Neural Typicality During Naturalistic 7T fMRI Tracks Cognitive Performance in Multiple Sclerosis

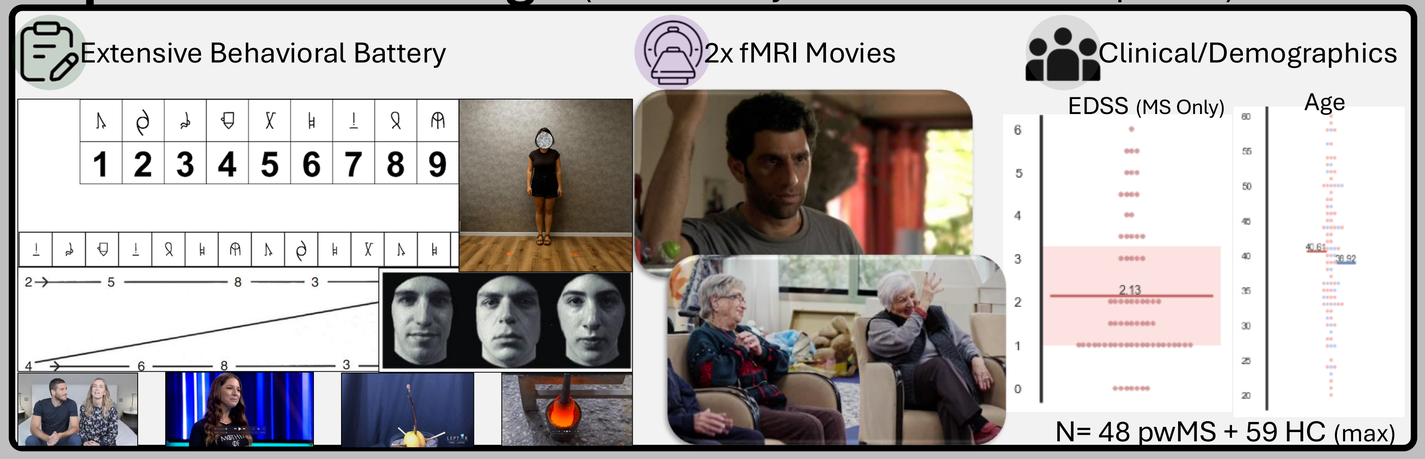
Ido Har Shalom[1], Aviv Jarbi[1], Michal Zamberg-Elad[1], Hadar Kolb[2], Michal Ramot[1]

Department of Brain Sciences, Weizmann Institute of Science[1]
Department of Neurology, Tel-Aviv Sourasky Medical Center[2]

