Grip-specific neural population dynamics are not shared between action and observation in the frontoparietal cortical grasping network

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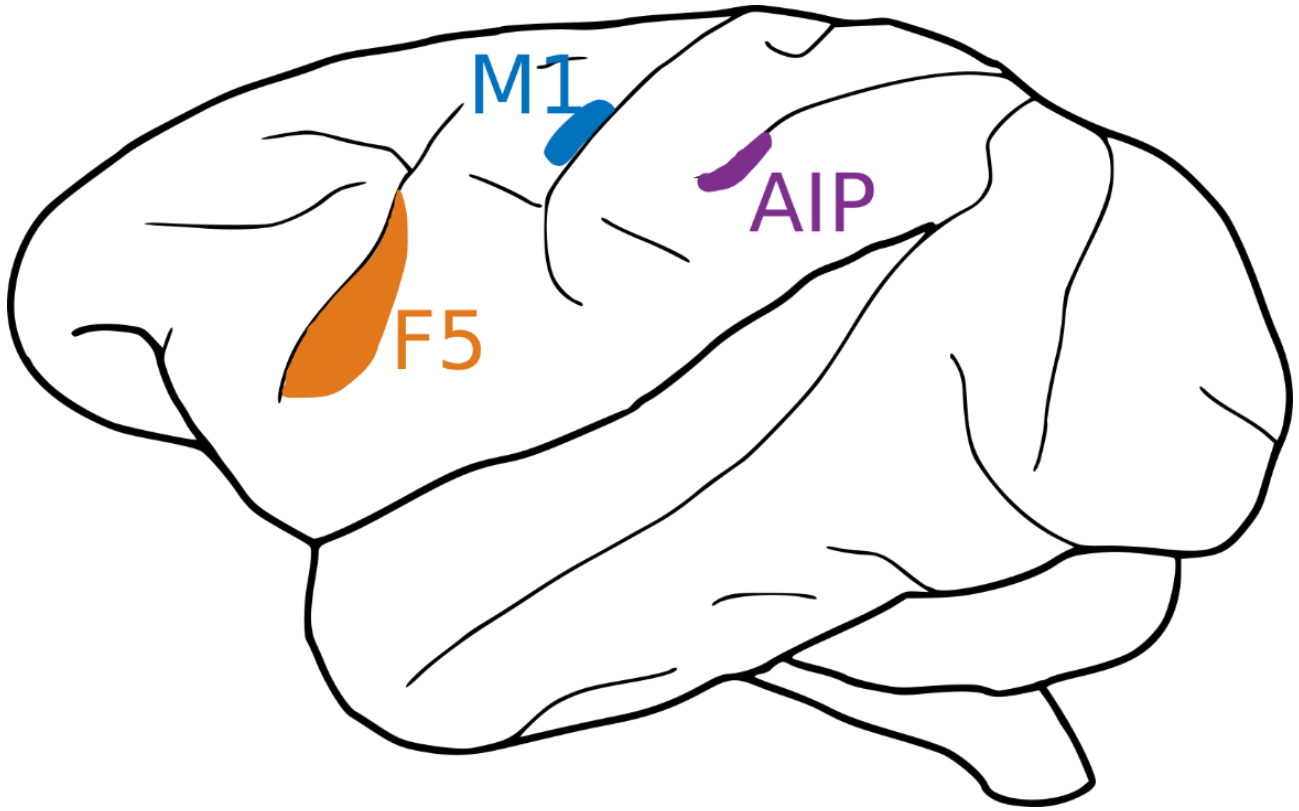
The frontoparietal grasping network is highly interconnected and mediates grasping behavior



Primary motor cortex (M1)

Rostral ventral premotor cortex (F5)

Anterior intraparietal area (AIP)

