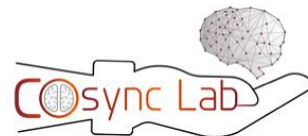


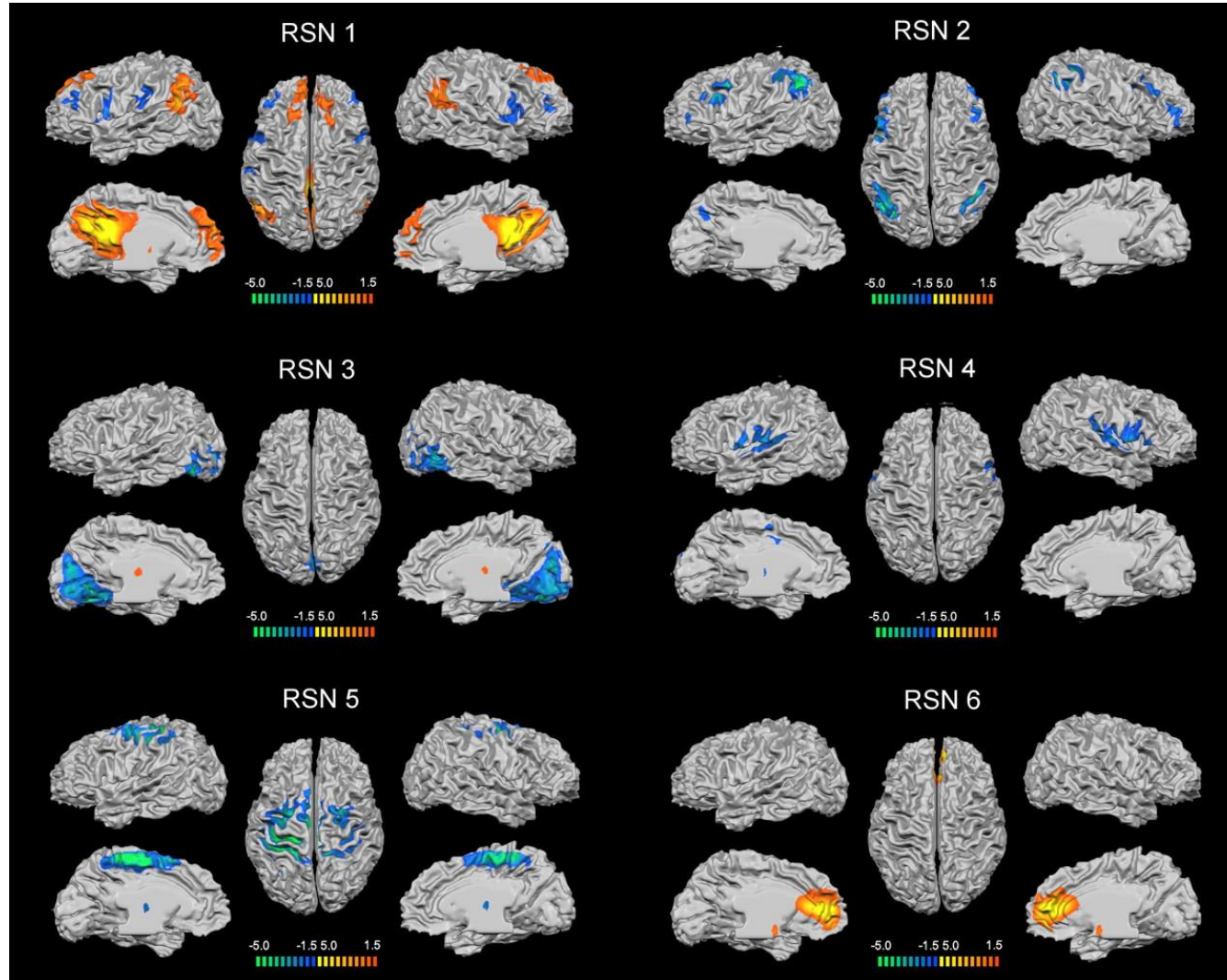


Task-dependent changes of topology and functional connectivity in the human brain

