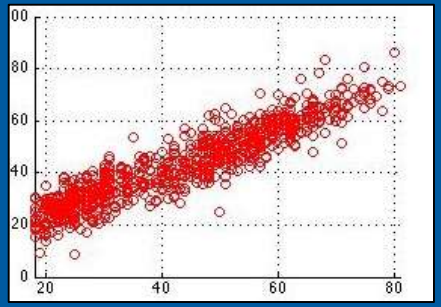
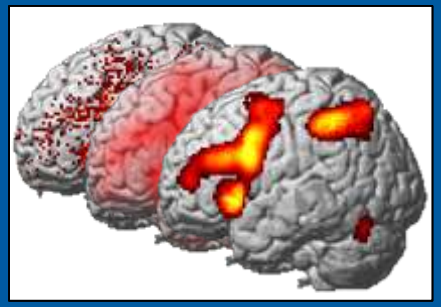
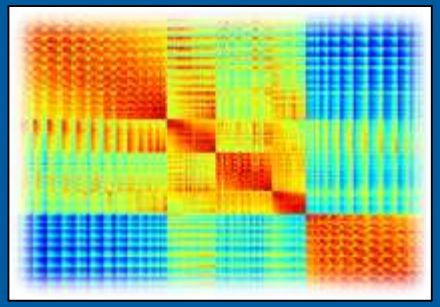
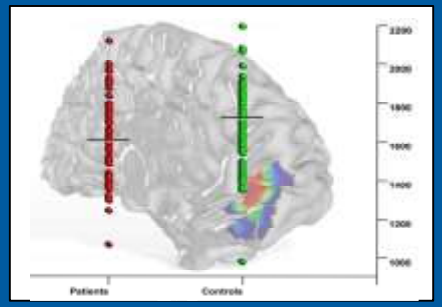
What can brain imaging and AI reveal about an individual person?

@INM7_ISN









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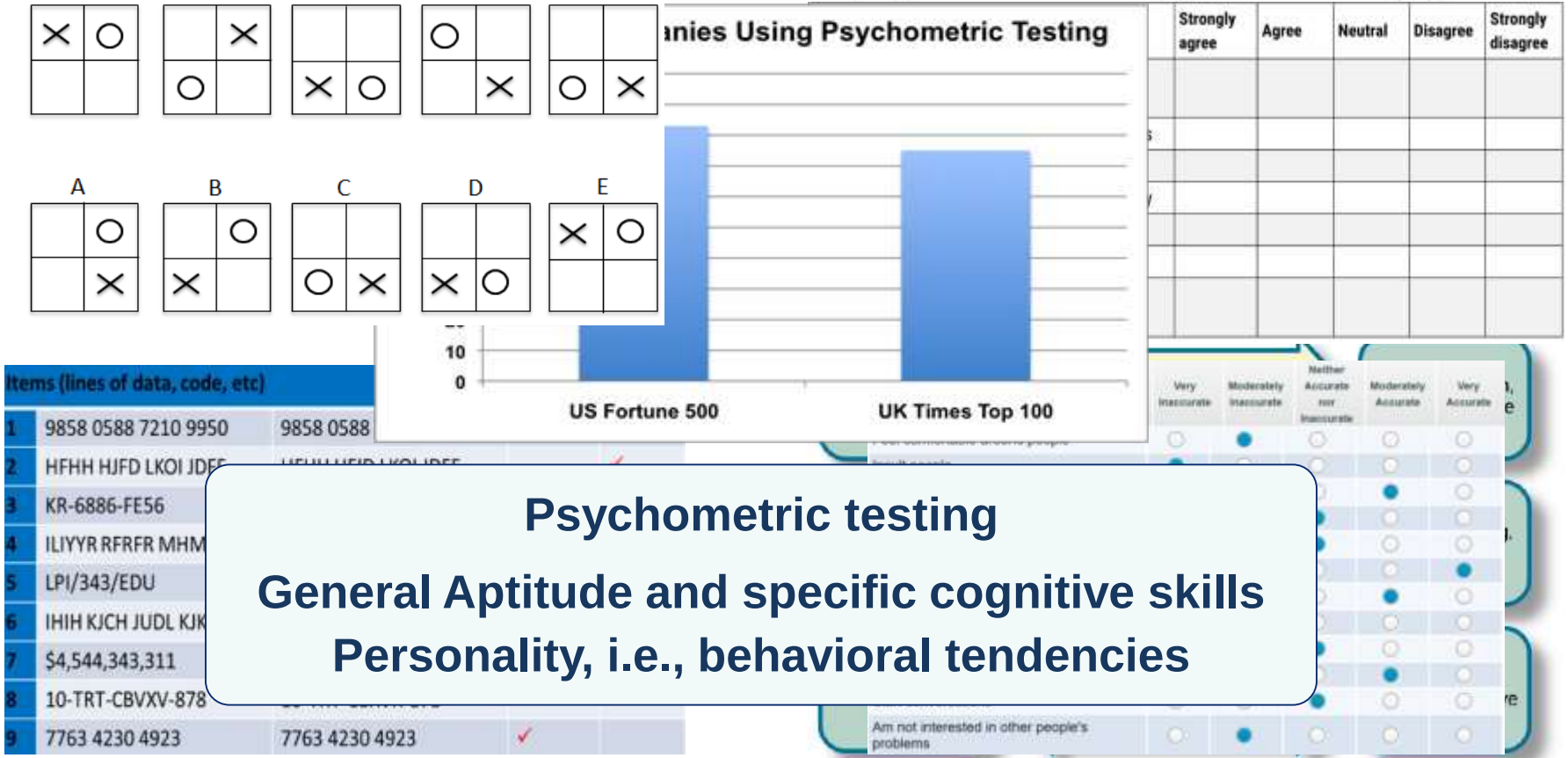
Psychometric assessment: Measuring candidates



Psychometric testing

General Aptitude and specific cognitive skills

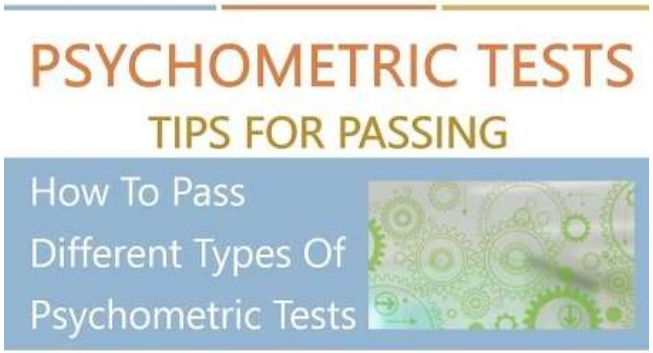
Personality, i.e., behavioral tendencies

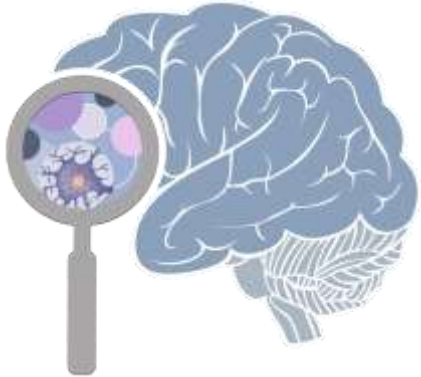
A critical assessment of assessment practices

Are measurements meaningful ?

