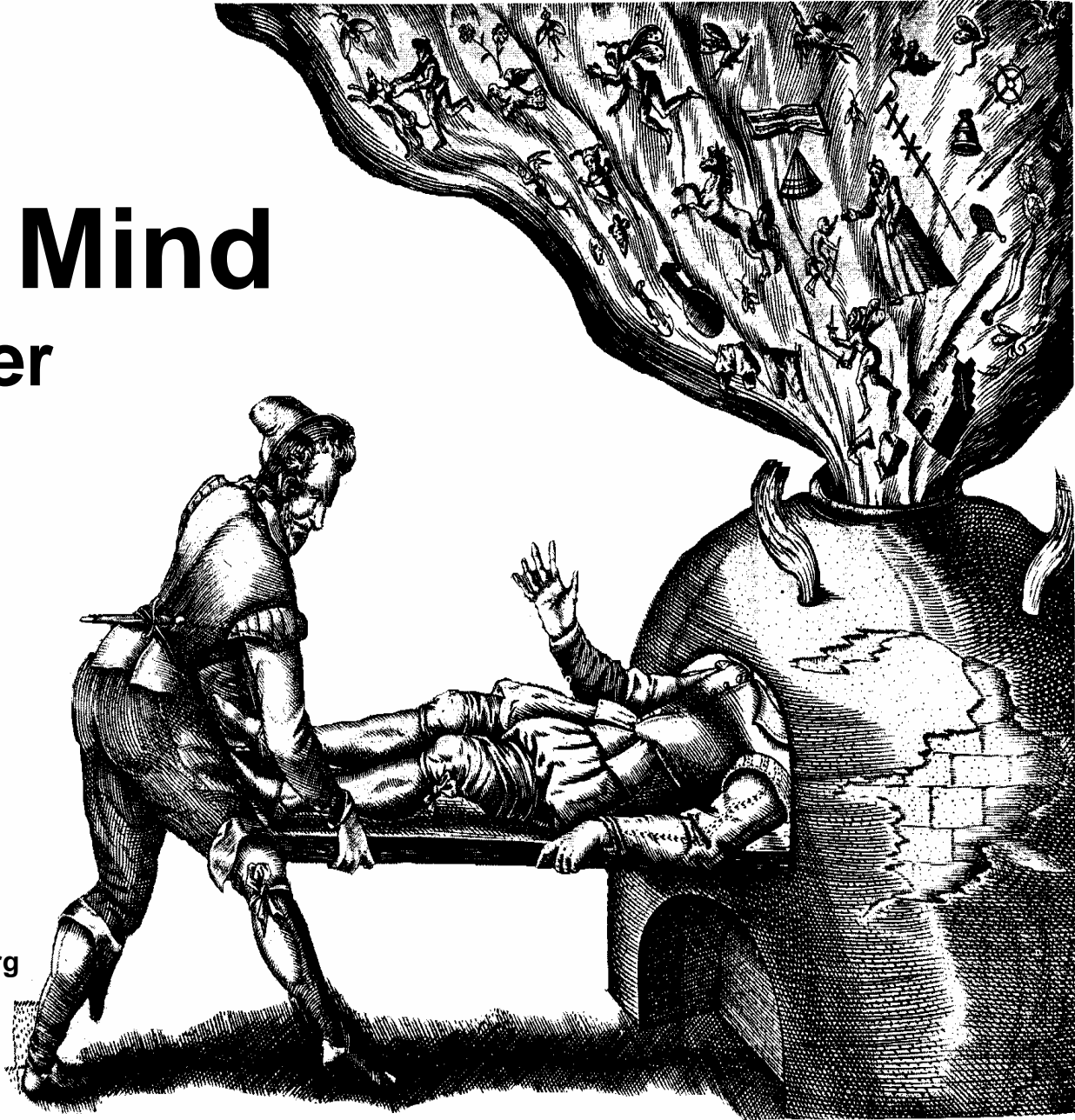


Brain and Mind

Spirit and Matter

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LMU München – Universität Regensburg
Experimental Psychology



A couple of definitions

- **Cognition:** The processes by which an organism gains knowledge of or becomes aware of events or objects in its environment. This knowledge is used for comprehension and problem-solving.
- **Biology:** the science of life and of living organisms, including their structure, function, growth, origin, evolution, and distribution.
- **Neurobiology:** the branch of biology concerned with the structure and function of cells of the nervous system.

A couple of definitions

- **Cognitive Science** is the scientific study of the mind and brain and how they give rise to behavior. The field is highly interdisciplinary and is closely related to several other areas, including:
 - Psychology
 - Artificial intelligence
 - Linguistics
 - Psycholinguistics
 - Philosophy
 - Neuroscience
 - Logic
 - Robotics
 - Anthropology
 - Biology
 - etc.

About the brain

- The part of the central nervous system situated within the skull.
- the organ that controls our body's thinking, reasoning, memory and emotions and regulates our balance, movements and coordination.
- Collection of nerve cells usually located at the anterior end of an animal, when present at all. The nerves coordinate information gathered by sense organs, locomotion, and most internal body activities.
- The physical part of an intelligent system (IS) where the mind functions.

About the mind

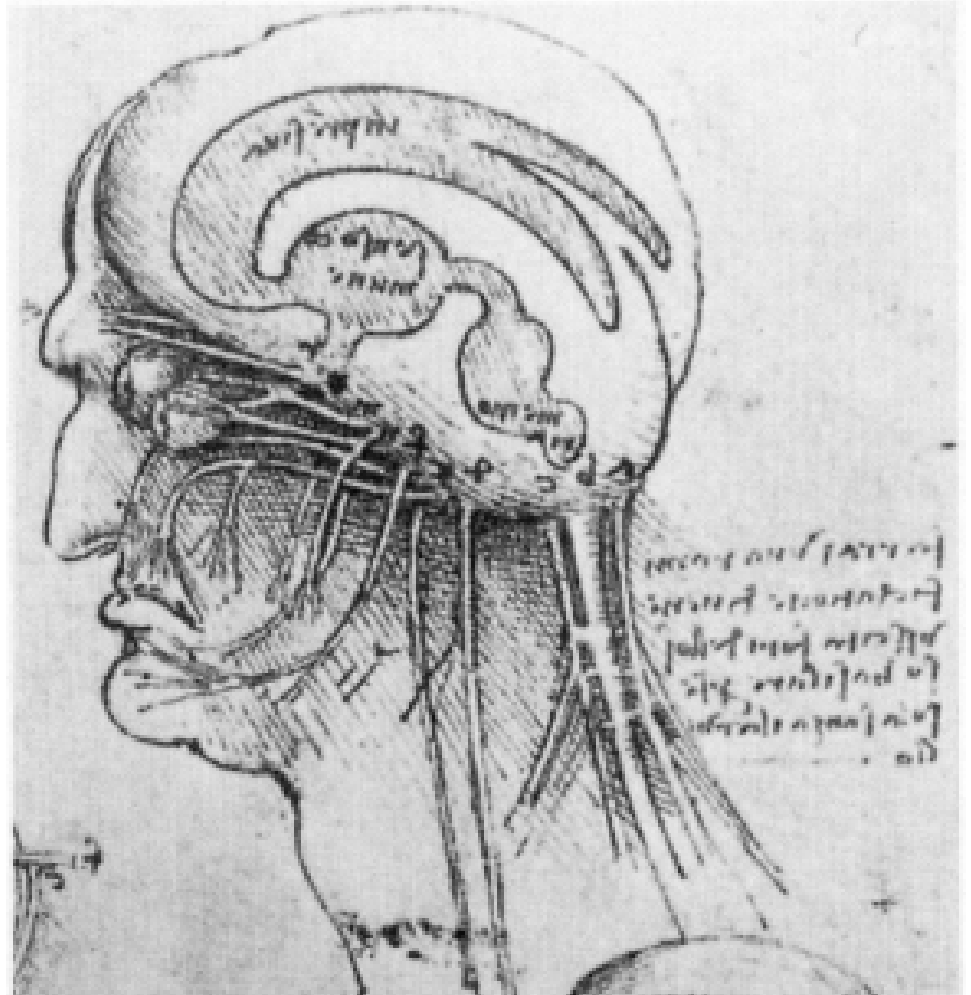
- The mind is the term most commonly used to describe the higher functions of the human brain.
- is responsible for one's thoughts and feelings; the seat of the faculty of reason.
- The processes and memories within the brain of an IS.
 - The main processes are transforming sensations into concepts, representing the present situation by concepts, choosing a response rule, and responding according to the response rule.
 - Further processes are the creation of higher level concepts and of response rules. Memories are the stored concepts and response rules.

