

Cognitive Science & Psychology: Mind, Brain and Behavior

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SPECS.UPF.EDU



SPECS synthetic perceptive, emotive and cognitive systems

2 Mind in Reality: res cogitans vs res extensa



God

Angels

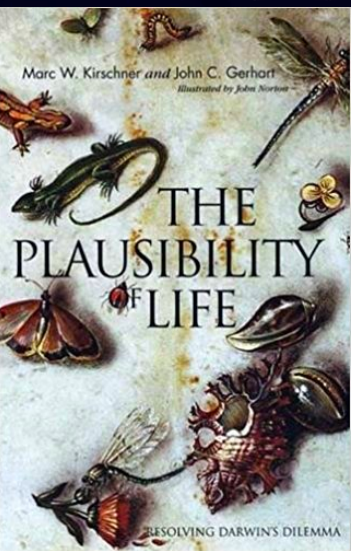
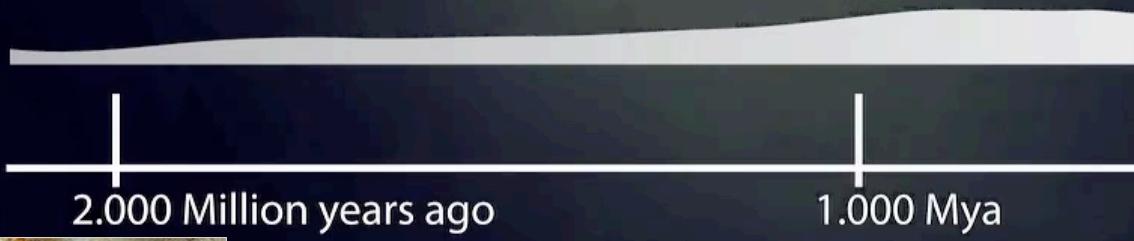
...

Lucifer

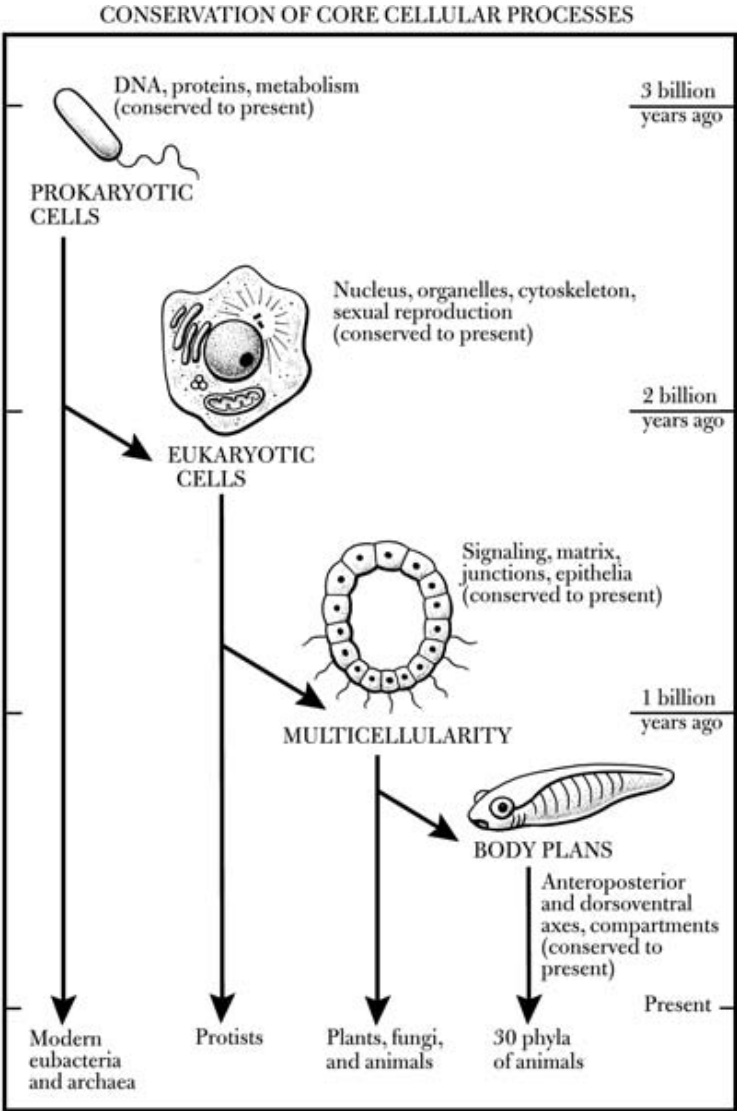
Retorica Christiana (1579) by Didacus Valdes

The *scala naturæ*, or great chain of being:

A combination of Aristotelian classification with Plato's ideas of the goodness of God, and of all potential life forms being present in a perfect creation, to organize all inanimate, animate, and spiritual beings into a huge interconnected system



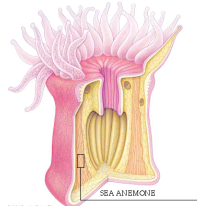
Evolution conserves organizational principles



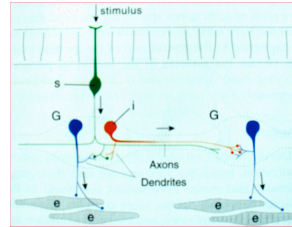
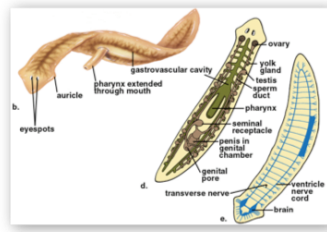
Sentence



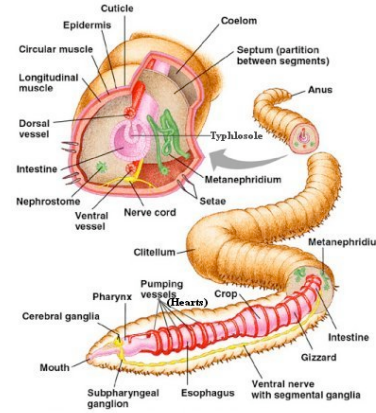
Kirschner & Gerhart (2007)
The Plausibility of Life



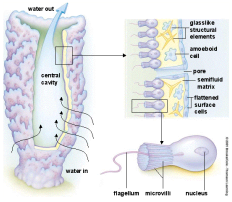
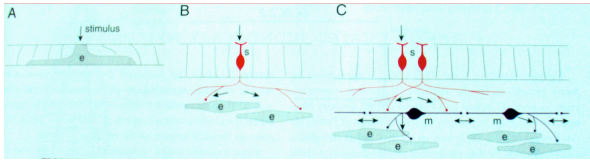
Nerve nets



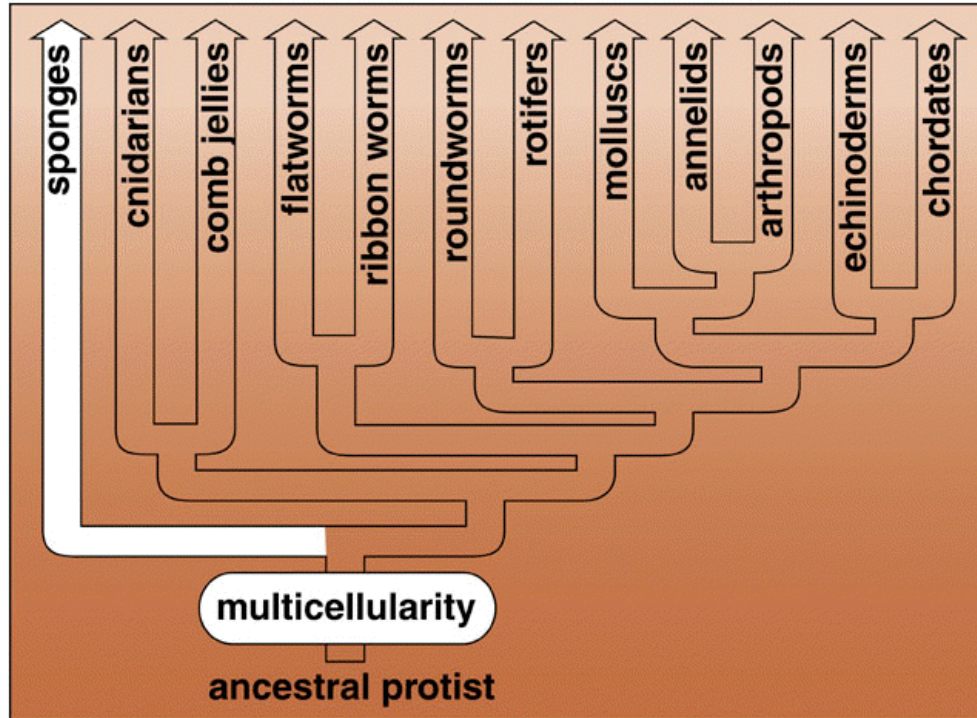
Segmented Cephalization



Segmented Ventral CNS



Cells

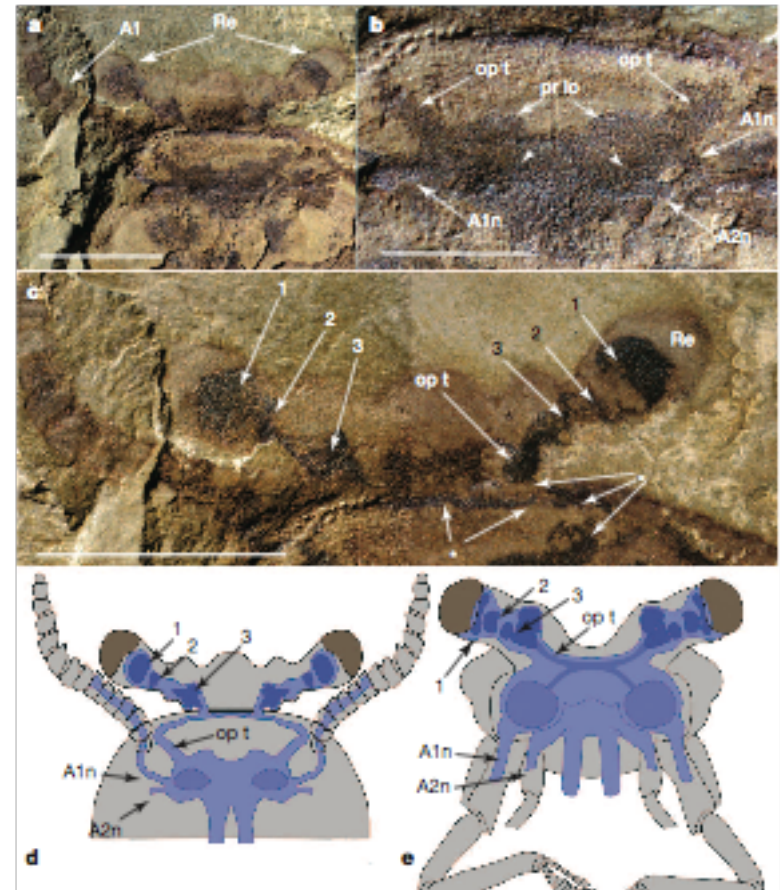


Conservation of design principles: Fuxianhuia protensa 520 Ma



Al, antenna; Ab, abdomen; Es, eye stalk; Ey, eye; Hs, head shield; Oc, optic capsule; Th, thorax. Scale bar, 1 cm.