Relationship test - concept

Relationship concept - outcome



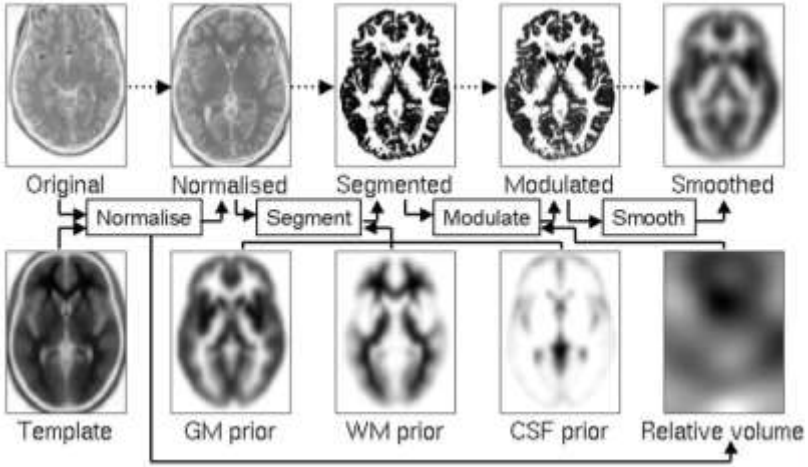


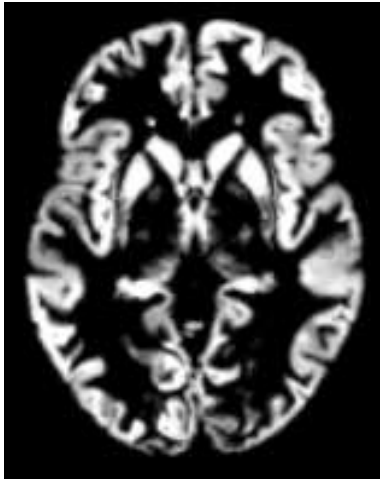
Outcome related to mental traits

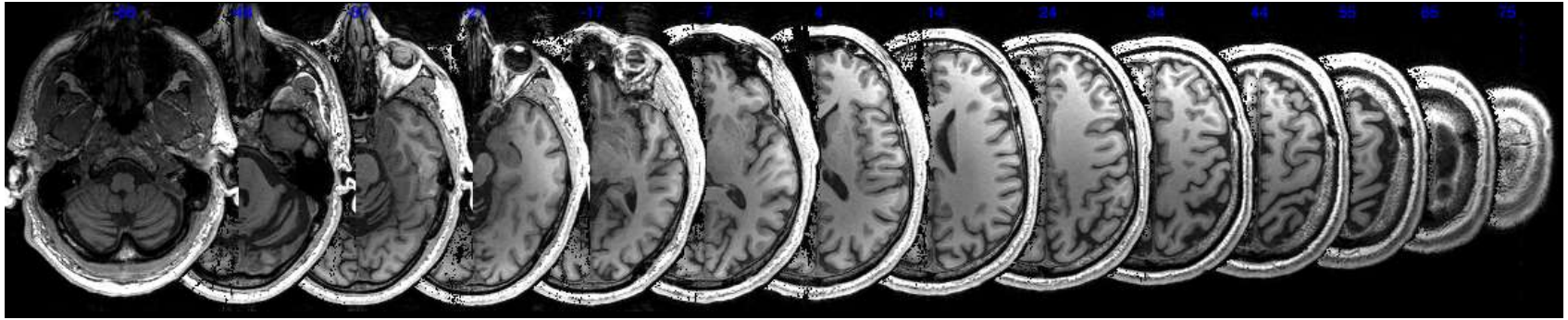
Inference on mind from behavior

Can we skip the noisy readout ?

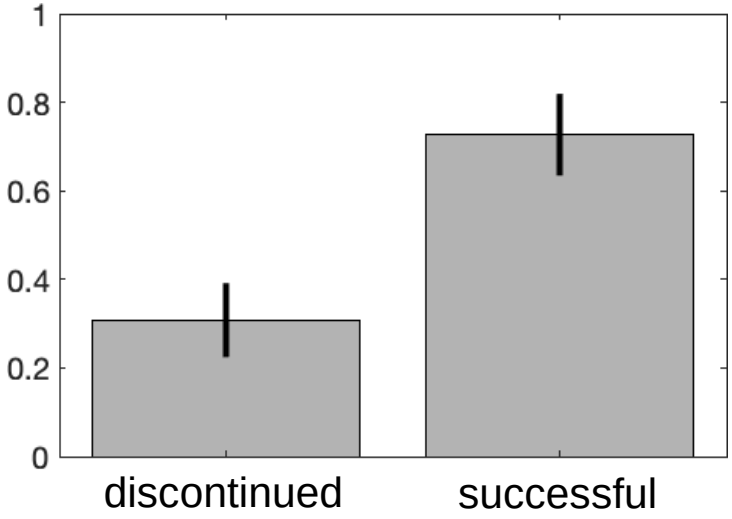
Structural MR imaging: Measuring the brain



