

24th Biennial Conference of the
European Society for Cognitive Psychology
(ESCoP)
September 4, 2025
Sheffield
UK

Mind blanking reports are mediated by altered arousal levels

Athena Demertzi, PhD

Director, Physiology of Cognition Lab
GIGA Institute
CRC-Human Imaging Unit
University of Liège
BELGIUM



LIÈGE université
GIGA
CRC Human Imaging

States of (Un)consciousness



Clinical

Disorders of Consciousness
Anaesthesia



Physiological

Sleep

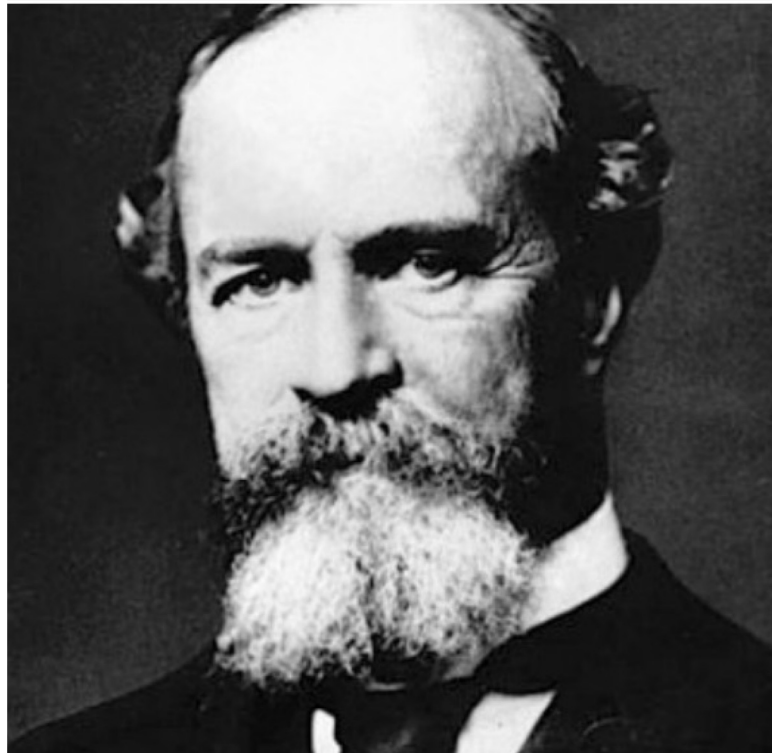


Wakefulness

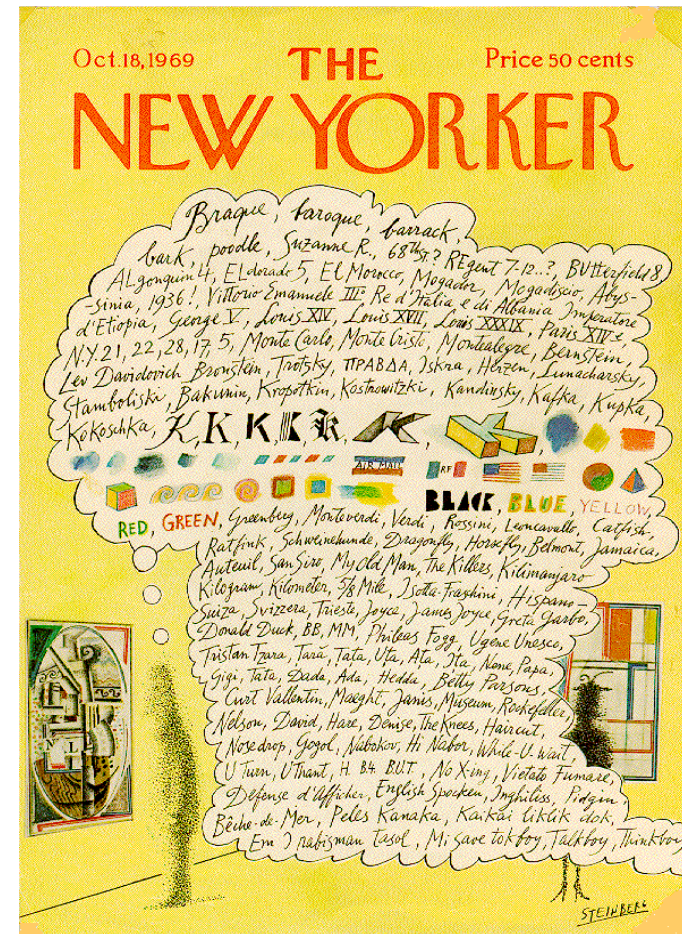
Mind Blanking

The stream of thought (Chapter IX)

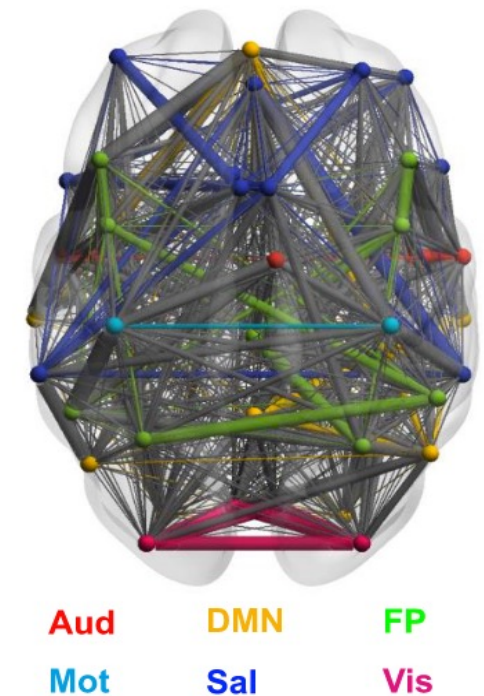
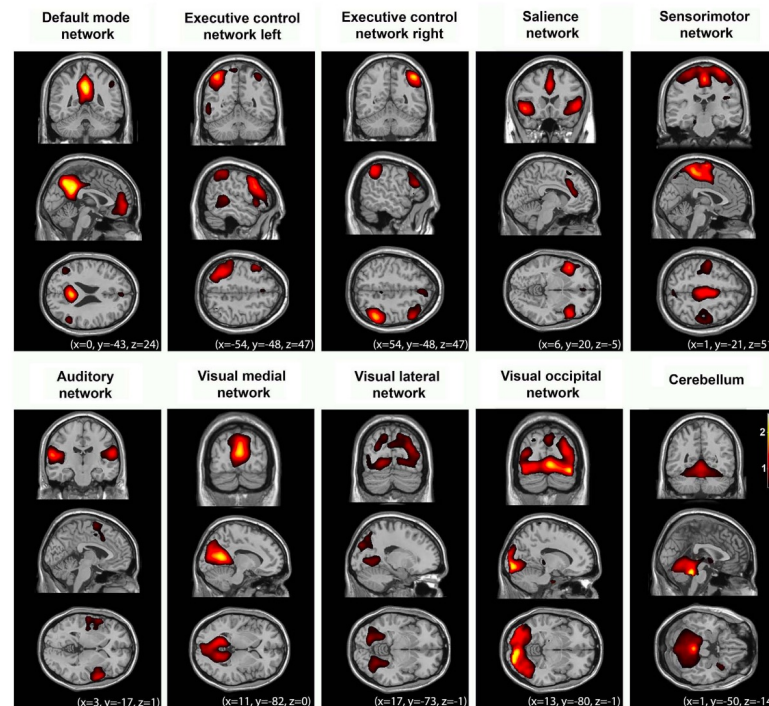
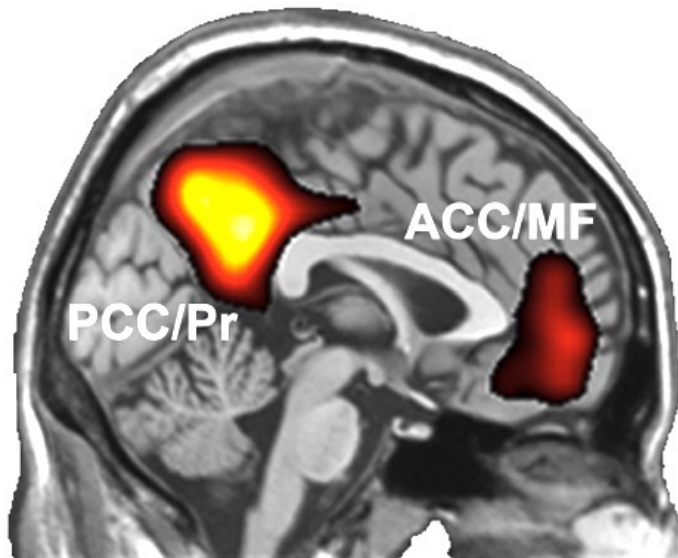
The principles of psychology 1890



William James (1842-1910)