About the mind

- The mind is a theater where perceptions play their part in rapid succession (David Hume, 1711-1776).
- The brain secretes thought as the liver secretes bile. (Pierre Jean Georges Cabanis, 1757-1808).
- The brain secretes thought as the kidney secretes urine. (Jakob Moleschott, 1822-1893).
- Neurophysiology becomes psychology but remains neurophysiology (Robert A. Charman)

Hydraulic fluid theory of brain function

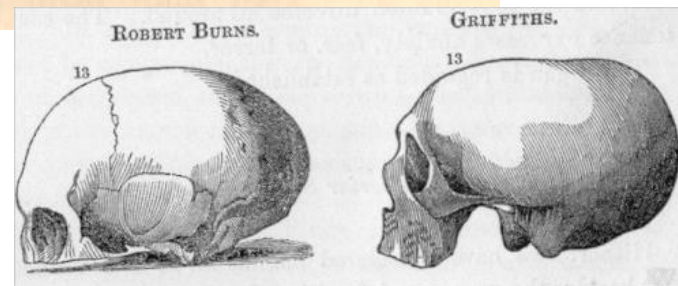
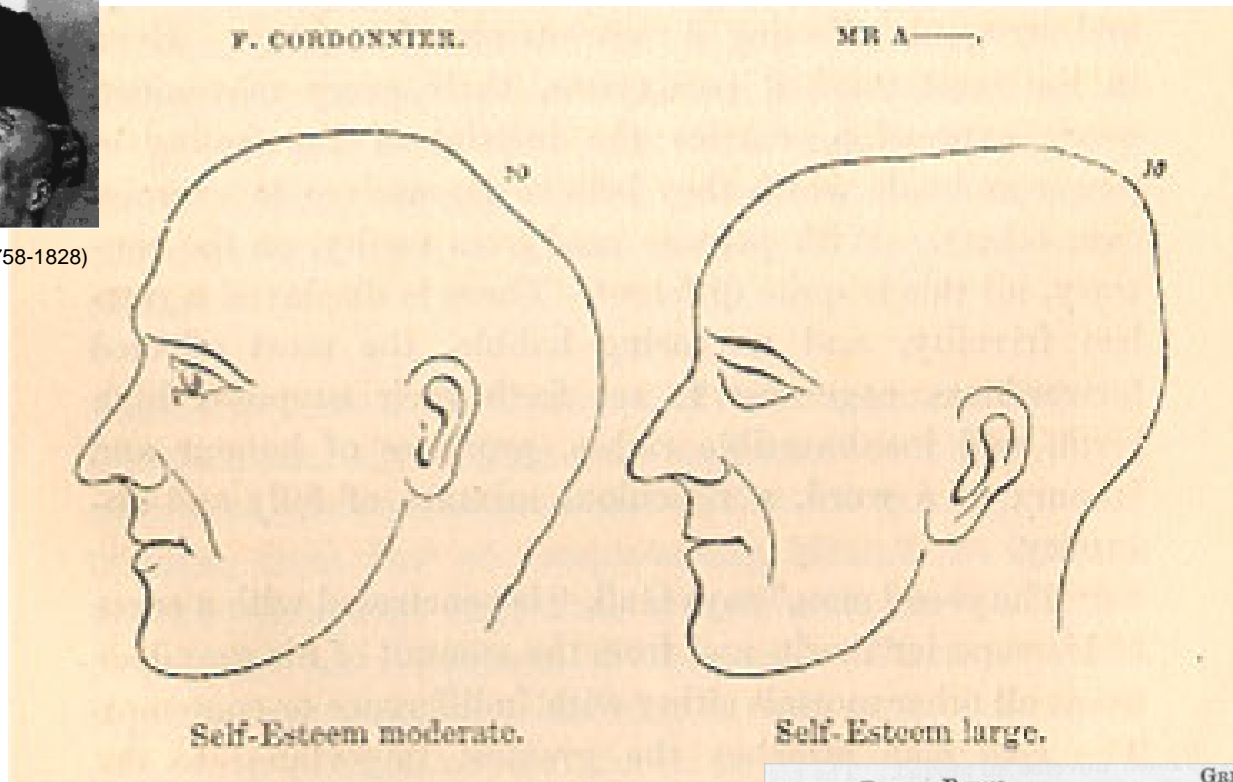
(Leonardo da Vinci XV century, Descartes XVI century)



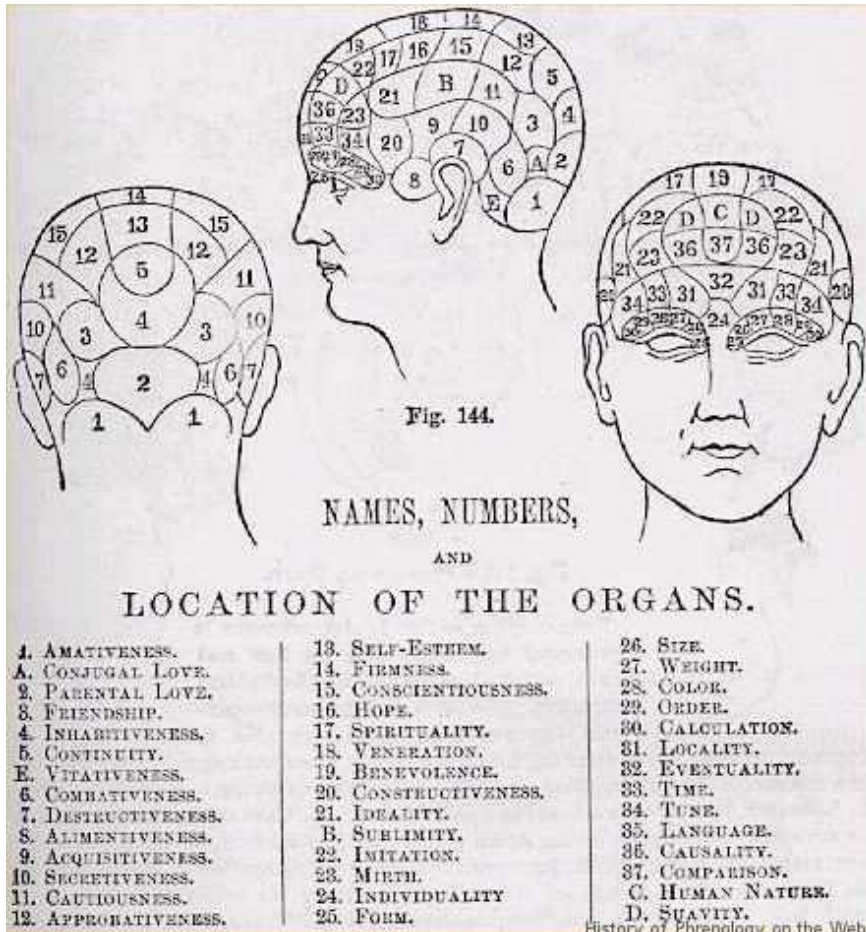


Franz Joseph Gall (1758-1828)

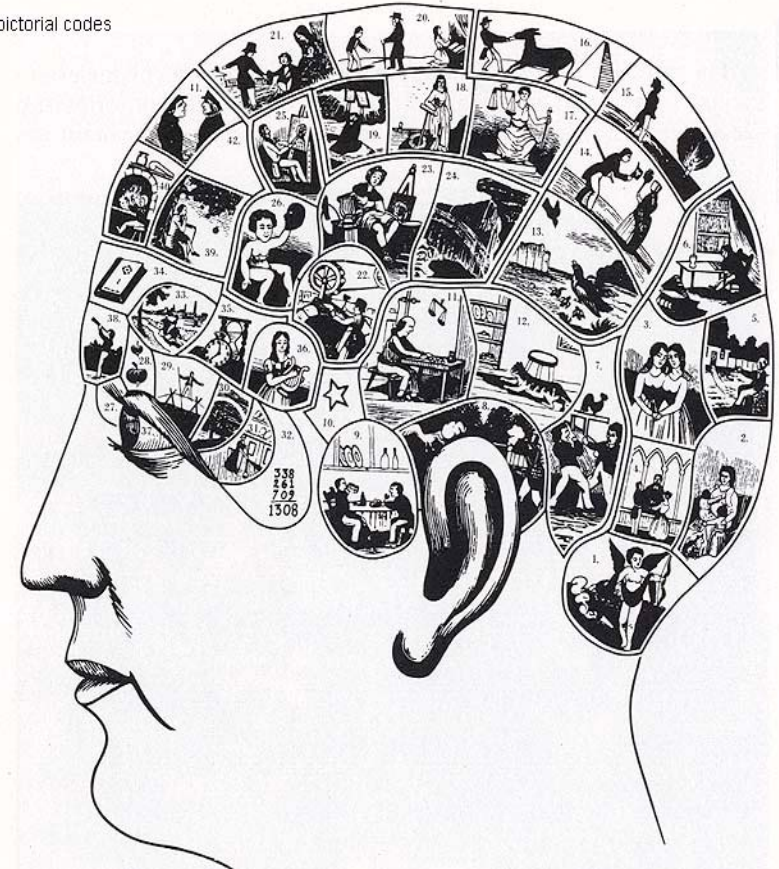
The Phrenology (1790-1880)



