introduction to neuroscience:
brain as a machine

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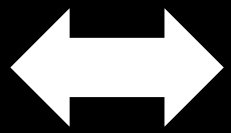
the brain

what do we know?
what don't we know?
what can we learn experimentally?

cartesian dualism

body: simple

- vision
- hearing
- touch
- ...



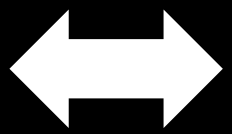
mind: complex

- feelings
- thinking
- personality
- ...

cartesian dualism

body: simple

- vision
- hearing
- touch
- ...

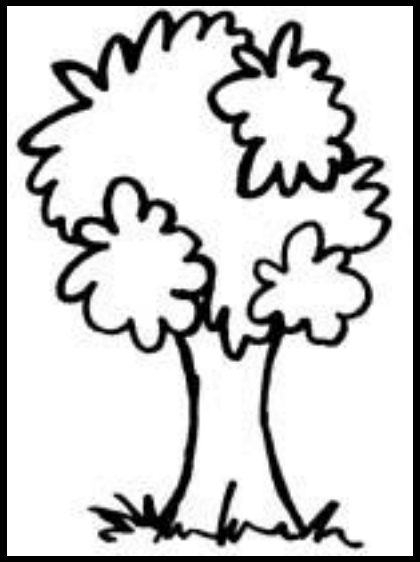


mind: complex

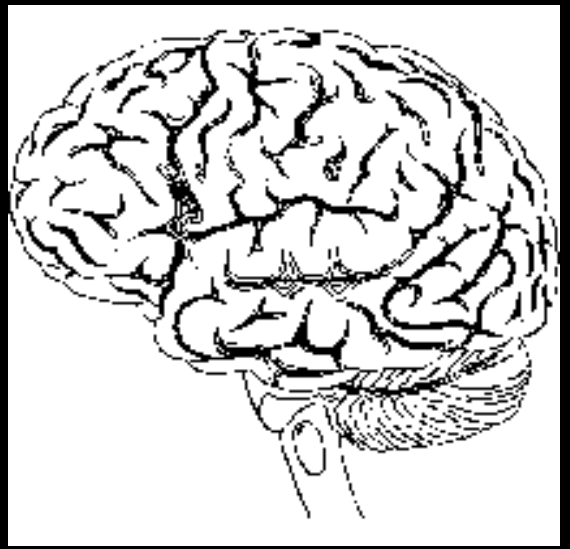
- feelings
- thinking
- personality
- ...

how do they interact?

cartesian dualism soul?

