

MODELING BRAIN DYNAMICS IN BRAIN TUMOR PATIENTS USING THE VIRTUAL BRAIN

ENBIT WORKSHOP 31/05/2018

Hannelore Aerts, drs.
Supervisor: Prof. Dr. D. Marinazzo

OVERVIEW

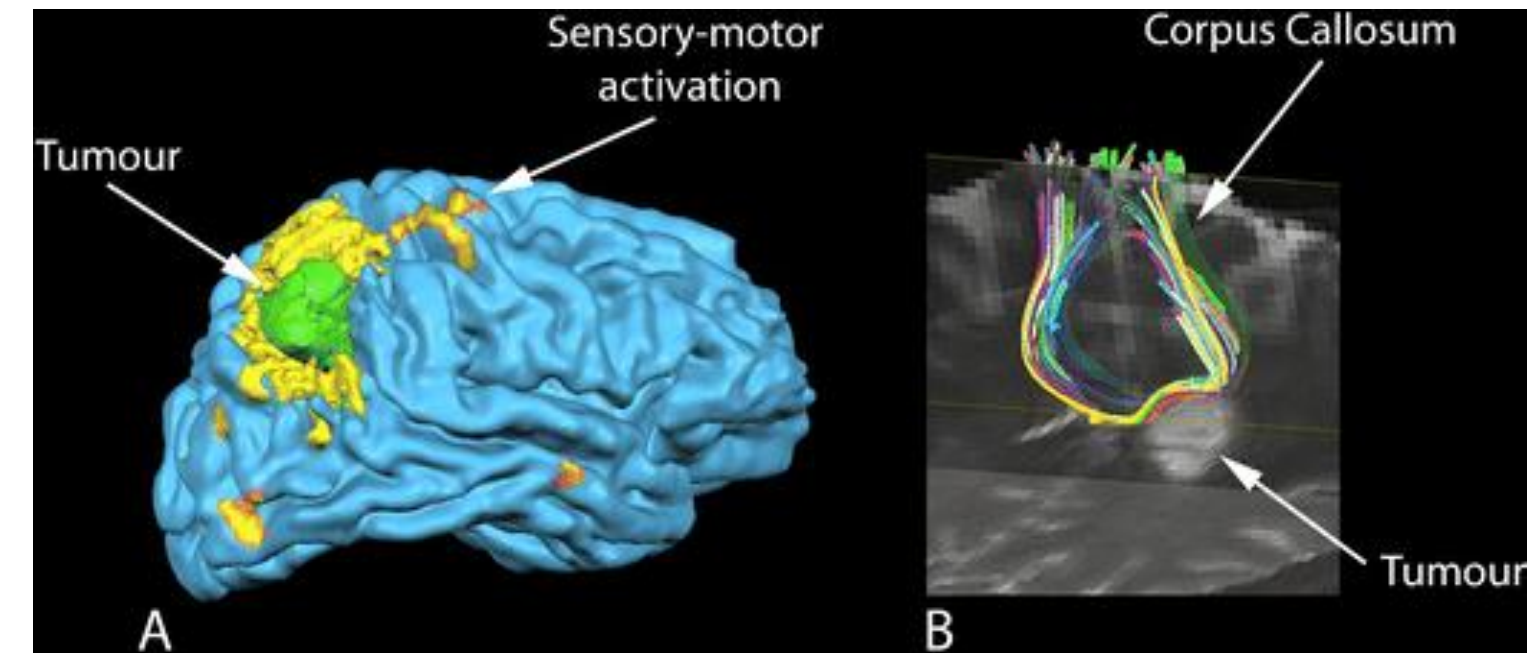
- Introduction
- Data
- Results
- Questions & discussion

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INTRODUCTION

- Presurgical planning for tumor resection using fMRI & DWI



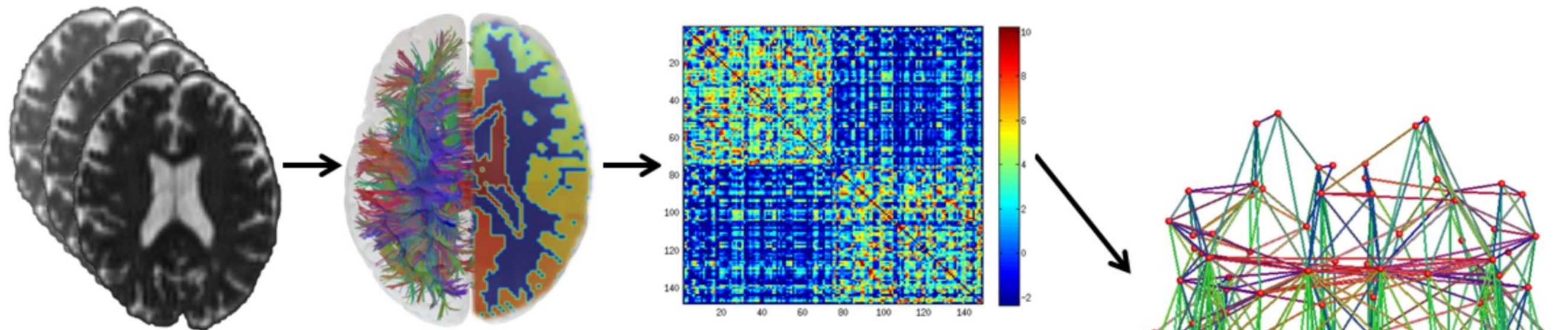
Dimou et al. 2013 (Neurosurgical Review)

- Prediction of outcome still difficult
- Possible solution: computational modeling

