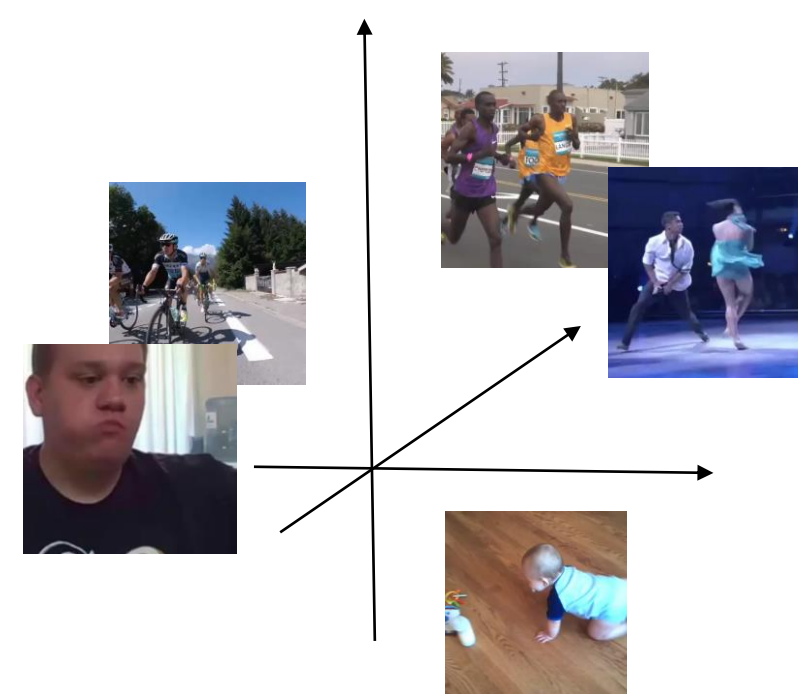


# Low- and High-Level Features Explain Neural Response Tuning During Action Observation

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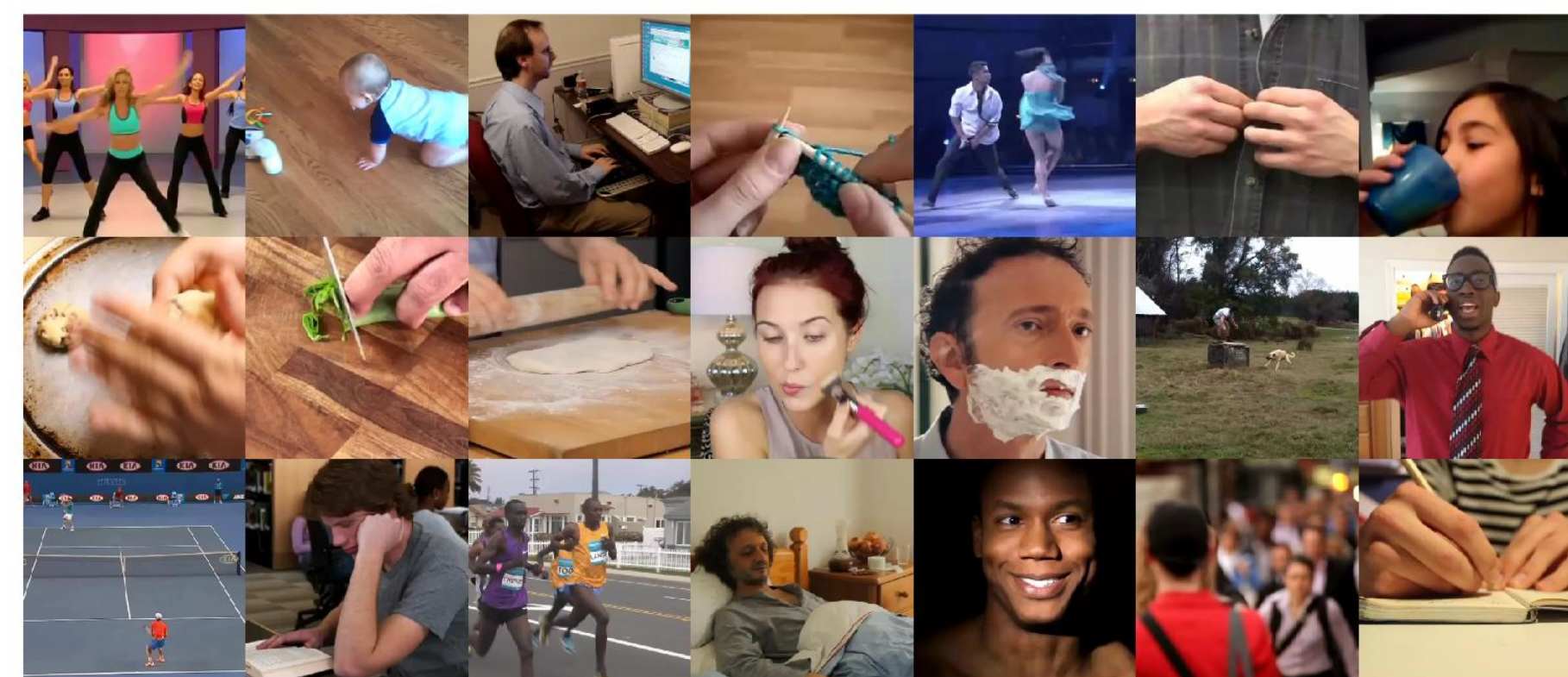
## Introduction