The Spontaneous Brain

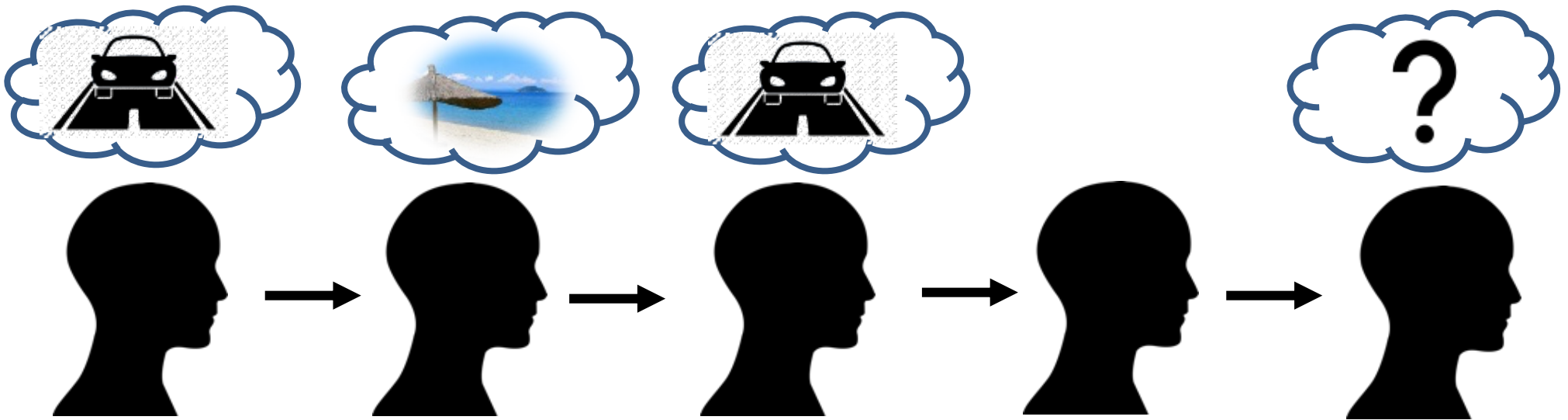


Raichle et al, *PNAS* 2001
 Demertzi, Soddu, Laureys, *Curr Opin Neurobiology* 2013
 Demertzi, [...], Deco. *Netw Neurosci* 2022

Heine, Soddu, Demertzi. *Front Psychol* 2012
 Demertzi & Gómez et al, *Cortex* 2014
 Demertzi & Antonopoulos et al, *Brain* 2015

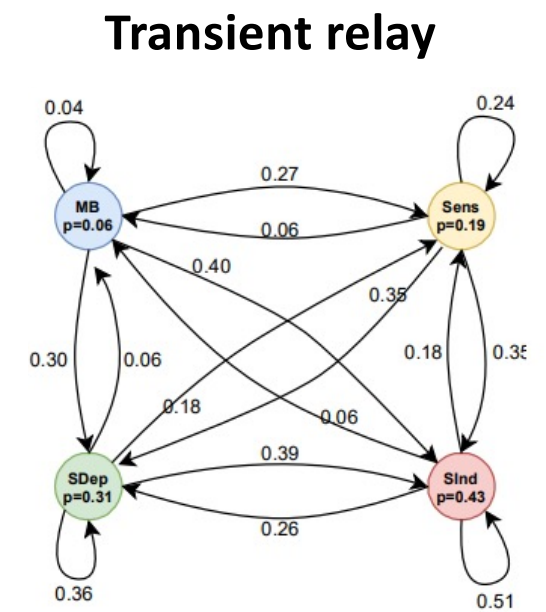
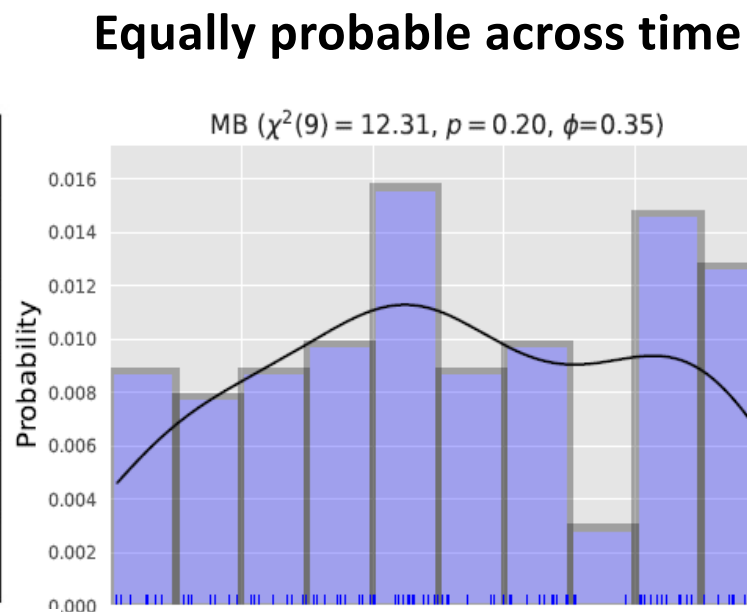
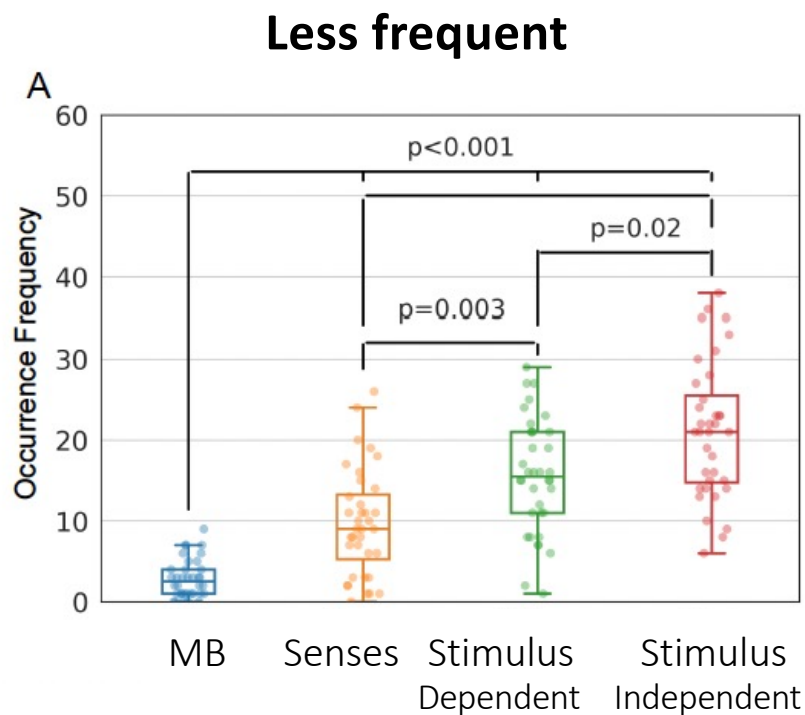
Sporns, et al. *PLoS Comput Biol* 2005
 Demertzi* & Tagliazucchi*, et al, *Sci Adv* 2019
 Mortaheb, et al. *Biol Psychiatry-CNNI* 2024

Mental states



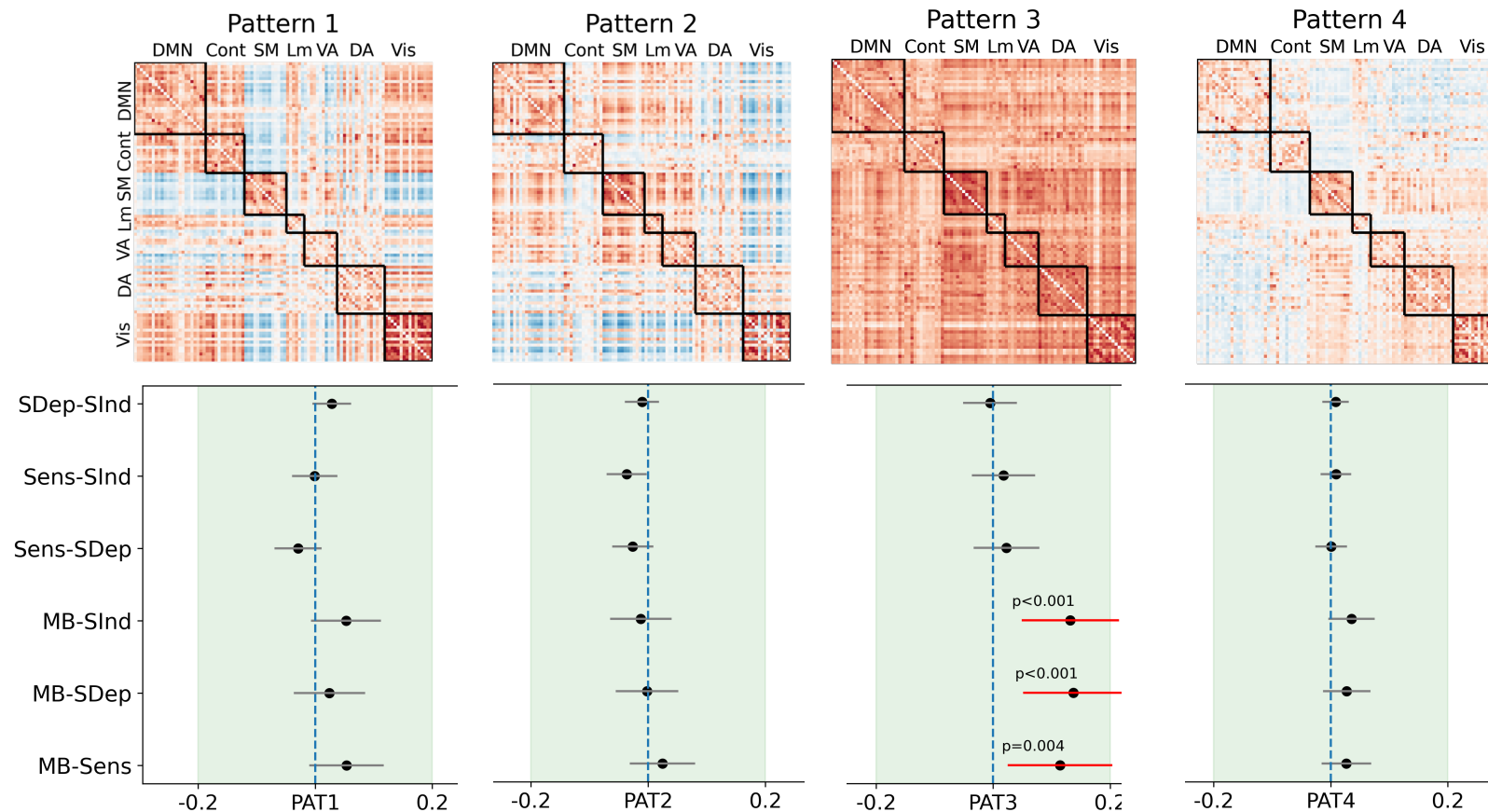
Slide courtesy: Boulakis Paris, Physiology of Cognition Lab

