EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Developmental
Computational
Psychiatry lab

Using smartphones to understand cognitive development

Tobias U. Hauser

Department for Psychiatry & Psychotherapy, University of Tubingen

German Centre for Mental Health (DZPG)

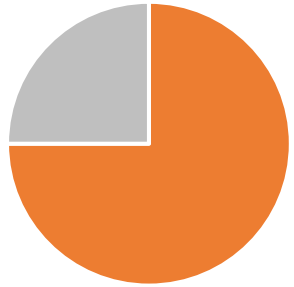
Max Planck UCL Centre for Computational Psychiatry & Ageing Research

Wellcome Centre for Human Neuroimaging, UCL

MAX PLANCK UCL CENTRE
for Computational Psychiatry and Ageing Research

wellcome
centre
human
neuroimaging

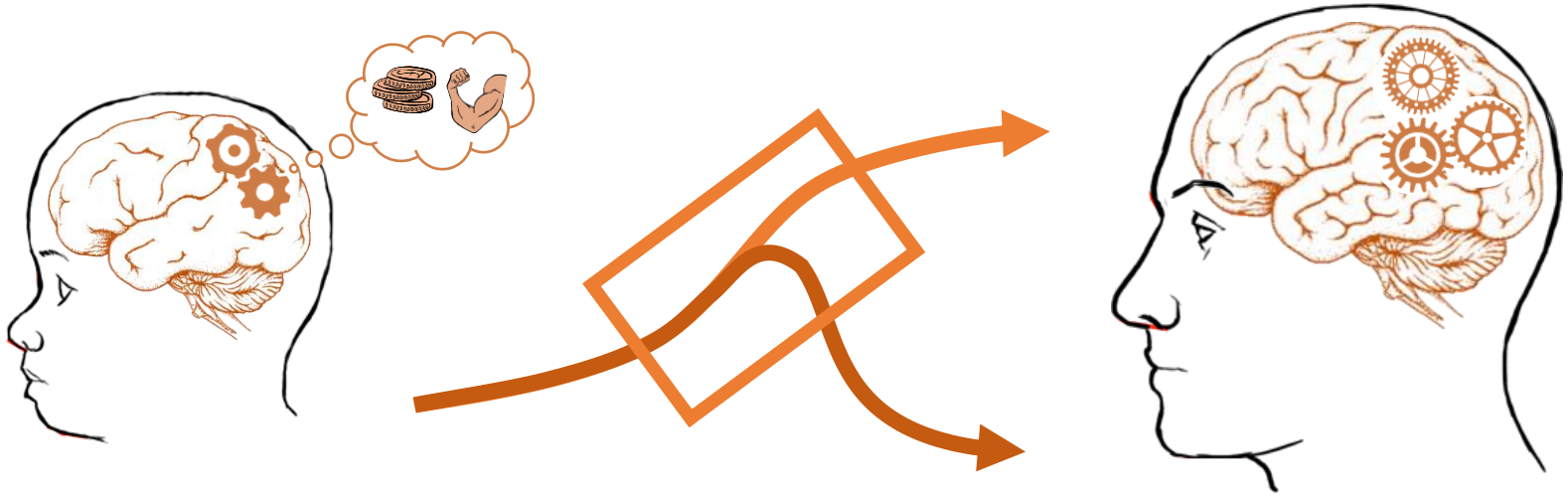
WHY IS DEVELOPMENT IMPORTANT?



75% psychiatric disorders begin before adulthood

Paus et al., 2008
Kessler et al., 2005

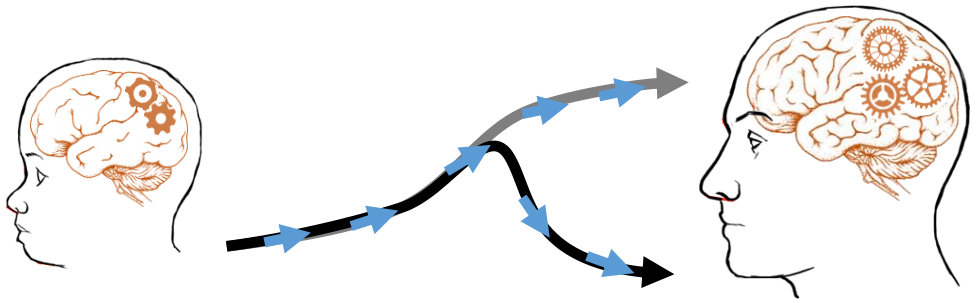
DEVELOPMENTAL COMPUTATIONAL PSYCHIATRY



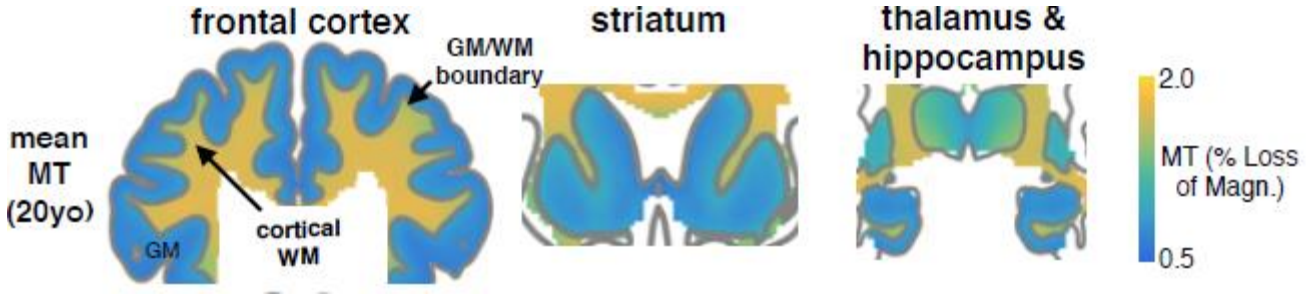
hypothesis: cognitive and brain developments contributes to emergence of mental illness

Hauser et al., 2019, *JCPP*

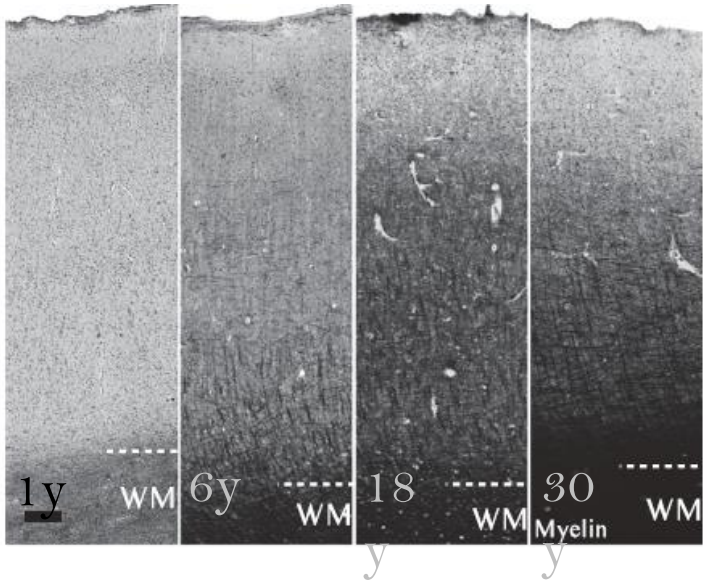
LINKING BRAIN DEVELOPMENT TO MENTAL HEALTH