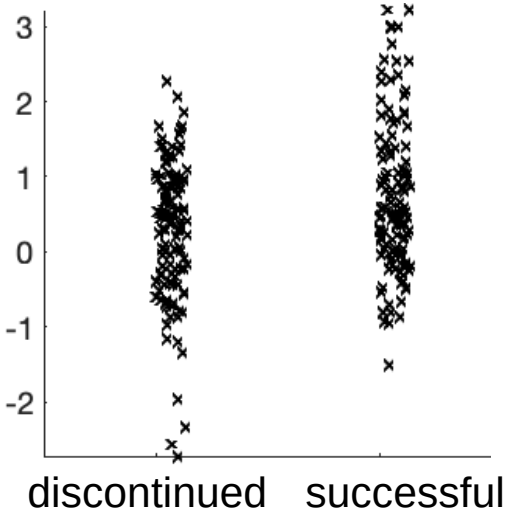




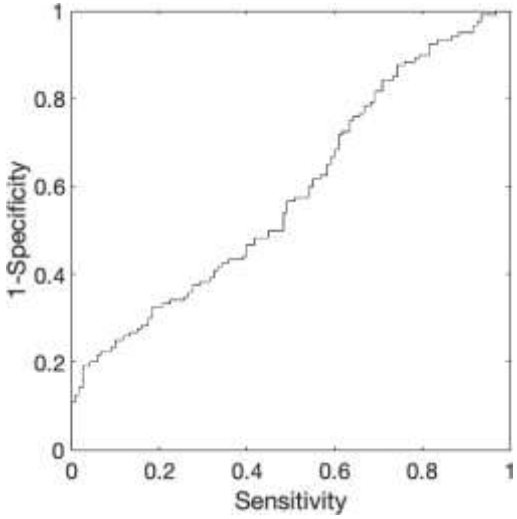
The limits of classical (associative) statistics



Successful trainees scored significantly higher on the XBT aptitude test (bars show mean and standard error)



More honest plot (same data)



Groups indistinguishable (AUC = .58)

When something is true on average, it may still be untrue for many

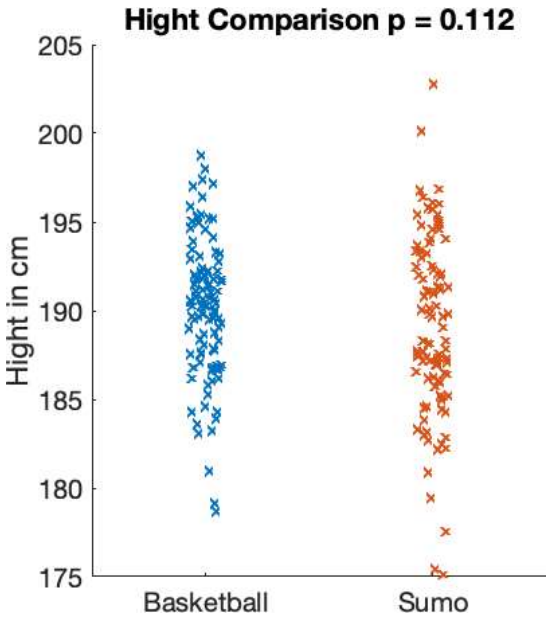
Classical statistics vs. machine-learning

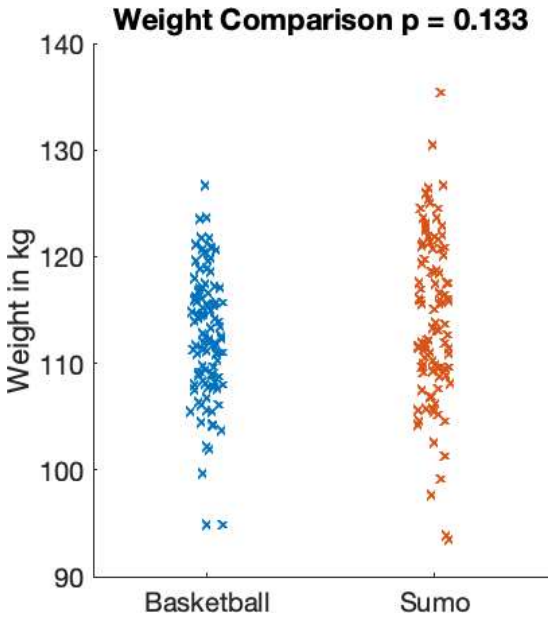
Multivariate patterns can greatly increase predictive power

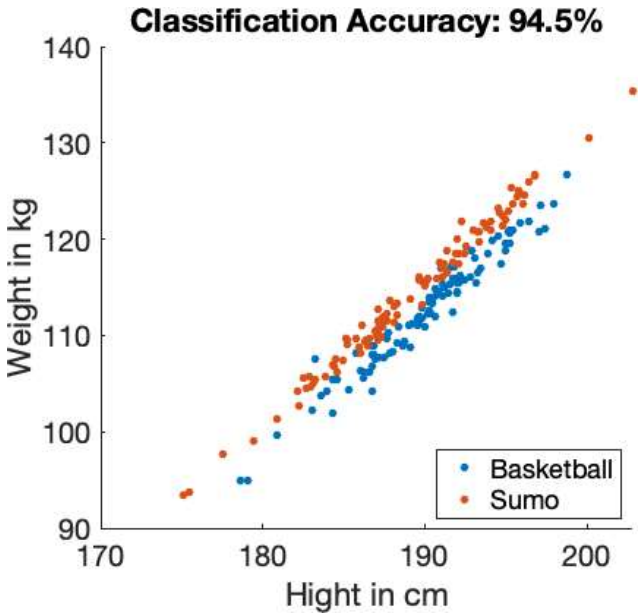
-> Machine-learning / AI

Most relevant questions focus on statements about new cases

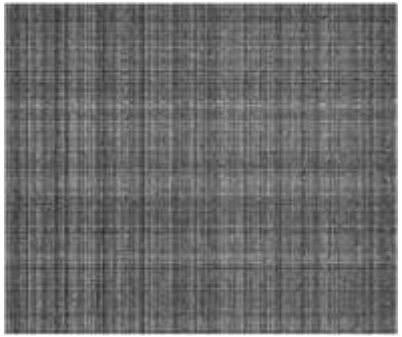
<u>Out-of-sample</u> prediction







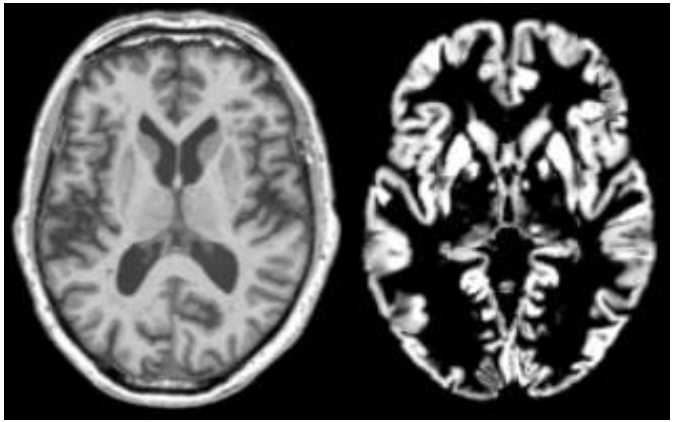
Machine-learning of MRI– phenotype relationships



