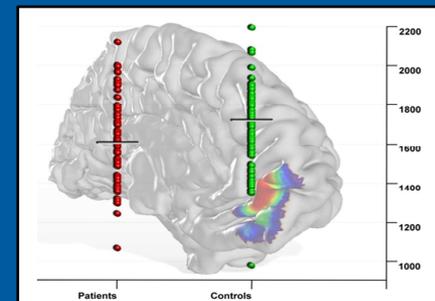
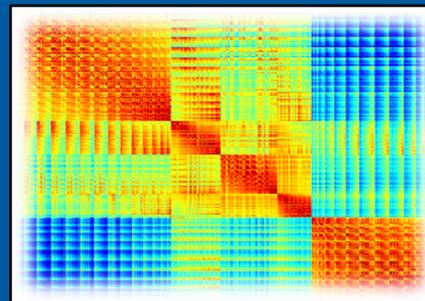
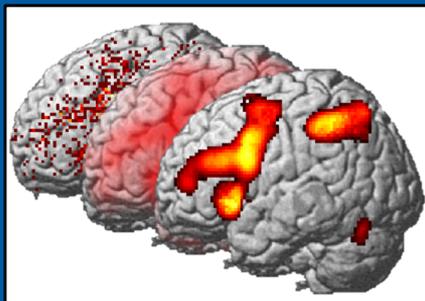
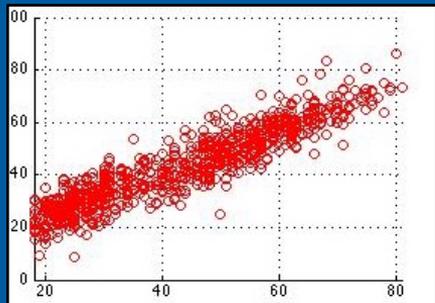


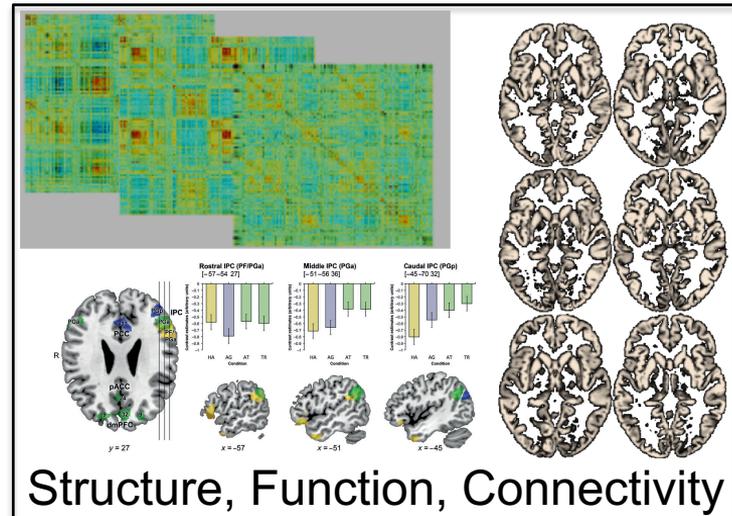
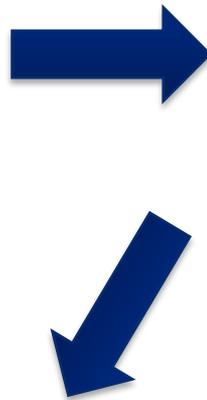
Bridging the gap: From large-scale aggregation to individual prediction