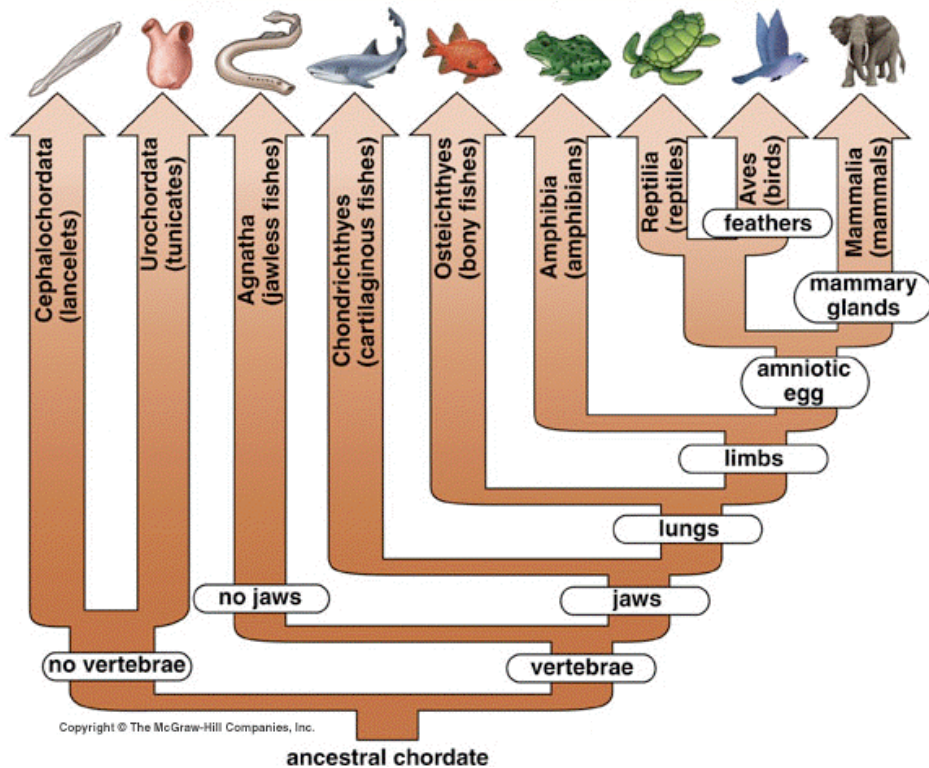
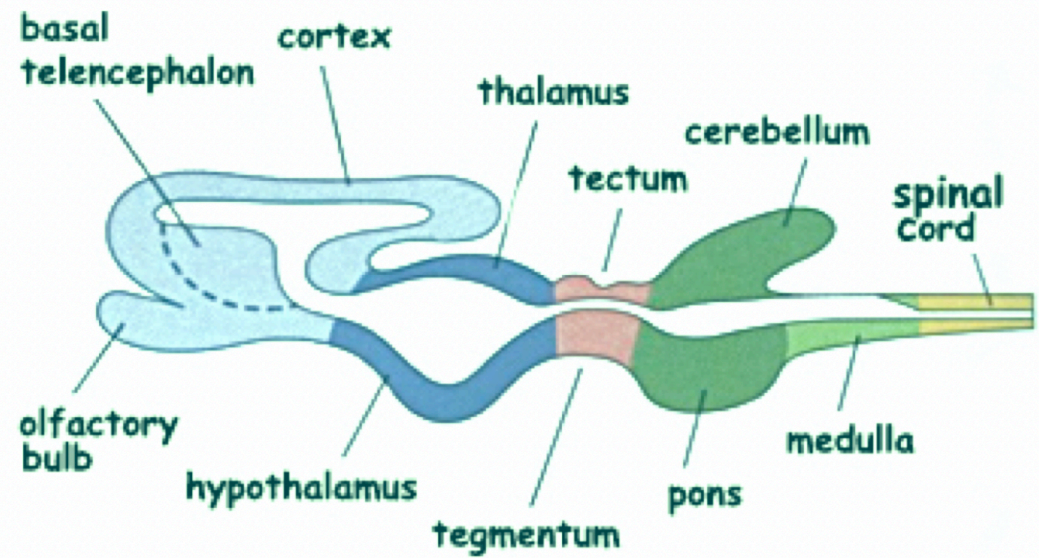
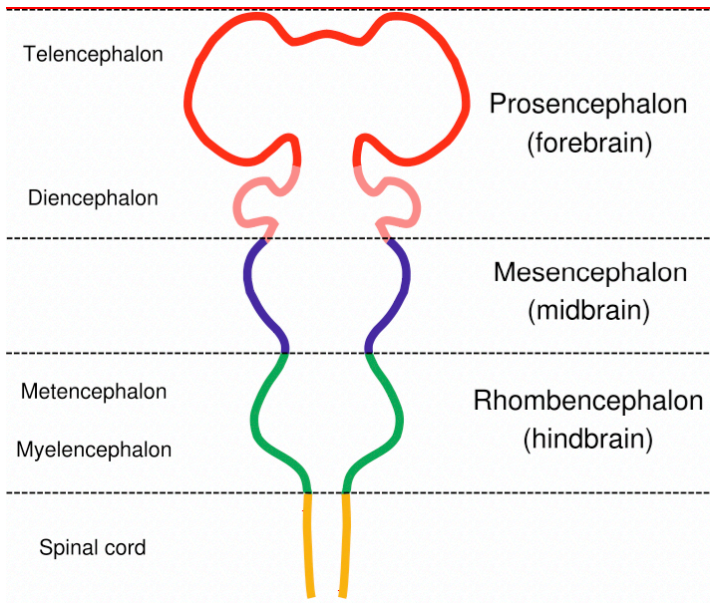
Ma et al 2012 Nature



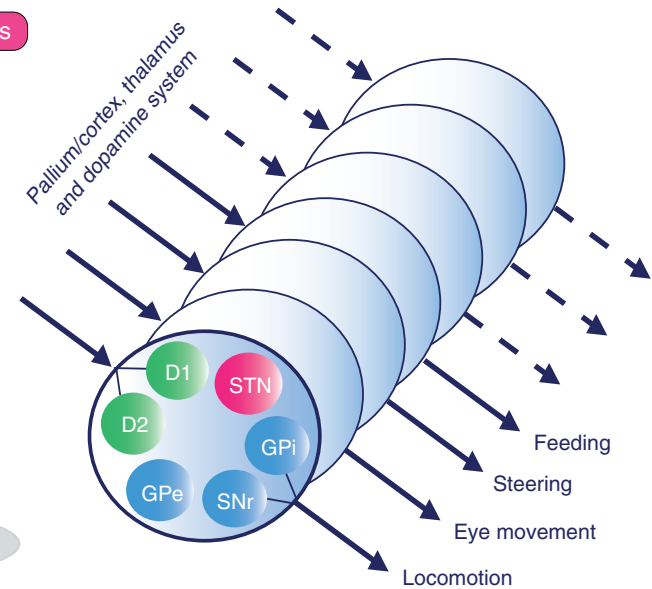
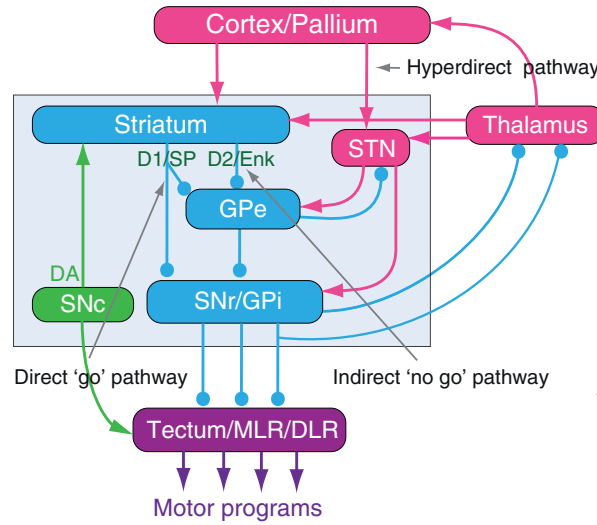
Fuxianhuia
520 Ma

Coenobita clypeatus
Now

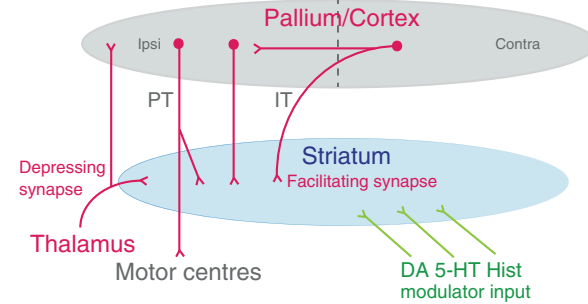
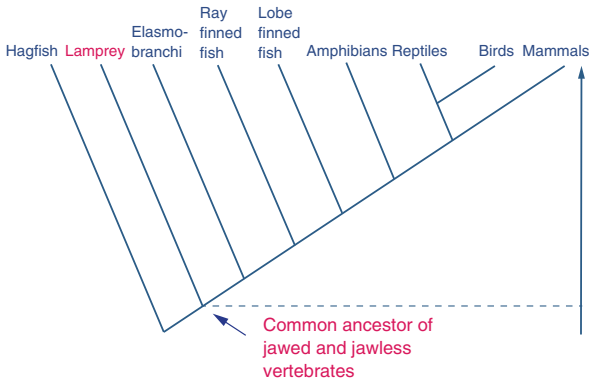




