

ENBIT workshop

NETWORKS AND COGNITION IN BRAIN TUMORS

May 31st 2018

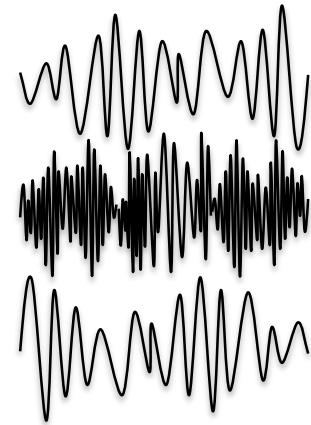
linda douw (l.douw@vumc.nl)

pertur-
bation



understanding human behavior through brain network theory

time



scale





VU University
Medical Center
Amsterdam



Amsterdam
Neuroscience

← ⏪ ⏴ ⏵ ⏹ Vorig | <https://www.vumc.nl/afdelingen/hersentumorcentrumamsterdam/>

VUmc Cancer Center Amsterdam
Hersentumorcentrum Amsterdam

PATIËNTEN VERWIJZERS ONDERZOEK ONDERWIJS

Vul een zoekterm in Zoeken

Hersentumorcentrum Amsterdam

Home
Het Hersentumorcentrum
Informatie voor patiënten
Informatie voor verwijzers
Nieuwe behandelingen
Onderwijs
Actueel
Steun ons
In de media
Agenda
Contact

Het hersentumorcentrum Amsterdam

Contactgegevens
Zie contactgegevens in linker menu.

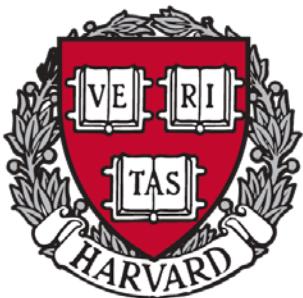
Video: Hoogleraar en neurochirurg Saskia Peerdeman over haar fascinatie voor de hersenen en waarom zij het belangrijk vindt om artsen en medisch specialisten op te leiden.

