Middlesex University London

KNOWING YOUR MIND: INSIGHTS FROM NEUROSCIENCE

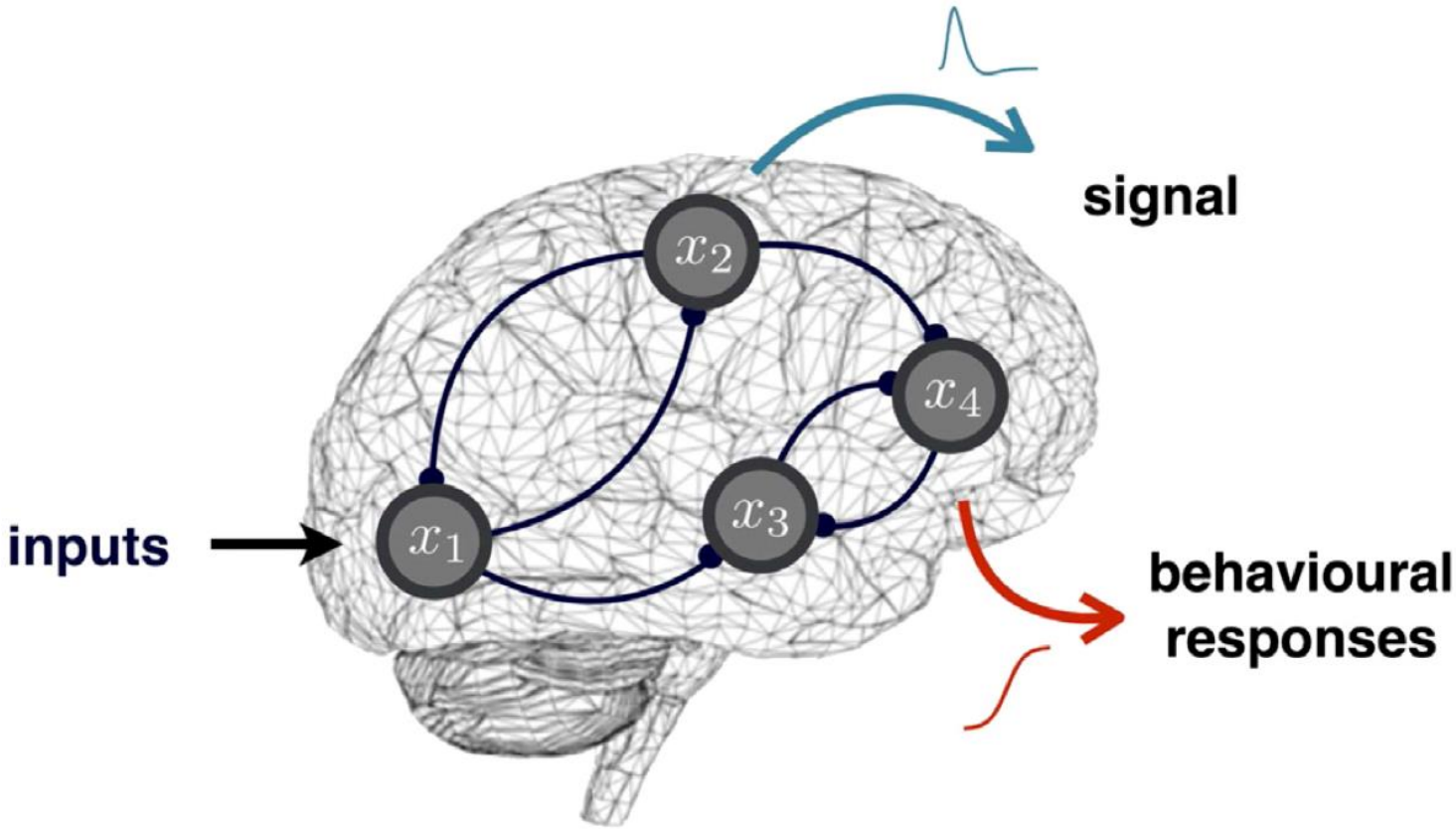
Dr Alexander Jones

&

Dr Jon Silas


Jones, Silas & Ward
Lab
A Cognitive Neuroscience Laboratory at Middlesex University
www.jones-silas-lab.com

What is Cognitive Neuroscience?



Overview

— How do we recognise objects?

— Are faces special?

— Reading the mind

— Brain computer interfaces

— Non-Invasive Brain Stimulation

— Q&A

HOW DO WE RECOGNISE OBJECTS?

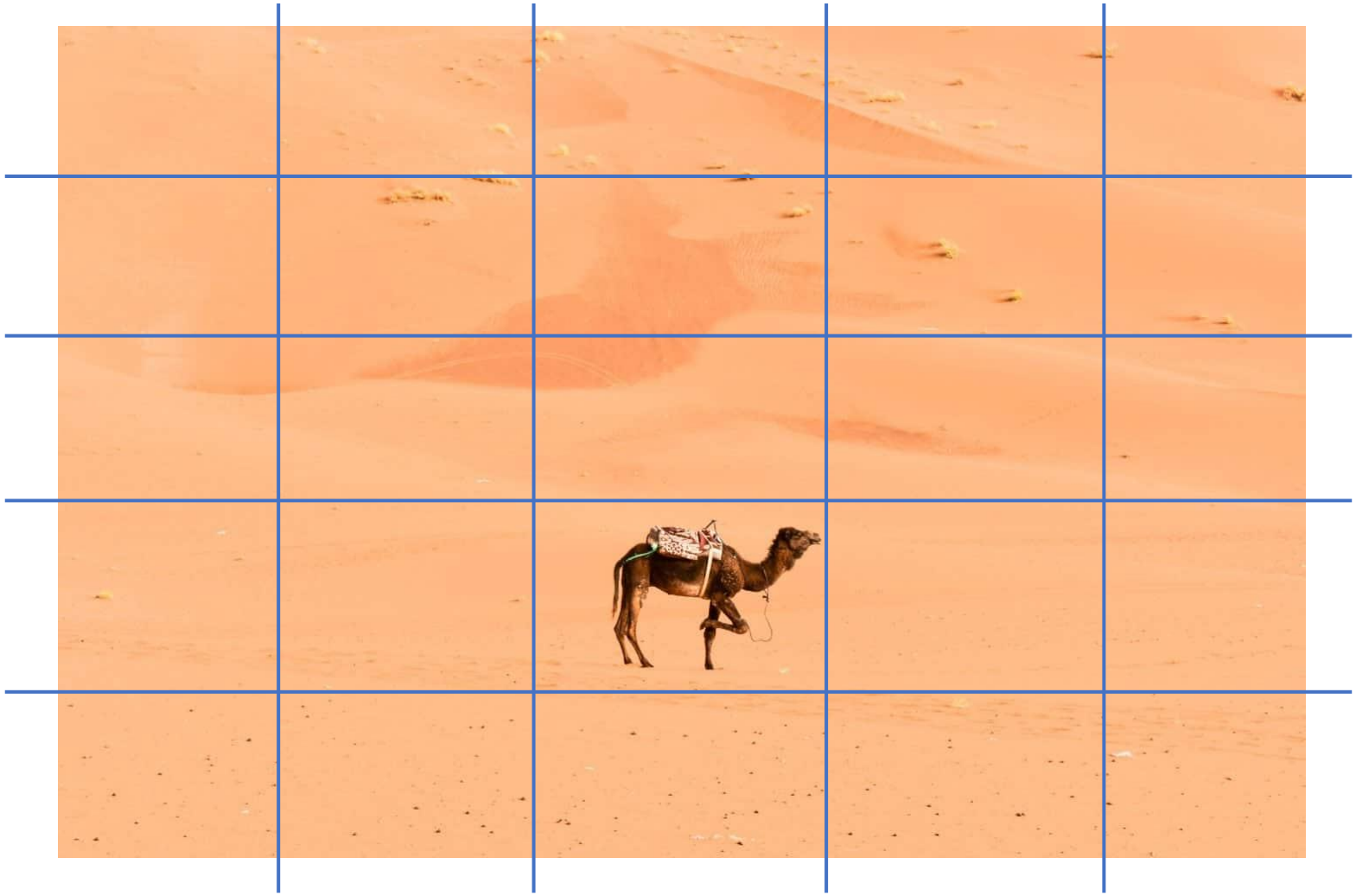
How do we recognize objects?

How do we recognize objects?

How do we recognize objects?

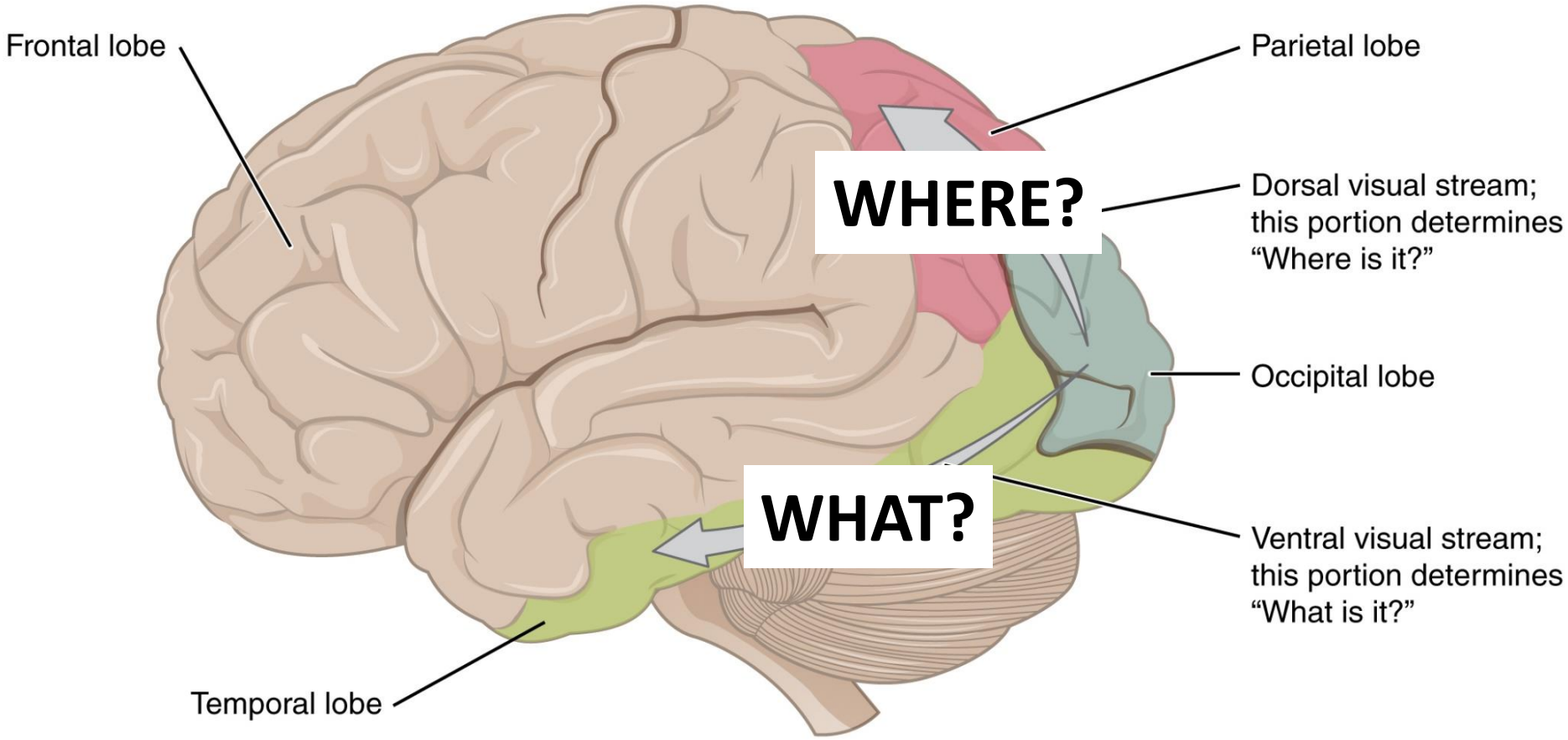
WHERE?