Simon B. Eickhoff
INM-7, Brain & Behaviour
Systems Neuroscience, HHU Düsseldorf

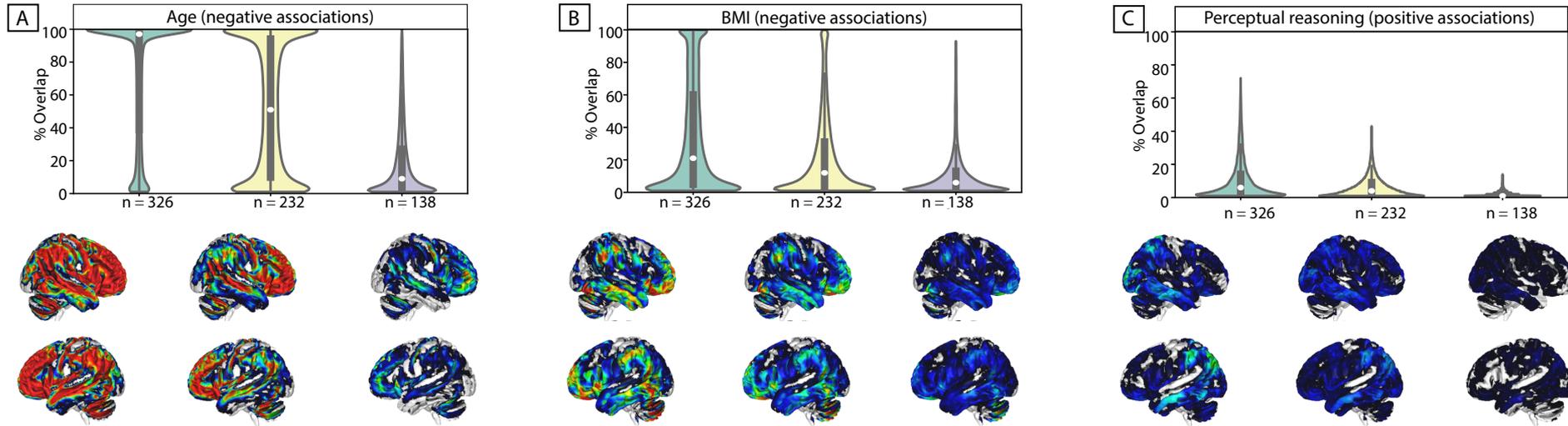


Experience, Health, Lifestyle ...



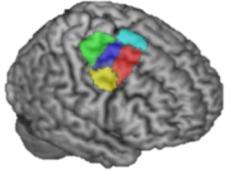
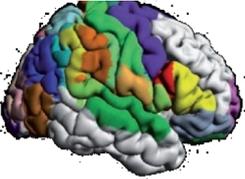
Cognitive performance, socio-affective functions, (psycho-) pathology

Brain-phenotype association need large samples



Clear gradient of replicability across phenotypes
Previous studies for cognitive traits likely underpowered

Atlases and
Parcellations



Prior knowledge on brain organization

Imaging
Behaviour
Genetics



Standardized Processing Pipelines

Human Brain Project

The Neuroinformatics Platform

Brain's Network Model

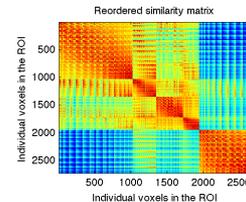
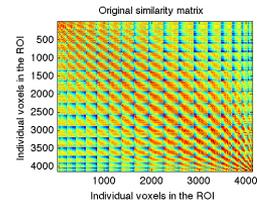
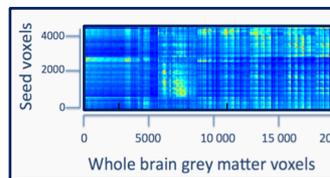
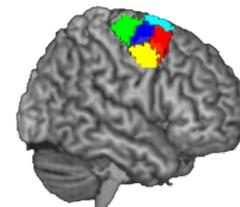
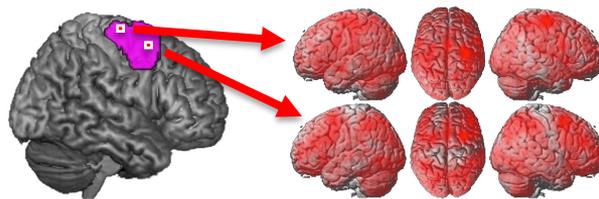
Dynamical Model of Local Brain area

Structural Neuroanatomical link

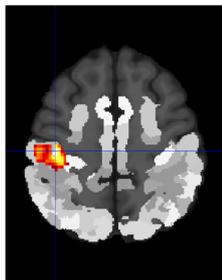
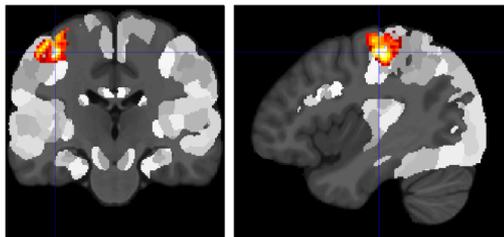
High-throughput analytics & Simulation