Ottavia Maddaluno, PhD
ottavia.maddaluno@uniroma1.it



1. Background

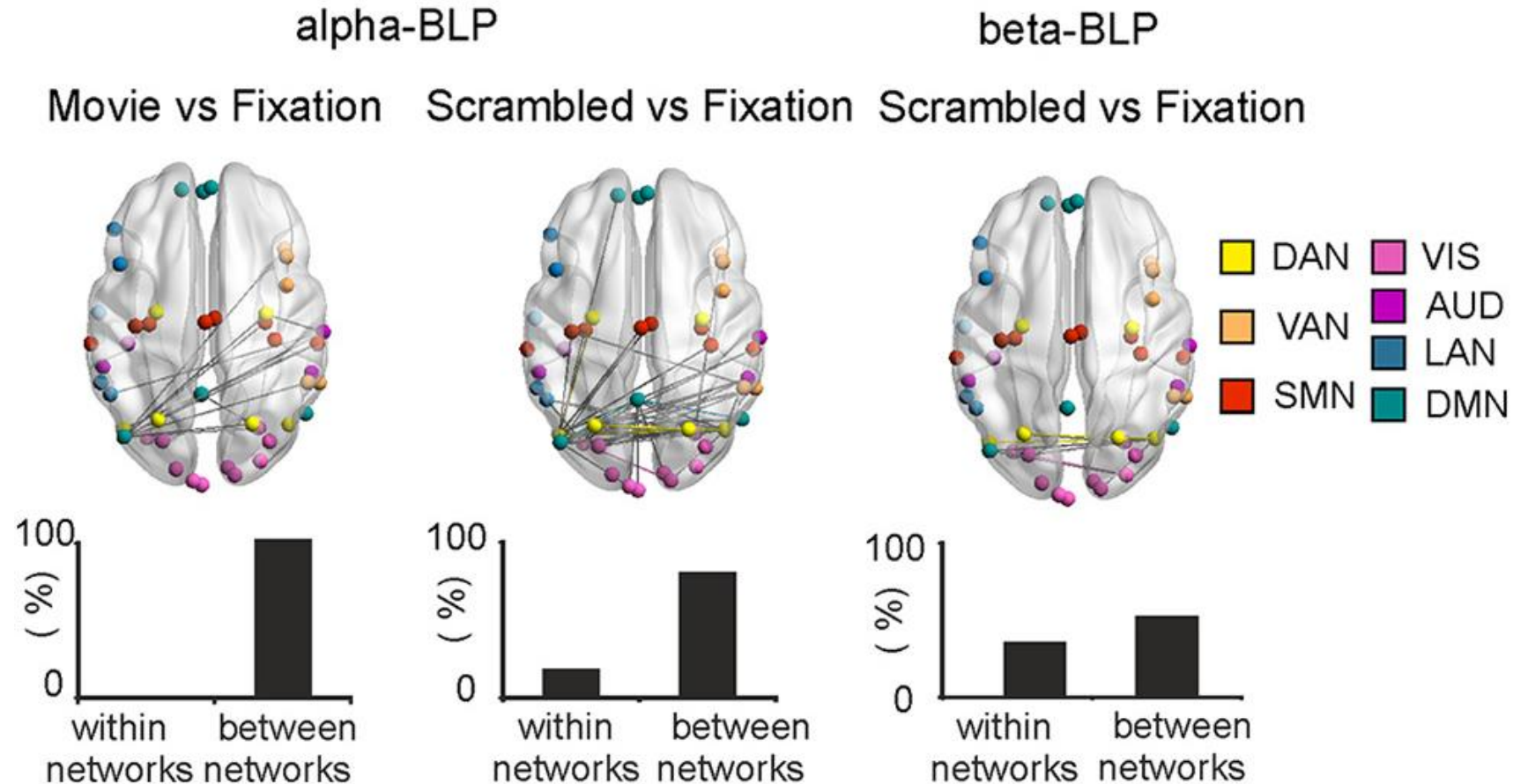


Mantini et al., *PNAS* 2007

1.1 Background



Topological reorganization of brain architecture in the alpha band after a visual task.

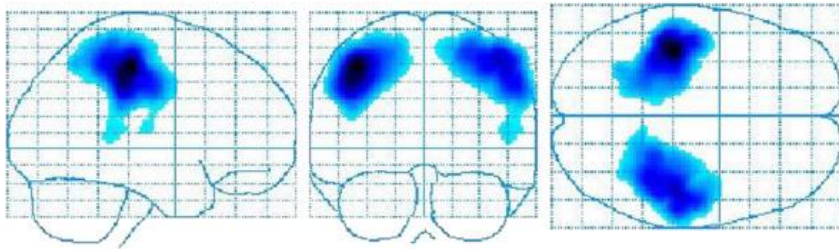


Betti et al., 2018 *J Neurosci*

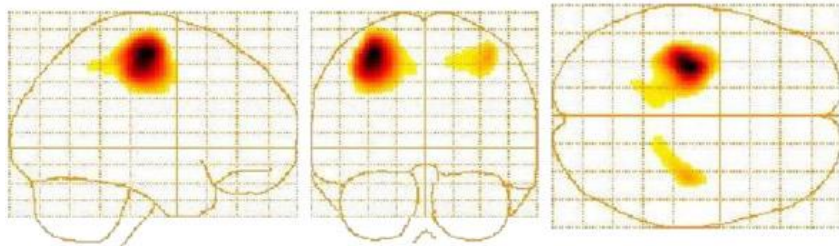
1.2 Background



Pre-movement mu ERD (8-14 Hz)

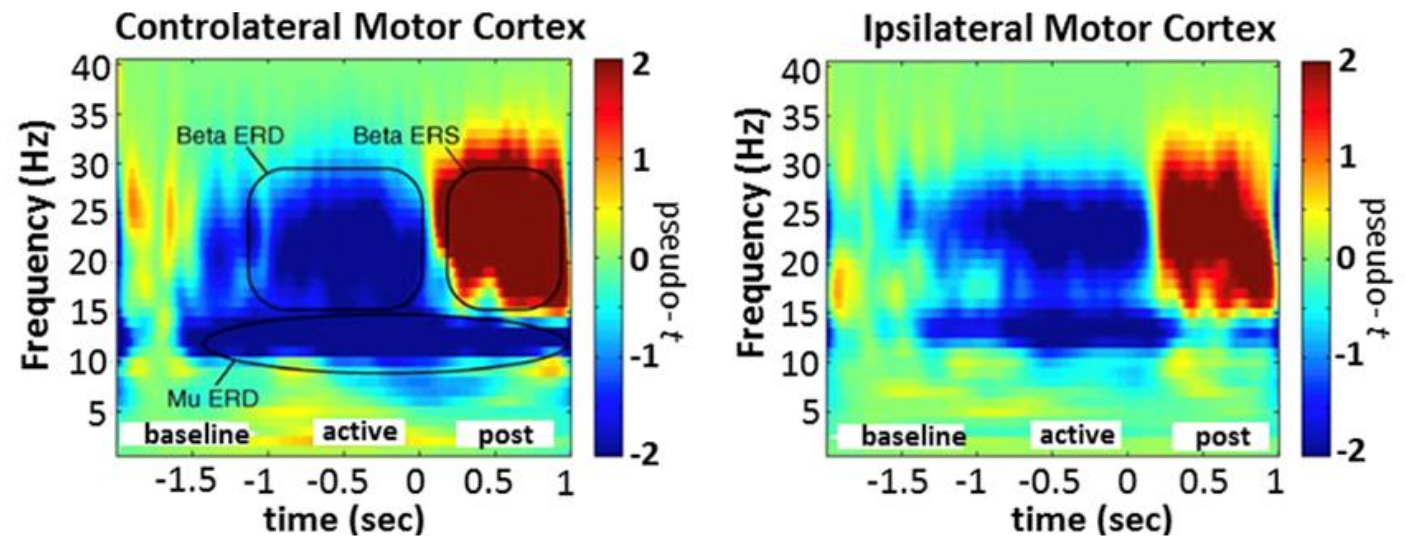


Post- movement beta rebound (15-25 Hz)



Cheyne et al. 2013, *NeuroImage*

Betti et al., 2021 *The Neuroscientist*

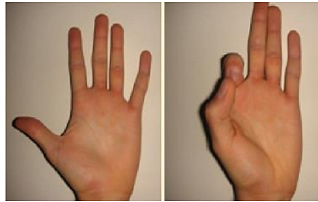


Time-frequency representation of increase or decrease in power in beta oscillations before, during and after the movement.