WHAT?



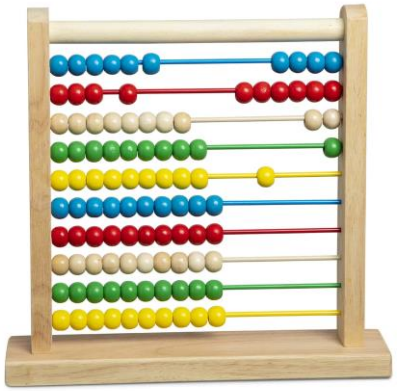
Ungerleider, L. G. and Mishkin, M. (1982). Two cortical visual systems. In “Analysis of Visual Behavior” (D. J. Ingle, M. A. Goodale, and R. J. W. Mansfield, eds.), pp. 549–586. MIT Press: Cambridge, MA.

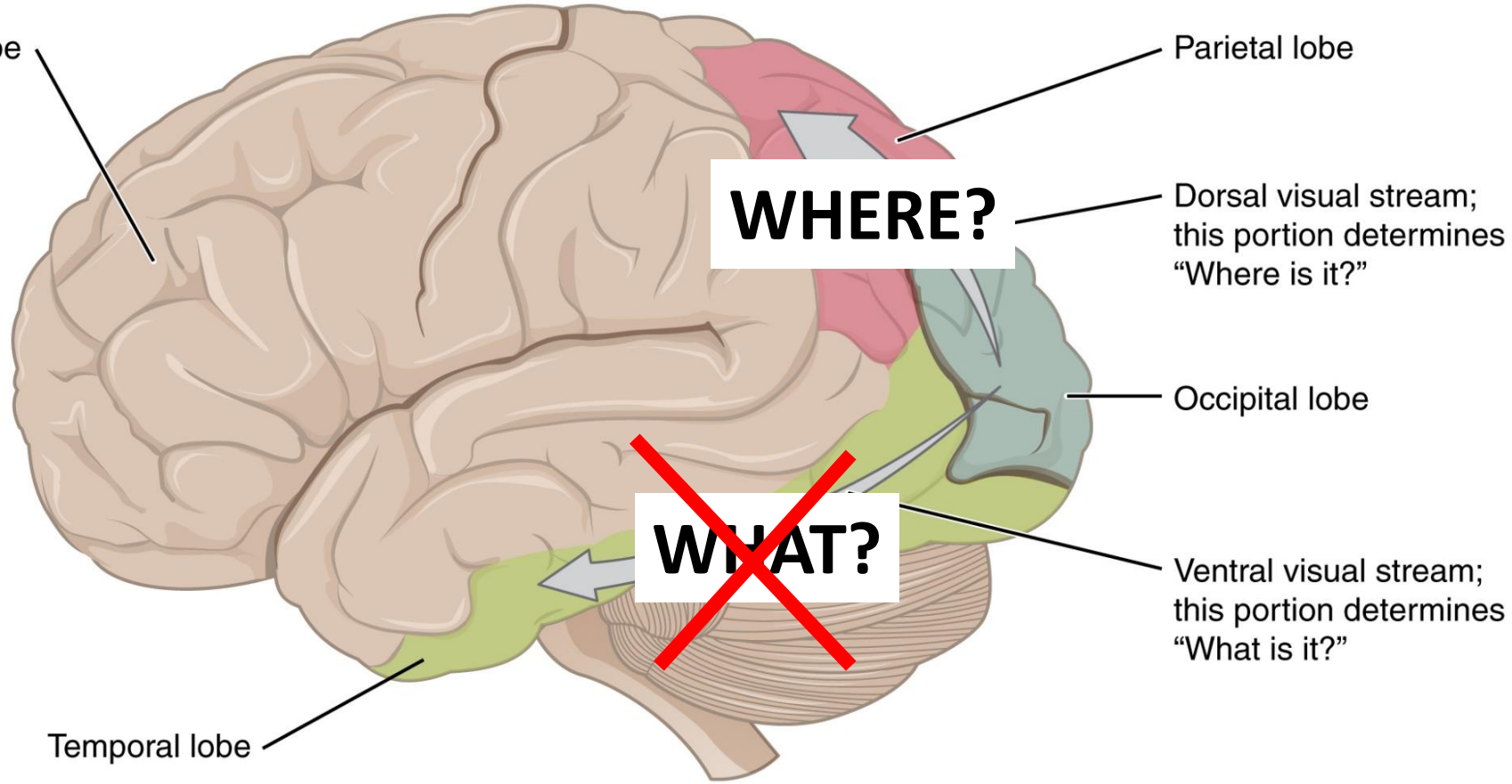
How do we recognize objects?



Ungerleider, L. G. and Mishkin, M. (1982). Two cortical visual systems. In "Analysis of Visual Behavior" (D. J. Ingle, M. A. Goodale, and R. J. W. Mansfield, eds.), pp. 549–586. MIT Press: Cambridge, MA.

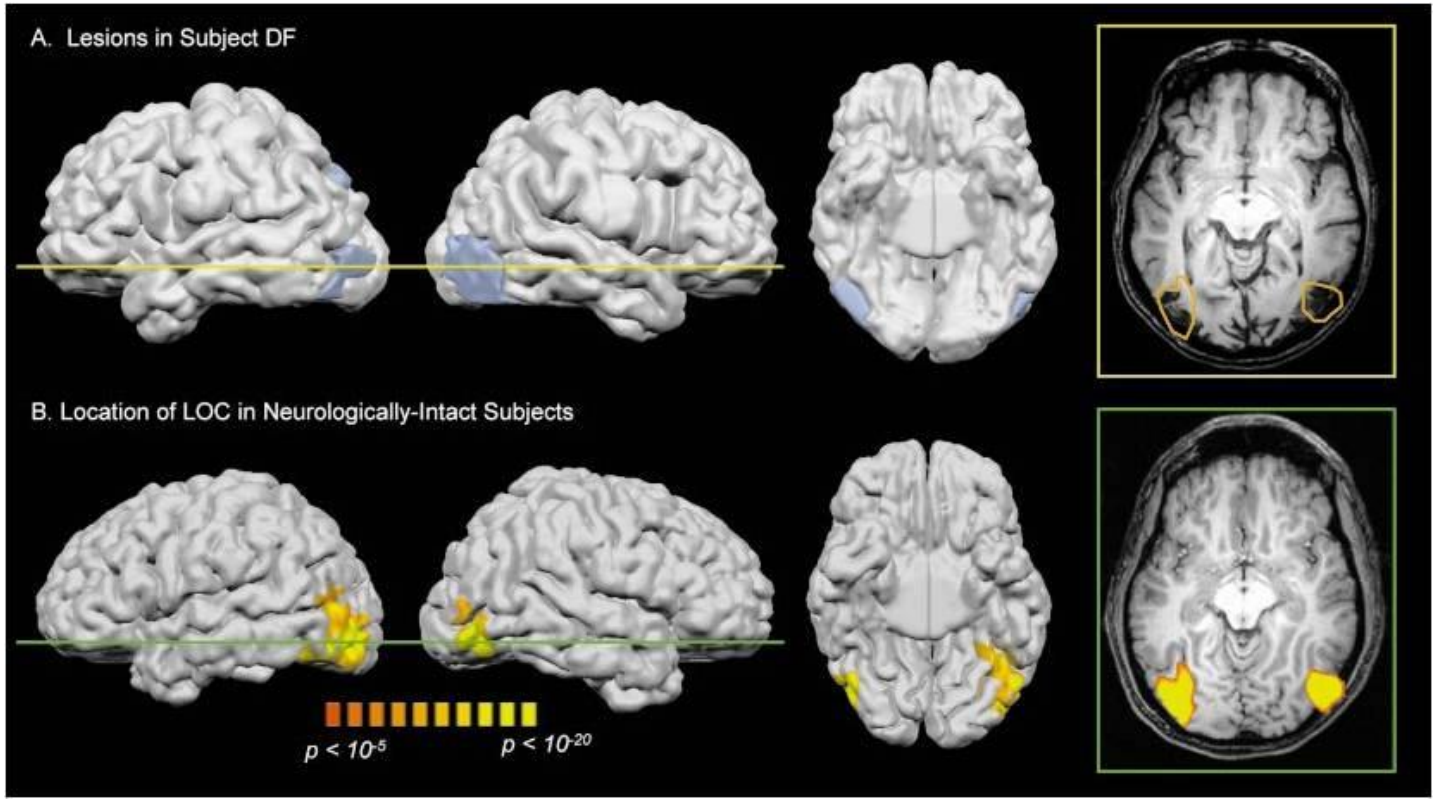
Visual agnosia – patient C.K.