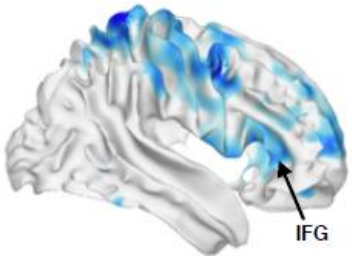
myelin-related (MT) brain development

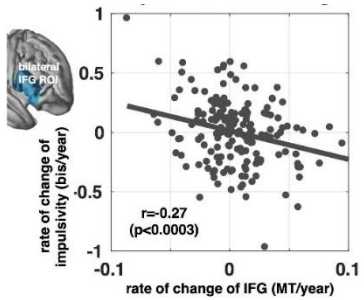


myelination



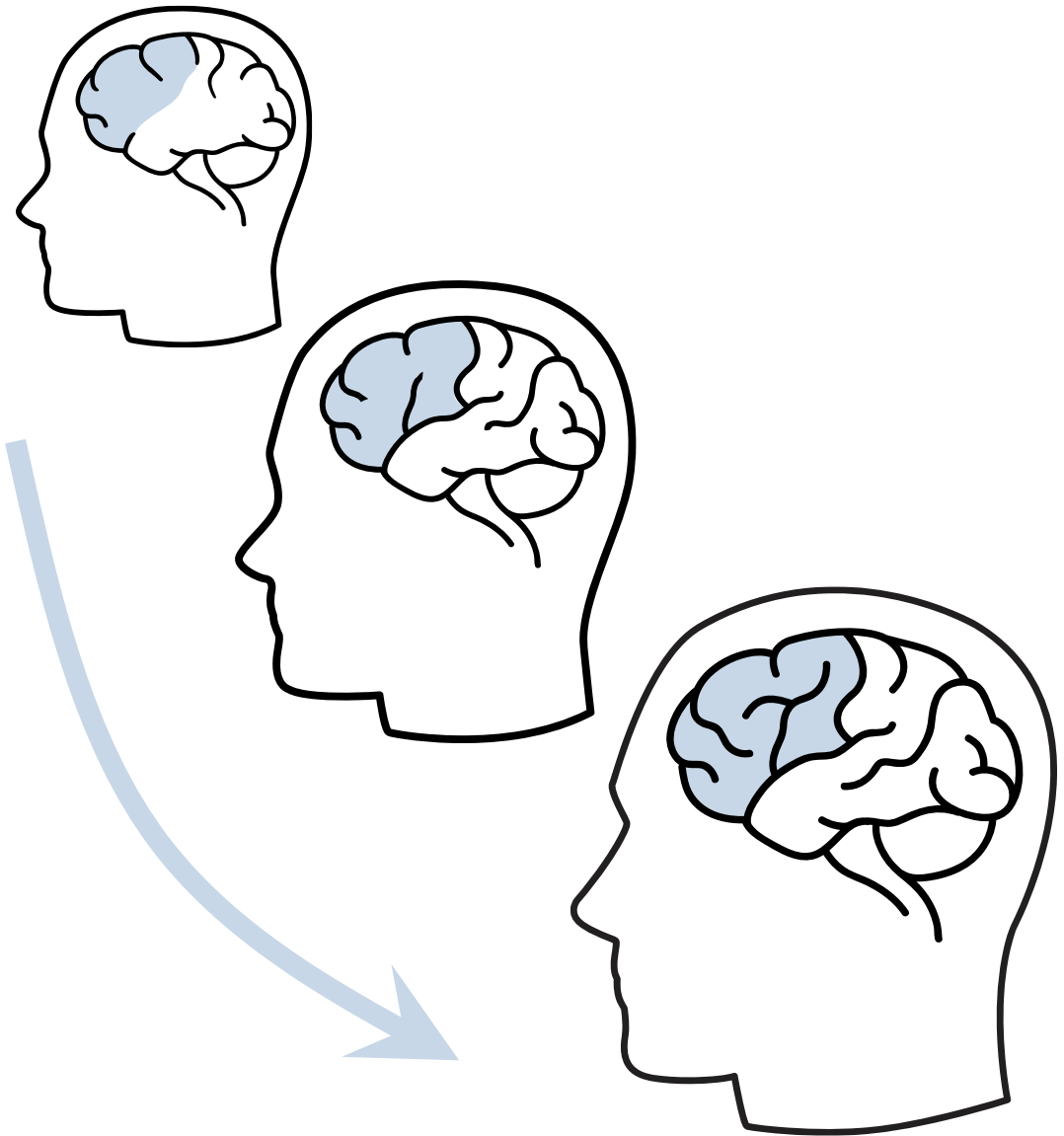
MT change linked to mental health





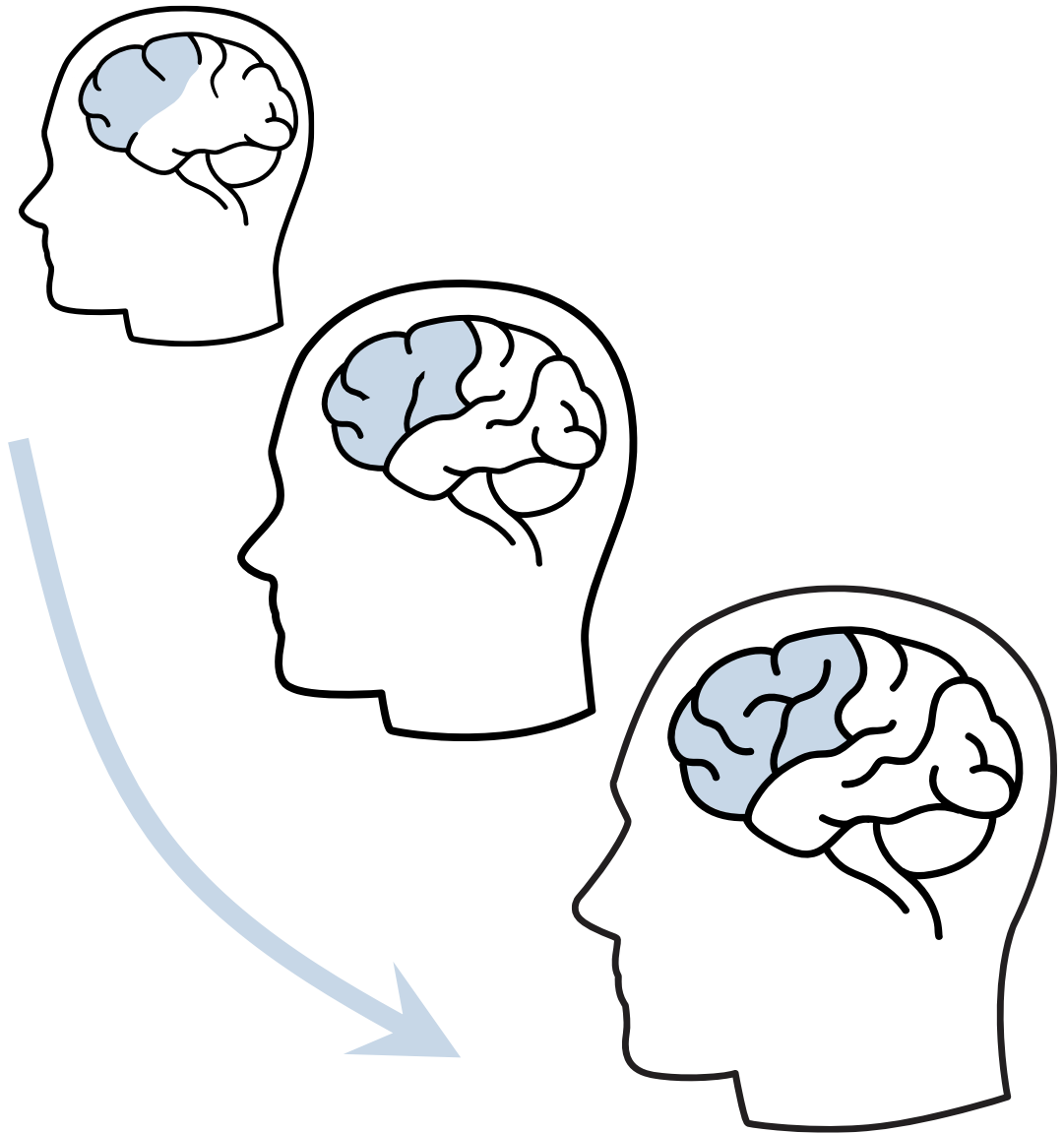
Ziegler*, Hauser* et al., 2019, *Nat Neuro*