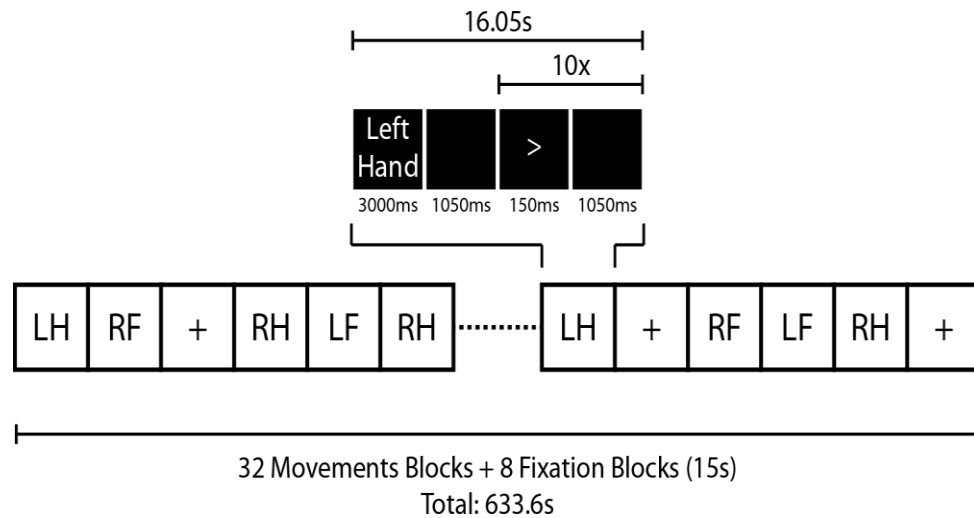
2 Materials & Methods



Hand movement:
finger tapping



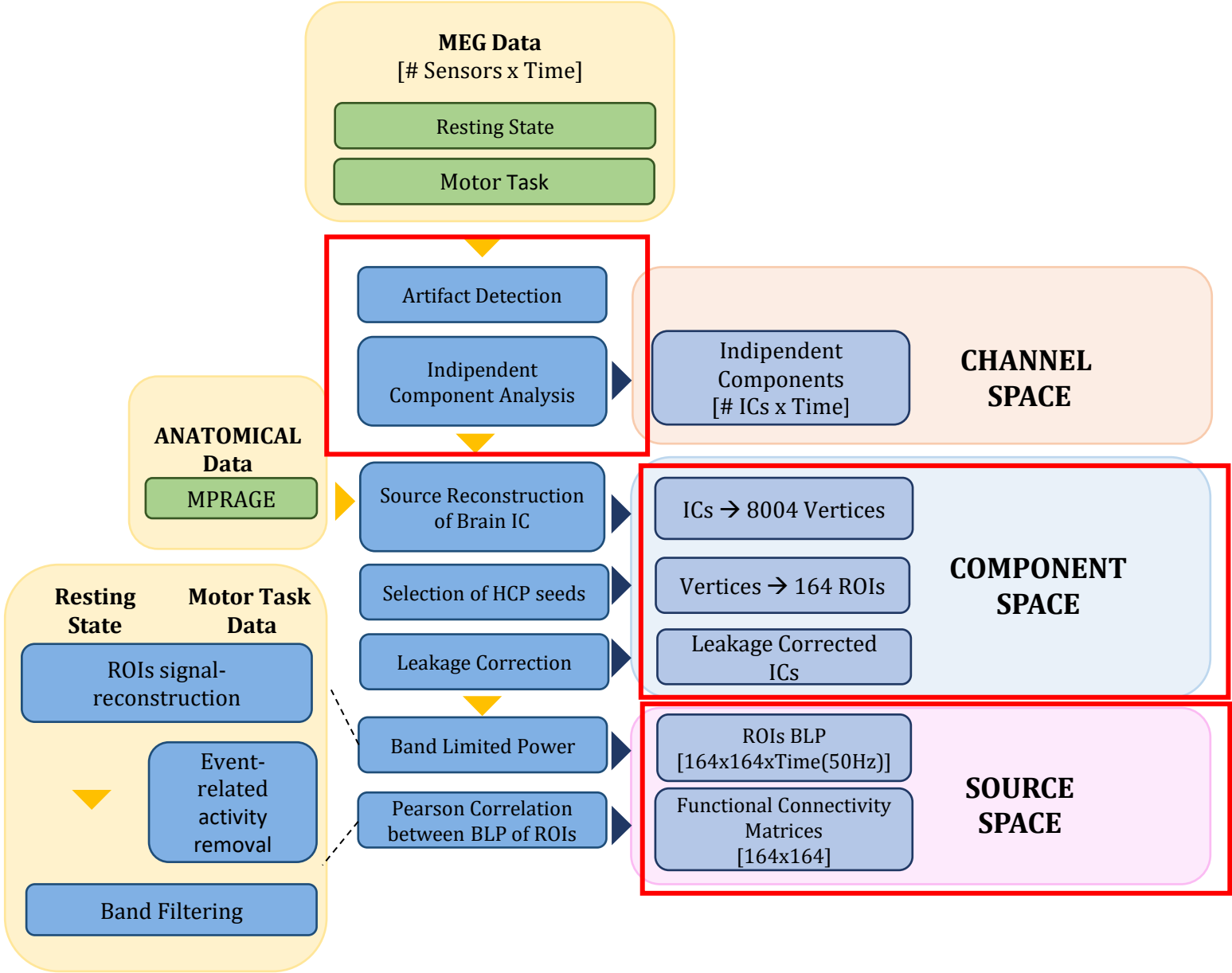
Foot movement:
squeeze toe



Motor task (adapted from Buckner et al., 2011; Yeo et al., 2011):