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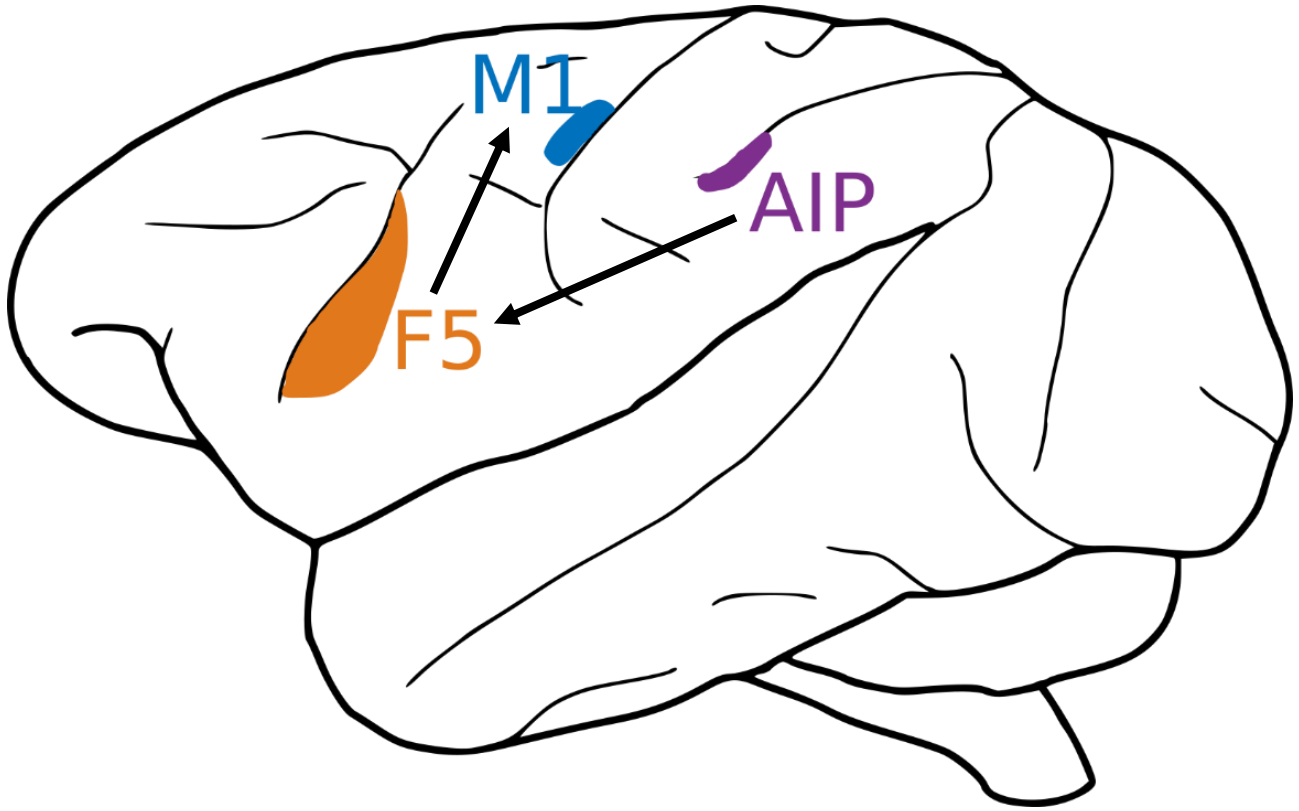
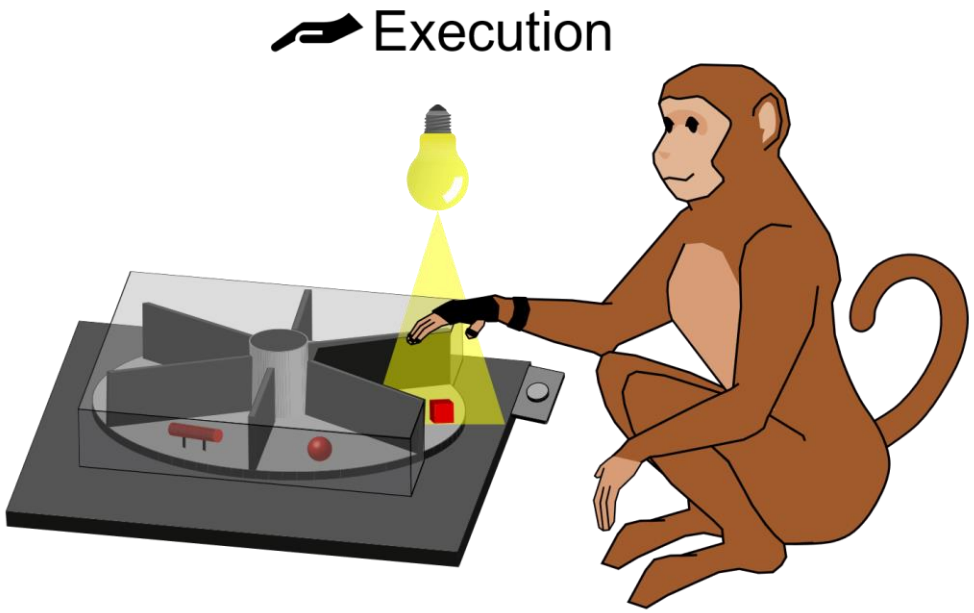


Primary motor cortex (M1)

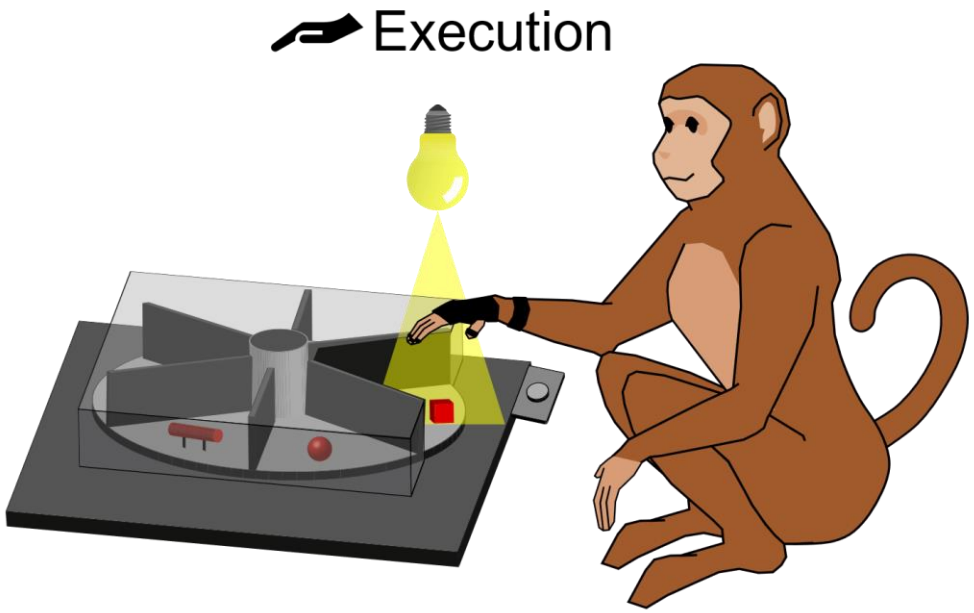
Rostral ventral premotor cortex (F5)