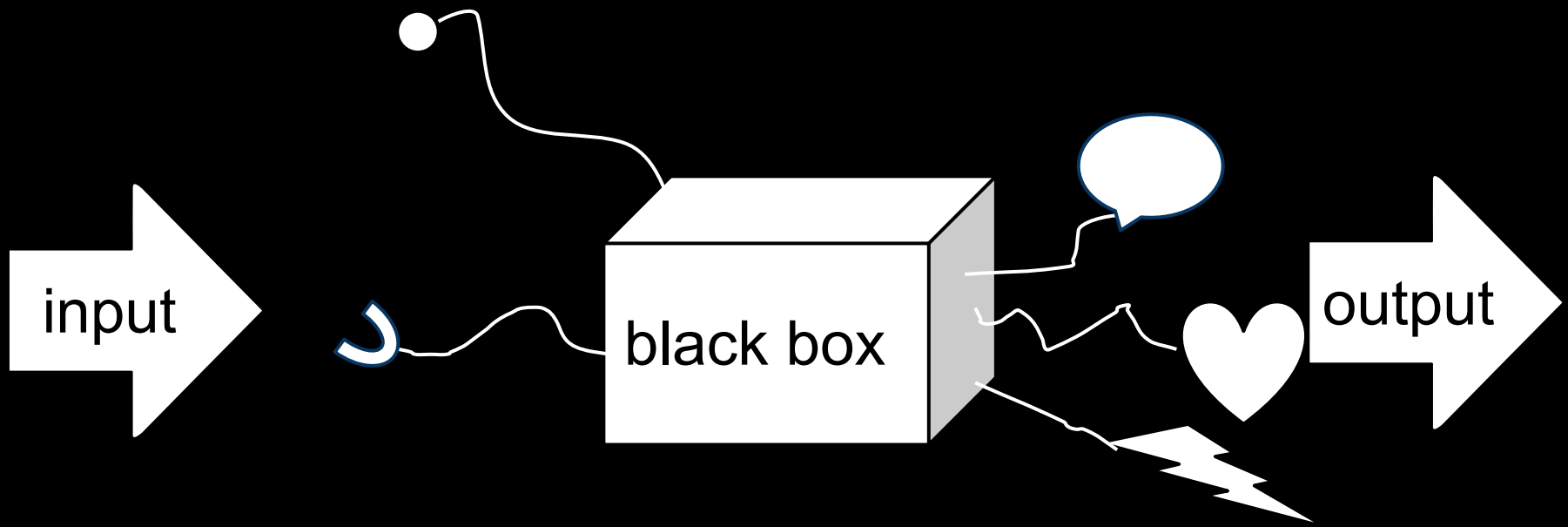


cksinfo



cksinfo

functionalism

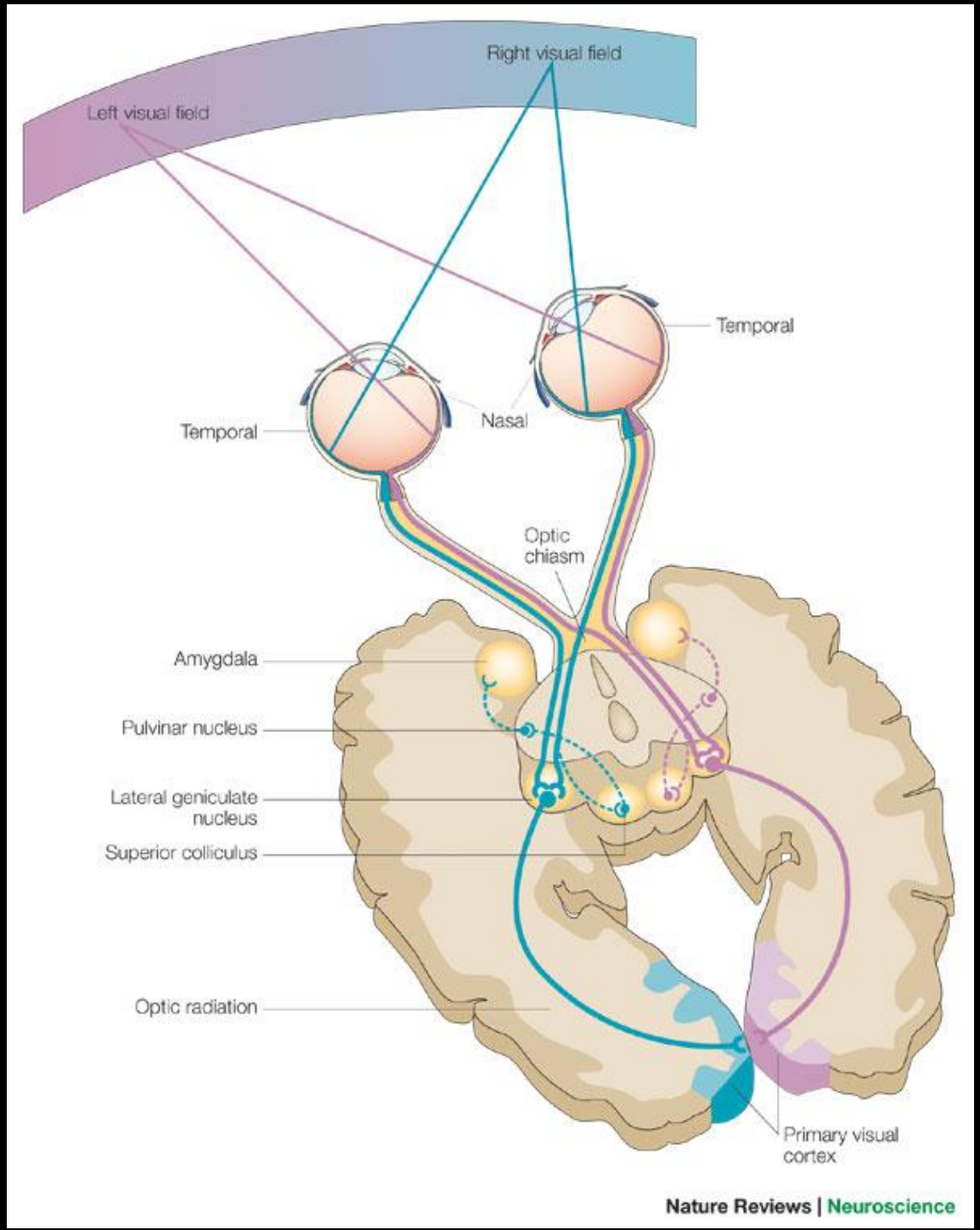


3 simple steps to consciousness

1 early vision
2 higher vision
3 higher cognitive funtions

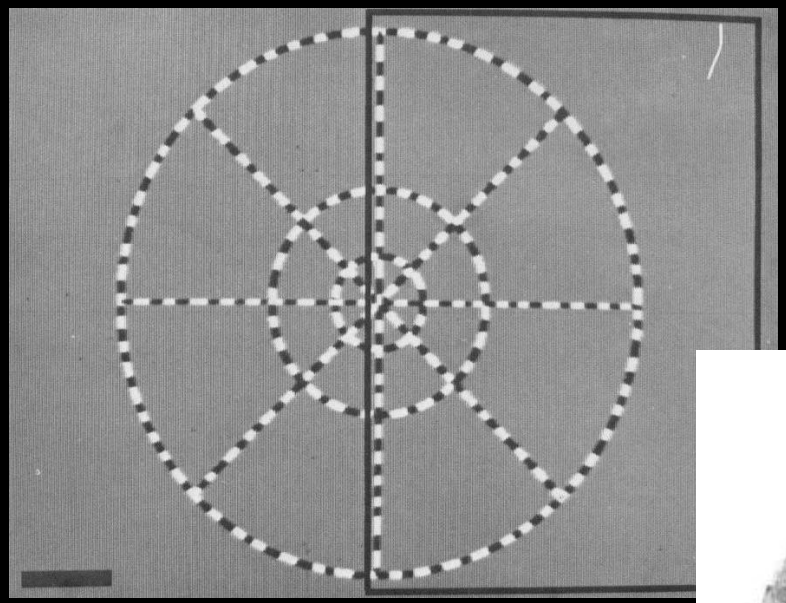
step 1

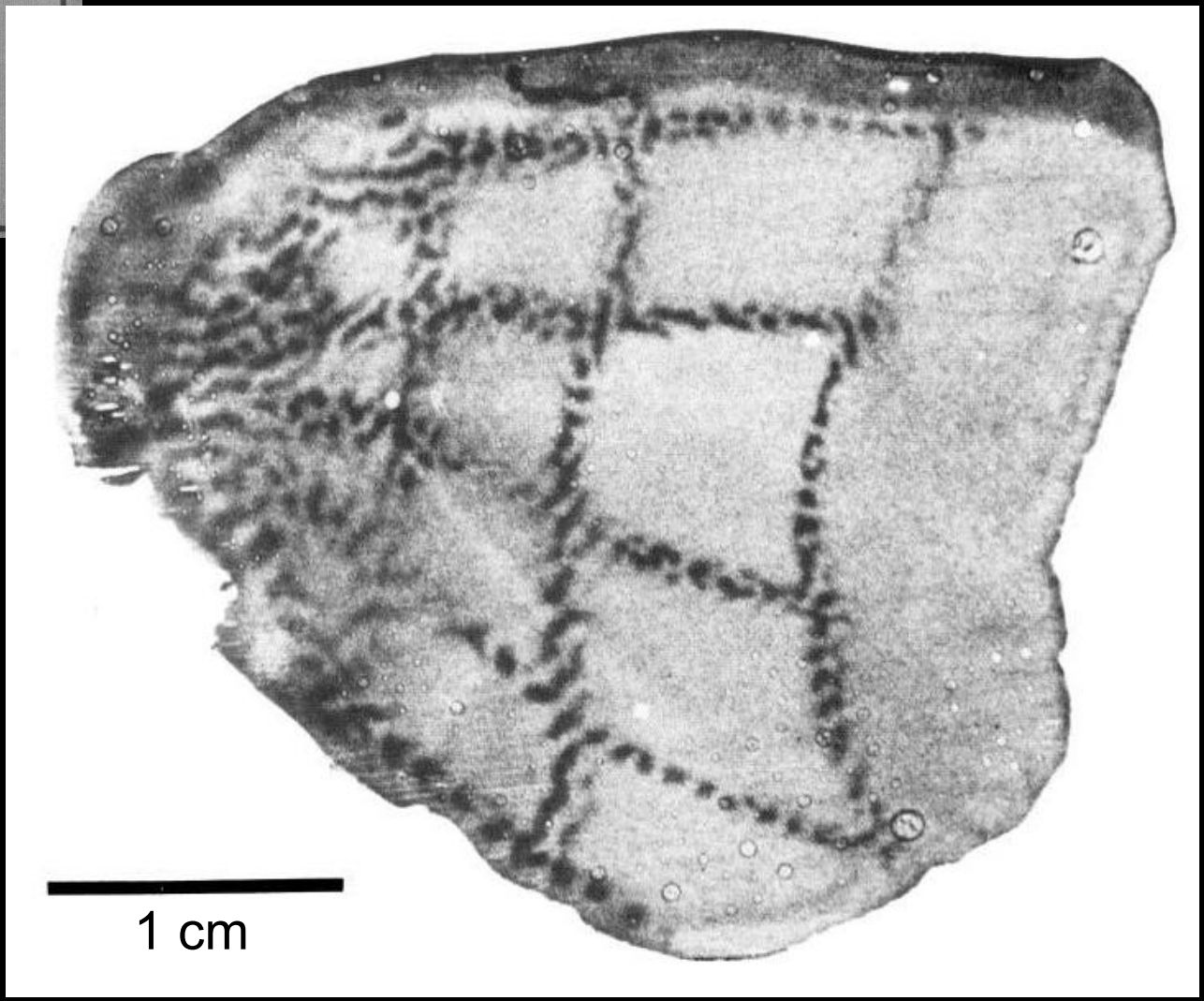
visual system



Hannula et al., *Nat. Rev. Neurosci.* (2005)