Mind Blanking

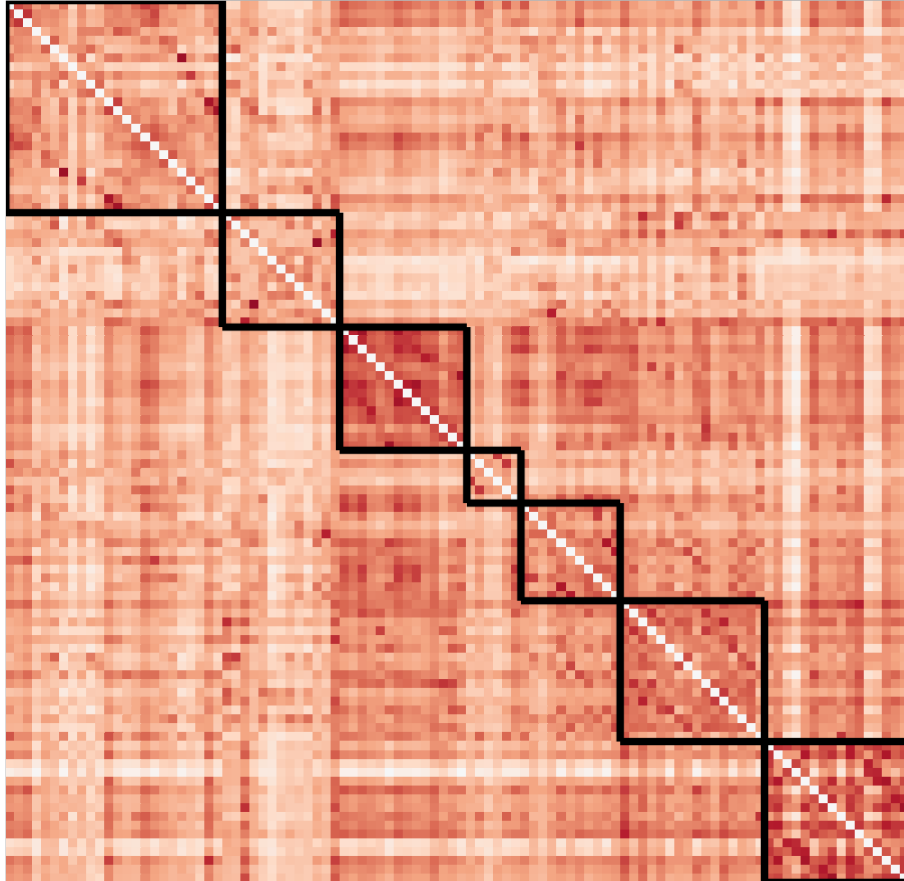


n subjects= 36
n probes = 50
duration = 48-58min

MB is linked to a hyper-connected pattern



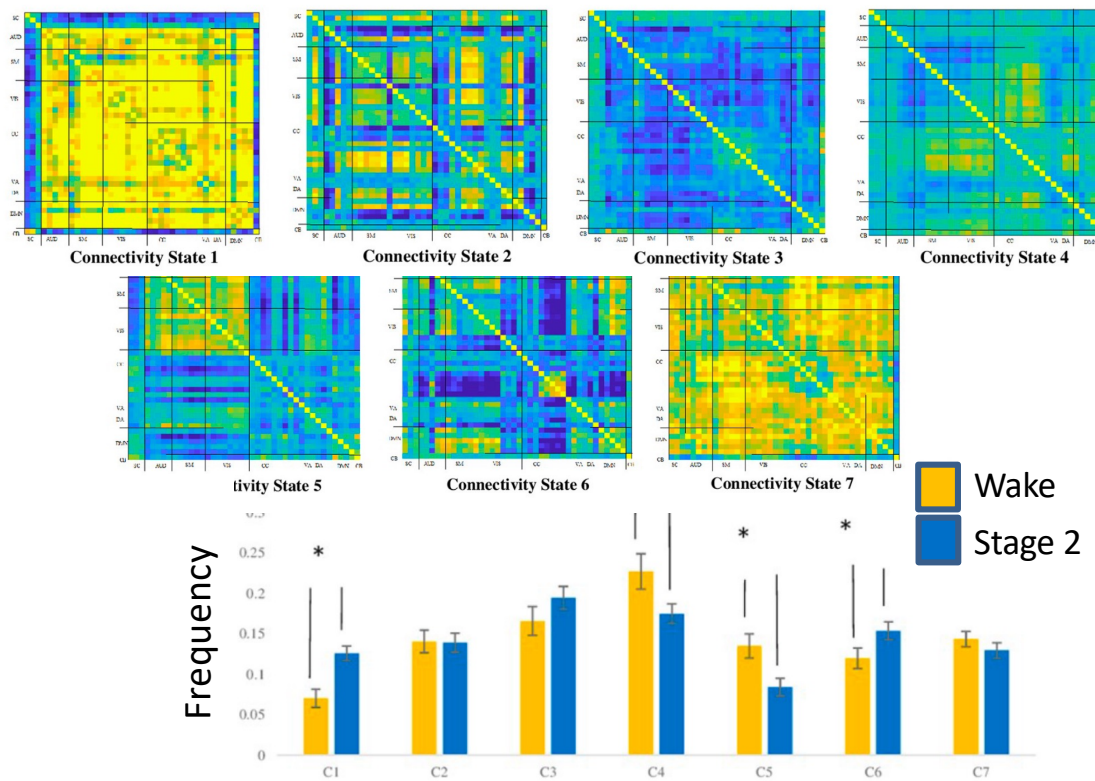
DMN Cont SM Lm VA DA Vis



**What is the
neurophysiological
substrate?**

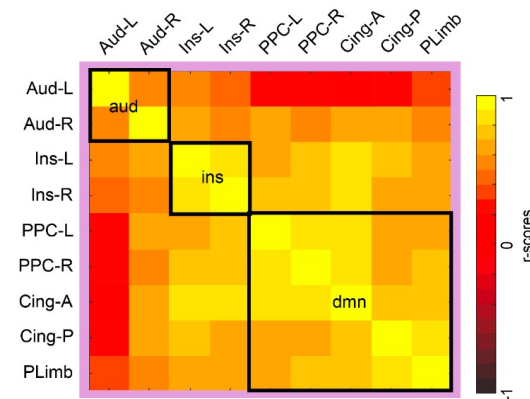
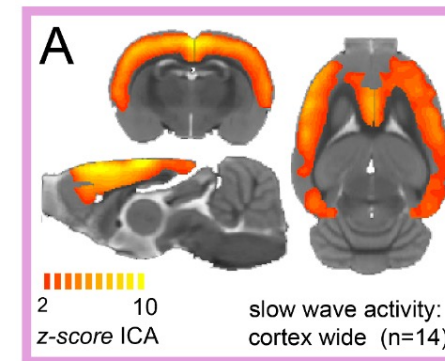
Higher connectivity in unconscious states

