

# Mapping cortical modules, their connectivity and functions

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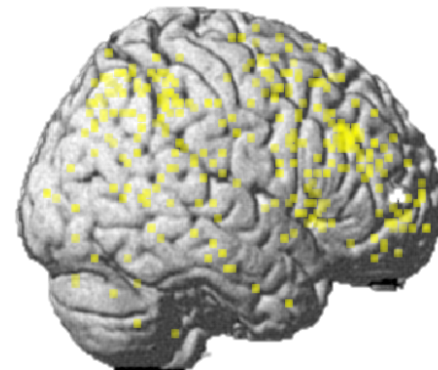
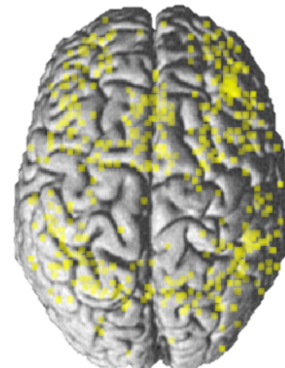
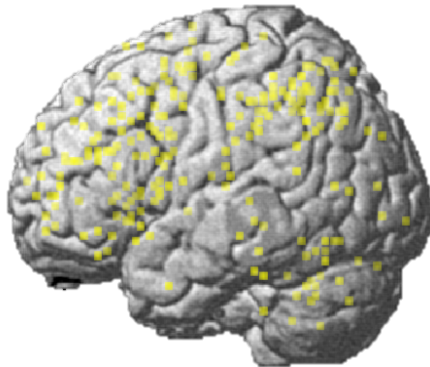
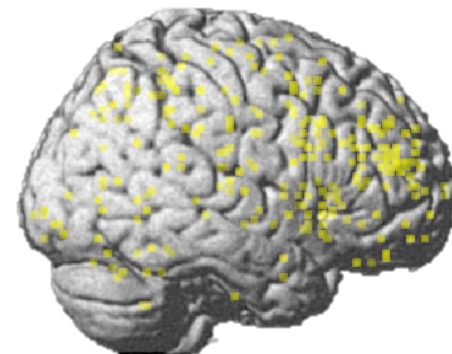
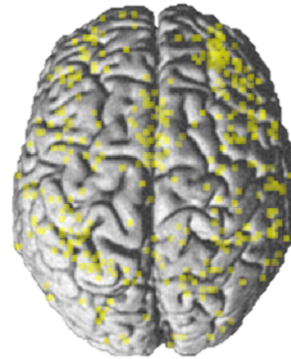
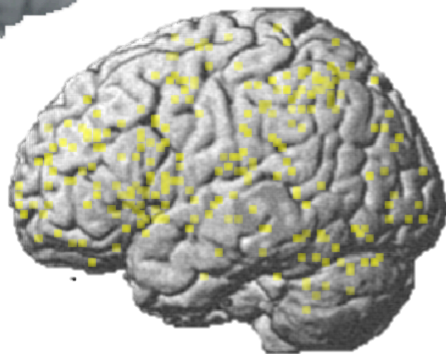
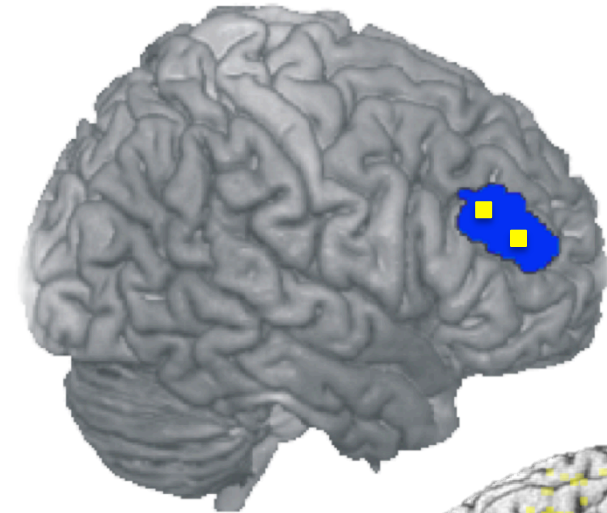
## Connectivity-based parcellation (CBP)

