What to do when stimuli (video, audio) are missing?

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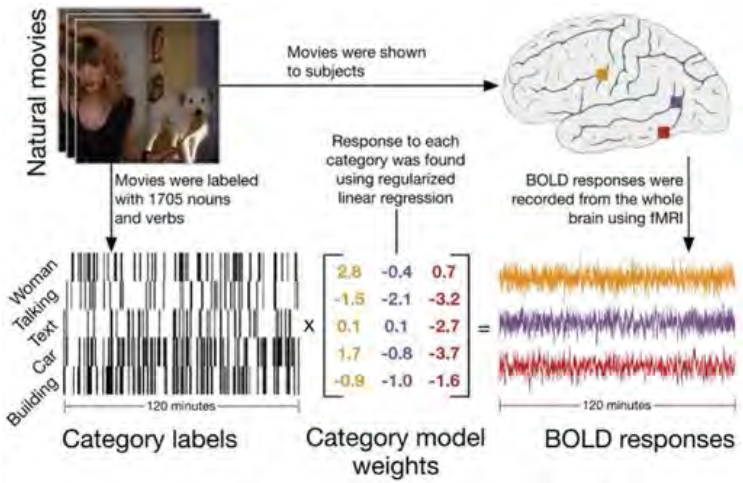
National Institute of Mental Health

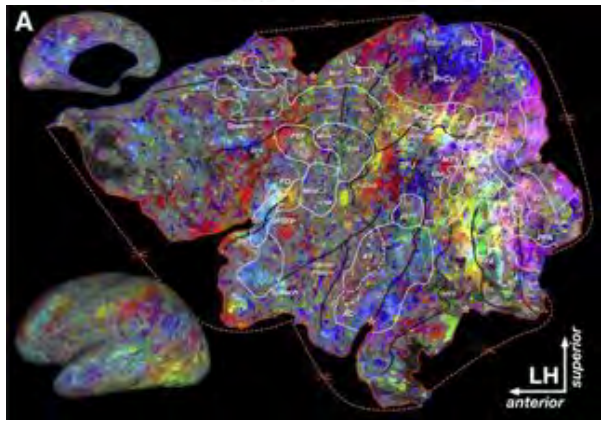
Introduction

Timing of Experimental Events

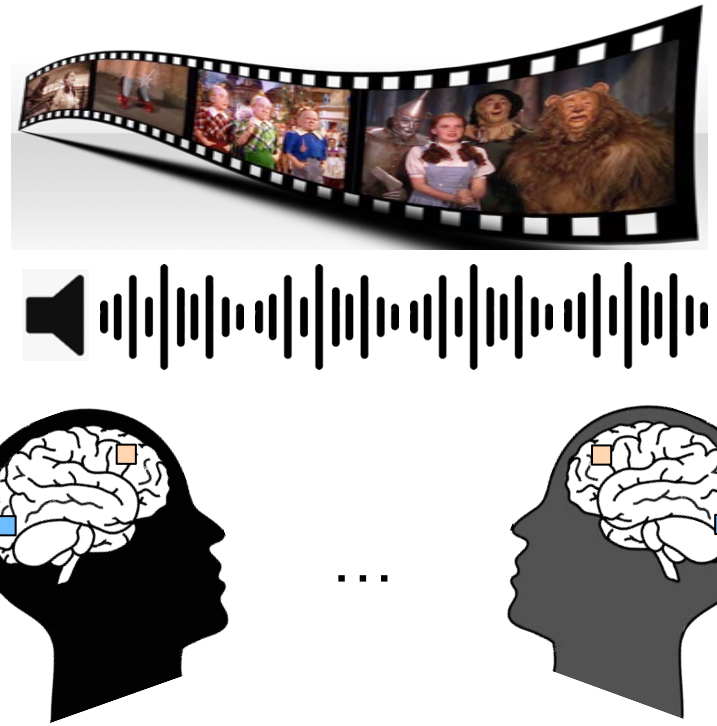
Naturalistic Stimuli in fMRI

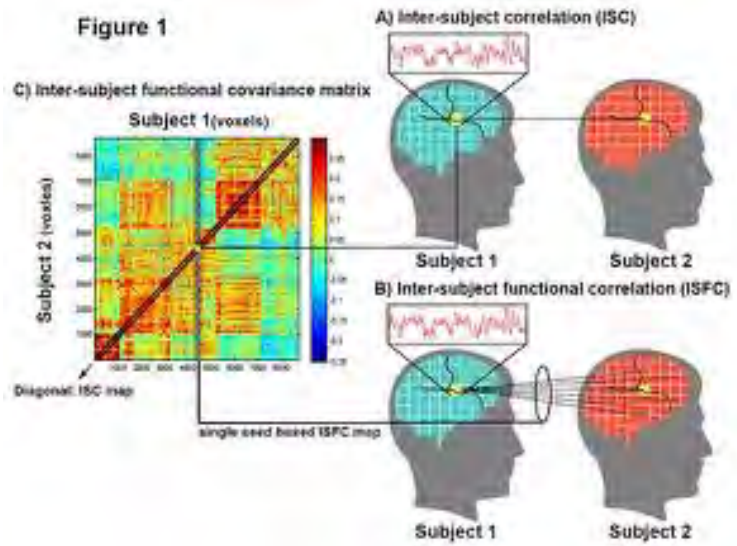
Expectation of Synchrony





Huth et al. Neuron (2012)





https://www.hassonlab.com/inter-subject-correlation

Introduction (II)

No Stimuli (i.e., Resting-State)

Timing & Nature of Experimental Events is unknown

There is no expectation of Synchronicity across subjects

Static FC

Time-varying FC

Hemodynamic Deconvolution

Low Dimensional Trajectories

IMAGE FROM: https://www.npr.org/sections/health-shots/2013/10/28/241383847/how-a-wandering-brain-can-help-people-cope-with-pain

Looking for correlates of conscious experience during resting-state

RESTING-STATE ONGOING EXPERIENCE

Non-Conscious / Automatic / Homeostatic Functions

Non-Conscious Component

Conscious Component

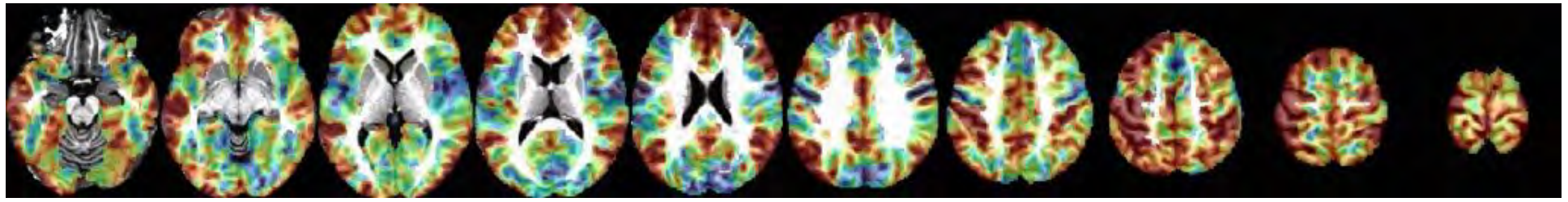
Plan future vacation

Hand discomfort and repositioning

Remember past argument with partner

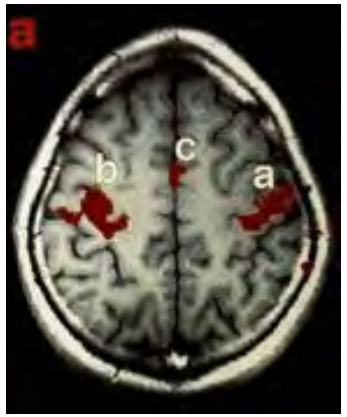
Lower limb discomfort and repositioning

Focus attention on scanning noise

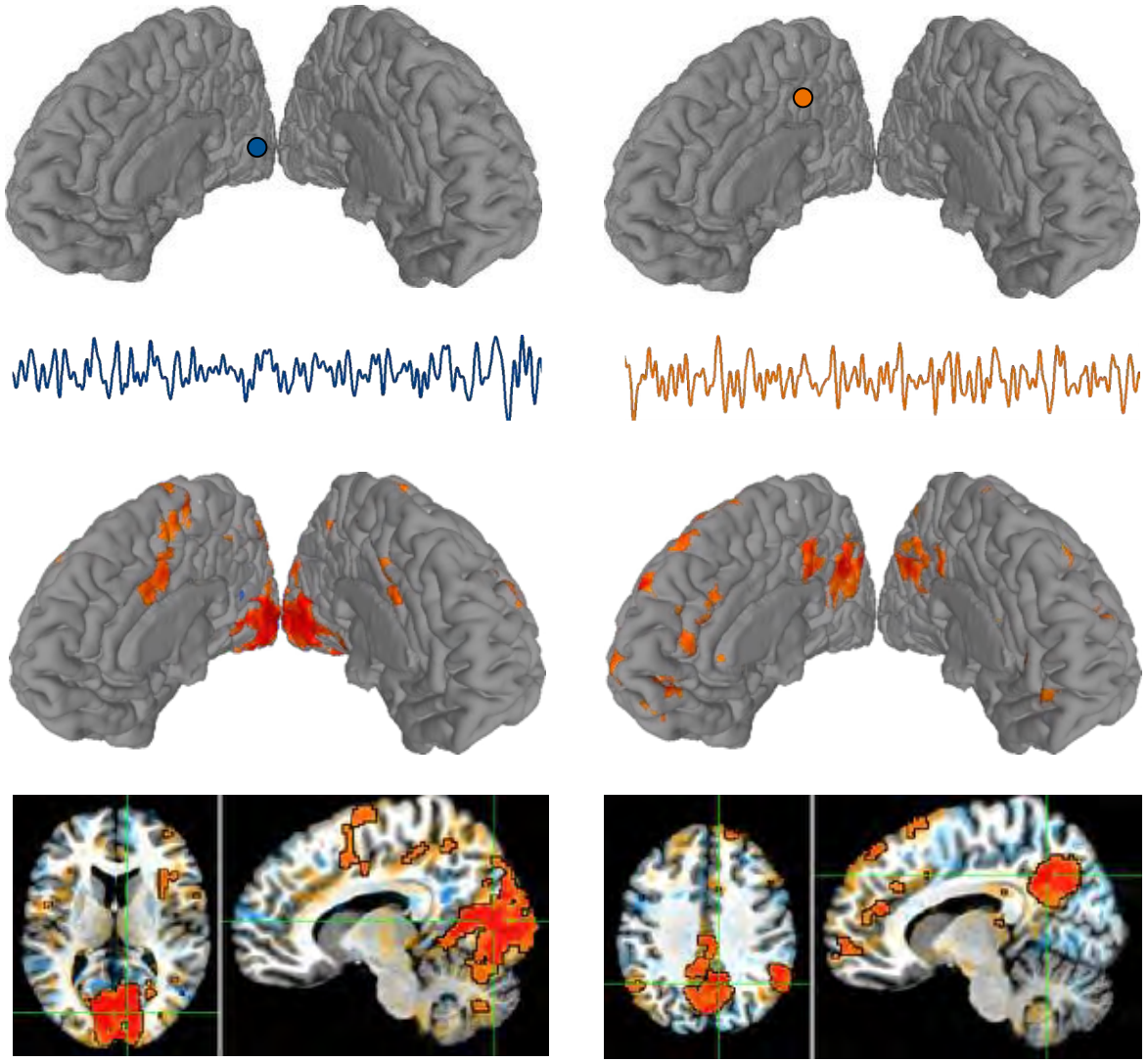


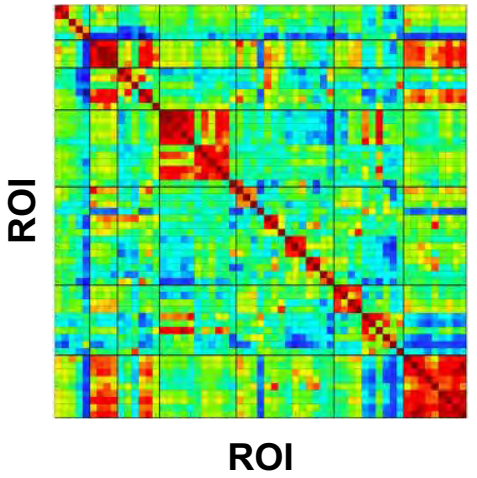
Gonzalez-Castillo et al. J Neuroscience (2021)