THE PROBLEM



- **expensive**
- **highly selected samples**
- **few repeats**

COGNITIVE ONLINE ASSESSMENTS AS A PROXY



- **quick**
- **easy**
- **repeatable**

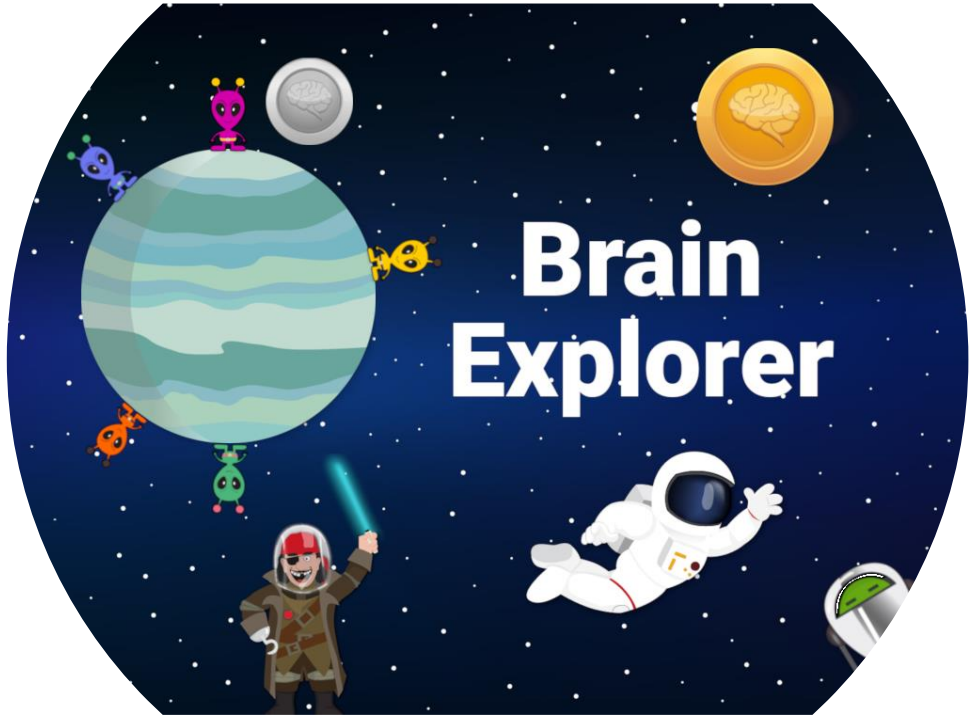
BRAIN EXPLORER APP

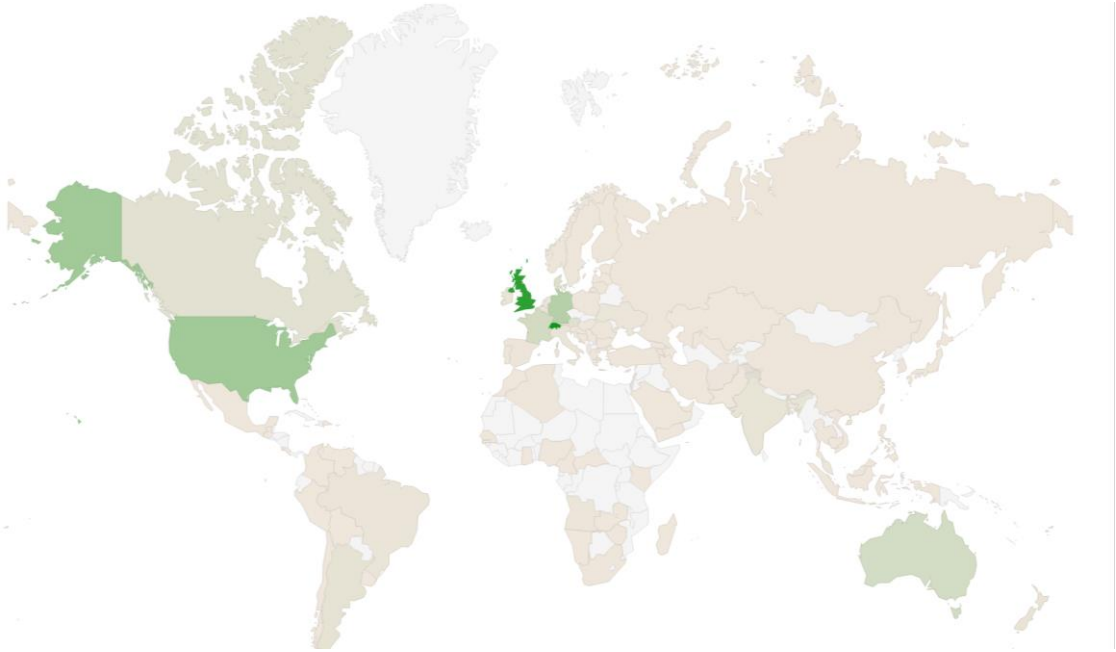
Brain Explorer

- App for Android & Apple
- multiple cognitive domains
- symptom questionnaires
- multi-lingual
- global
- >10,000 users

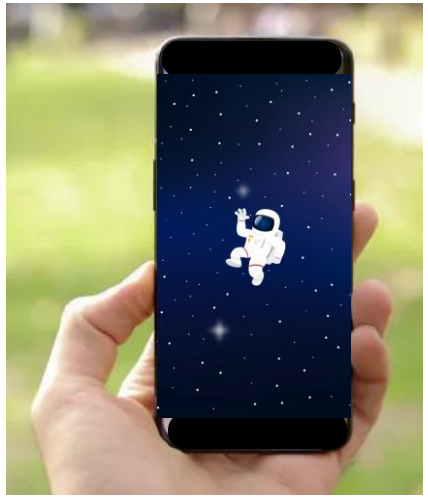
scan me!