Machine-learning of variability & brain-behaviour
relations in health and disease

Mapping brain areas across scales and features



Crosshair Position		Hide Crosshair	
mm:	-40.0 -22.0 54.0	BBox (nonzero)	<input type="checkbox"/>
vx:	57.0 111.0 133.0	Colormap "hot"	<input type="checkbox"/>
Cytoarchitecture			
Area 4p (PreCG)			
45.8%	Area 4a (PreCG)		
39.1%	Area 4p (PreCG)		
1.1%	Area 3b (PostCG)		
<input type="button" value="Add SPM"/>			
<input type="button" value="Add Image"/>			
<input type="button" value="Remove"/>			
SPM: Right > Left Response [p<0.05 (FWE), k=25]			
(625 vox): -40 / -22 / +54 (8): -40 / -22 / +54			
Assignment based on Maximum Probability Map			
30.5% in Area 3b (PostCG) [15.0 activated]			
21.7% in Area 4p (PreCG) [18.4 activated]			
12.6% in Area 4a (PreCG) [5.4 activated]			
10.5% in Area 1 (PostCG) [5.1 activated]			
8.9% in Area 2 (PostCS) [4.1 activated]			
Probability exceedance (under cluster vs. entire map)			
1.90 [1.81; 2.00] for Area 4p (PreCG)			
1.74 [1.68; 1.80] for Area 3b (PostCG)			
1.15 [1.10; 1.20] for Area 4a (PreCG)			
1.08 [1.03; 1.13] for Area 1 (PostCG)			
0.95 [0.90; 1.00] for Area 2 (PostCS)			
Top probabilities at peak voxels (union)			
0.97 for Area 4a (PreCG)			
0.96 for Area 4p (PreCG)			
0.88 for Area 3b (PostCG)			
0.65 for Area 1 (PostCG)			