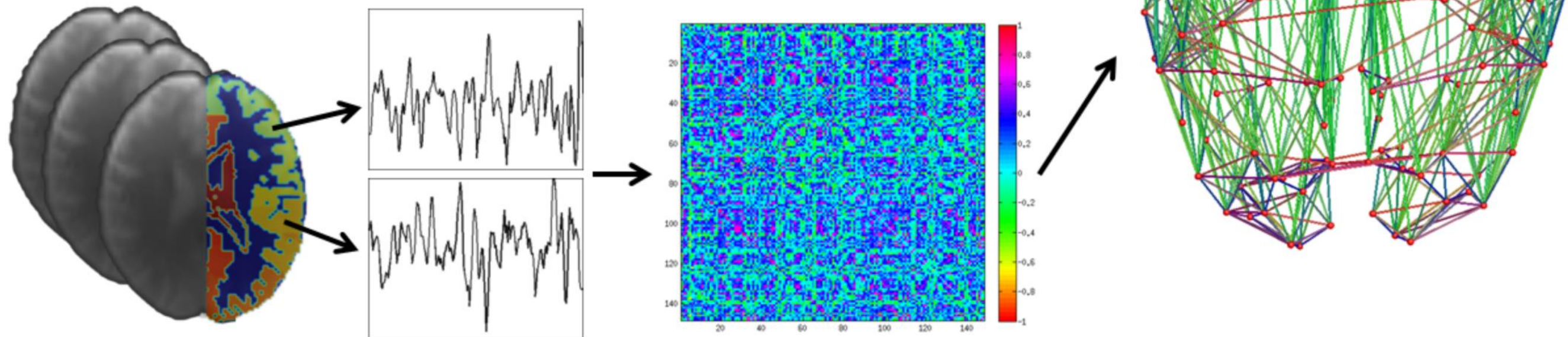
INTRODUCTION

Connectivity matrices

DWI

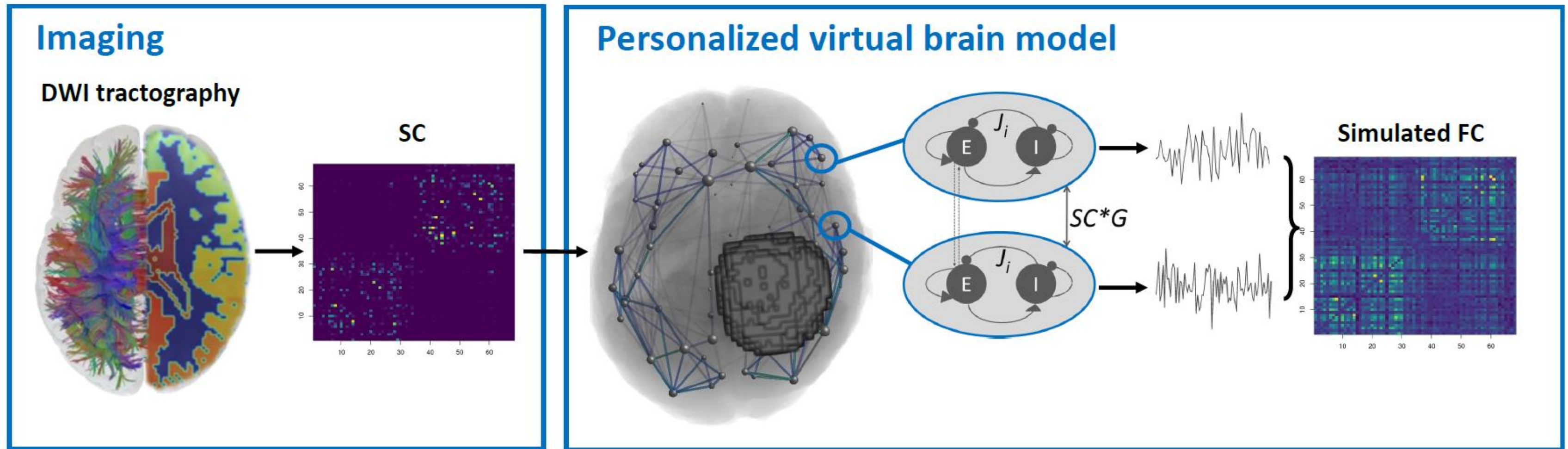


fMRI



INTRODUCTION

Computational modeling workflow

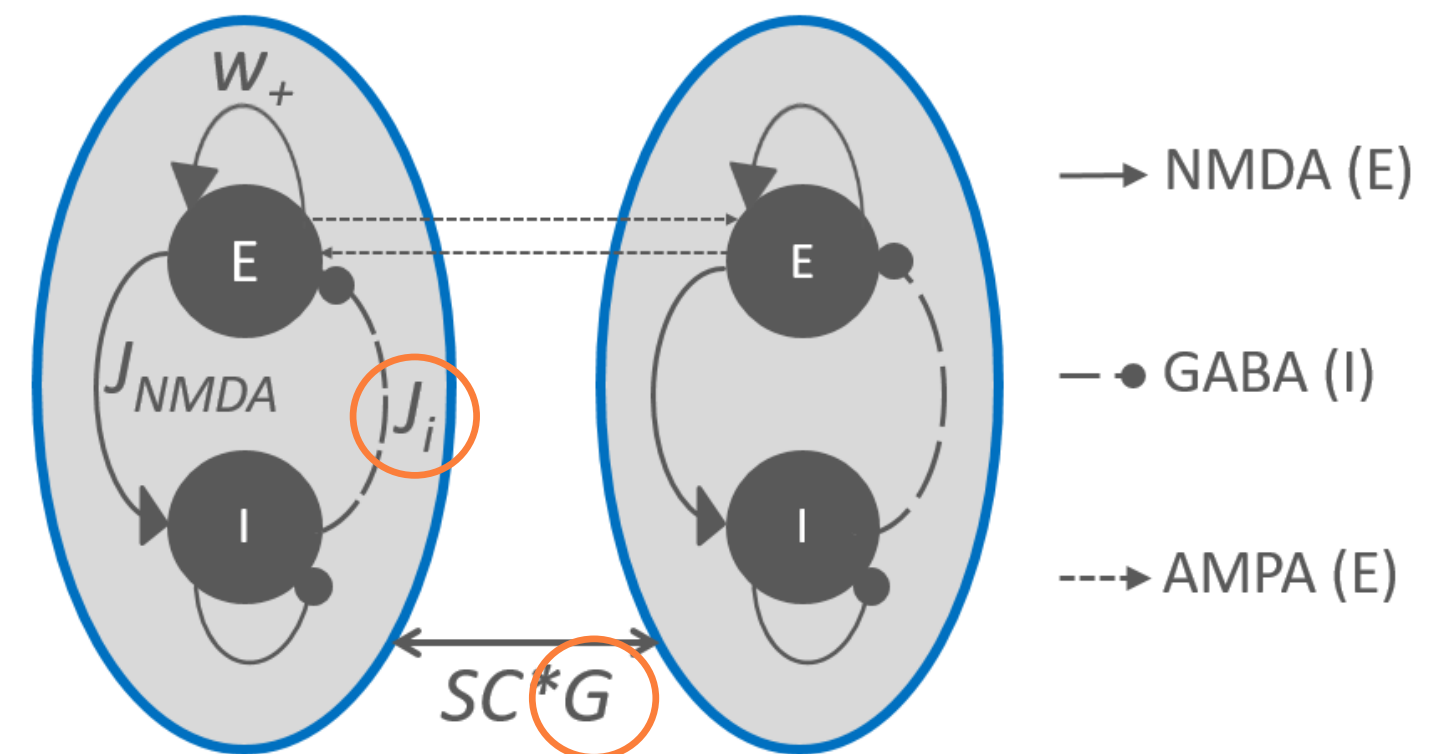


INTRODUCTION

- Select plausible model: Reduced Wong-Wang model (*Deco et al. 2014*)



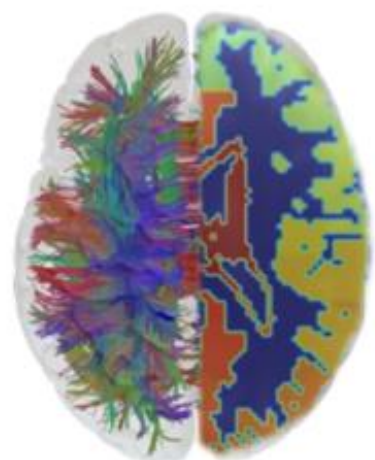
- Examine model parameters:
 - between brain tumor patients & controls
 - between tumor and healthy regions