• Informatie voor patiënten • Informatie voor verwijzers

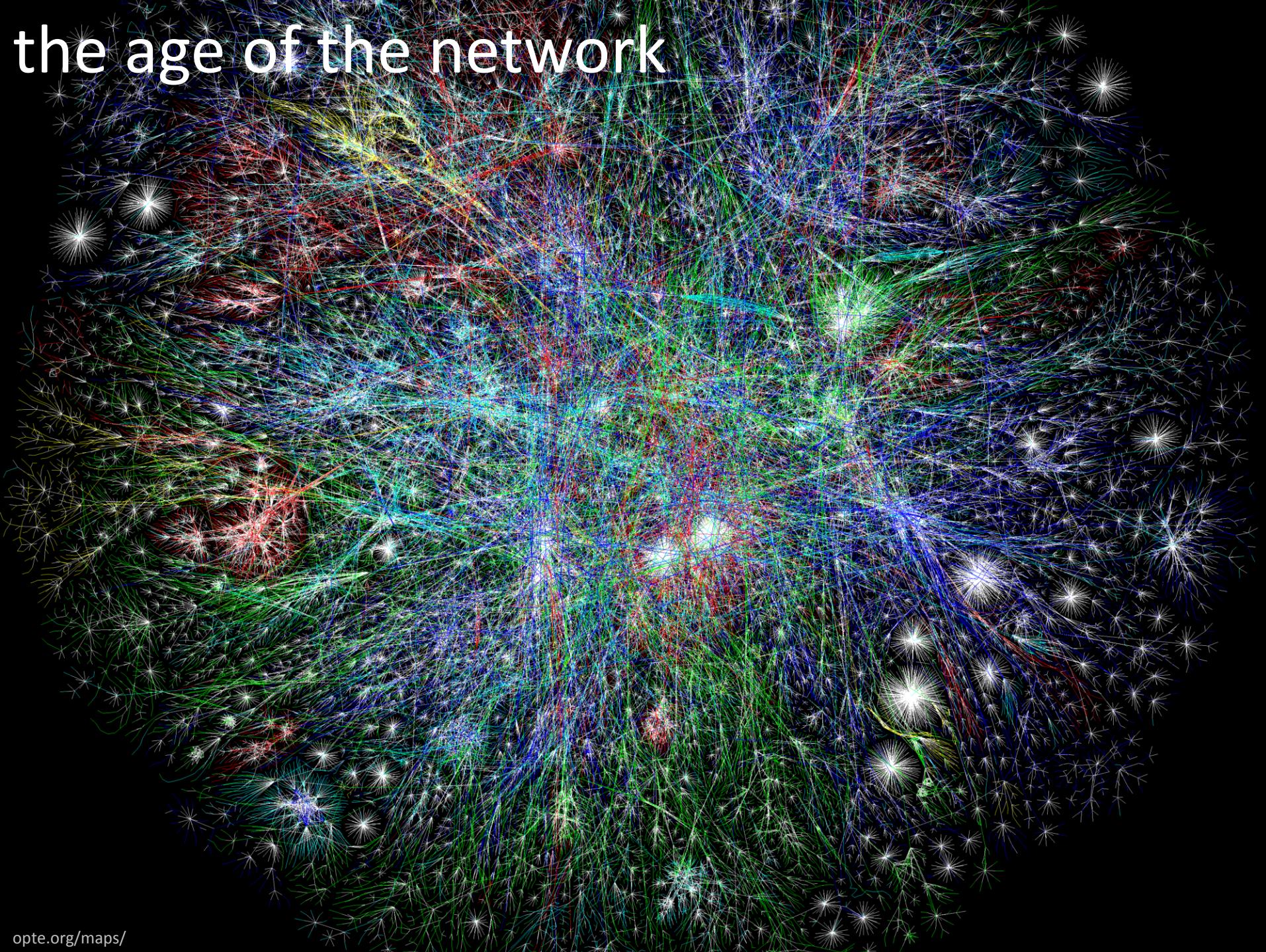
• Experimenteel onderzoek • Steun ons



Athinoula A.
**Martinos
Center**
For Biomedical Imaging

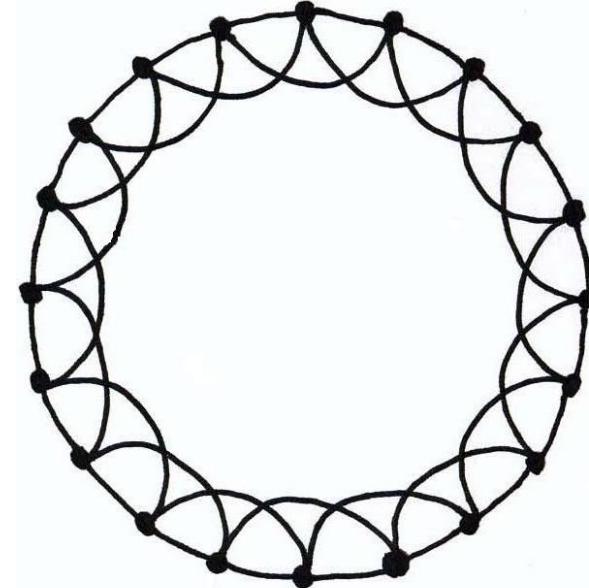


MIT



graph theoretical concepts I

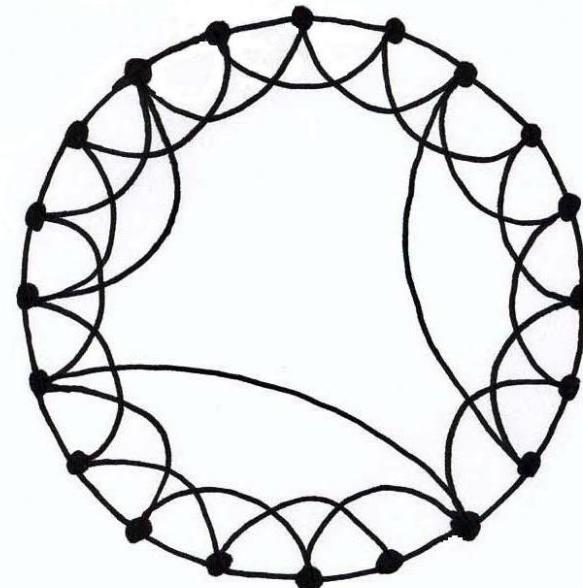
regular



high clustering (C)

high path length (L)