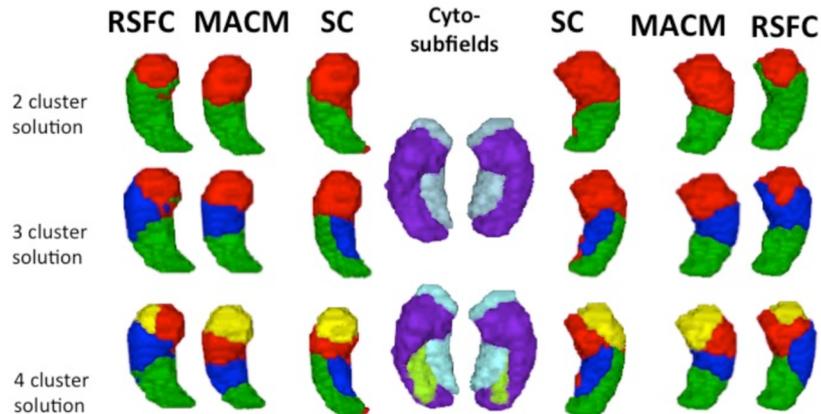
Macroanatomy: Precentral Gyrus

33.0% Precentral Gyrus
28.0% Postcentral Gyrus

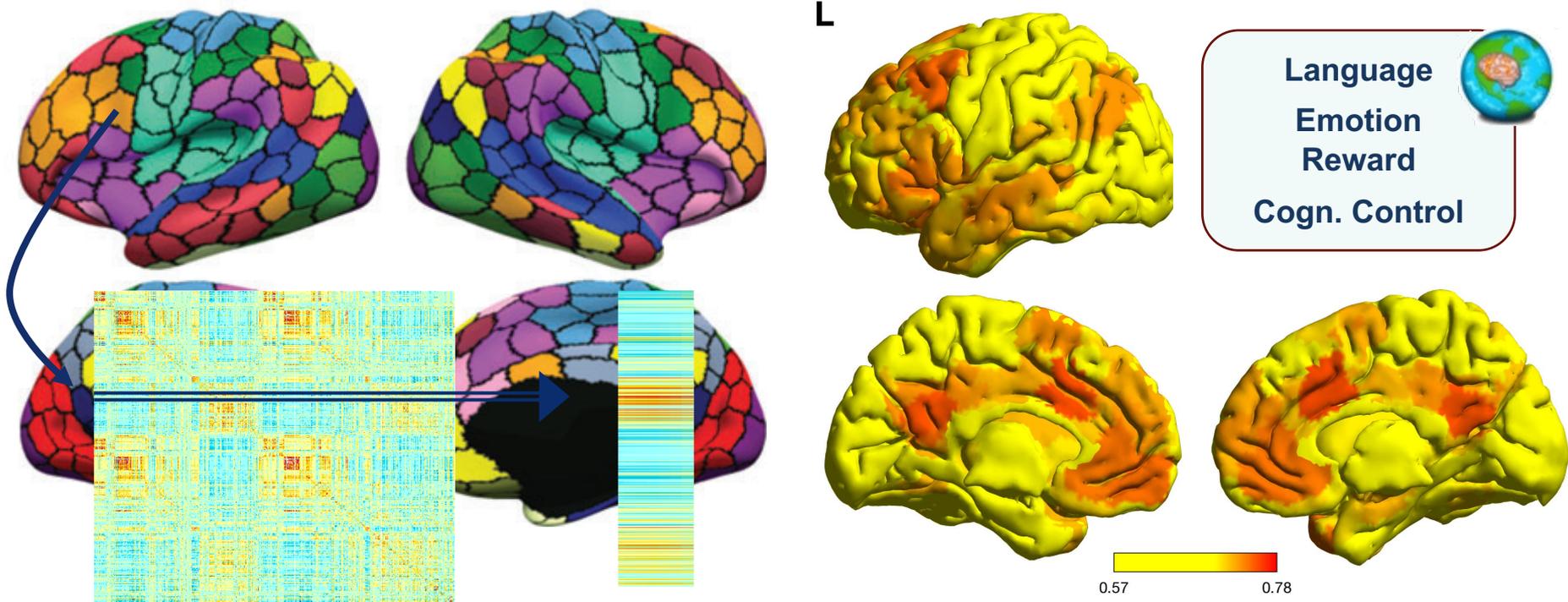
Assignment based on Maximum Probability Map
65.9% in Postcentral Gyrus [7.6 activated]
18.6% in Precentral Gyrus [1.8 activated]

Probability exceedance (under cluster vs. entire map)
1.72 [1.71; 1.79] for Postcentral Gyrus
0.97 [0.93; 1.00] for Precentral Gyrus

Top probabilities at peak voxels (union)
0.99 for Postcentral Gyrus
0.93 for Precentral Gyrus

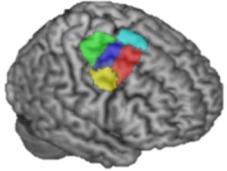
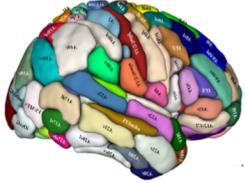


Mapping fingerprint – phenotype relationships



**Can we accurately predict sex of a new subject from region-wise FC profiles?
(SVM, nested optimization, between-sample prediction, N=434 / 310)**

Atlases and
Parcellations



Consolidated
functional data



ANIMA

Prior knowledge on brain organization

Imaging
Behaviour
Genetics



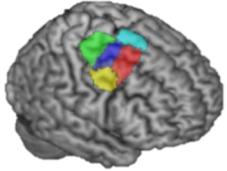
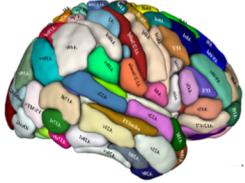
Standardized Processing Pipelines

High-throughput analytics & Simulation

The box contains three main components: 1) The Human Brain Project logo, a colorful faceted sphere with "HP" in the center. 2) "The Neuroinformatics Platform" showing a server room with a "JURECA" sign. 3) "Brain's Network Model" showing a brain with a network of red nodes and green links, with a legend for "Dynamical Model of Local Brain area" and "Structural Neuroanatomical link".

