

G149: Characteristic Traits of Mild cognitive impairment in Parkinson's disease

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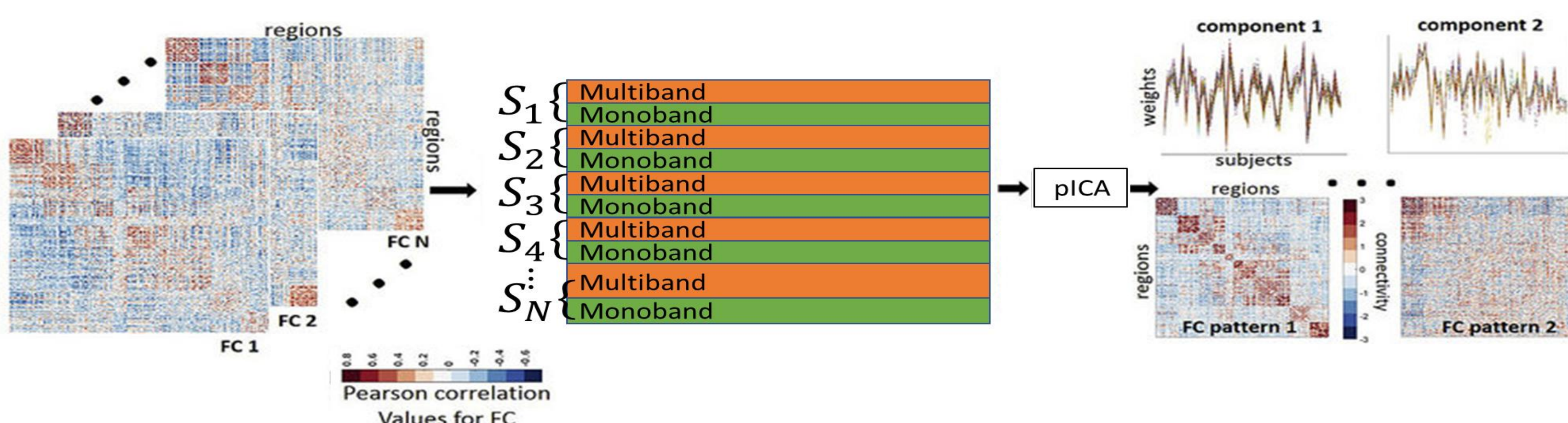
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Background

- Mild cognitive impairment (MCI), frequent in Parkinson Disease (PD), is a well-known risk factor for dementia.
- Functional connectivity resting state networks (RSNs), such as the default mode, dorsal attention, executive control and sensorimotor networks, have been reported to correlated with cognitive deficits in PD. Inter-network connectivity is crucial as well [1,2].
- This study investigates how whole-brain functional networks are affected by MCI in PD using a Connectome ICA (connICA) analysis with resting state functional MRI (RS-fMRI).