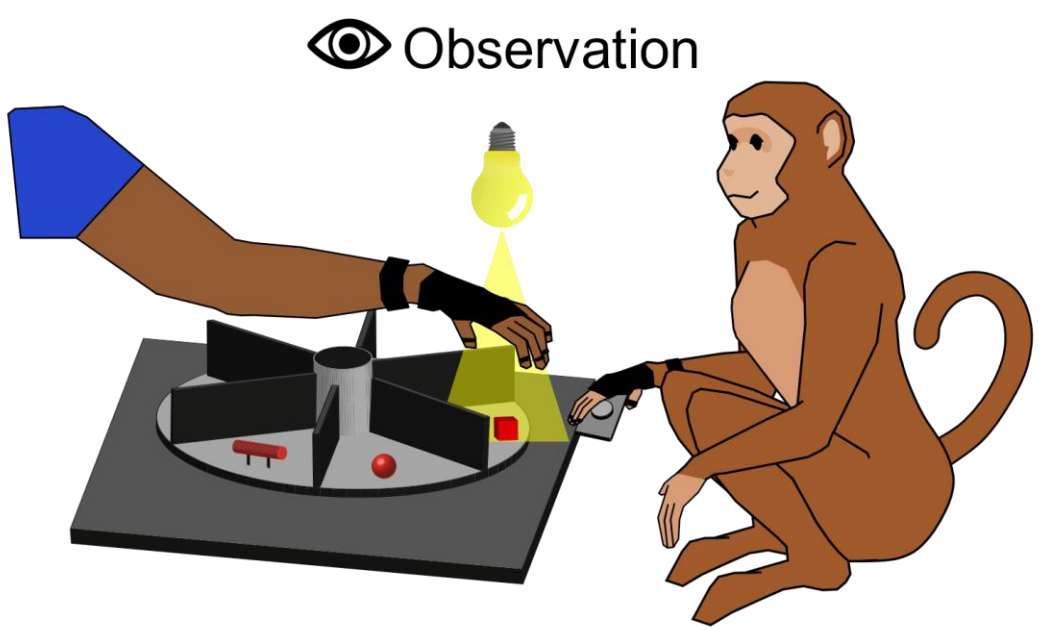
Anterior intraparietal area (AIP)