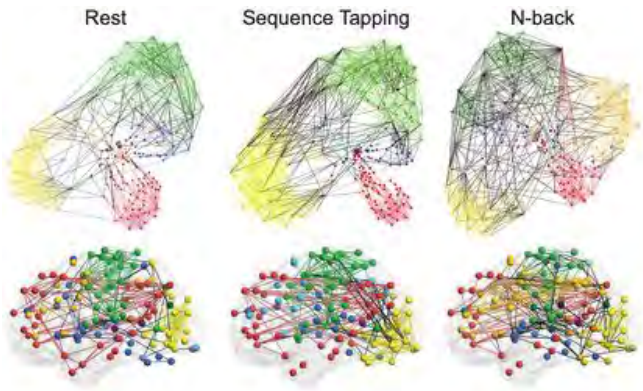
Static FC



Biswal et al. MRM (1995)

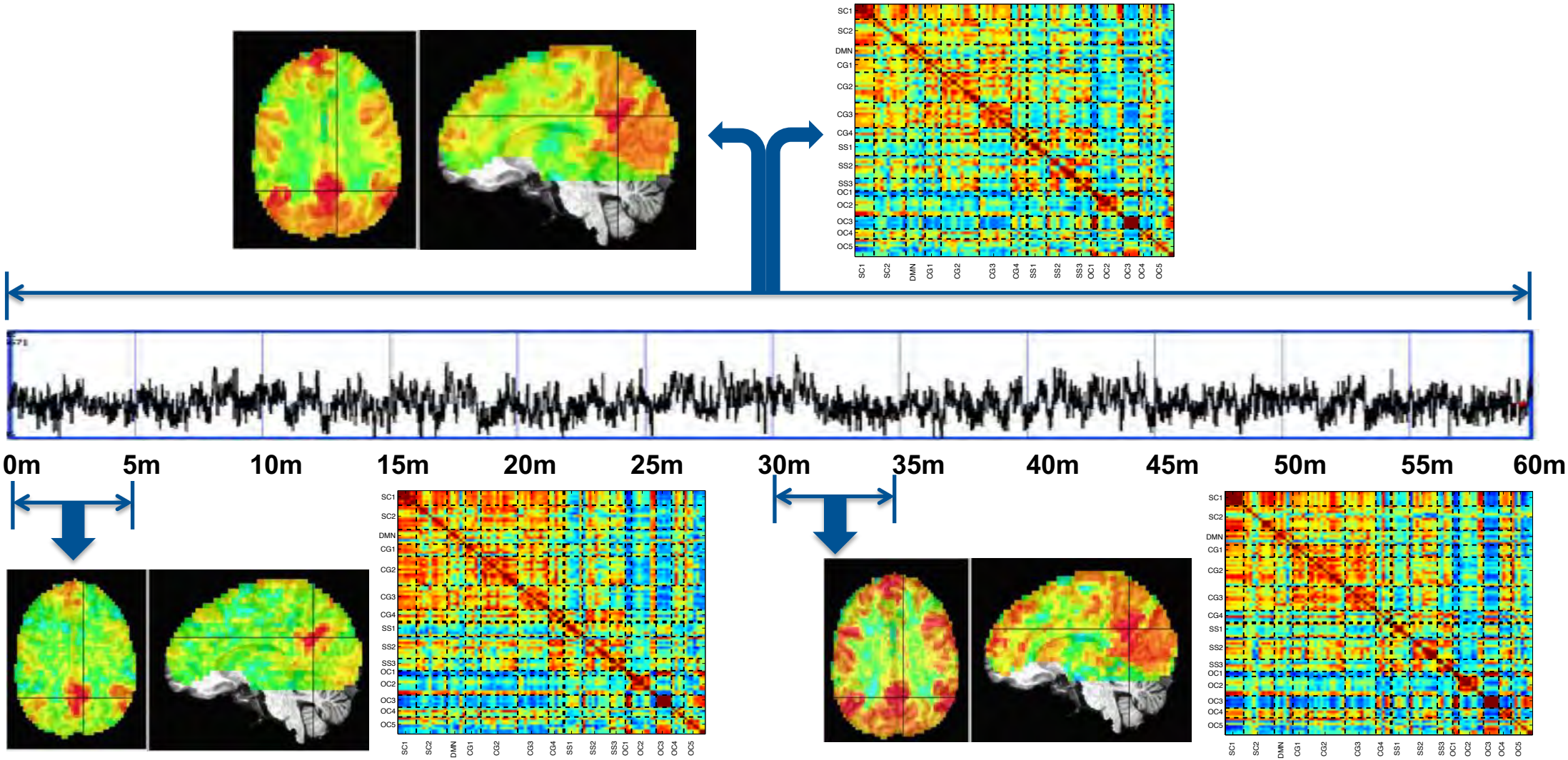




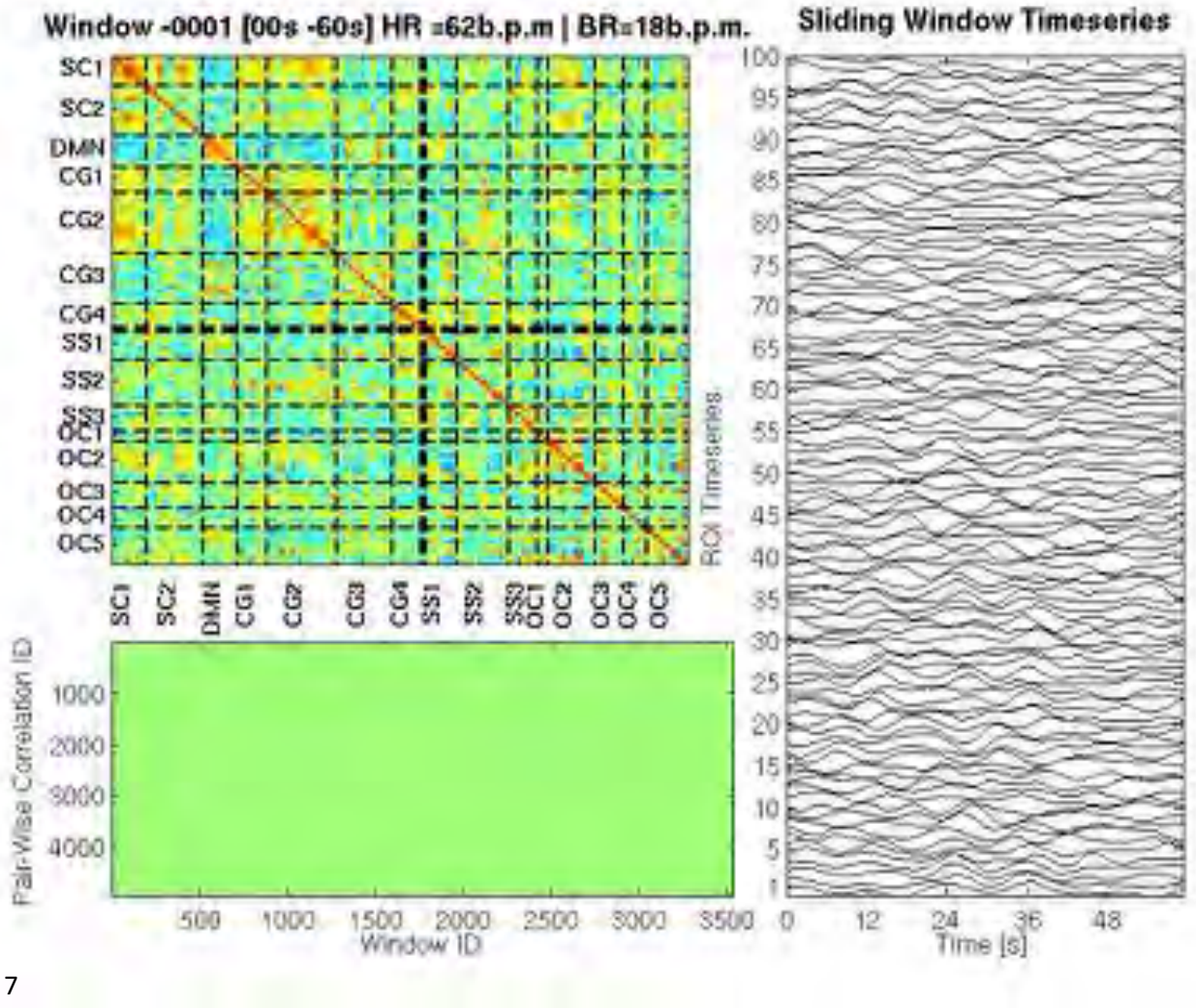


Cohen J & D'Esposito M. J Neuro (2016)