We witness a wide variety of activities every day. **What activity features (dimensions) organize how the brain perceives others' activities?**



Lingnau & Downing (2015); Hafri et al. (2017); Wurm et al. (2017); Giese & Poggio (2003); Isik et al. (2016); Fabbri et al. (2016)

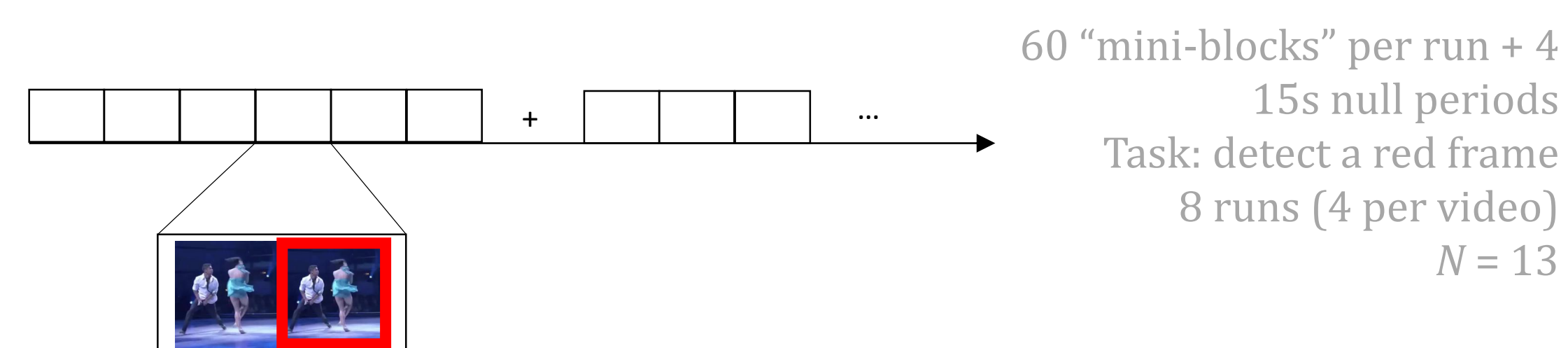
## Stimuli



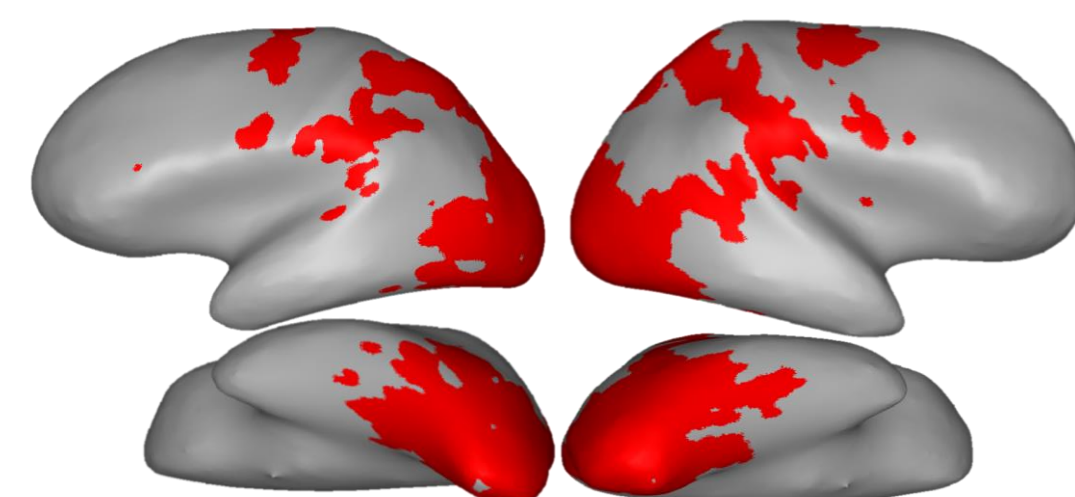
120 2.5s videos of 60 activities (American Time Use Survey)  
**A wide sample of our everyday visual experience**