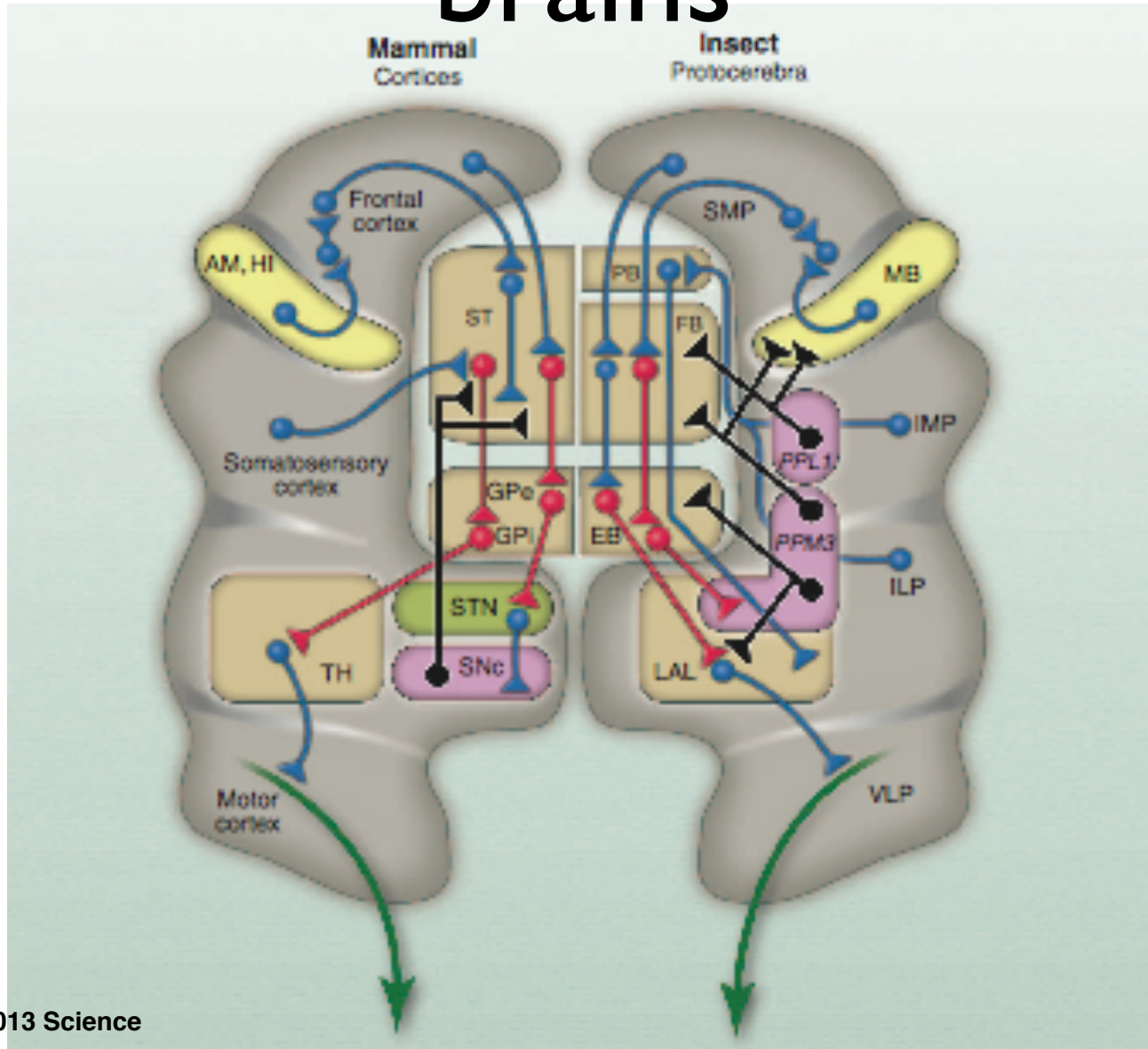
The Lamprey Action Selection circuit



Current Biology



Mammalian versus Invertebrate brains

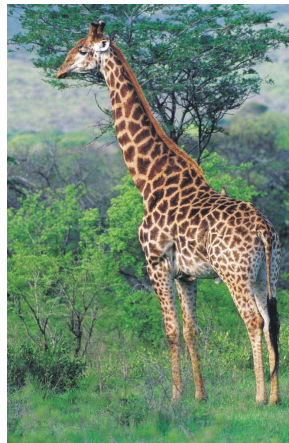


Lamarck proposes Lamarckianism (1800)

Jean-Baptiste Lamarck
August 1, 1744 - December 18, 1829



- The inheritance of acquired characters or *soft inheritance*
- The first truly cohesive theory of evolution.
- **2 principles:**
 - 1: the environment gives rise to changes in animals.
 - 2: life is structured in an orderly manner
- **2 forces** are at work:
 - *Le pouvoir de la vie*: The complexifying force drives animals from simple to complex forms.
 - *L'influence des circonstances*: a force adapting animals to their local environments and differentiating them from each other force adapted them to local environments through interaction with the environment and the *use and disuse* of characteristics, differentiating them from other organisms.
- These forces must be explained as a necessary consequence of basic physical principles, favoring a materialistic attitude toward biology.



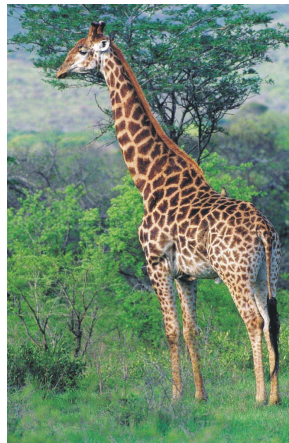
Lamarck proposes Lamarckianism (1800)

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August 1, 1744 - December 18, 1829



- **2 Laws:**

- 1: In every animal which has not passed the limit of its development, a more frequent and continuous **use** of any organ gradually strengthens, develops and enlarges that organ, and gives it a power proportional to the length of time it has been so used; while the permanent **disuse** of any organ imperceptibly weakens and deteriorates it, and progressively diminishes its functional capacity, until it finally disappears”
- 2: All the **acquisitions** or losses wrought by nature on individuals, through the influence of the environment in which their race has long been placed, and hence through the influence of the predominant use or permanent disuse of any organ; all these are **preserved** by reproduction to the new individuals which arise, provided that the acquired modifications are common to both sexes, or at least to the individuals which produce the young”



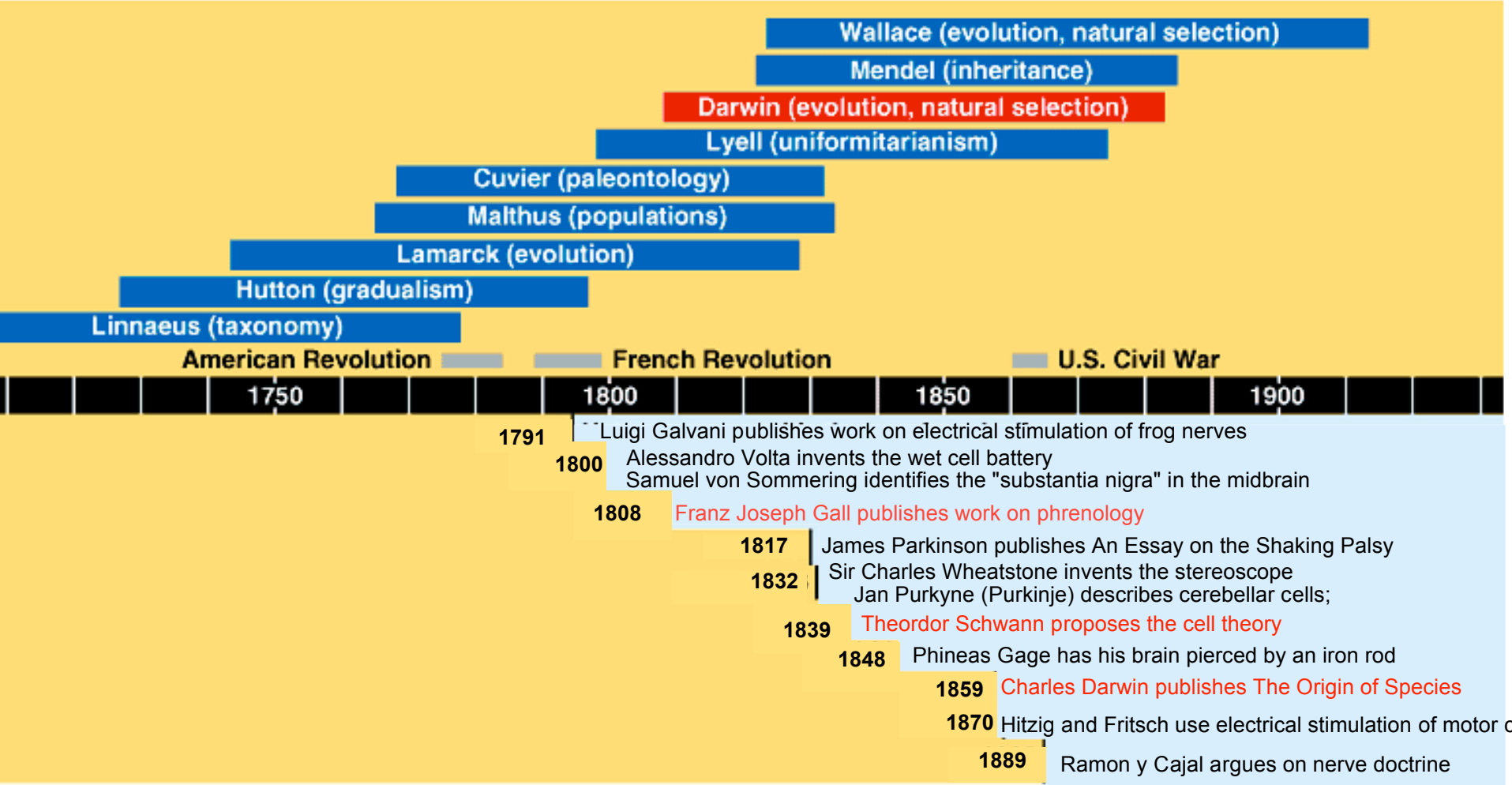
History of evolutionary thought is long

- Anaximander (c. 610–546 BC) proposed that life had originally developed in the sea and later moved onto land.
- Empedocles (c. 490–430 BC) wrote of a non-supernatural origin for living things where adaptation did not require an organizer or final cause. According to Aristotle: "Wherever then all the parts came about just what they would have been if they had come to be for an end, such things survived, being organized spontaneously in a fitting way; whereas those which grew otherwise perished and continue to perish..." although Aristotle himself rejected this view.
- In the late 19th century Erasmus Darwin proposed "that all warm-blooded animals have arisen from one living filament... with the power of acquiring new parts" in response to stimuli, with each round of "improvements" being inherited by successive generations (Zoonomia).
- An idea further elaborated by his grandson.



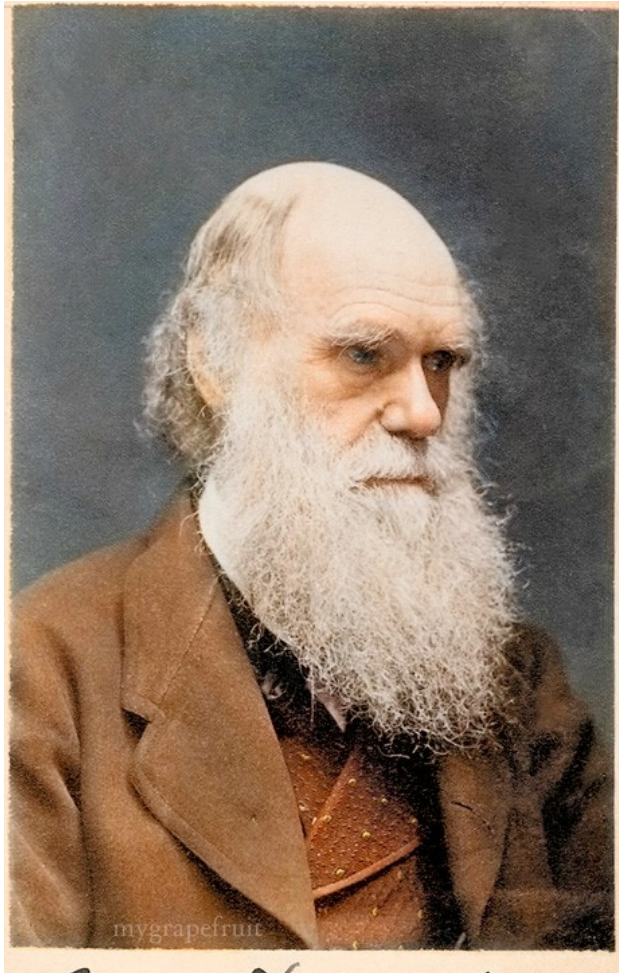
12 December 1731 - 18 April 1802

"Would it be too bold to imagine that, in the great length of time since the earth began to exist, perhaps millions of ages before the commencement of the history of mankind would it be too bold to imagine that all warm-blooded animals have arisen from one living filament, which the great First Cause endued with animality, with the power of acquiring new parts, attended with new propensities, directed by irritations, sensations, volitions and associations, and thus possessing the faculty of continuing to improve by its own inherent activity, and of delivering down these improvements by generation to its posterity, world without end!" ([Zoönomia](#))