Static vs. Time-varying FC



Basic Quantification of tvFC



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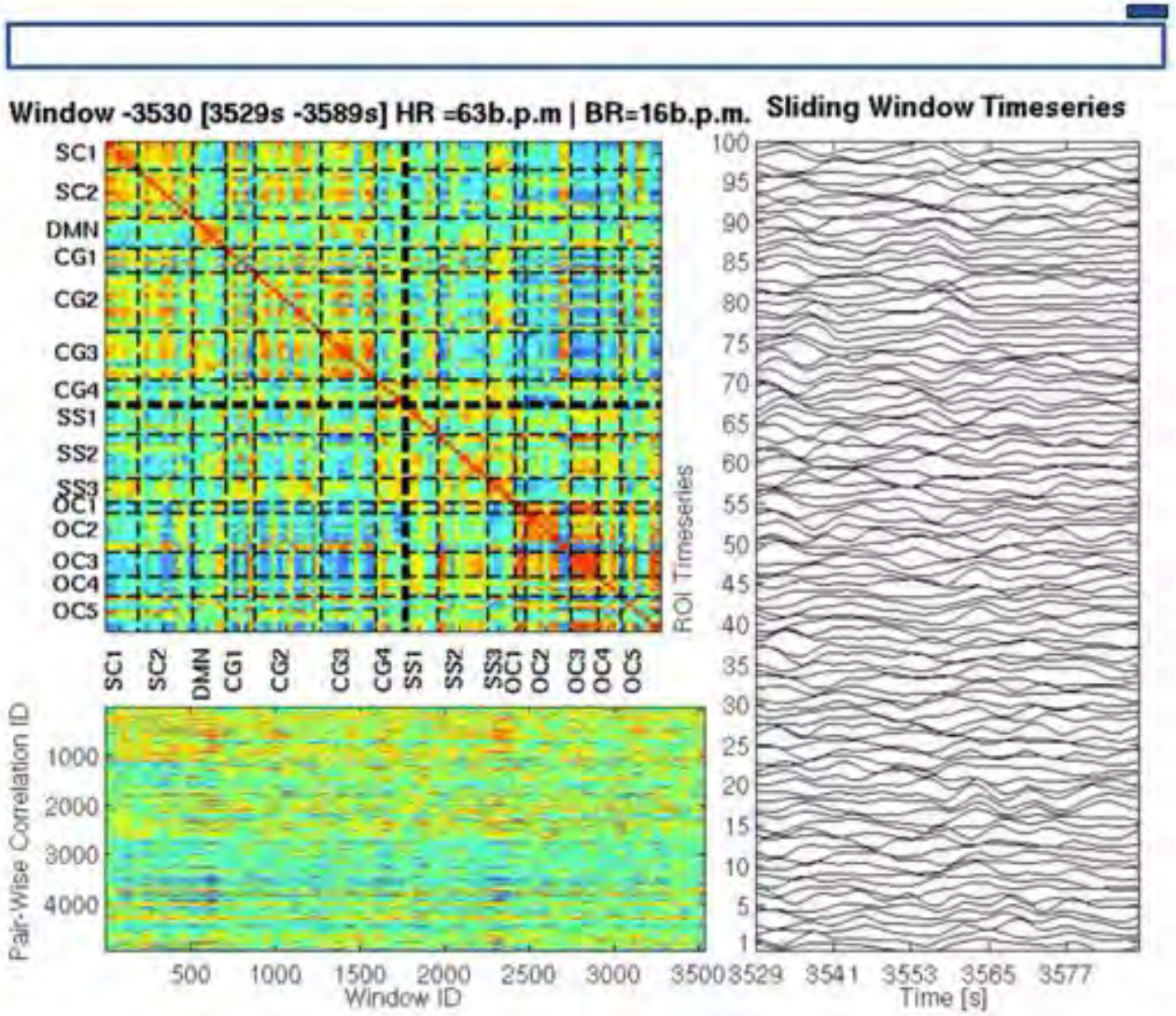
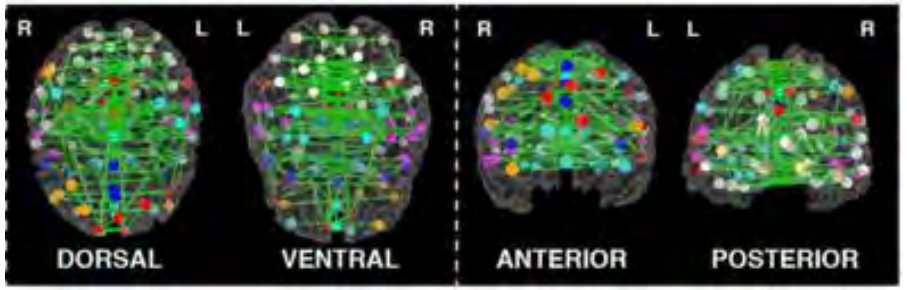
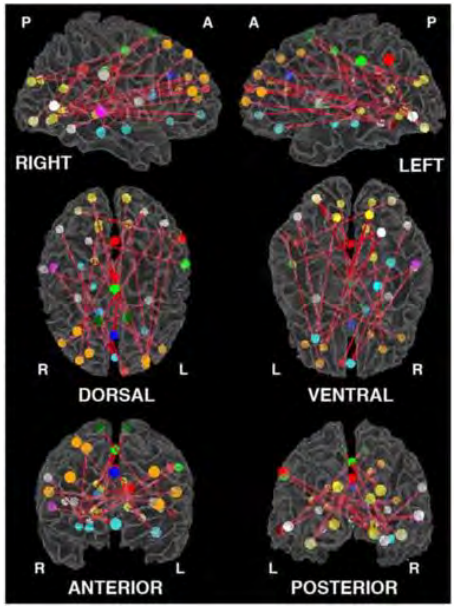


MOST STABLE CONNECTIONS



MOST VARIABLE CONNECTIONS

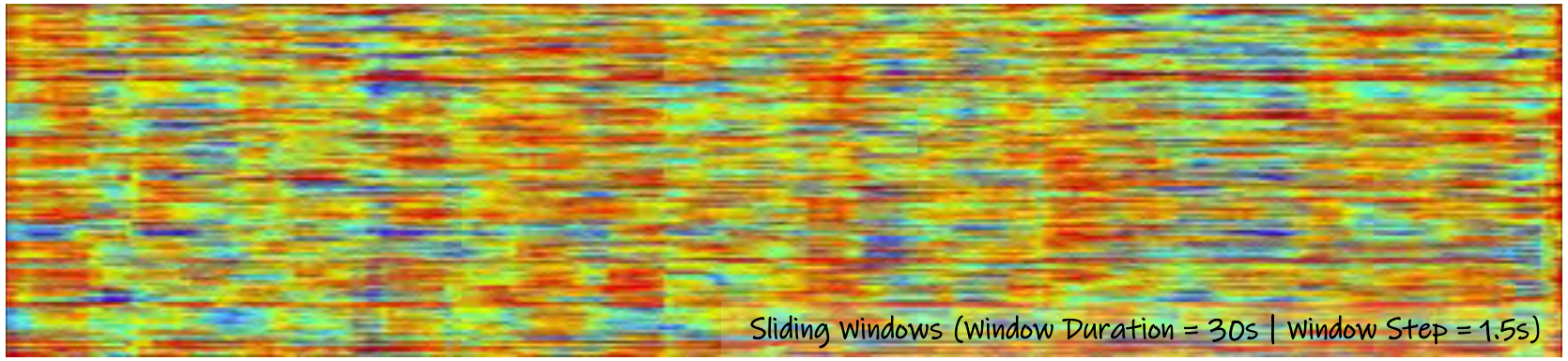


Gonzalez-Castillo et al. Frontiers in Neuroscience (2014)

Constructing Temporal Trajectories of tvFC data

- Ongoing Resting Experience
- Dynamic FC Perspective

Sliding Window Correlation Analysis



Gonzalez-Castillo et al. NeuroImage (2019)

NIH National Institute of Mental Health

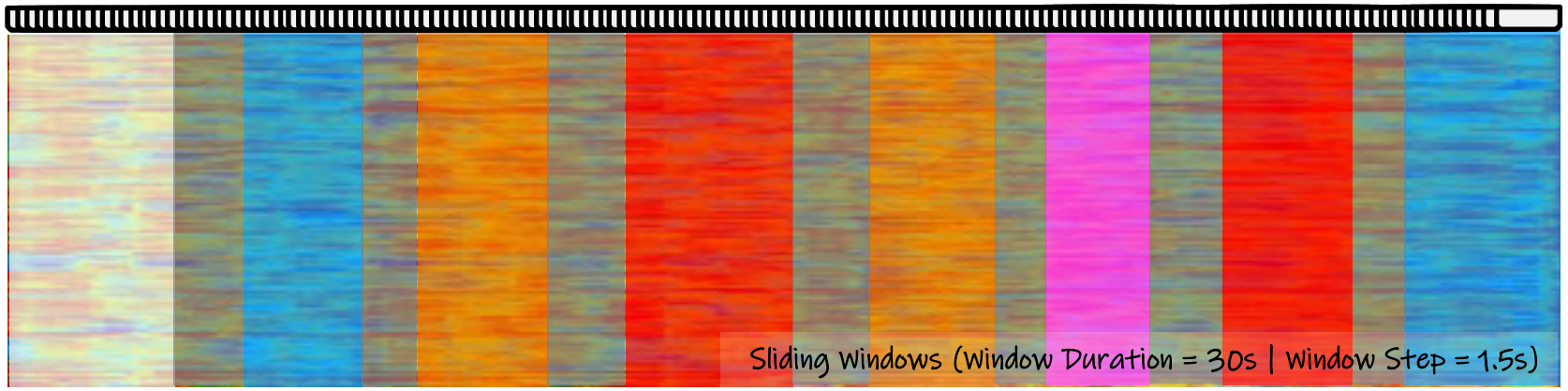
Constructing Temporal Trajectories of tvFC data

Ongoing Resting Experience

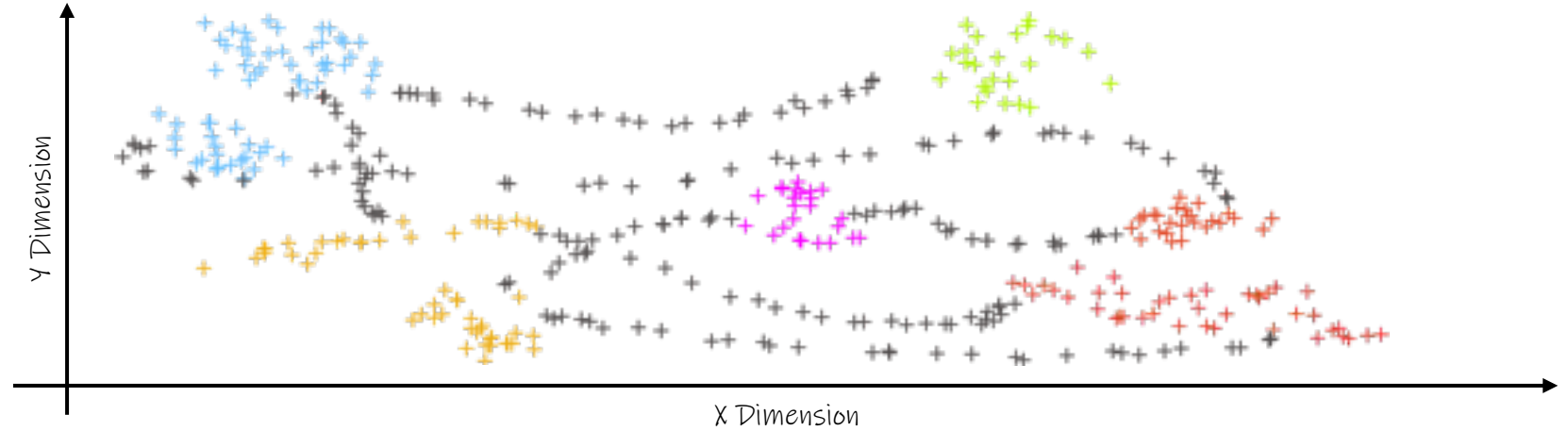
Dynamic FC Perspective

Low Dimensional Representation

Sliding Window Correlation Analysis



Manifold Learning



Gonzalez-Castillo et al. NeuroImage (2019)