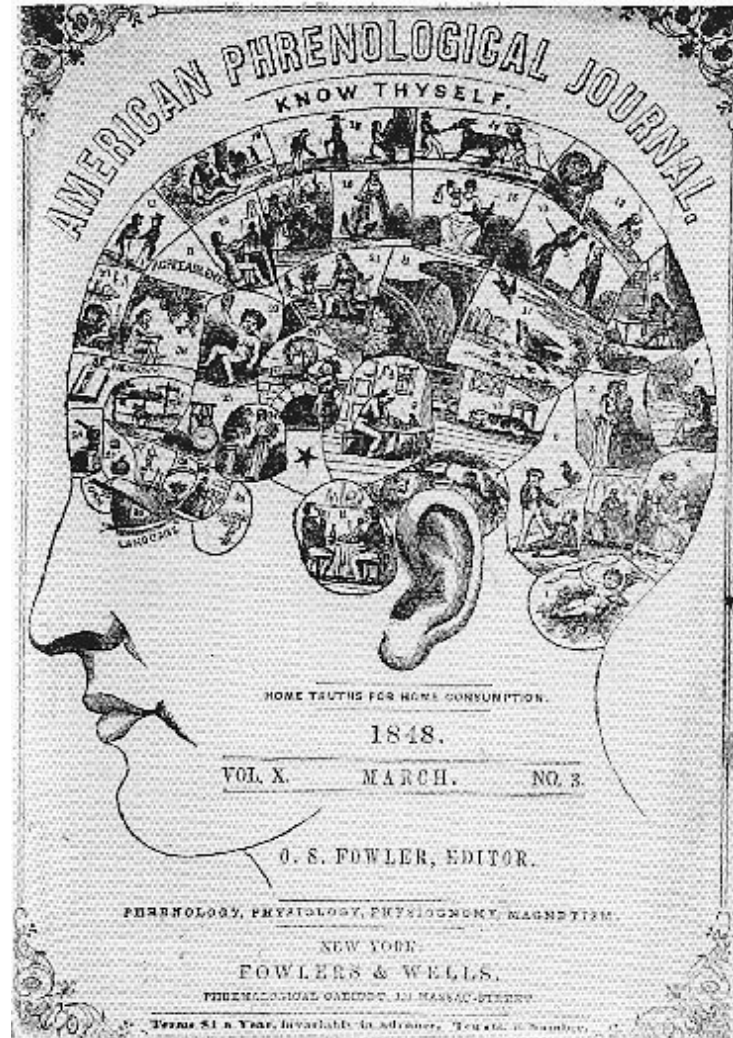
The Phrenology (1790-1880)



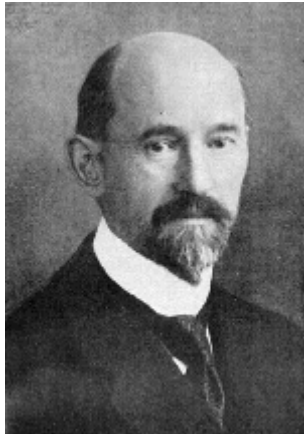
pictorial codes



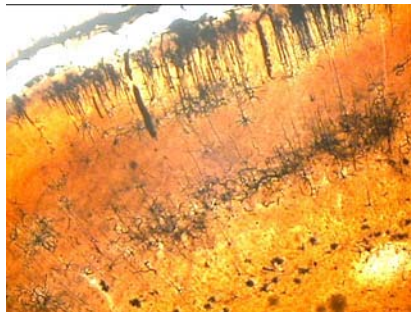
The Phrenology (1790-1880)



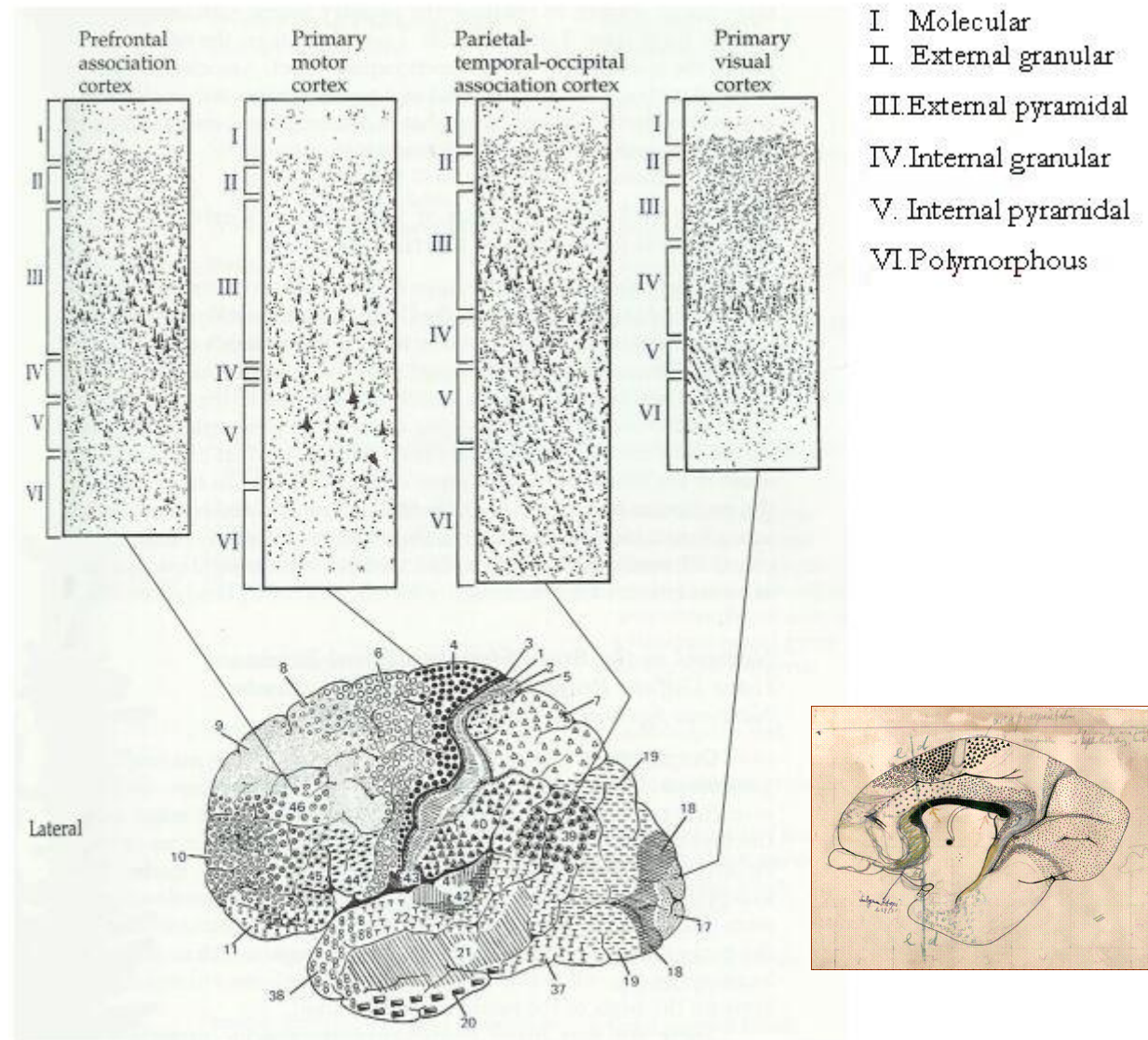
Brodman's Cytoarchitectonic Map (1909)



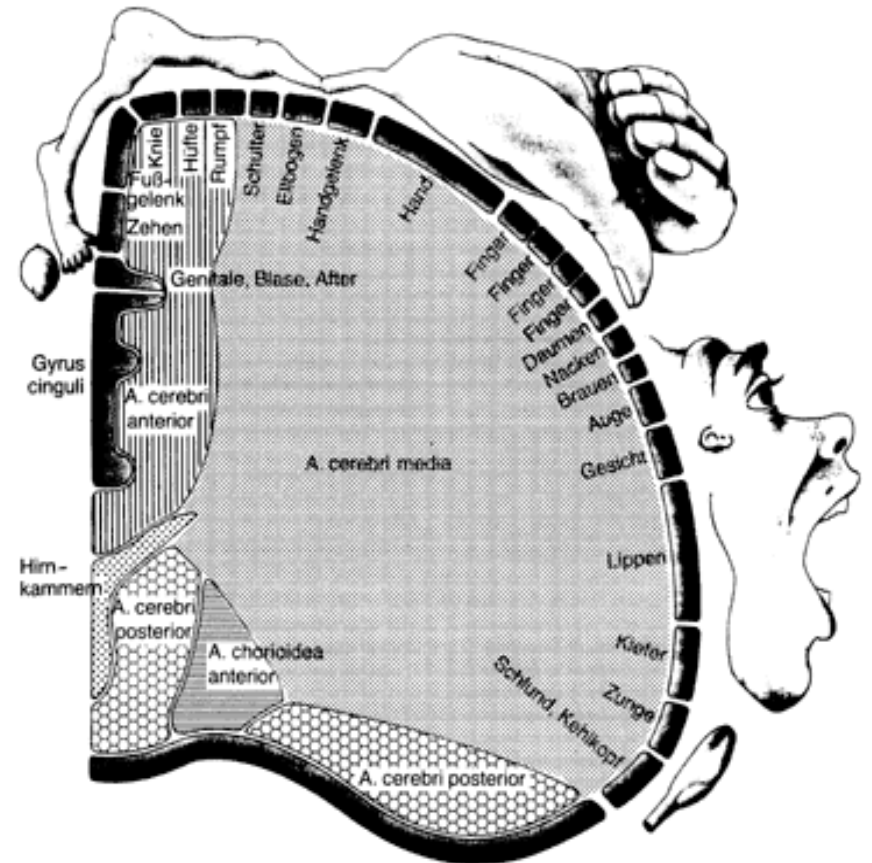
Korbinian Brodmann (1868-1918)