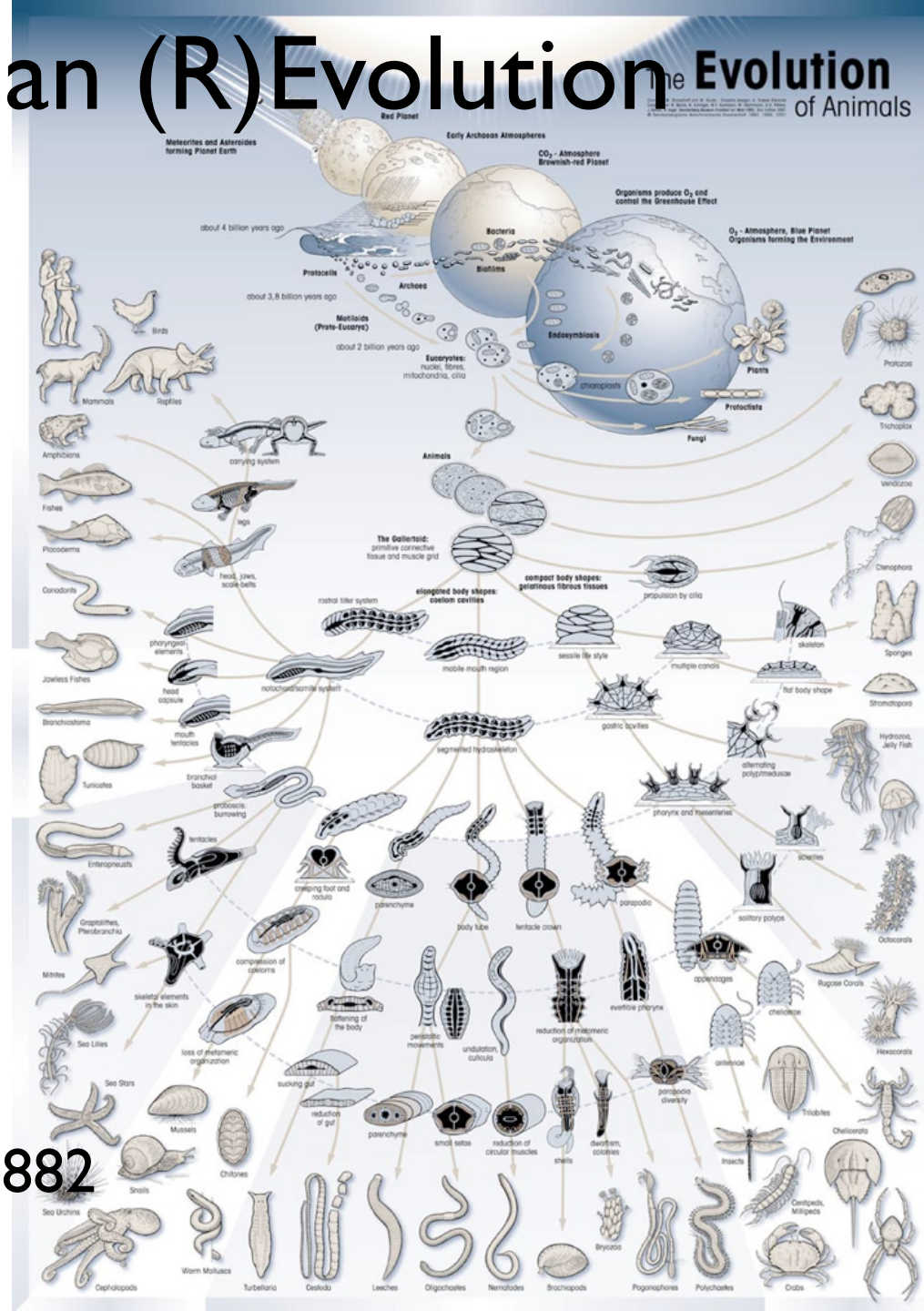


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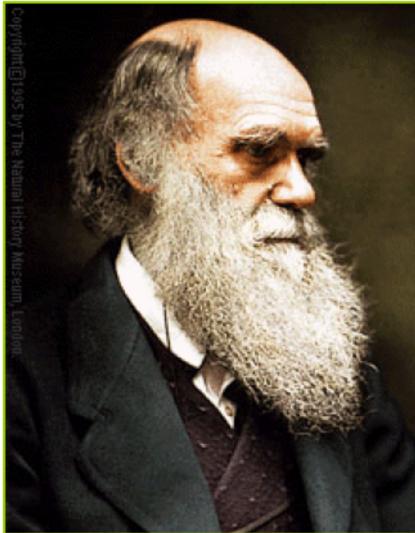
The Darwinian (R)Evolution the Evolution of Animals



Charles Robert Darwin 1809-1882

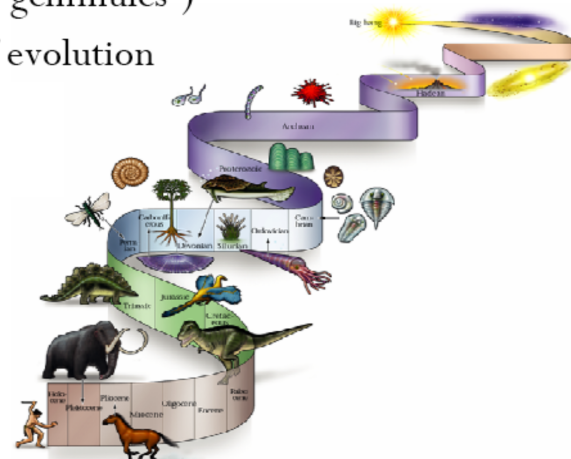


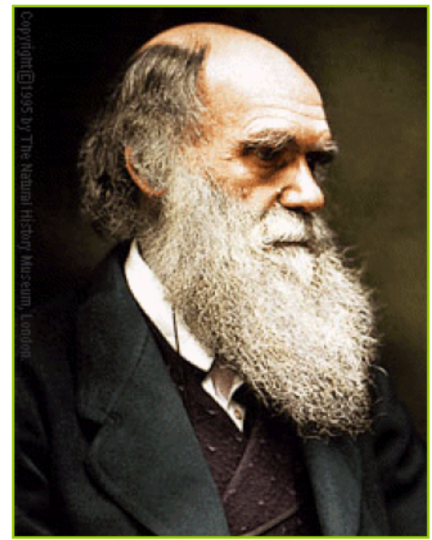
Darwin



Charles Darwin

- Born February 12, 1809
- Dropped out of medical school at 18
- Graduated from the University of Cambridge at 22 (degree in theology)
- Voyage of the Beagle (1831-1836)
- *On the Origin of Species* (1859)
- Natural selection ('gemmules')
- Unifying theory of evolution



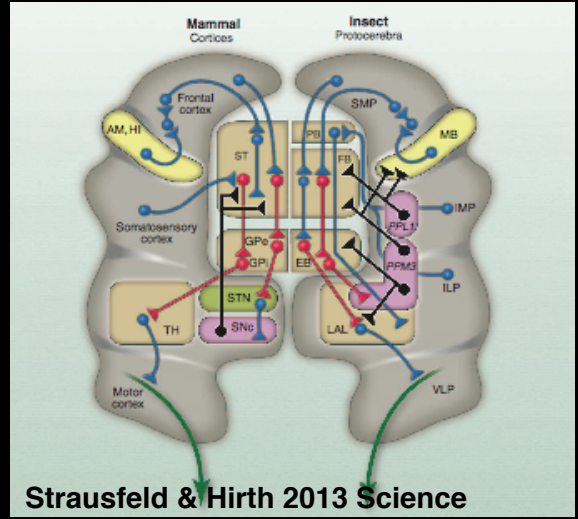
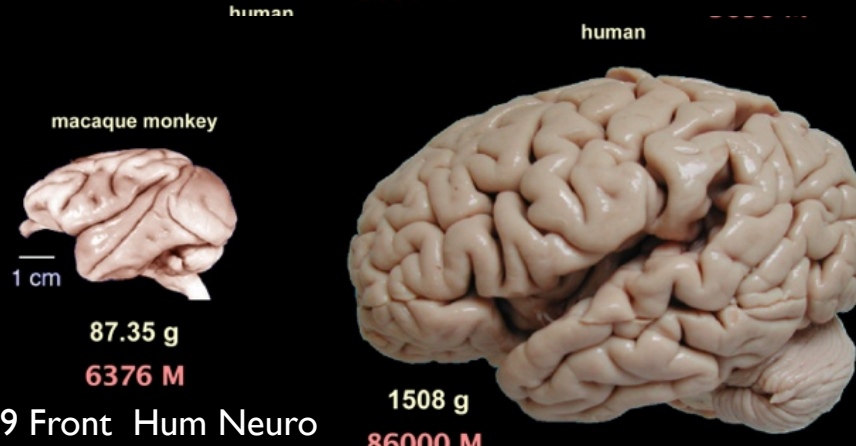
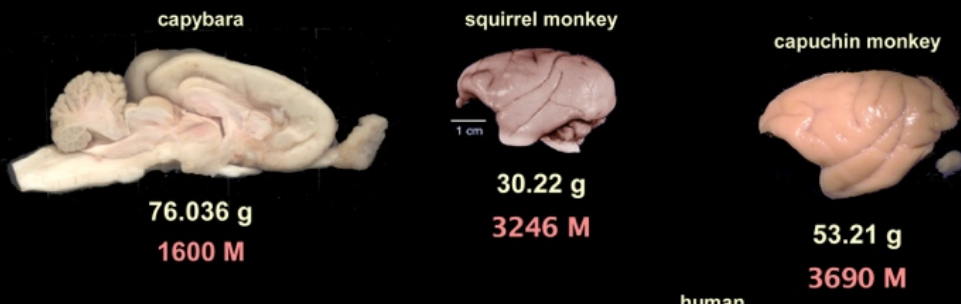
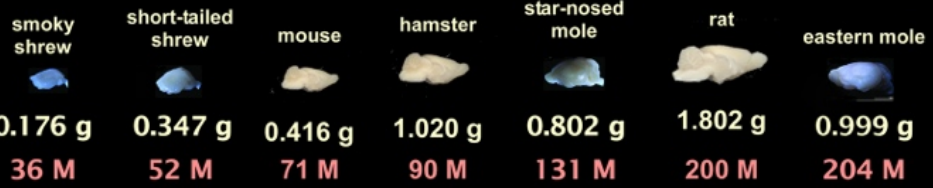


Charles Darwin

Principles

- **Inherited** variation
- **Survival** leads to amplification (reproduction)
- **Competition** for resources
- **Variation** gives unique advantages / disadvantages

Design principles



Herculano-Houzel 2009 Front Hum Neuro

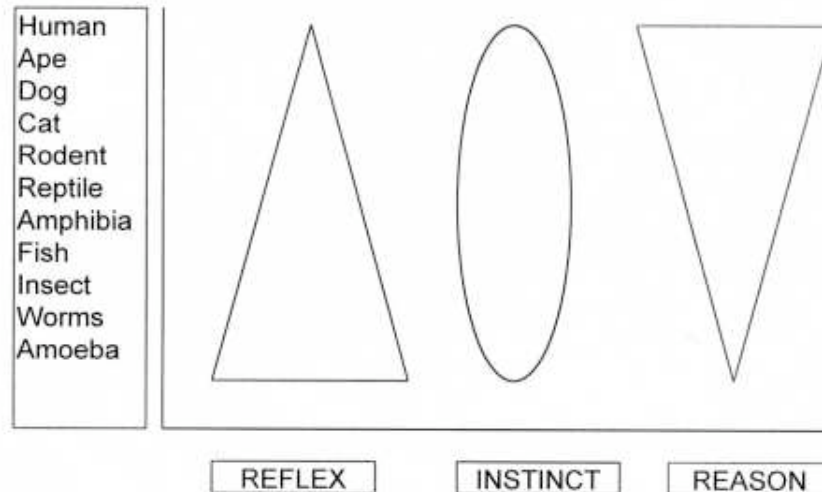
From evolution by selection to the comparative study of learning and adaptation

"The question at once arises how these superior adaptive responses are selected from the multiplicity of responses of which an organism is capable, and then fixated and perpetuated. To those who tried to answer this question, hedonism and the pleasure-pain principle provided the principle of selection, and the laws of association the mechanism of fixation".