- Finger tapping (with right or left hand)
- Toe squeezing (with right or left foot)

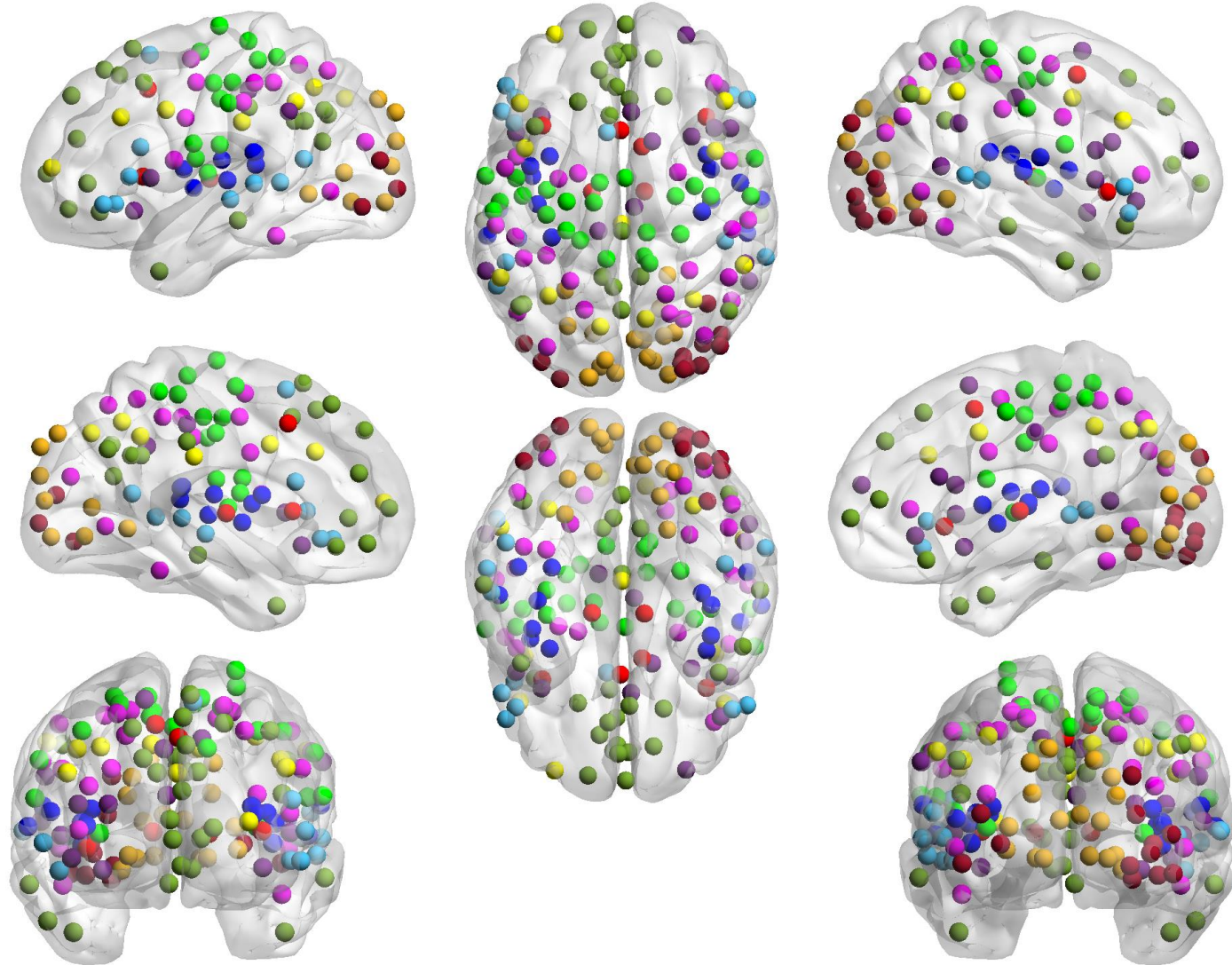
2.1 Materials & Methods – Pipeline overview