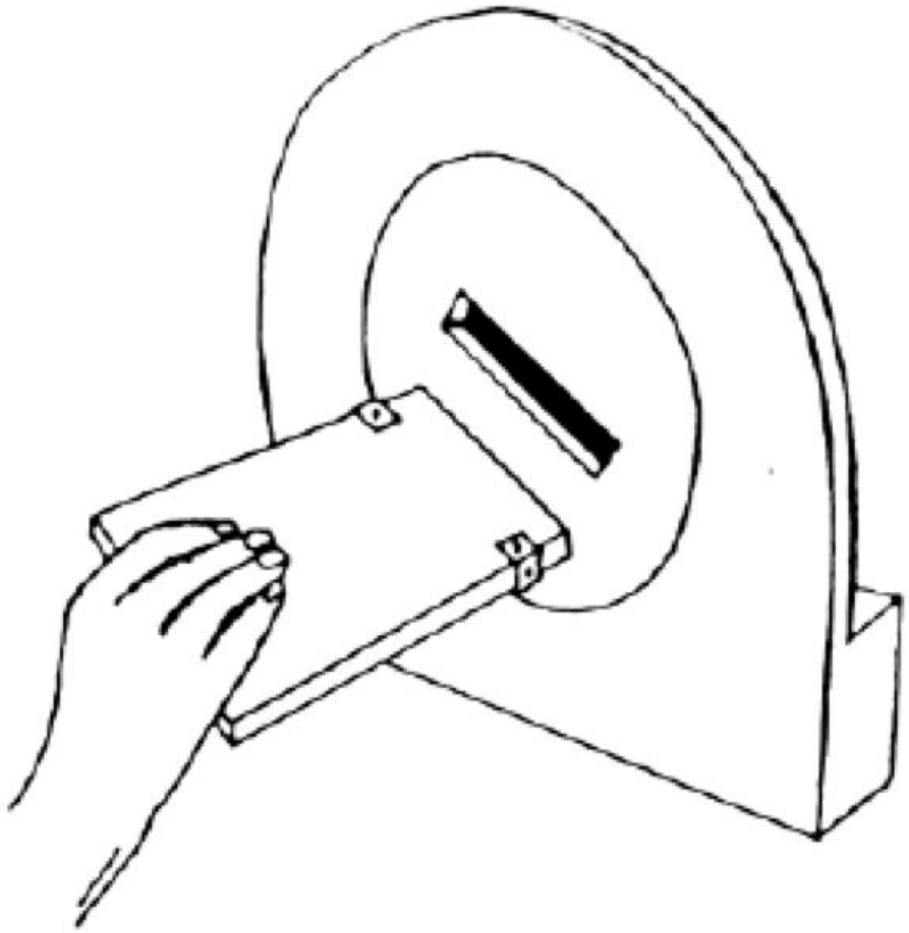
Behrmann, M.; Moscovitch, M.; Winocur, G. (1994). "Intact visual imagery and impaired visual perception in a patient with visual agnosia". *Journal of Experimental Psychology. Human Perception and Performance*. **20** (5): 1068–87.

Visual agnosia – patient D.F.



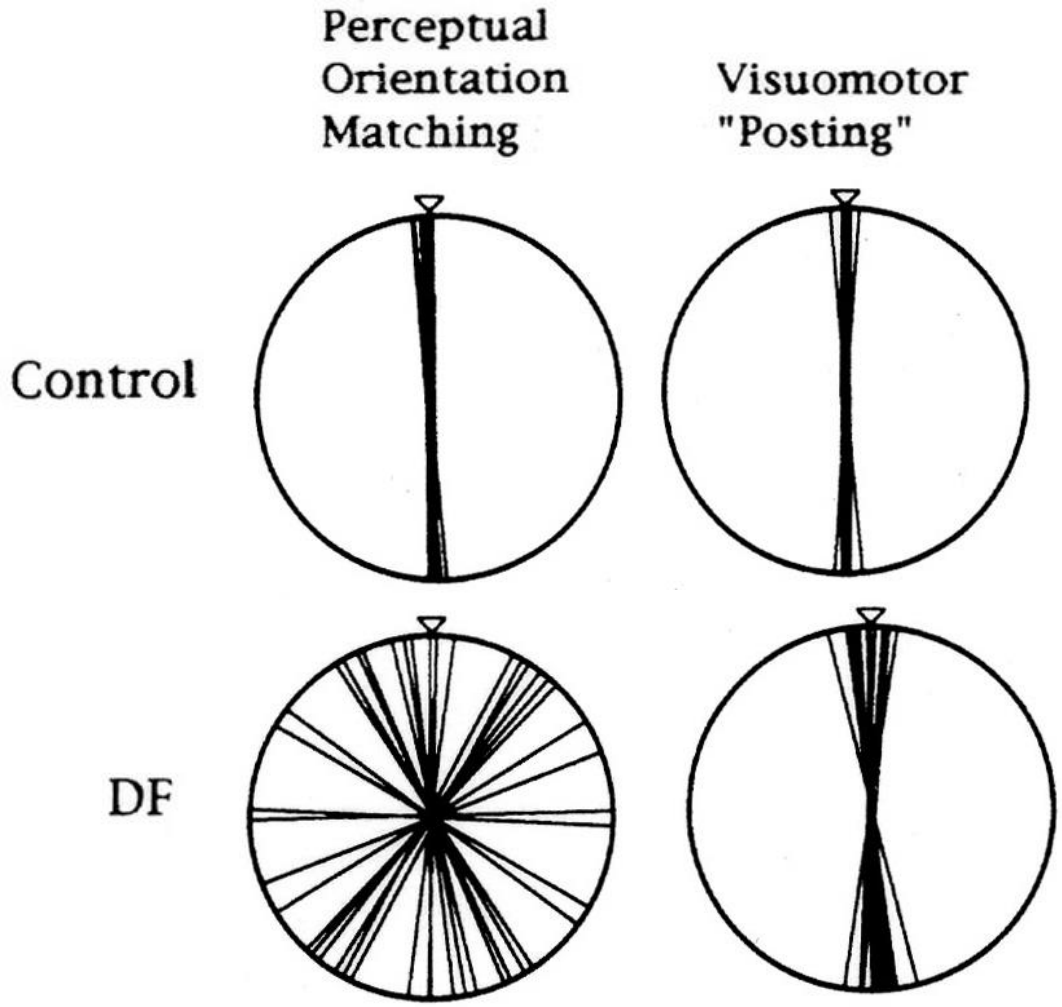
Goodale, M. A., Milner, A. D. (1992). "Separate visual pathways for perception and action". *Trends Neurosci.***15** (1): 20–5

Visual agnosia – patient D.F.



Goodale, M. A., Milner, A. D. (1992). "Separate visual pathways for perception and action". *Trends Neurosci.***15** (1): 20–5

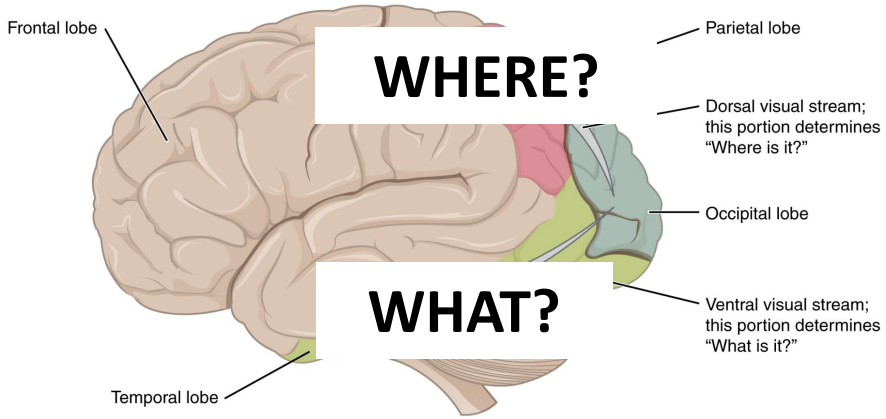
Visual agnosia – patient D.F.



Goodale, M. A., Milner, A. D. (1992). "Separate visual pathways for perception and action". *Trends Neurosci.***15** (1): 20–5

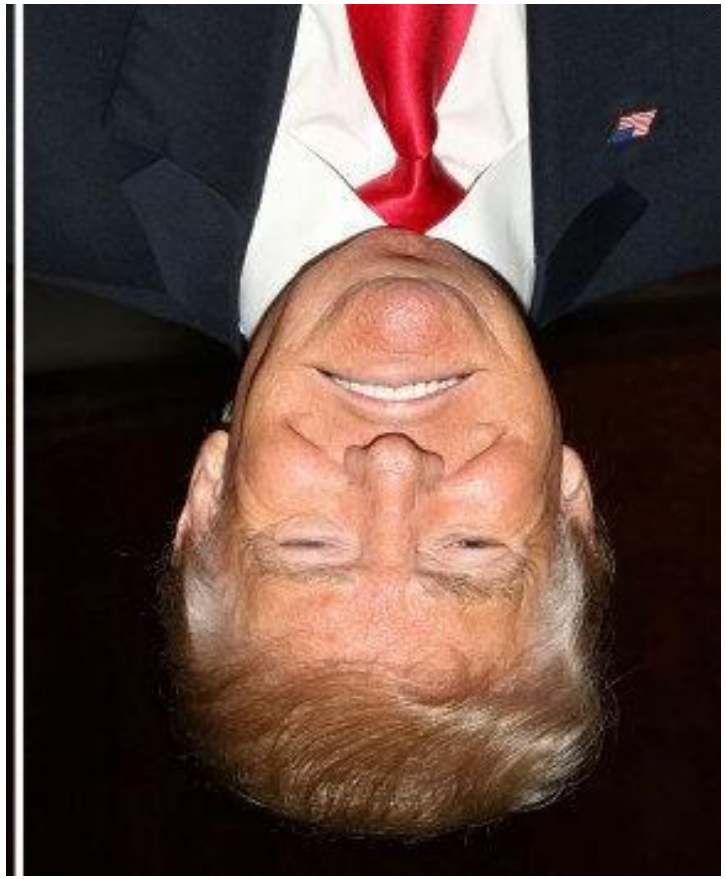
How do we recognize objects? – evidence from patients

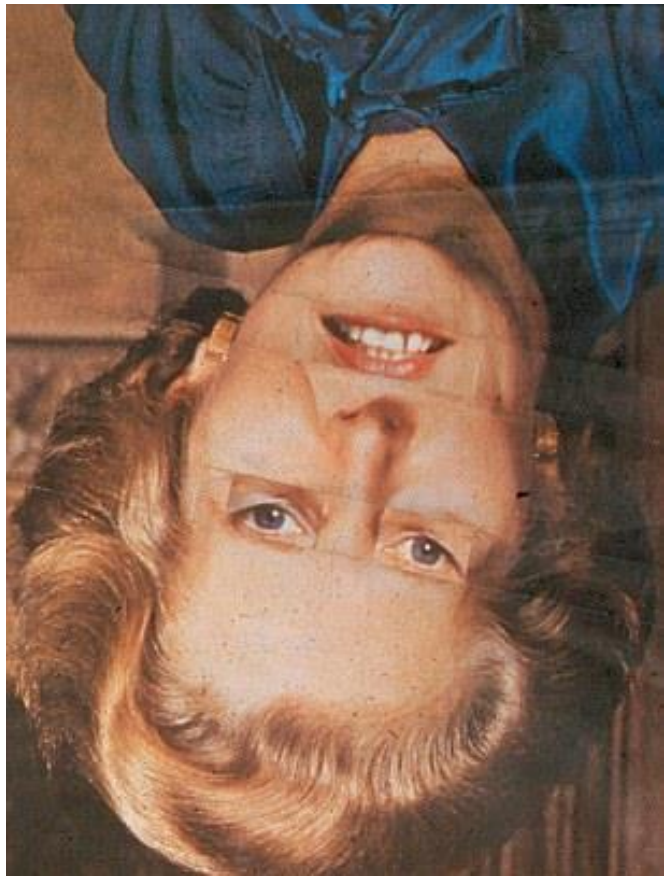
- Patients with damage to ventral stream can lead to visual agnosia
- Visual agnosia = can see but not recognise objects
- Object recognition occurs in stages
- Object recognition relies on **what** and **where**
- Object recognition close links to motor system & operates without our awareness



ARE FACES SPECIAL?