Constructing Temporal Trajectories of tvFC data

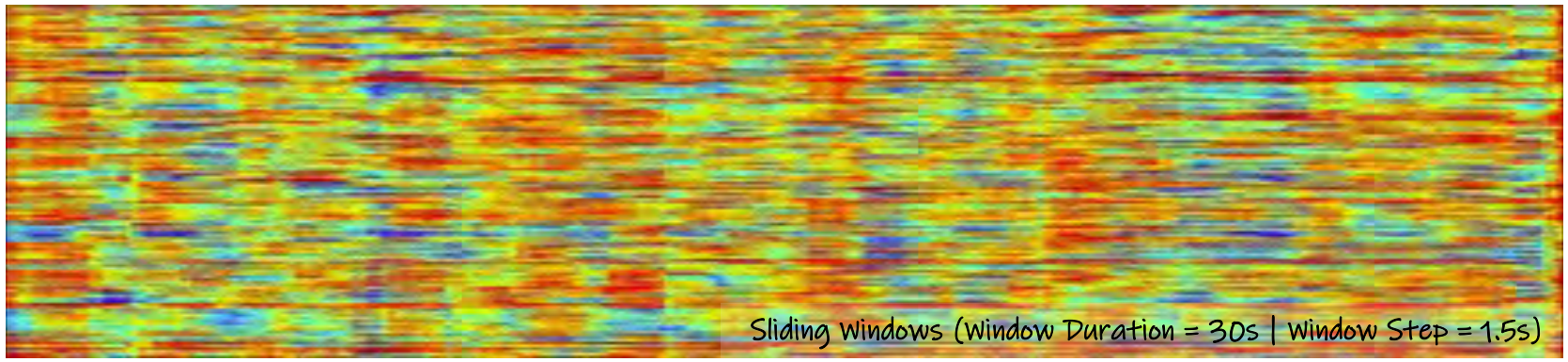
Ongoing Resting Experience

Dynamic FC Perspective

Low Dimensional Representation

fMRI Resting State Scan

Sliding Window Correlation Analysis



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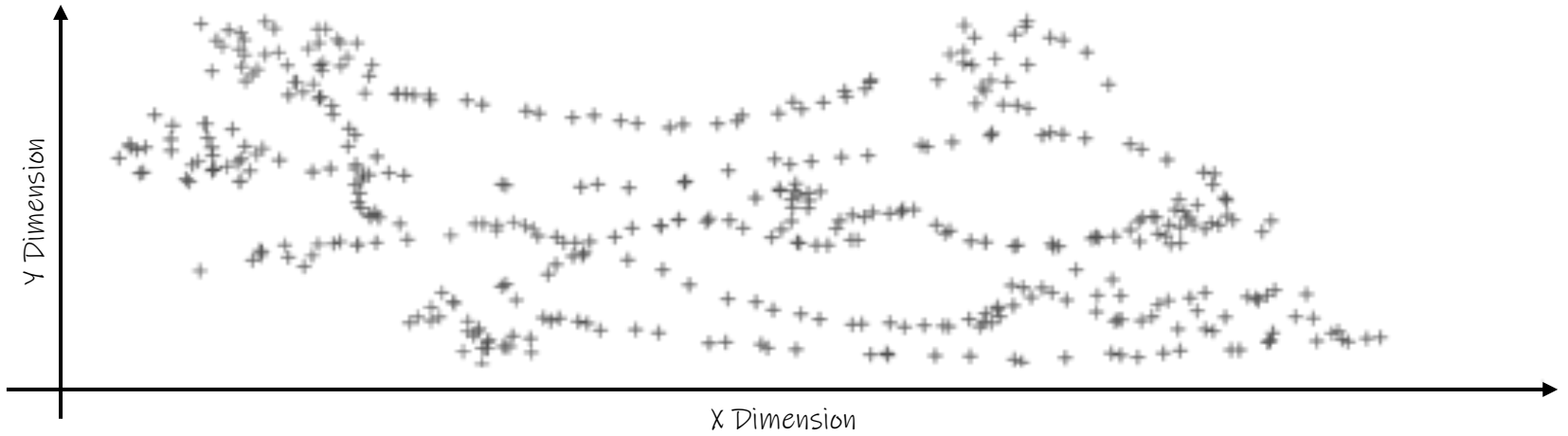

Gonzalez-Castillo et al. NeuroImage (2019)

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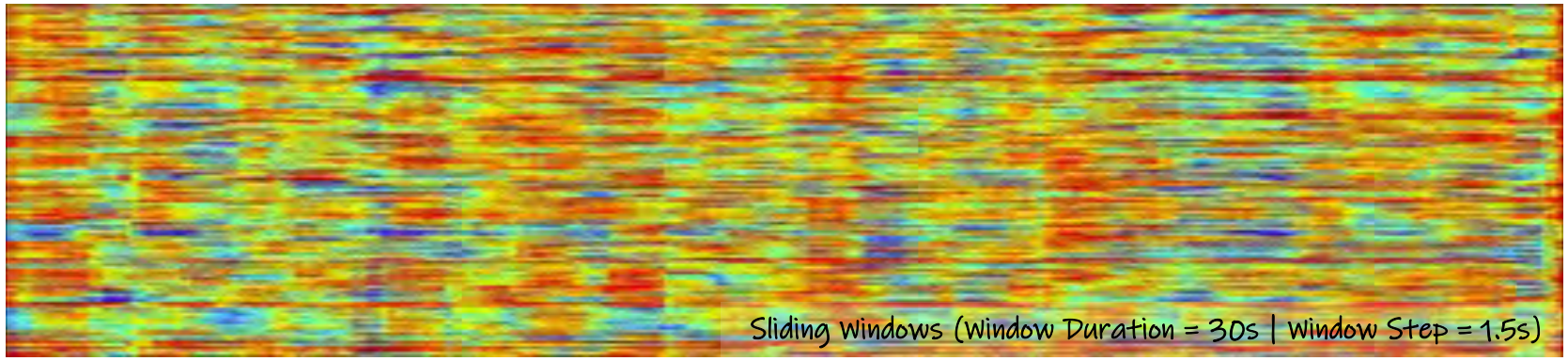

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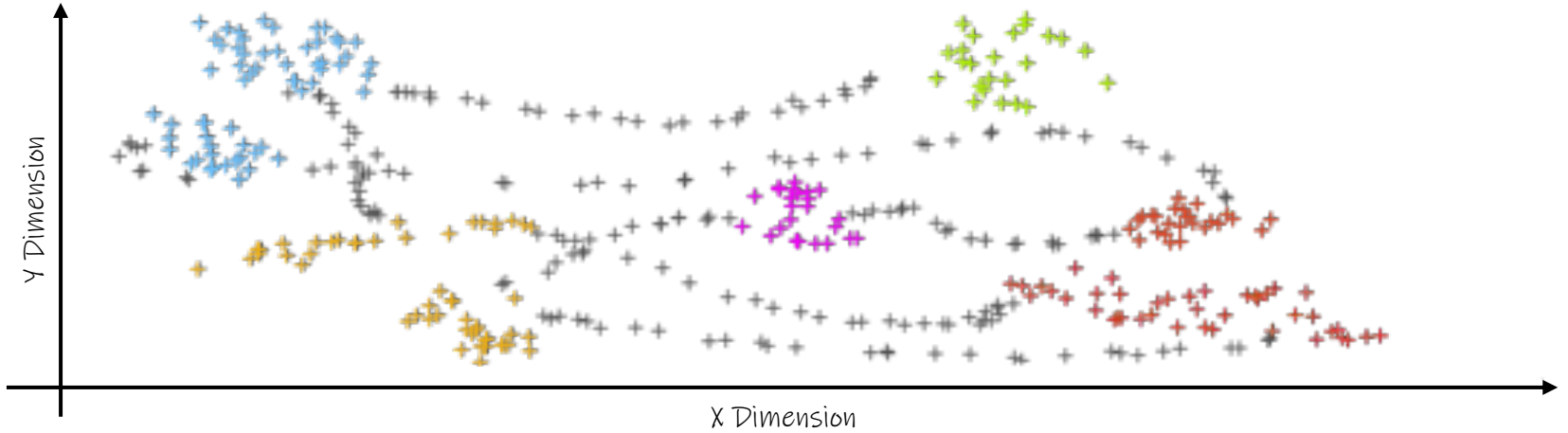

Gonzalez-Castillo et al. NeuroImage (2019)

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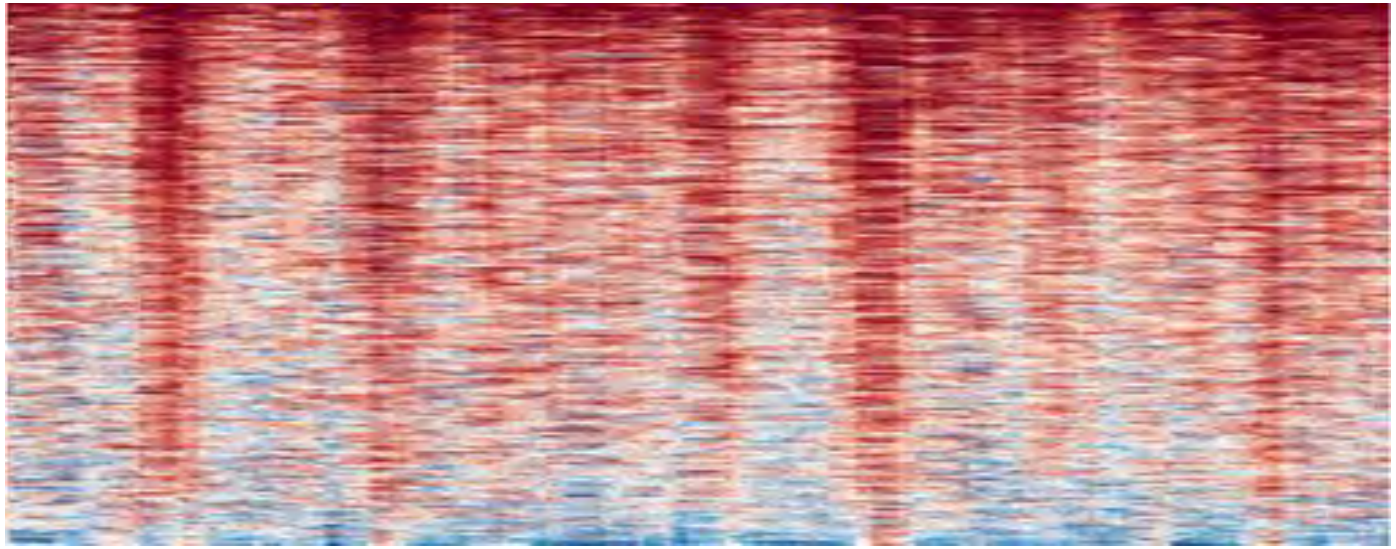