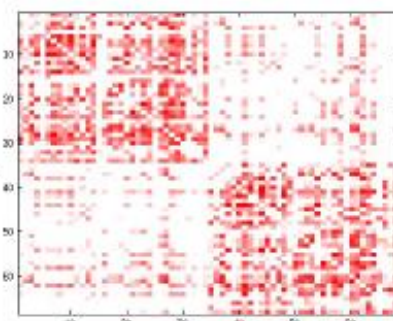
INTRODUCTION

Imaging

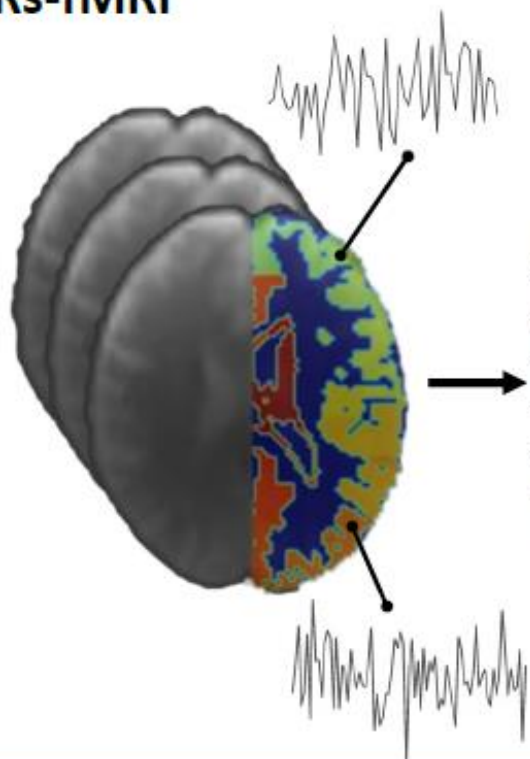
DWI tractography



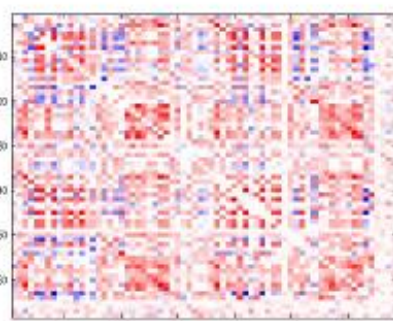
SC



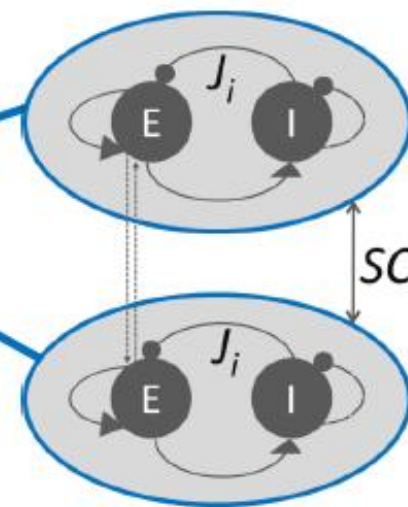
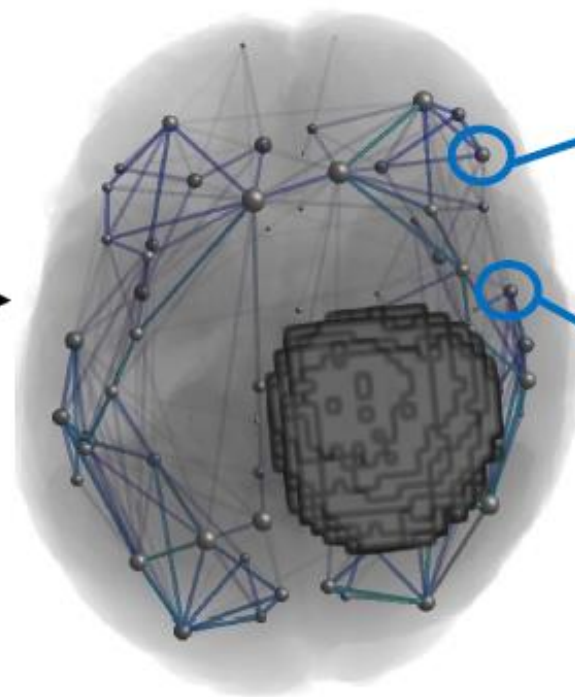
Rs-fMRI



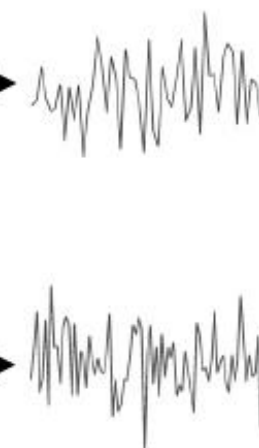
Empirical FC



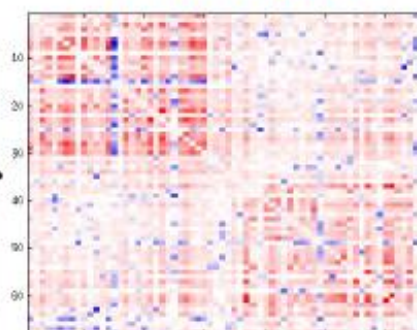
Personalized virtual brain model



$SC * G$

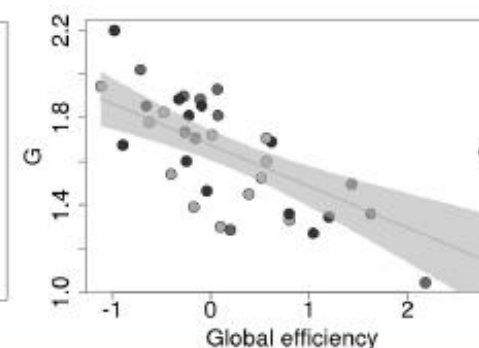
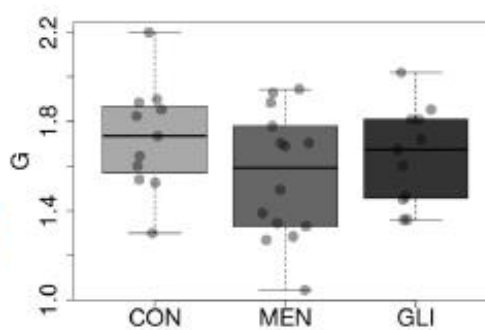


Simulated FC

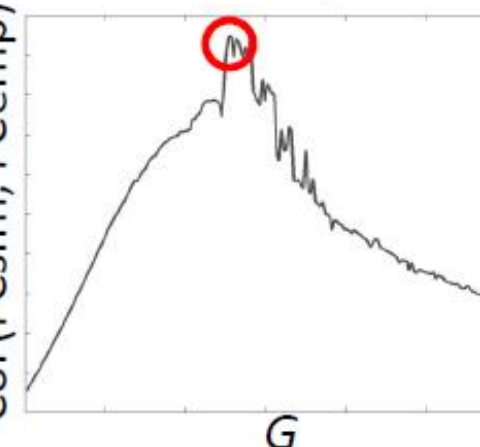


Identify individual model parameters

& run statistics



Cor(FCsim, FCemp)



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Subjects

14 meningioma patients (MEN)