(Postman 1947, pp. 491)

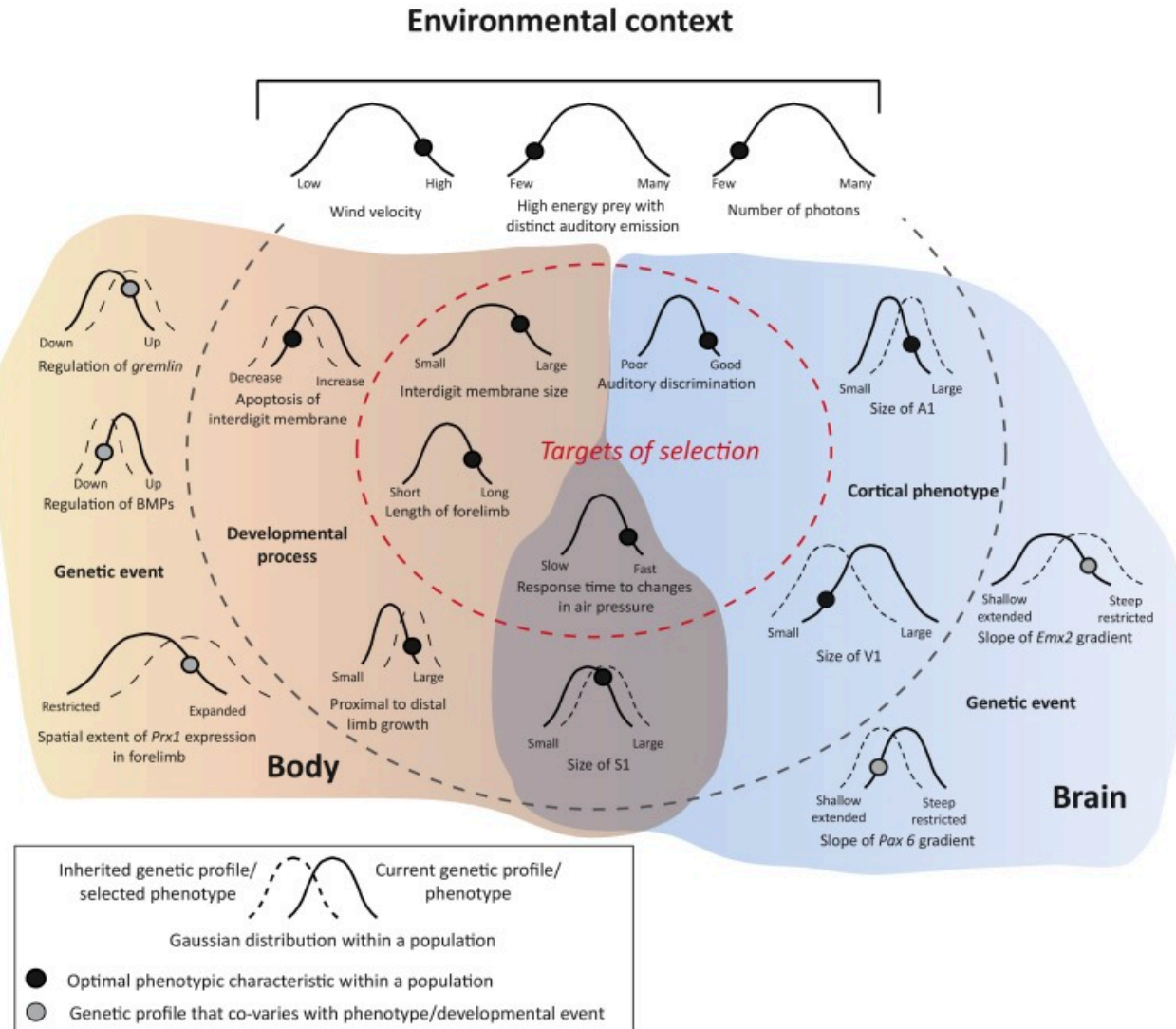
Post Darwin, comparative psychology is taking off

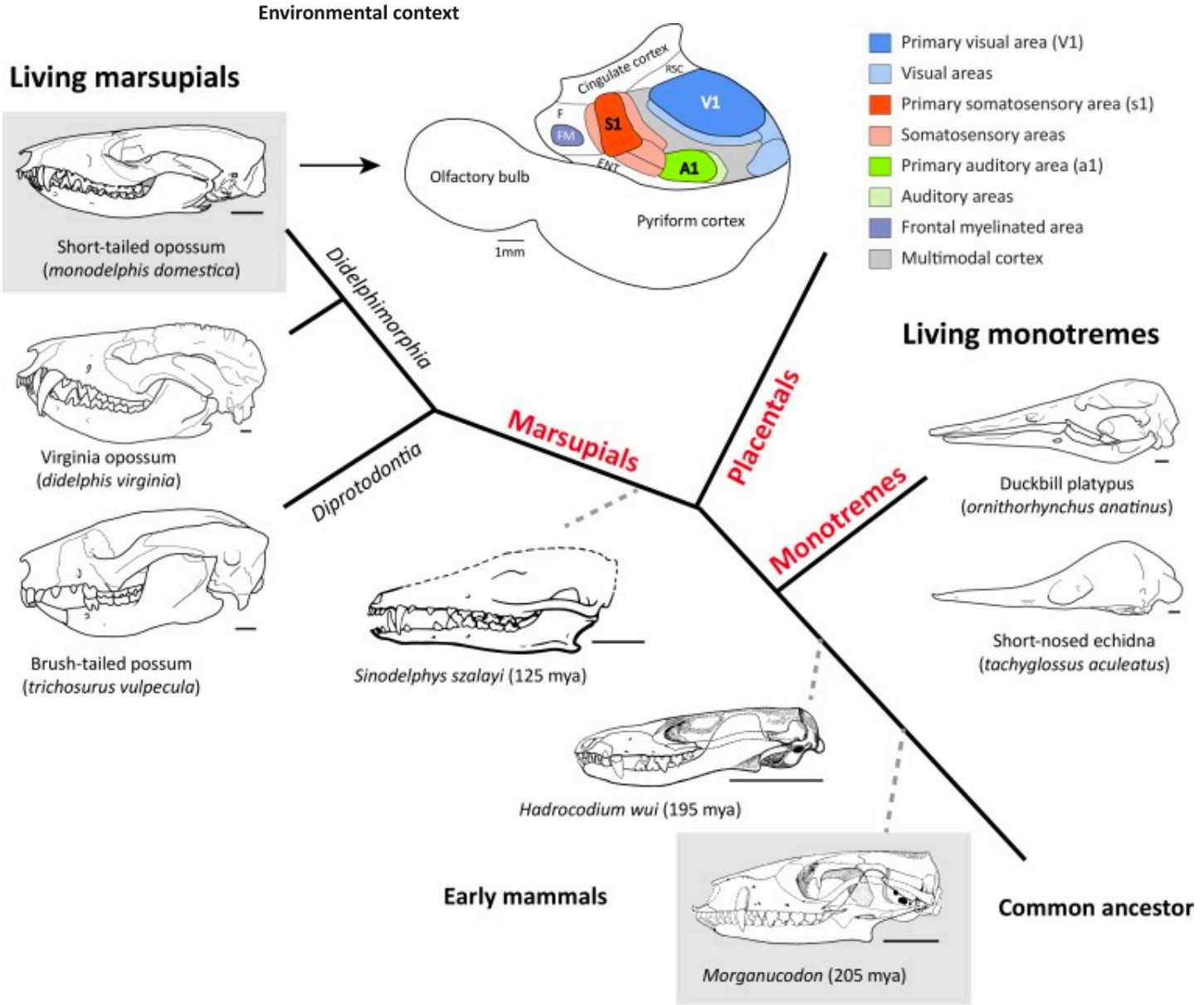
“...Rengger describes a monkey employing a stick herewith to prise open the lid of a chest, which was too heavy for the animal to raise otherwise. This use of a lever as a mechanical instrument is an action to which no animal other than a monkey as ever been known to attain;...my own observation has fully corroborated that of Rengger in this respect” (Romanes 1967, pp. 52).



Romanes, G. (1888). *Animal Intelligence*, New York: Appleton

Contemporary study of evolution is cast in terms of epi-genetics





Trends in Neurosciences

3 Humans are animals

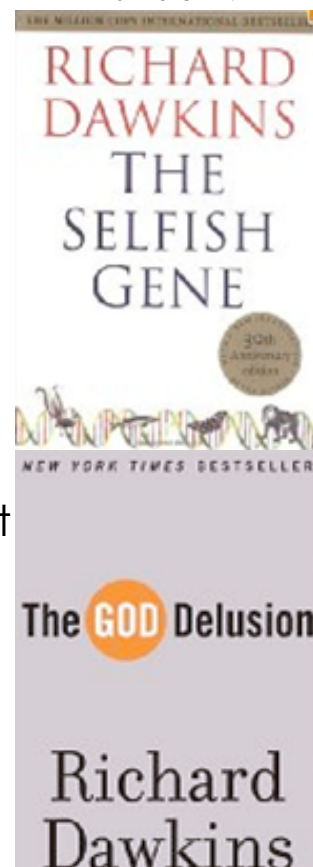
Evolution has no goal

Dawkins: The Selfish Gene

- The gene-centred view of evolution:
 - "all life evolves by the differential survival of replicating entities"
 - the gene is the principal unit of selection in evolution
- Ruthlessly reductionistic
- The paradox of altruism
- Has give rise to sociobiology and evolutionary psychology
- Meme: the cultural equivalent of a gene:
 - describes how Darwinian principles might be extended to explain the spread of ideas and cultural phenomena.
 - memetics
- *The Blind Watchmaker* (1986)
 - evolution progresses through "blind" non-teleological processes
 - even in the time of Hume, God was not considered a complete explanation for complex biological structures, but man had to wait for Darwin before it was possible to be an intellectually fulfilled atheist
- 9/11 is evidence of religion as dangerous nonsense that was undeserving of respect.
- The existence of God is a scientific hypothesis.