## Neural Measures

1. Collect neural responses to each video (fMRI)



2. Restrict analysis to reliable voxels

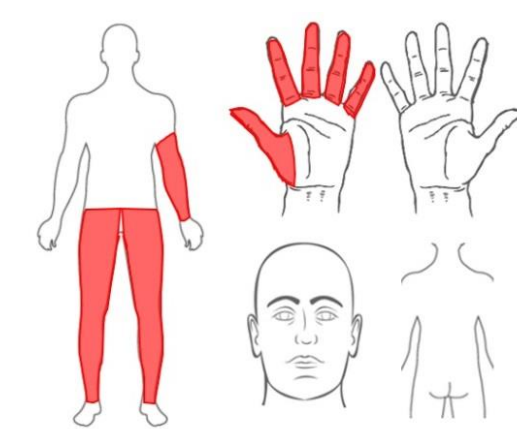


## Results 1: Voxel-wise Modeling

*Which features fit well, and where?*

Hypothesized tuning properties

### Body Parts



Select the body parts involved in the activity

### Activity Target

What is this activity directed at?

- an object
- another person
- your own body
- space

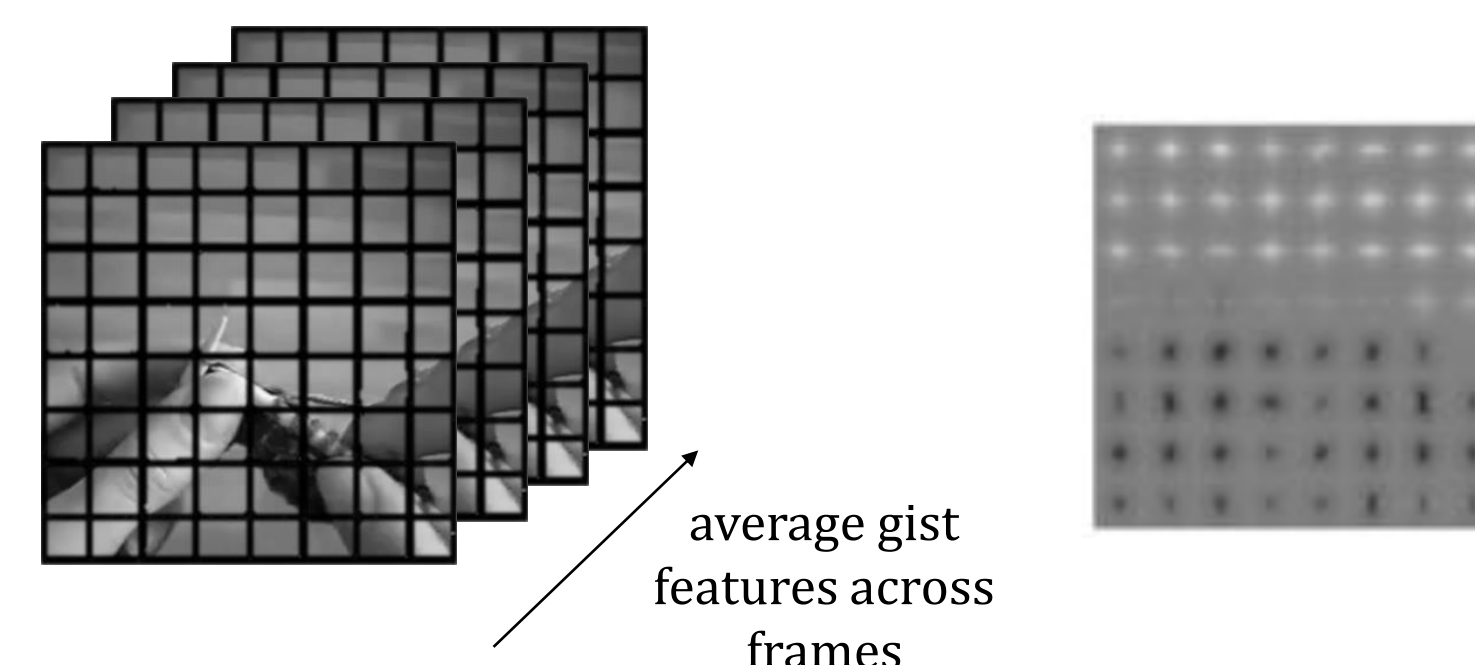
### Effort

How much effort does this activity involve for the average person?



### Gist

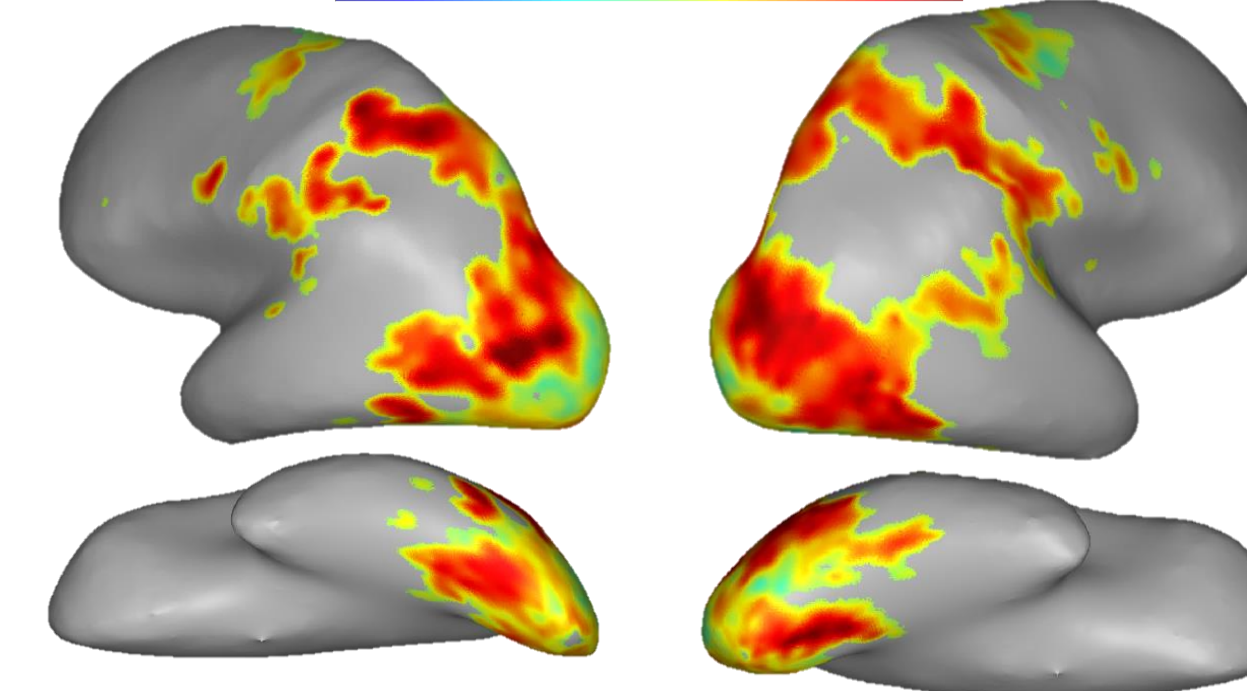
Oliva & Torralba (2001)