Cortical modules show distinct connectivity profiles

Computation of each voxel's interactions

Clustering based on these profiles

Eickhoff, Bzdok, Laird, Roski, Caspers, Zilles, Fox; *Neuroimage* 2011



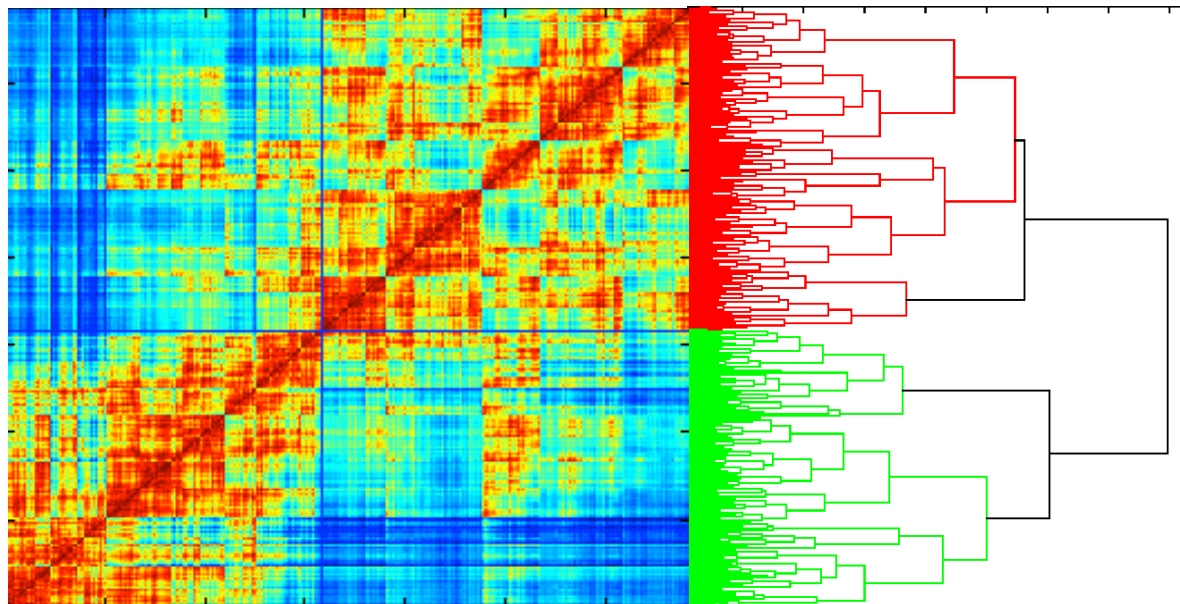
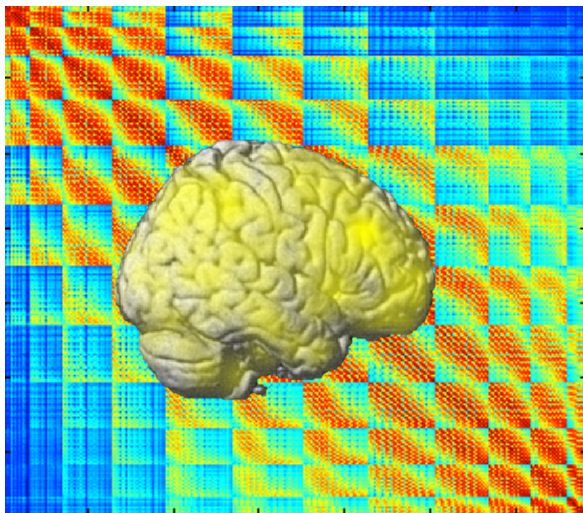
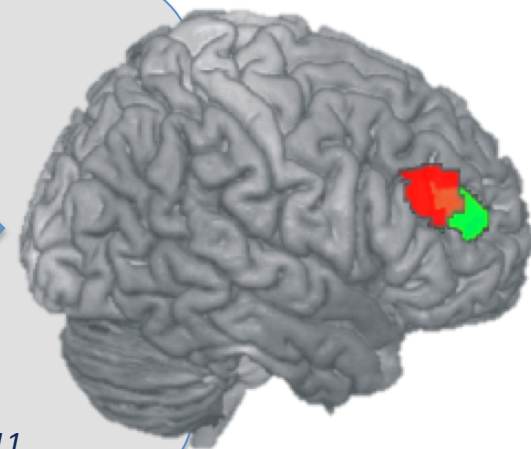
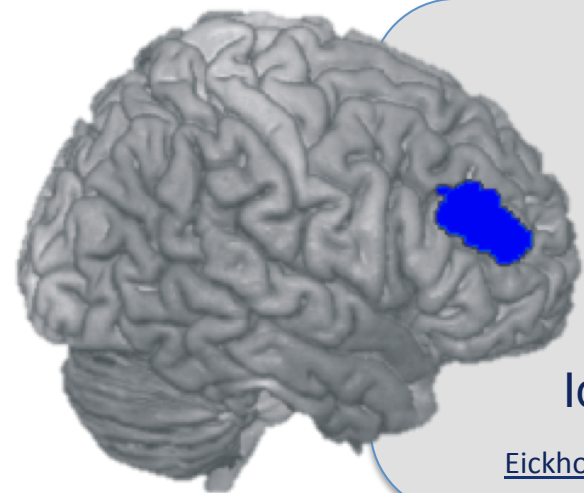
## Connectivity-based parcellation