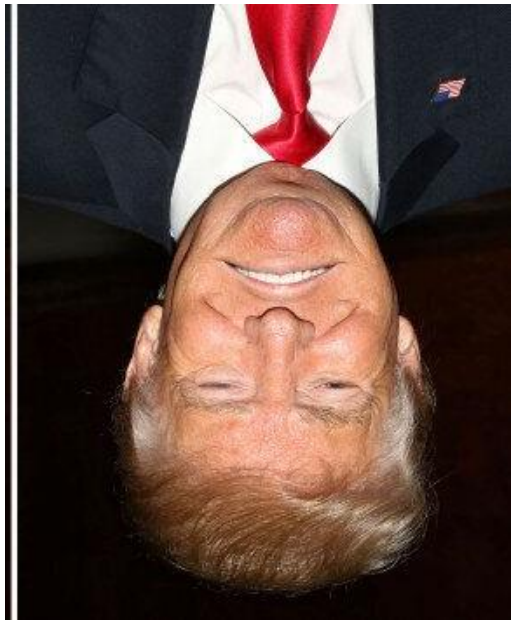
Faces – are they special?

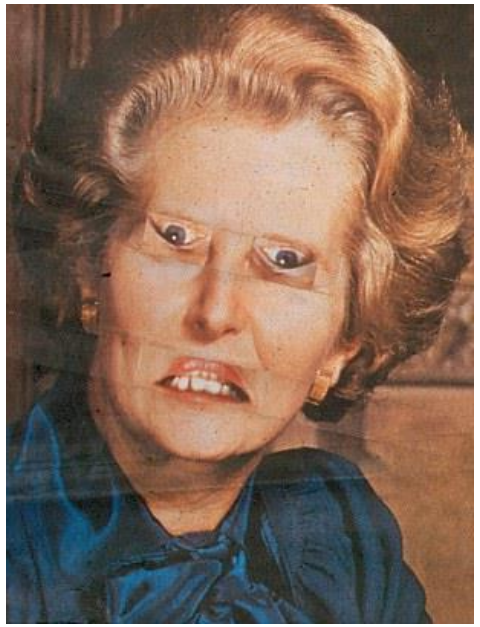


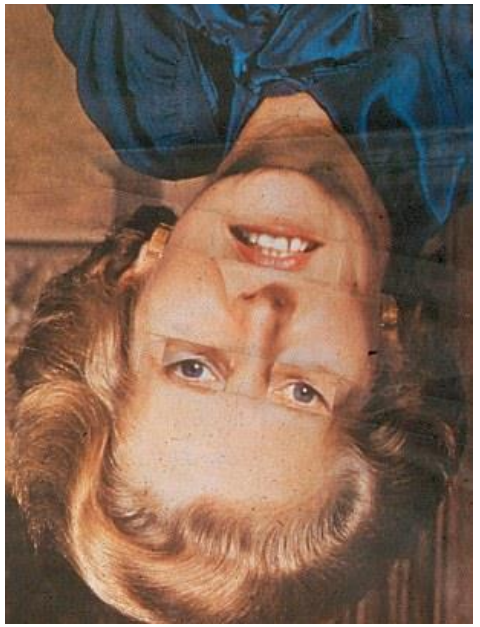


Faces – are they special?

Faces – are they special?

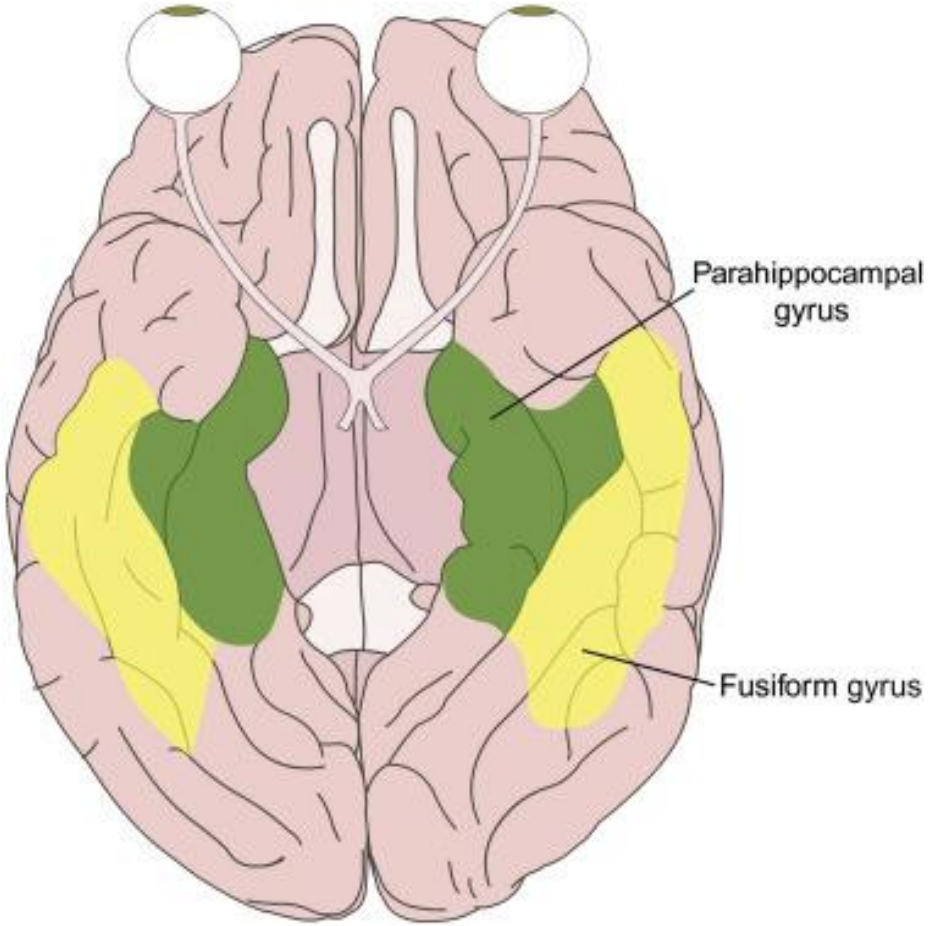






Face blindness (Prosopagnosia)

Face blindness (Prosopagnosia)



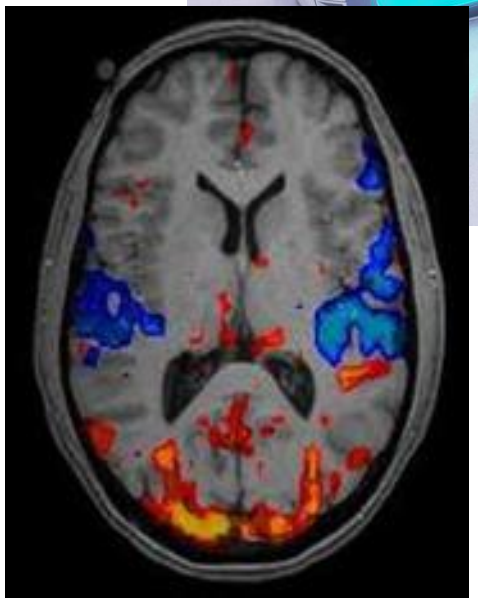
READING THE MIND

Using machines to measure brain activity

fMRI

Functional Magnetic Resonance Imaging is a relatively recent technique that allows us to measure brain activity