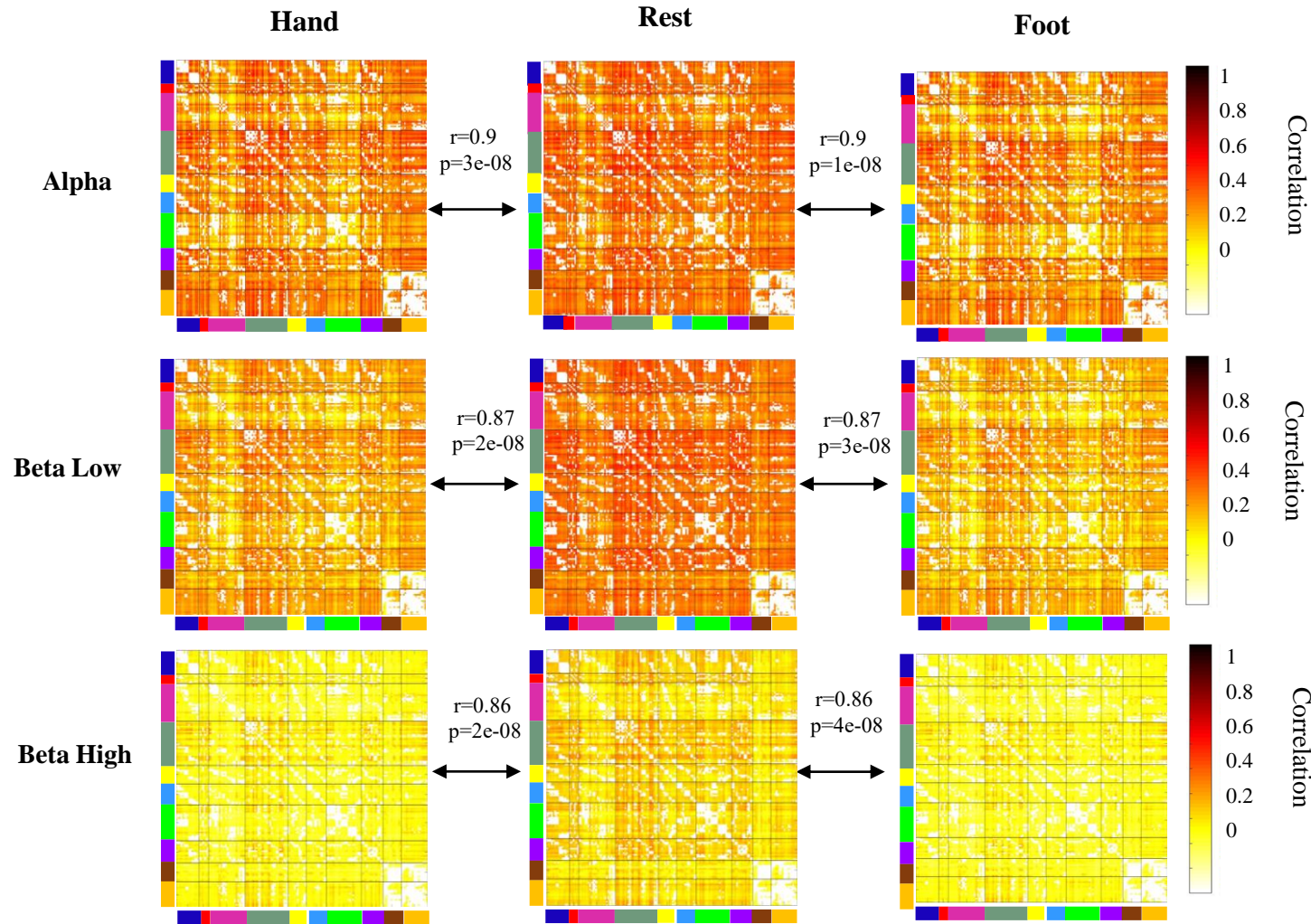
2.2 Parcellation – 10 networks



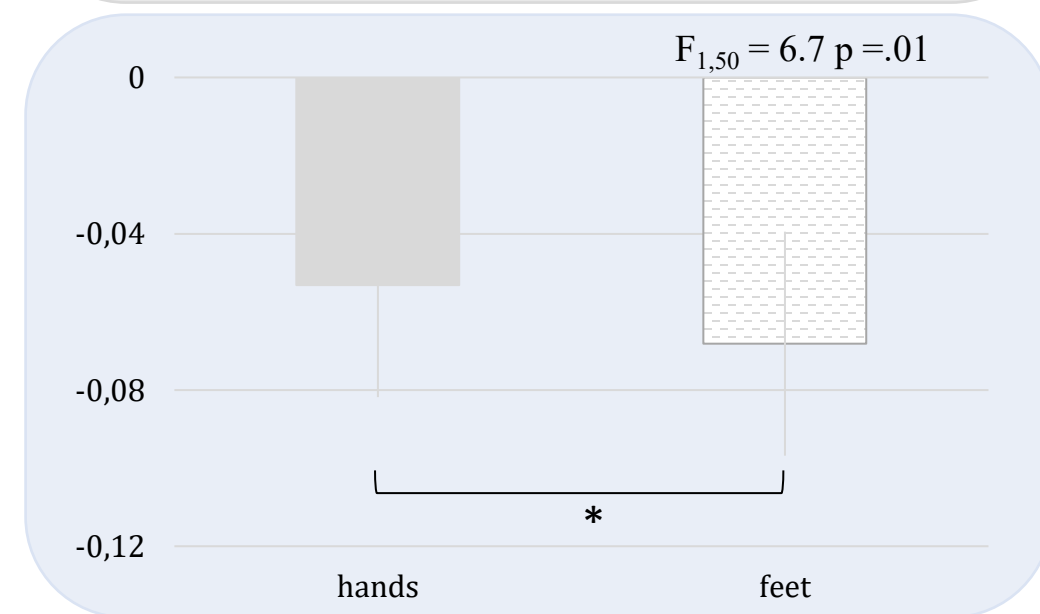
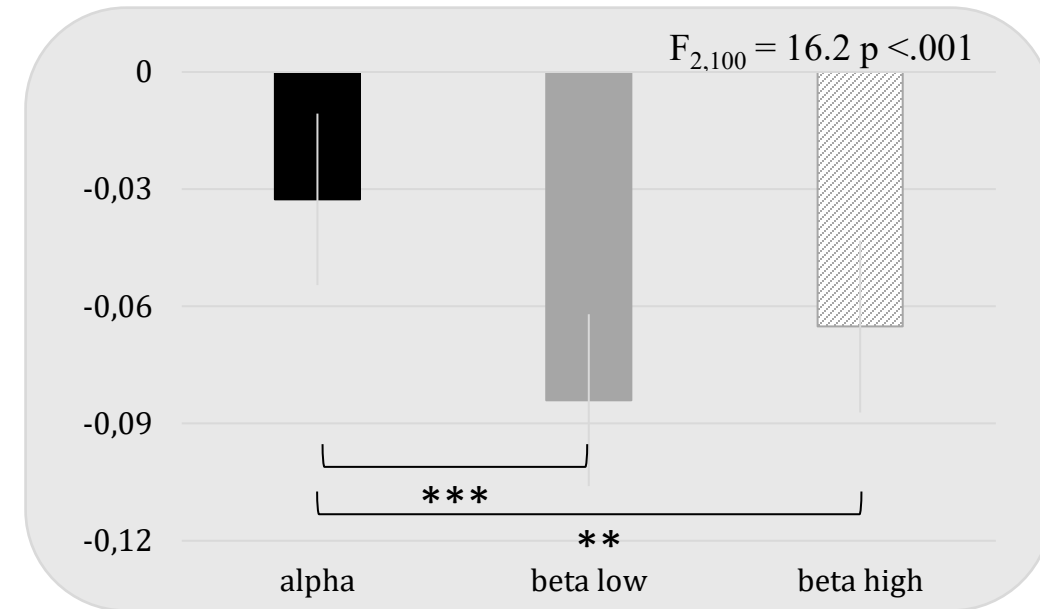
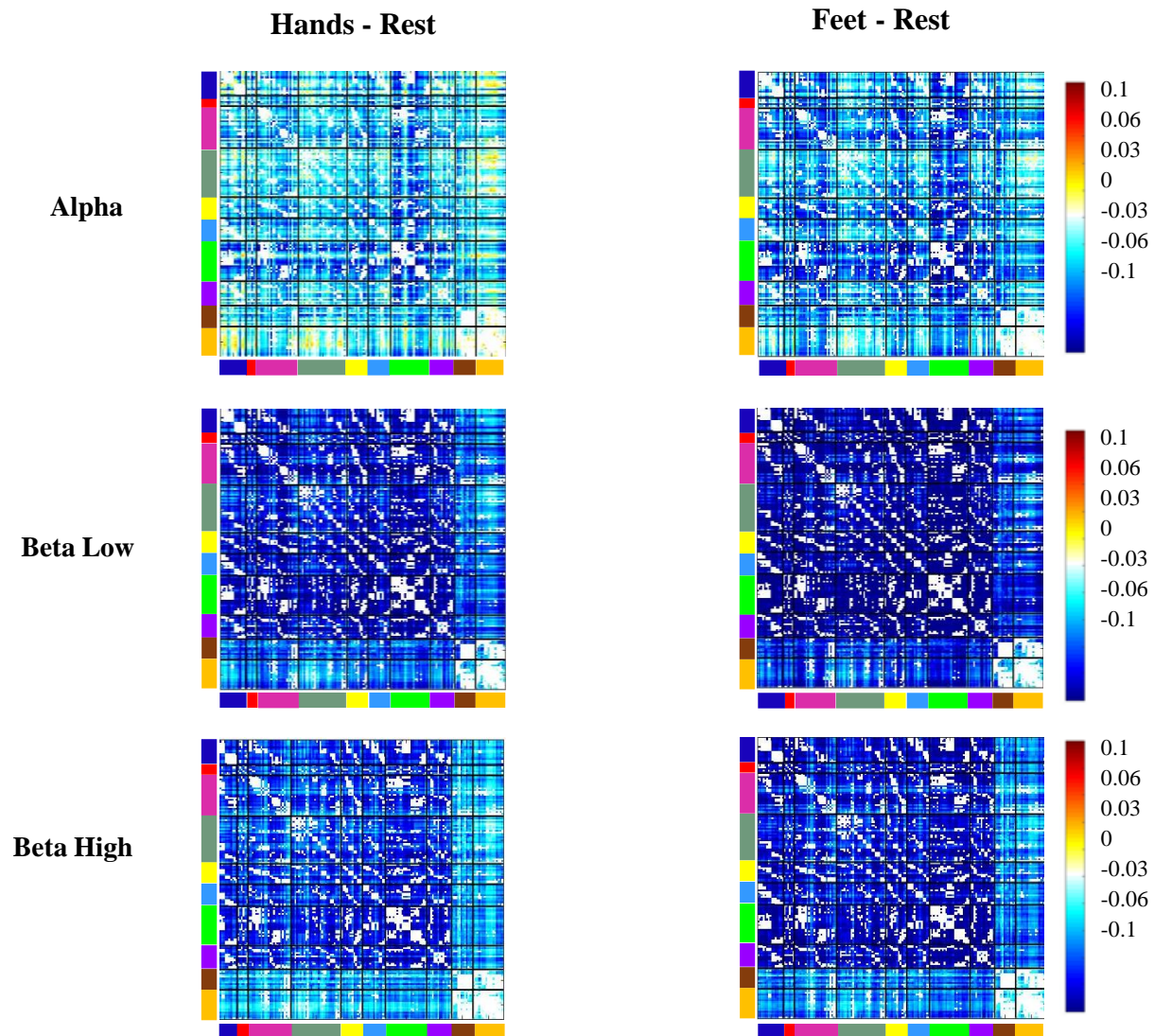
- *Auditory Network (AN)*
- *Control Network (CON)*
- *Dorsal Attention Network (DAN)*
- *Default Mode Network (DMN)*
- *Fronto-parietal Network (FPN)*
- *Language Network (LN)*
- *Motor Network (MN)*
- *Ventral Attention Network (VAN)*
- *Visual Foveal Network (VFN)*
- *Visual Peripheral Network (VPN)*