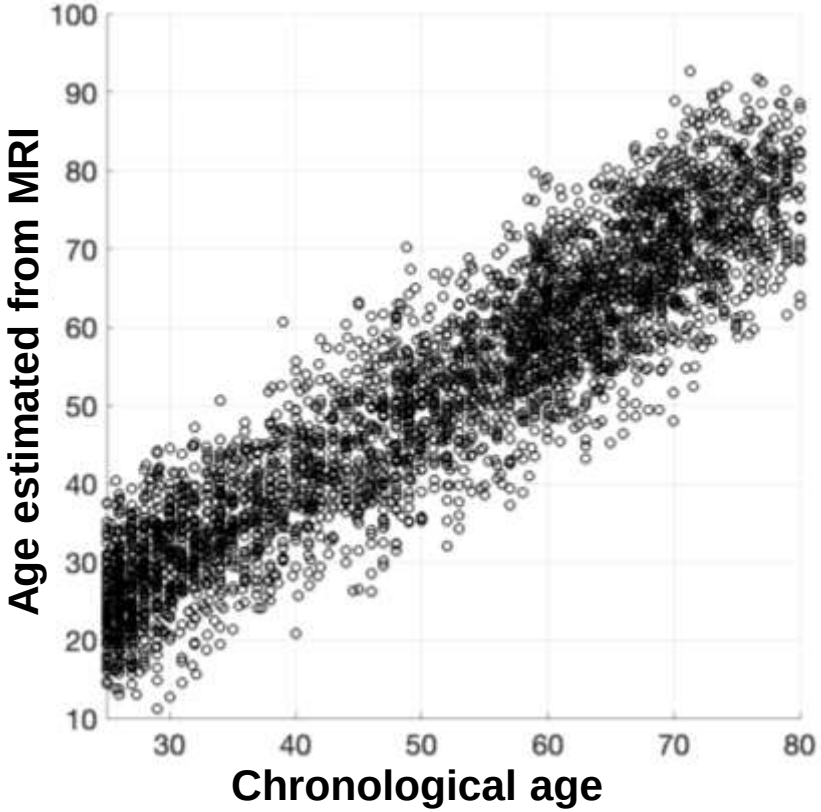
37 y, ♂□, good
52 y, ♀□, bad
65 y, ♀, fair
71 y, ♂□, good
44 y, ♂□, good
28 y, ♀, fair