NREM sleep Humans



El-Baba et al, *PLOS One* 2019

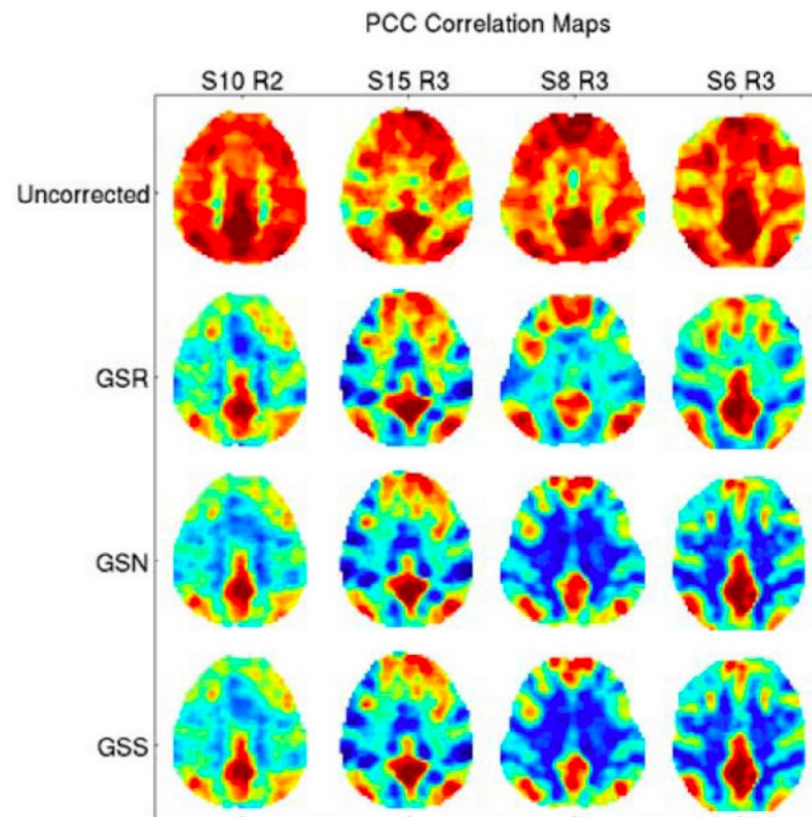
Isoflurane anesthesia Rats



Aedo-Jury et al, *eLife* 2019

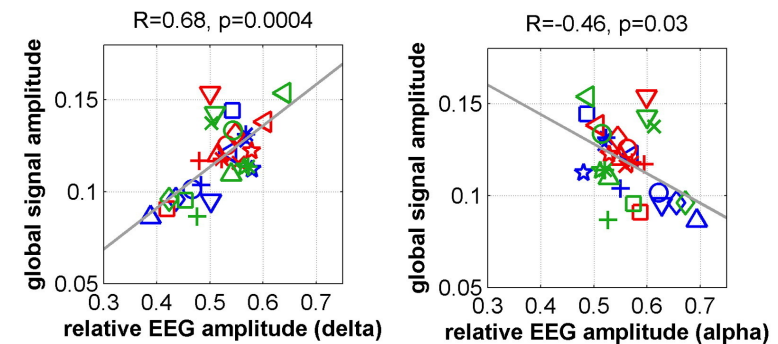
Higher Global Signal amplitude → Lower vigilance

The Global Signal

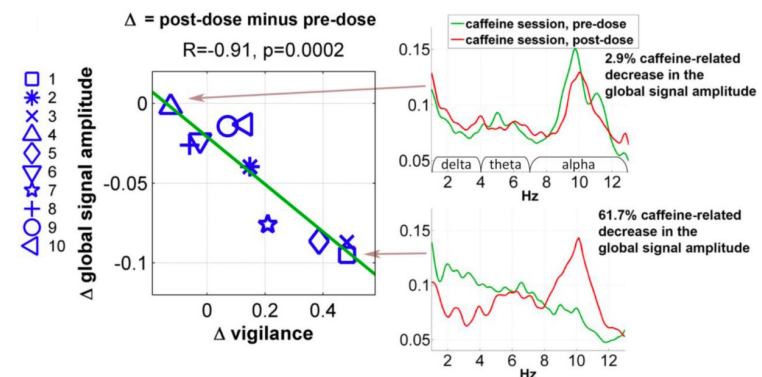


Liu et al, *NeuroImage* 2017

GS amplitude is linked to low arousal

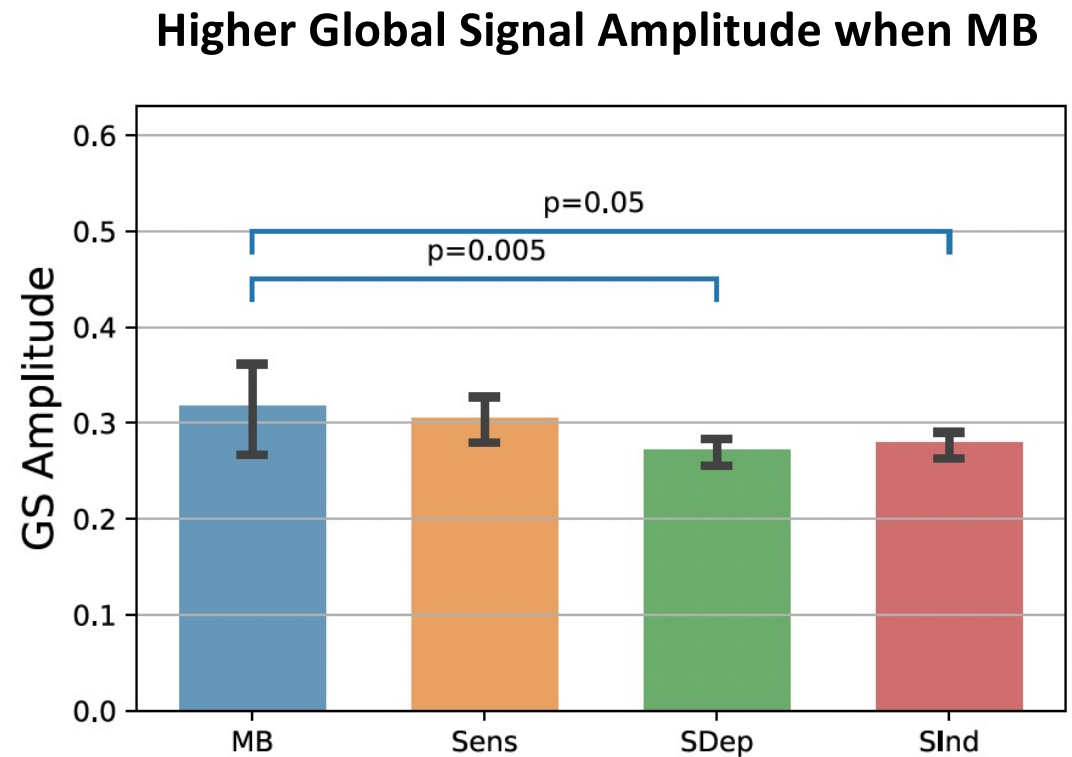
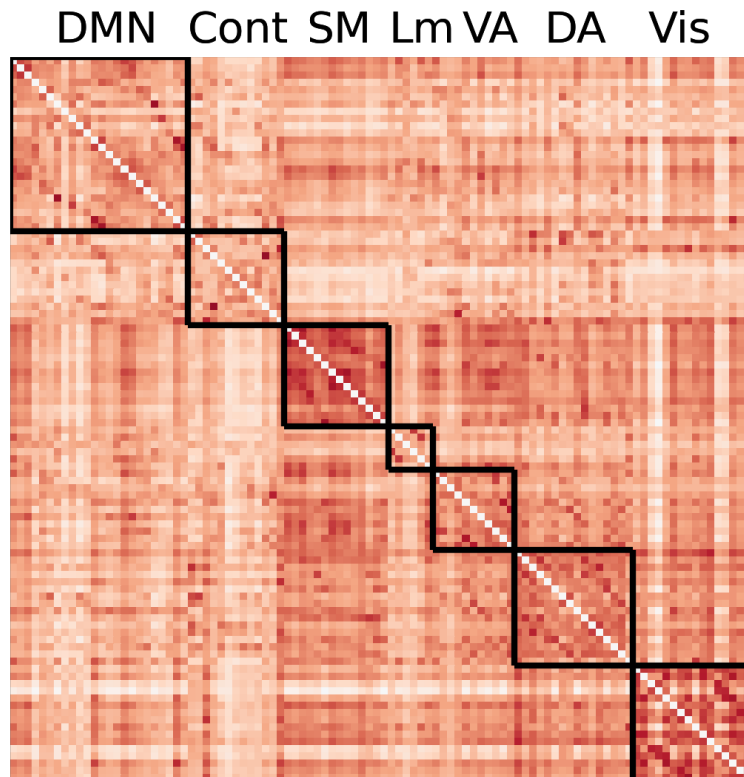