- Non-invasive
- No radiation
- High spatial resolution
- Commonly used in press



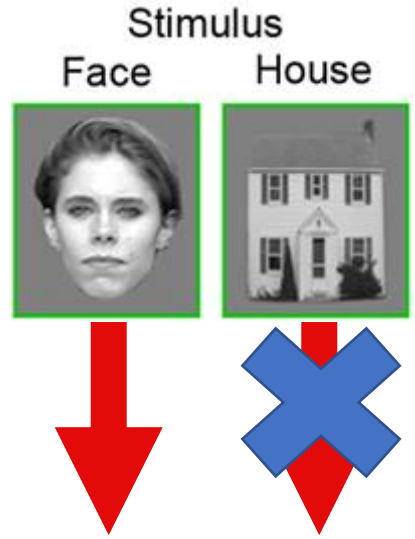
Seeing faces

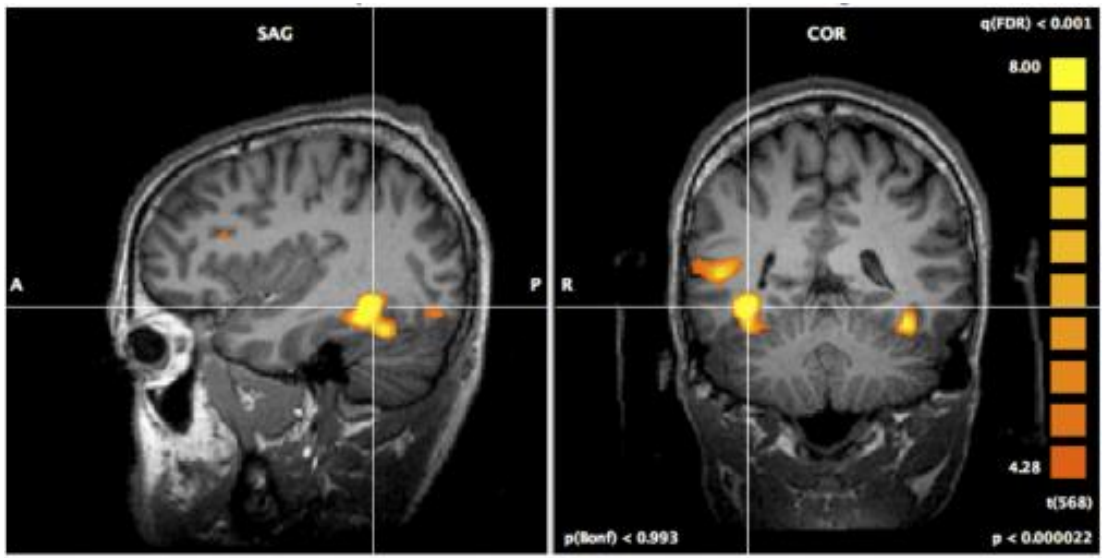
— Unique to human faces

— Allows for further exploration

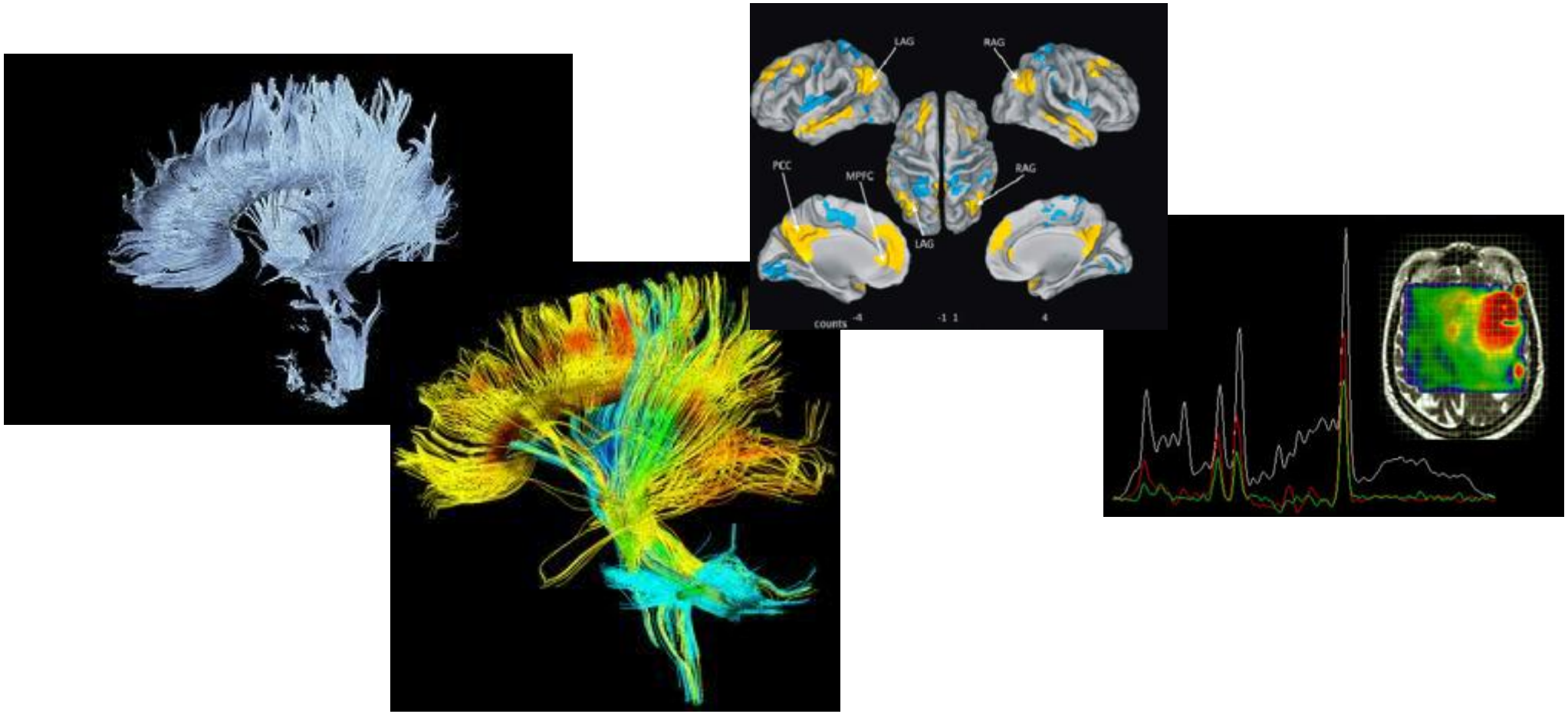
— Doesn't respond to emotional expressions

— Is atypically active in schizophrenia

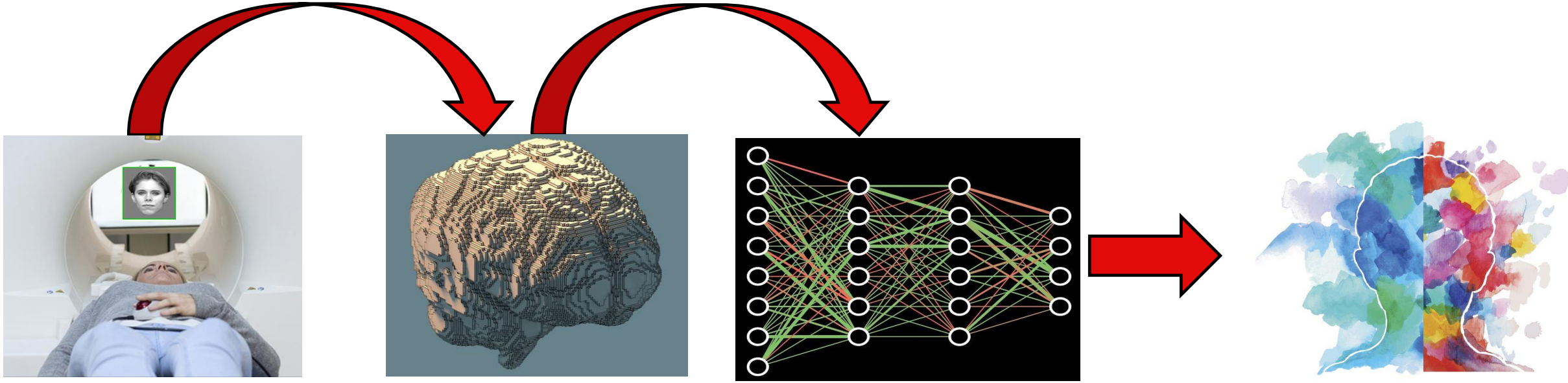




fMRI – beyond blobs!



Pattern analysis



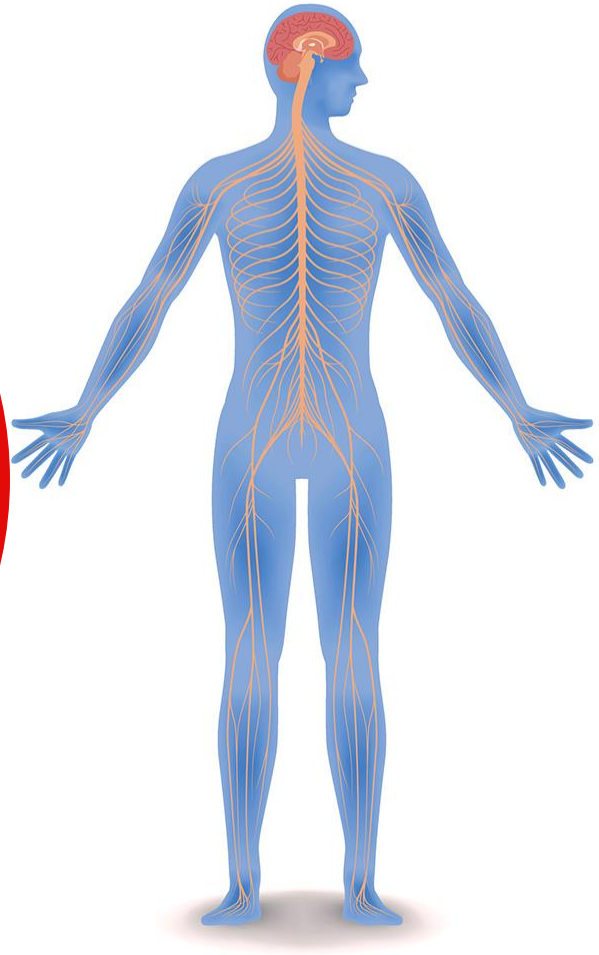
Mind reading

Presented clip

Clip reconstructed from brain activity

BRAIN COMUTER INTERFACES

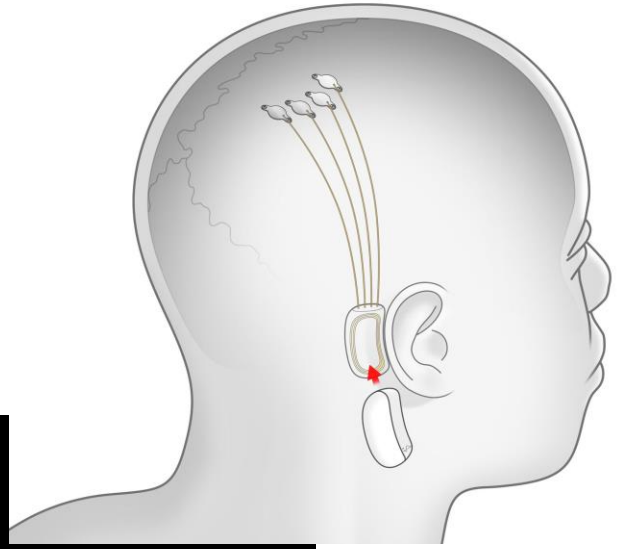
What is BCI?