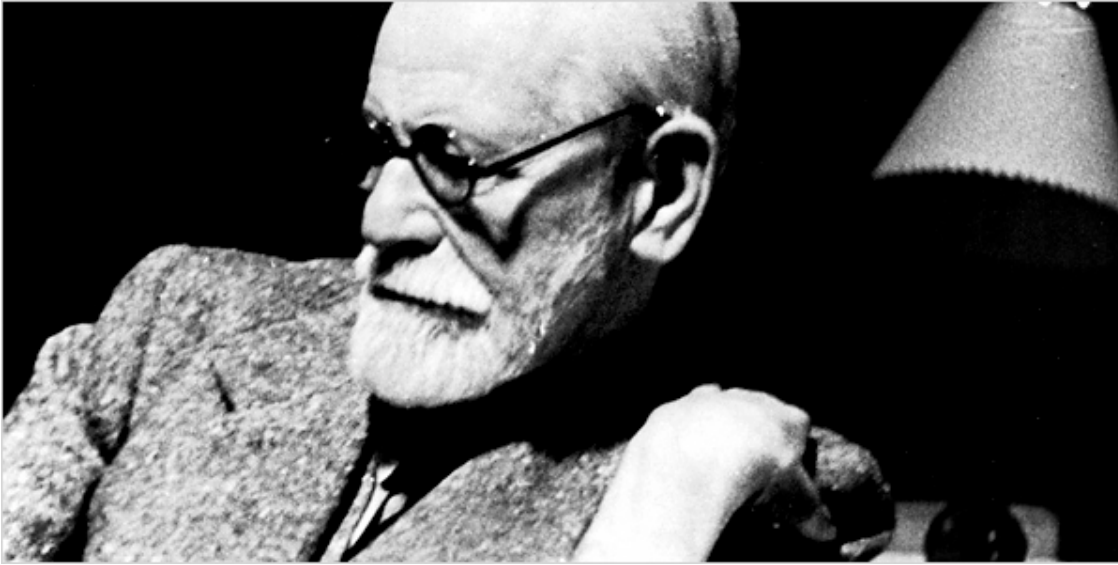
Clinton Richard Dawkins
26 March 1941



Freud

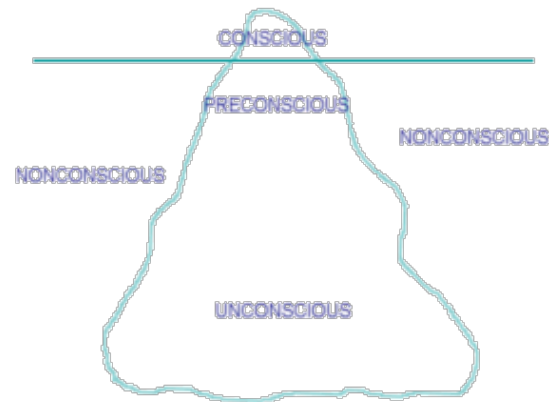
Behavior and experience is motivated by sex

We are not aware of most of our the mental states that influence our personality and experience

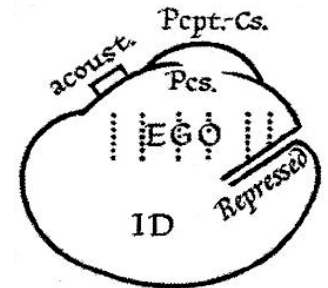


The Ego comprises that part of personality that includes defensive, perceptual, intellectual-cognitive, and executive functions. Conscious awareness resides in the ego, although not all of the operations of the ego are conscious. The ego separates what is real and organises thoughts and makes sense of them and the world around us.

(May 6, 1856 – September 23, 1939)



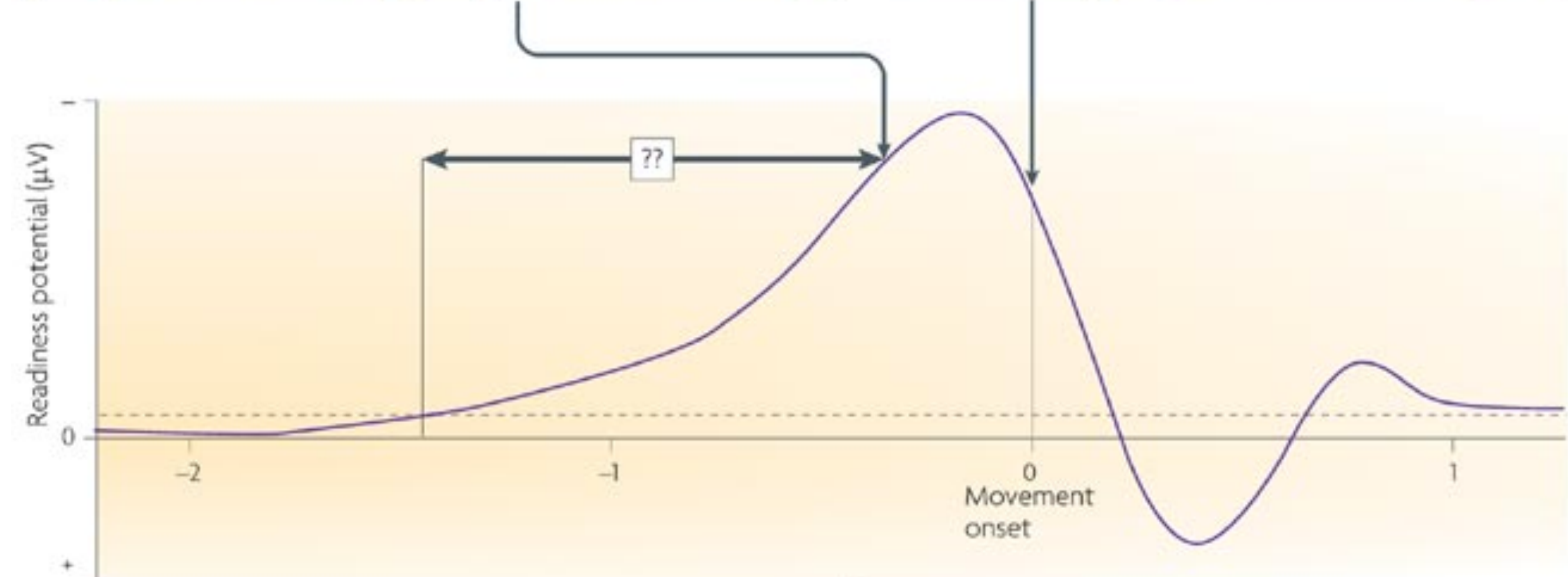
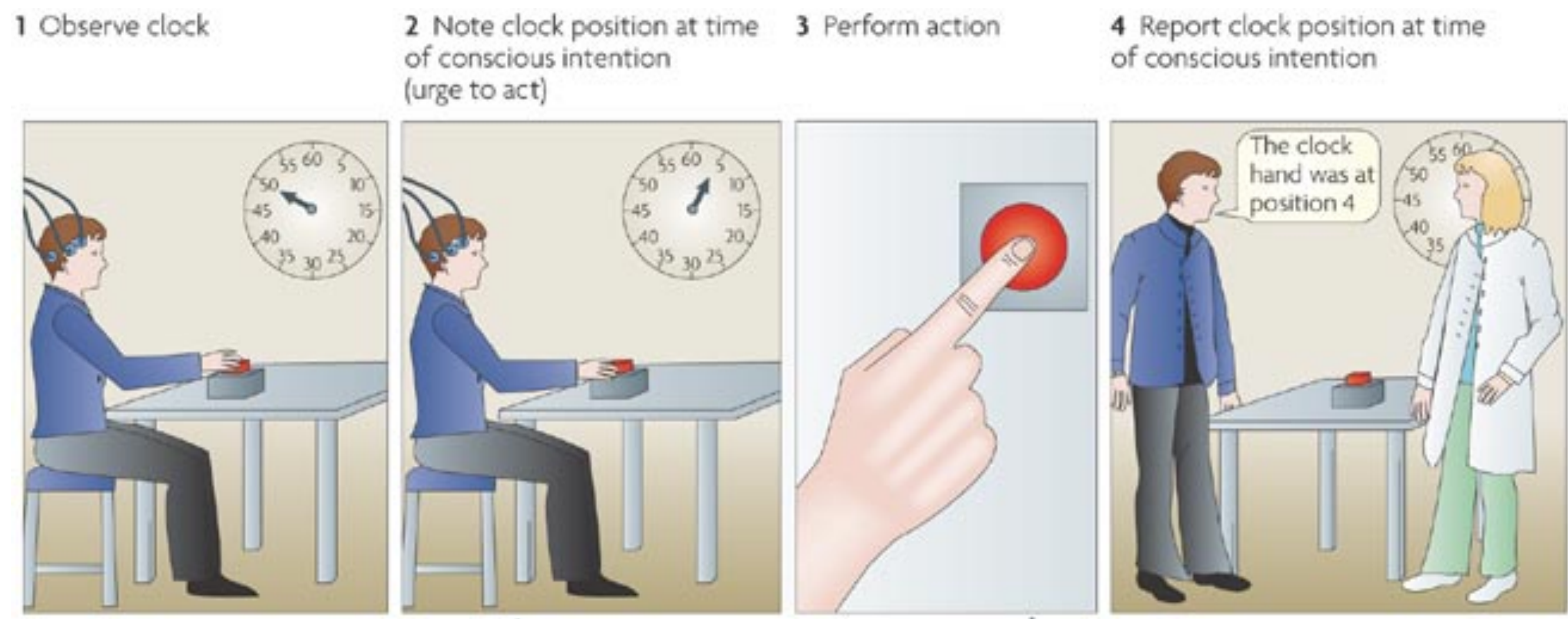
specs.upf.edu



Freud, 1923

122

Paul Verschure

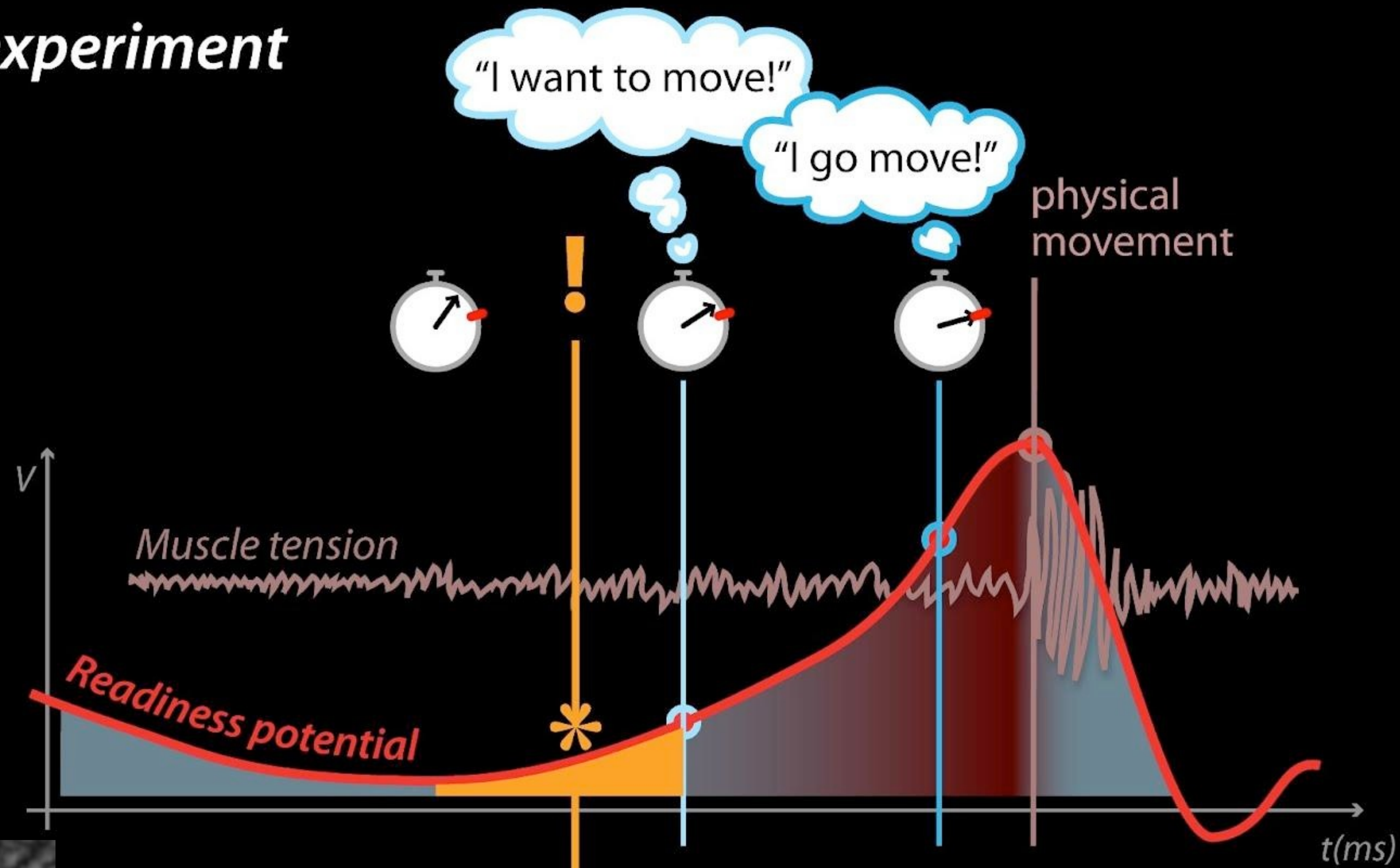


Haggard 2008 Nature Reviews Neuroscience



Ben Libet (1916 - 2007)