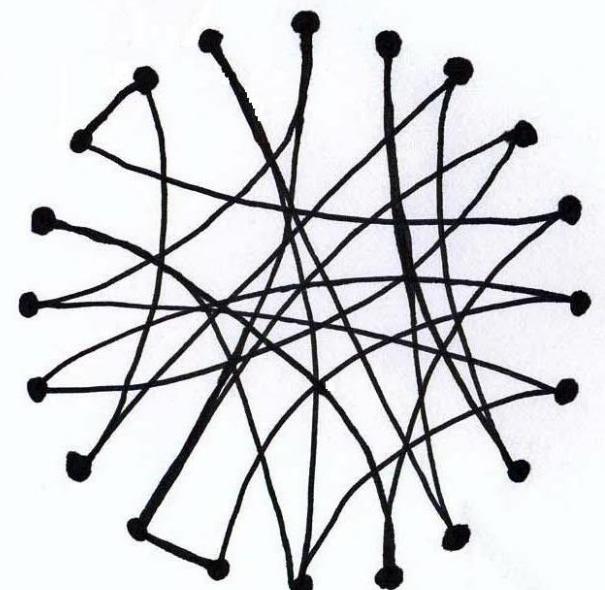
small world



high C

low L

random

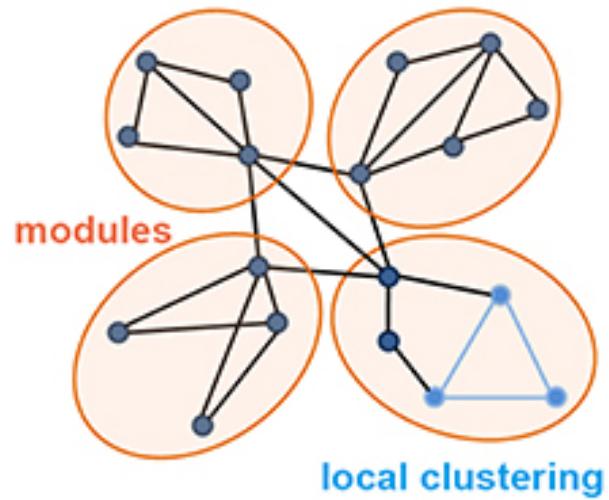


low C

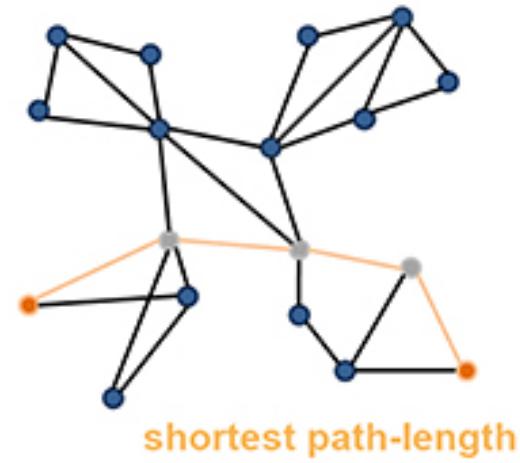
low L

graph theoretical concepts II

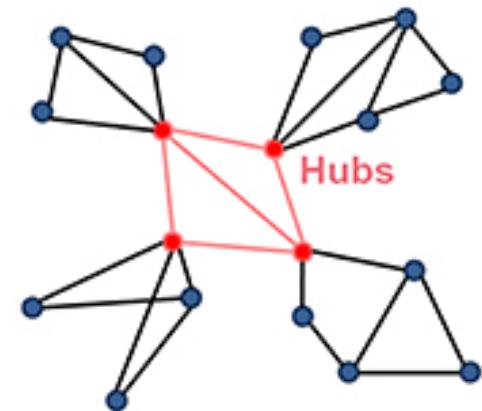
A Network segregation



B Network integration

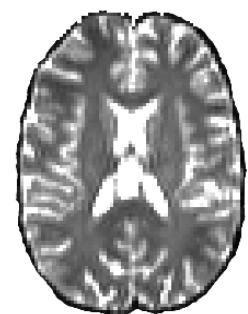


C Hubs and rich-club



overview of brain network methods

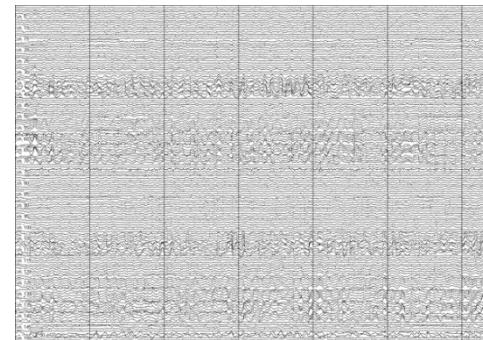
diffusion MRI



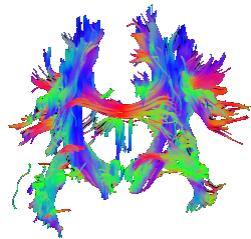
rs-fMRI



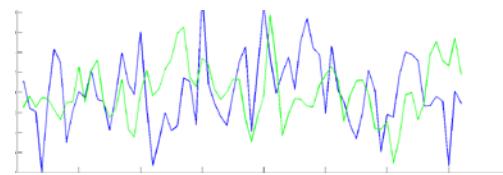
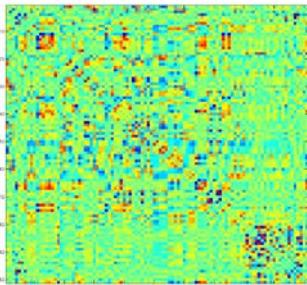
EEG/MEG



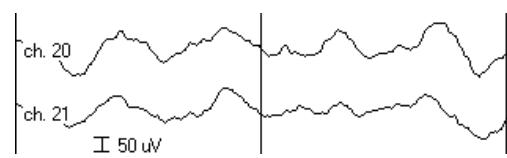
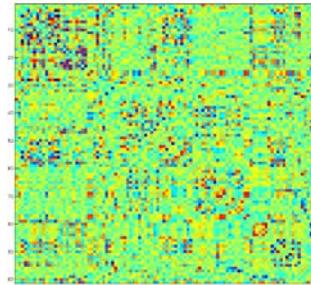
raw data