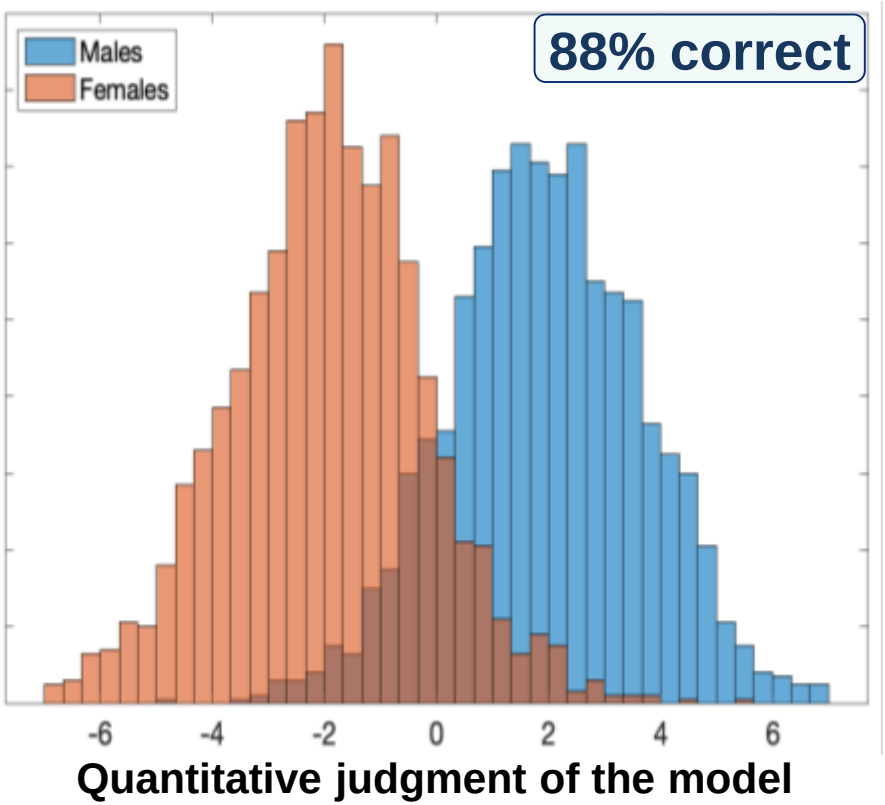
Train Model

28 y, ♀
good

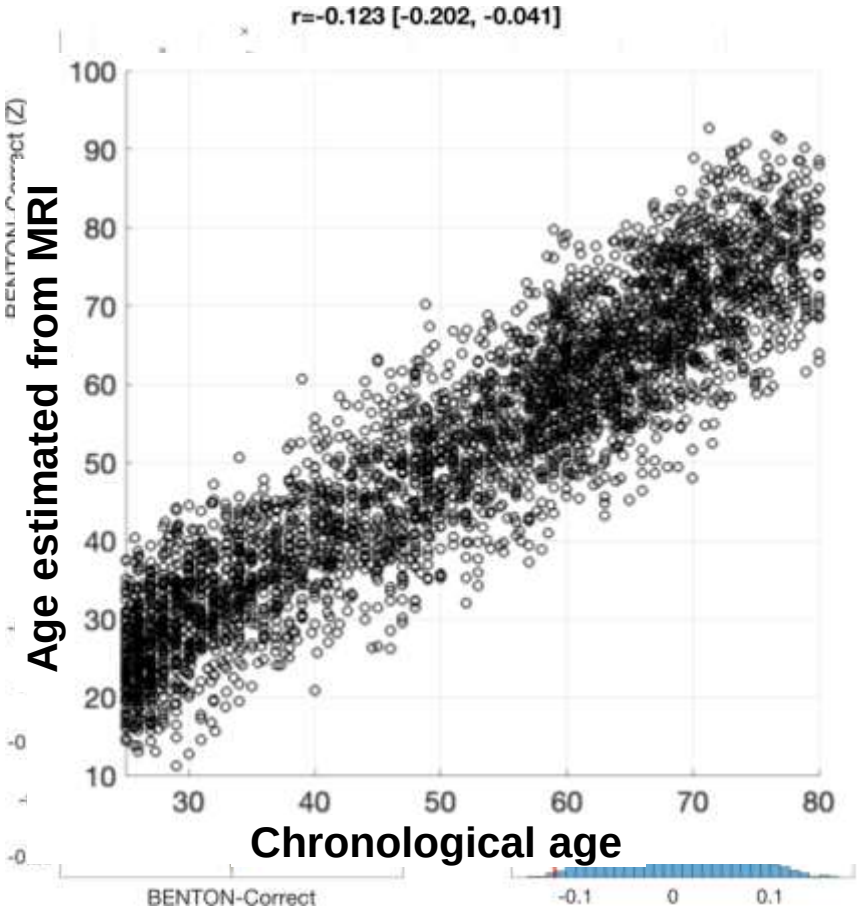


Predicting individual information from MRI scans

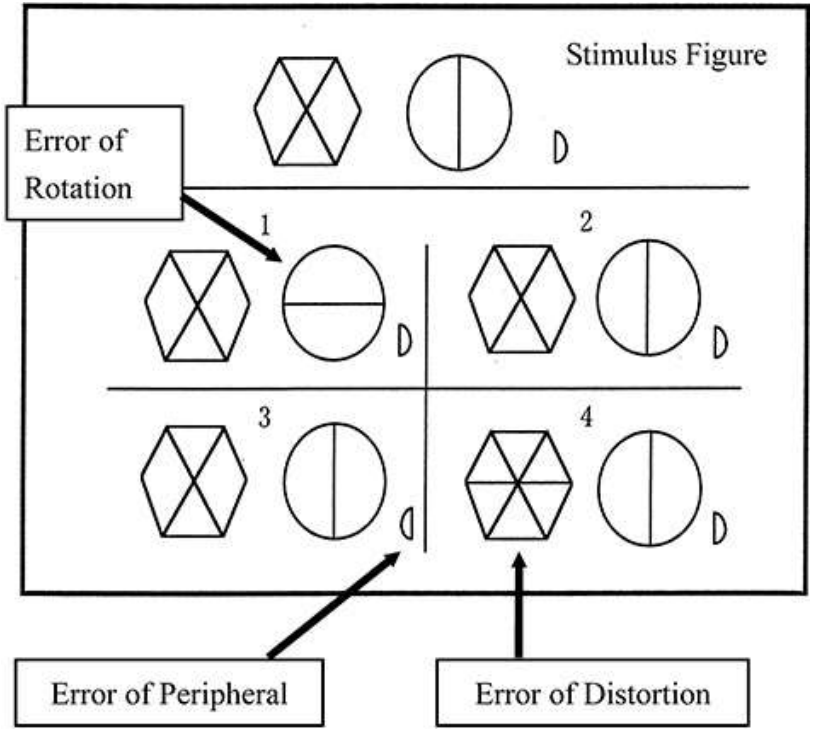




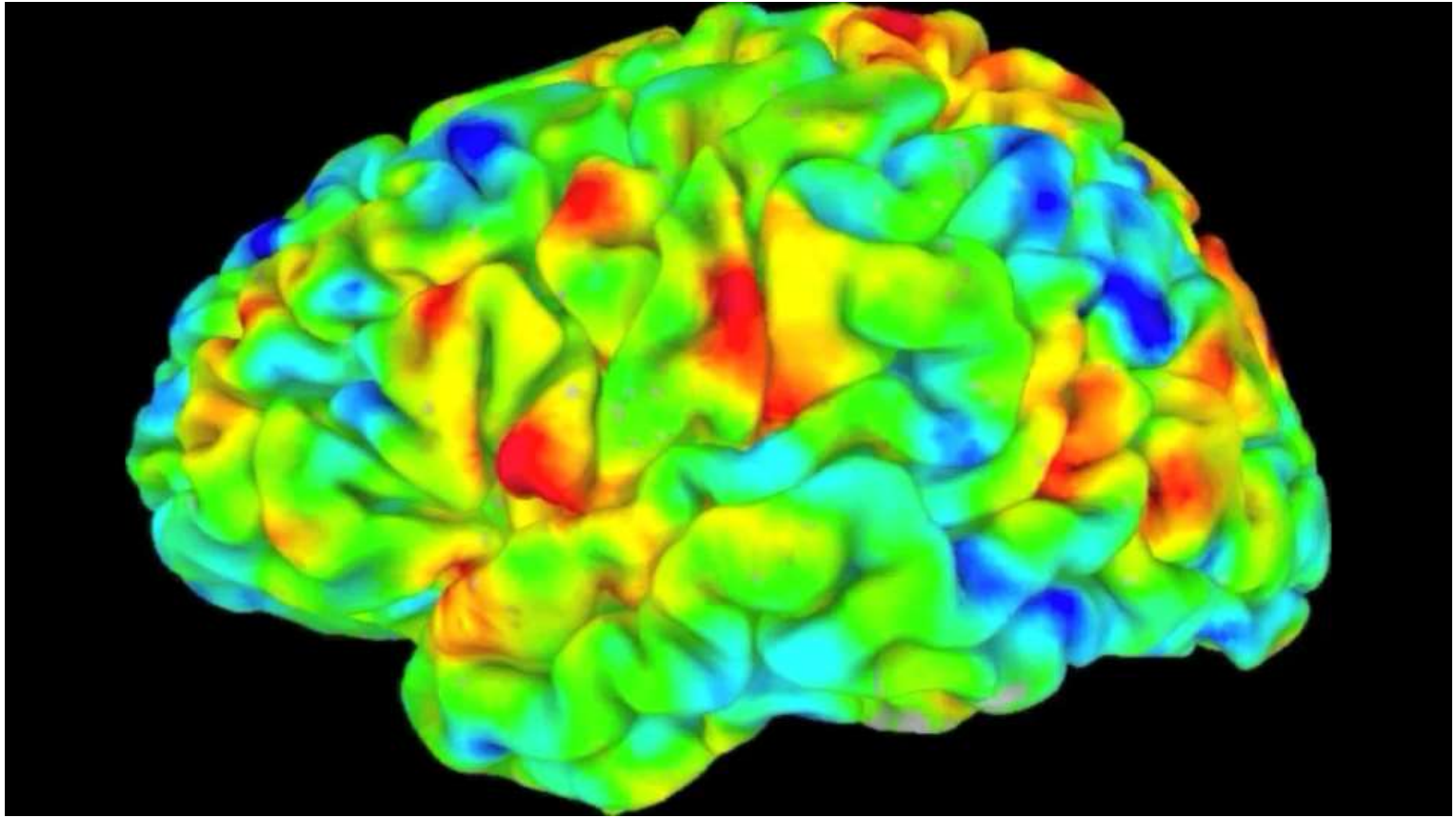
Brain age as a marker of cognitive status