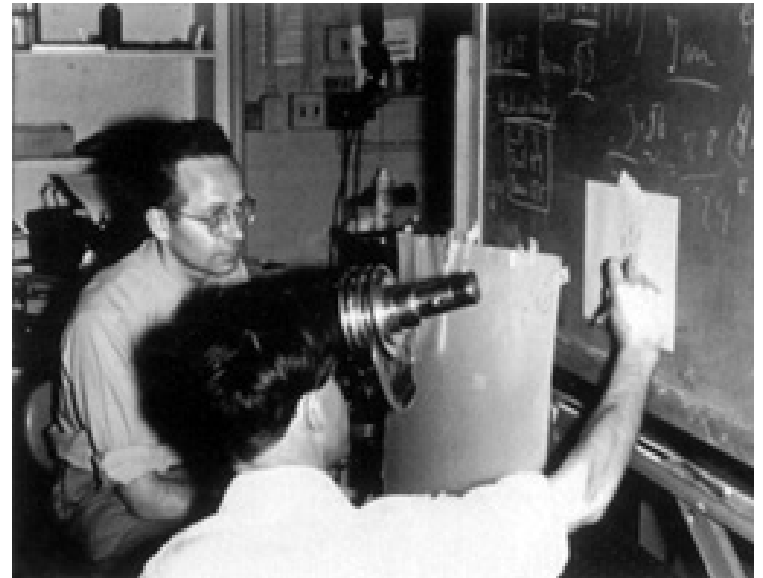
Silver staining technique



Penfield's homunculus (1930)



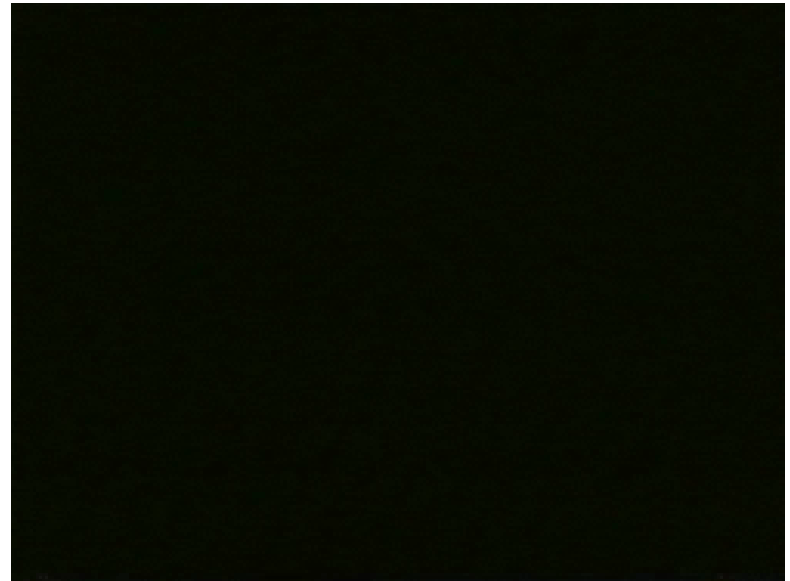
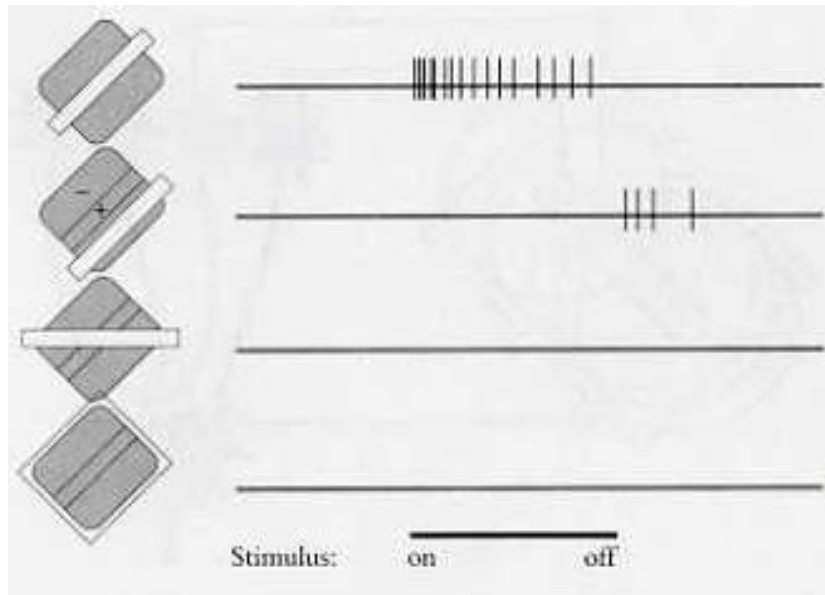
Hubel and Wiesel single cell recordings in cat striate cortex (1958)



David H. Hubel & Torsten N. Wiesel.

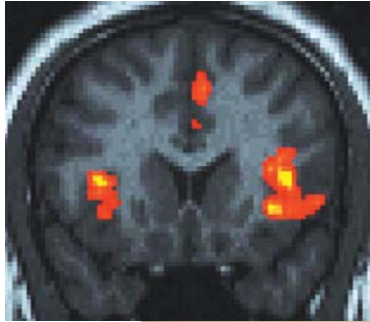
1981 Nobel Prize in Physiology for their discoveries concerning information processing in the visual system

Hubel and Wiesel single cell recordings in cat striate cortex (1958)

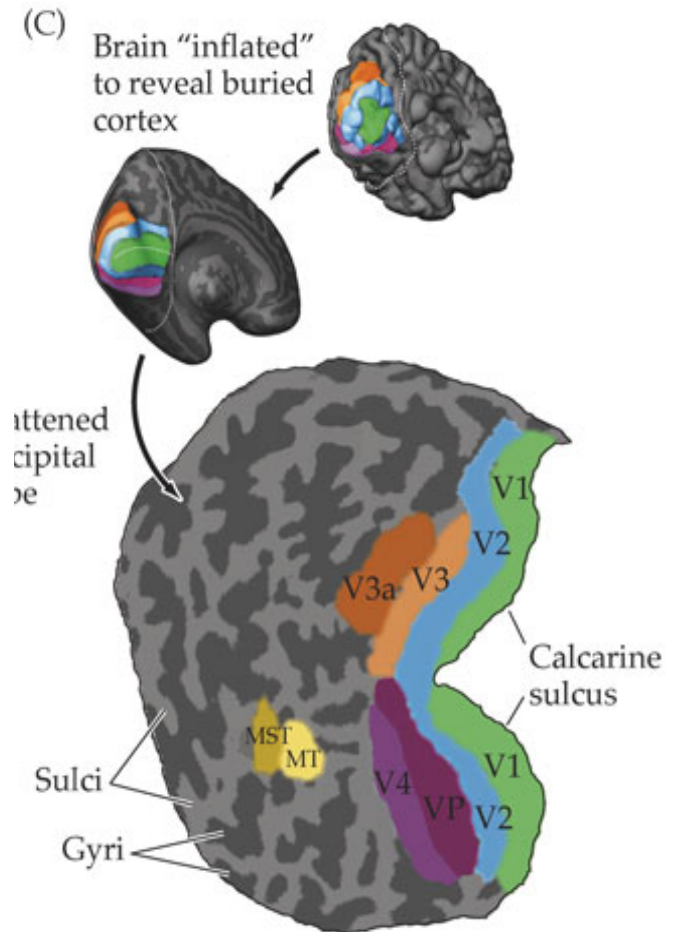
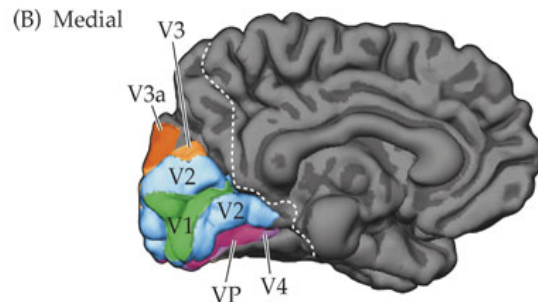
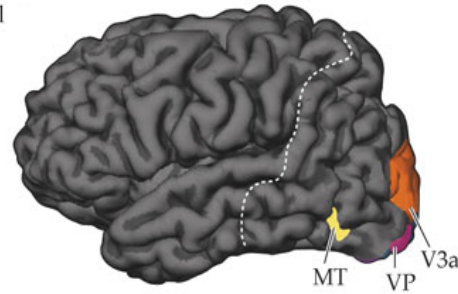
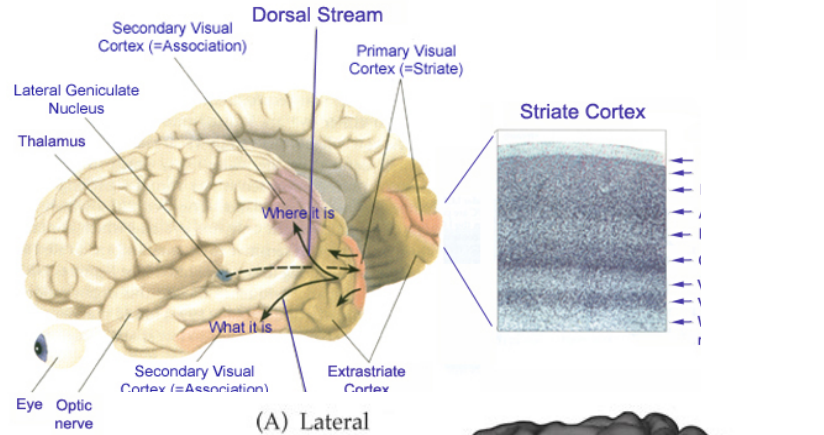