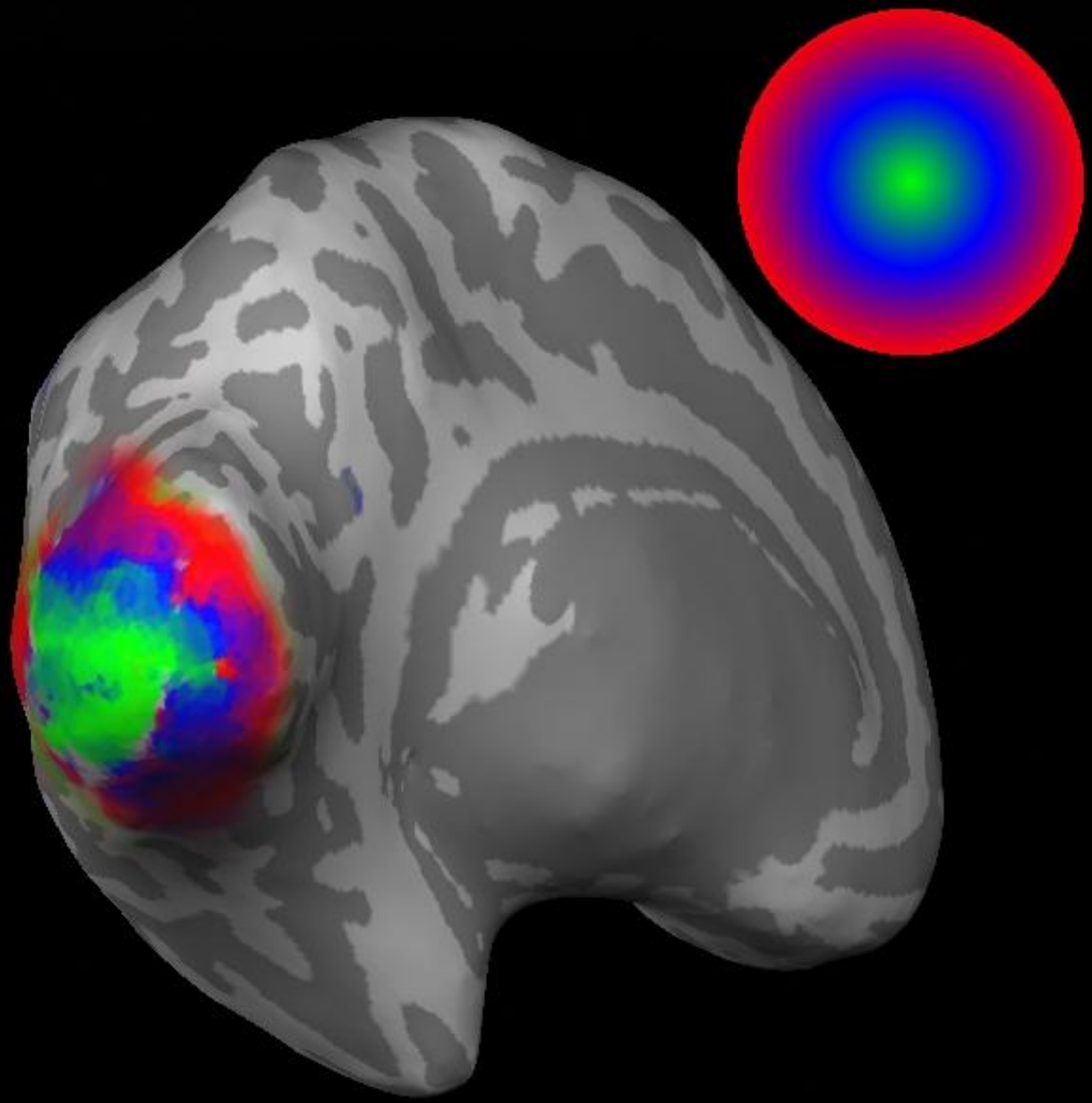
retinotopy





Tootell et al., *J. Neurosci.* (1988)

retinotopy



from E. Vul

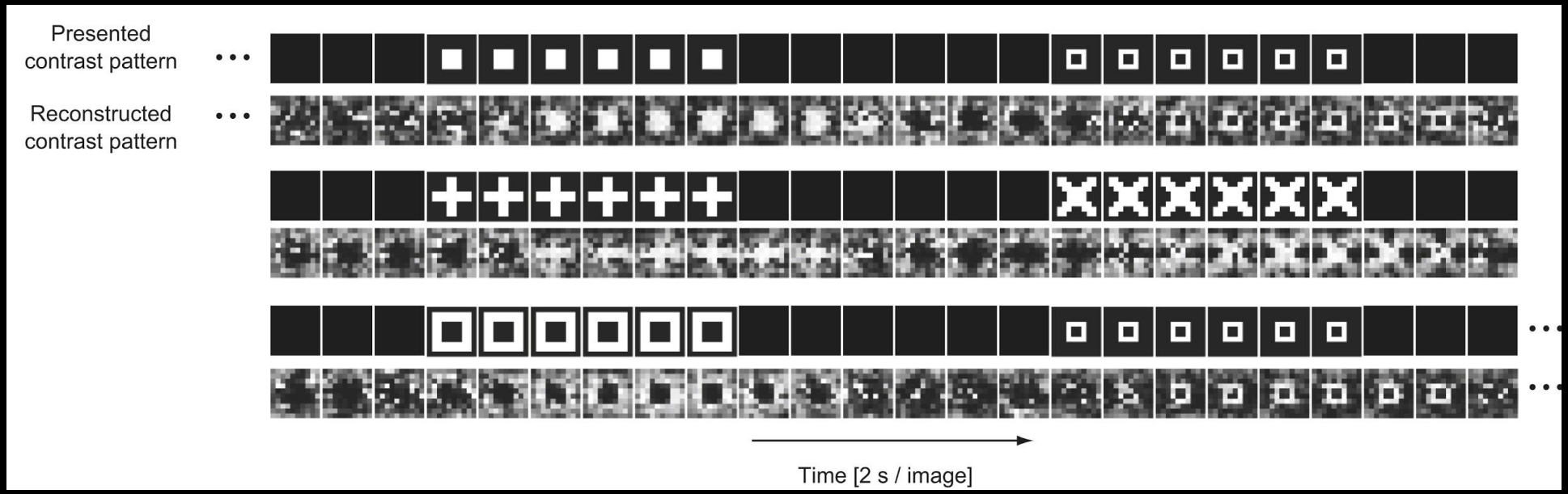
mind reading

Mean of reconstructed contrast pattern

Presented contrast pattern

Miyawaki et al., *Neuron* (2008)

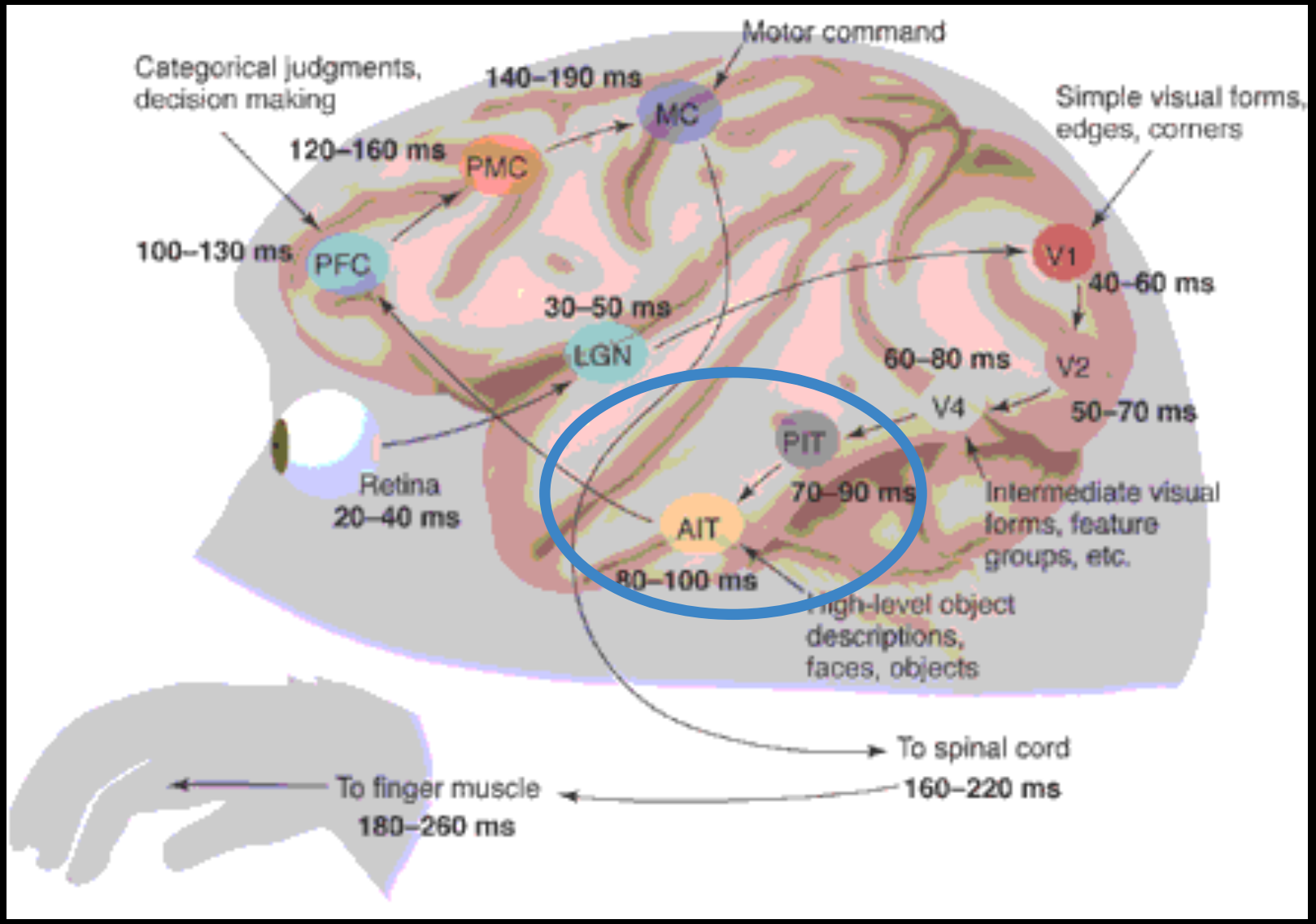
mind reading



Miyawaki et al., *Neuron* (2008)