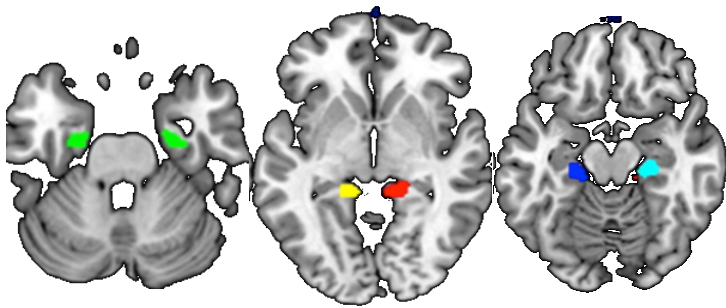
Whole-brain connectivity per voxel

Computation of cross-correlation  
Similarity in the co-activation patterns

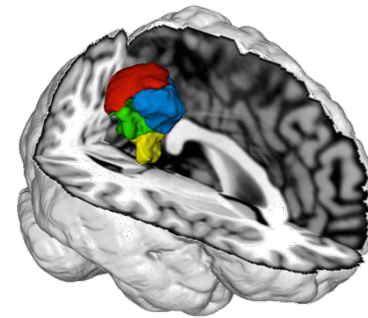
Identify groups via cluster-analyses

Eickhoff, Bzdok, Laird, Roski, Caspers, Zilles, Fox; *Neuroimage* 2011

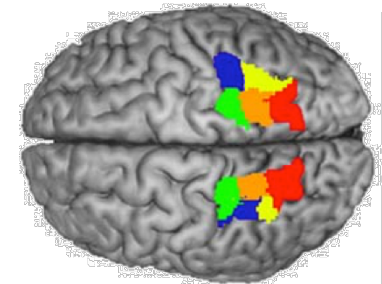




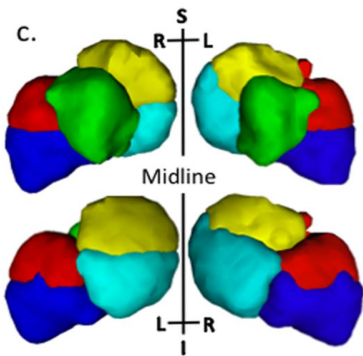
**Subiculum:** Chase et al., *Neuroimage* 2015



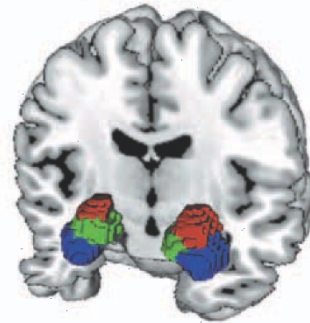
**PrC / PCC:** Bzdok et al., *Neuroimage* 2015