GS amplitude decreases with caffeine intake



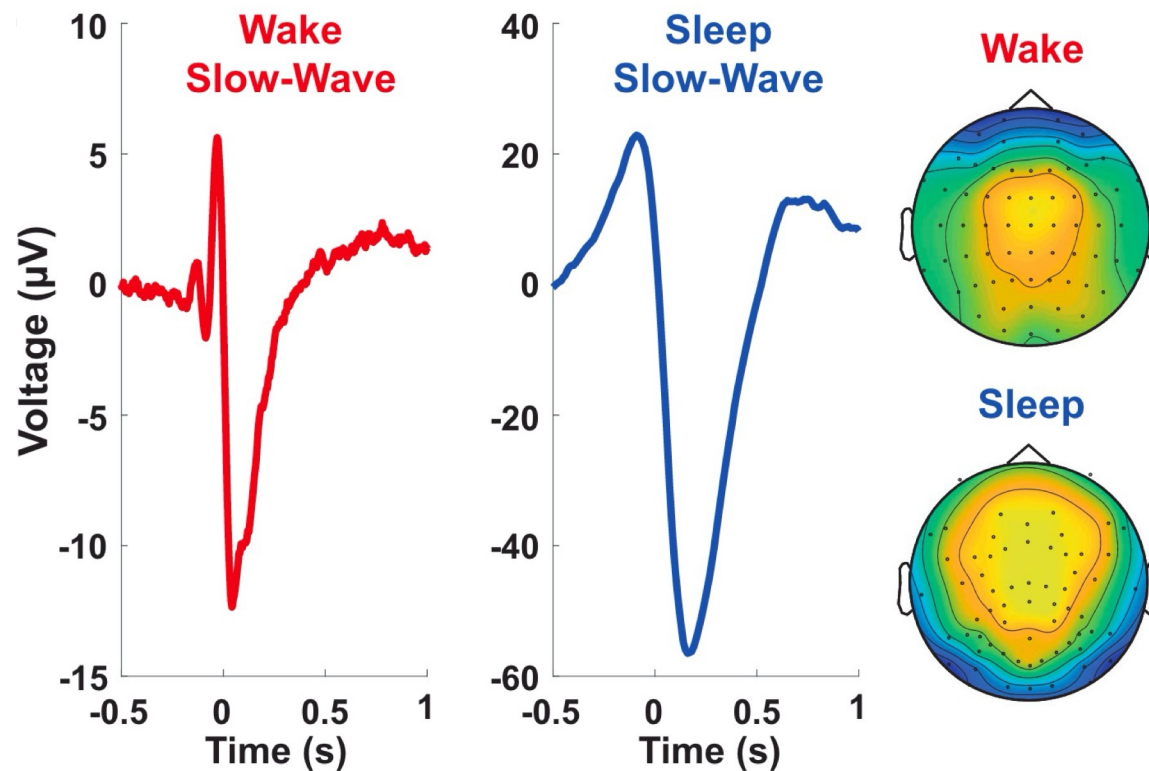
Wong et al, *Neuroimage* 2013

MB is mediated by low arousal levels

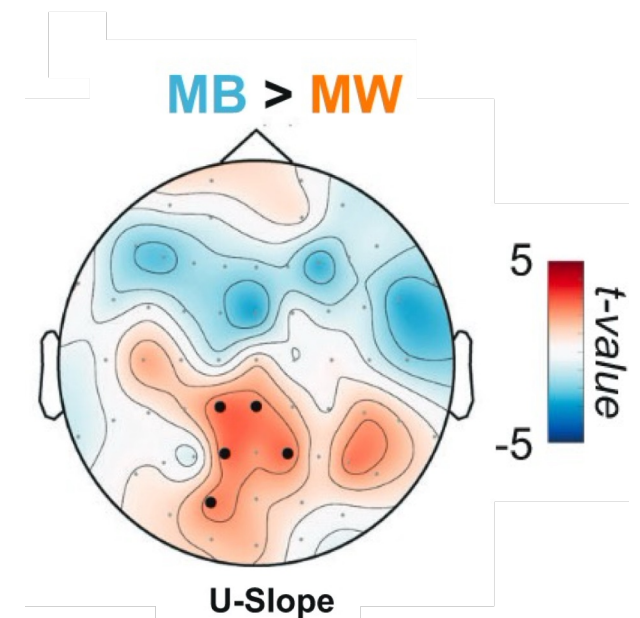


Slow wave-like activity in wakefulness

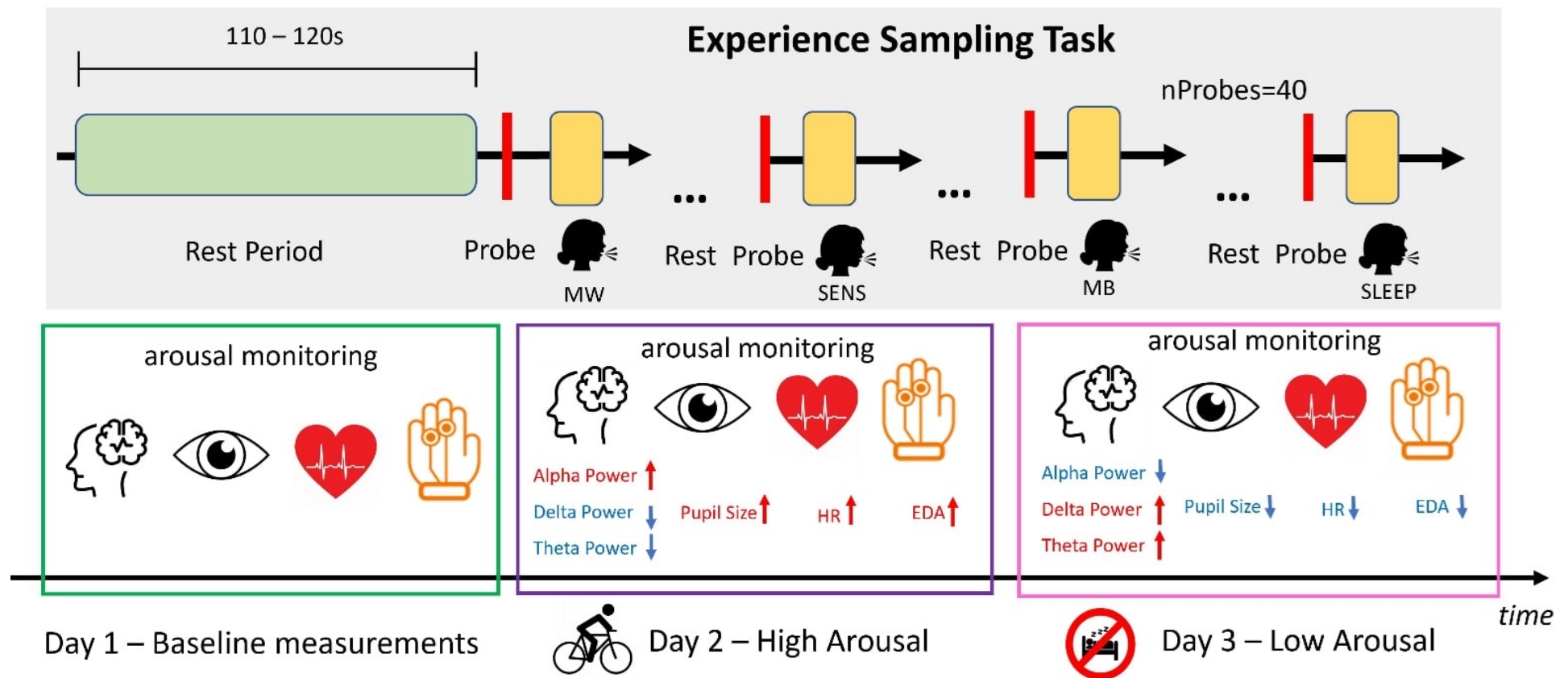
Properties of slow waves



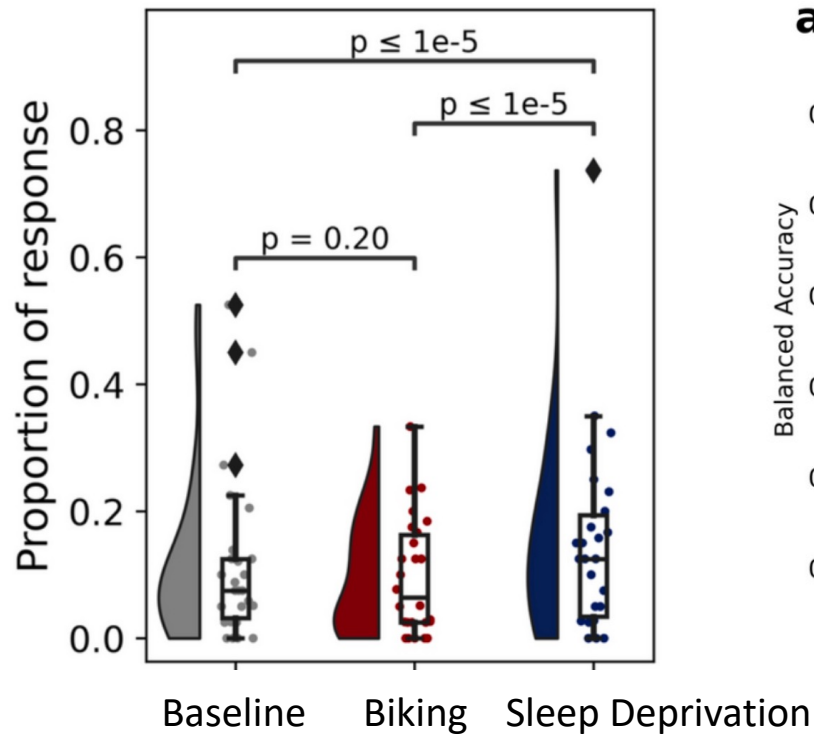
Predictive of mental states



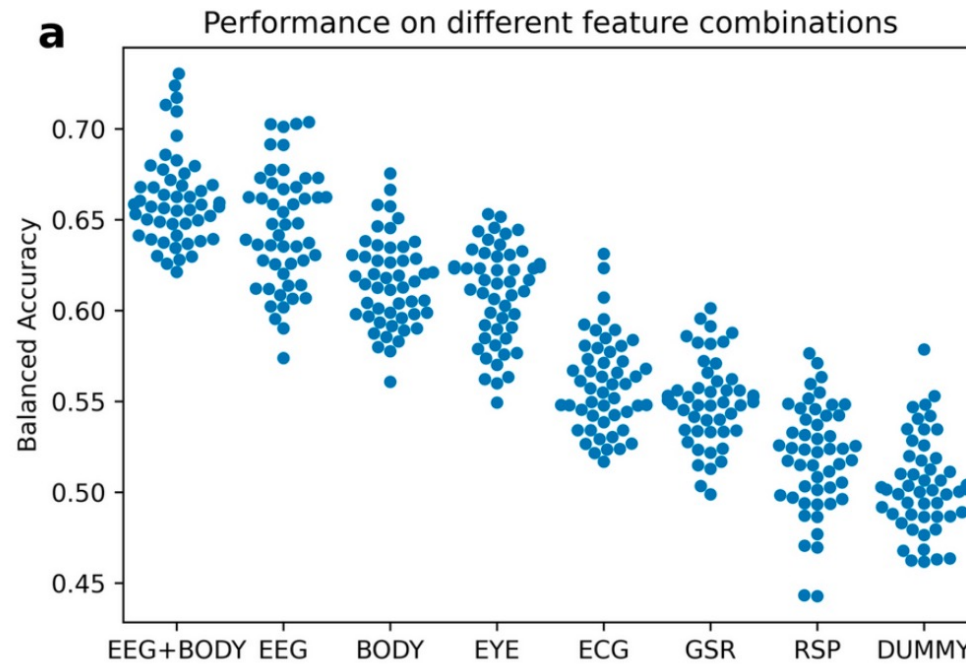
Does arousal mediate MB?