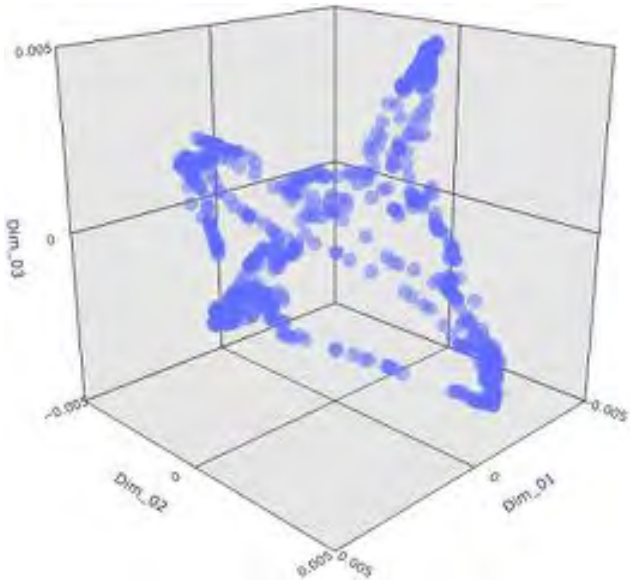

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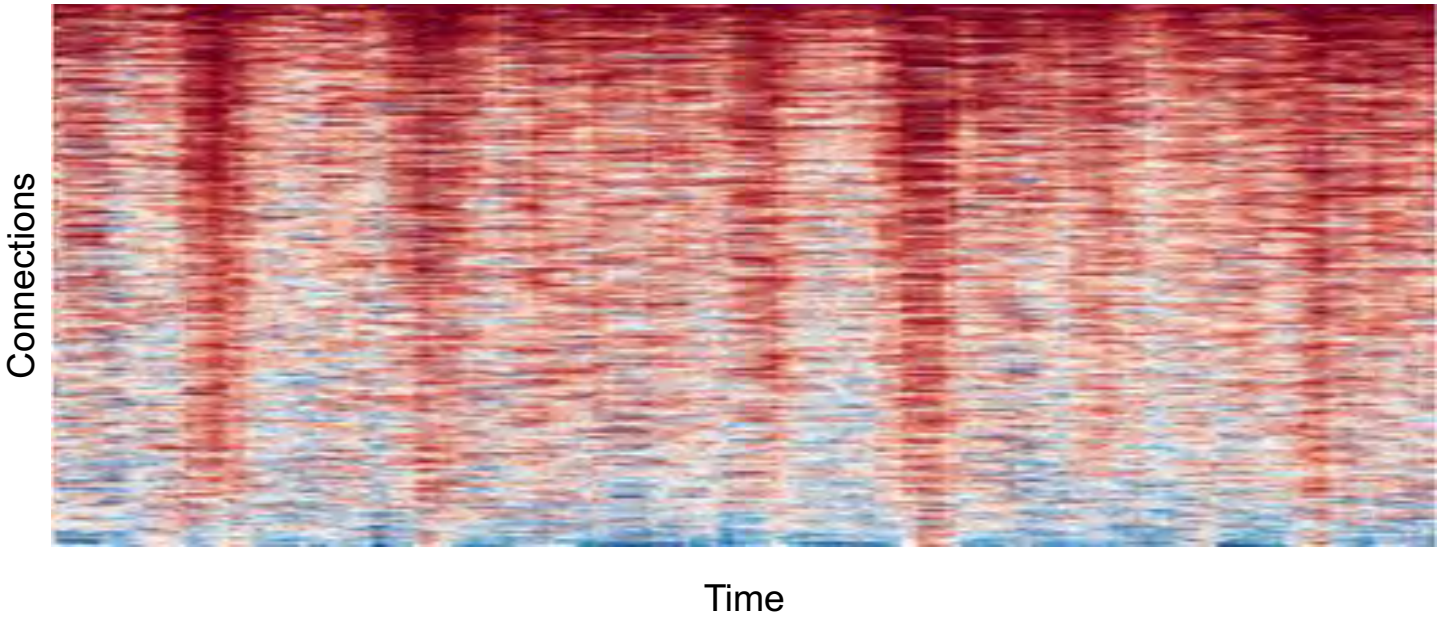
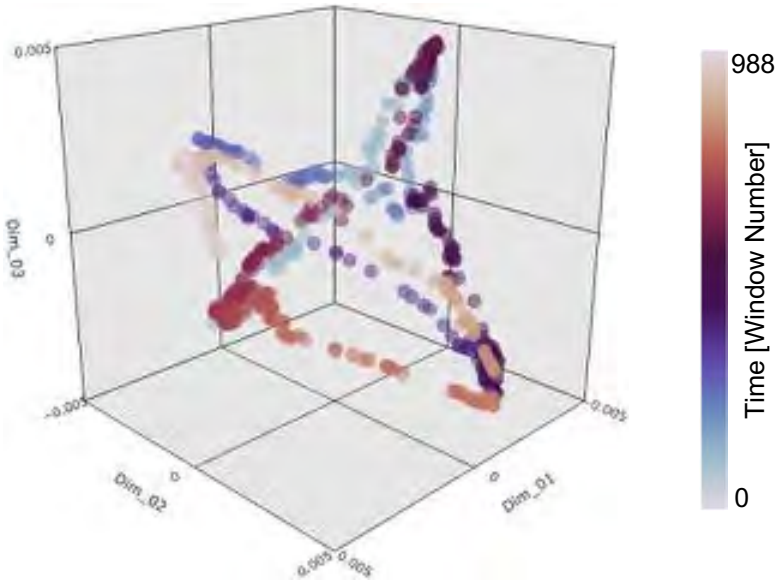
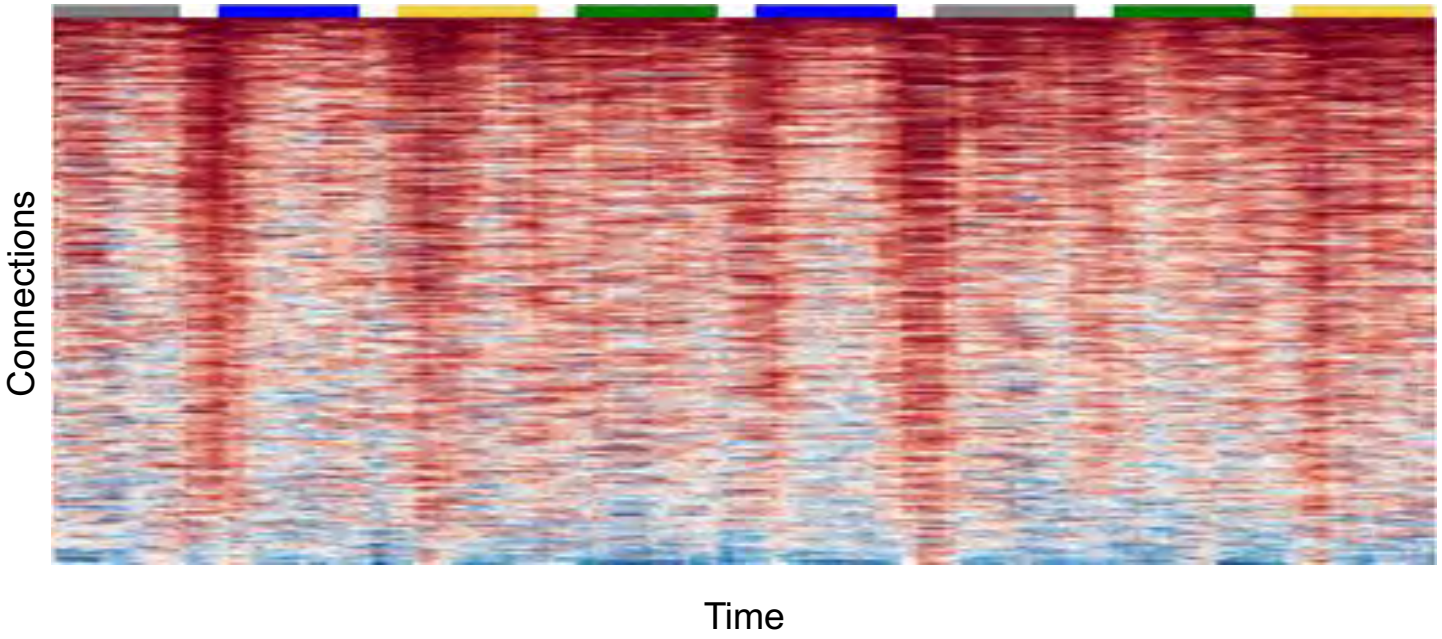
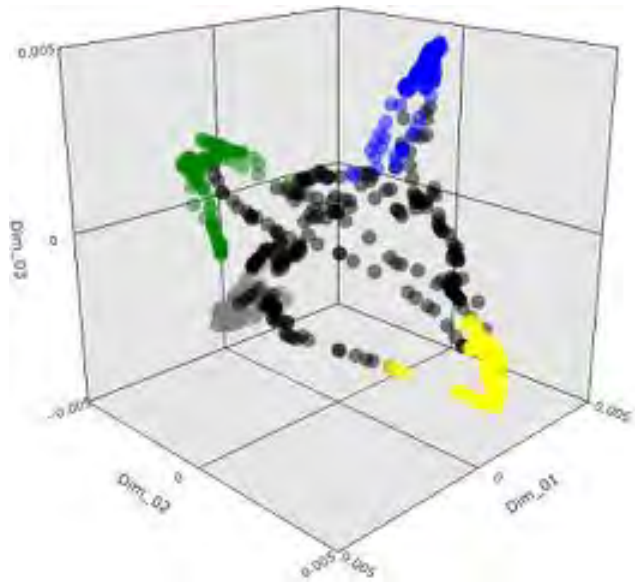