Libet's experiment



**-300 to -500ms
preconscious decision**

RP follows:

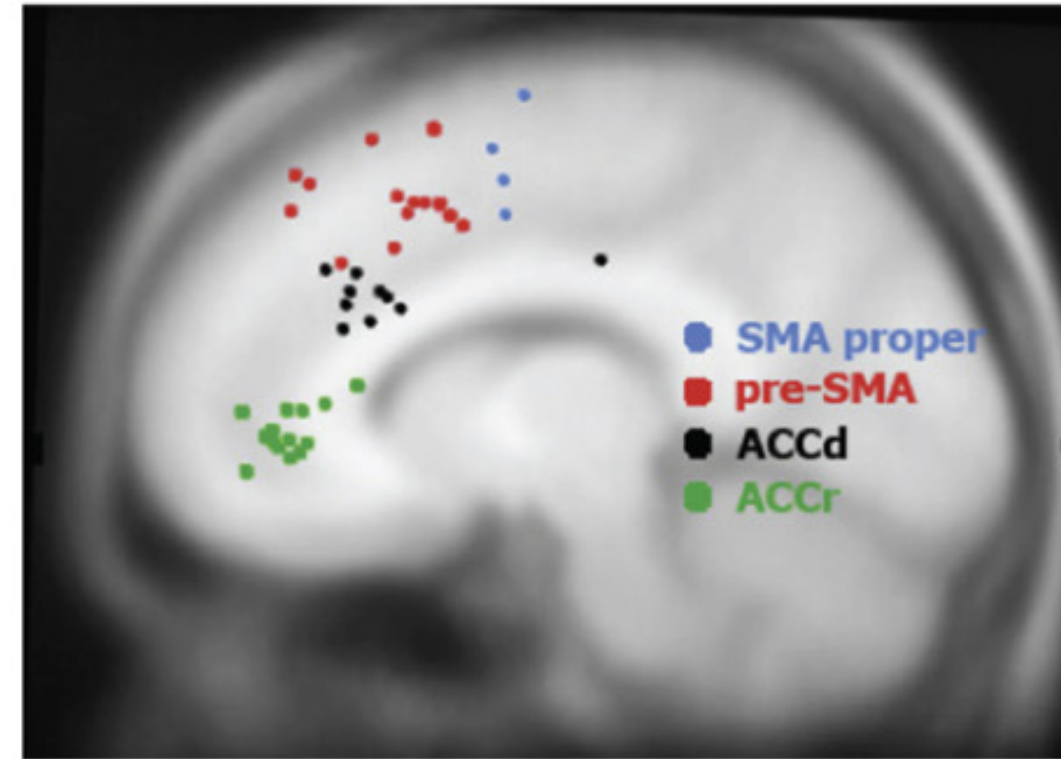
- After decision
- Post-decisional
- Reflects causal chain
- Ontologically real
- Nonconscious
- Precedes awareness



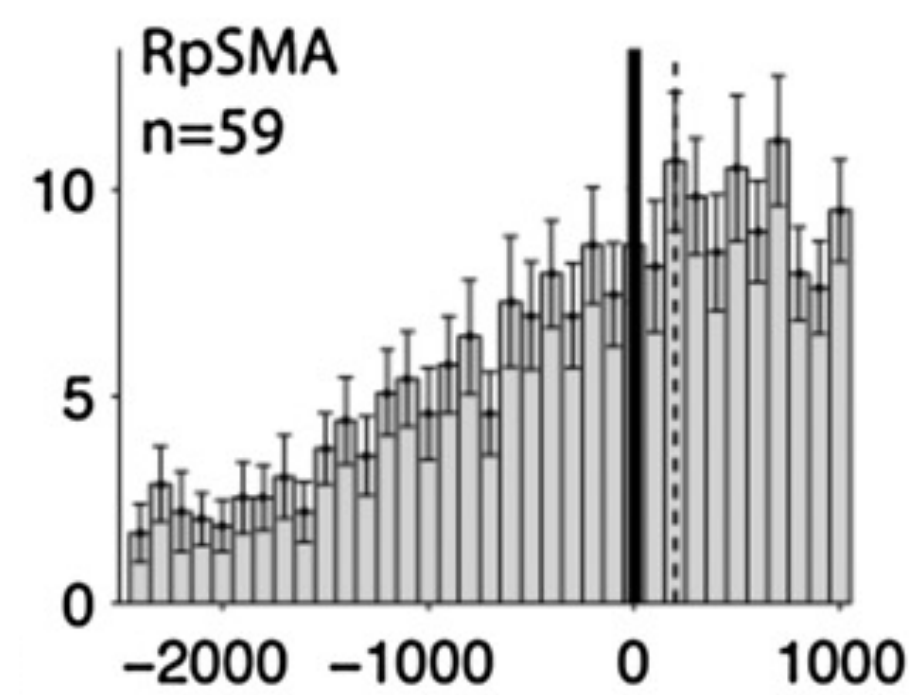
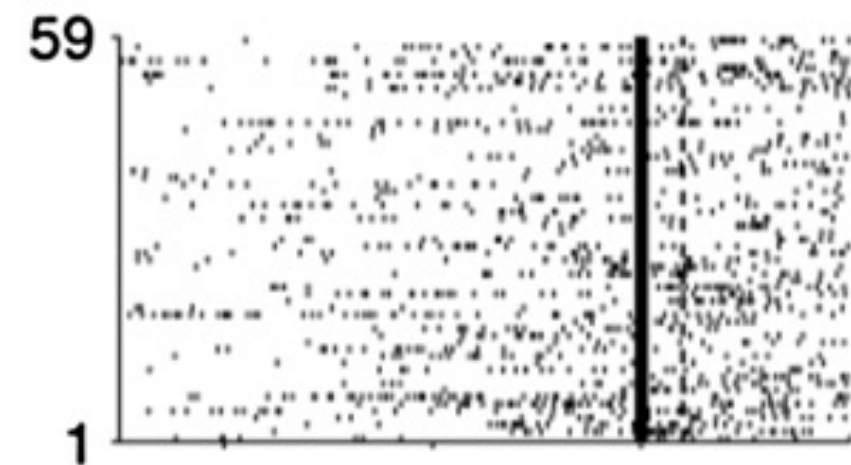
Ben Libet (1916 - 2007)

Libet (1983) 1704

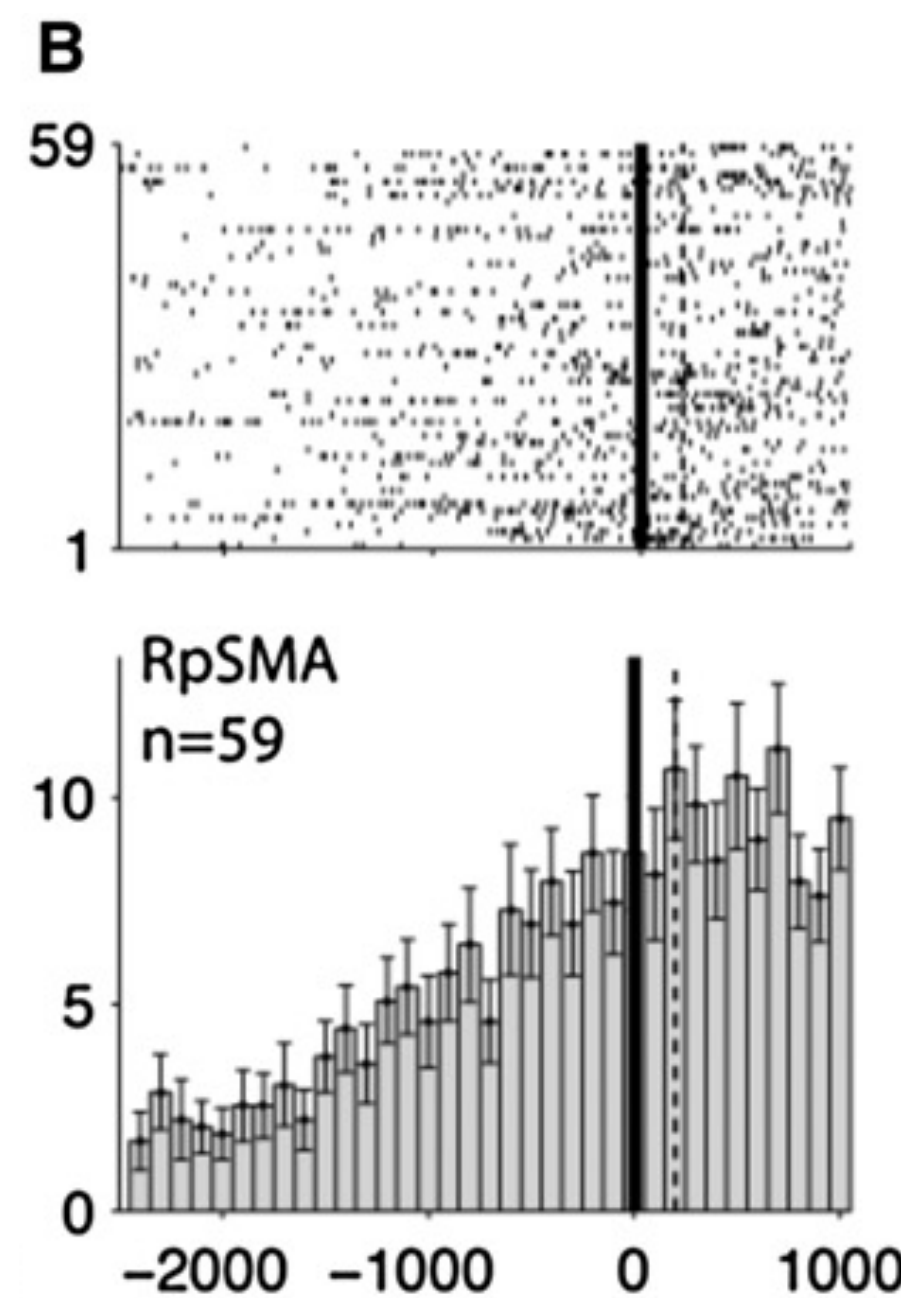
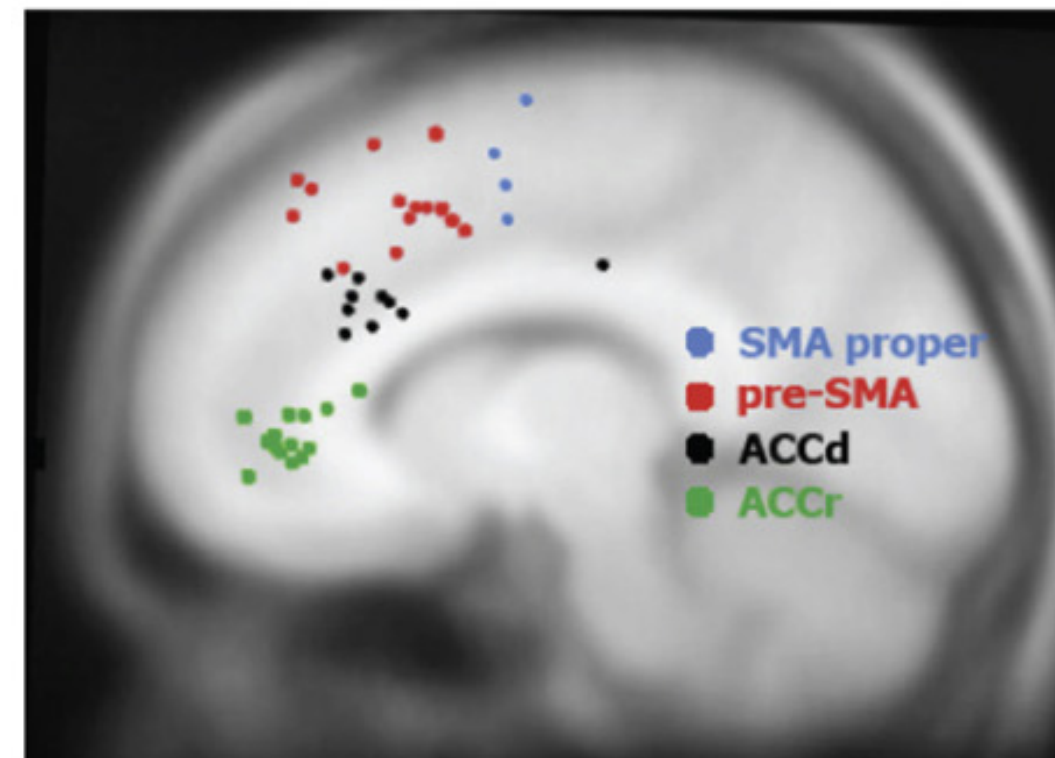
Also in single cells