Grasp execution

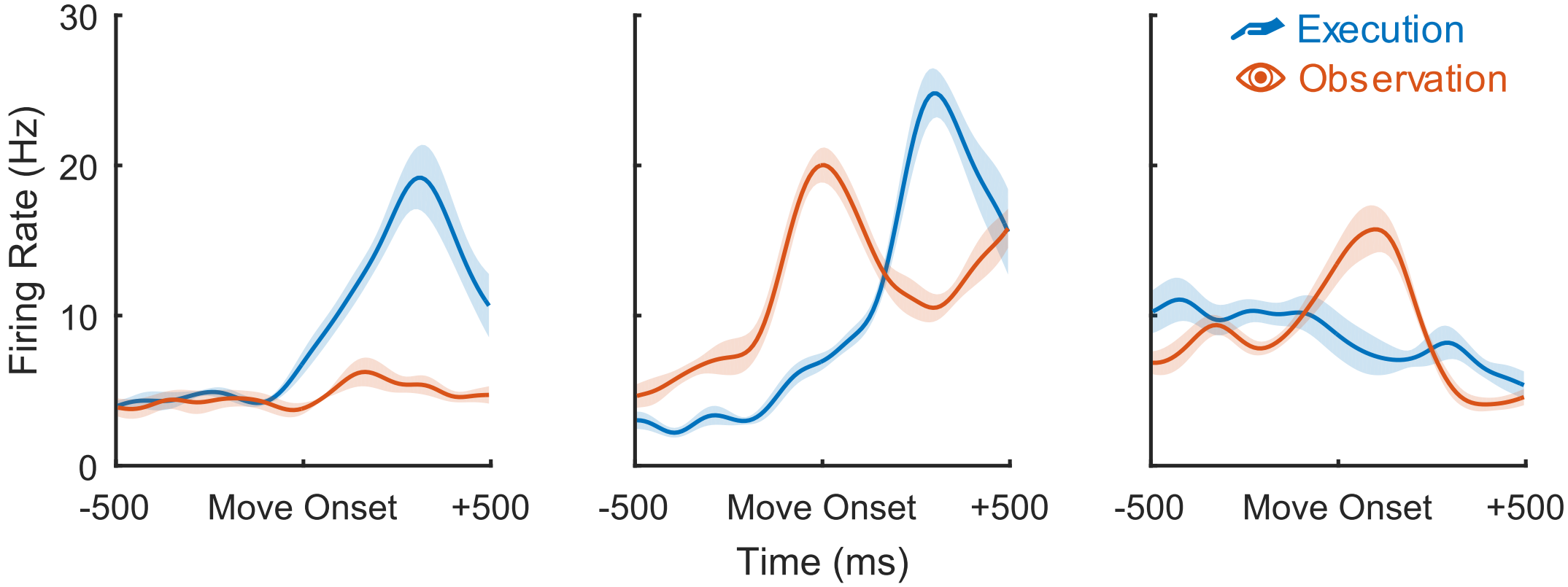


Grasp execution and observation

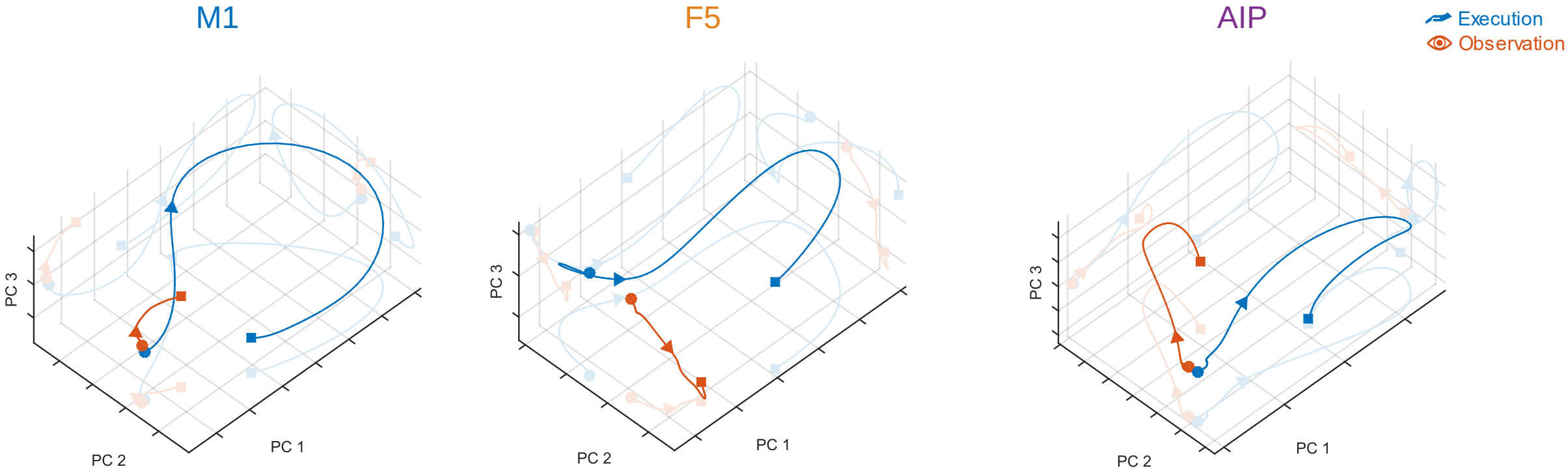




There is a broad spectrum of relative preference for observation and execution throughout each population



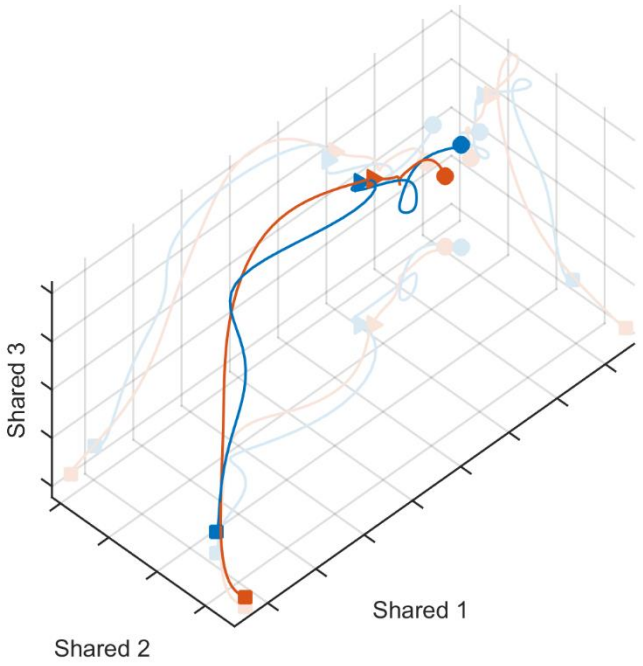
State-space analysis reveals generally non-overlapping patterns of activity



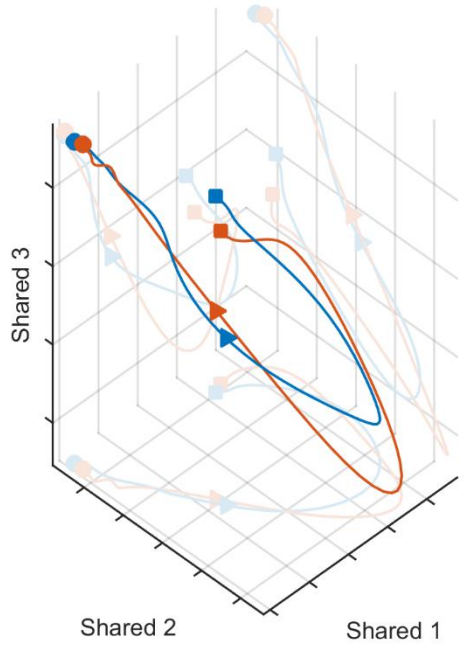
● -500ms ▶ 0 ms ■ +500 ms from Move Onset

A common subspace captures patterns of activity actually shared between execution and observation