Constructing Temporal Trajectories of tvFC data

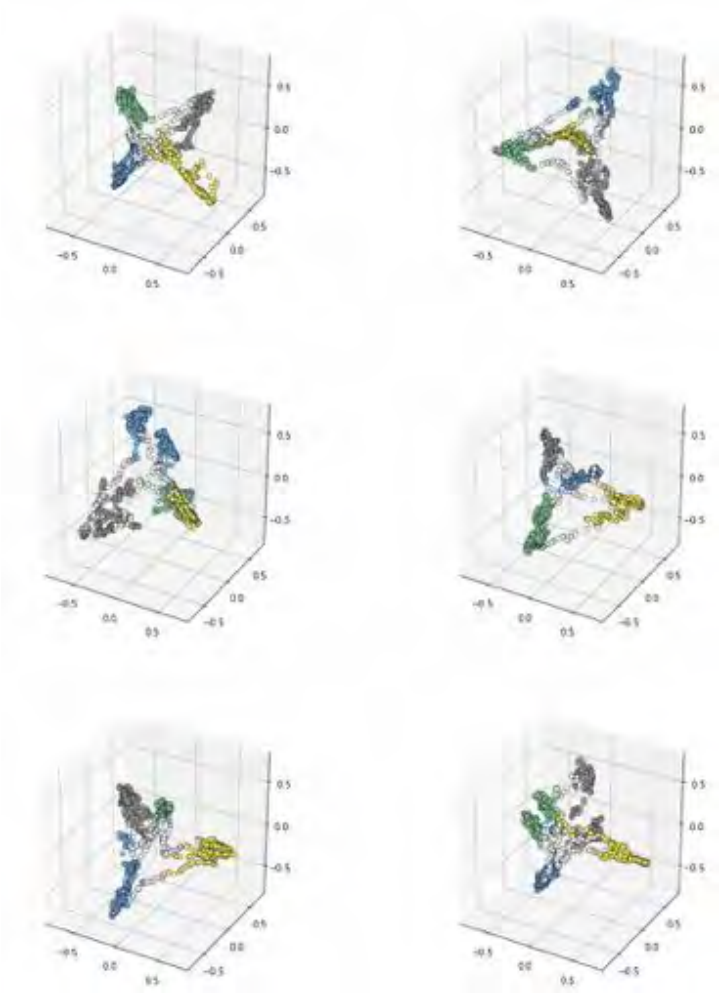
Rest 2-Back Math Video



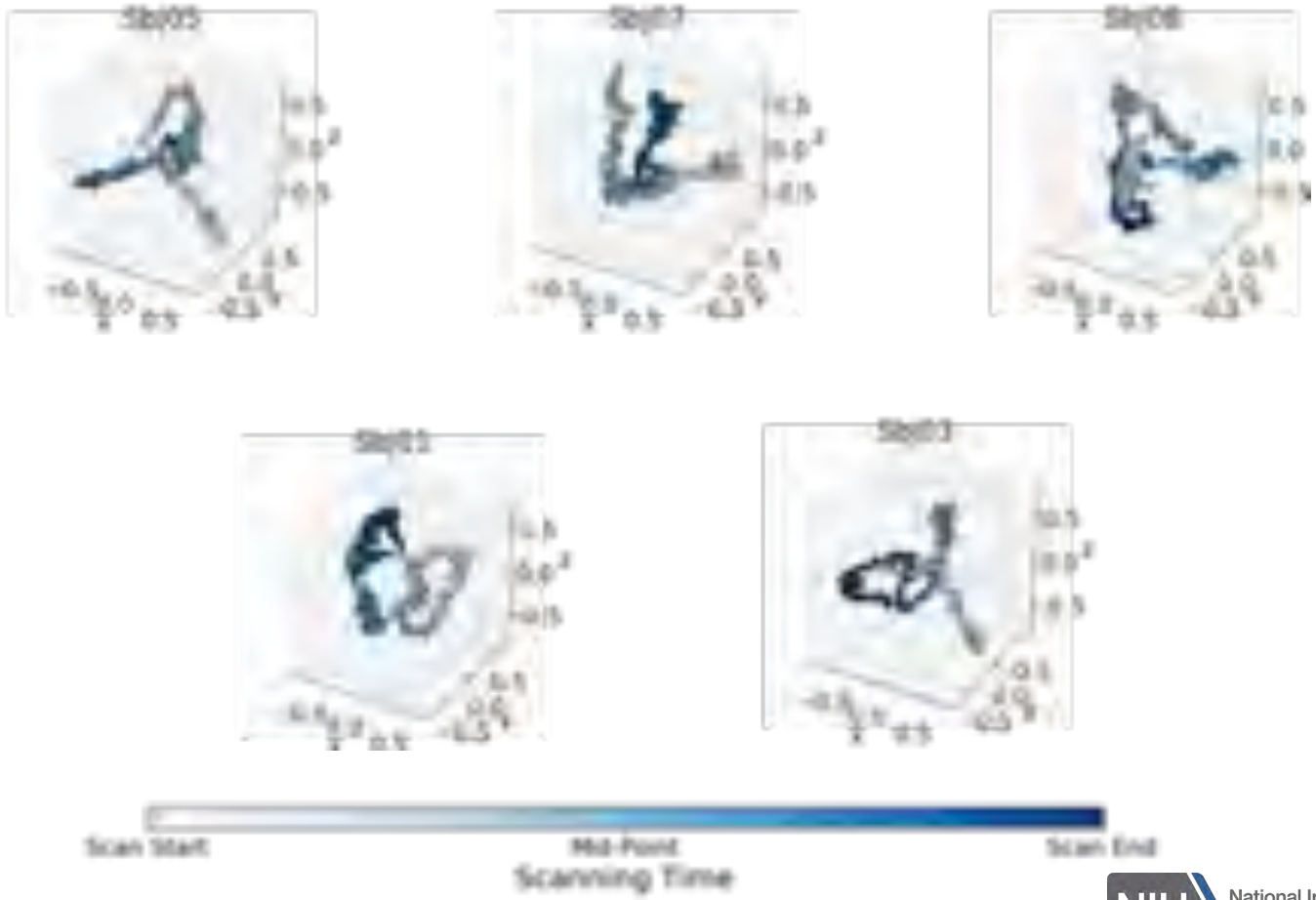


Constructing Temporal Trajectories of tvFC data

Multi-task Data



Resting-State Data



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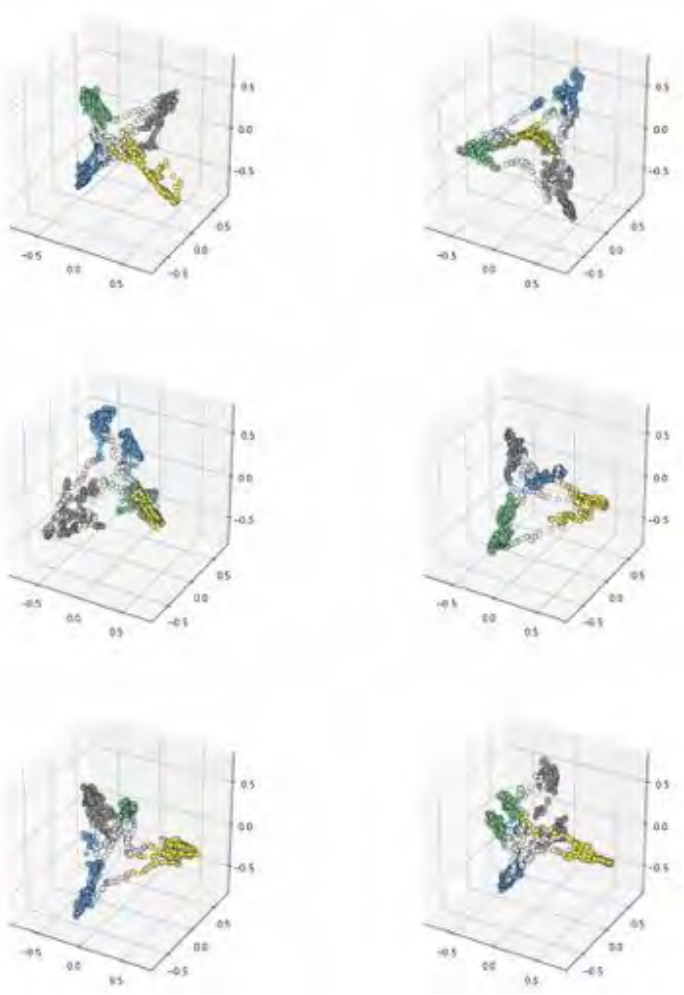

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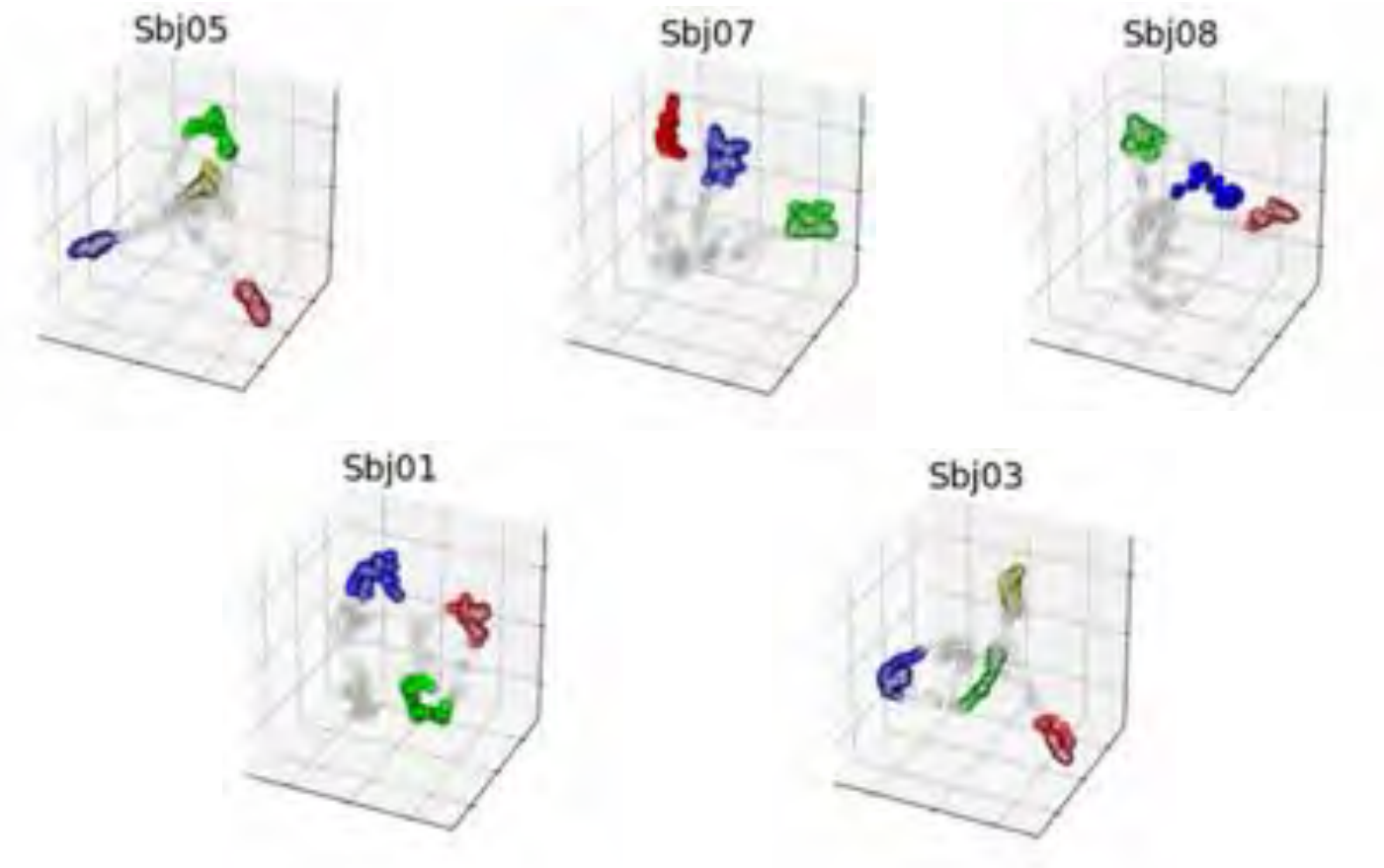
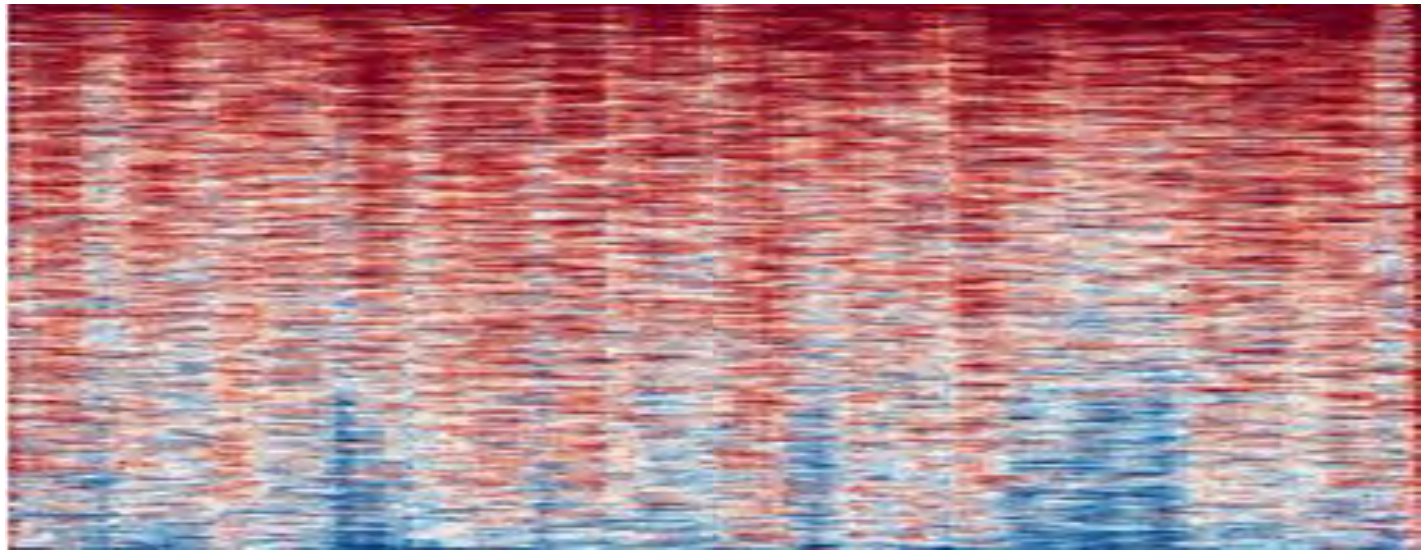