number/probability of
white matter fibers

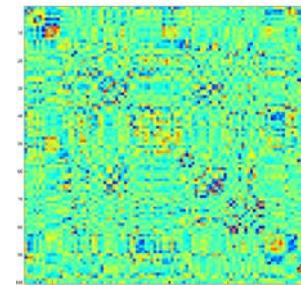


correlation between
time series



correlation between
time series

preprocessing

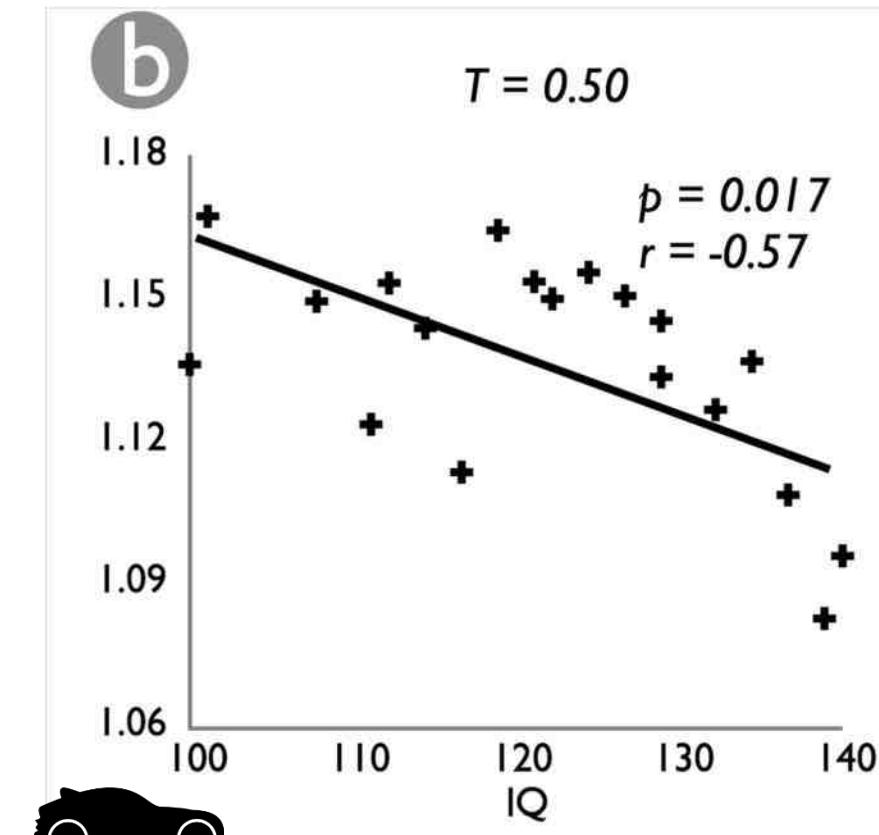


connectivity
extraction

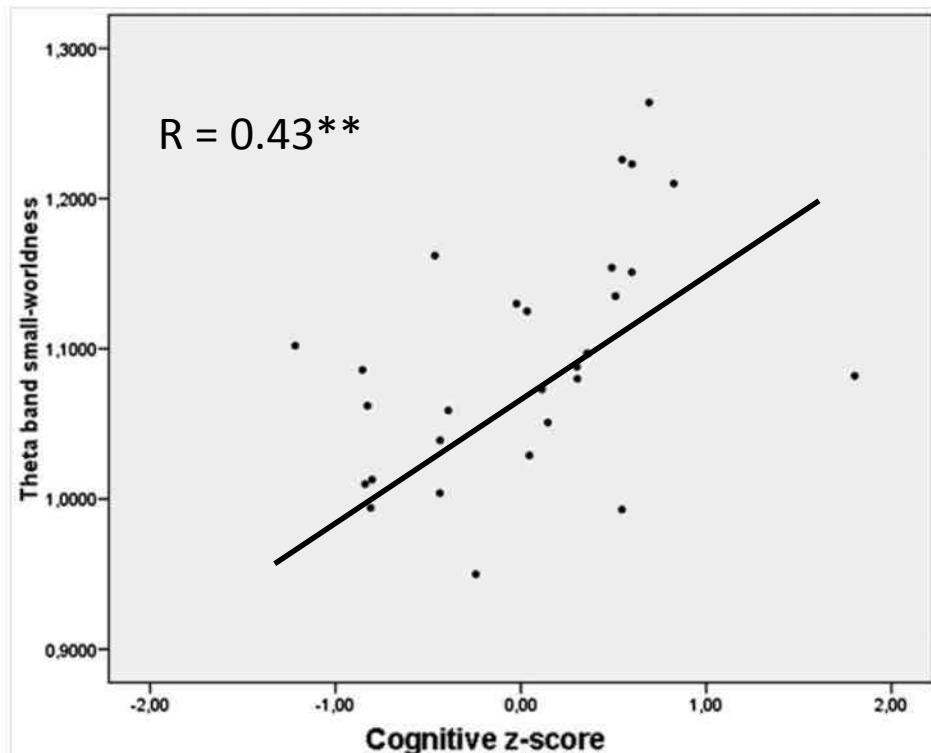
adjacency matrix

global network topology and cognition

IQ
resting-state fMRI path length

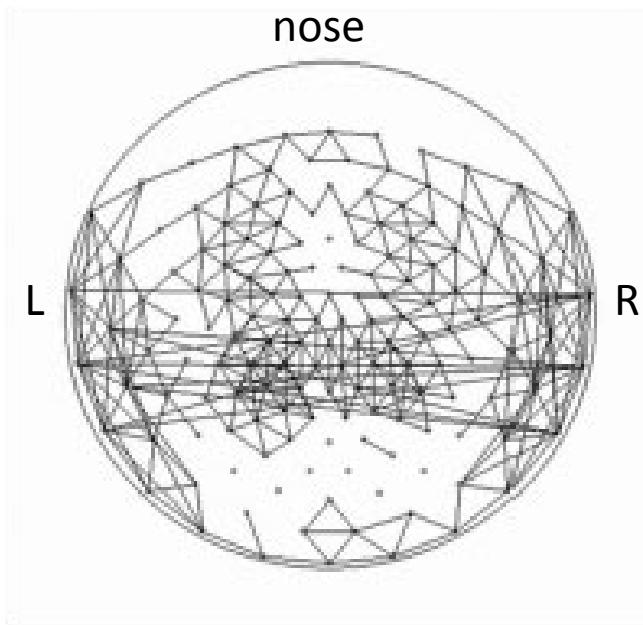


neuropsychological test battery
MEG theta band small worldness

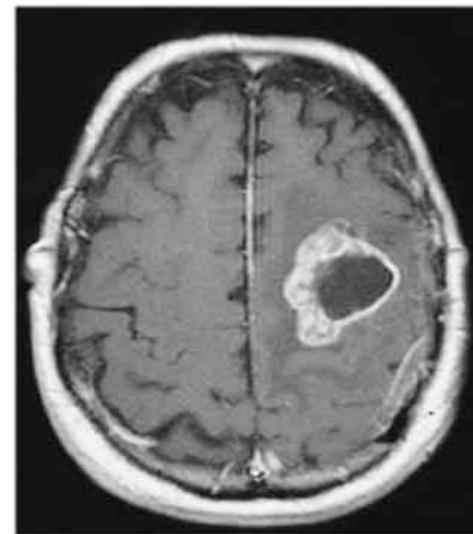