13 grade I, 1 grade II

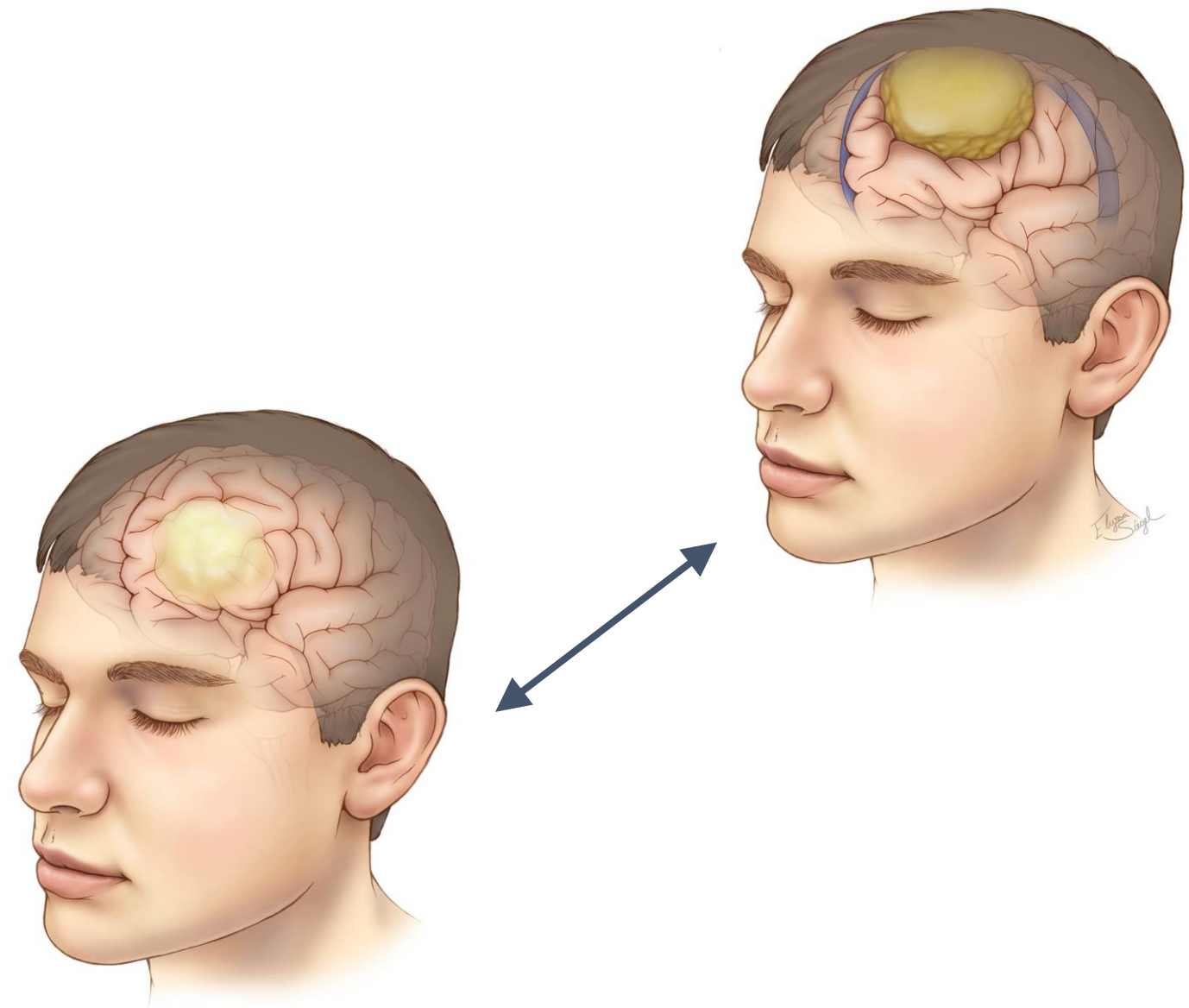
6 left hem, 5 right hem, 3 bilateral

11 glioma patients (GLI)

7 grade II, 1 grade II-III, 3 grade III

6 left hem, 5 right hem

11 control subjects (CON)



DATA

Measures

MRI: T1w, DWI, rs-fMRI

Cognition: reaction time, working memory, planning accuracy, spatial span length

Questionnaires: demographics, lifestyle, emotional functioning, social functioning

→ Data on OpenNeuro & ENBIT repository soon!