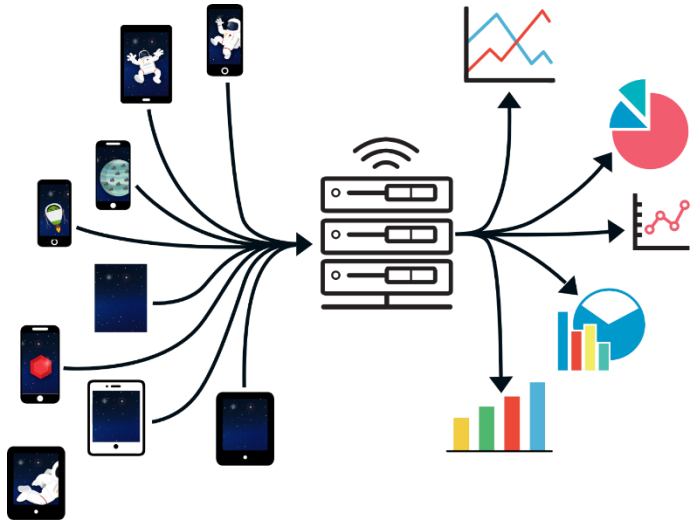
www.brainexplorer.net





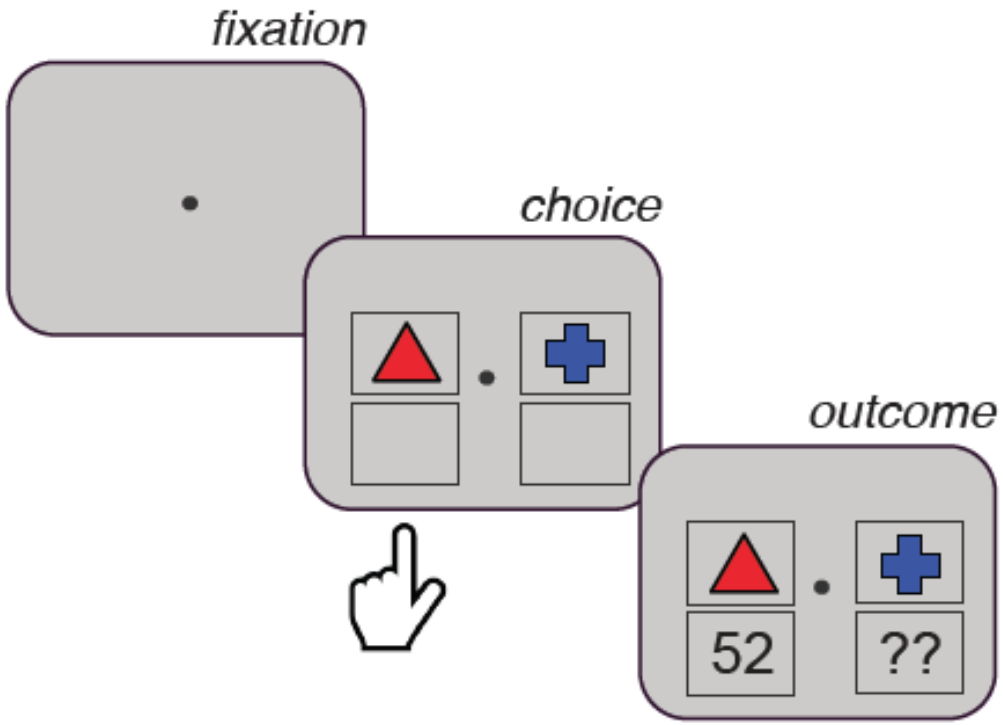
BRAIN EXPLORER APP

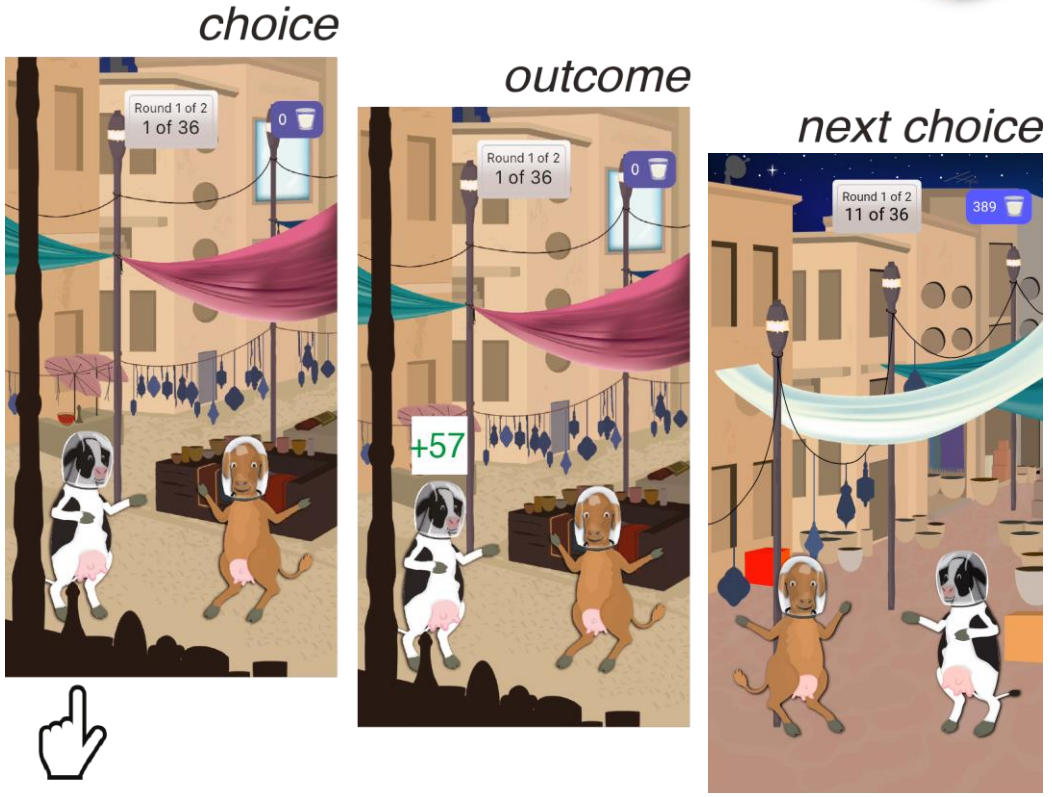




- incentive structure:
  - fun & entertainment
  - competition & self-evaluation
- much shorter games than in lab / paid online experiments
- minimal instructions, little “quality” control
- rewards (medals, ranks, awards)

FROM LAB TO PHONE: COGNITIVE FLEXIBILITY





Skvortsova & Hauser, 2022

COGNITIVE FLEXIBILITY ON THE PHONE

Prolific sample: N=392 (204F)

- detailed instructions & entry quiz
- 144 trials
- monetary incentive for performance

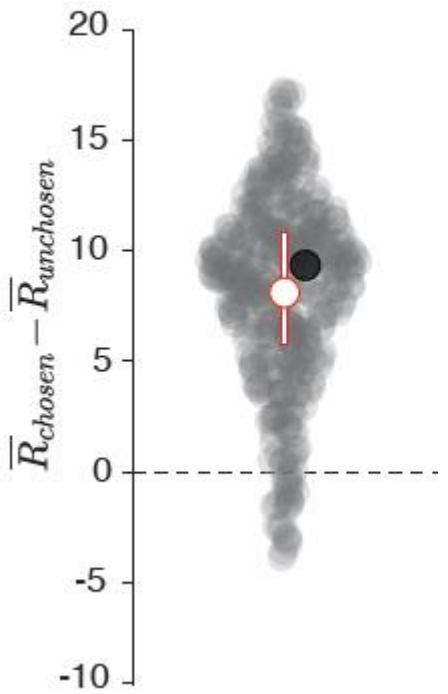
Smartphone sample: N=2610 (1499F)

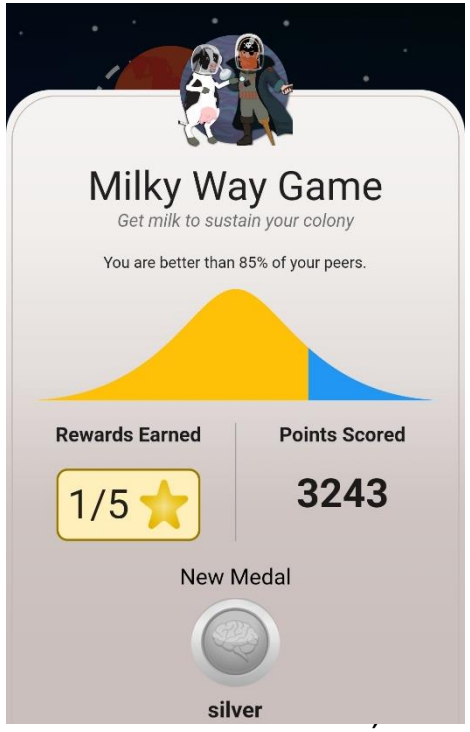
- minimal instructions & no quiz
- 72 trials
- heavily animated
- medals and badges for performance