glioma and the functional brain network

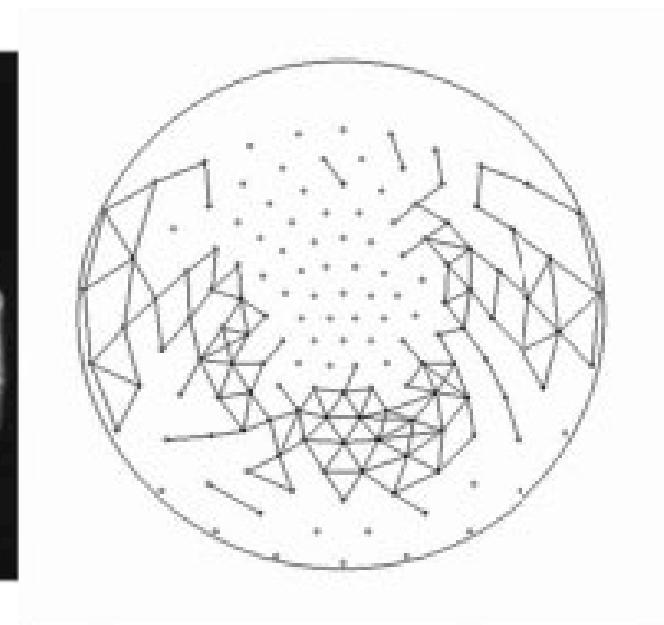
healthy network



patient MRI

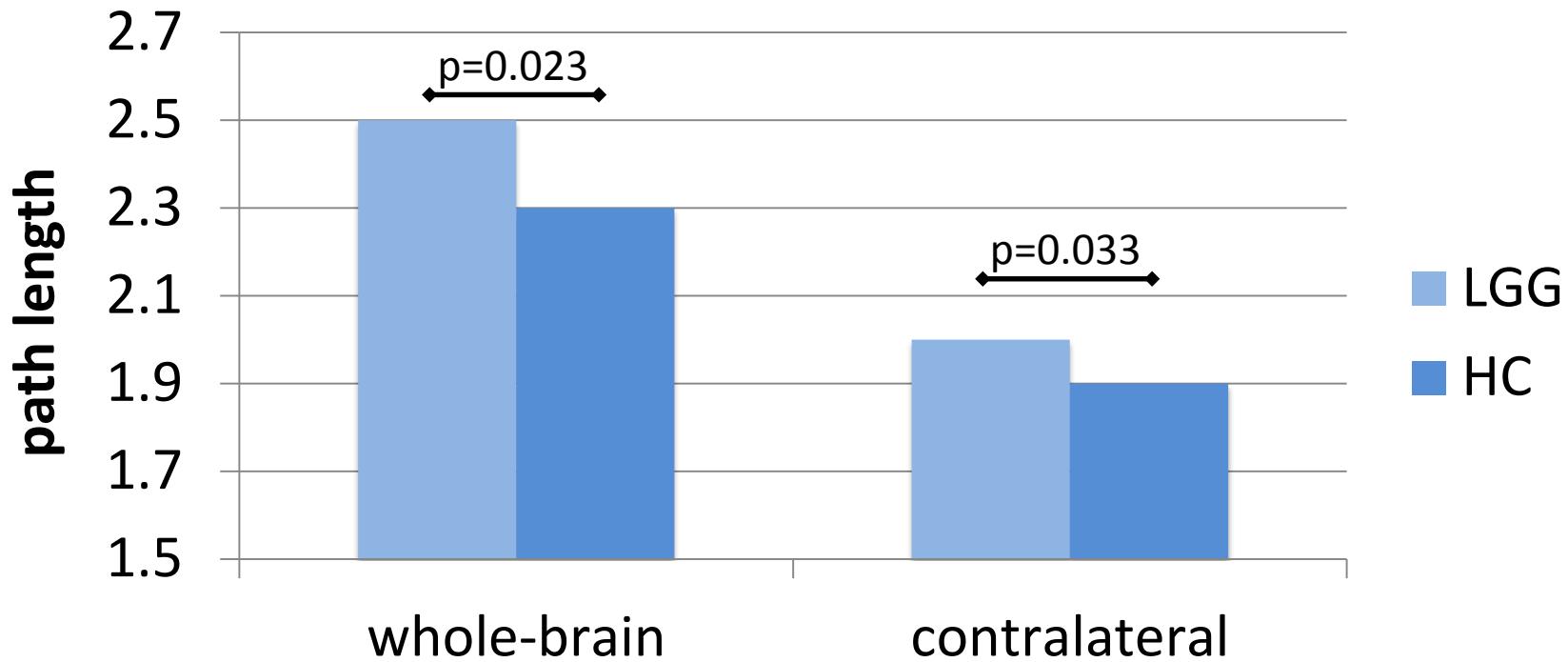


patient network

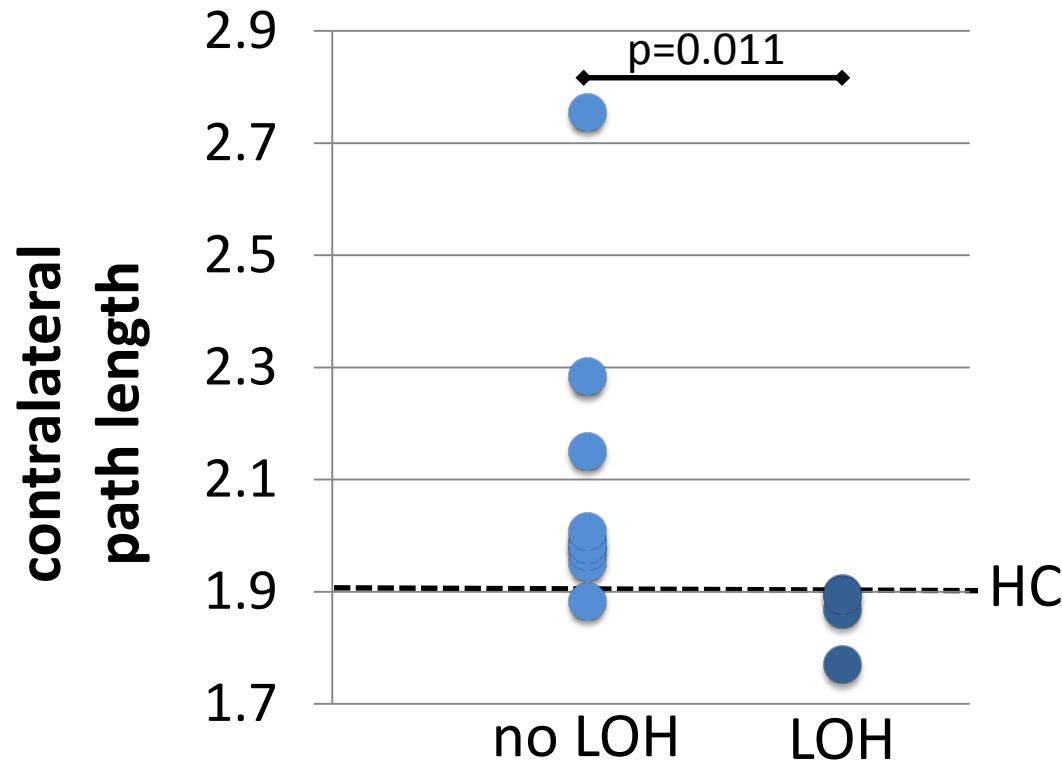


Bartolomei et al (2006) Clin Neurophysiol, van Dellen et al (2012) NeurolImage Clin, van Dellen et al (2012) PLoS ONE, van Dellen et al (2013) NeurolImage, Derkx et al (2014) Curr Opin Oncology, Derkx et al (2017) NeurolImage Clin, Douw et al (2010) BMC Neurosci, Douw et al (2015) SNO