**Neural activity leads to conscious
perception**

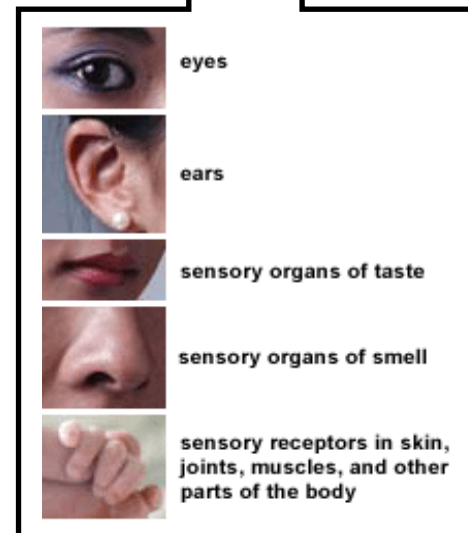
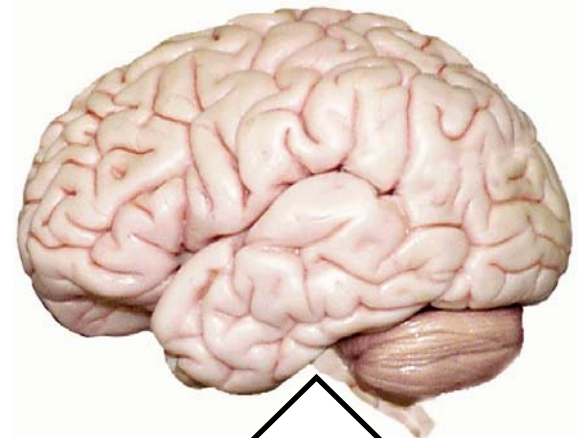
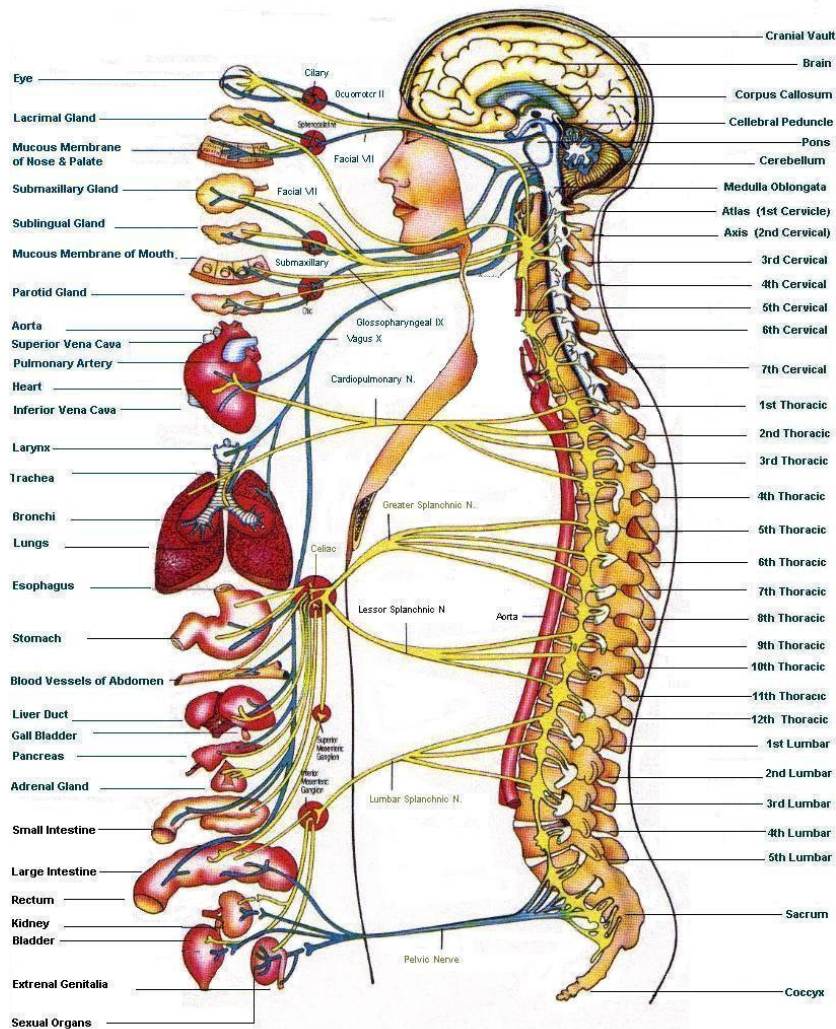
Functional brain imaging (fMRI)



3D reconstruction, inflating and flattening techniques



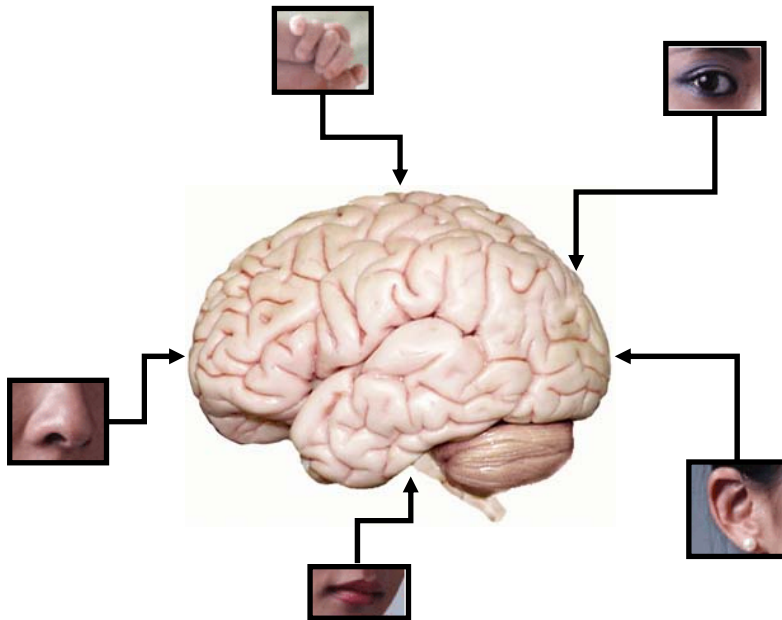
Only signals that pass through the cortex give rise to mental experience



**Our psychological world is based on
the incomplete versions of the
physical world delivered by our
sensory organs!!!**

The role of attention:

allocate the limited processing resources to optimize performance.

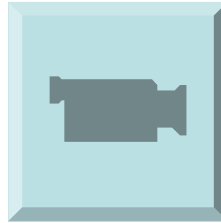


**Our psychological world is based on
filtered versions (by attetion)...**

**...of the incomplete versions of the
physical world delivered by our sensory
organs!!!**

The role of attention:

allocate the limited processing resources to optimize performance.