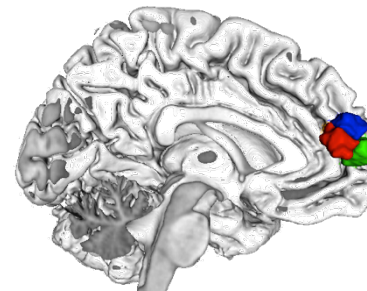
**SPL:** Wang et al., *Hum Brain Mapp* 2015



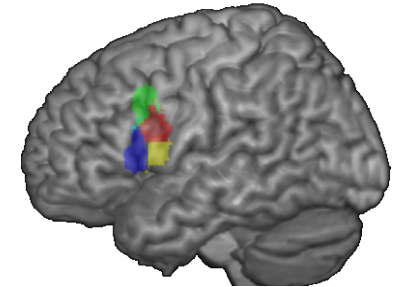
**Pulvinar:** Barron et al., *Hum Brain Mapp* 2015



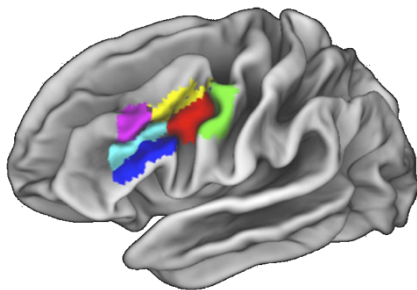
**Amygdala:** Bzdok et al., *Hum Brain Mapp* 2013



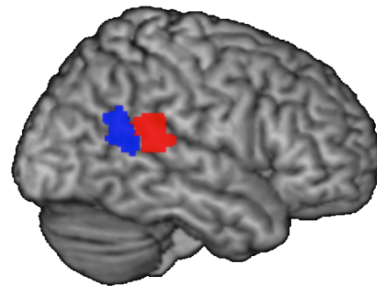
**dmPFC:** Eickhoff et al., *Cerebral Cortex* 2015



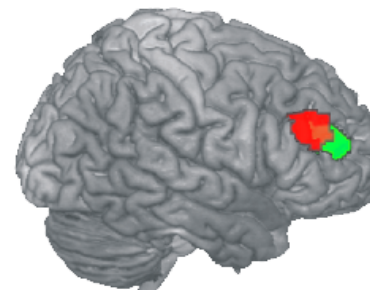
**BA 44:** Clos et al., *Neuroimage* 2015



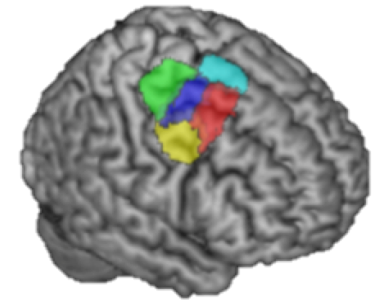
**IFJ:** Muhle-Karbe et al., *Cerebral Cortex* 2015