glioma and the anatomical brain network

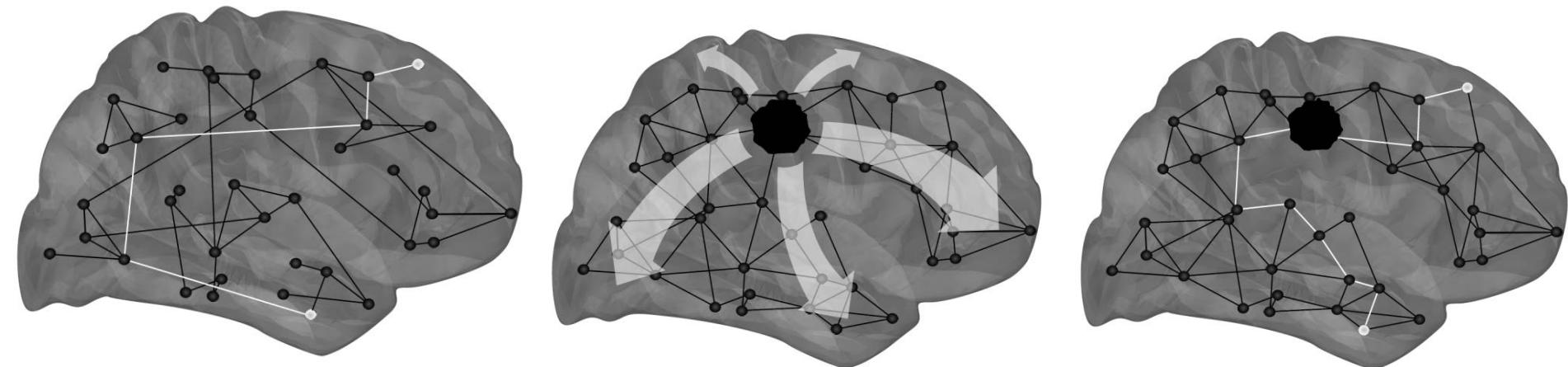


association with molecular subtype



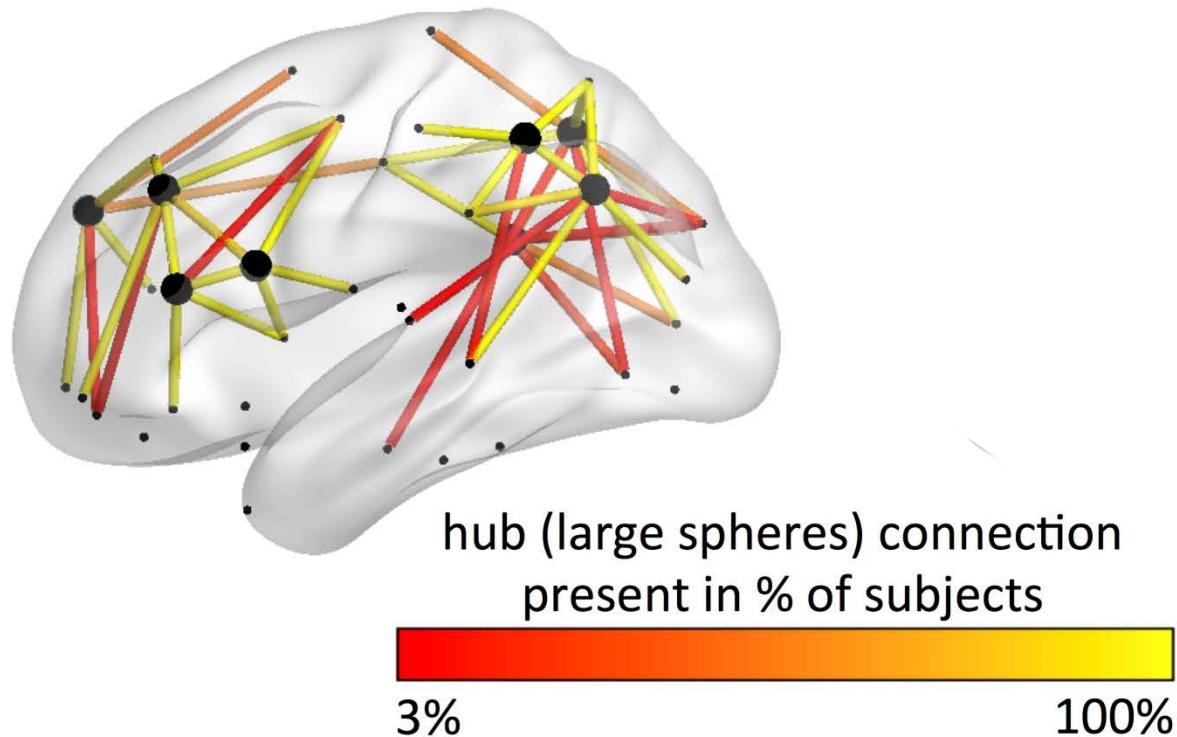
'functional network disease': symptoms I cognition, epilepsy

A. The normal brain network



'anatomical network disease': symptoms II phase of the disease, molecular subtype, prognosis

A Healthy controls ($n = 60$)

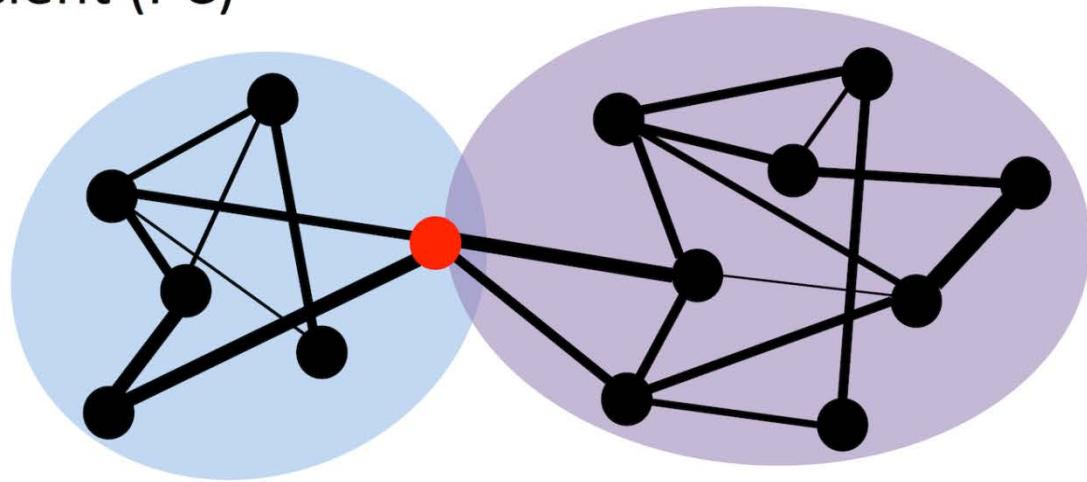
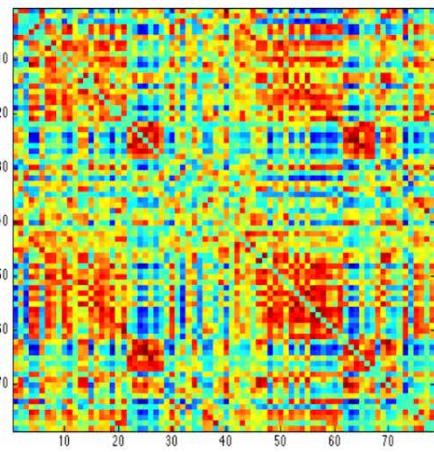


graph theoretical concepts III



graph theoretical concepts III

A participation coefficient (PC)