ENBIT workshop 31/05/2018



OVERVIEW

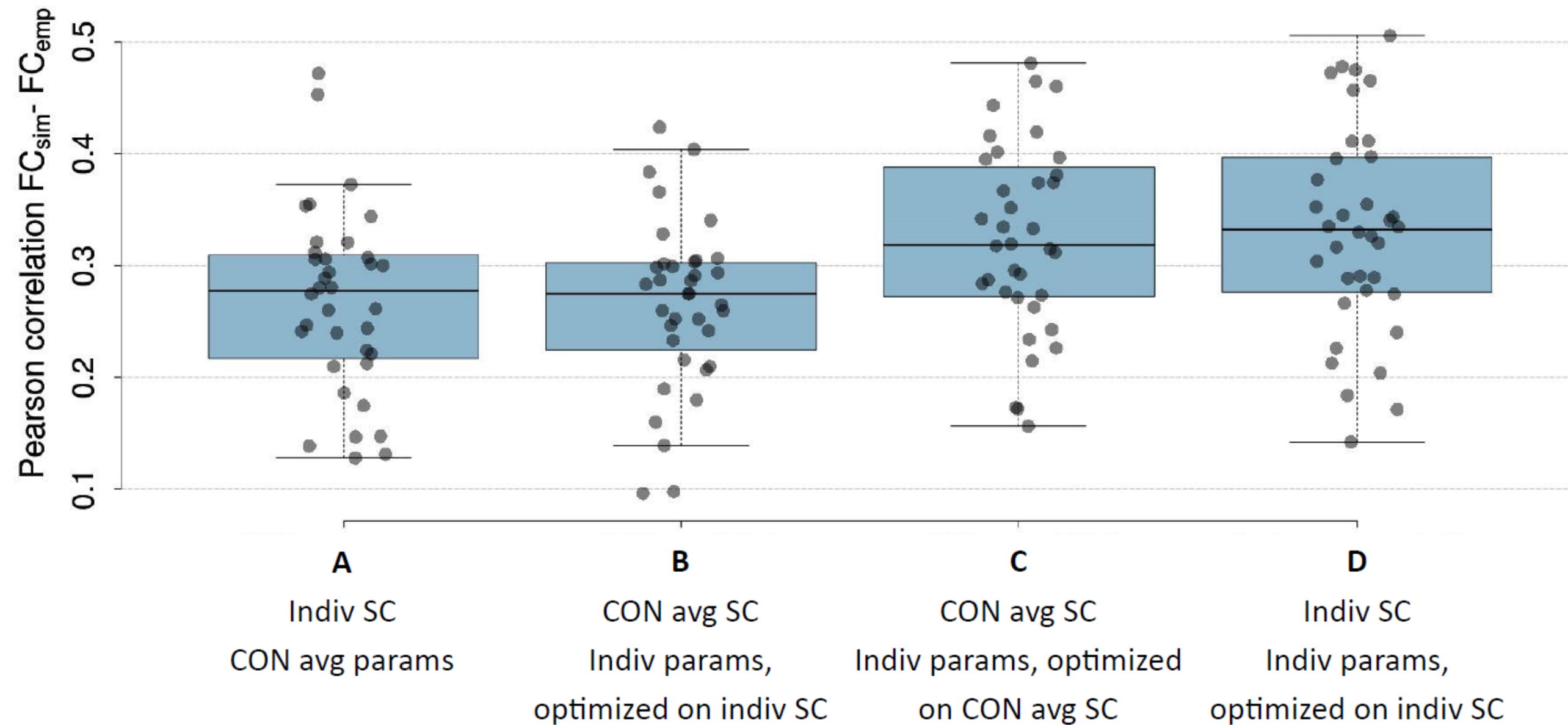
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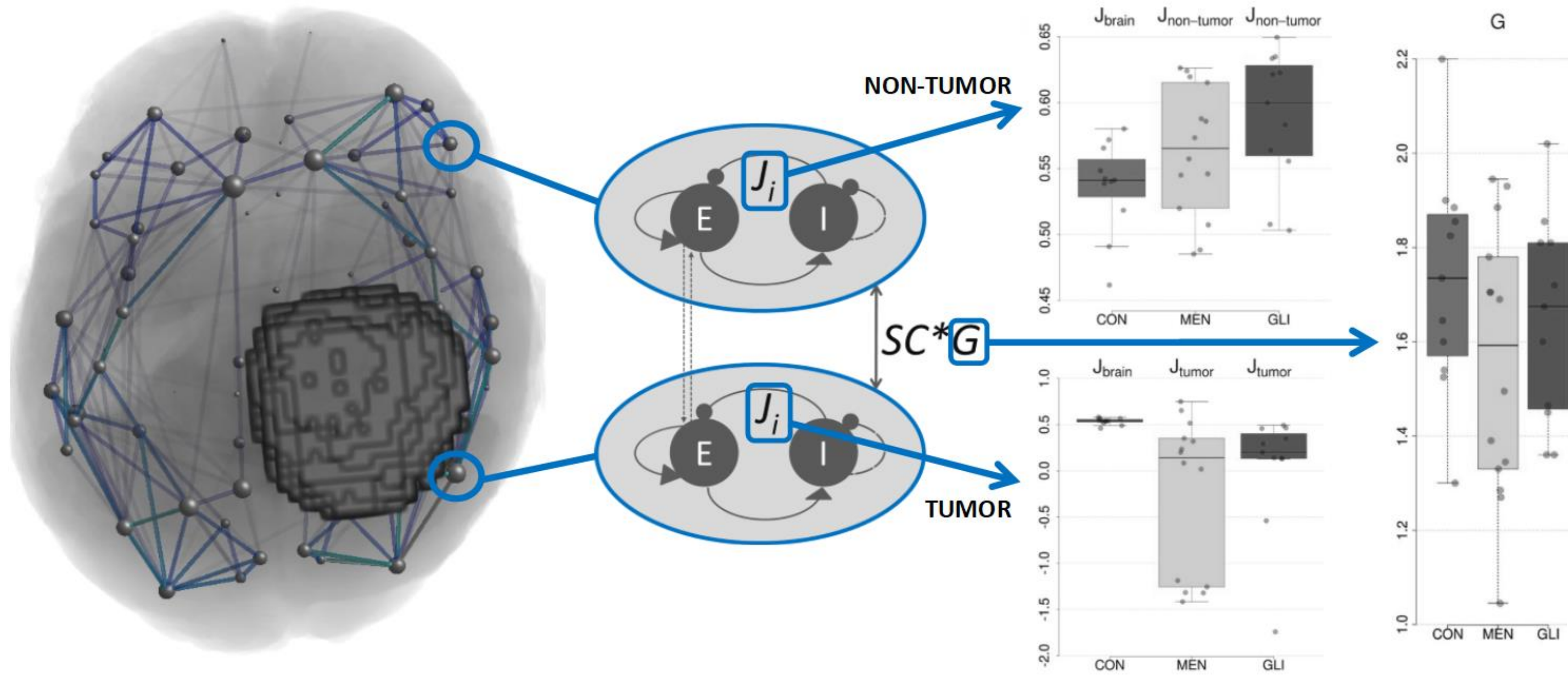
RESULTS