Key Takeaways

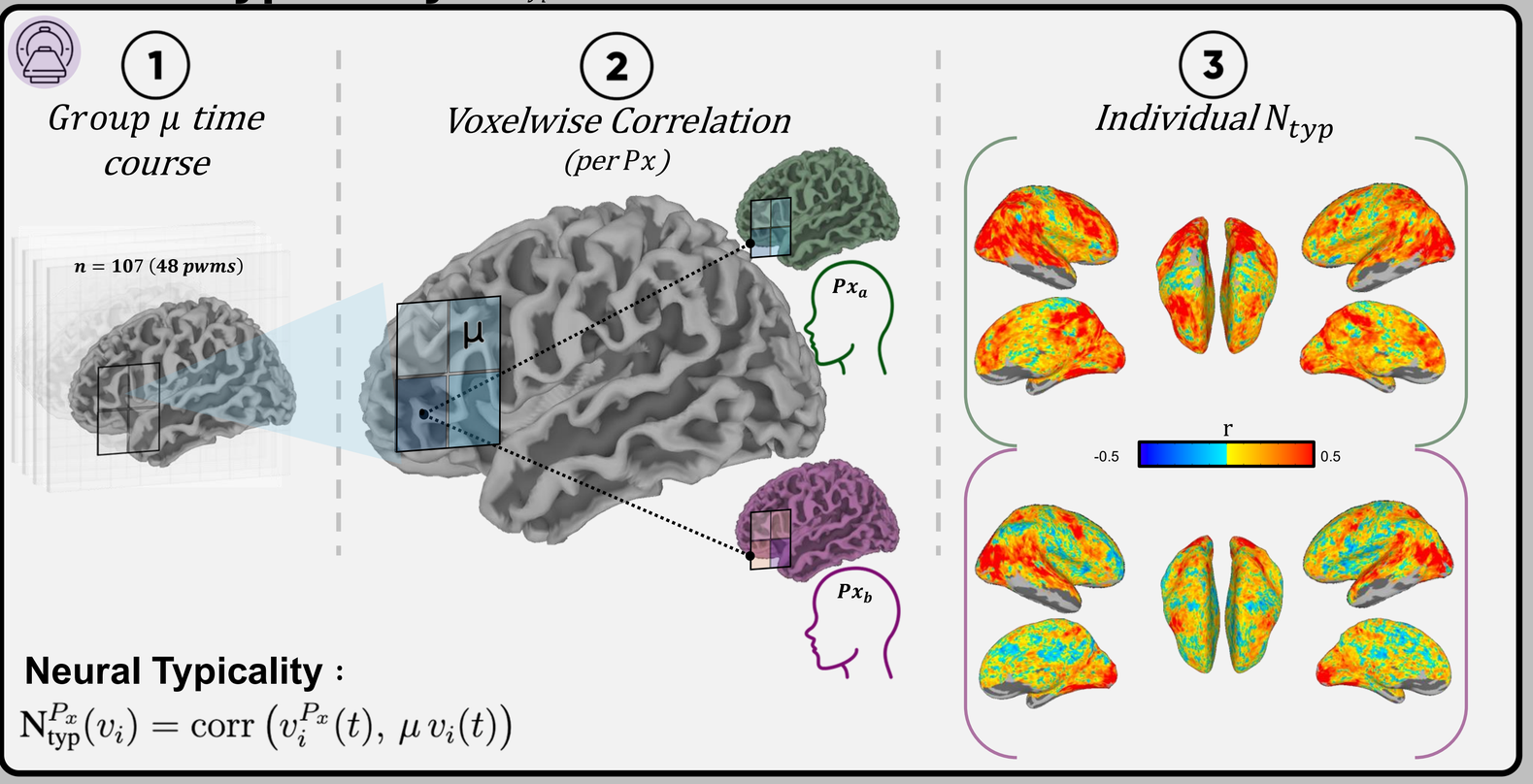
- Neural Typicality (N_{typ}) during movie watching can serve as a brain based-marker predictive of cognitive performance
- Multiple Sclerosis (MS) is associated with reduced N_{typ}, with patients showing more atypical neural responses than healthy controls
- Regions with MS-related disruption in N_{typ} overlap with those linked to behavior
- Same regions, different dynamics: MS alters how the brain processes cognition

Experimental Design (Two full days of data collection per Px)



Neural Typicality :

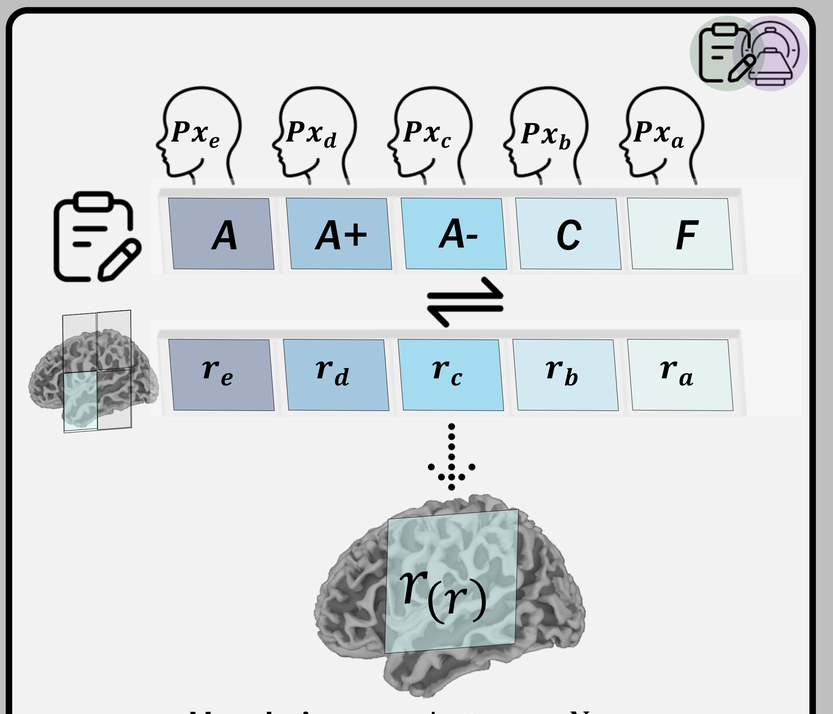
For a given Px and movie:
N_{typ} is defined as the voxel-wise corr. with the mean time-course