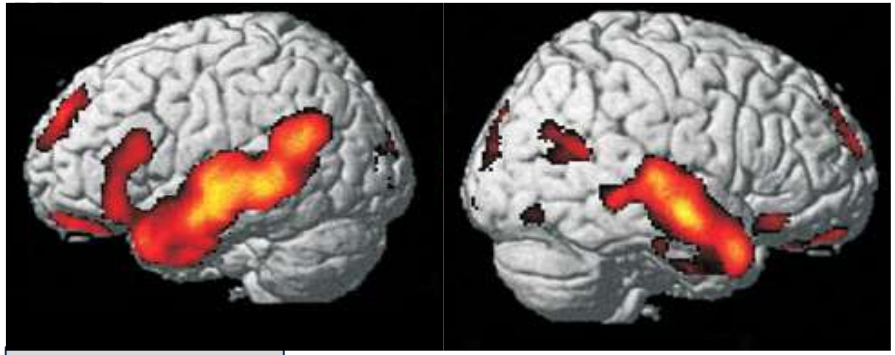
Does BrainAge indicate cognitive status?



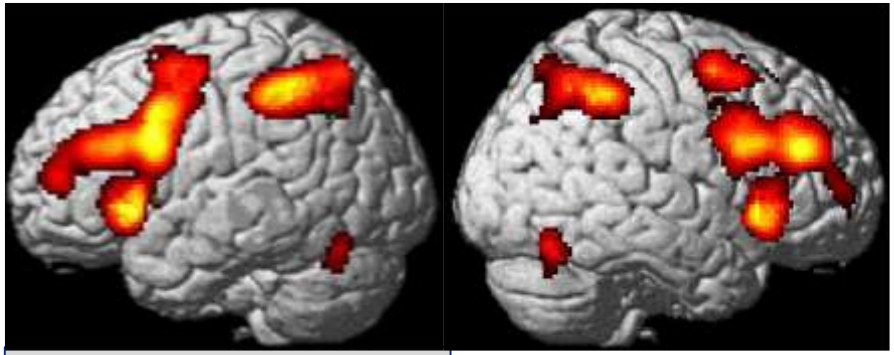
Functional MR imaging: Network dynamics



Functional MR imaging: Network dynamics

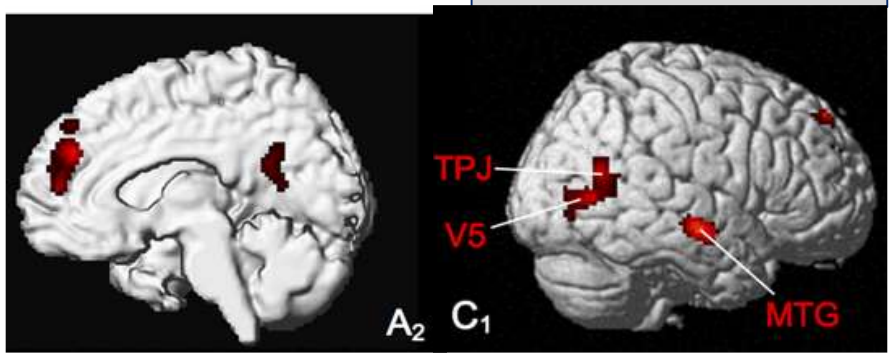


Language

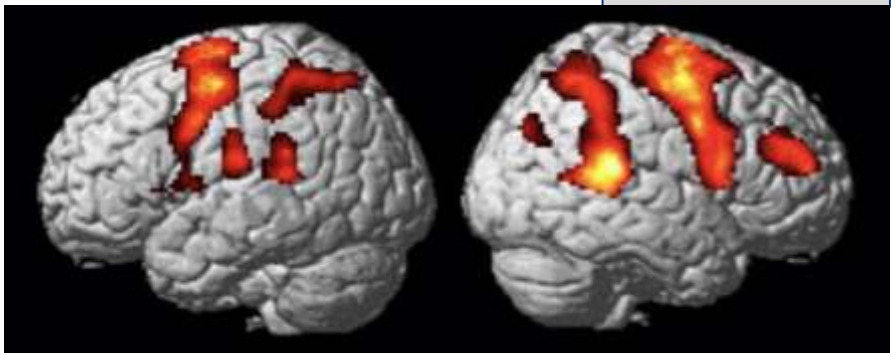


Working memory

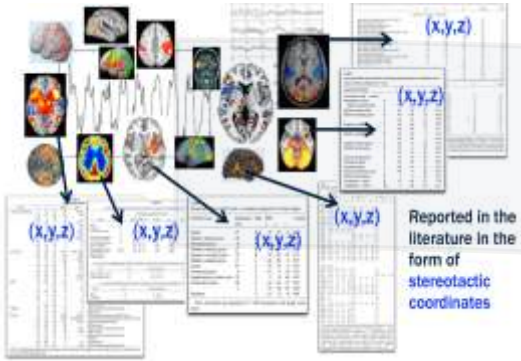
Social cognition

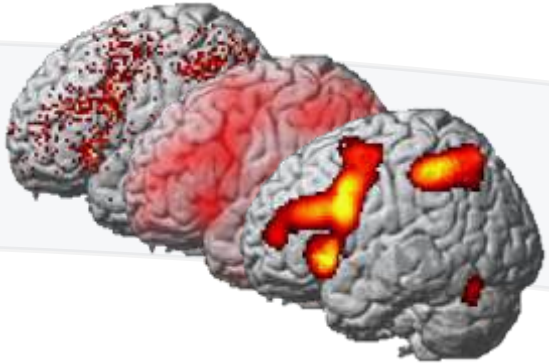


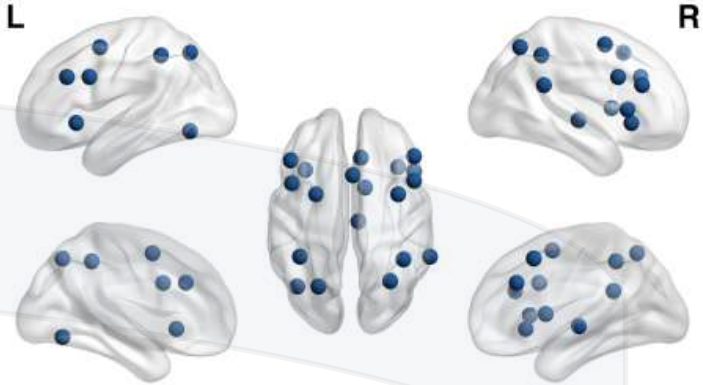
Movement

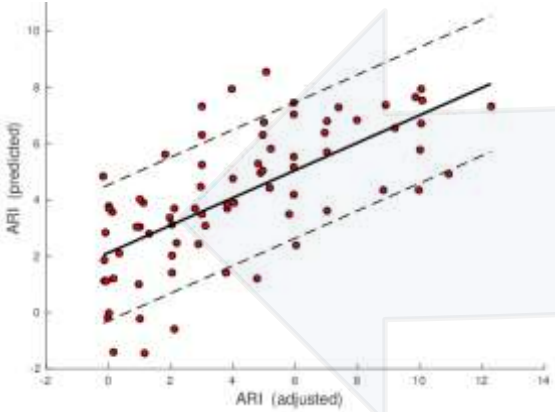


Predicting individual traits from network dynamics