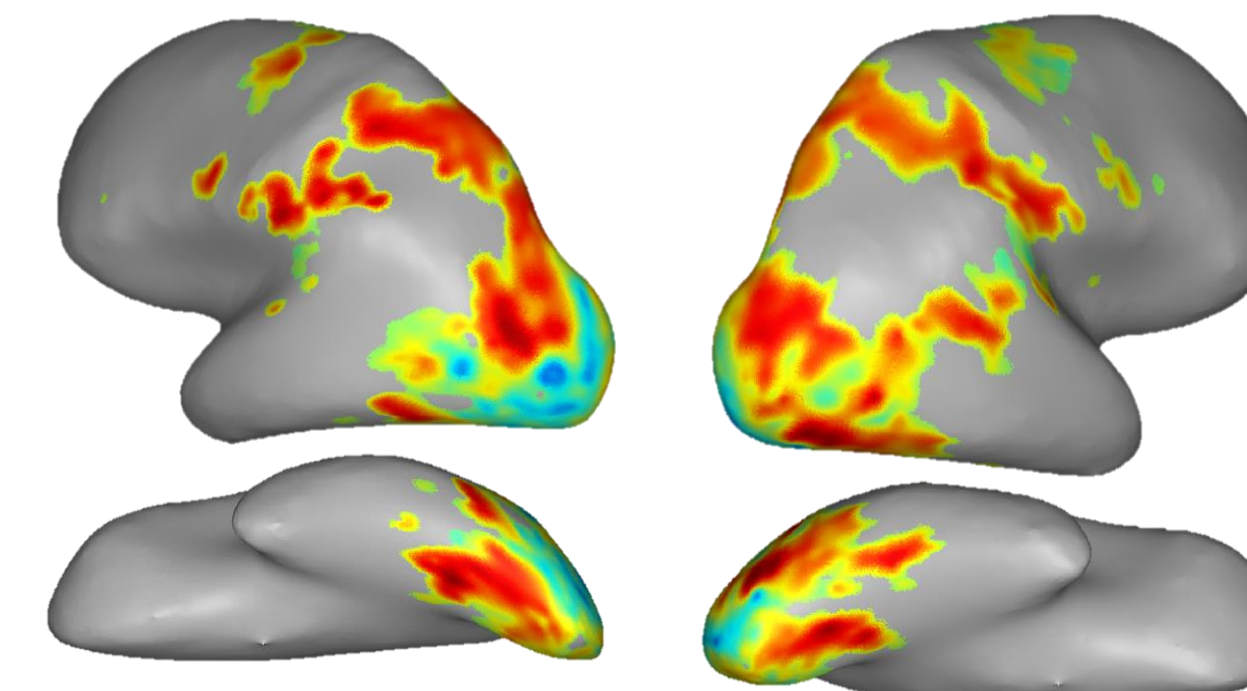
Capture global form and low-level visual properties

Model Performance  
(leave-2-out cross-validation)

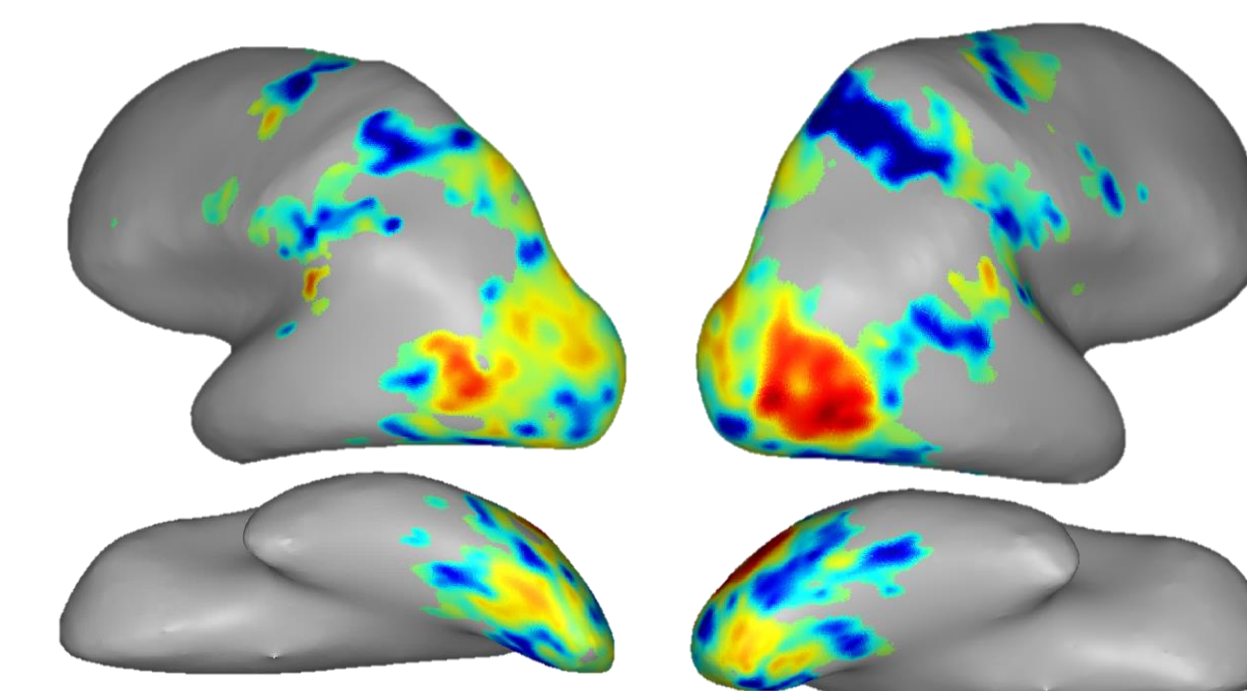
$r(\text{predicted patterns, actual patterns})$