step2

visual system



C. Cain; from Thorpe & Fabre-Thorpe, *Science* (2001)

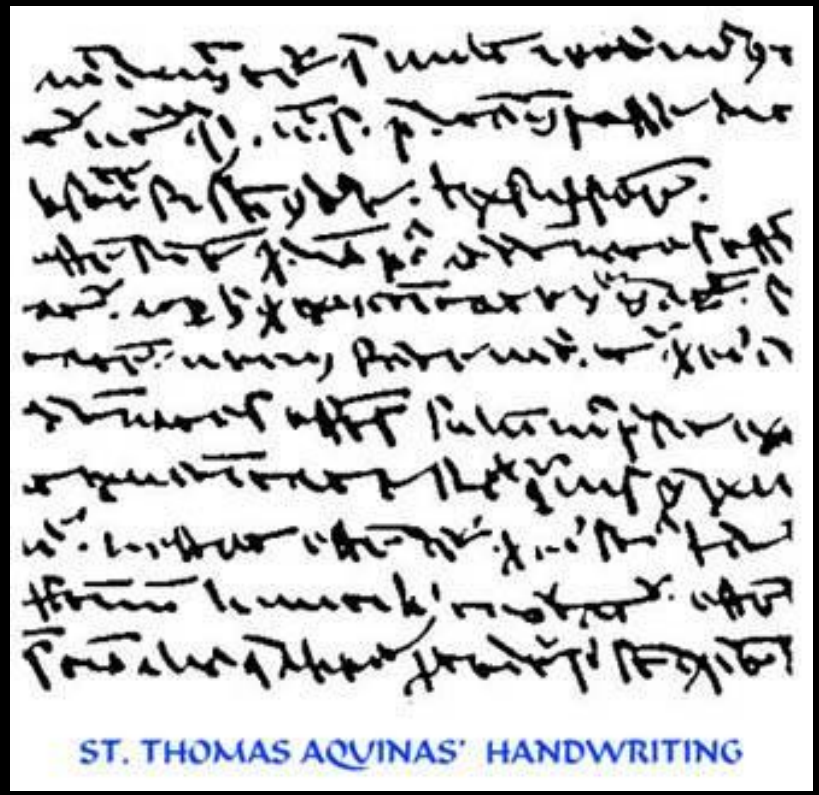
modularity

information processing:
distributed or specialized?

prosopagnosia

cannot recognize faces
can recognize objects,
places, letters

mod. from B. Balas

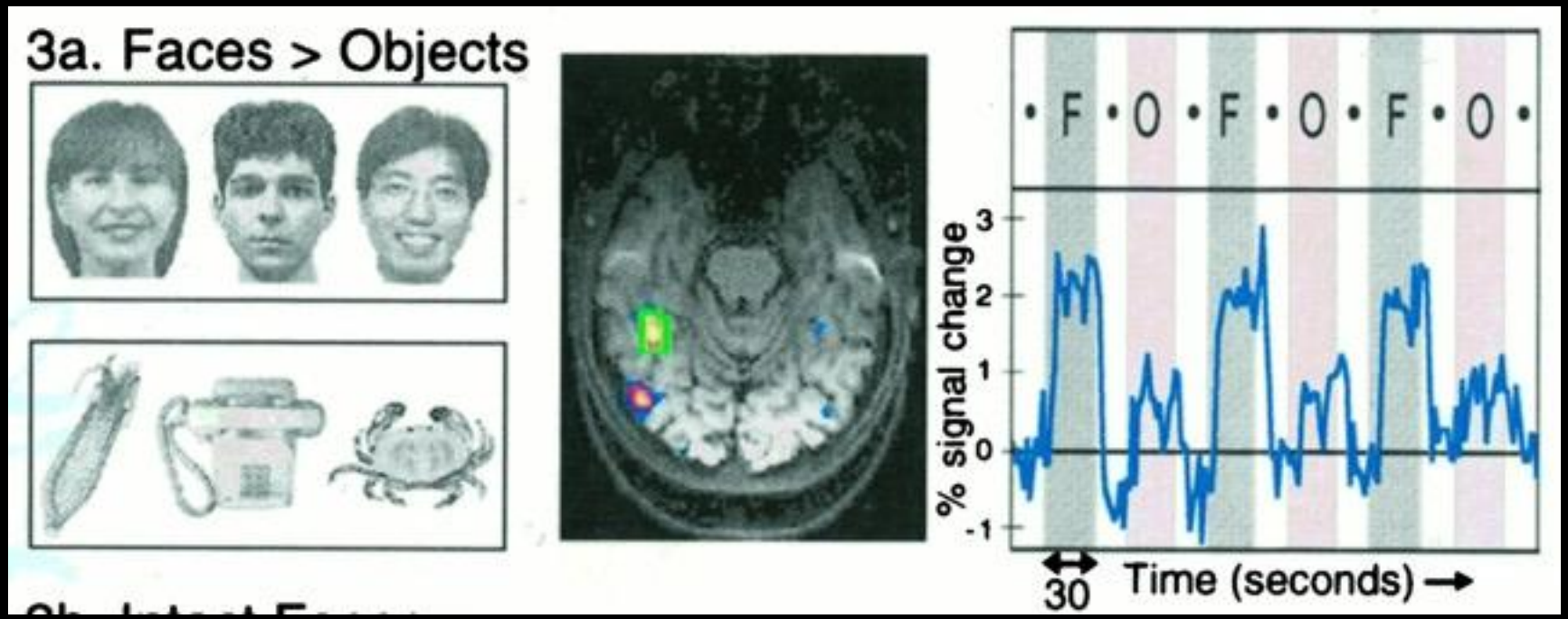


from M. Ogilvie

fMRI

Image Editor @ Flickr

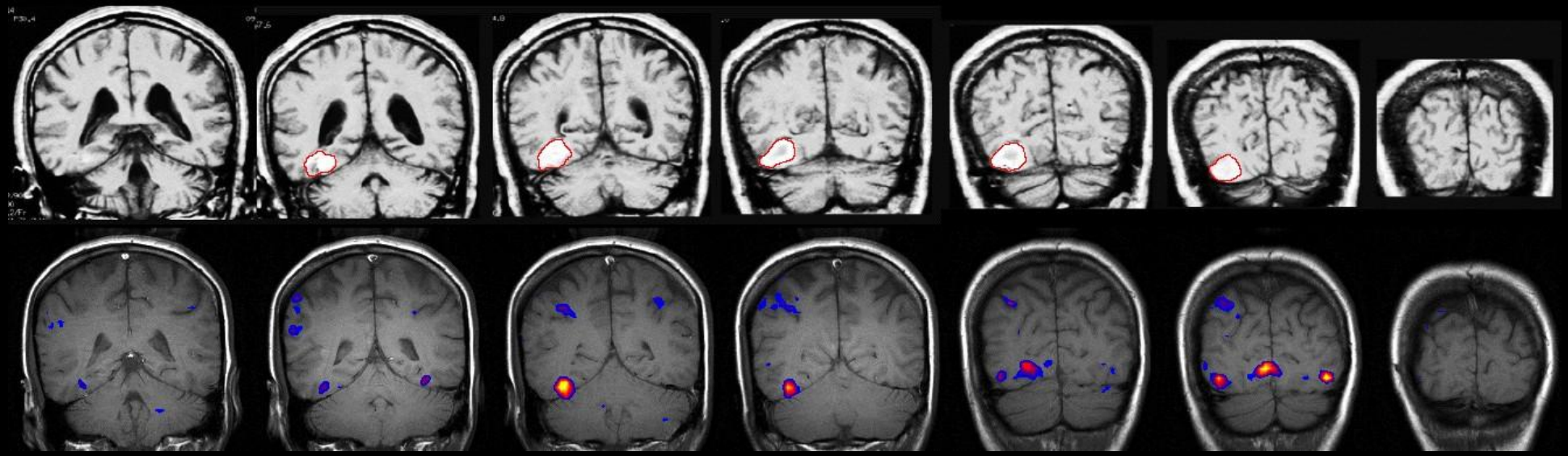
face module?