**TPJ:** Bzdok et al., *Neuroimage* 2013

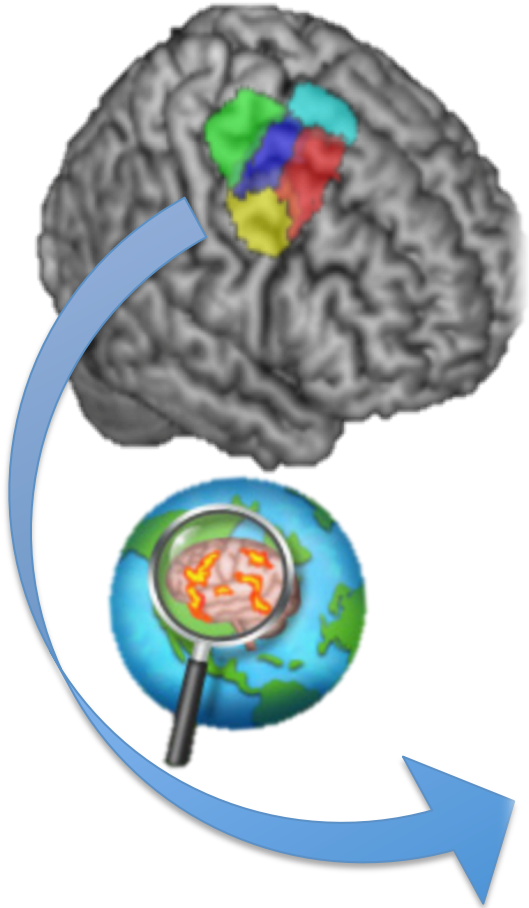


**IFS / DLPFC:** Cieslik et al., *Cerebral Cortex* 2013



**PMd:** Genon et al., *Cerebral Cortex* in press

# MACM-CBP



	Caudal	Central	Rostral	Ventral	Dorsal
Interoception	Green				
Action execution	Green	Blue		Yellow	Cyan
Motor learning	Green	Blue			
Shape vision		Blue			
Soma cognition		Blue			
Action imagination		Blue			
Action observation		Blue		Yellow	Cyan
Motion vision		Blue	Red	Yellow	Cyan
Spatial cognition		Blue	Red		
Working memory		Blue	Red		
Attention		Blue	Red		
Reasoning		Blue	Red		
Action inhibition		Blue	Red	Yellow	Cyan
Music cognition		Blue	Red	Yellow	Cyan
Vision		Blue	Red	Yellow	Cyan

# Connectivity measures

## MACM

## RSFC

## PDT

**Meta-analytic  
Connectivity Modeling**

**Resting-State  
Functional Connectivity**

**Probabilistic Diffusion  
Tractography**

**Dataset** Task-based fMRI and PET  
**group studies**

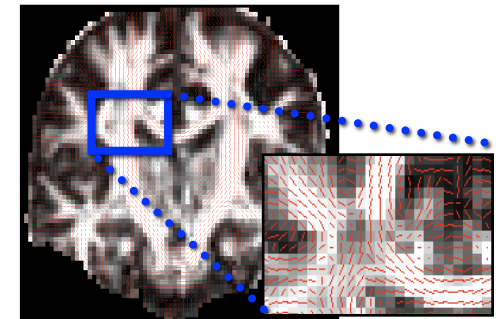
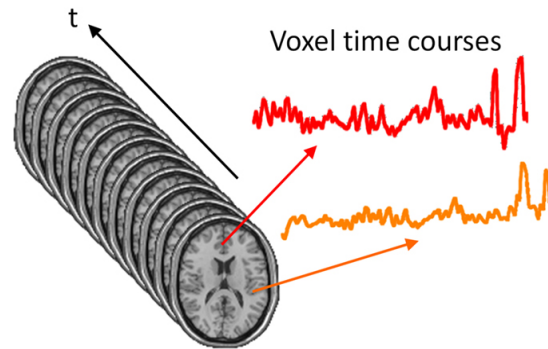
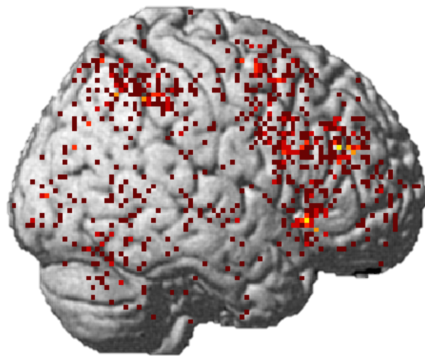
fMRI RS data of **subjects**