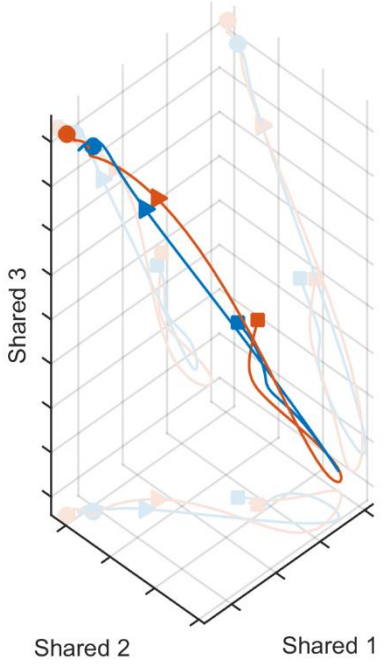
M1



F5



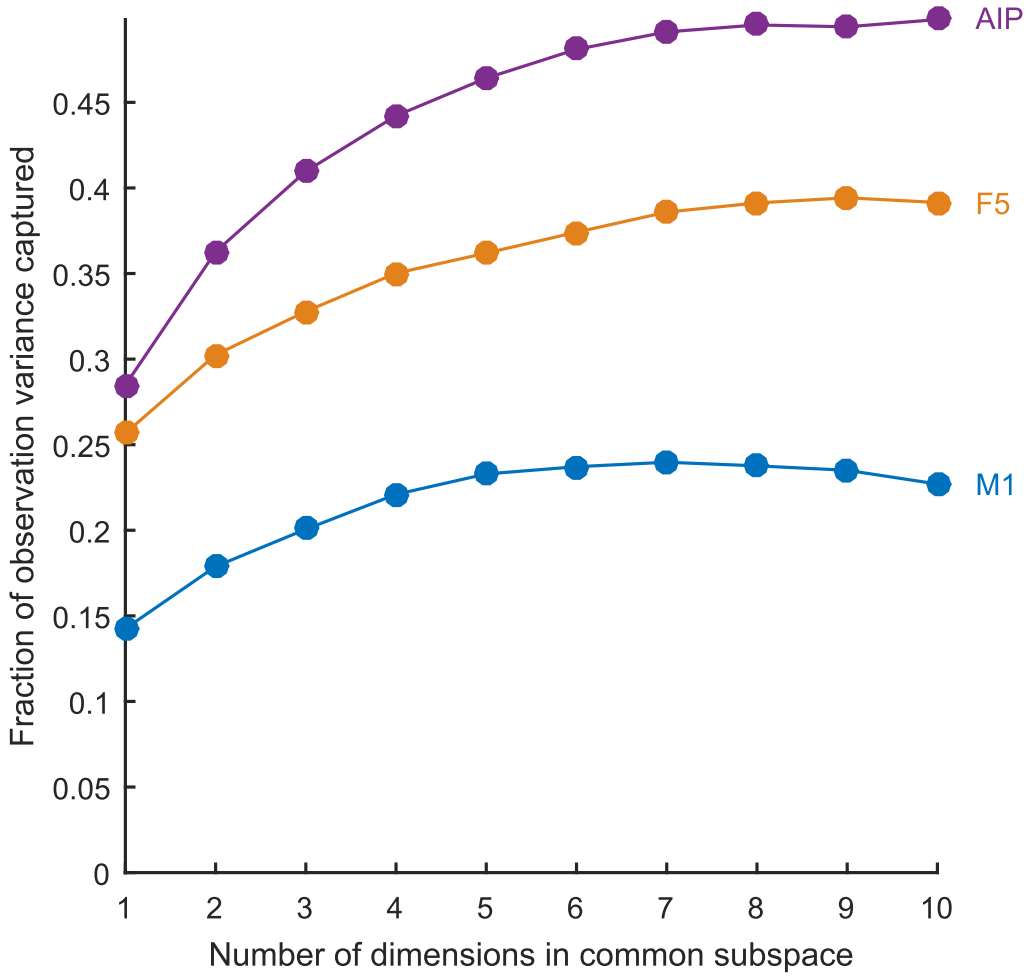
AIP



Execution
Observation

● -500ms ▶ 0 ms ■ +500 ms from Move Onset

The common subspace explains less variance from AIP to F5 to M1



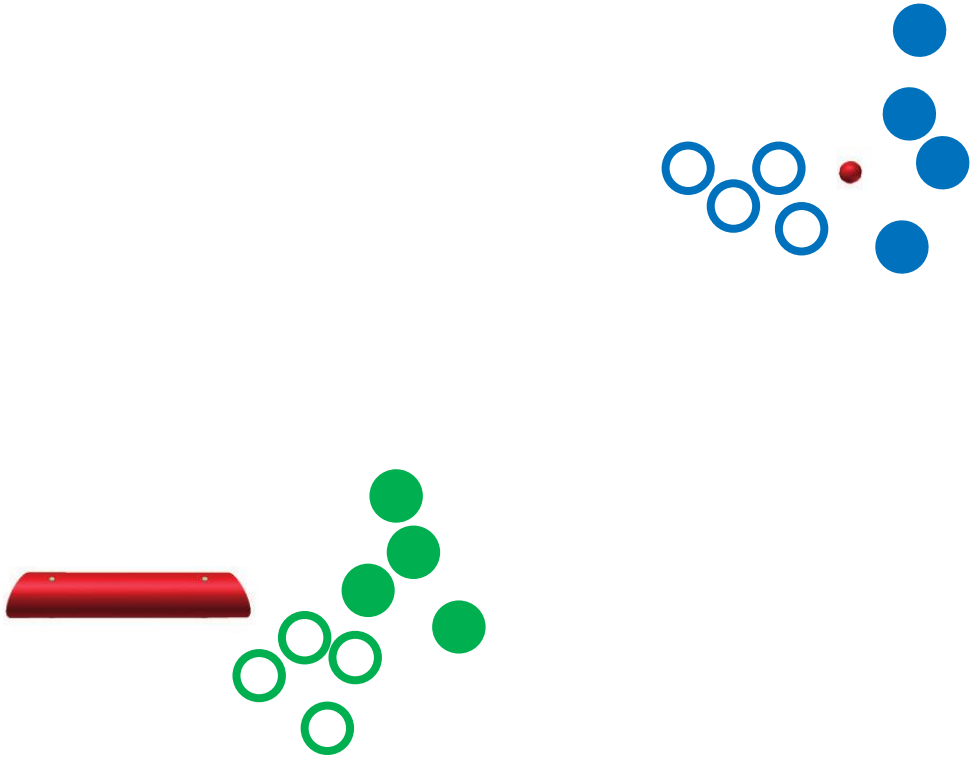
Grip representations should form distinct clusters in neuronal state space