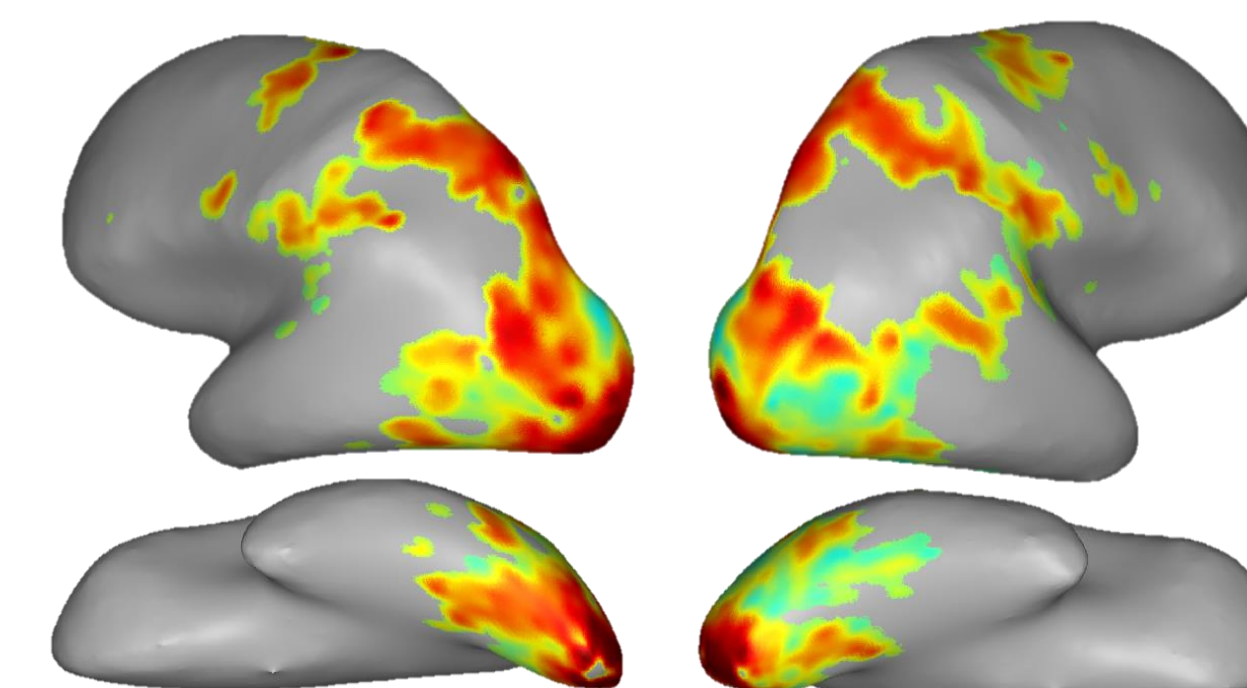
Good fits along ventral and parietal streams (not just EBA)