Human Computer Interfaces

Brain Computer Interfaces

Neuralink

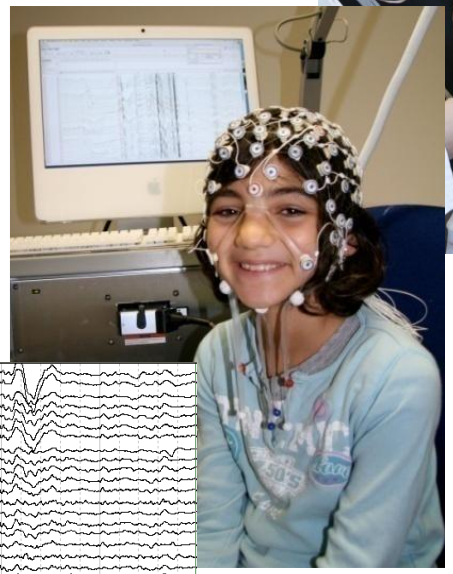


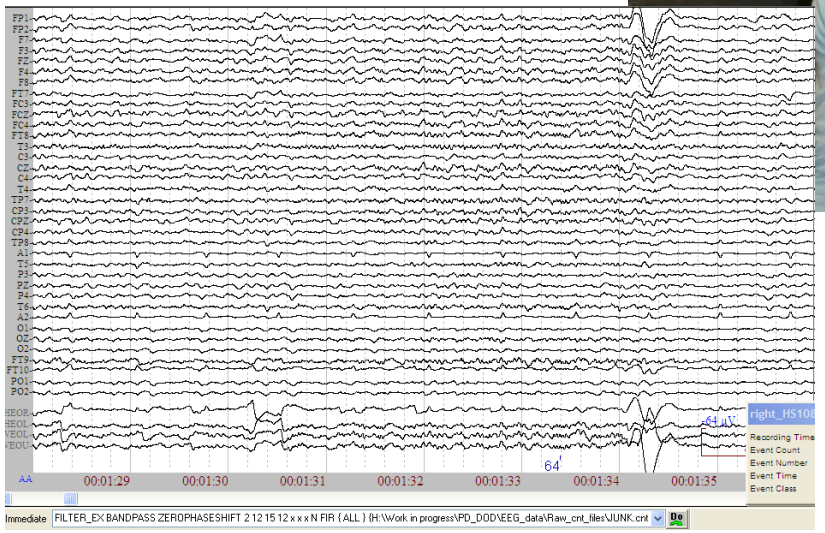
In monkeys

EEG

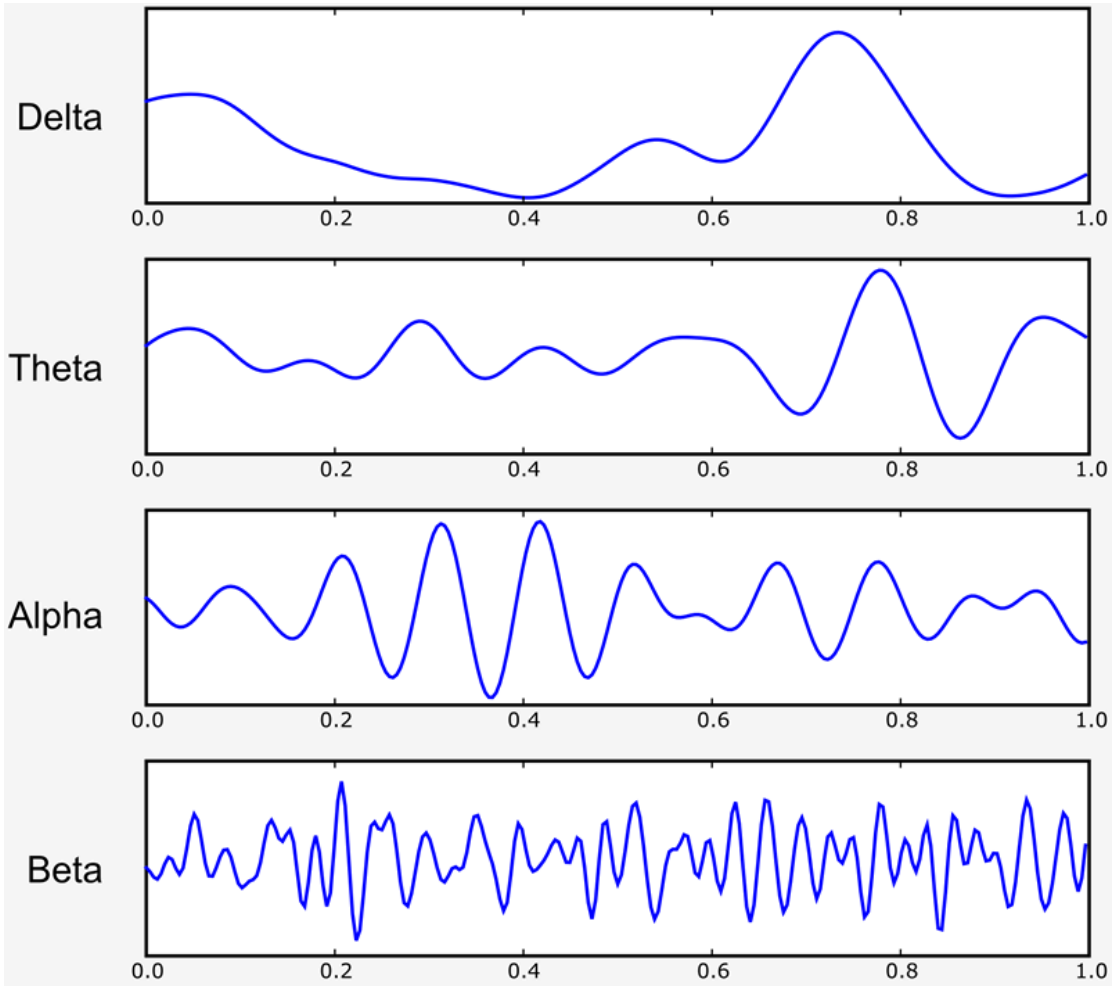
Electroencephalography (EEG) - measures brain activity directly on the surface of the scalp.

- Excellent temporal precision.
- Direct measure of brain activity.
- Non-invasive.
- Relatively cheap.
- Relatively mobile.

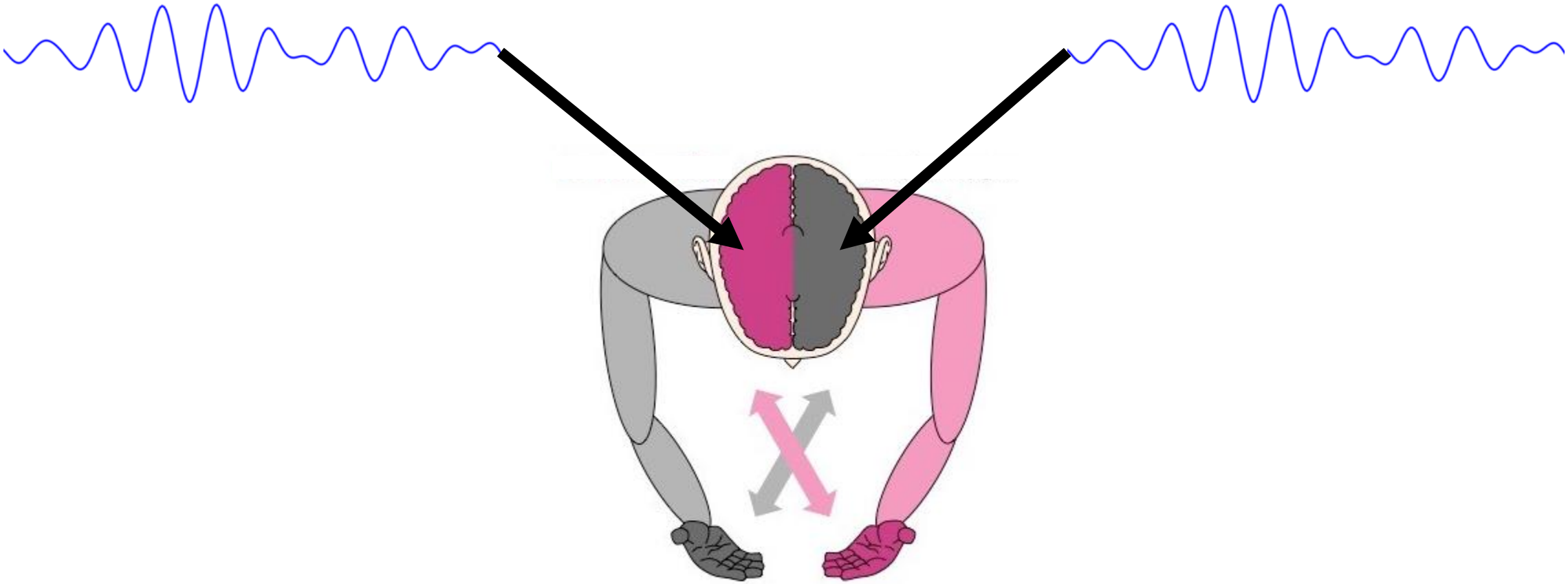




Waveforms



Movement brain signals



Contralateral wiring research

Neuropsychologia 48 (2010) 2417–2426

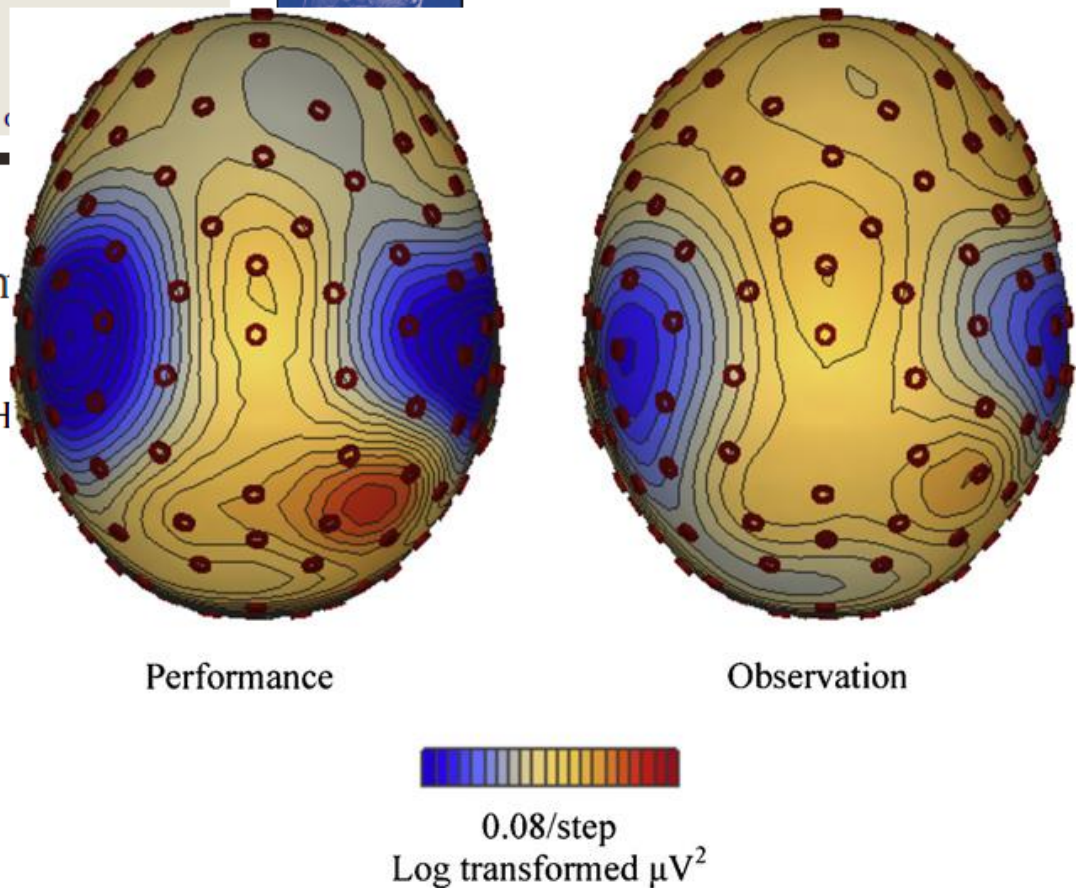
Contents lists available at ScienceDirect