Exe 

Grip representations during execution and observation should overlap

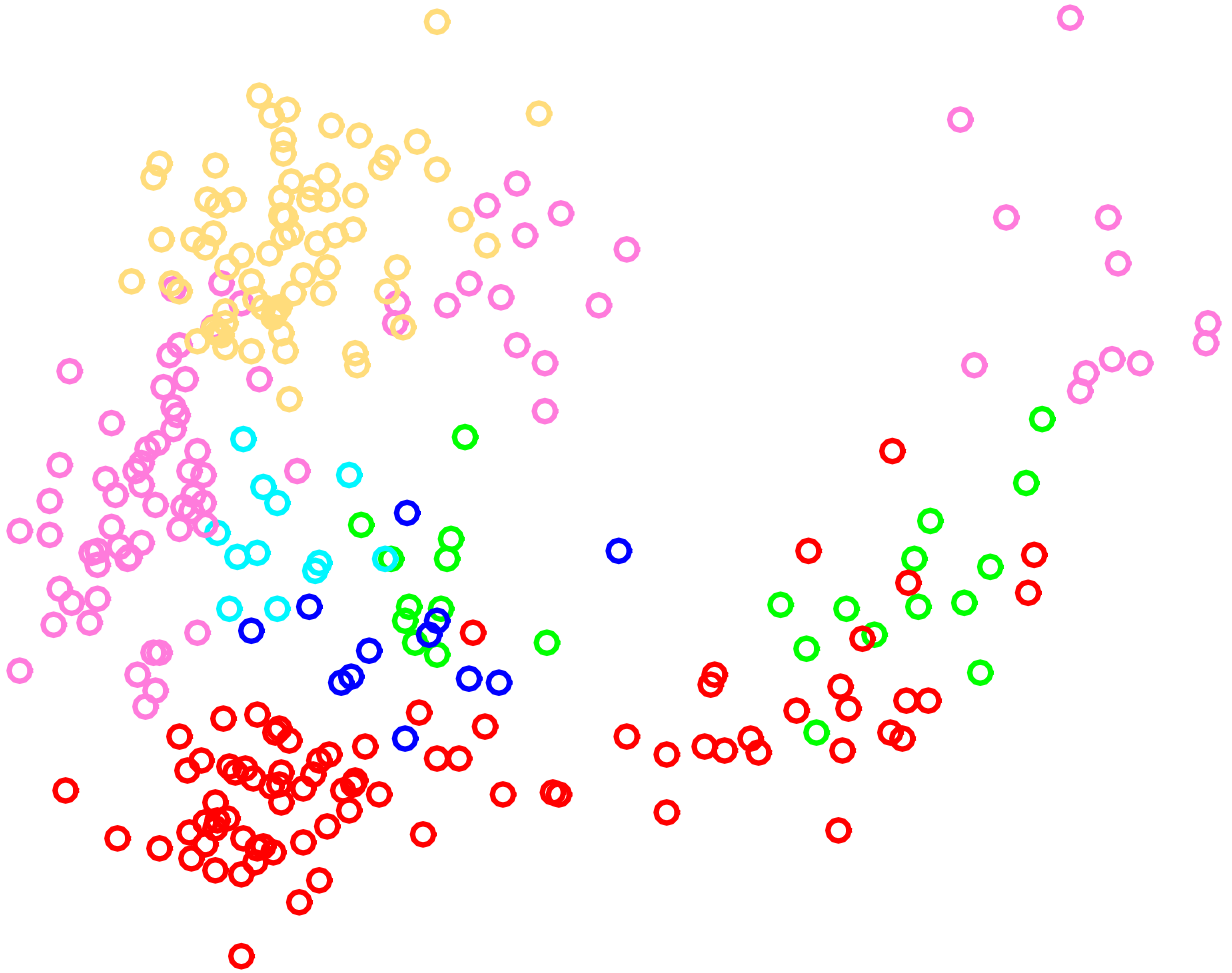
Exe

Obs

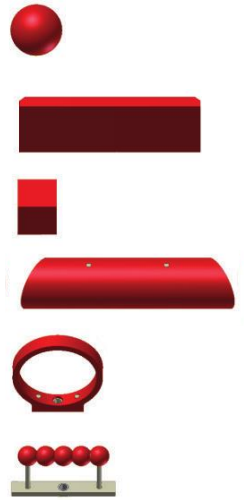


Grip representations form clusters during execution

Exe 



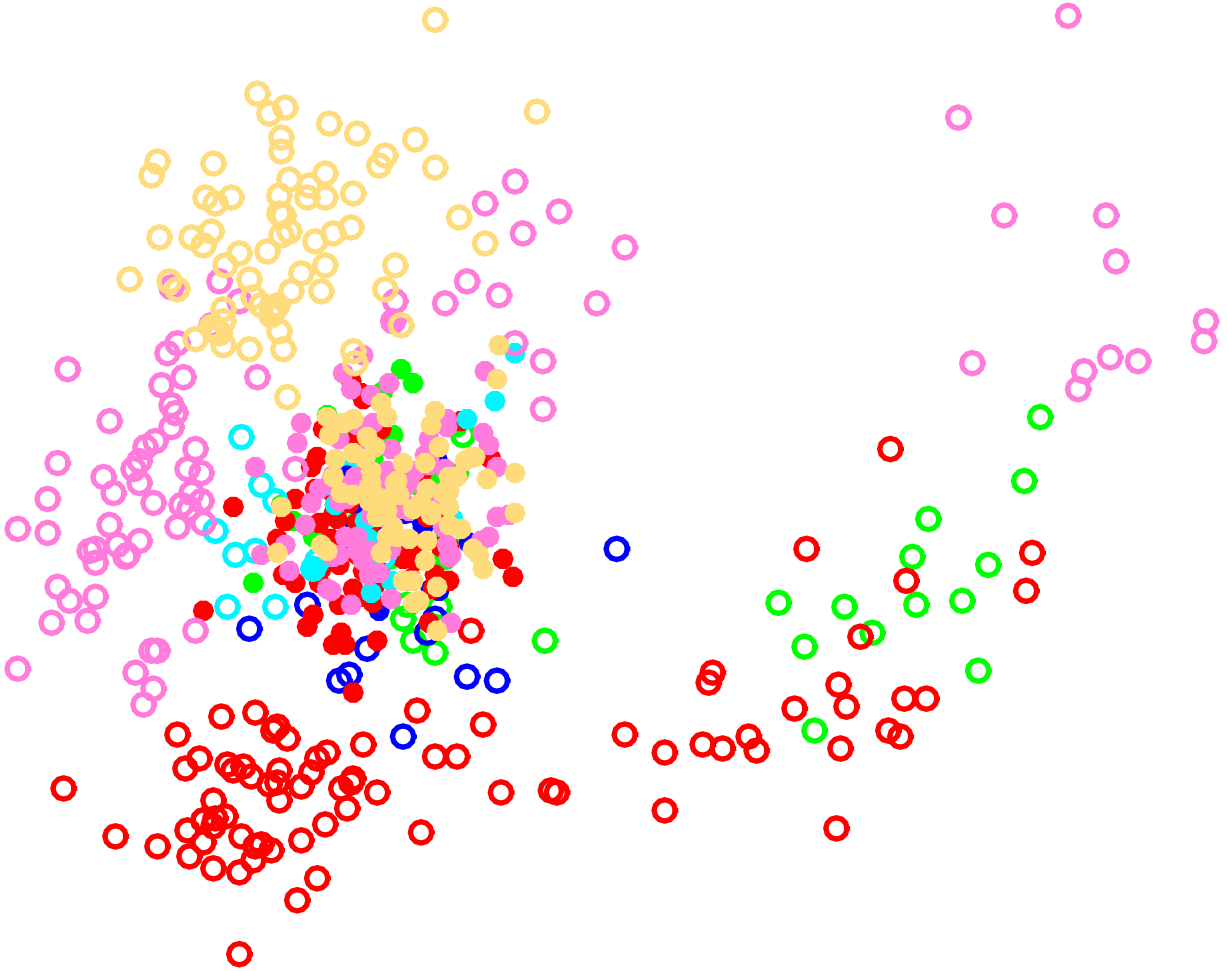
Ball
Bar
Cube
Cylinder
Ring
Special



Shared grip clusters do not emerge in a low-dimensional space