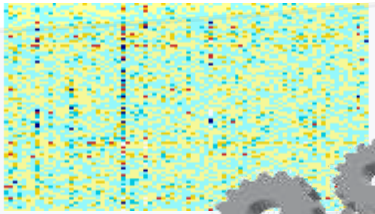




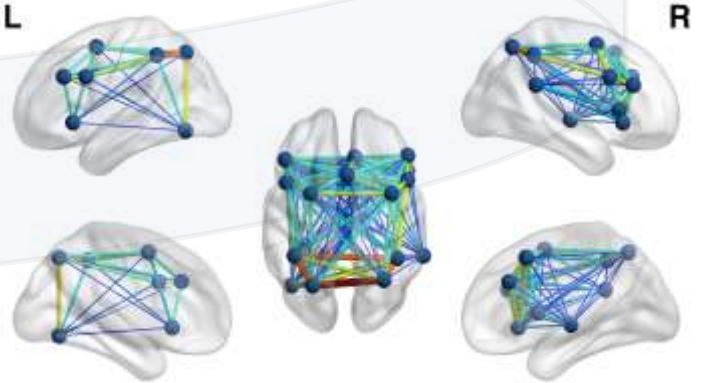




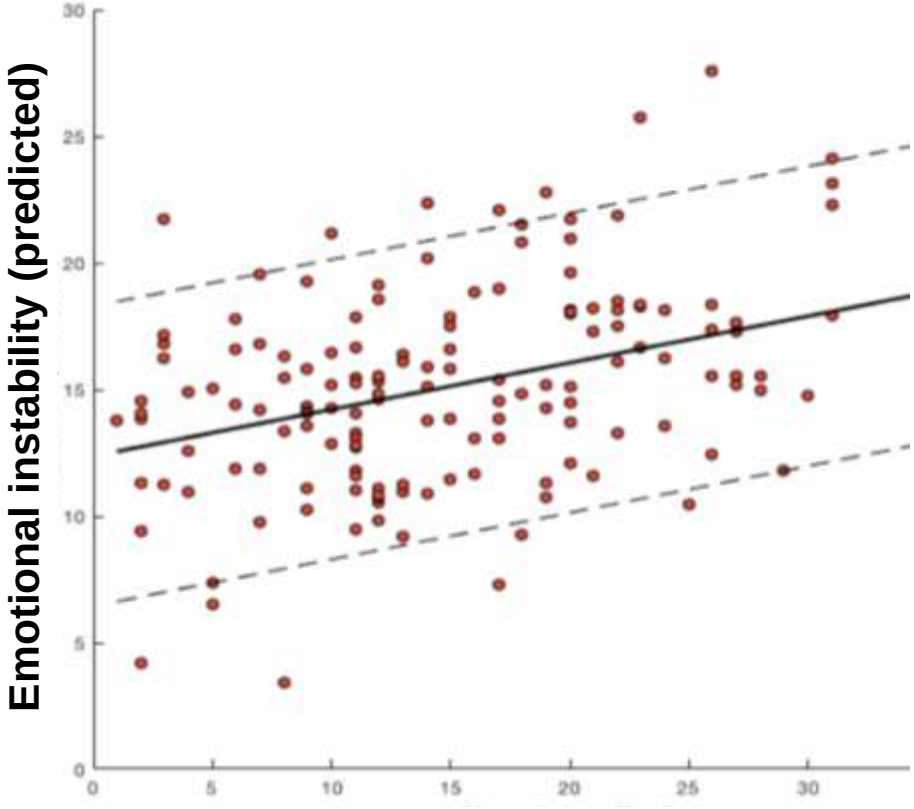
Konnektivität

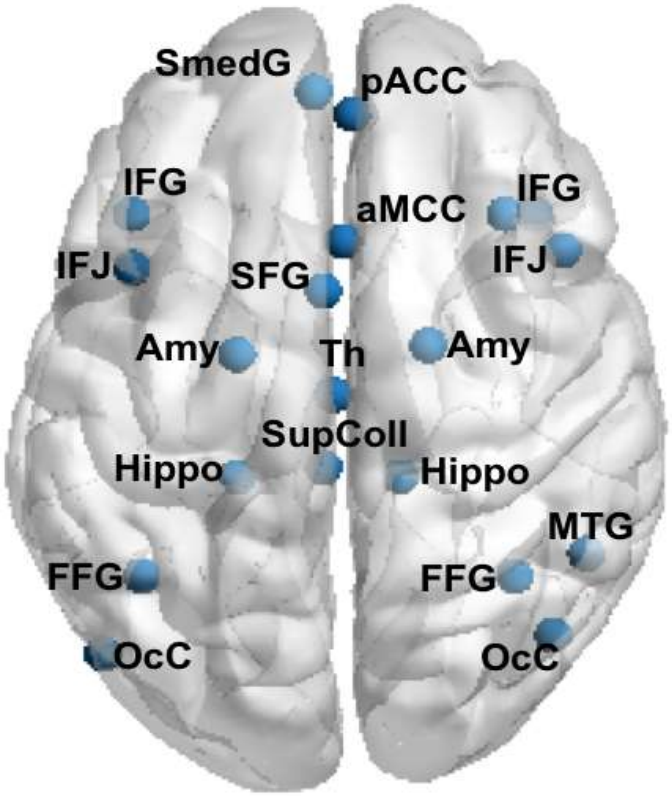


Phänotyp



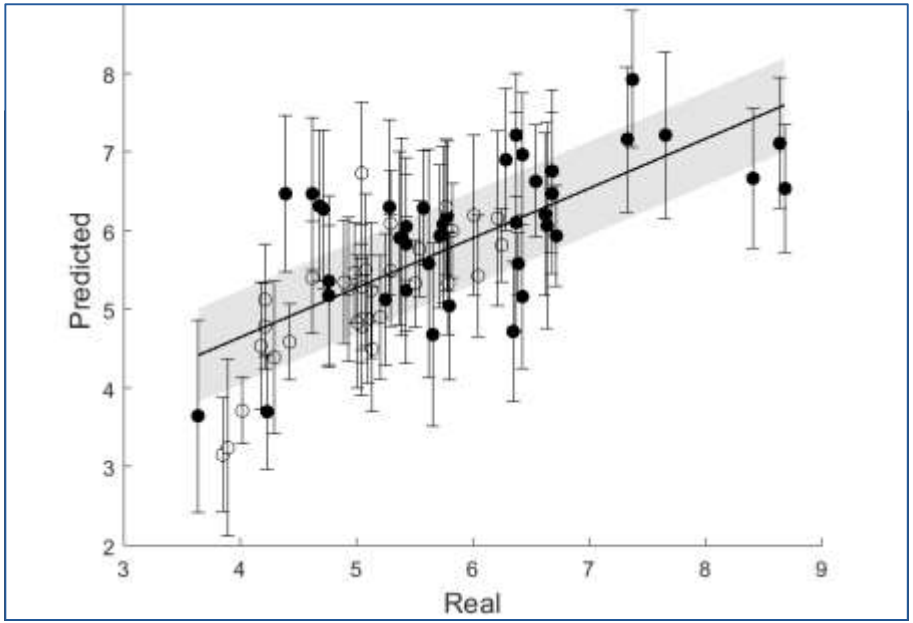
Predicting individual traits from network dynamics



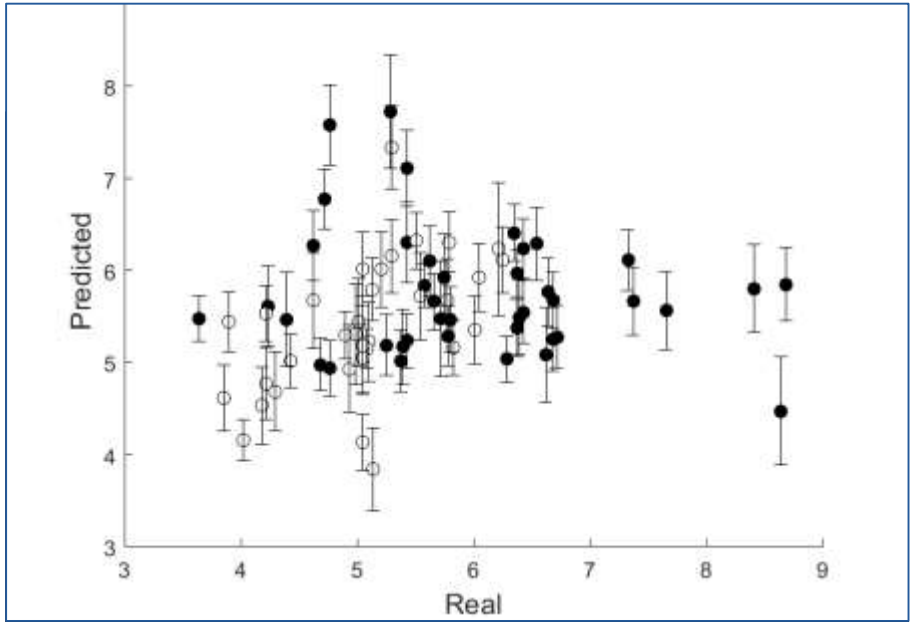


Emotion processing network

Predicting individual traits from network dynamics



Cognitive action control: ***Cieslik et al., 2015***



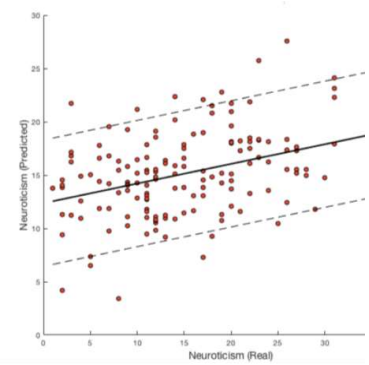
Social-affective network: Amft et al., 2014

