Relating EEG microstates to the Default Mode Network

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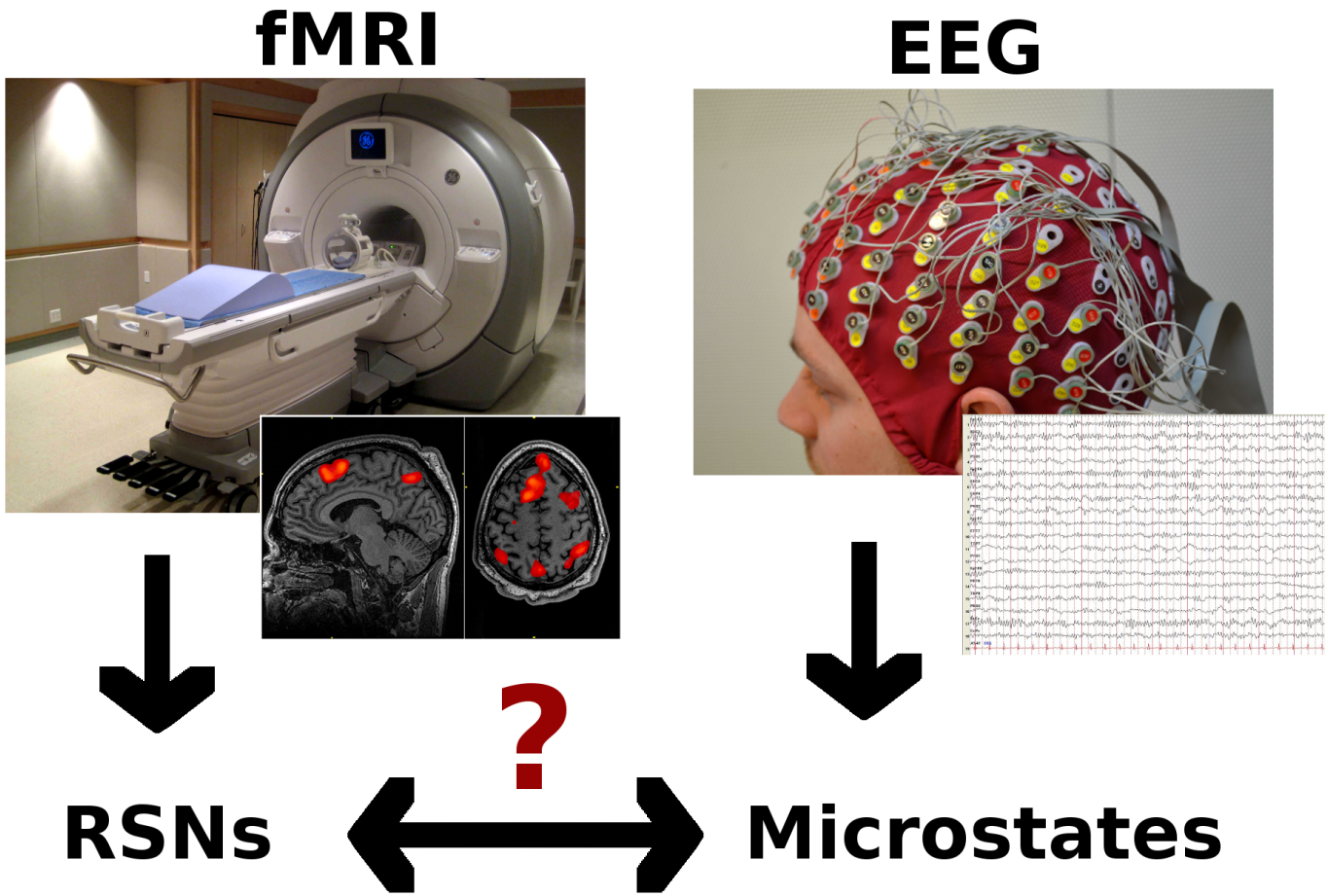
Hypothesis: RSN (DMN) can be found by both fMRI and EEG