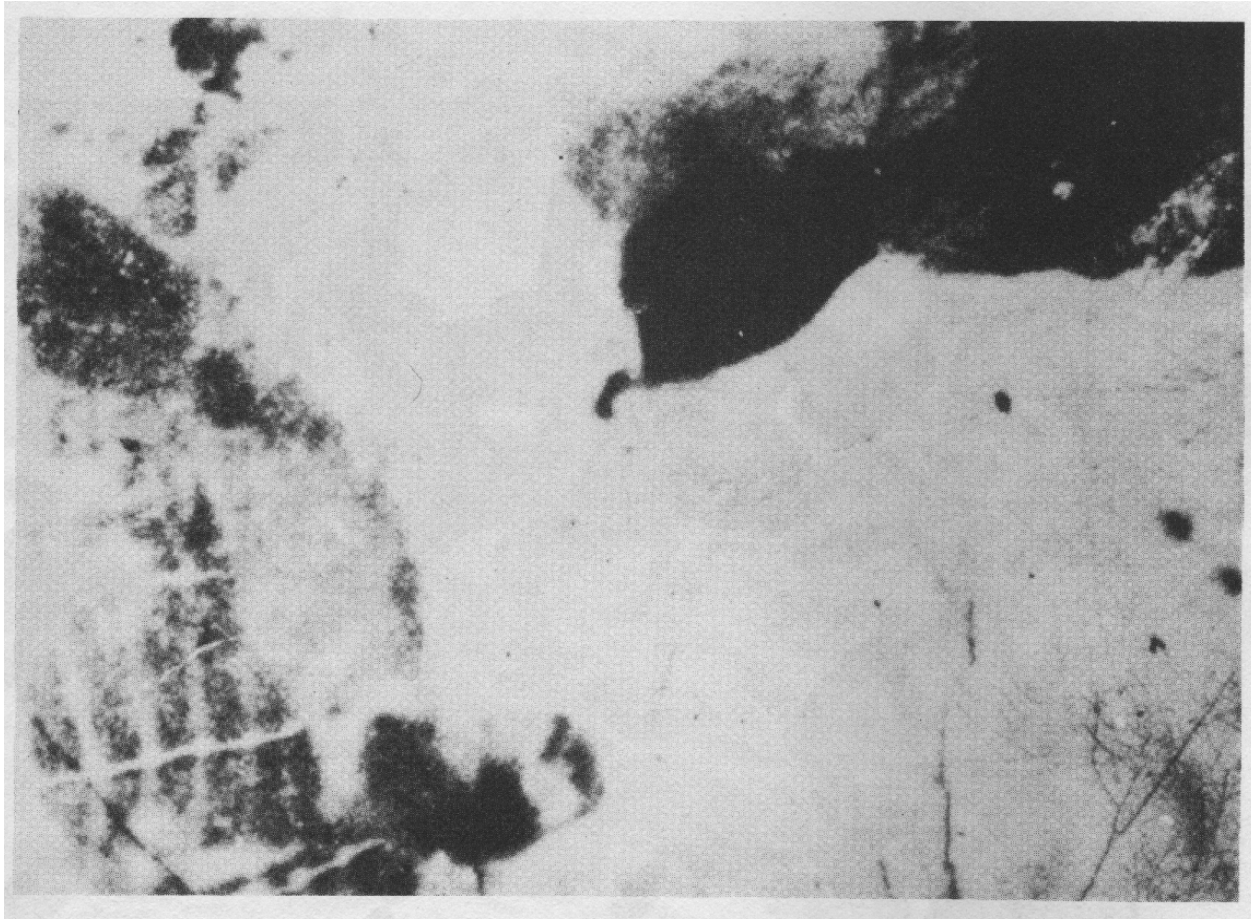
Attentional blindness



**Sensory information is not the only
source of information used to
construct our psychological world...**

**...also available *cognitive*
information influences this
construction process.**

The top-down influence in perceiving



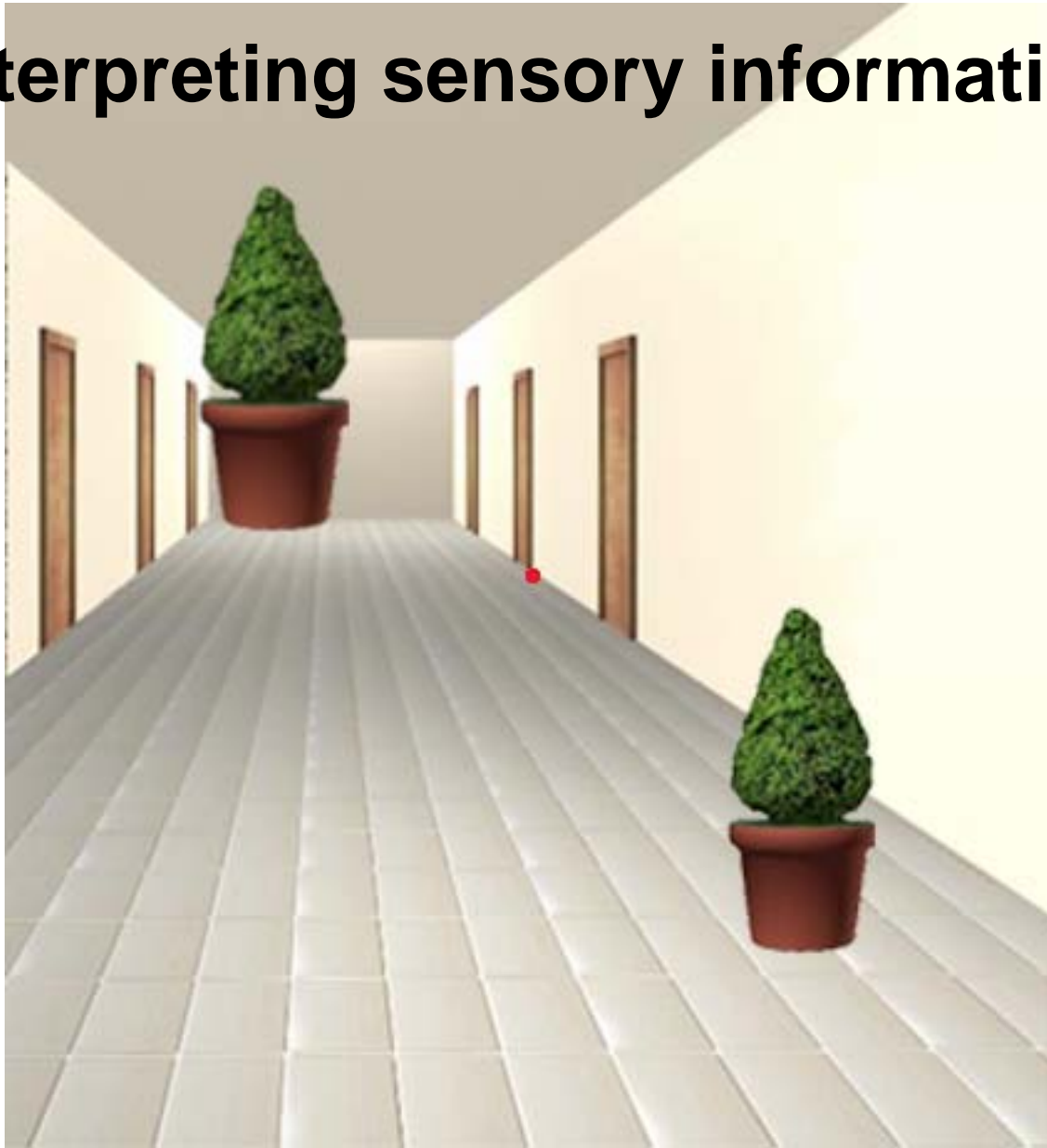
**Our interpretation of the world is not
only based on information gained by
our sensory organs...**