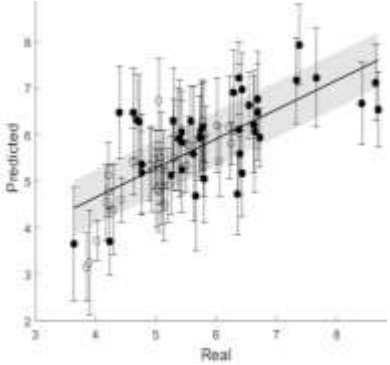
r = 0.51 **Working memory for actions** **r = 0.13**

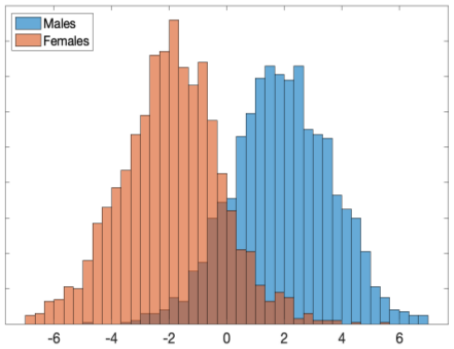
The future of work – individual assessment by AI ?

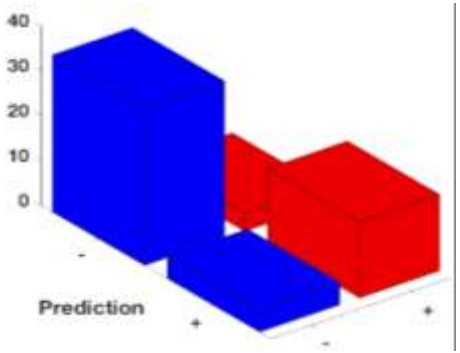
Disruptive potential

- Direct assessment of mental traits
- Objective and unbiased inference
- Not reliant on theoretical constructs









Broad perspectives

- Medical focus funding-driven
- Target vector can be anything
- Inference on future outcomes

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