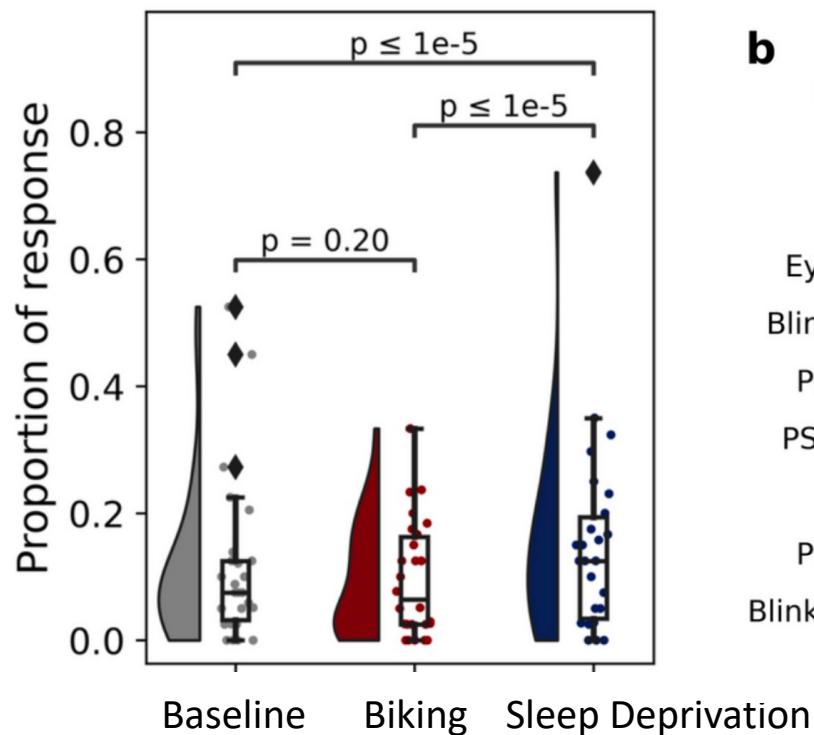
Altered arousal increases MB reports



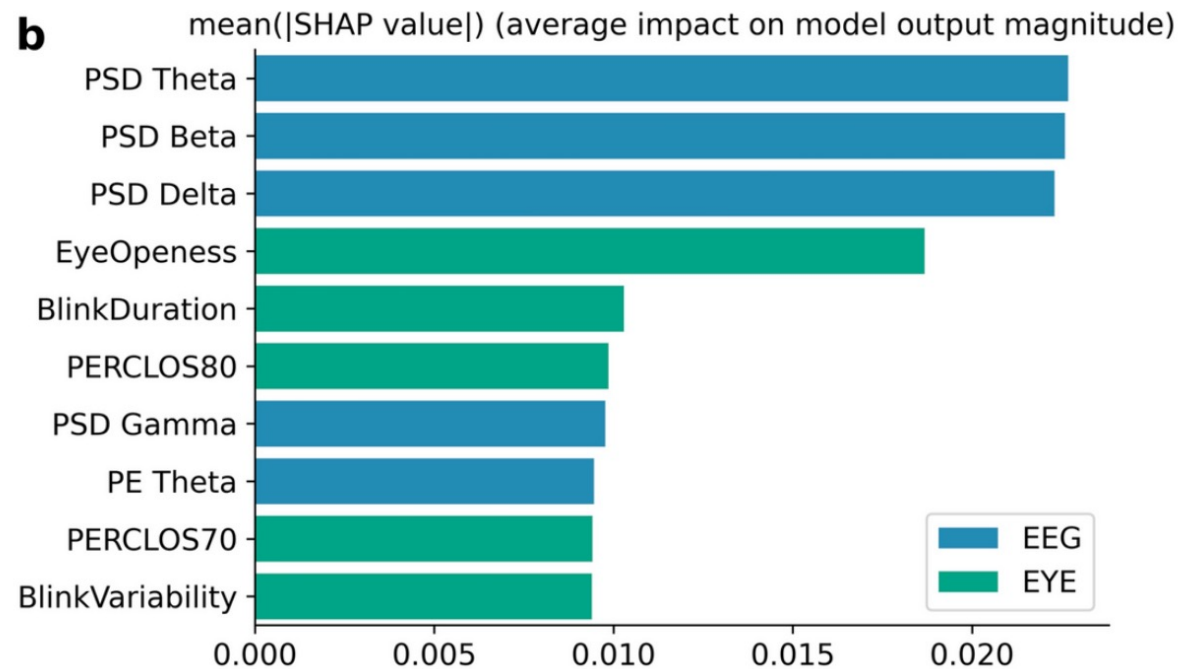
but MB was more frequent in
first half of post-exercise vs. second half