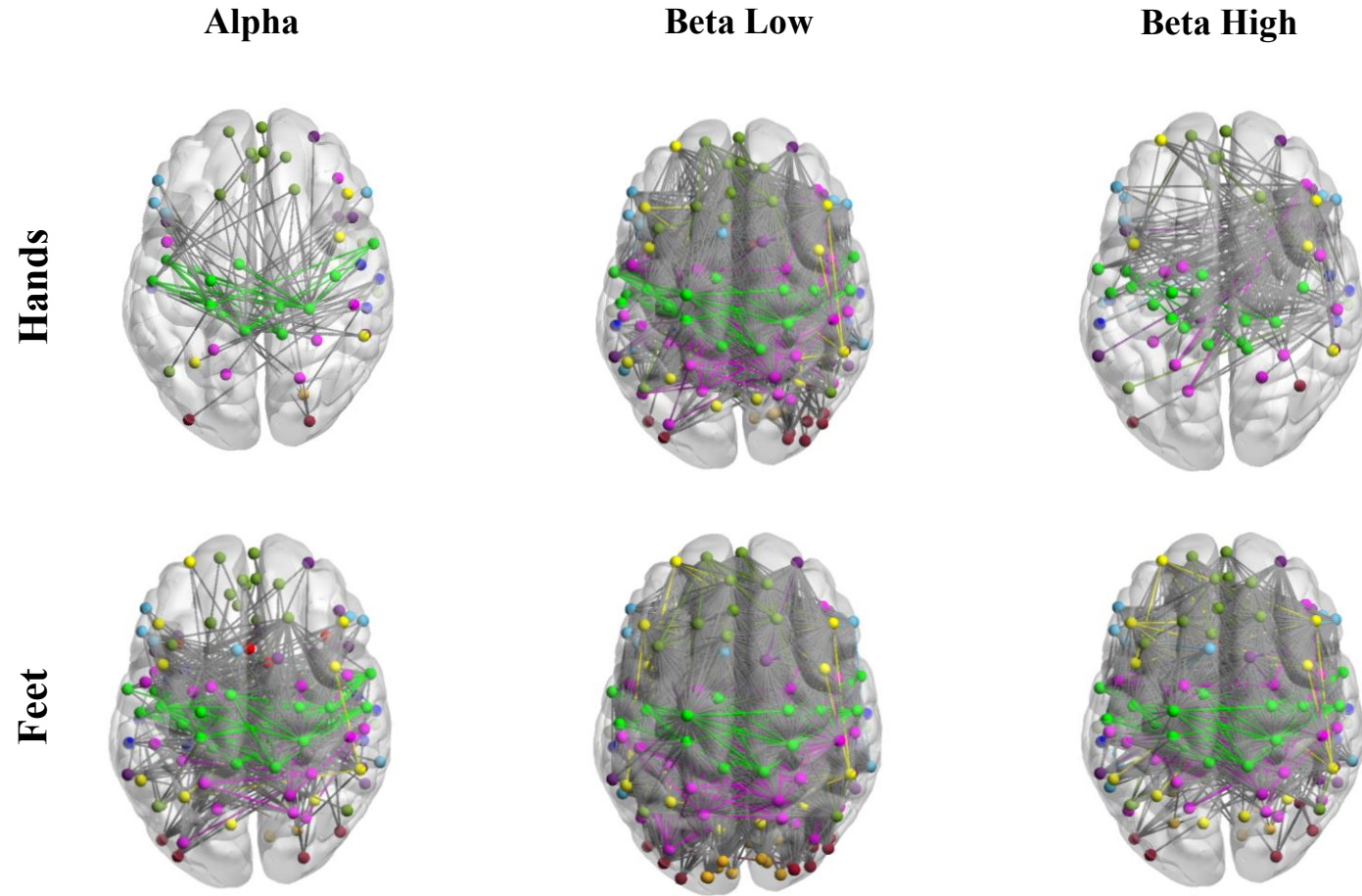
3 Results – Topography maintenance



3.1 Overall decrement of functional connectivity



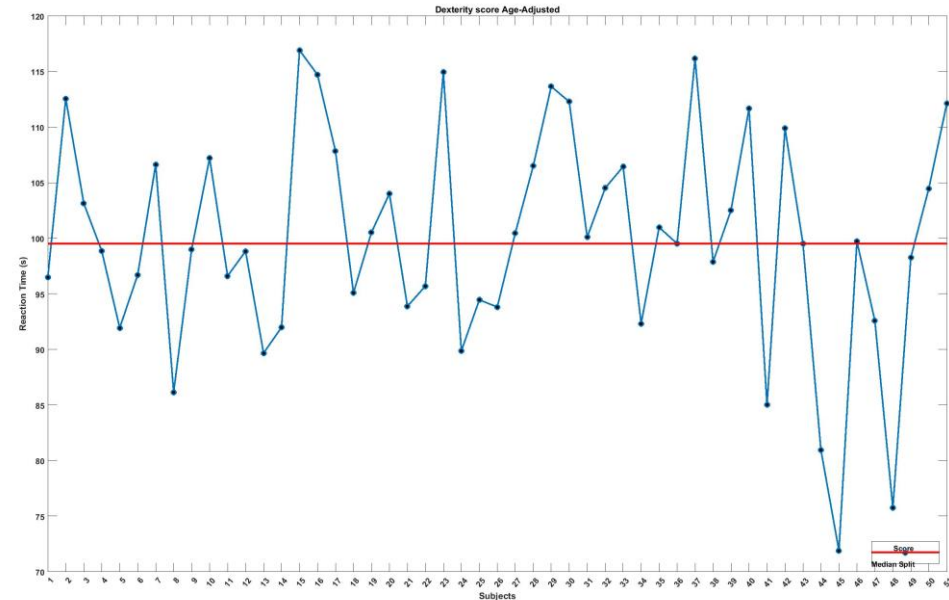
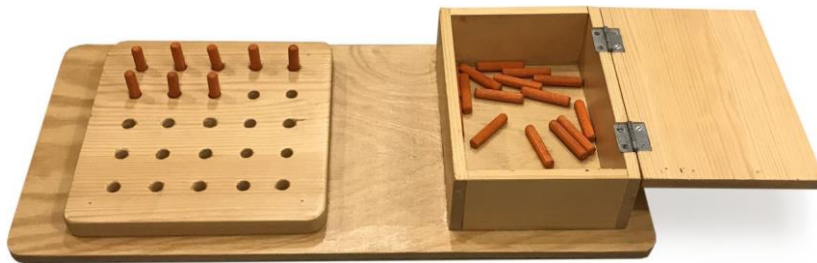
3.2 Topology



3.3 Results – connecting behavioral measures to FC



Nine-Hole Peg Test as a measure finger dexterity



The sample was splitted into two groups accordingly to their manual dexterity (*i.e.*, nine-hole peg test scores): *high performers* and *low performers*.

3.4 Rest vs Task topography - high vs low performers



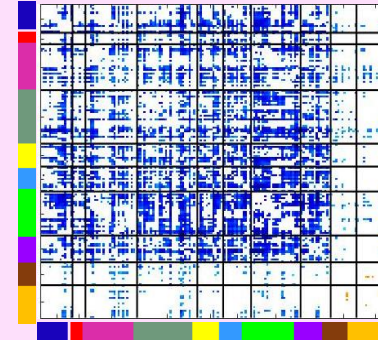
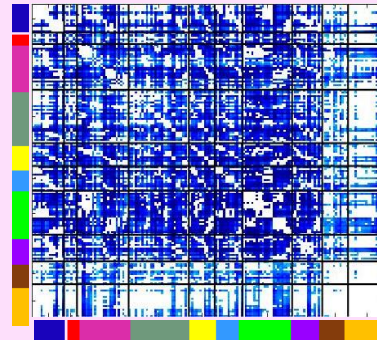
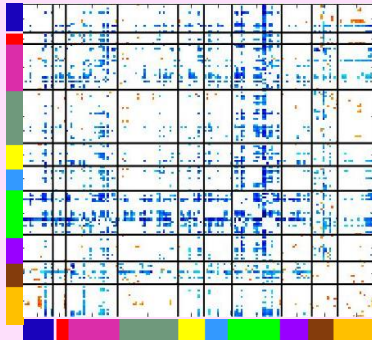
Right Hand