DWI data of **subjects**

**Input** MNI coordinates of peaks

Signal fluctuations

Estimated fiber direction



**Measure** **Likelihood** of co-activation

**Correlation** across time-series

**Trace count** across WM

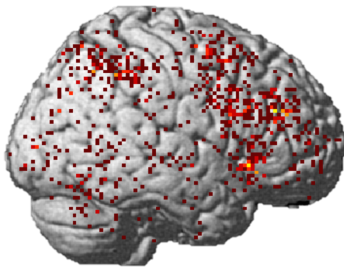
**Context**  $\approx$  Task FC

$\approx$  Unconstrained FC

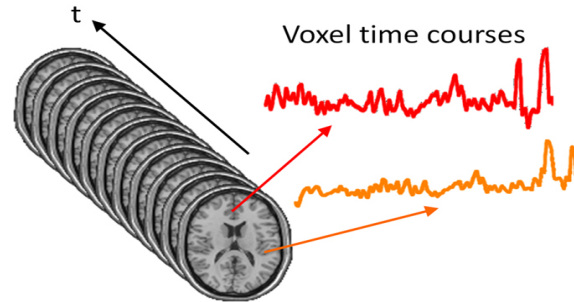
$\approx$  Structural connectivity

# Multimodal CBP

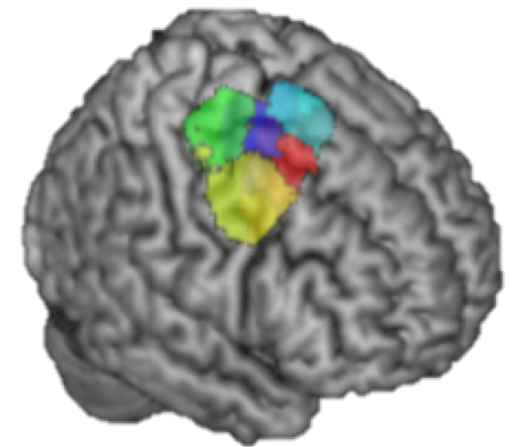
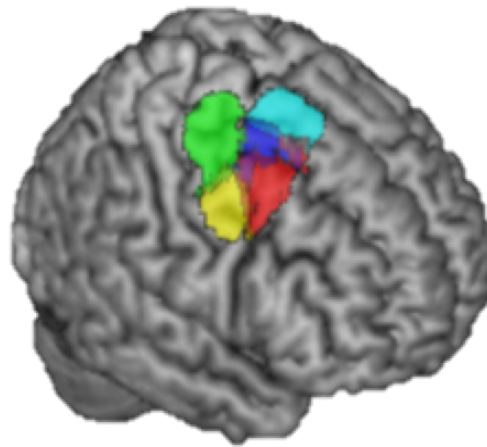
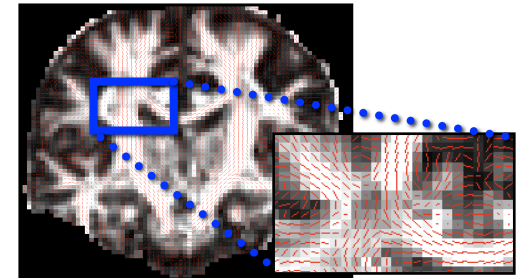
MACM-CBP



RSFC-CBP



PDT-CBP



# Thank you for your attention

Brain Network Modelling Group

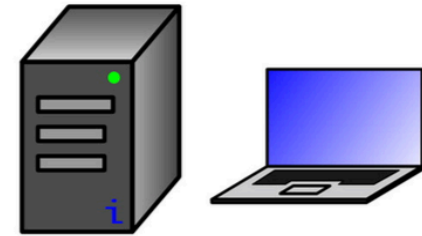






**ANIMA**

download



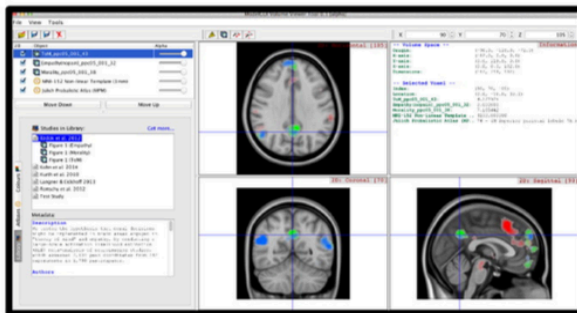
Local storage

upload

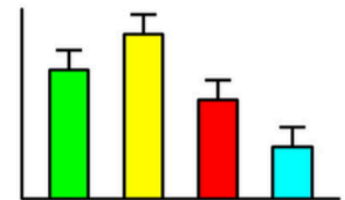
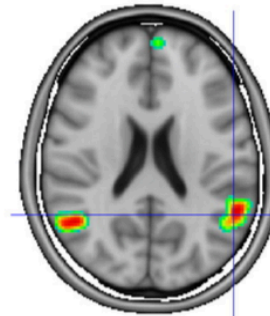
look directly