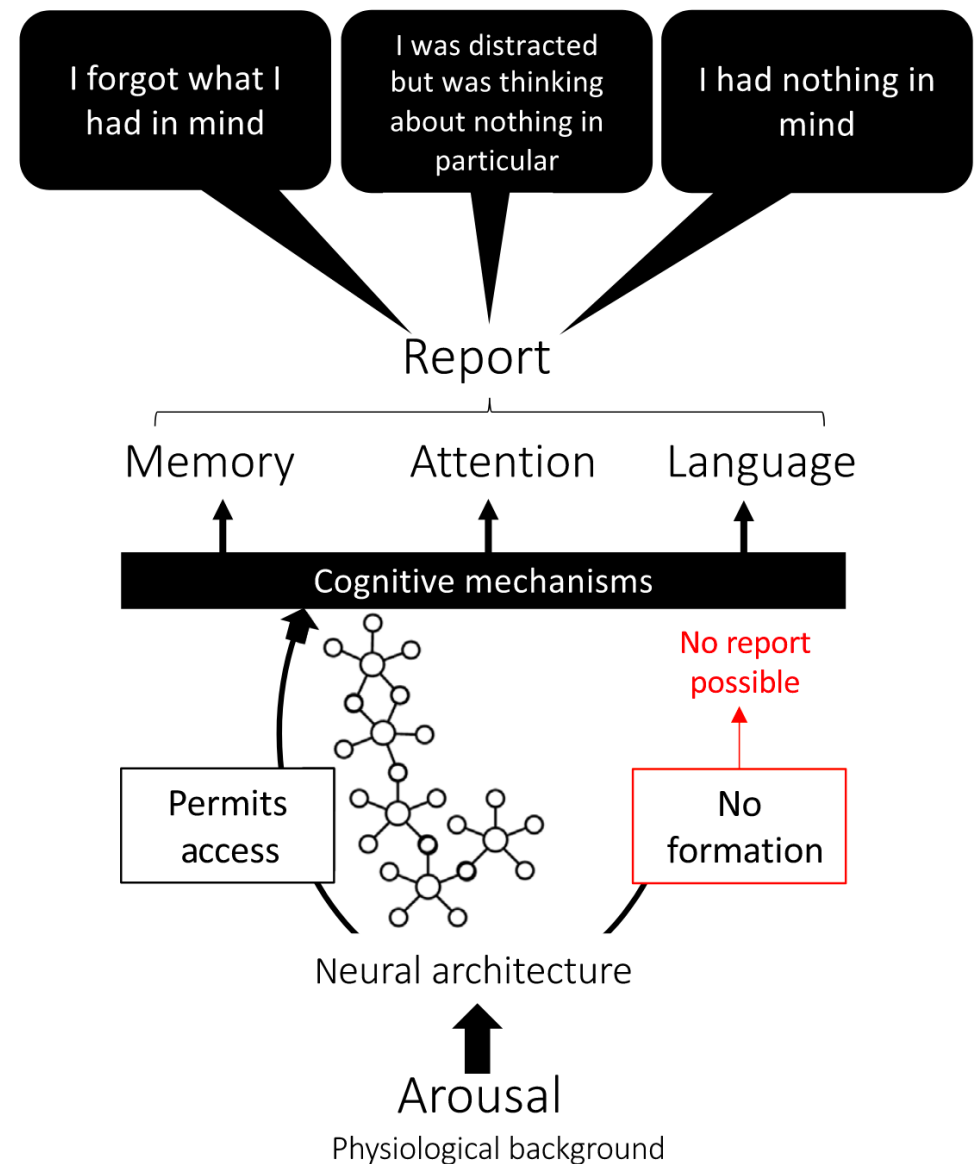
Altered arousal increases MB reports



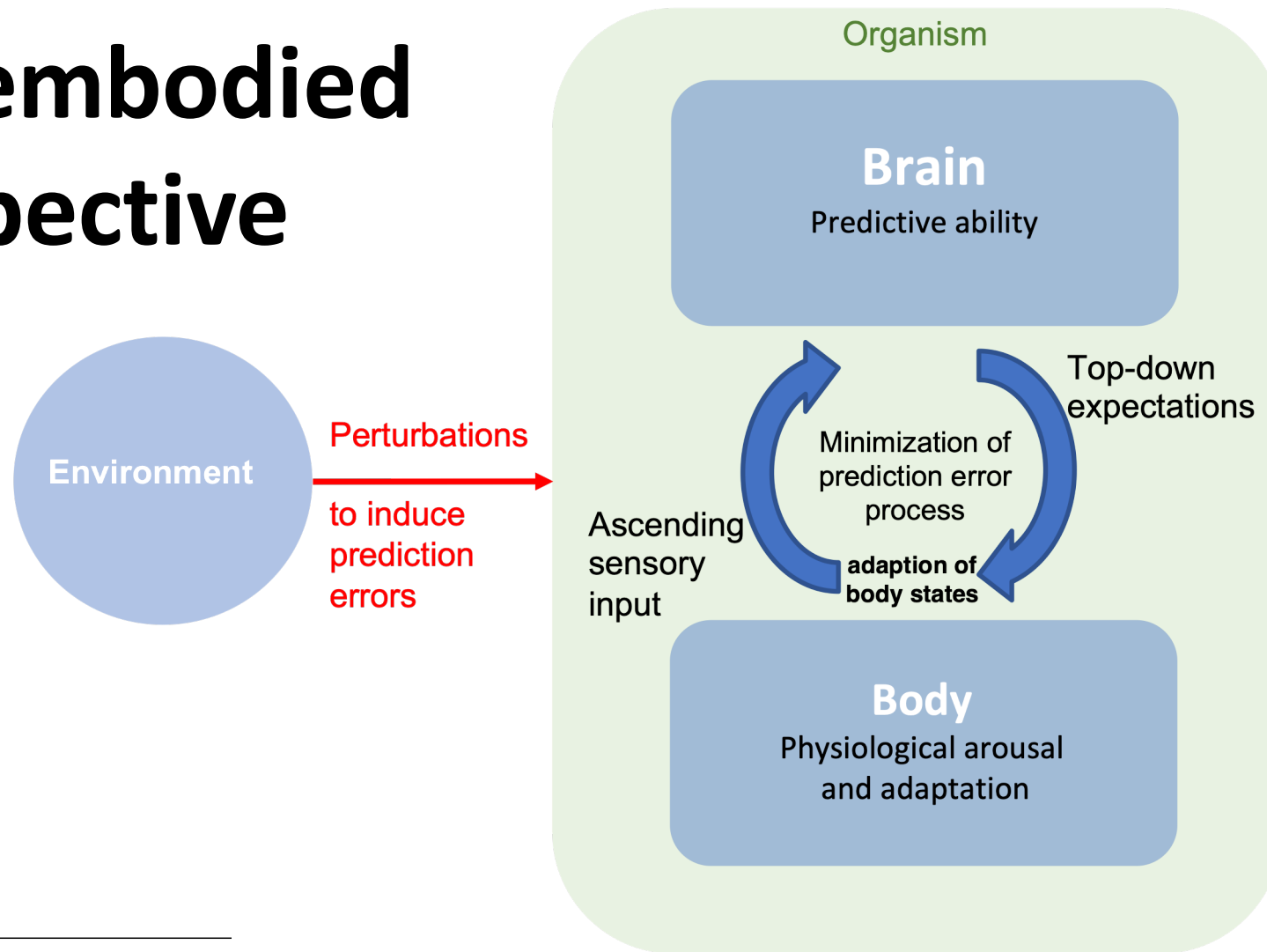
but MB was more frequent in
first half of post-exercise vs. second half



A physio-cognitive account of the phenomenology of MB



The embodied perspective

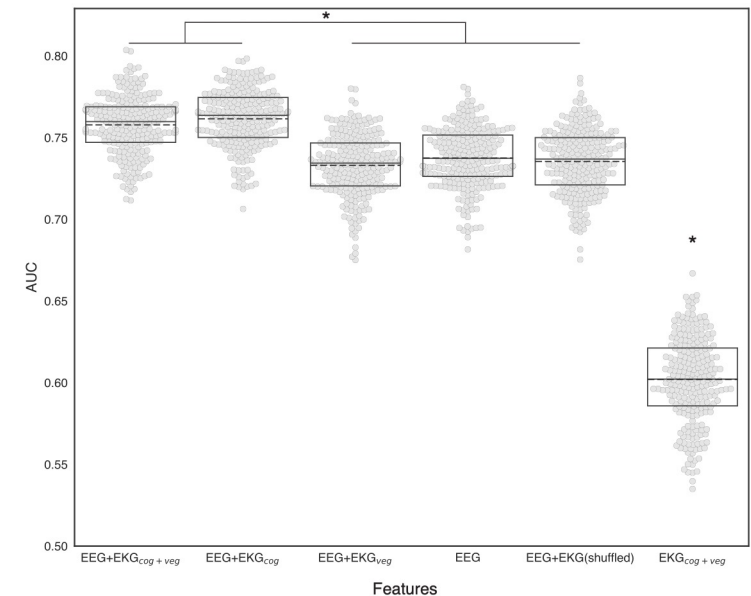
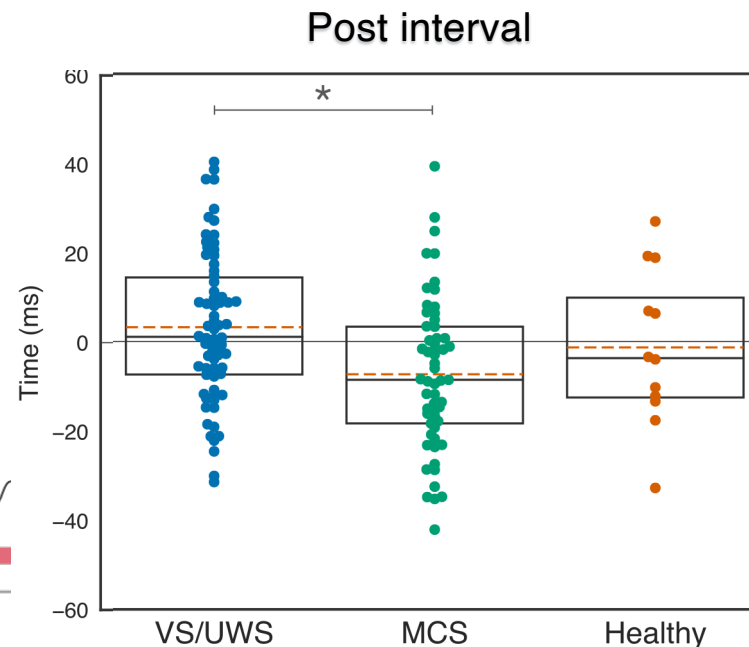
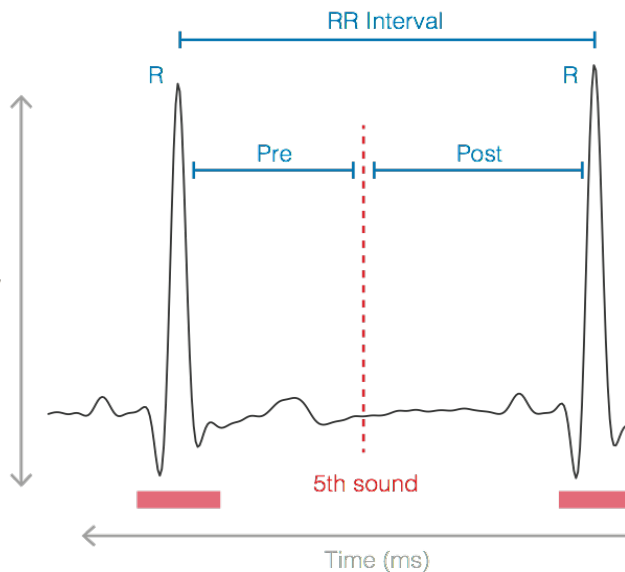