Neuropsychologia

journal homepage: www.elsevier.com/locate/neuropsych

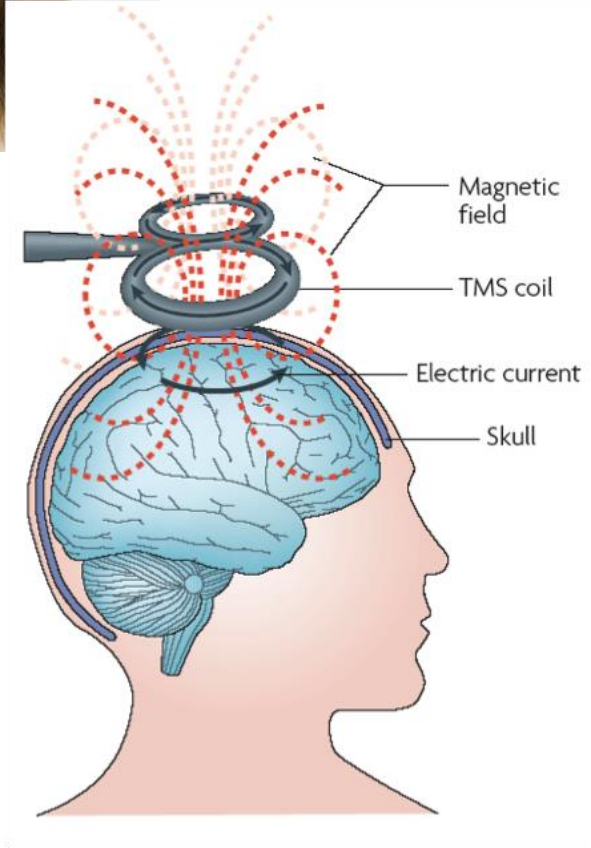
Sex and individual differences in induced and evoked EEG m
of action observation

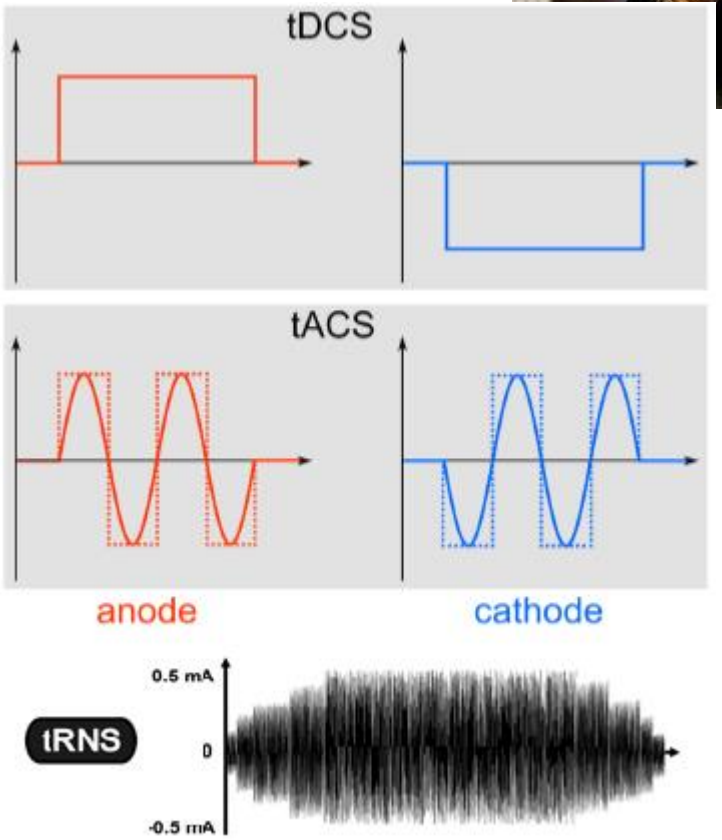
Jonathan Silas, Joseph P. Levy*, Maria Kragh Nielsen, Lance Slade, Amanda H



Imagining movement

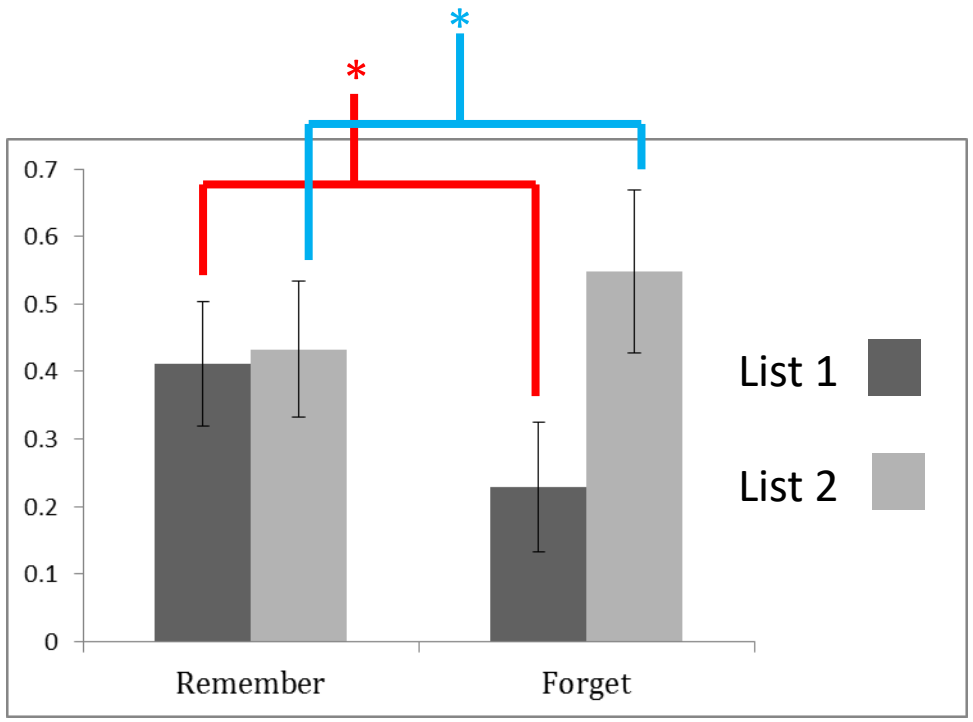
Non-Invasive Brain stimulation

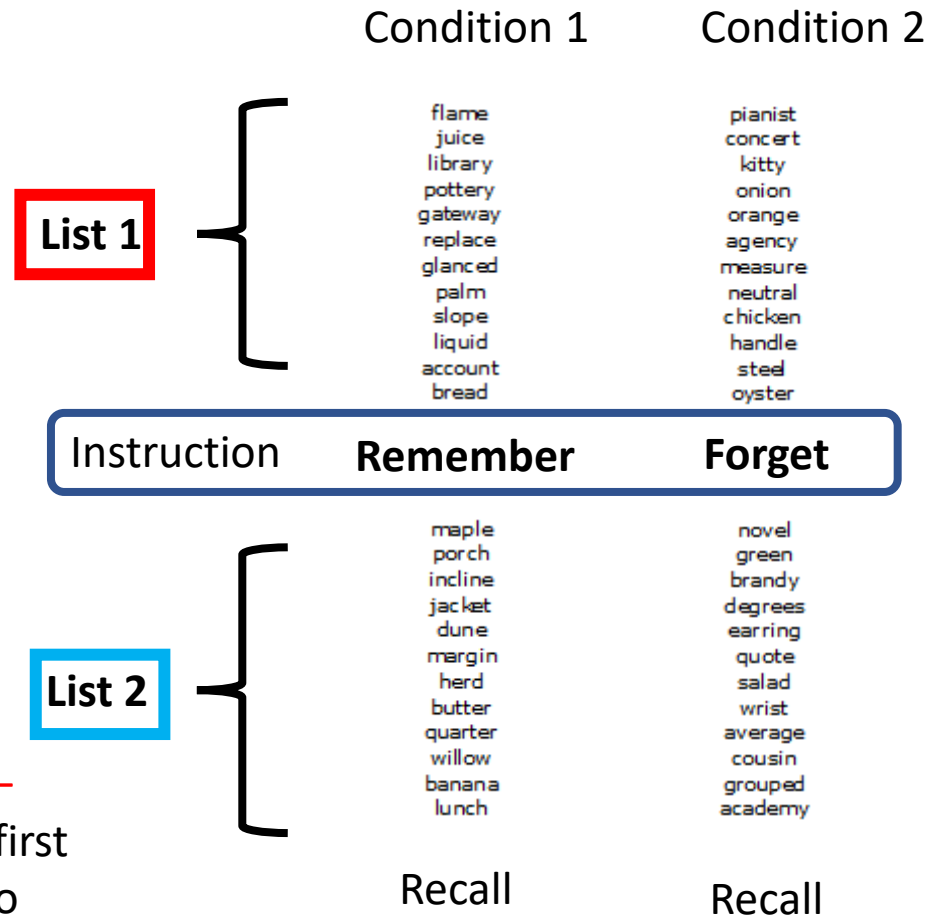




Directed forgetting

Two lists of words are sequentially presented to participants to be committed to memory under two conditions – remember and forget.





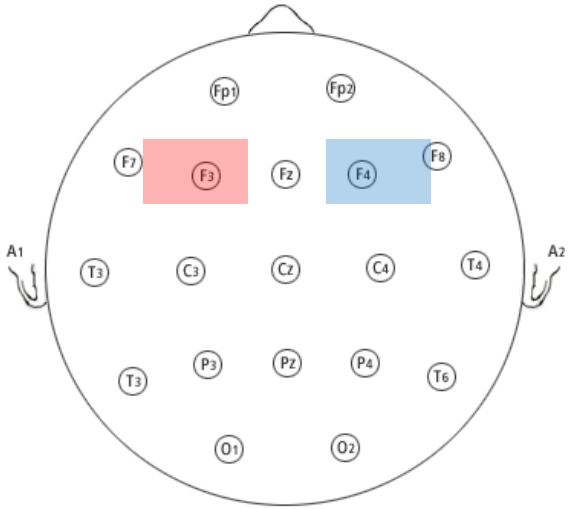
* A cost to forgetting – fewer items from the first list, when instructed to 'forget', are remembered.