Kanwisher et al., *J. Neurosci*. (1997)

prosopagnosia

prosopagnosic patient

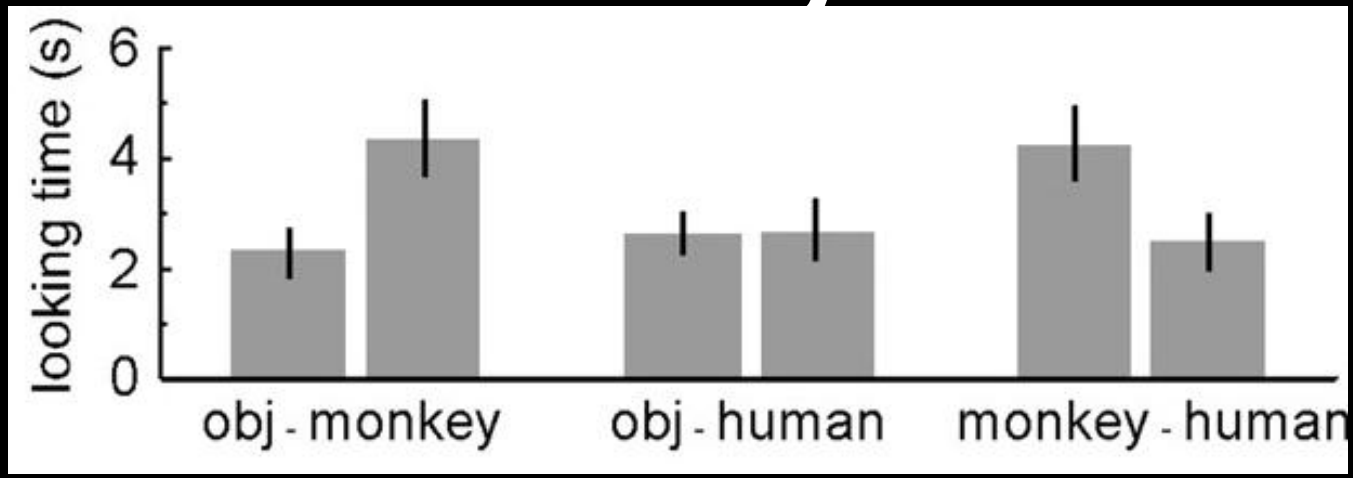


nancy kanwisher

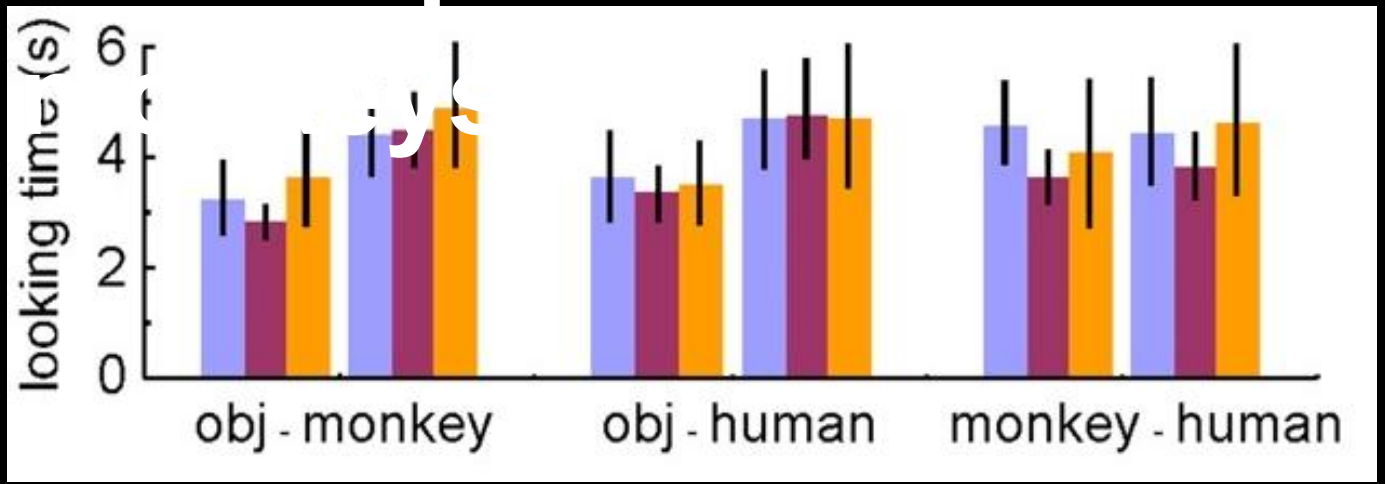
mod. from N. Kanwisher, Wada & Yamamoto, *J. Neurol. Neurosurg. Psychiatry* (2001)

face processing innate?

normal monkeys

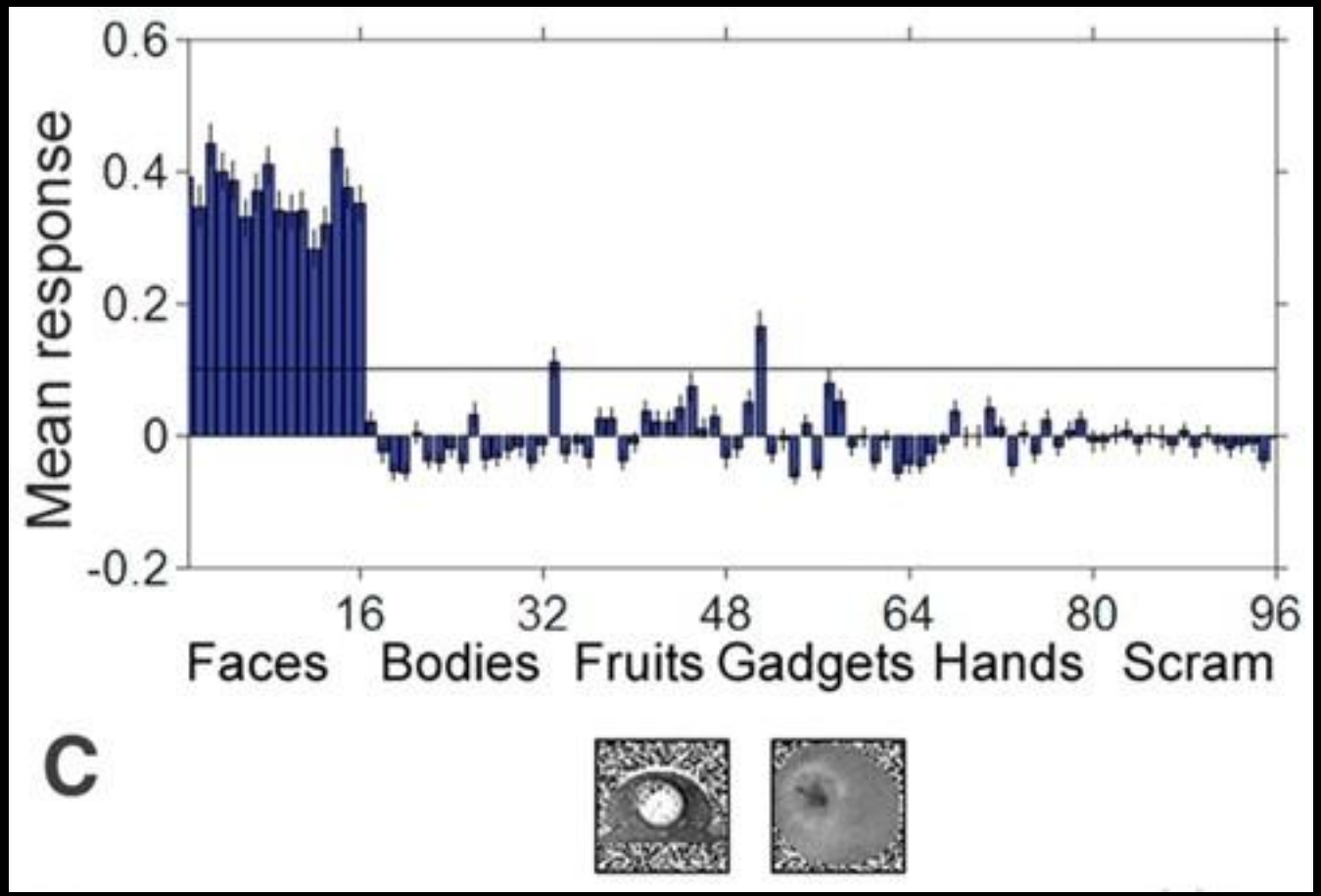


face-deprived



Sugita, *PNAS* (2008)