Exe

Obs



Ball

Bar

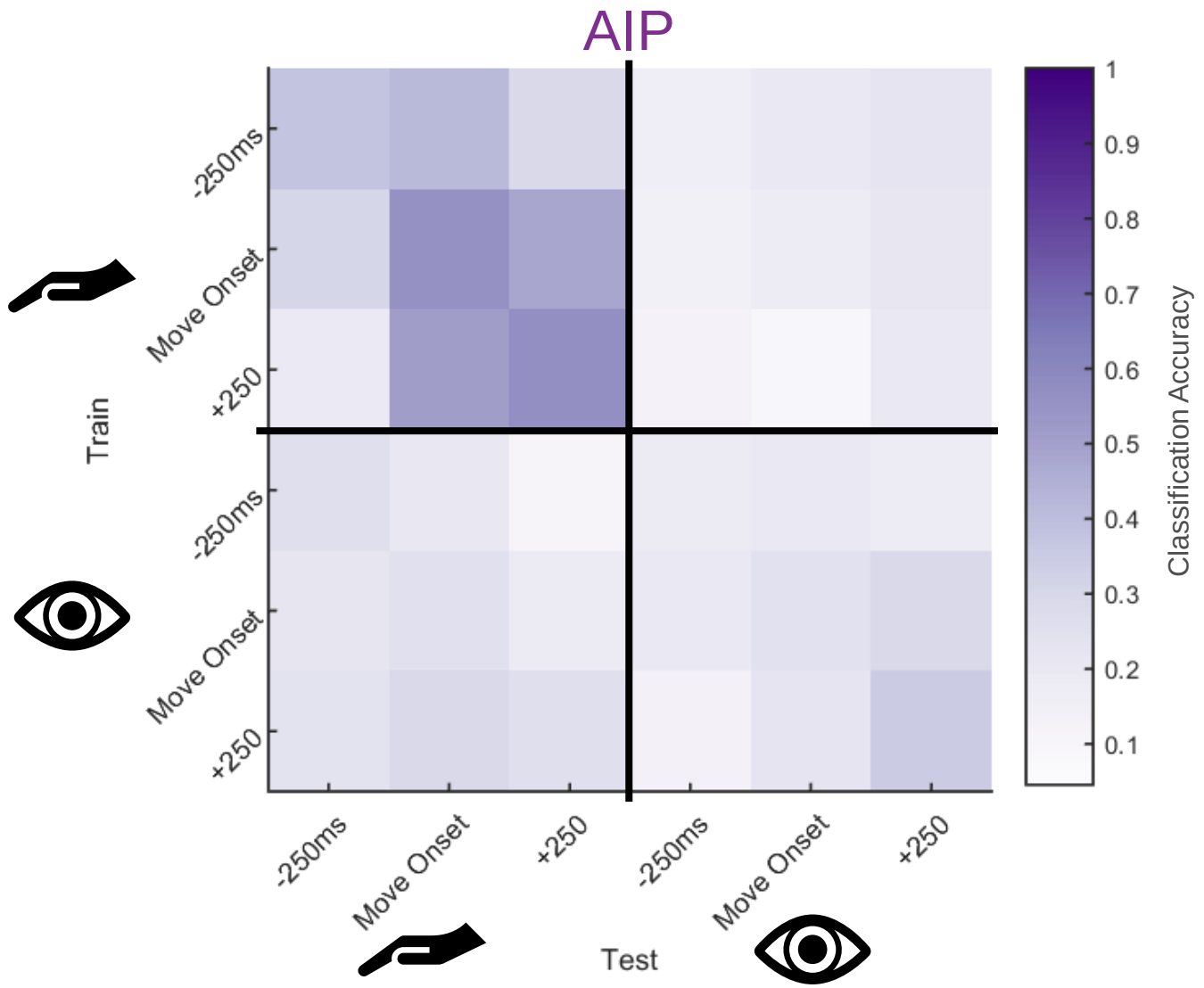
Cube

Cylinder

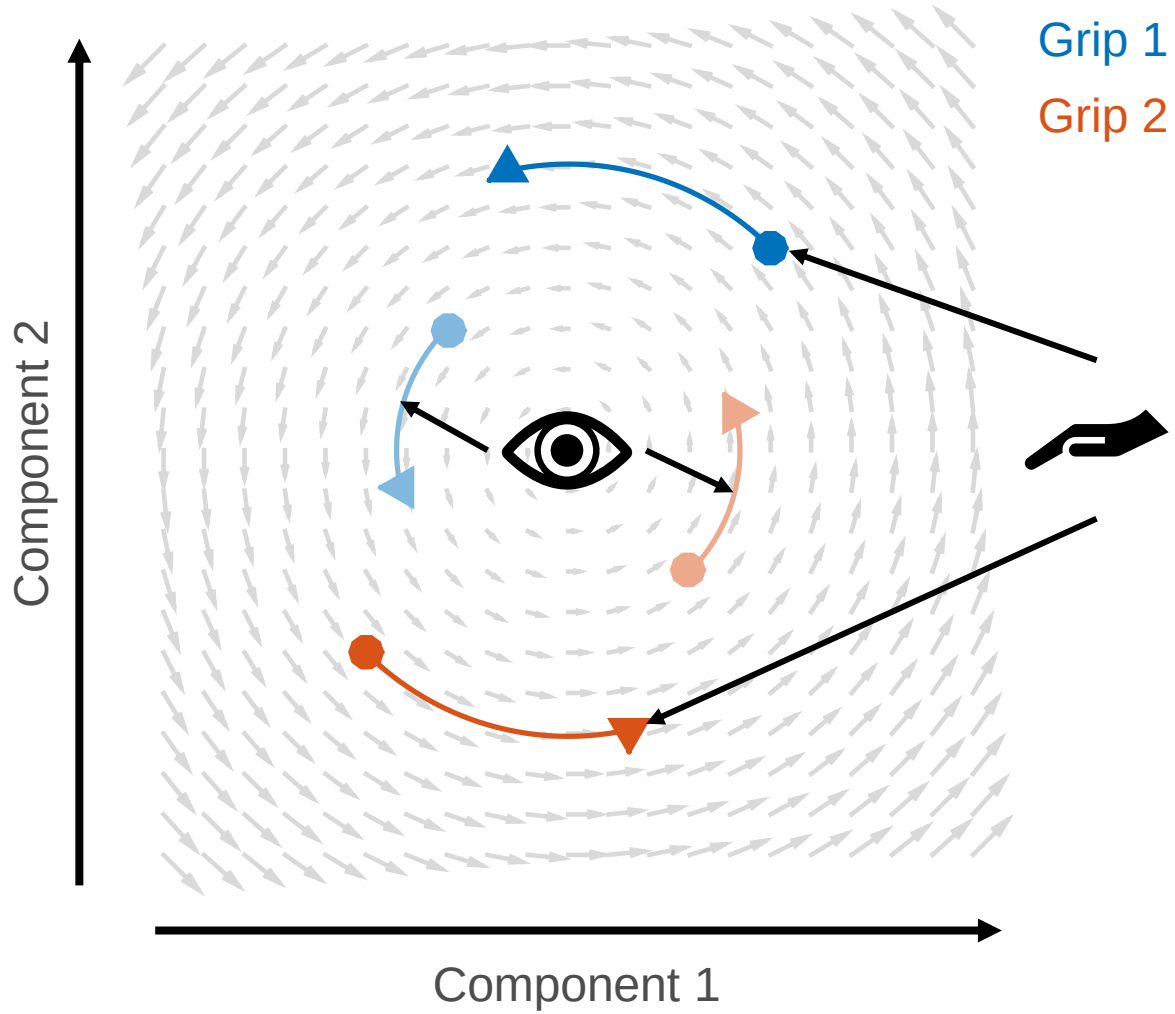
Ring

Special

Cross-classification reveals no shared grip clusters even in a higher-dimensional space



In development: state space dynamics may yet reveal shared grip-specific structure



Summary of results

- There is no clustering of neurons into clear mirror and nonmirror populations
- There are shared activity patterns between execution and observation
- Shared activity is most prevalent in AIP, least in M1
- These shared activity patterns do not seem to capture grip-specific information

Thank you!

Neurobiology Laboratory ca. 2018

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