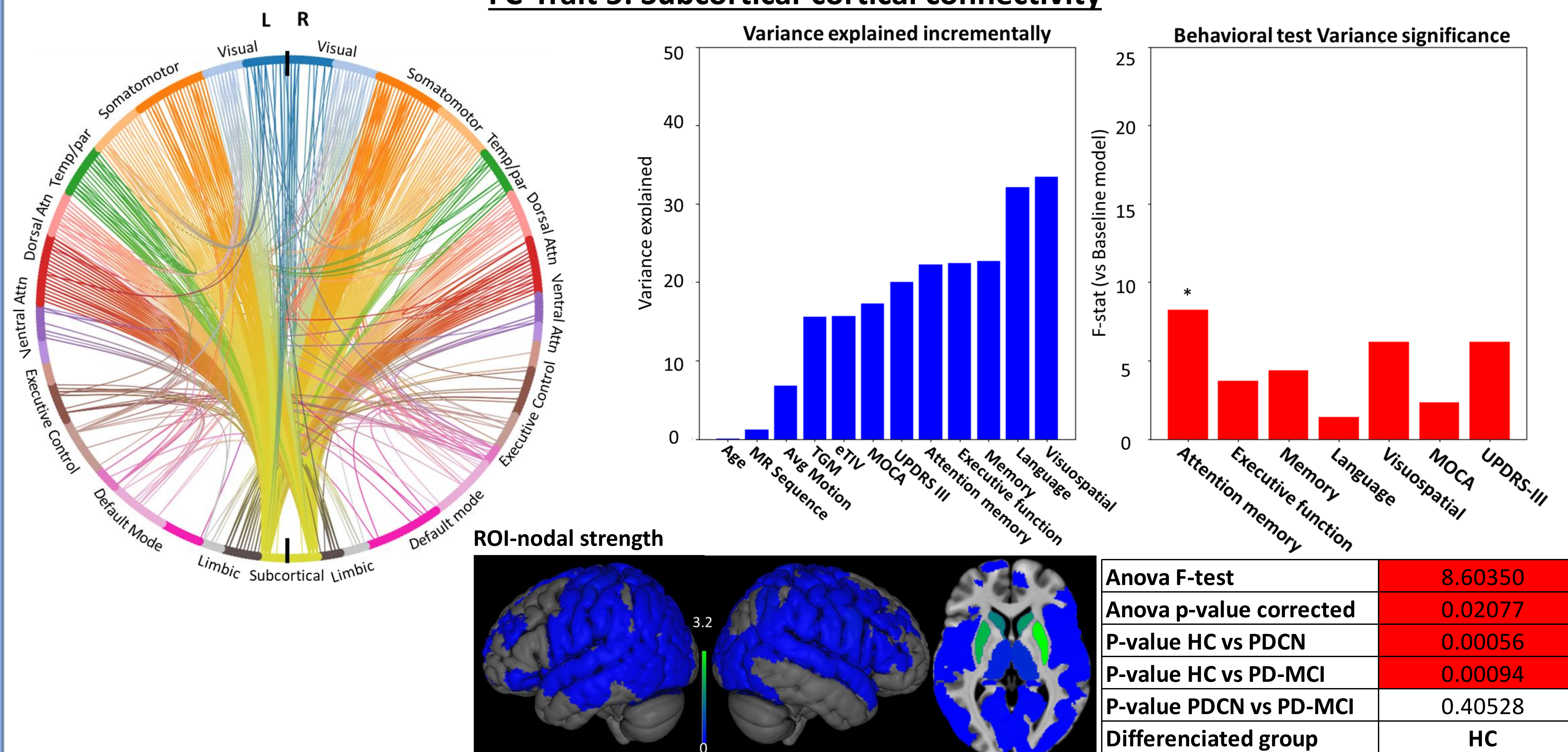
Methods

- Subjects:** 59 patients (26 PD-cognitively normal (PDCN) & 33 PD-MCI) vs. 28 healthy controls (HC). PD patients performed study under parkinsonian medication.
- MRI data acquisition:** 3T Siemens Trio with 32 channel head coil: T1-w (MPRAGE) & T2-w (TSE) anatomical scans (1 mm³ voxels). Two 10 min eyes-open RS-fMRI acquisitions (EPI, 3 mm iso voxels, TE= 28ms) at TR = 2s and TR = 0.8 s (multiband factor = 3).
- Anatomical preprocessing:** Brain parcellation was performed using Schaefer's atlas [3] plus subcortical areas of the Freesurfer's Destrieux atlas (Aparc2009) [4]. Anatomical images were coregistered to the functional space.
- fMRI preprocessing:** Despiking, slice timing, distortion correction, head realignment, motion scrubbing and nuisance regression (6 Legendre polynomials, realignment parameters + temporal derivatives, 5 principal components of WM, ventricle CSF voxels, and brain's edge voxels).
- 21 HC, 21 PDCN & 23 PD-MCI subjects remained for further analysis after motion scrubbing based on Euclidean norm of framewise displacement (80% scans with < 0.4 mm) [5]
- FC analysis:** FC matrices (Pearson correlation) were input to ConnICA [6] using MELODIC with 65 independent FC-traits, which was the optimal PCA component for subject identifiability [7].