stationary versus dynamic

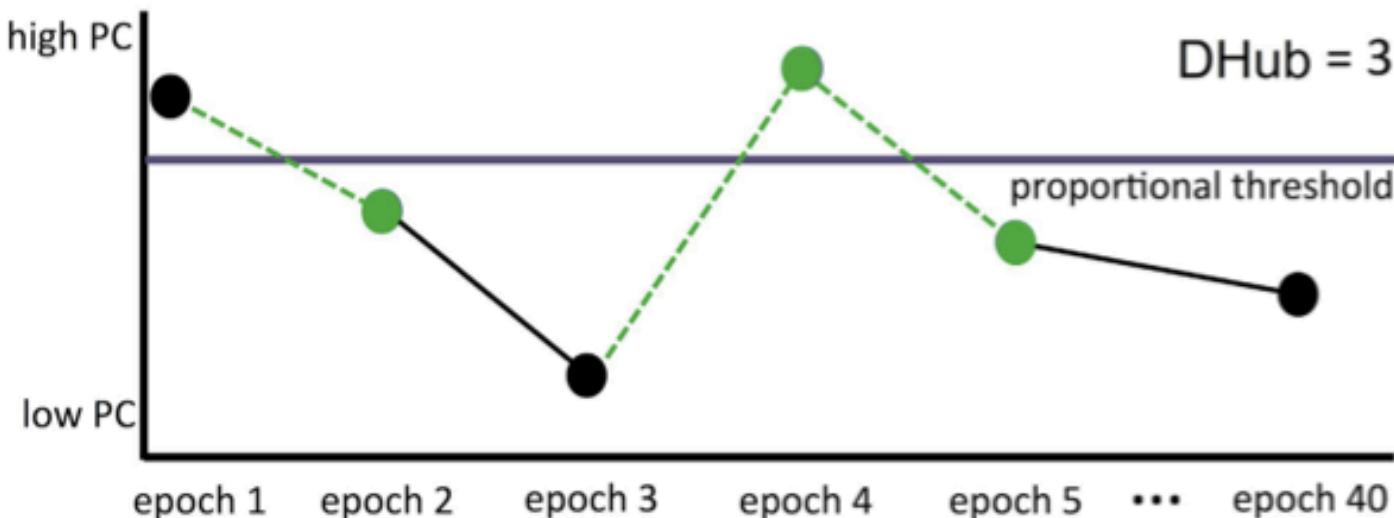
c Stationary hub score (SHub)

$$SHub = \overline{PC}_{\text{epoch } 1:40}$$

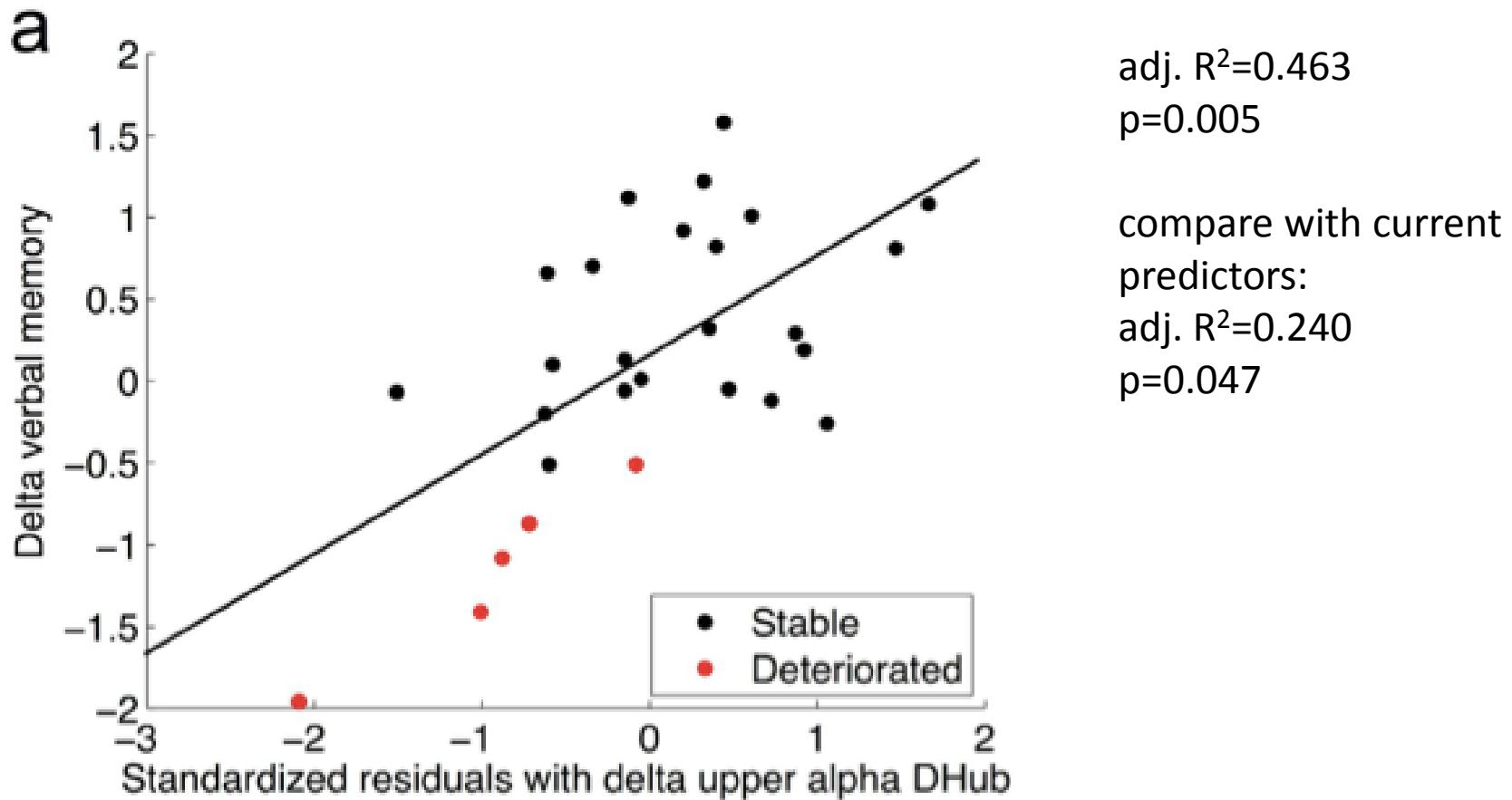
d Dynamic hub score (DHub)