similar performance

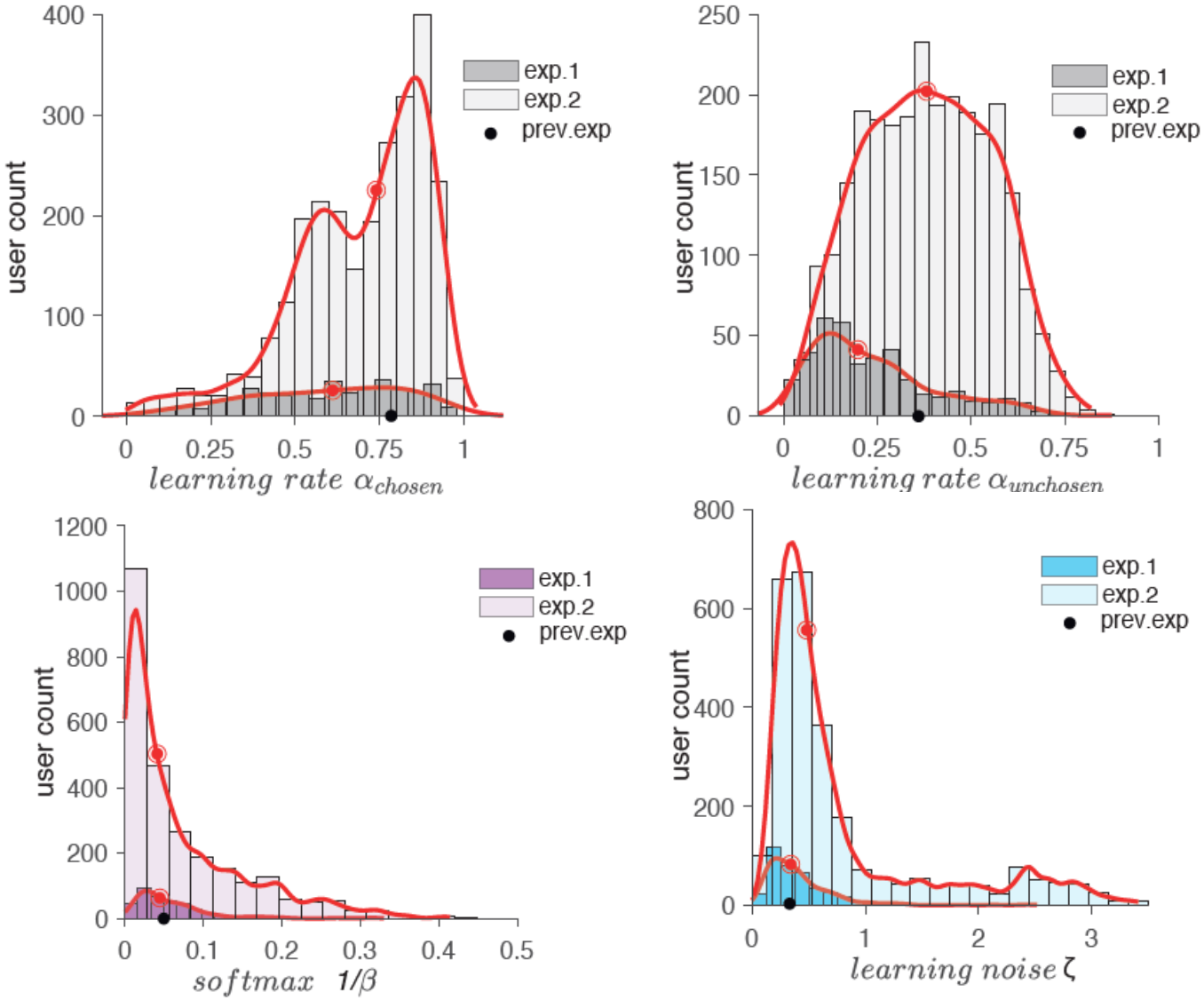
prolific app

previous exp. data



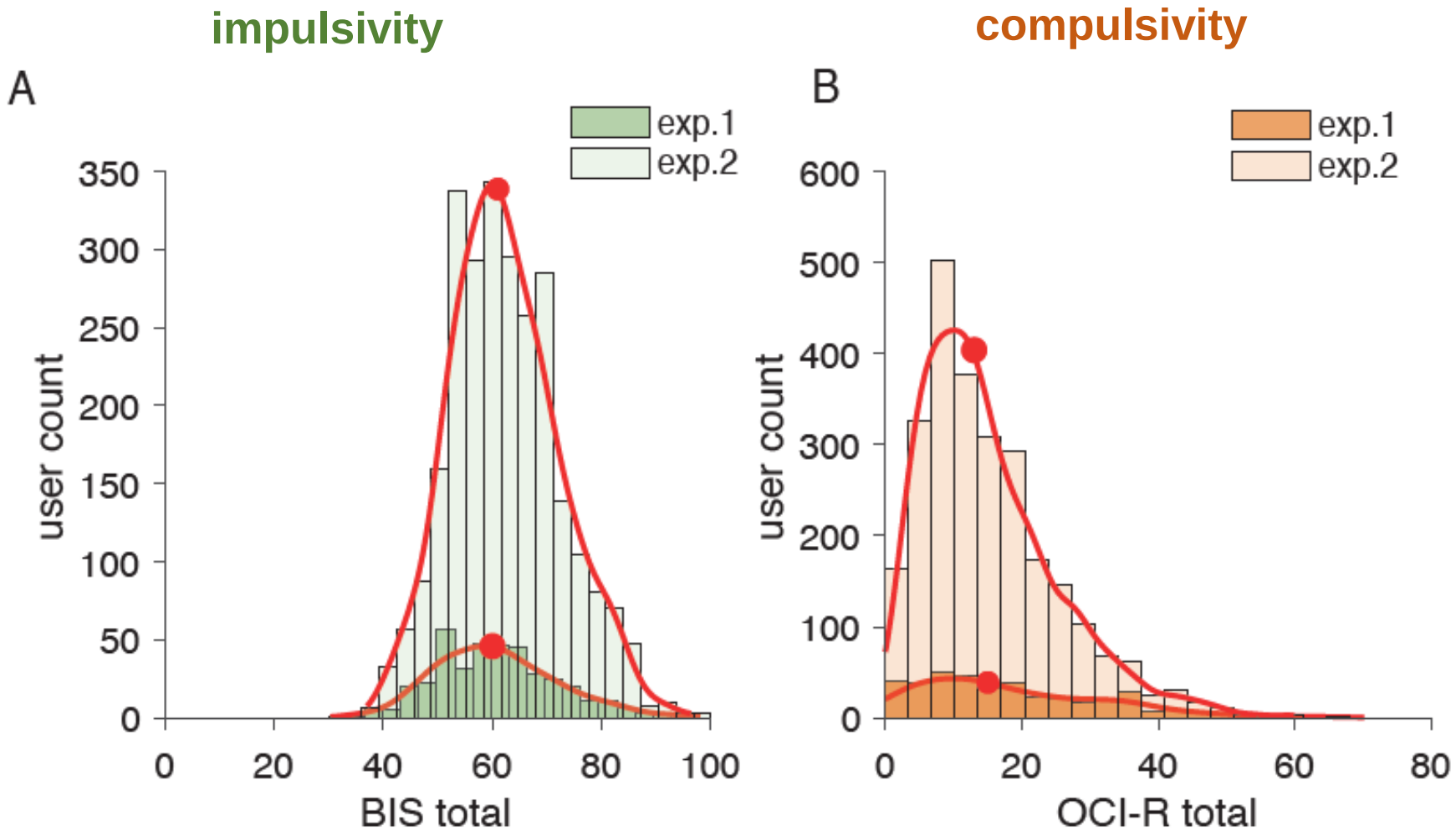


TASK PARAMETERS ACROSS PLATFORMS



Skvortsova & Hauser, 2022

PSYCHIATRIC SYMPTOMS ACROSS PLATFORMS

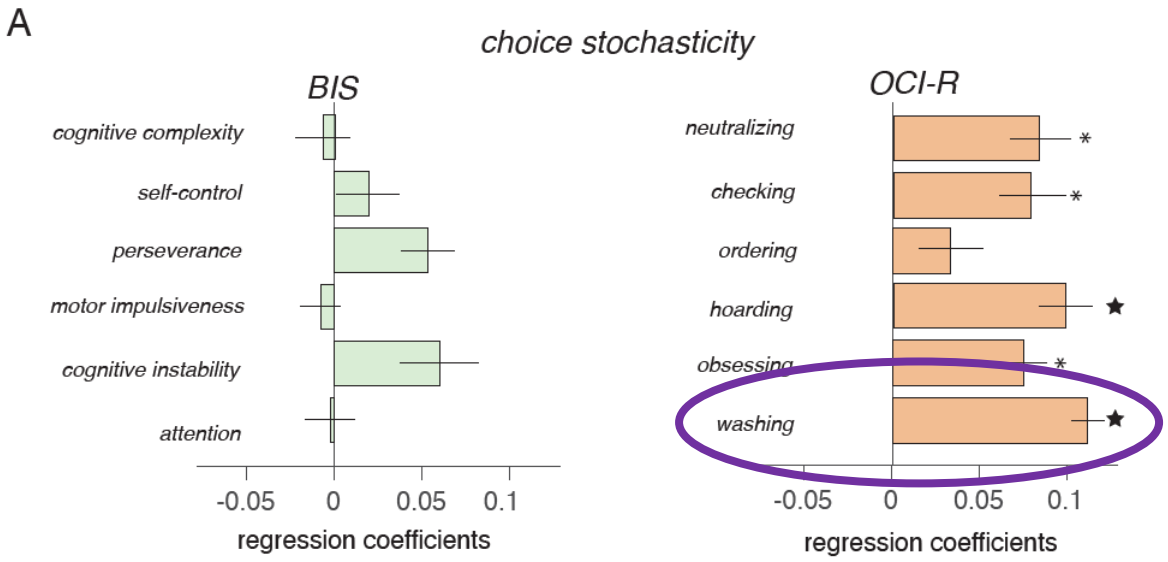


Skvortsova & Hauser, 2022

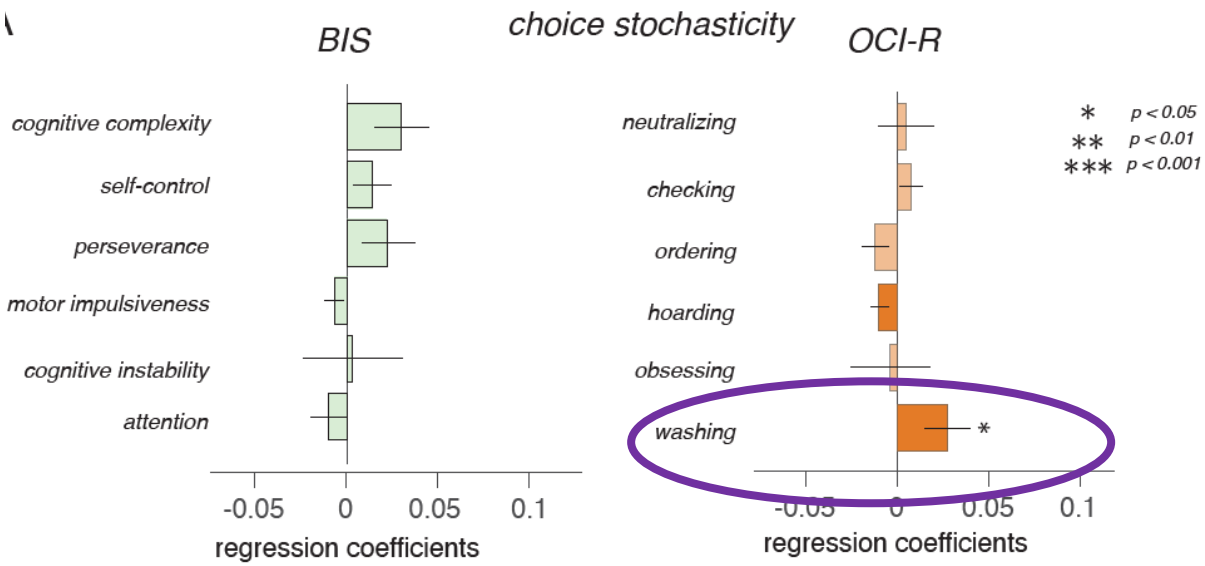
REPRODUCIBILITY MENTAL HEALTH LINKS

compulsivity & choice stochasticity

prolific sample



Brain Explorer sample

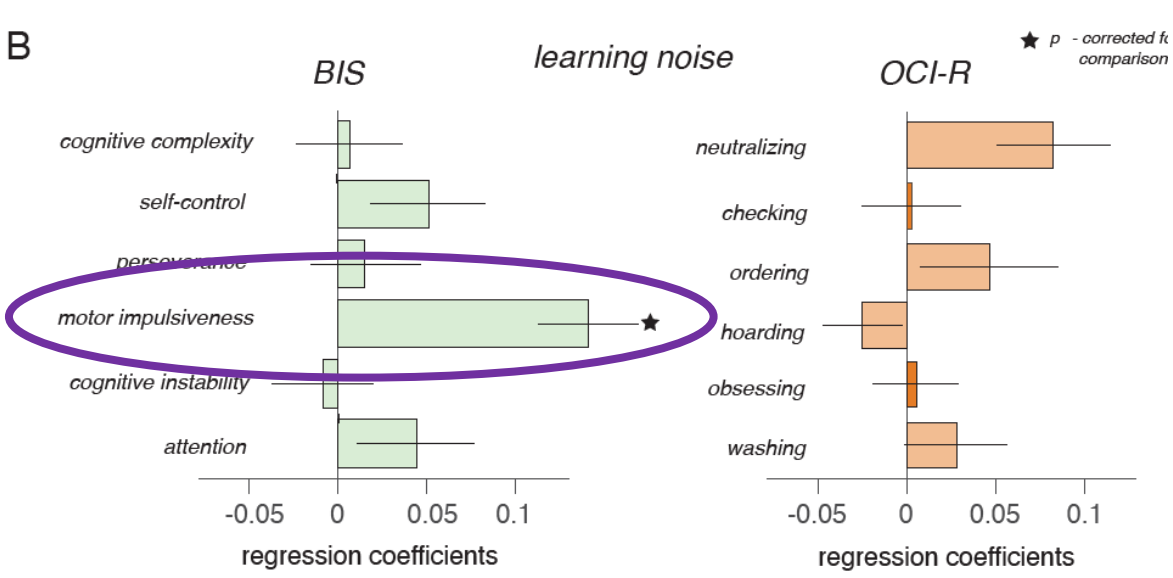


Skvortsova & Hauser, 2022

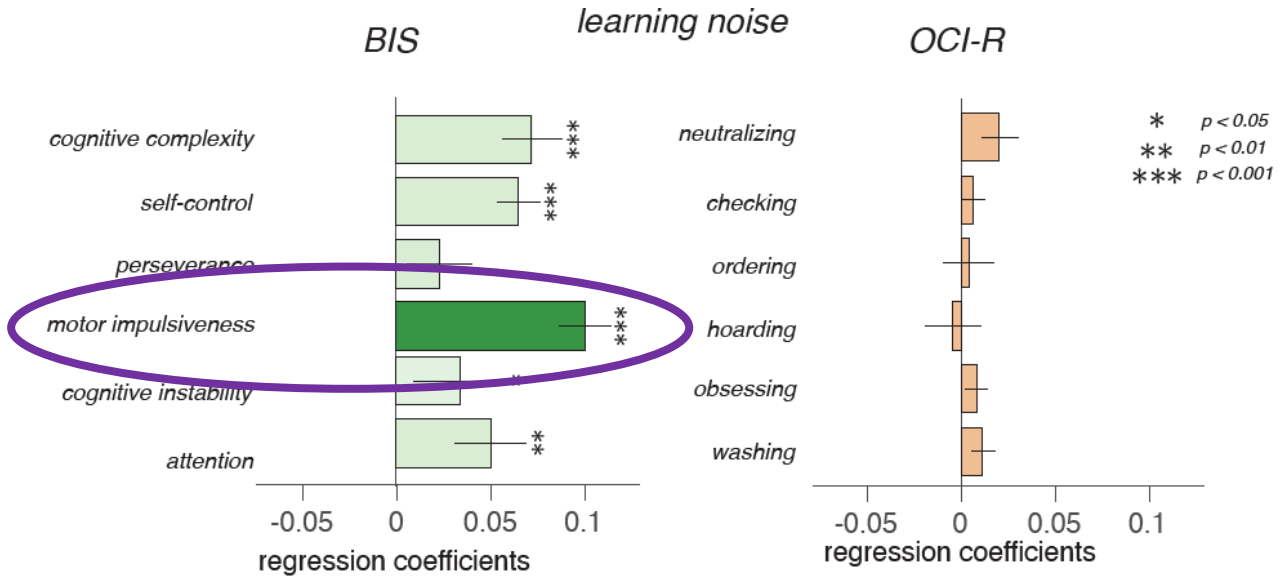