**...but also on the way our
brain interprets it.**

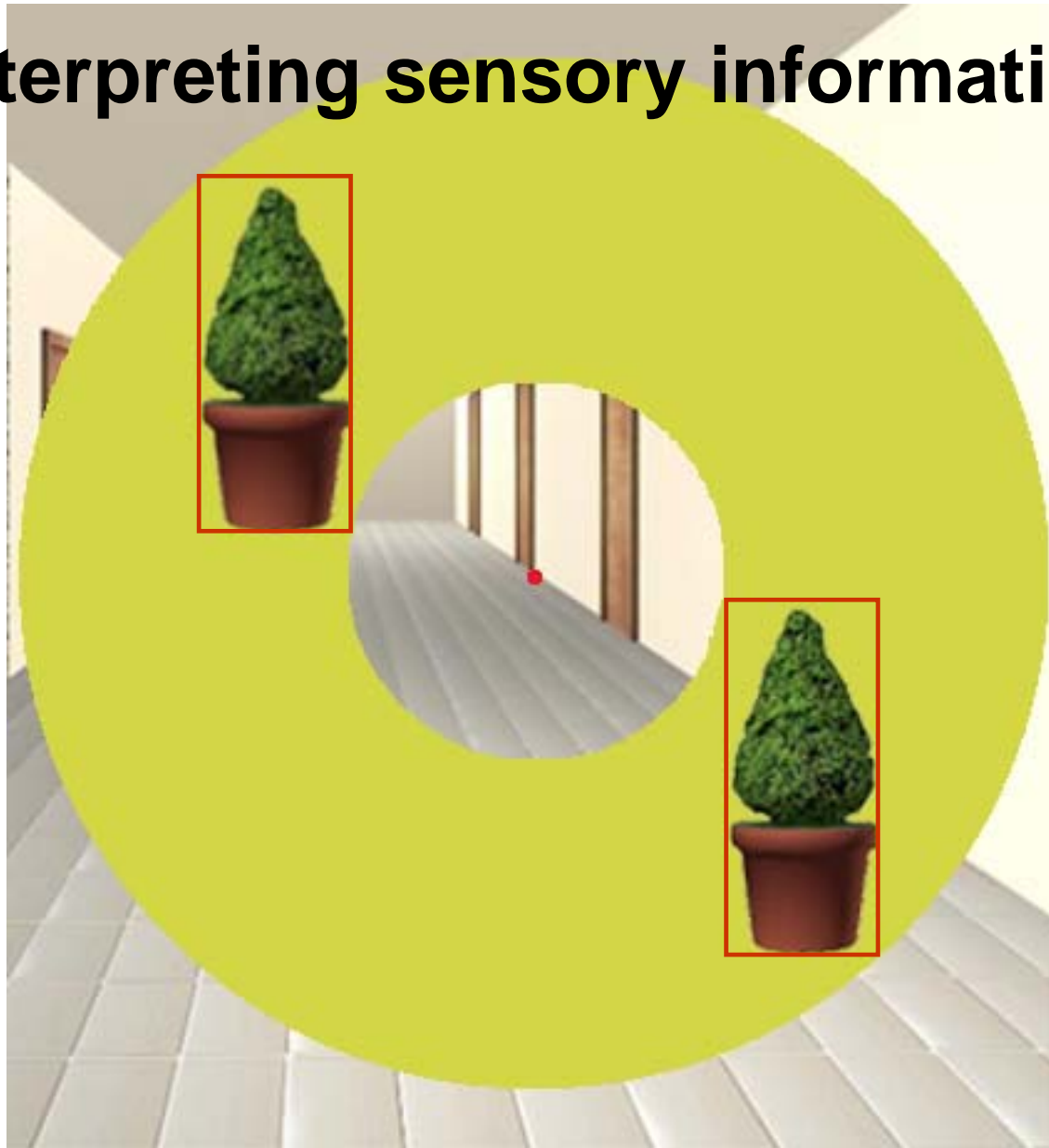
Interpreting sensory information



Interpreting sensory information

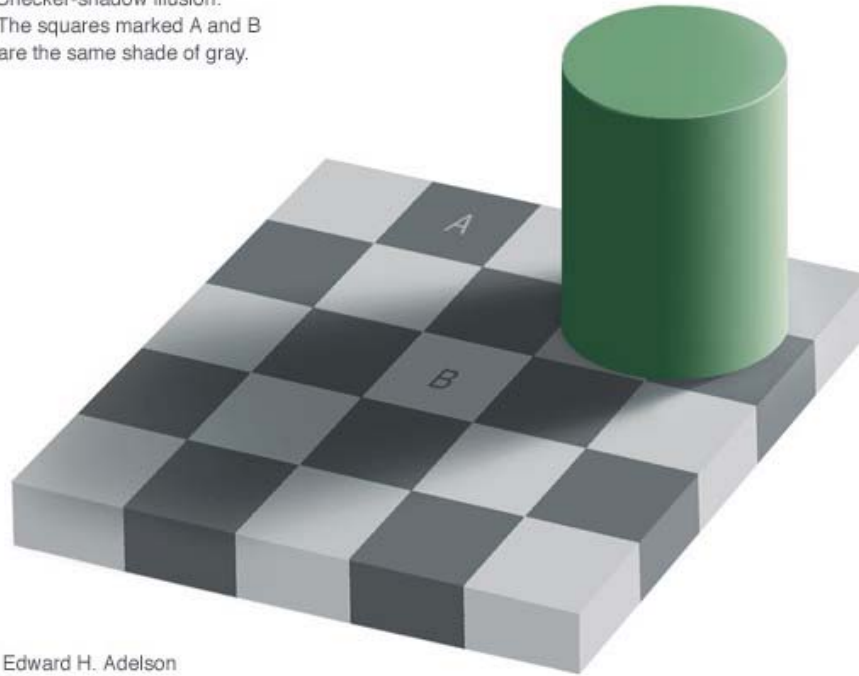


Interpreting sensory information



Interpreting sensory information

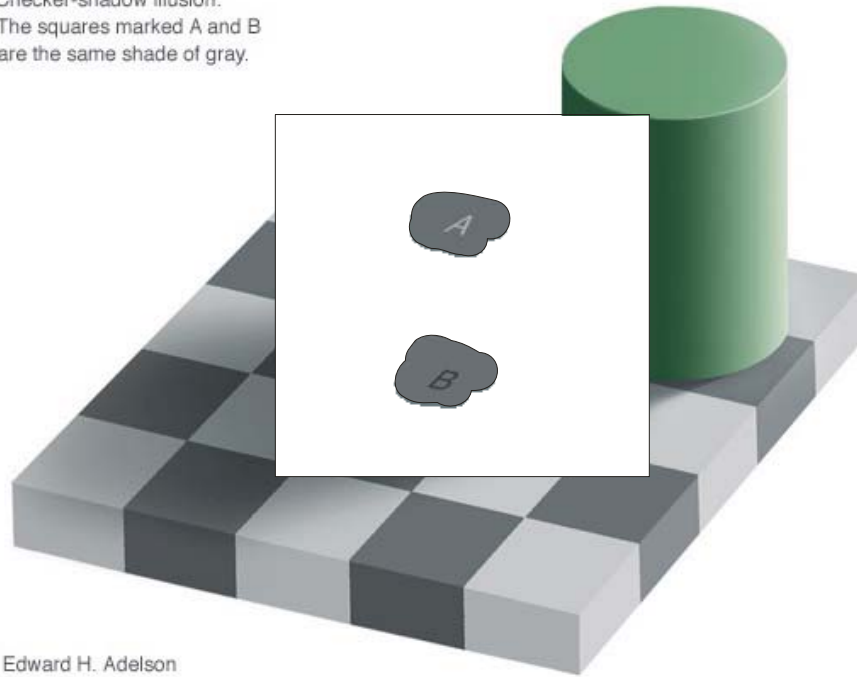
Checker-shadow illusion:
The squares marked A and B
are the same shade of gray.



Edward H. Adelson

Interpreting sensory information

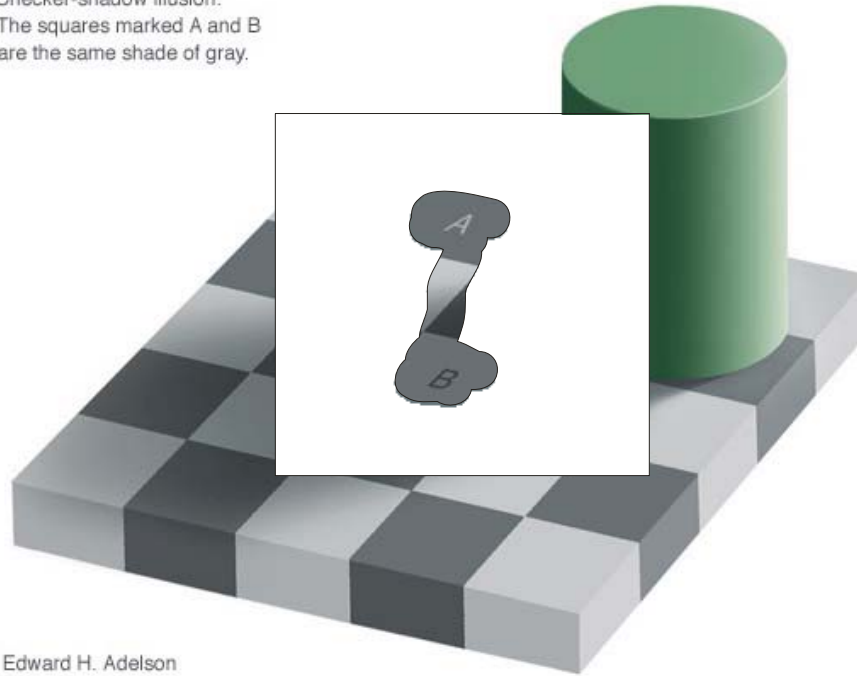
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Edward H. Adelson

Interpreting sensory information

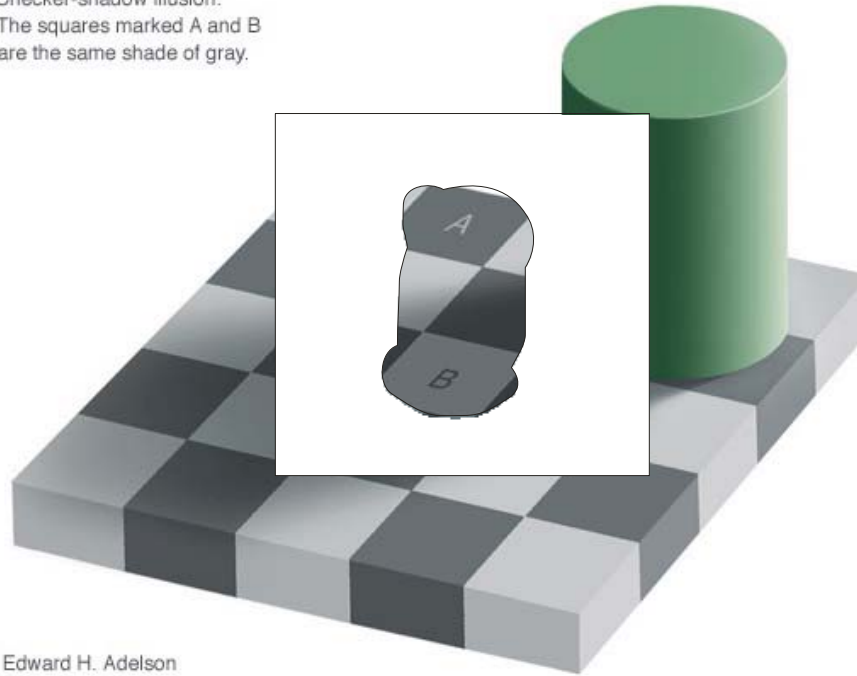
Checker-shadow illusion:
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Edward H. Adelson

Interpreting sensory information

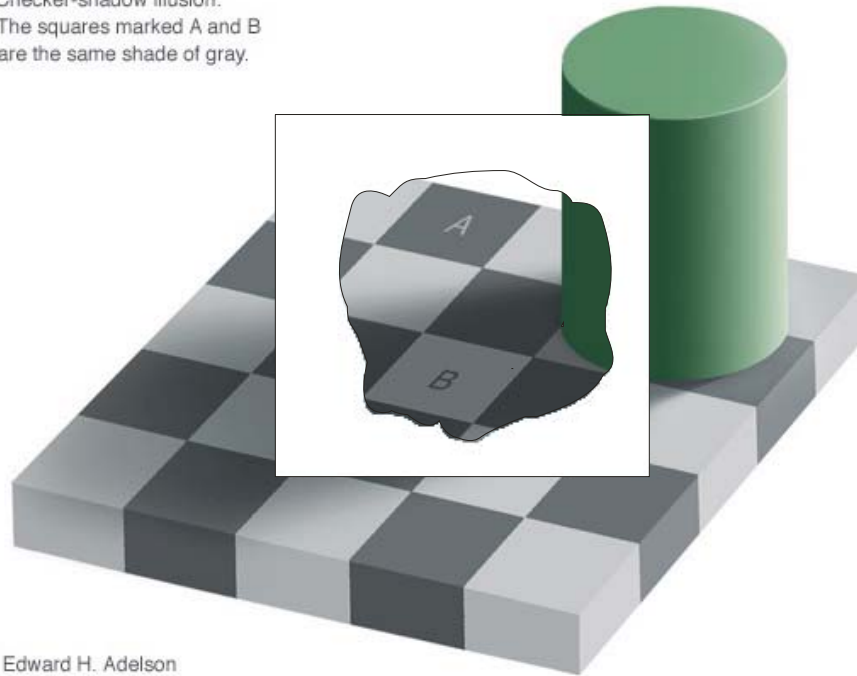
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Interpreting sensory information