Decoding of mental activity at periods of interest



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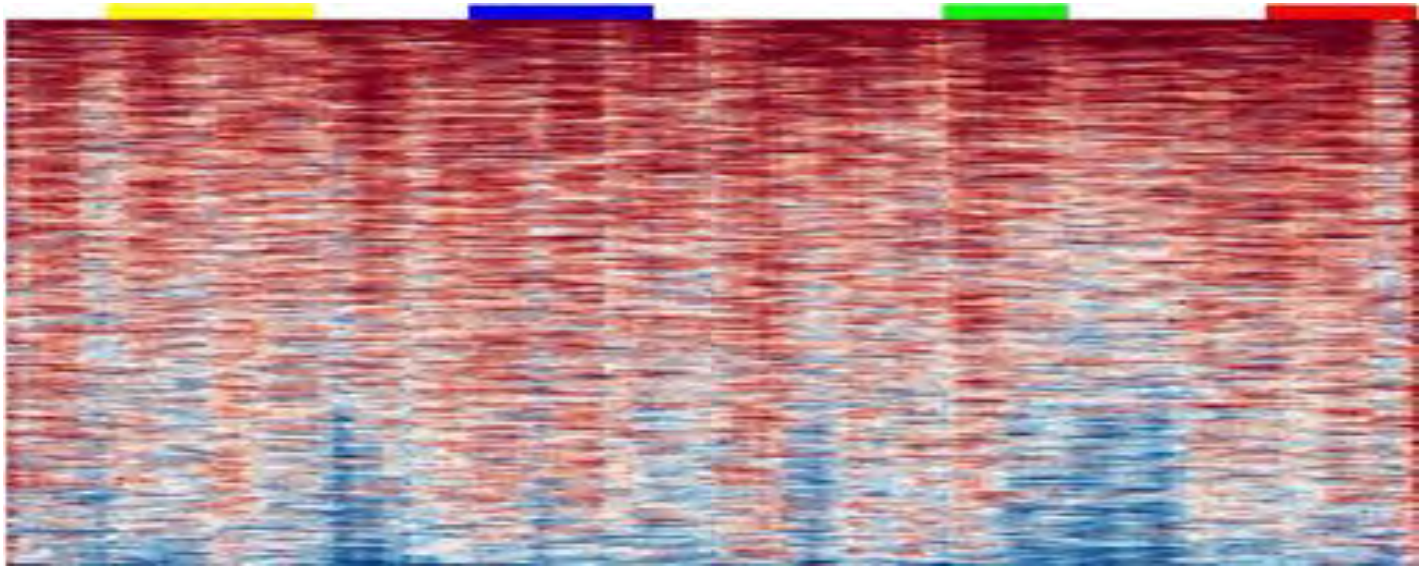

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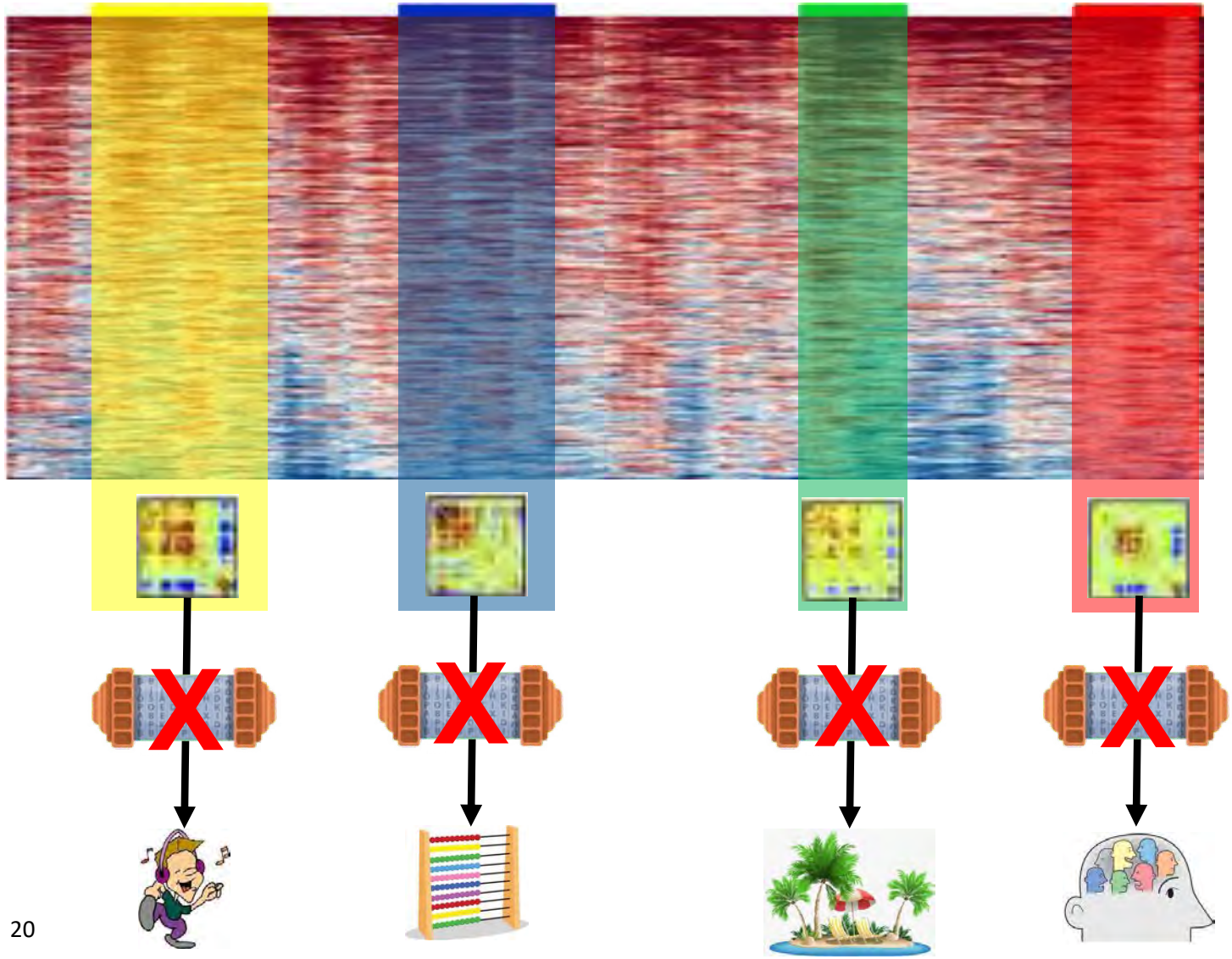

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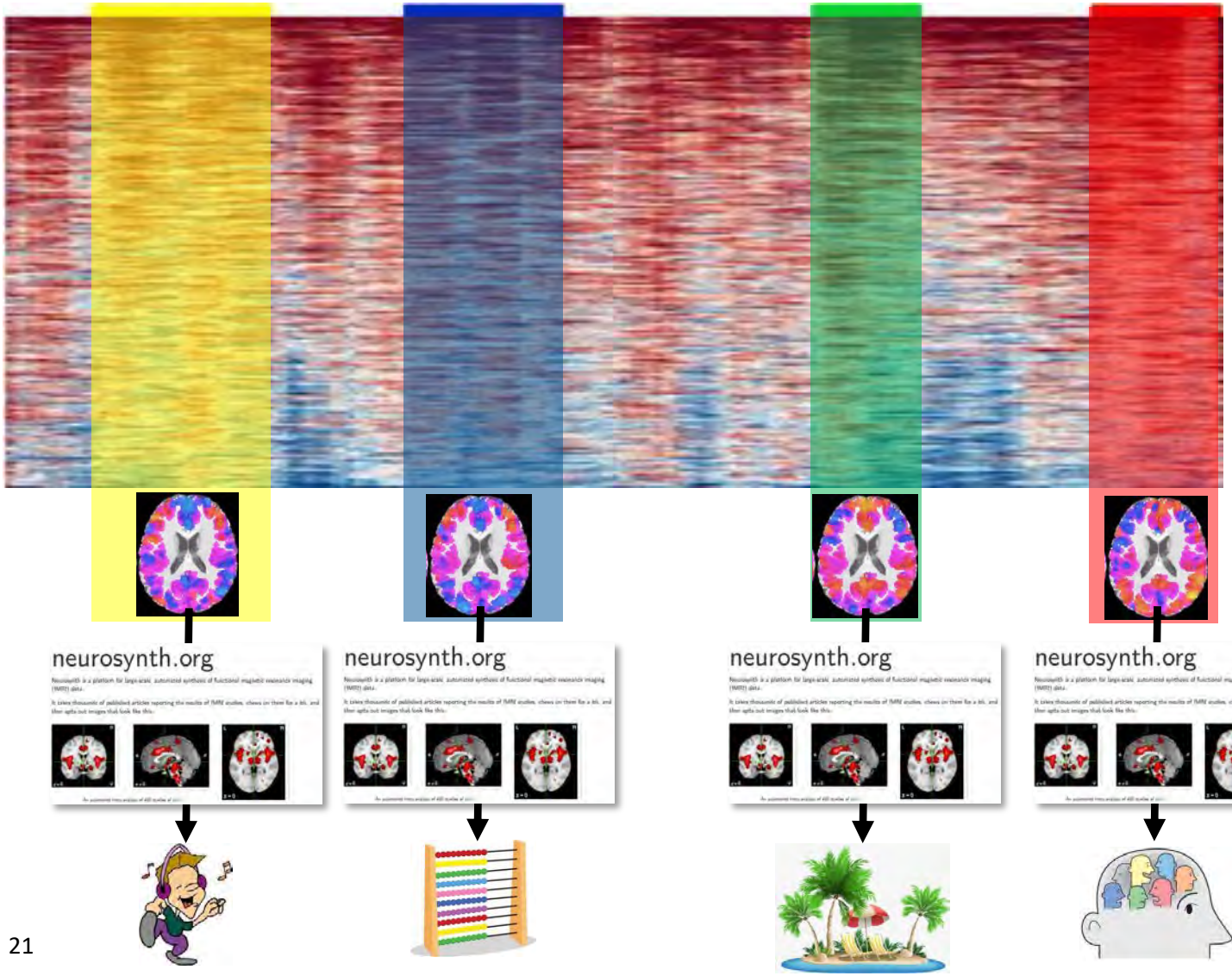
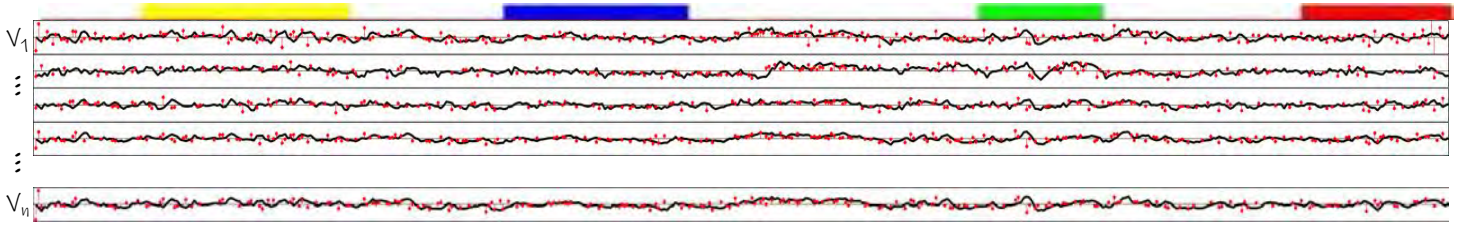
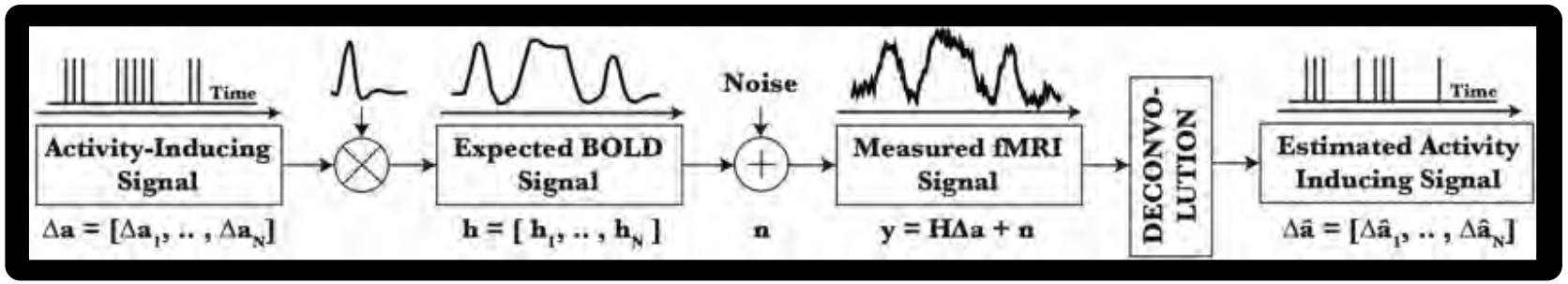