Machine-learning of variability & brain-behaviour
relations in health and disease

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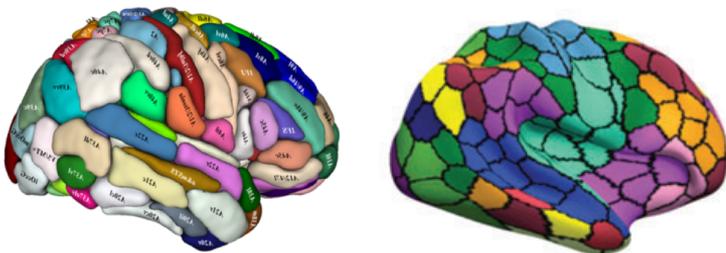
High-throughput analytics & Simulation

- Dynamical Model of Local Brain area
- Structural Neuroanatomical link

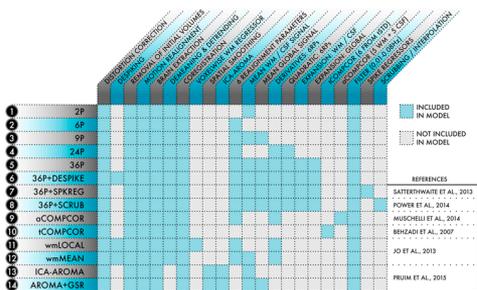
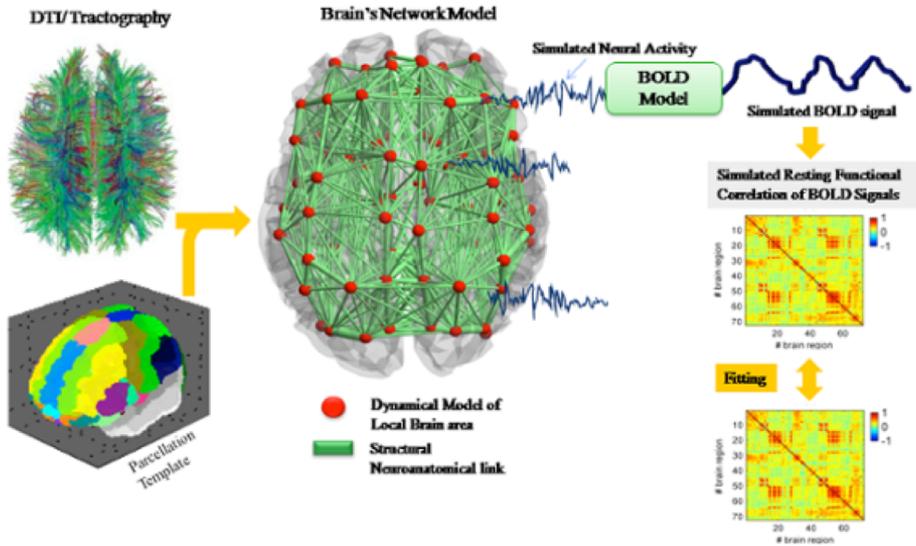
Simulation

Machine-learning of variability & brain-behaviour
relations in health and disease

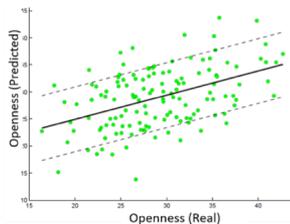
Mesoscopic modelling of whole-brain dynamics



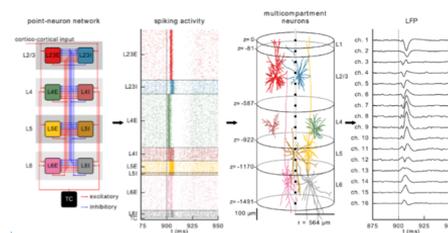
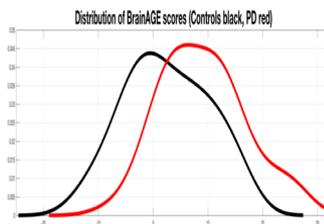
Evaluation of parcellations and granularities



Comparison of pre-processing pipelines



Dynamic features of variability



Bridging the scales



DFG



Aachen

Danilo Bzdok
Kathrin Reetz
Frank Schneider
Karl Zilles

Düsseldorf / Jülich

Katrin Amunts
Svenja Caspers

Oxford

Thomas Nichols

Maryland

Peter Kochunov

San Antonio

Peter Fox

Miami

Angela R. Laird

Beijing

Tianzi Jiang
Lingzhong Fan

Philadelphia

Christos Davatzikos

Singapore

Thomas Yeo

Stanford

Amit Etkin

Teheran

Masoud Tahmasian