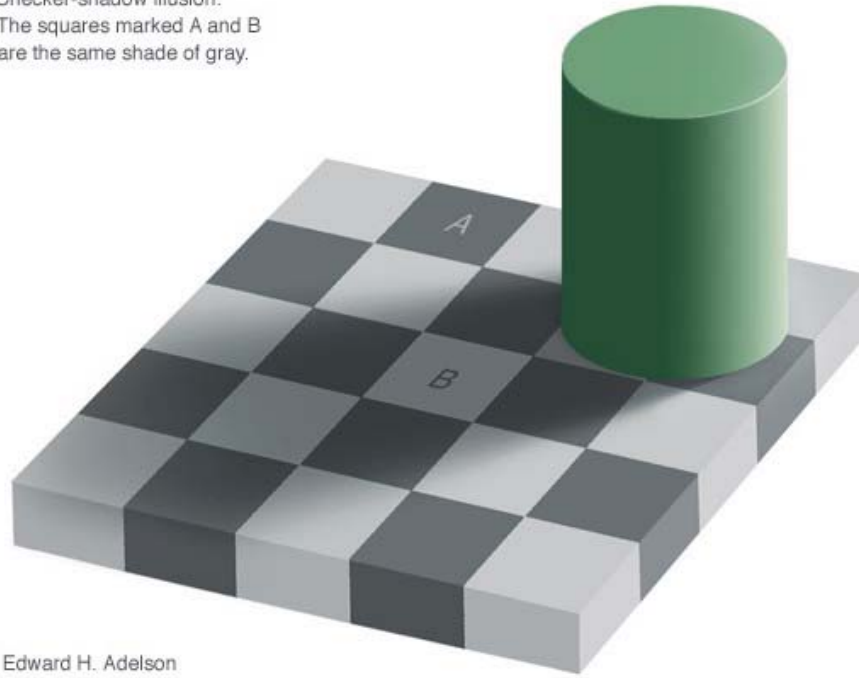
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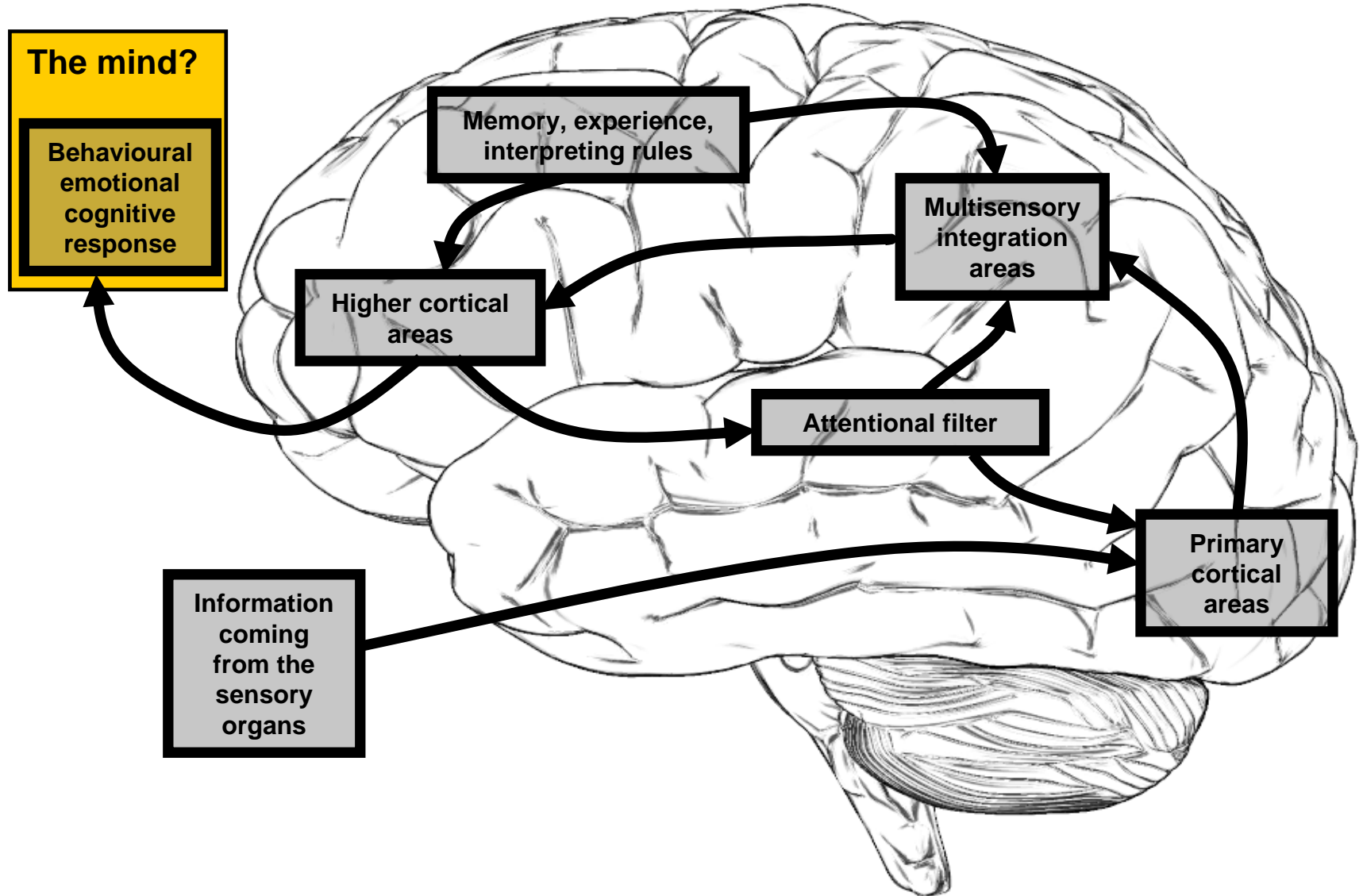
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Edward H. Adelson

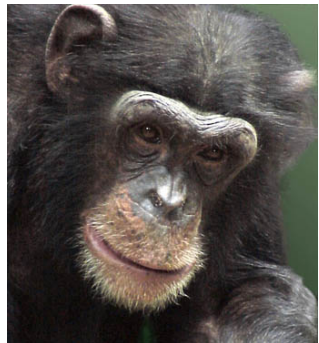
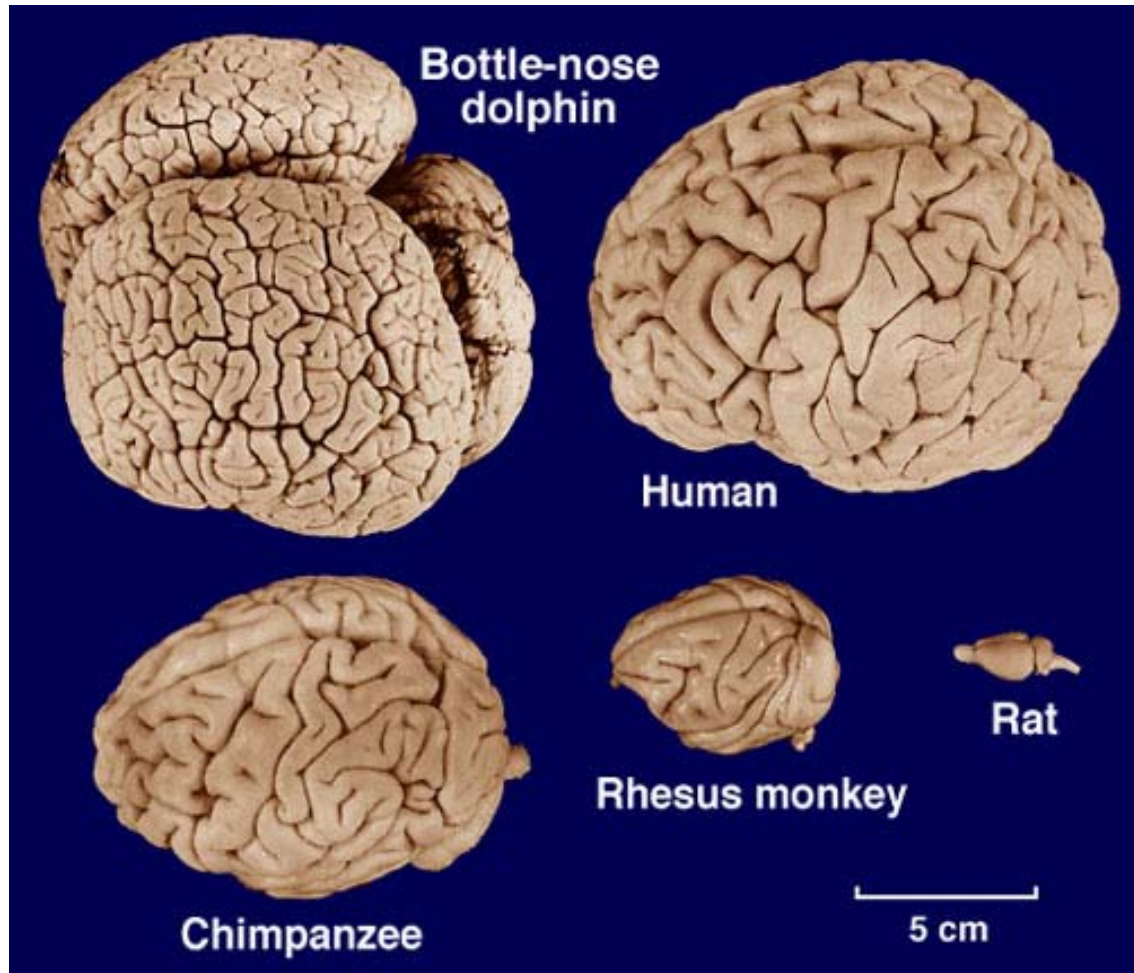
The construction of the psychological world



Neocortex is a requisite and size seems to matter: do other animals have minds?



EQ 5.31



EQ 2.49



EQ 7.44



EQ 0.40



EQ 2.09

EQ = Encephalization quotient, a measure of relative brain size

Thanks!!!