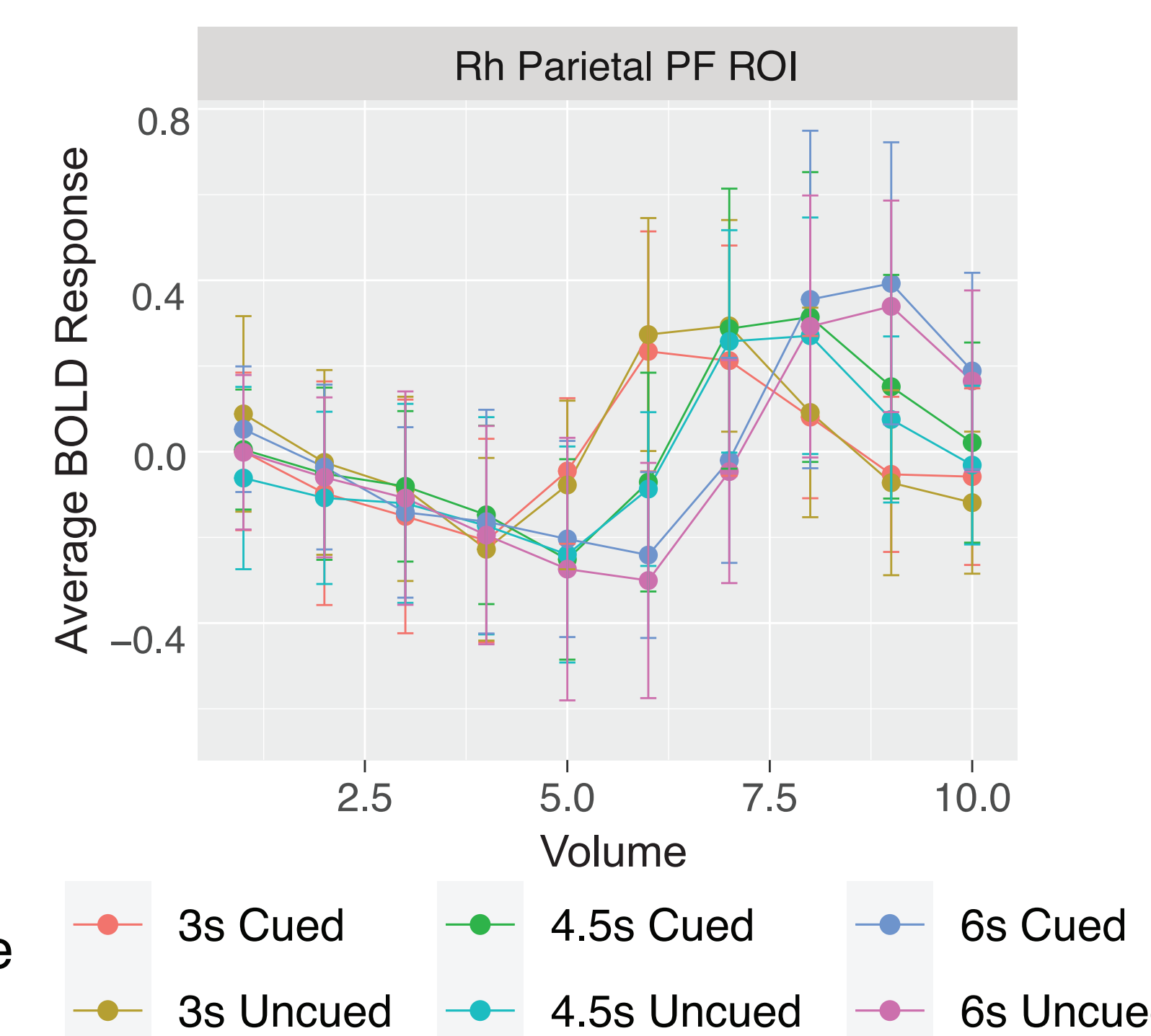
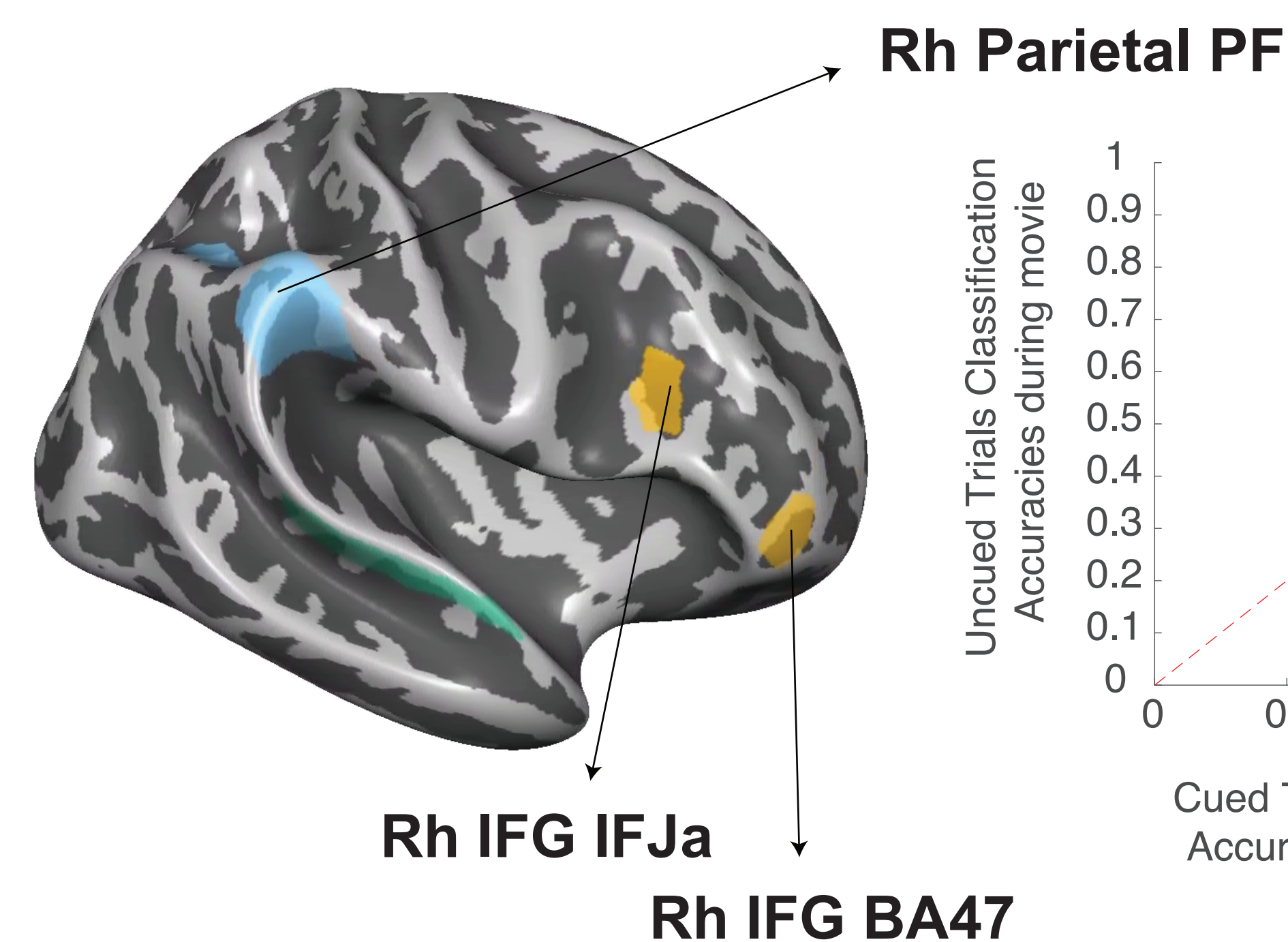
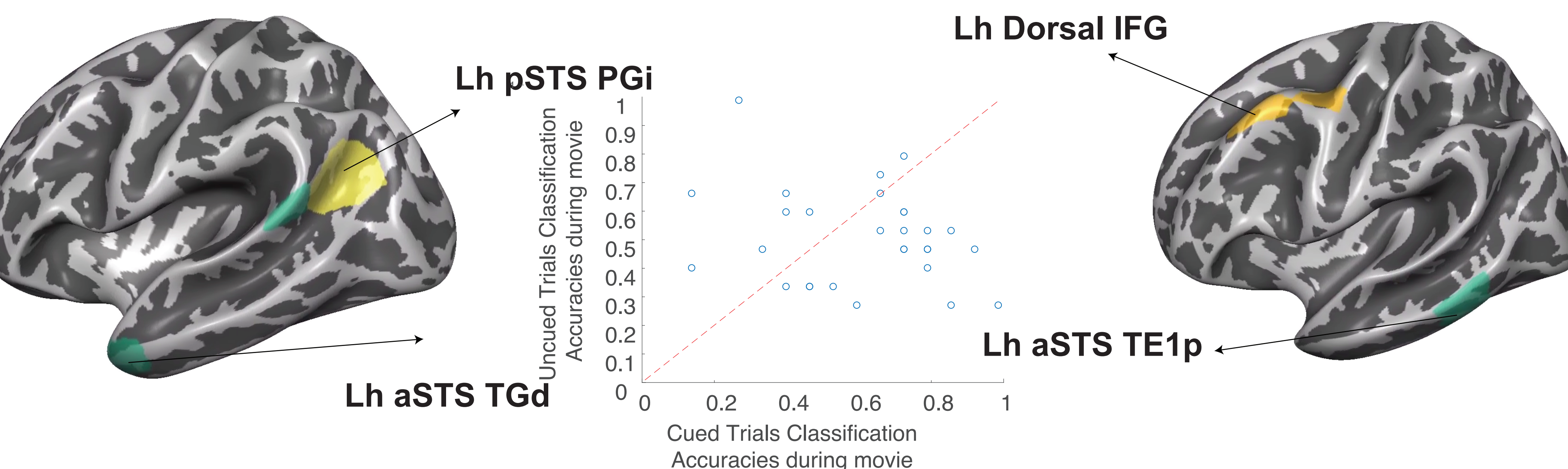
- T1-weighted images segmented using Freesurfer
- T2\*-weighted images preprocessed with fmripRep
- fMRI data registered to native surfaces
- ROIs defined by xx atlas parcellation

## Results

### Encoding Interval



### Anticipatory Interval



## Future Direction

### Cross training:

Does information in the anticipatory interval share statistical structure with the encoding interval? Train MVPA with sensory encoding interval and test with sensory encoding interval.

### Cross decoding:

Train MVPA or RSA on one ROI and test another ROI to evaluate the transferability of information, for example, IFG and test on pSTS.

## Acknowledgement

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### Citations

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