REPRODUCIBILITY MENTAL HEALTH LINKS

impulsivity & learning noise

prolific sample

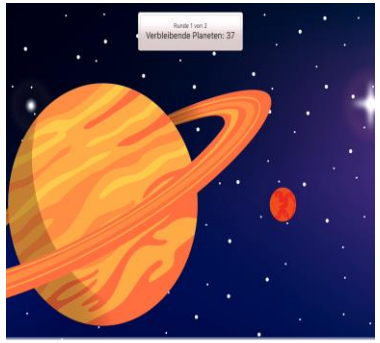


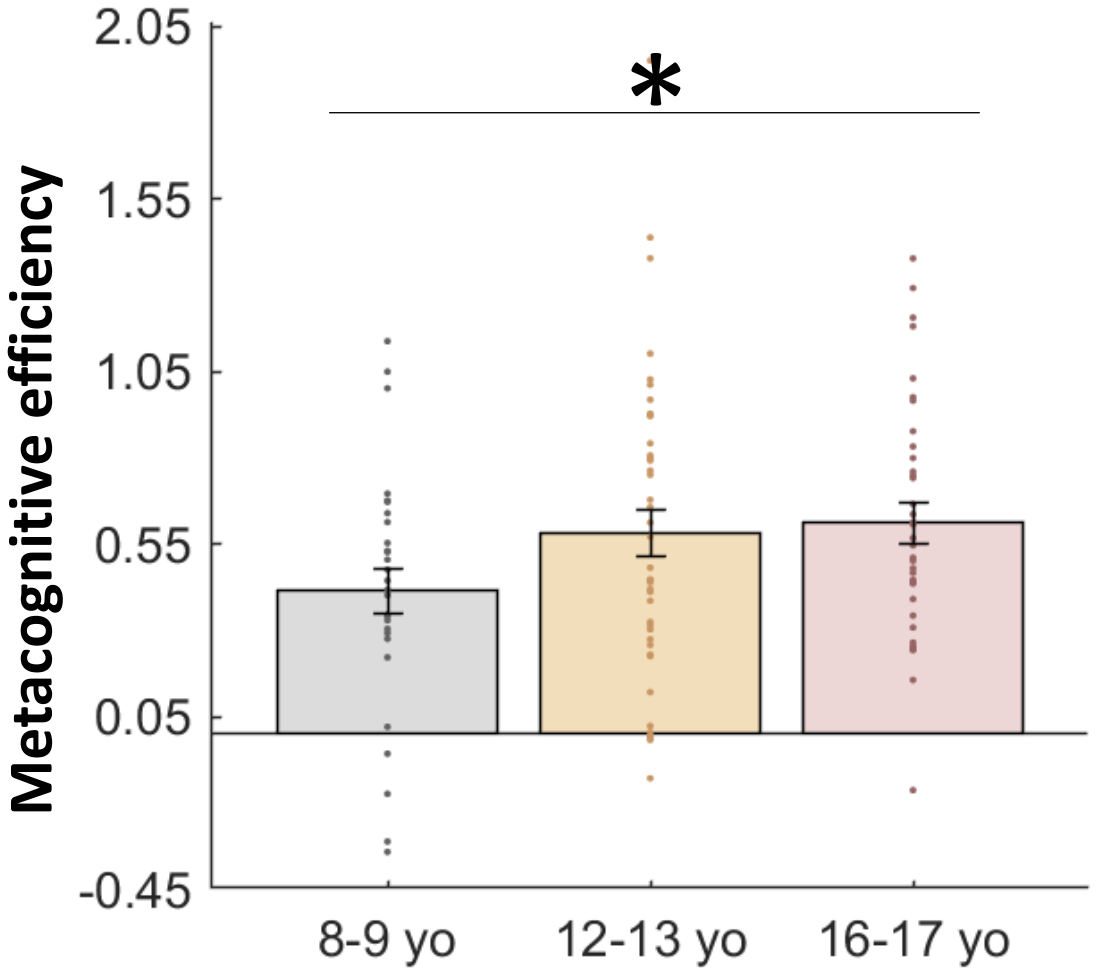
Brain Explorer sample

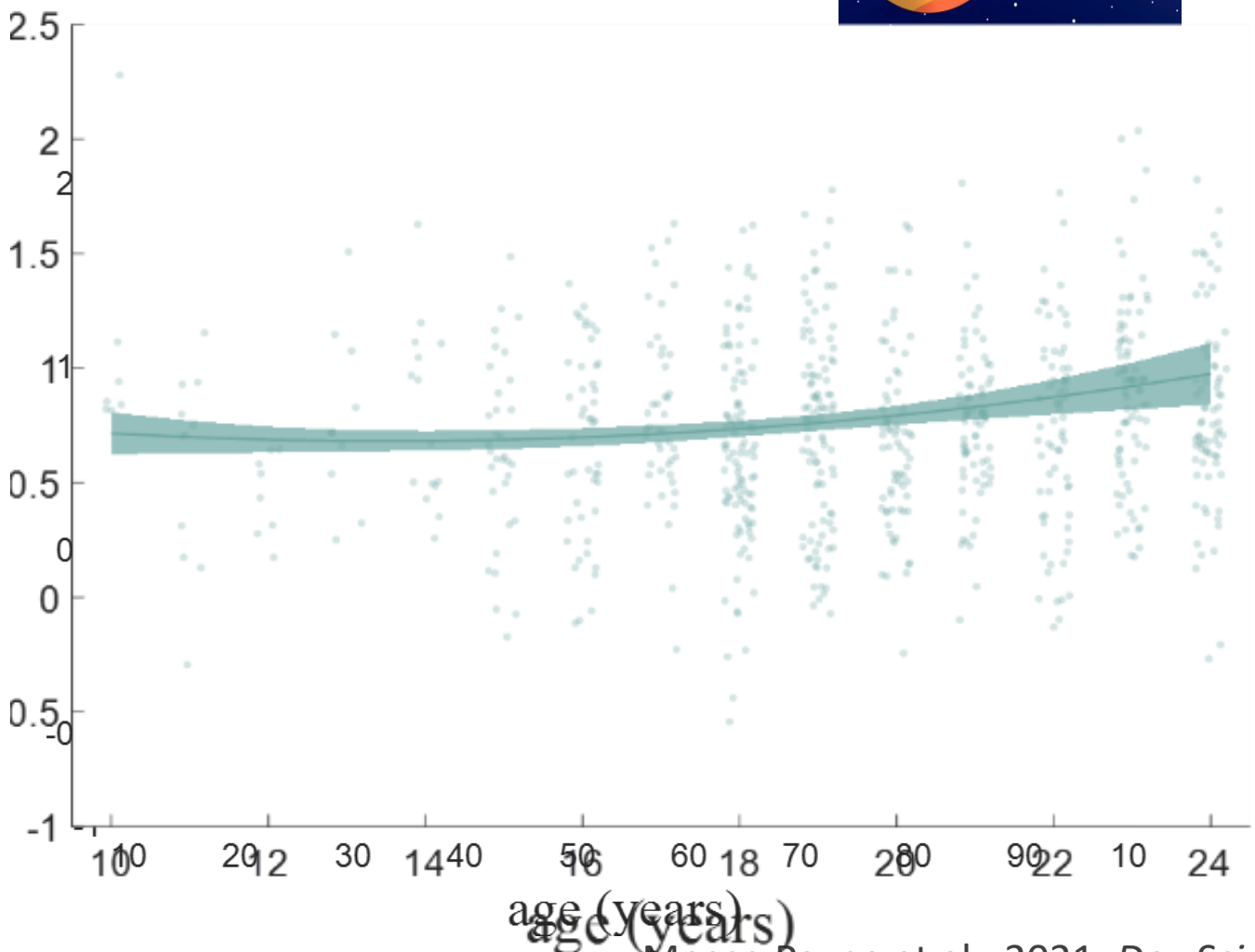


Skvortsova & Hauser, 2022

DEVELOPMENT ON PHONES

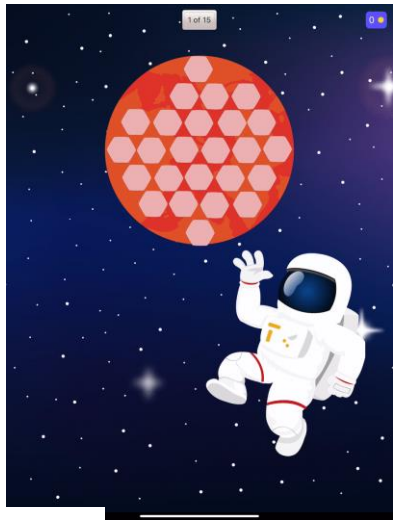






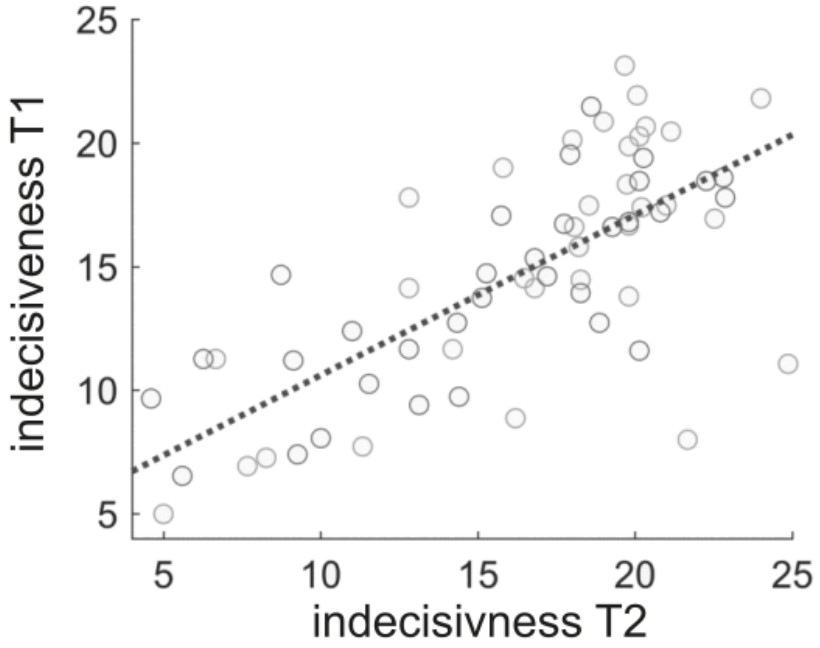
Moses-Payne et al., 2021, *Dev Sci*

RELIABILITY ON PHONES



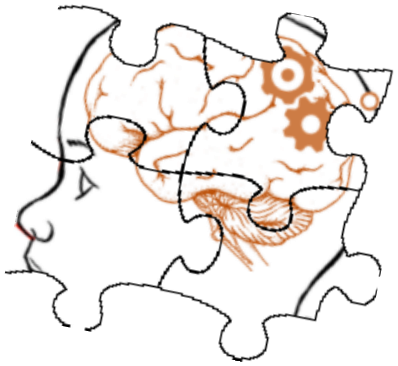
Information Sampling Task

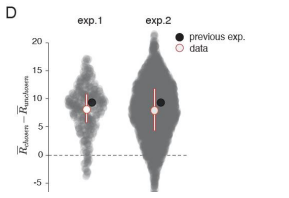
laboratory