(1) Importance of personalized virtual brain models



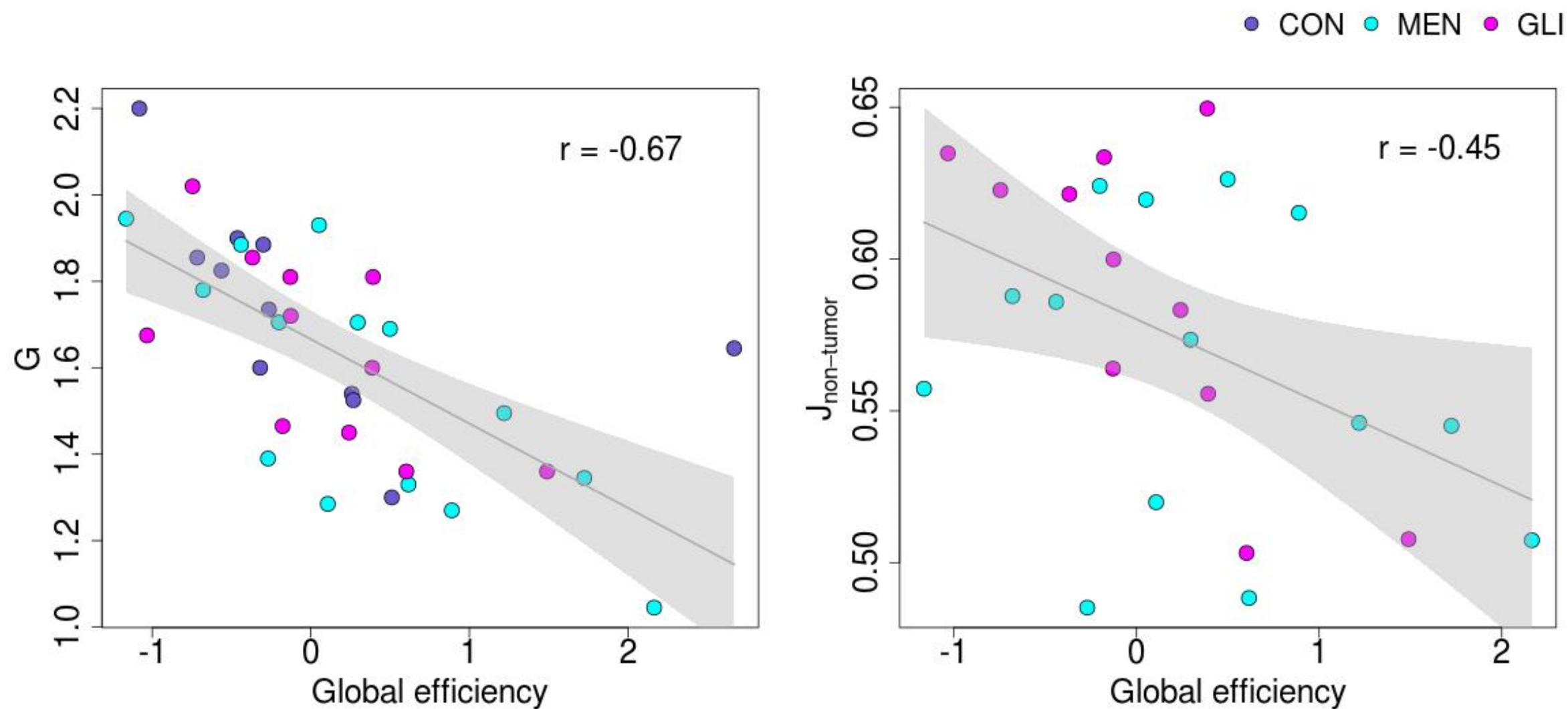
RESULTS

(2) Group differences in model parameters



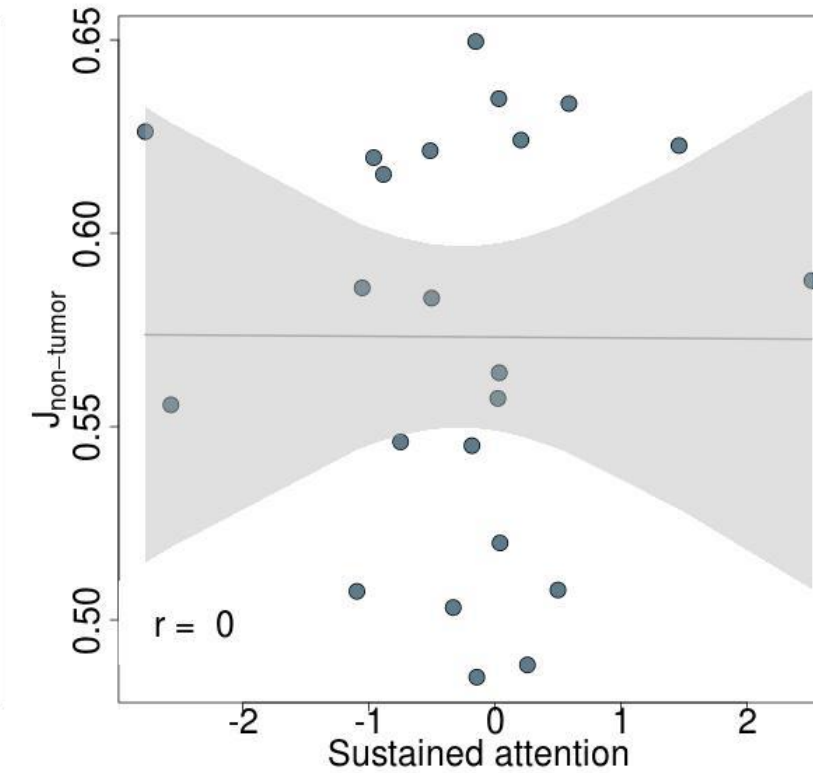
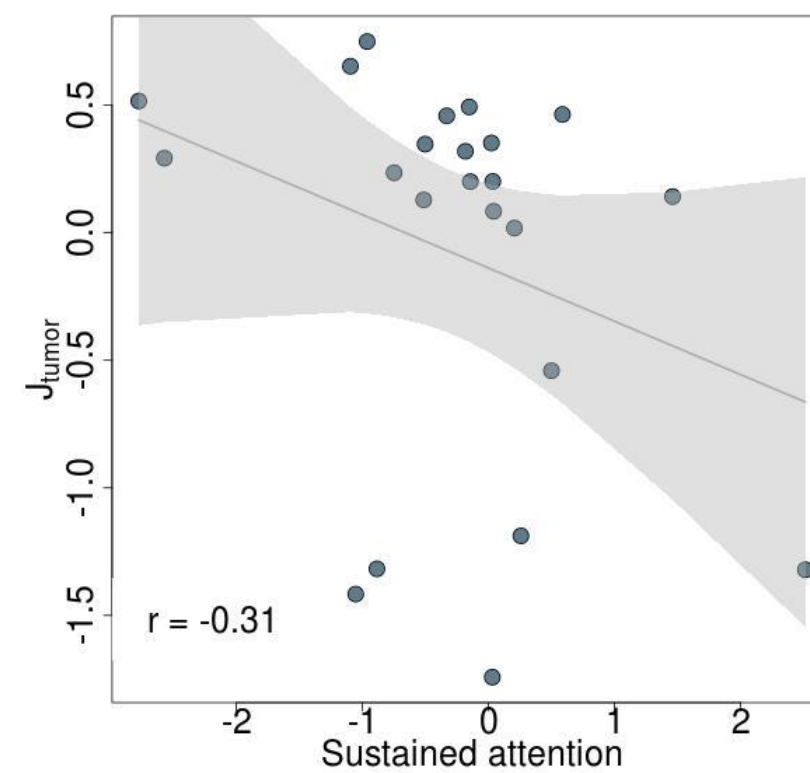
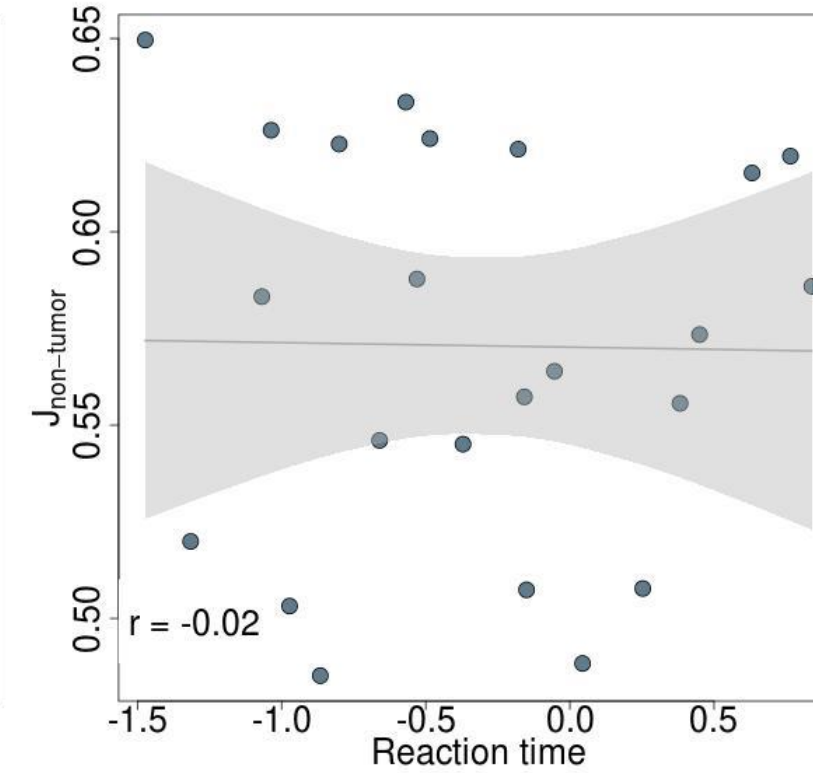
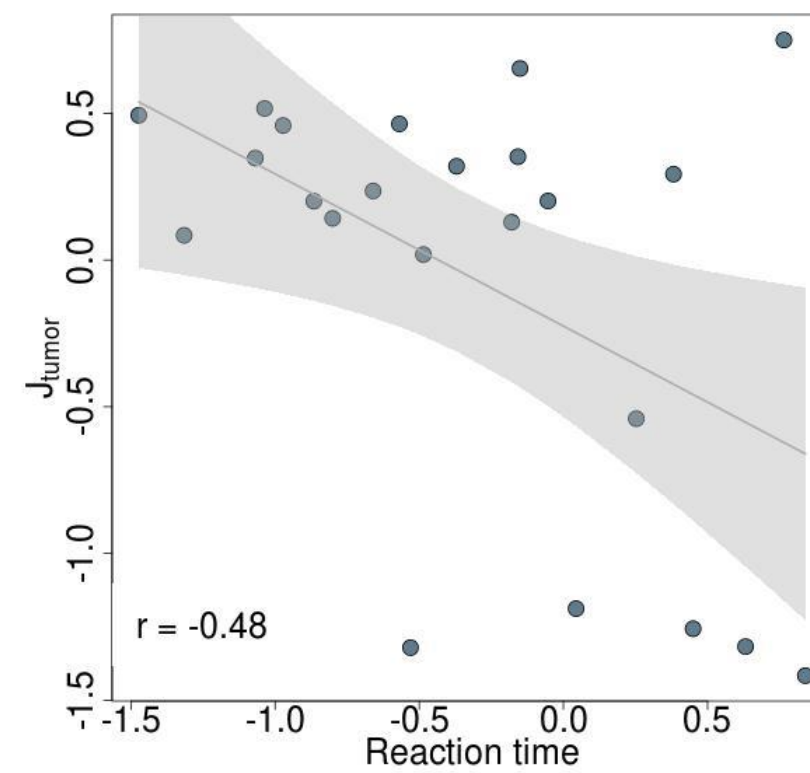
RESULTS

(3) Model parameters correlate with structural network topology



RESULTS

(3) ... and cognition



RESULTS

More information:
see paper



Research Article: New Research | Novel Tools and Methods

Modeling Brain Dynamics in Brain Tumor Patients Using the Virtual Brain

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Thank you for your attention!

Questions, comments,
feedback, ideas, ...?

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