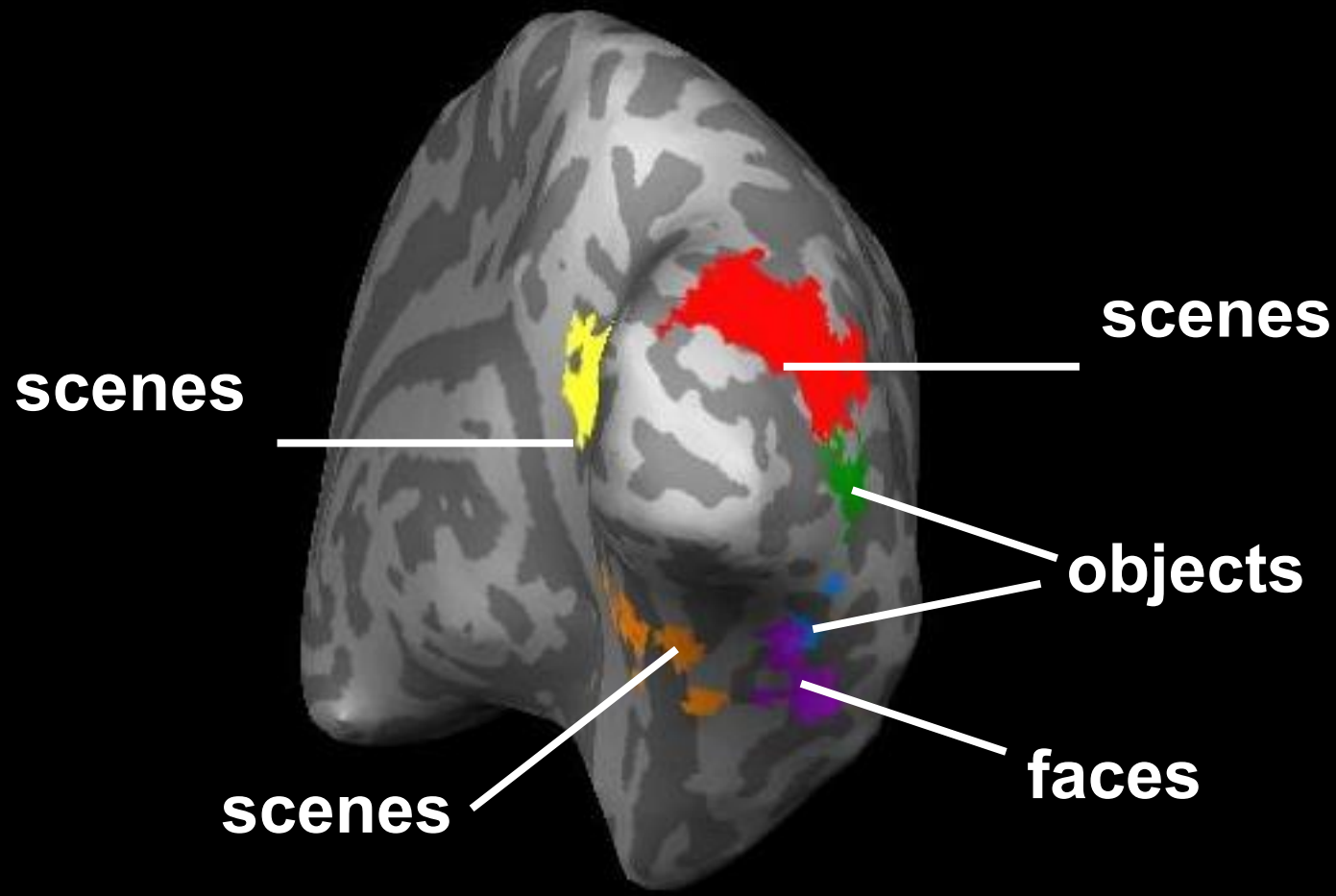
face module



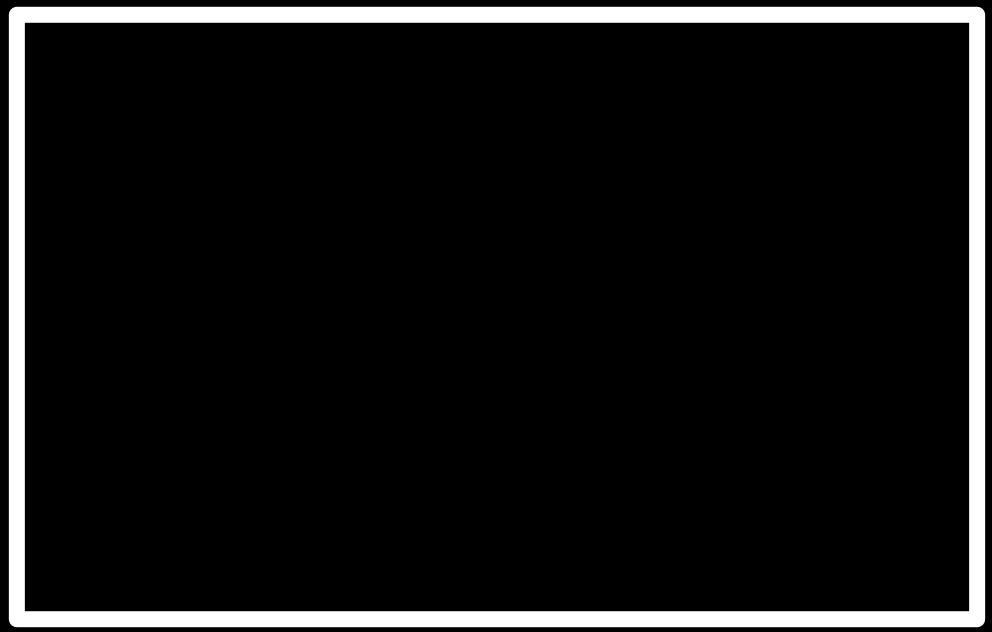
97% face-selective cells

Tsao et al., *Science* (2006)

category-selective regions

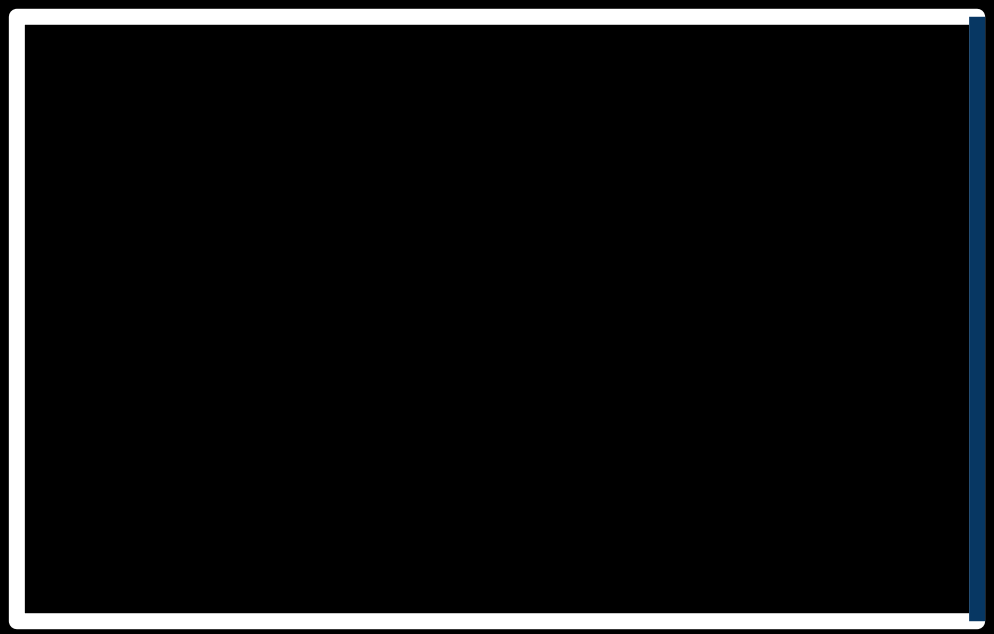


geometry module



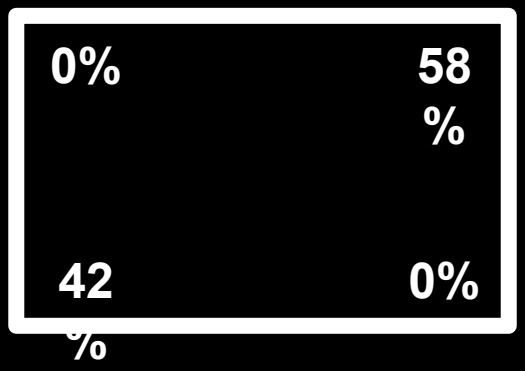
Hermer & Spelke, *Nature* (1994)

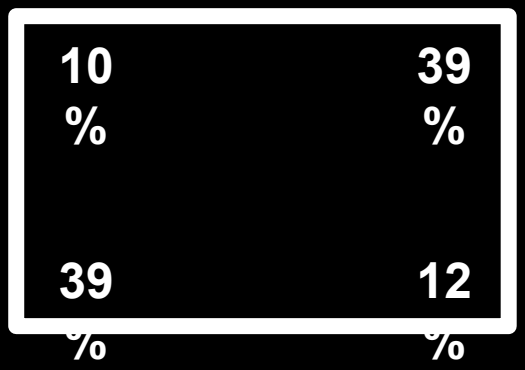
geometry module



Hermer & Spelke, *Nature* (1994)