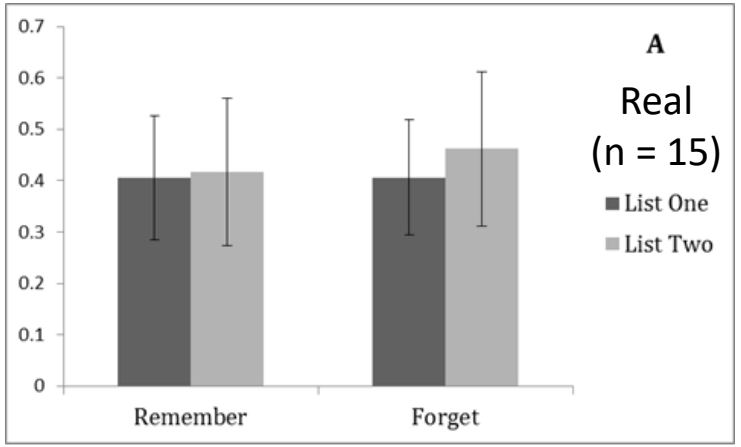
* A benefit to forgetting – more items from the second list, when instructed to 'forget', are remembered.

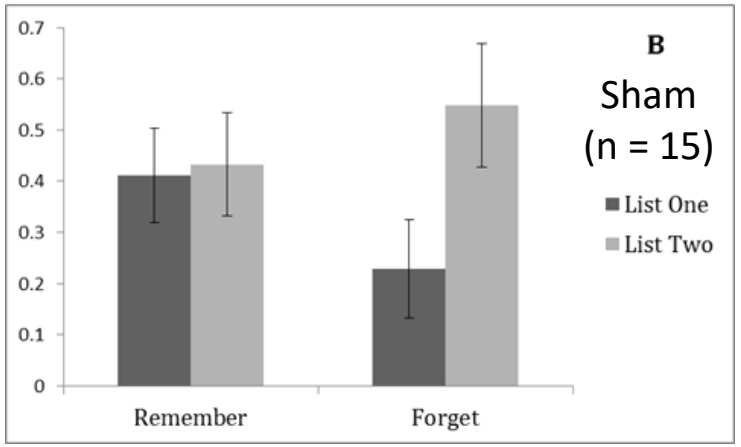
Silas & Brandt (2016). Neuroscience Letters

Why does directed forgetting happen?

- 10 minutes 1mA Transcranial Direct Current Stimulation (tDCS) before memory test.
- Double blind sham controlled study.

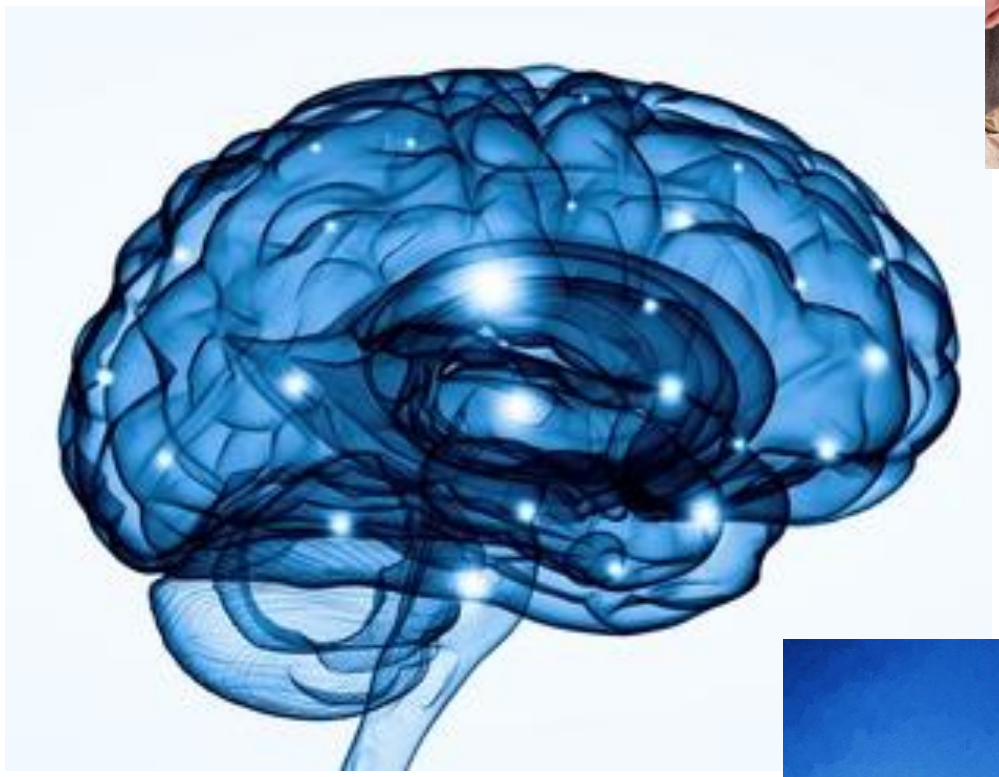






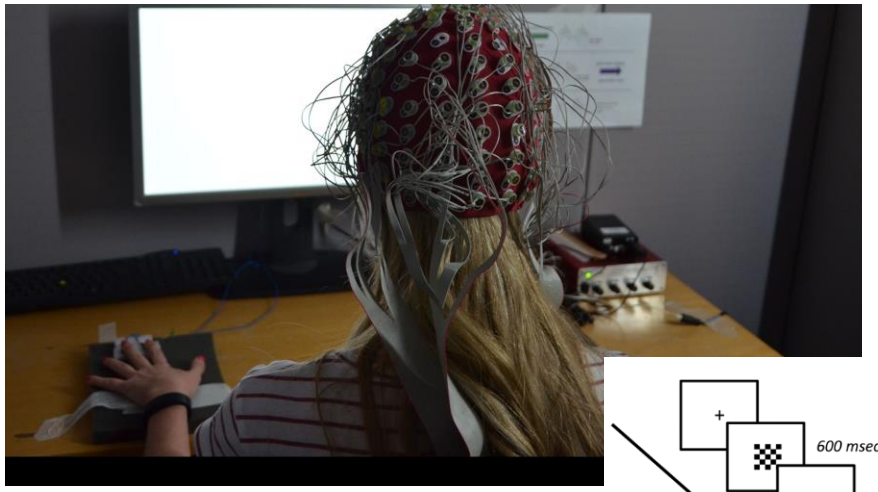
Right frontal cathodal tDCS abolishes directed forgetting effects supporting the role of inhibition in directed forgetting.

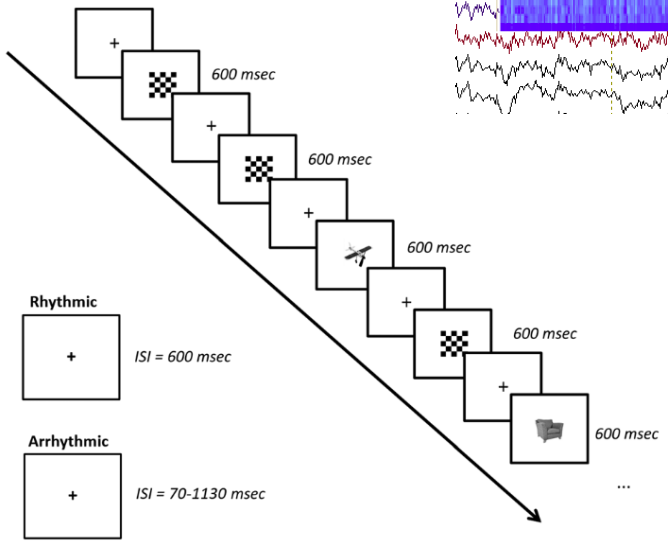
Silas & Brandt (2016). Neuroscience Letters

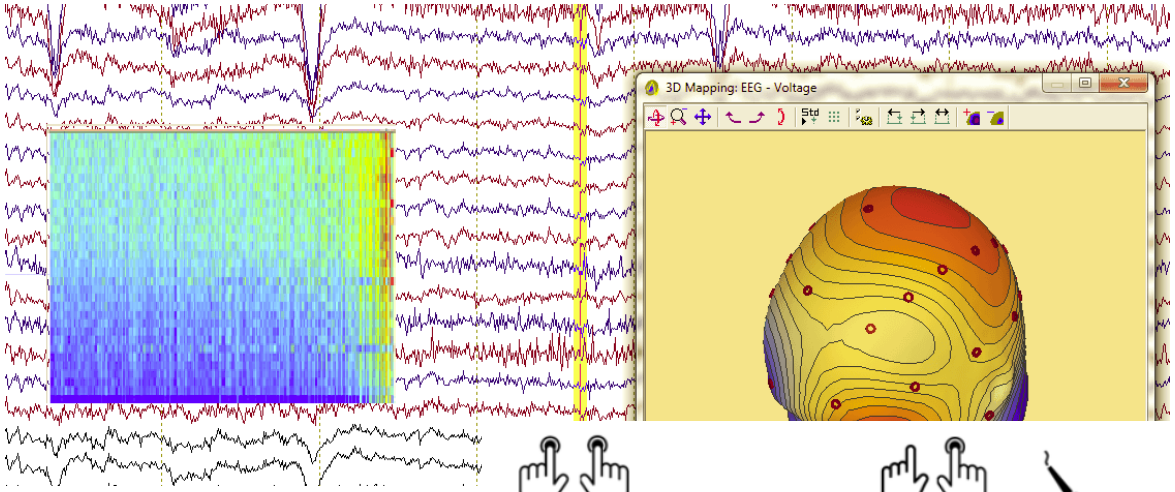


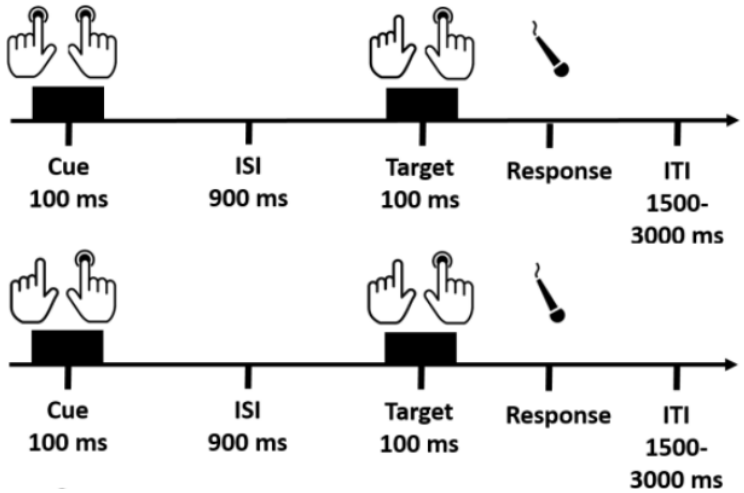

THIS WAY
THAT WAY
ANOTHER WAY

Current research in the Jones, Silas & Ward lab









THANKS!

Q&A