Neural Typicality :

$$\mathrm{N}_{\mathrm{typ}}^{P_x}(v_i) = \mathrm{corr}\left(v_i^{P_x}(t),\ \mu\, v_i(t)\right)$$

Brain to Behavior

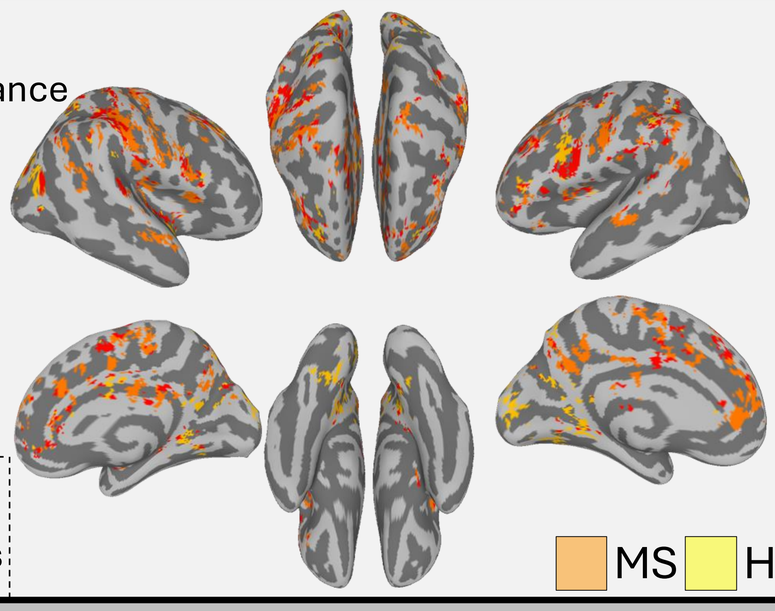


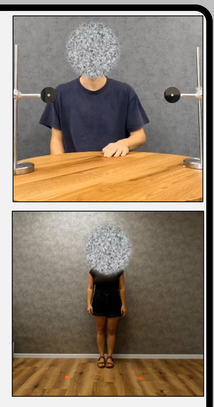
Voxelwise corr. between N_{typ} and behavioral performance

Voxel-wise N_{typ} to Behavior Corr.