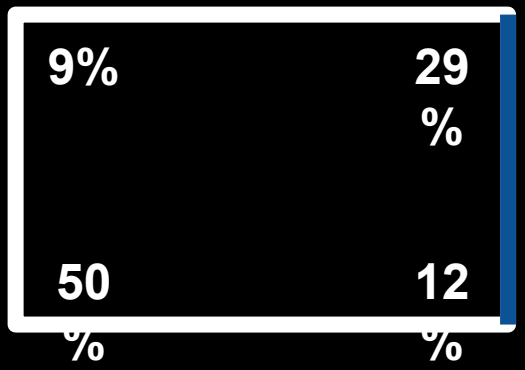
geometry module





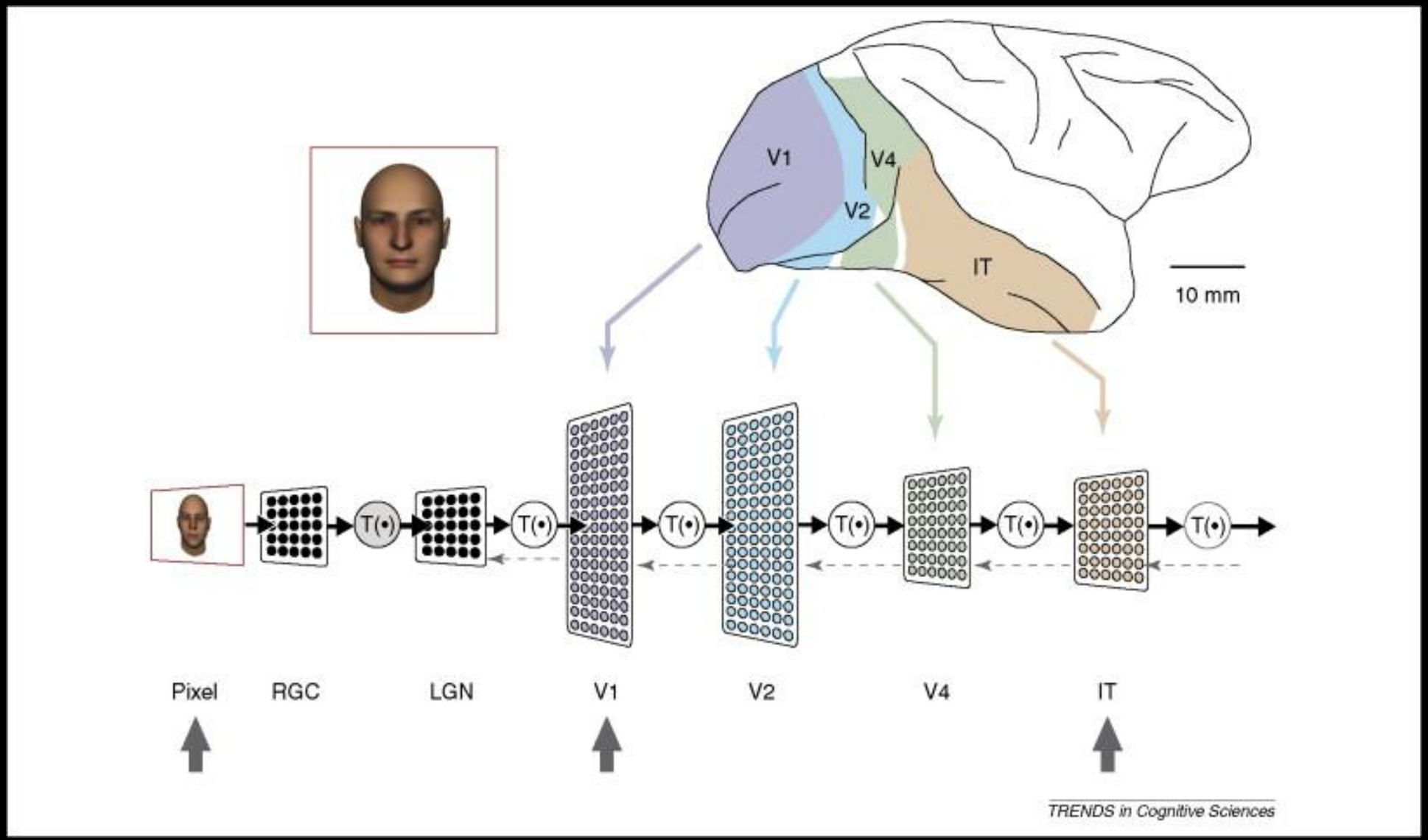
adults

kids



Hermer & Spelke, *Nature* (1994)

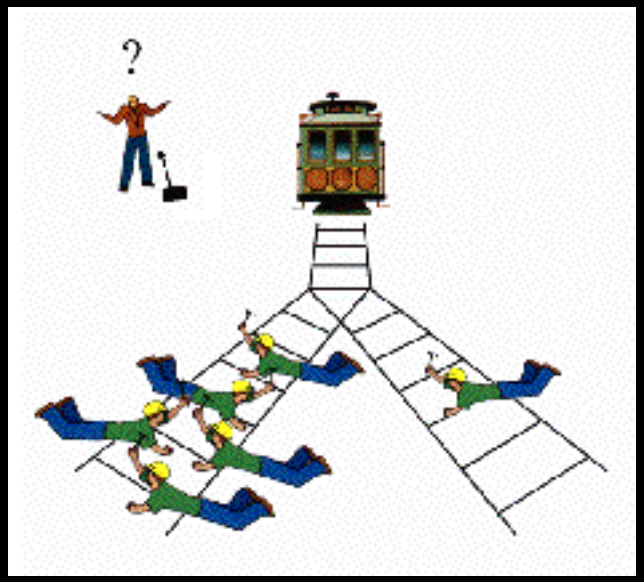
visual system



DiCarlo & Cox, *TiCS* (2007)