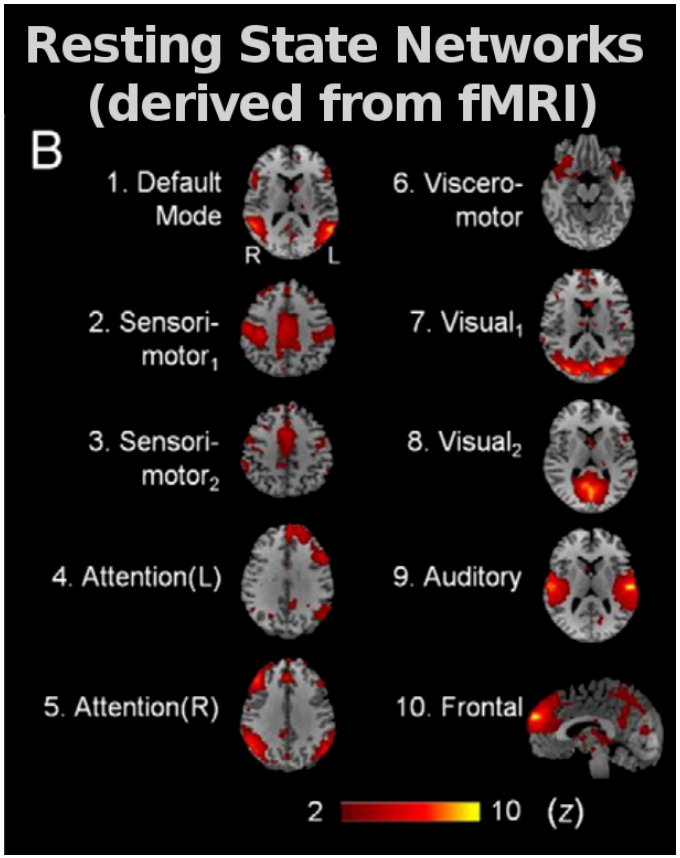
[Yuan et al., 2012] - Data-driven approach based on temporal ICA
13 microstates (EEG) and 10 RSNs (BOLD fMRI)



Motivation - The Brain's Dark Energy

Default Mode Network - [Raichle, 2011]

- Energy consumption decreases only a few % during rest
- Why consume energy at rest
- Resting State Networks (Sensory/motor, visual etc.)
- DMN - Most researched RSN

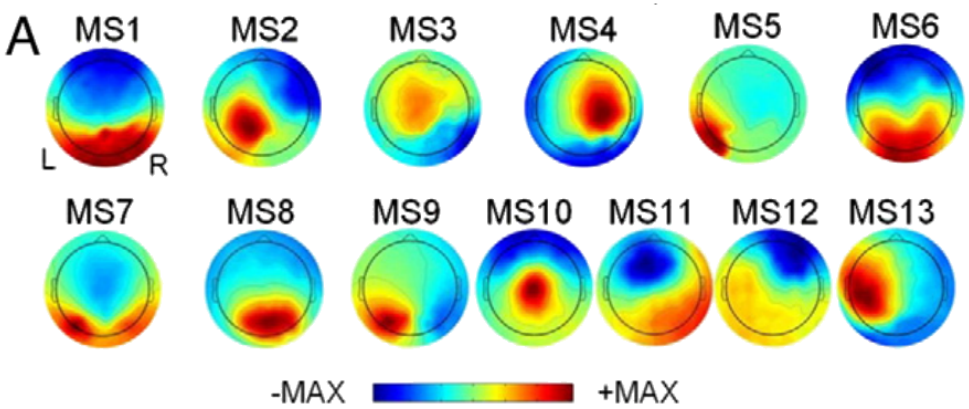


Source: [Yuan et al., 2012]

Microstates - The Atoms of Thought

[Lehmann and Skrandies, 1980]

- Transient quasi stable states ($\sim$100 ms)
- Unique topographic distribution of the electrical field potential
- Like the RSNs, the microstates are altered in a variety of brain disorders



Microstates (derived from EEG)

Source: [Yuan et al., 2012]

Data

- Simultaneous EEG and BOLD fMRI measurements of 20 patients recorded in Glostrup Hospital by Egil Rostrup and Ulrich Lindberg
- 10 minutes brain activity from 30 diodes (EEG)
- Default Mode Network ICA component of BOLD fMRI
- Cleaned data
- Artefacts still present (eye blink, heartbeat, movement etc.)

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Method and Plans

1. Artifact removal in EEG data
    - ICA, Spectrograms
2. Detecting Microstates
    - Global Field Power
    - Temporal ICA
3. Predict DMN from microstates
    - GLM (Regularized)
    - Gaussian process
    - Hemodynamic response function

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Questions?

Lehmann, D. and Skrandies, W. (1980).
Reference-free identification of components of checkerboard-evoked multichannel potential fields.
Electroencephalography and clinical neurophysiology, 48(6):609–621.

Raichle, M. E. (2011).
The restless brain.
Brain Connectivity, pages 3–12.

Yuan, H., Zotev, V., Phillips, R., Drevets, W. C., and Bodurka, J. (2012).
Spatiotemporal dynamics of the brain at rest — exploring {EEG} microstates as electrophysiological signatures of {BOLD} resting state networks.
NeuroImage, 60(4):2062 – 2072.