import

use directly



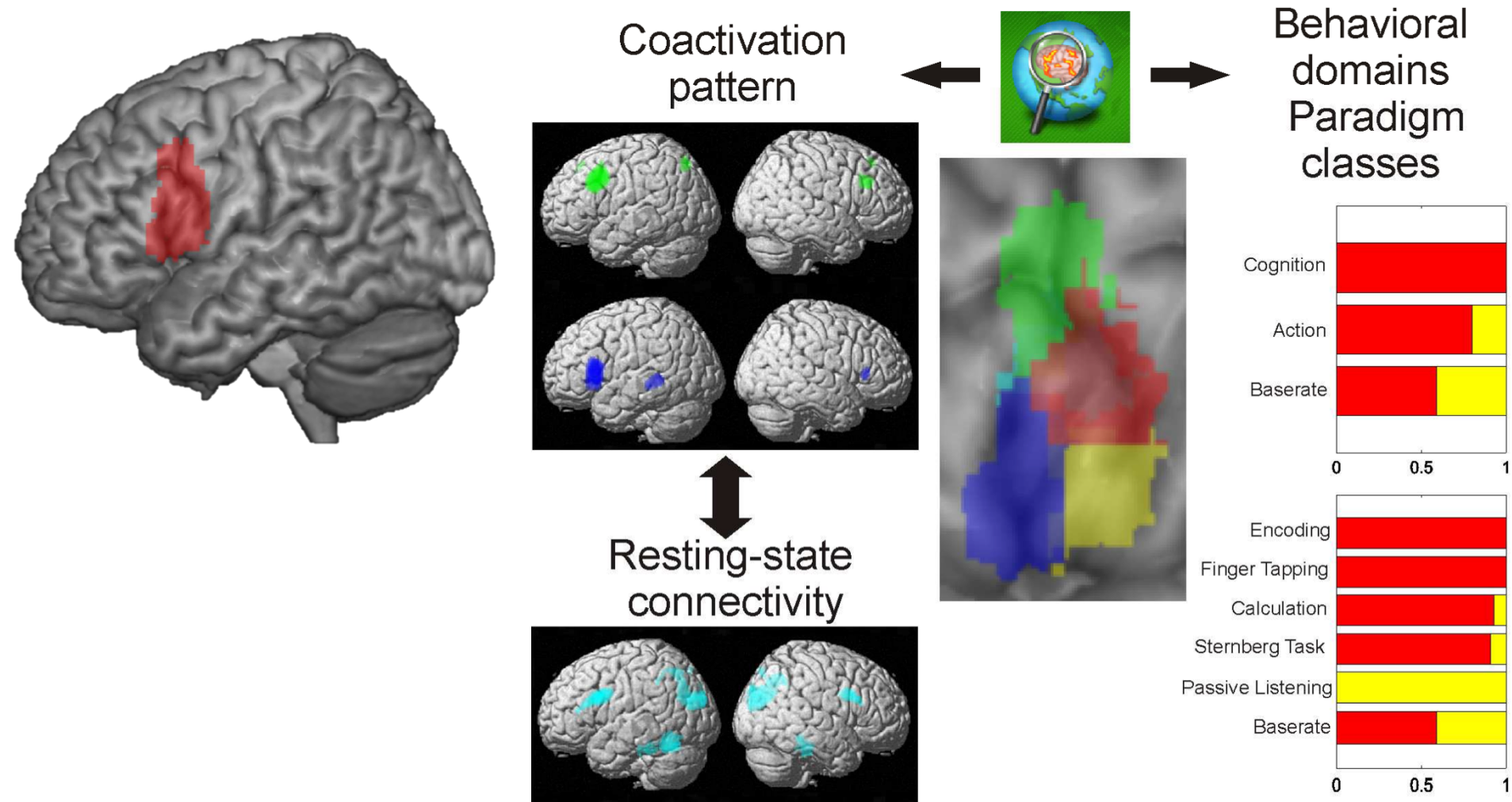
Volume Viewer



Further analyses

<http://anima.fz-juelich.de>

# CBP-pipelines developed at the INM-1



Mapping cortical segregation, connectivity and functions

Quantitative evaluation of each parameter

*Clos et al., Neuroimage 2013*  
*Fox et al., Ann Rev Neurosci, 2014*  
*Eickhoff et al., Hum Brain Mapp 2015*