Alpha

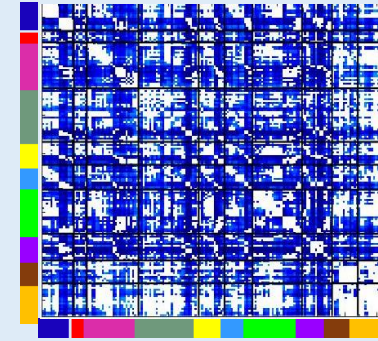
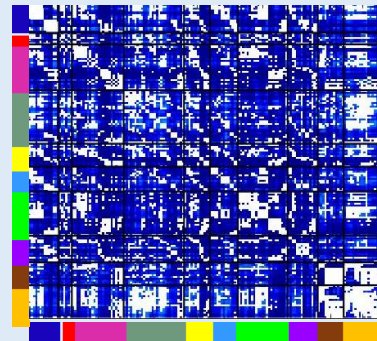
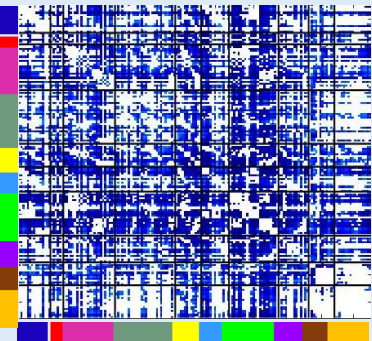
Beta Low

Beta High

High performers



Low performers



3.4.1 Rest vs Task topography - high vs low performers

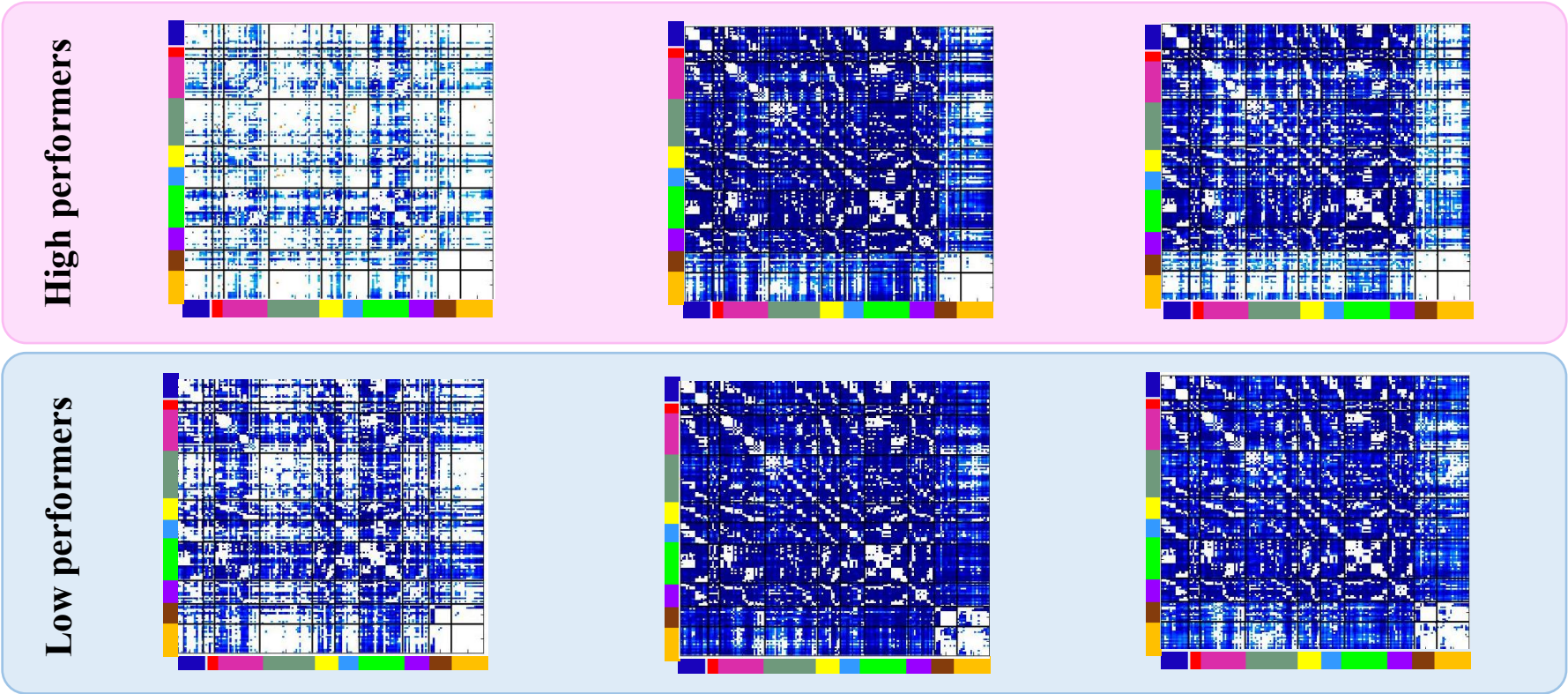


Right Foot

Alpha

Beta Low

Beta High



- Task execution preserves the intrinsic topography structure.
- Feet movements reorganize whole brain connectivity, especially in beta low.
- High performers exhibit a stability of the topography parallel to a reorganization of the task-dependent networks (i.e., SMN/DAN), by contrast, individuals with lower manual dexterity show a whole-brain reorganization in all bands.
- This stability/flexibility pattern appears selectively in the alpha-band.
- The balance between the task-dependent reorganization of the SMN/DAN and the stability of the other RSN may be considered as a neurophysiological marker of manual dexterity in the alpha band.



Thank you!



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