$$DHub = \text{sum}(\text{transitions } (PC_{\text{epoch } 1:40}))$$

e

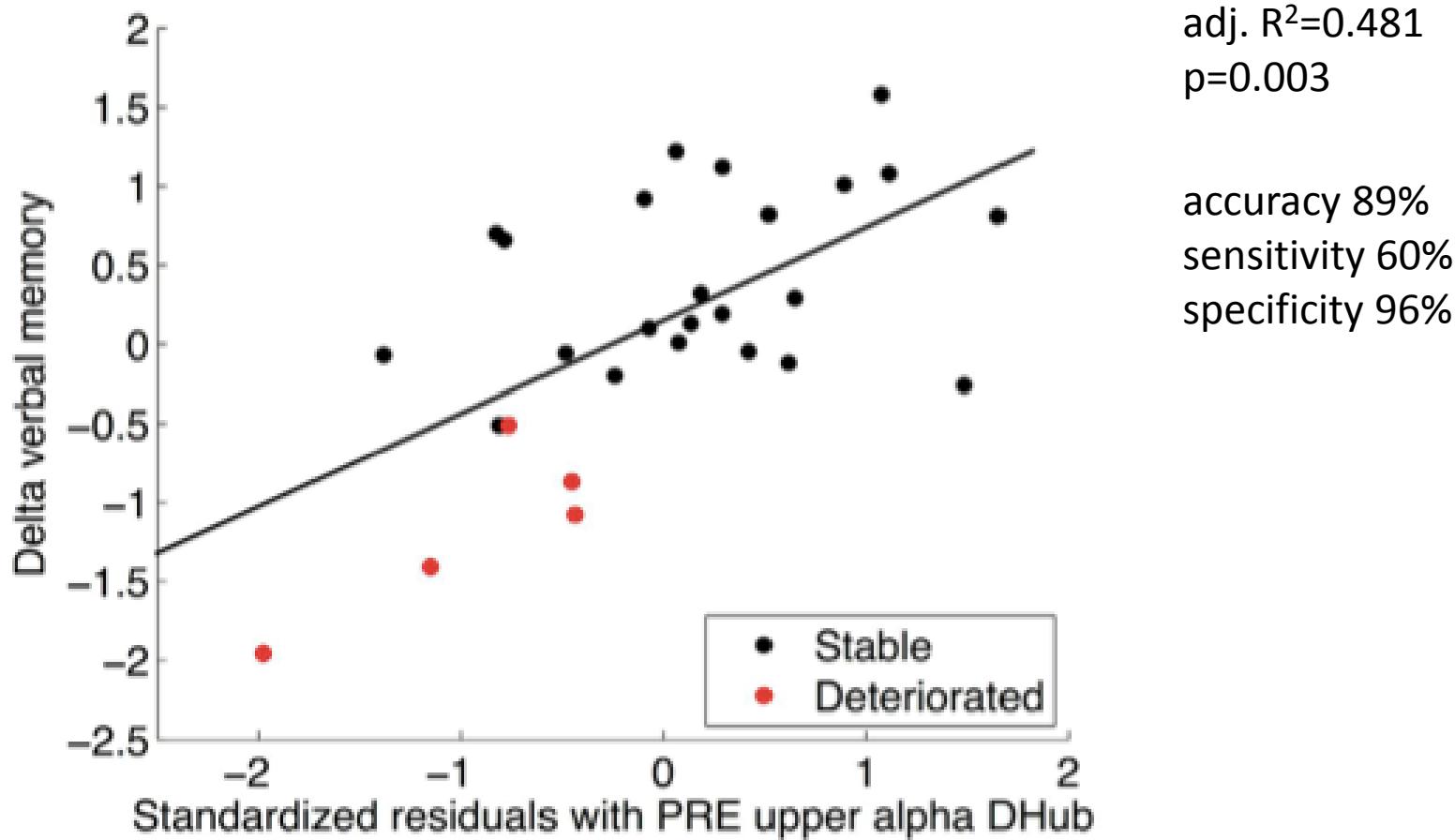


dynamic participation *tracks* cognitive decline



dynamic participation *predicts* cognitive decline

b



conclusions

- glioma impacts the global multimodal brain network
- different network properties relate to different clinical variables
- brain network properties may aid in diagnostics and prognostics



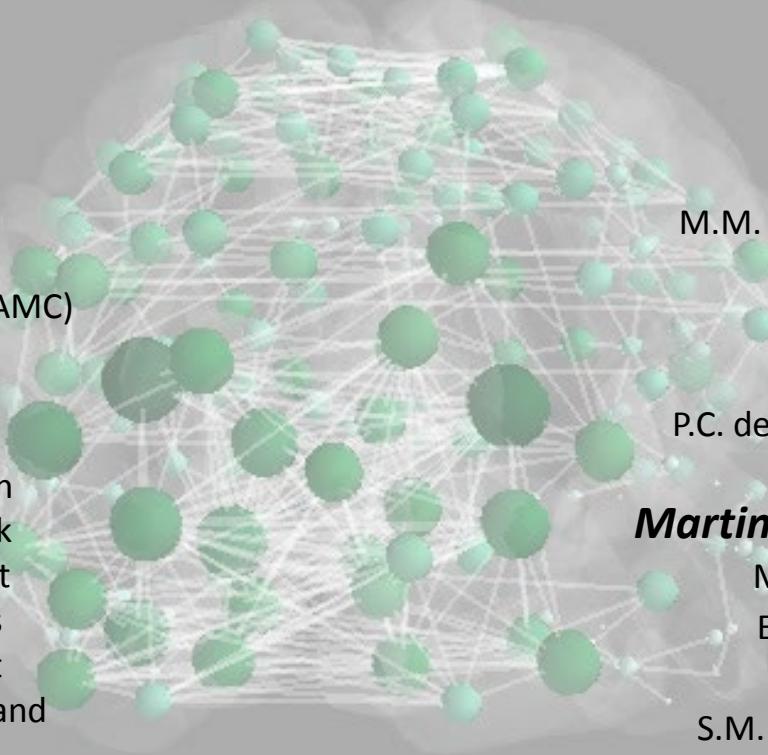
Jolanda
Derk



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Numan

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E. van Dellen
B.W. van Dijk
Q. van Geest
J.J.G. Geurts
M. de Groot
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H.E. Hulst
M. Klein
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J.C. Reijneveld
P.J. Ris



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N. Tanaka
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D.G. Wakeman



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**Branco Weiss
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Nederlandse Organisatie voor Wetenschappelijk Onderzoek