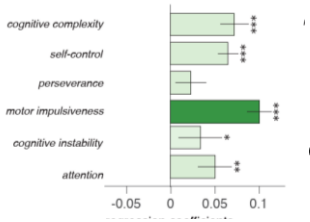
test-retest reliability: ICC=.55
Consistency: Cronbach α=.95

SUMMARY

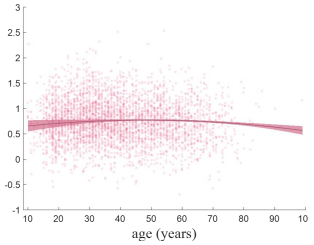




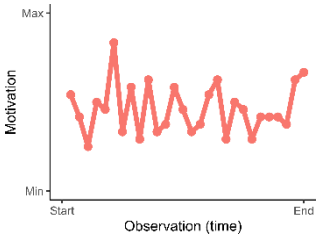
- Similar behaviour in lab and on app



- Similar (but weaker) associations with mental health



- Similar developmental patterns



- Daily fluctuations capturing meaningful symptoms

MAX PLANCK UCL CENTRE
for Computational Psychiatry and Ageing Research

EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

wellcome centre human neuroimaging

Developmental
Computational
Psychiatry lab

www.devcompsy.org

postdoc positions available:
www.devcompsy.org/join-the-lab/

wellcome

erc

THE ROYAL SOCIETY

JACOBS FOUNDATION
Our Promise to Youth

Medical Research Foundation

BRAIN & BEHAVIOR
RESEARCH FOUNDATION
Awarding NARSAD Grants

LEVERHULME TRUST

Carl Zeiss Stiftung

Vasilisa Skvortsova
Tricia Seow
Nadescha Trudel
Benjamin Chew
Magda Dubois
Magda del Rio

Alisa Loosen
Karen Hoang
Maddy Payne
Sam Hewitt
Aislinn Bowler
Johanna Habicht

t.hauser@ucl.ac.uk
@tobiasuhauser
www.tobiasuhauser.com

FENS KAVLI
NETWORK OF EXCELLENCE

YAE