Human Movement Prediction Performance

N_{typ} in Movie #1

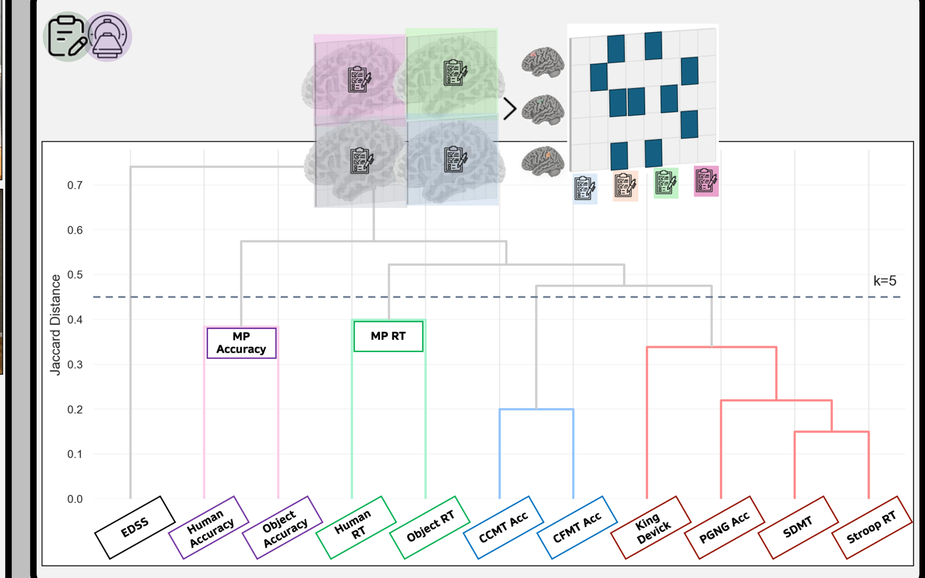




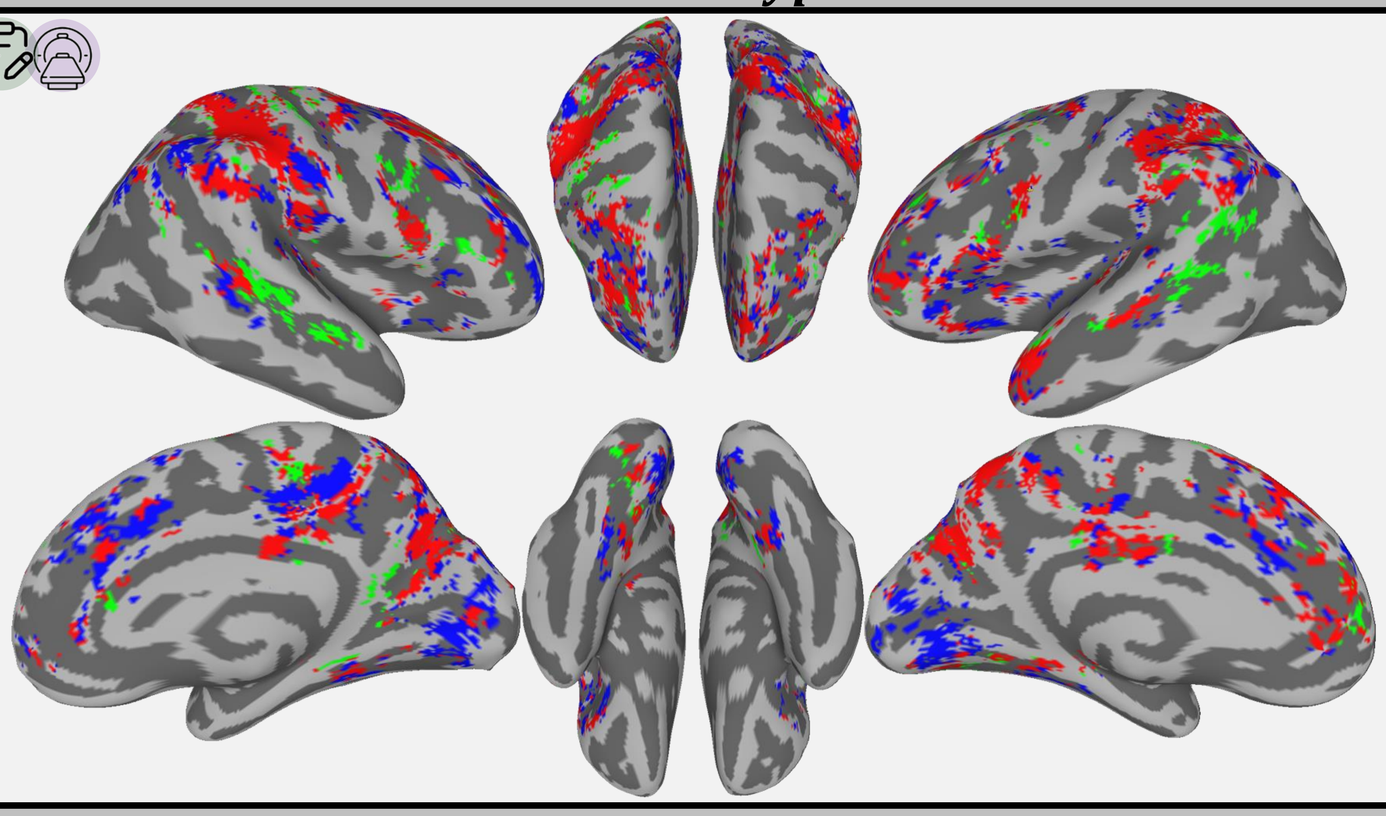
- Threshold *r=0.3*
- Clusters >200 voxels

MS HC Overlap (NN=1)

Task Clustering by Neural Profiles



N_{typ} Correlates to Task Performance



1 Voxels with MS-HC N_{typ} Differences

2 Voxels with N_{typ} - Behavior Correlations

3 Overlap

3 Overlap

Regions that differentiate MS and HC individuals based on N_{typ} during **Movie #2**

Regions where N_{typ} during **Movie #1** correlates with task performance

MS-related differences overlap with those predictive of cognitive performance

Ido.Har-Shalom@weizmann.ac.il