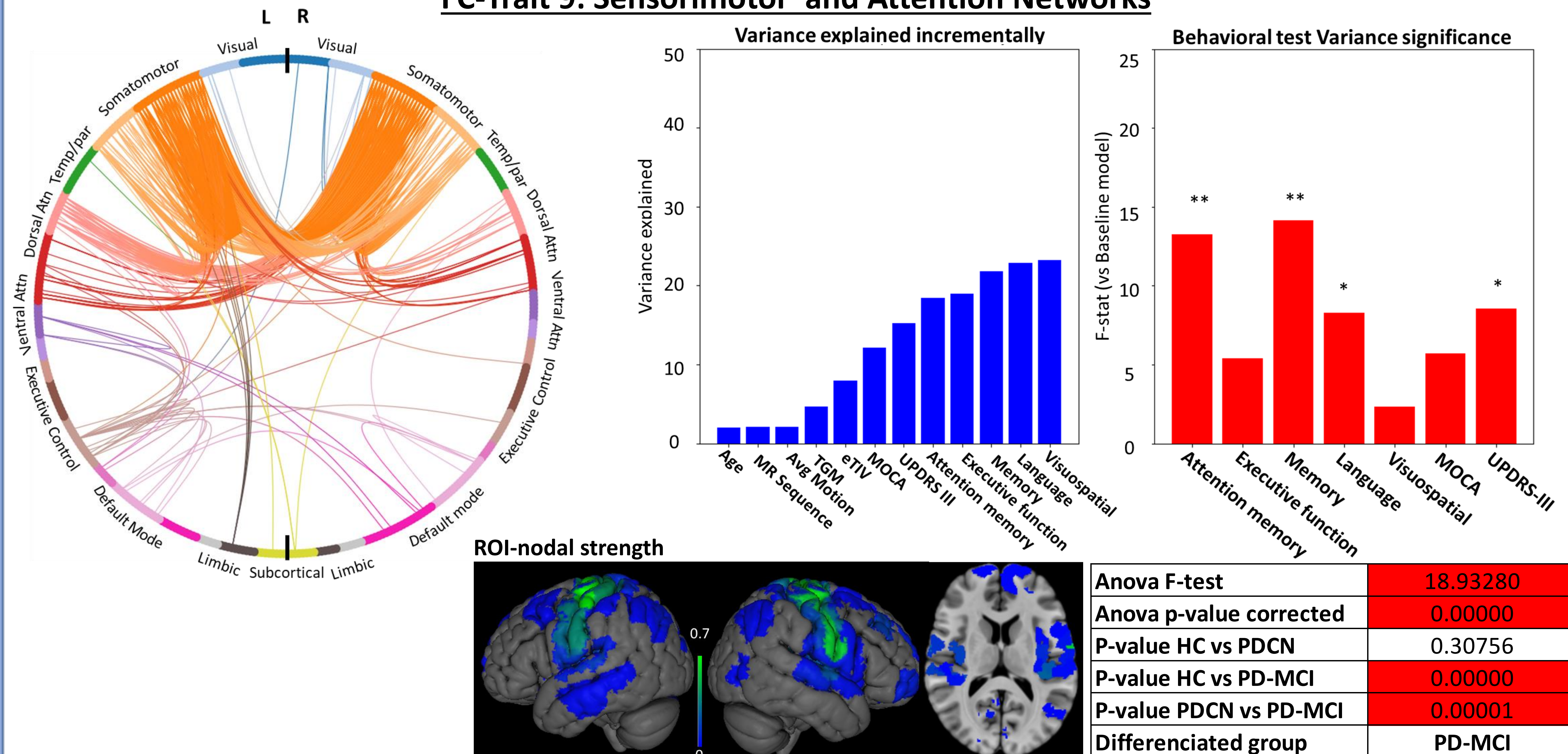


- Linear mixed effect (LME) model on the weights of each FC-trait with group (HC, PDCN, PD-MCI) with the sequence (monoband, multiband) as fixed factor, and subjects as random factor. Anova p-values are corrected (Bonferroni method).
- Incremental ANOVAs and individual F-tests were computed to evaluate the relationship between the FC-traits and neuropsychological assessments.

FC-Trait 5: Subcortical-cortical connectivity



FC-Trait 9: Sensorimotor and Attention Networks



Results and discussion

- FC-trait 5 has subcortical hubs in putamen, caudate and thalamus, highlighting a clear manifestation of the ganglia-thalamo-cortical alterations [8] at the onset of PD. This FC-trait is mainly associated with attentional tests implying attentional deficits at the beginning of PD.
- FC-trait 9 mainly involves inter- and intra-hemispheric connections between regions of the primary and secondary motor and somatosensory cortices and dorsal and ventral attention networks. Although UPDRS-III is link to this trait, attention and memory behavioral test are significantly linked suggesting a motor disfunction in the PD-MCI patients that is related to attentional and memory impairments. The significance of language test could be an effect from the semantic fluency test.
- To sum up, functional connections between attentional and sensorimotor regions are key for PD-MCI development, and explain attention and memory behavioral deficits that are typically observed.

Cognitive and motor tests

- Unified Parkinson Disease Rating Scale (UPDRS)
 - Montreal Cognitive Assessment (MOCA)
- MCI diagnosis according to Movement Disorder Society Task Force Guidelines (level II) using the following tests:
- Attention and Memory: Inverse digit span memory test, Symbol digit modalities test
 - Executive function: Trail making test B, Phonetic fluency
 - Memory: Rey Auditory Verbal Learning Test (RAVLT), Rey-Osterrieth complex figure test (ROCF)
 - Language: Semantic fluency test, Boston naming test
 - Visuospatial: Object decision and number location from the Visual Object and Space Perception Battery (VOSP)

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