Cardiac acceleration to oddballs only in minimally conscious patients

Auditory oddball paradigm
Bekinschtein et al., PNAS, 2009

Cardiac cycle-phase acceleration
only in MCS

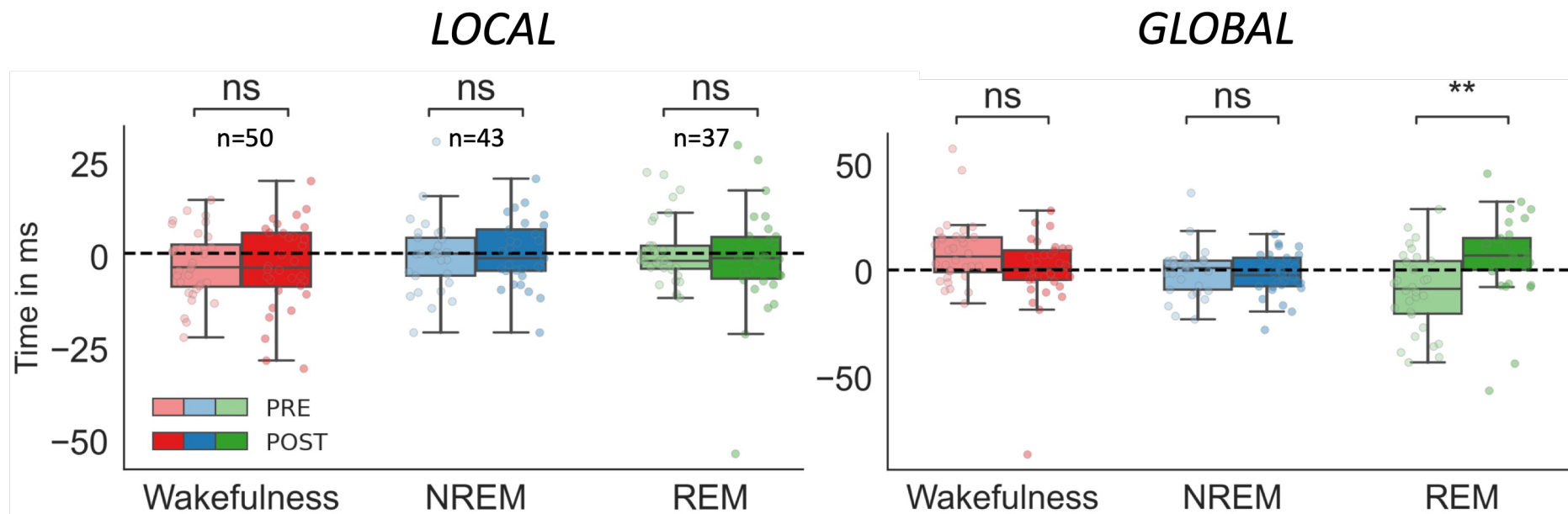
Electrocardiographic markers carry
independent information from EEG



Cardiac deceleration to oddballs for global deviants only in REM

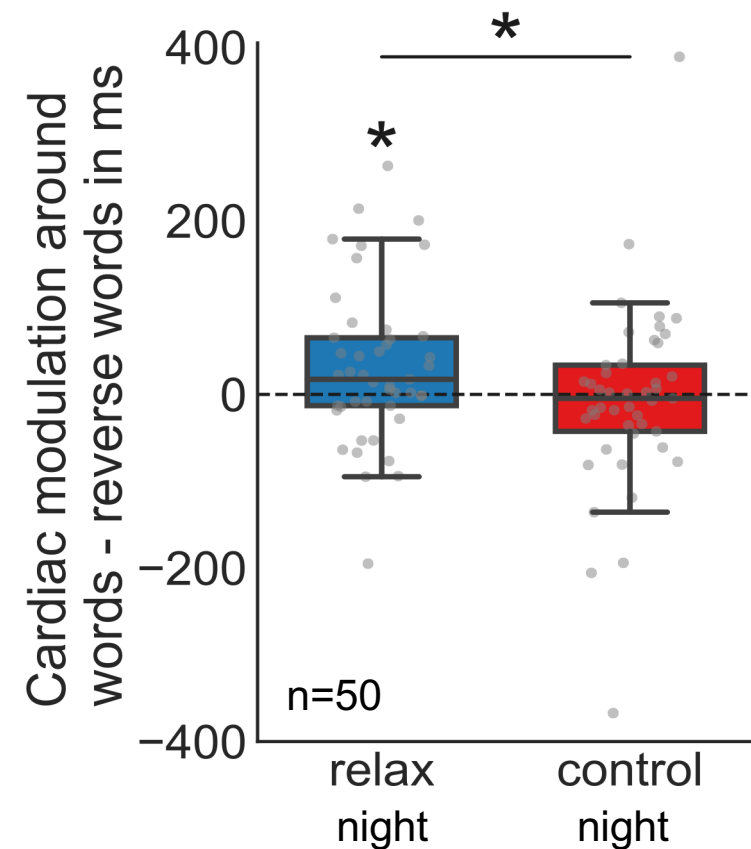
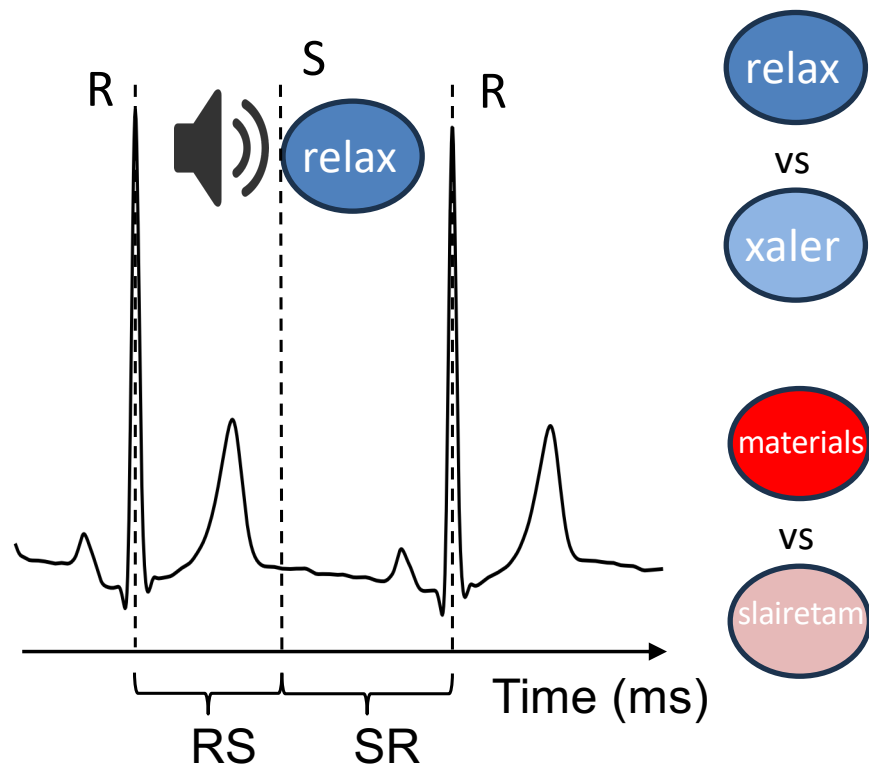
EEG: Strauss, Sitt, King, Elbaz, Azizi, Buiatti, Naccache, van Wassenhove, Dehaene, S, *PNAS* 2015

EEG: Blume, Niedernhuber, Spitschan, Slawik, Meyer, Bekinschtein, & Cajochen. *Sleep* 2022



Cardiac deceleration after listening to relaxing words during sleep

Cardiac modulation = SR - RS

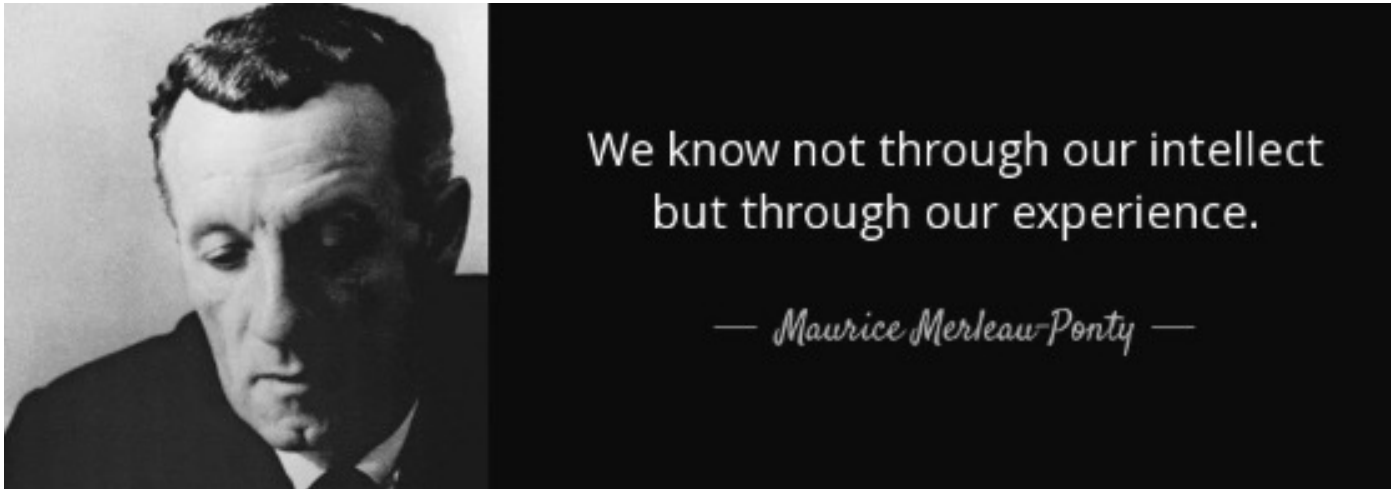


Conclusions

The brain supports content-full and content-less mental states

The body reacts to perturbations during unconsciousness

Thinking has an embodied perspective





Physiology of Cognition Lab



COLLABORATORS

Federico RAIMONDO (FZ Jülich)
Sepehr MORTAHEB
Matthieu KOROMA
Christina SCHMIDT
Christine BASTIN
Christophe PHILLIPS
Gilles VANDEWALLE
Fabienne COLLETTE

INTERNATIONAL COLLABORATORS

Thomas ANDRILLON	Marzia DE LUCIA
Jenny WINDT	Andria PELENTRITOU
Antoine LUTZ	Christine BLUME
Aniko KUSZTOR	Jan REMAEKERS
Kristian SANDBERG	Natasha MASON
Timo Torsen SCHMIDT	Pablo MALLARONI