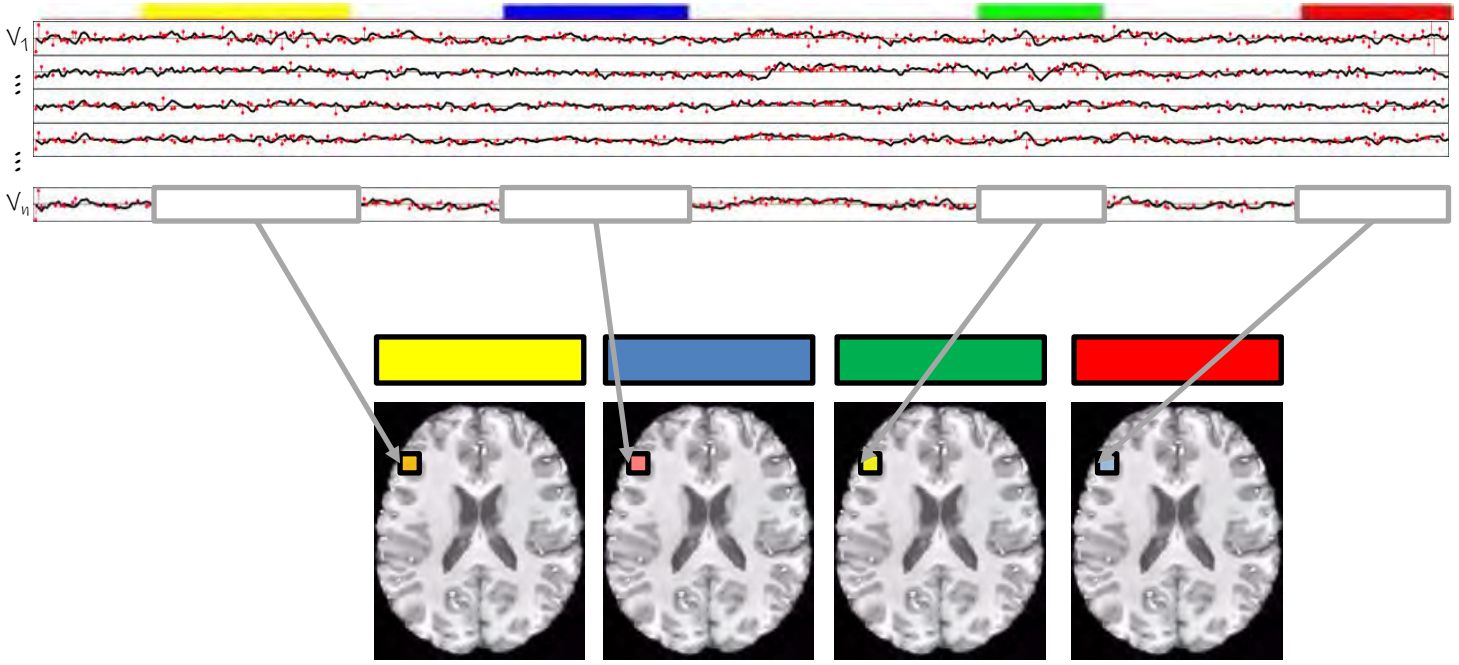
Hemodynamic Deconvolution





Hemodynamic Deconvolution – Find Most Prominent Activity Inducing Events
(SPFM; *Caballero-Gaudes et al. HMB 2011*)

Hemodynamic Deconvolution



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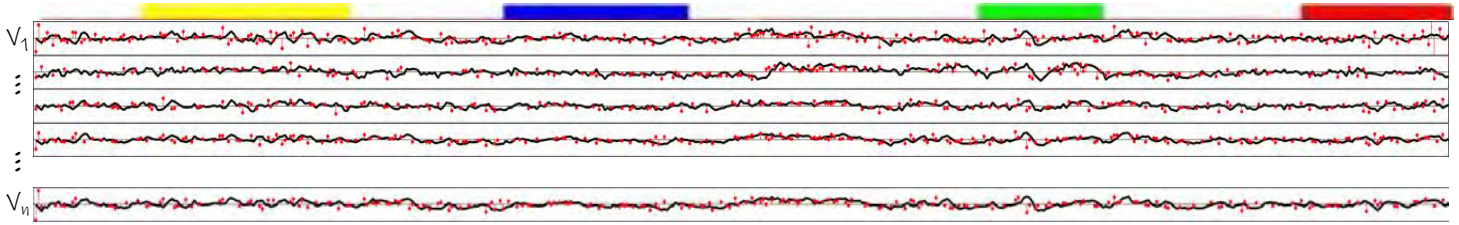
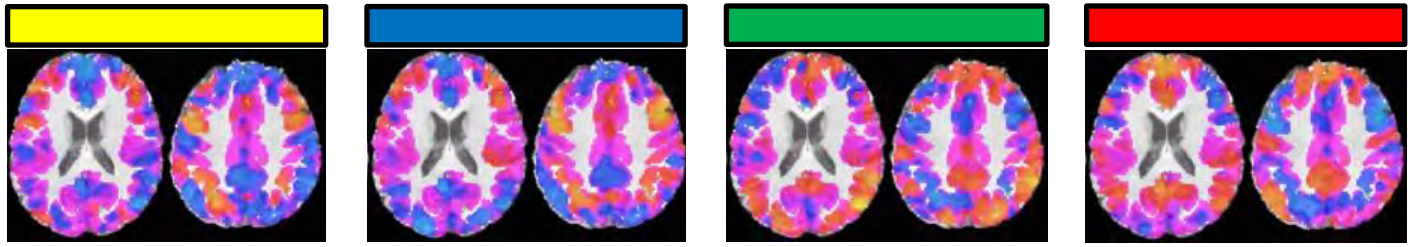
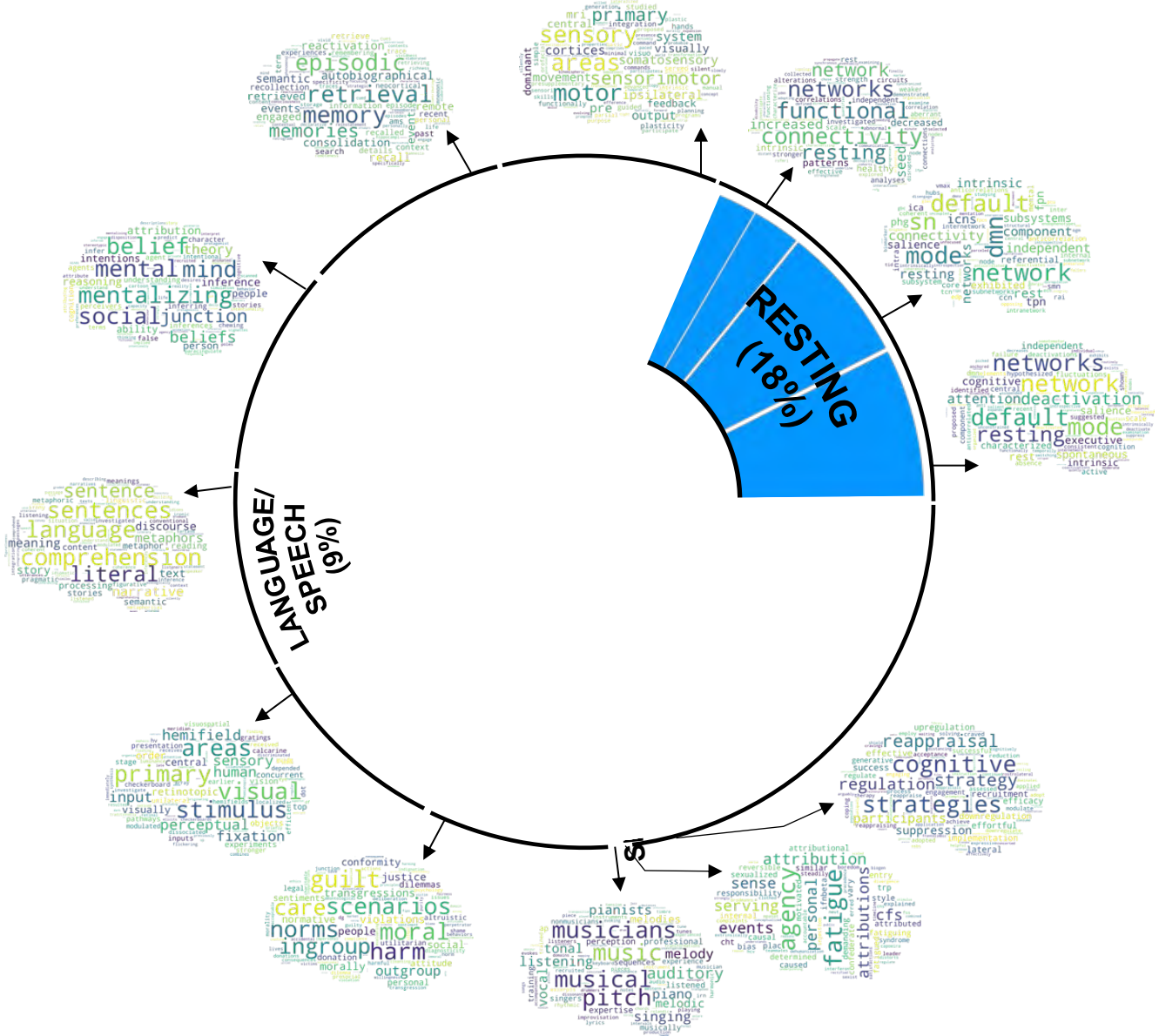




What were subject doing during rest?



Data-driven estimates of covert cognition agree with previous reports of what are the most common mental activities subjects perform during rest.

Gonzalez-Castillo et al.
NeuroImage (2019)

Conclusions

- *tvFC Trajectories + Deconvolution + Reverse Inference (Neurosynth)* can help us uncover the cognitive correlates of distinct activity/connectivity patterns during rest.
- Subject's mental state modulates estimates of FC during resting-state scans.

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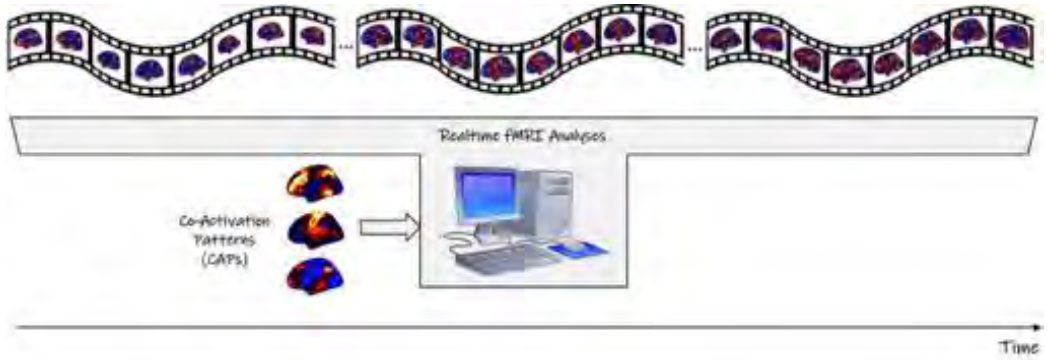
- *tvFC Trajectories + Deconvolution + Reverse Inference (Neurosynth)* can help us uncover the cognitive correlates of distinct activity/connectivity patterns during rest.
- Subject's mental state modulates estimates of FC during resting-state scans.
- Further validation with real-time fMRI approaches.



- Resting-state methods can be easily adapted to naturalistic paradigms.
- Construction of meaningful low dimensional trajectories requires thoughtful selection of analytic parameters.