step3

moral cognition



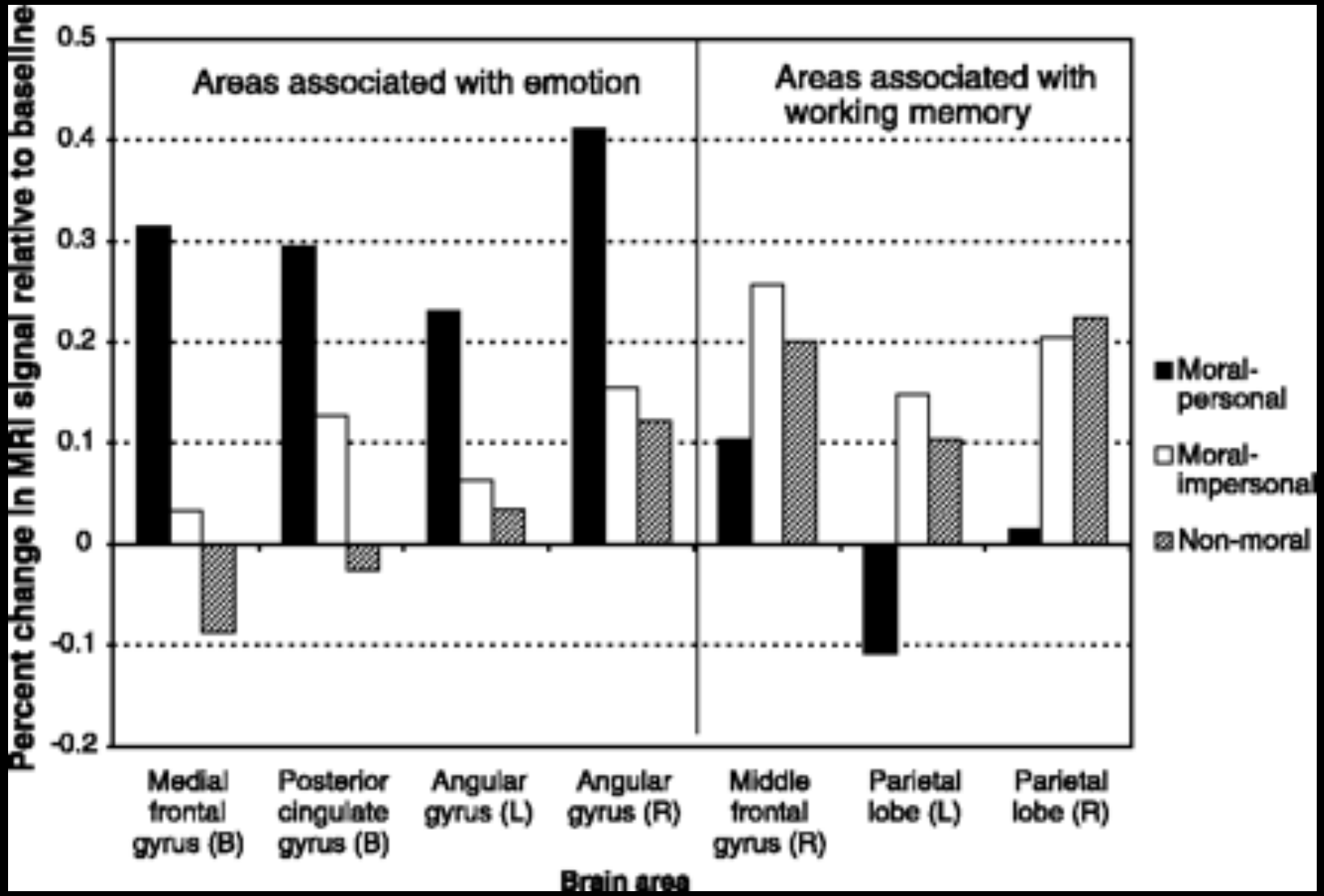
trolley problem

footbridge problem

where does your morality originate from?

from J. Greene

moral cognition



Greene et al., *Science* (2001)

theory of mind

false belief

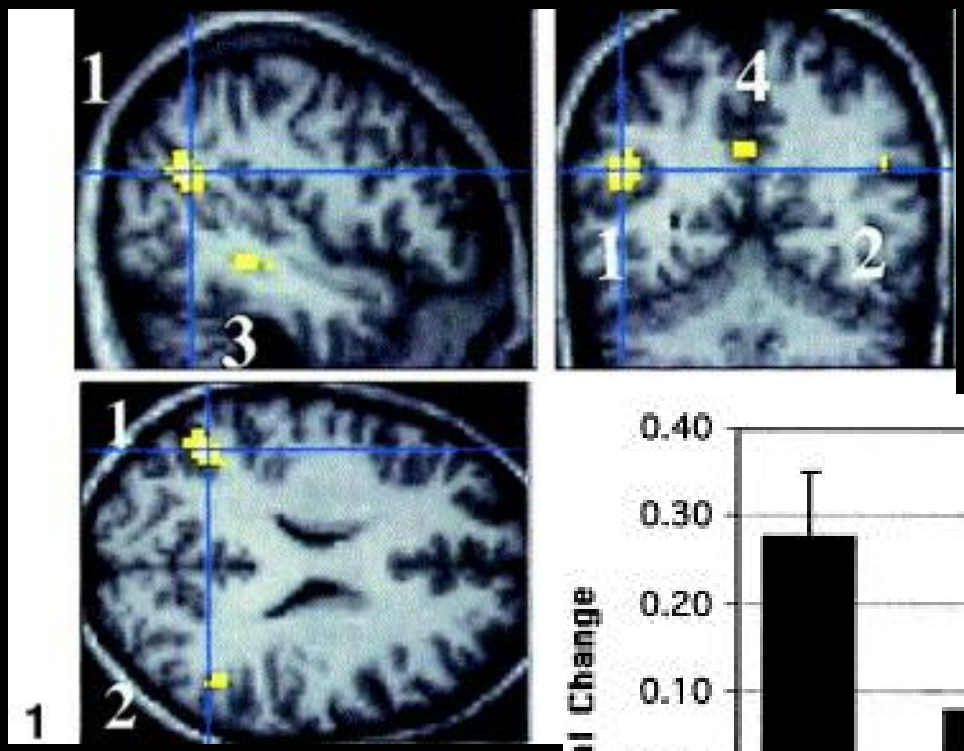
John told Emily that he had a Porsche. Actually, his car is a Ford. Emily doesn't know anything about cars though, so she believed John. *When Emily sees John's car she thinks it is a porsche/ford.*

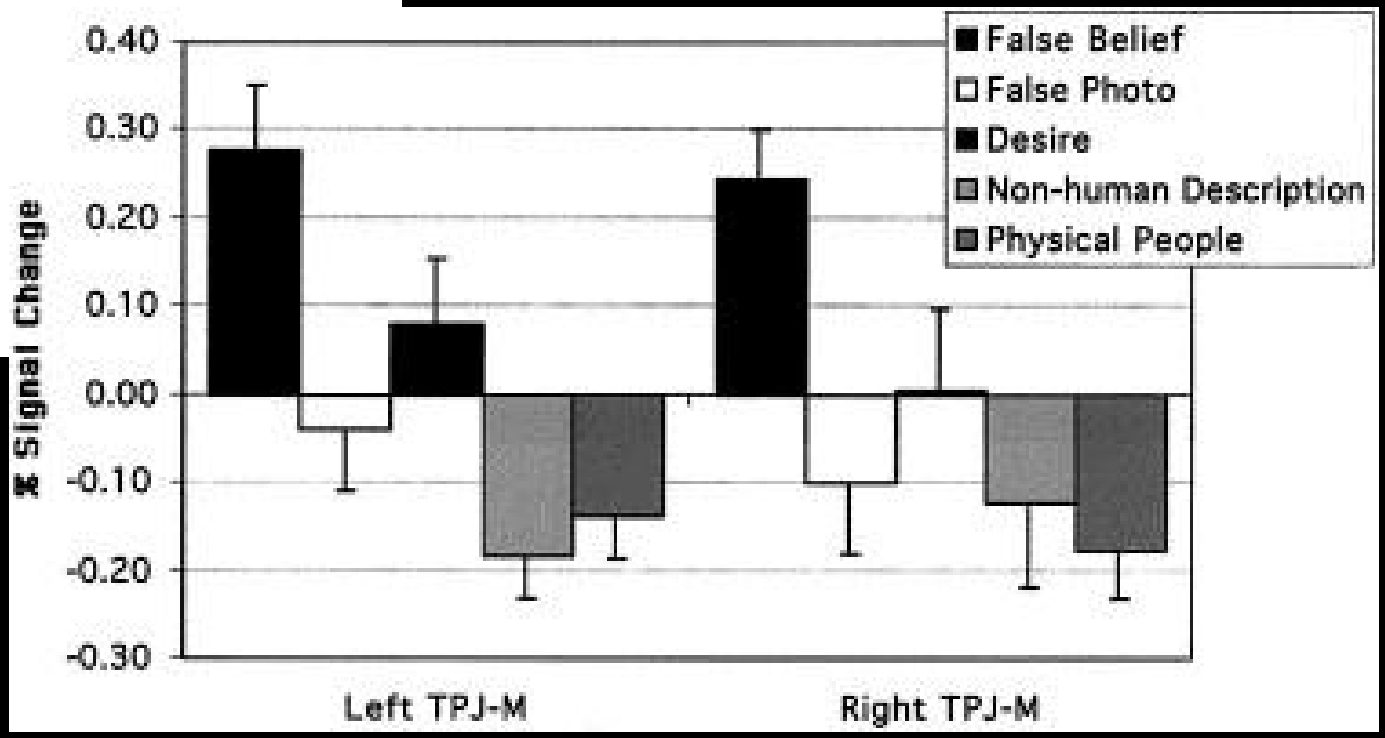
false photograph

A photograph was taken of an apple hanging on a tree branch. The film took half an hour to develop. In the meantime, a strong wind blew the apple to the ground. *The developed photograph shows the apple on the ground/branch.*

Saxe & Kanwisher, *NeuroImage* (2003)

theory of mind





Saxe & Kanwisher, *NeuroImage* (2003)

con
scious
ness

simple to complex

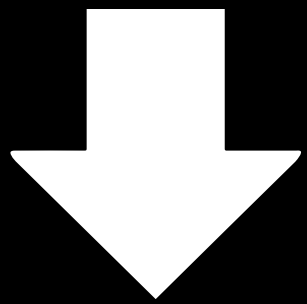
is there anything special about consciousness?

simple to complex duburys

mother's death

child's loss

impotence



suicide

simple to complex

is there anything special about consciousness?

maybe it is a result of interactions of simple components

thank you

slides available at jonaskubilius.mp | qbilius@alum.mit.edu