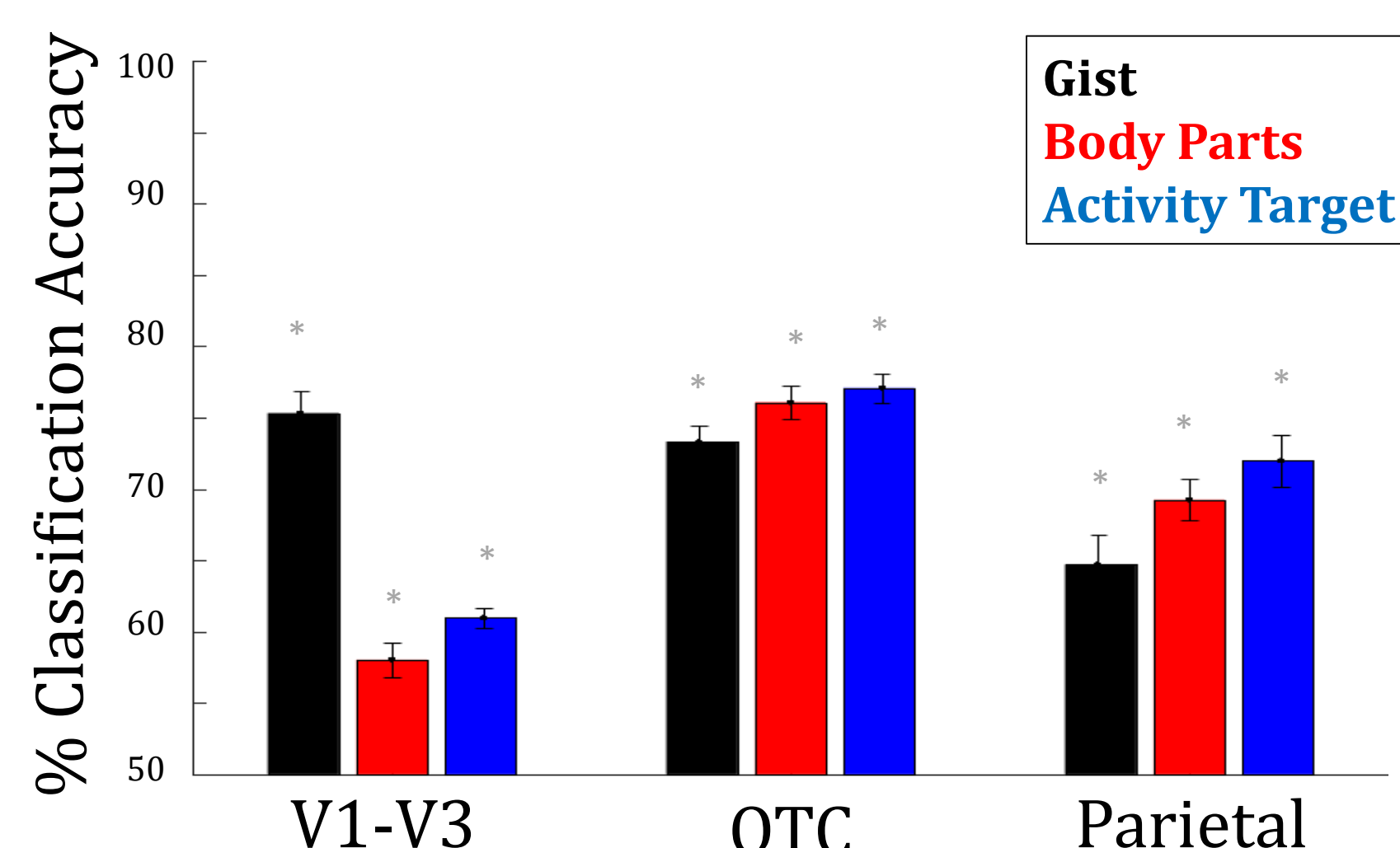
Good fits along ventral and parietal streams (not just a complement of body parts)



Focal success in lateral temporal cortex (near EBA)



Fits best in V1-V3 (but surprisingly good along ventral and parietal streams)



All models do unexpectedly well over most of visual cortex.

Gist performs best in V1-V3, but high-level models perform best outside of V1-V3.

## Results 2: Data-Driven Structure

*Can we discover new parcellations of visual cortex?*

Cluster voxels based on their response profiles.  
Plot the videos with the highest response in each cluster.



## Observations

- Clusters recapitulate known structure
  - Retinotopy
  - Mirrored ventro-lateral scene network
- Two parietal networks that link to lateral temporal cortex (reflecting activities' tool-relevance?)

## Conclusions