B



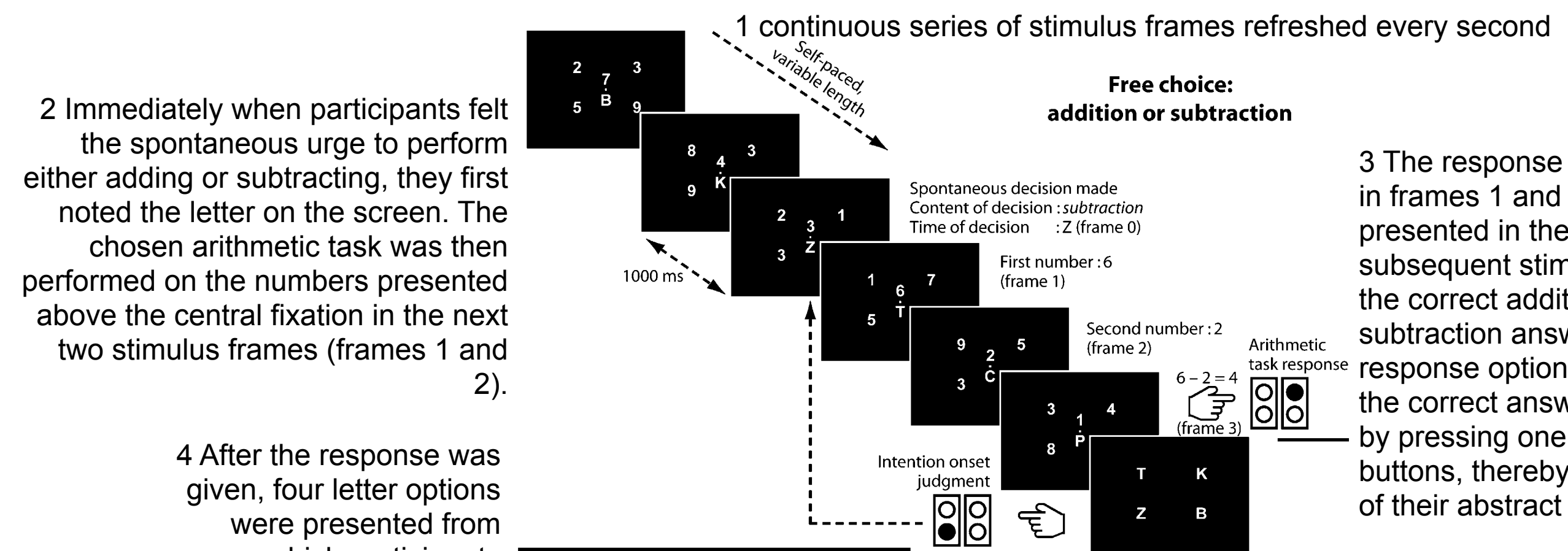
Also in single cells and with long time windows



2 Immediately when participants felt the spontaneous urge to perform either adding or subtracting, they first noted the letter on the screen. The chosen arithmetic task was then performed on the numbers presented above the central fixation in the next two stimulus frames (frames 1 and 2).

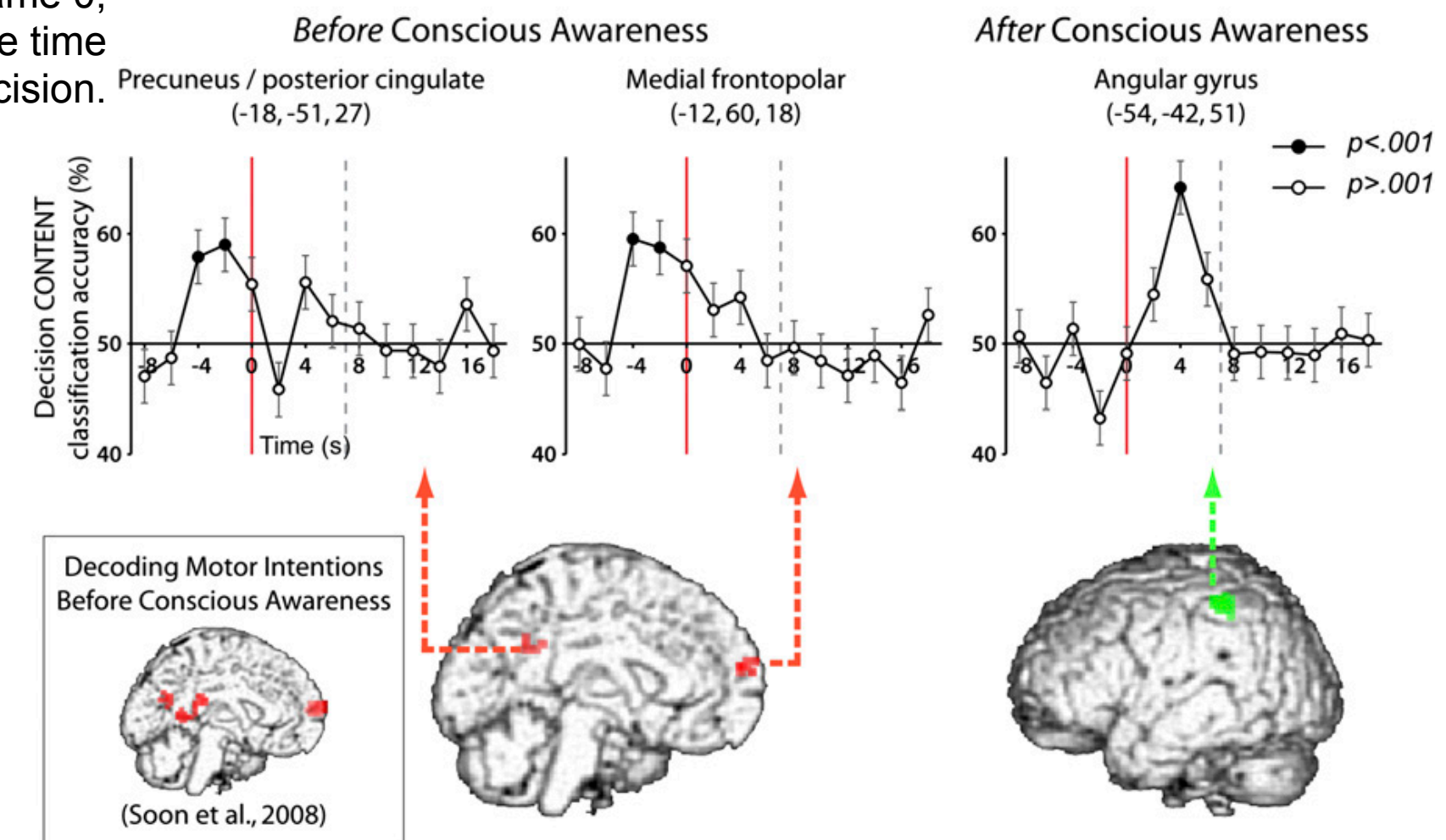
4 After the response was given, four letter options were presented from which participants selected the letter presented at frame 0, thereby revealing the time of conscious decision.

Up to 4 s before the conscious decision: a medial frontopolar region and a region straddling the pre-cuneus and posterior cingulate began to encode the outcome of the upcoming decision (Fig. 2). ... the information was encoded in the fine-grained spatial pattern of activation, rather than any global increase or decrease in neural activity.

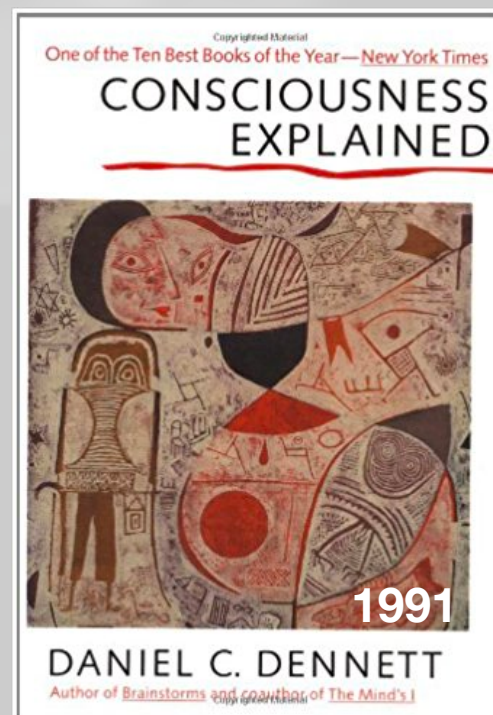
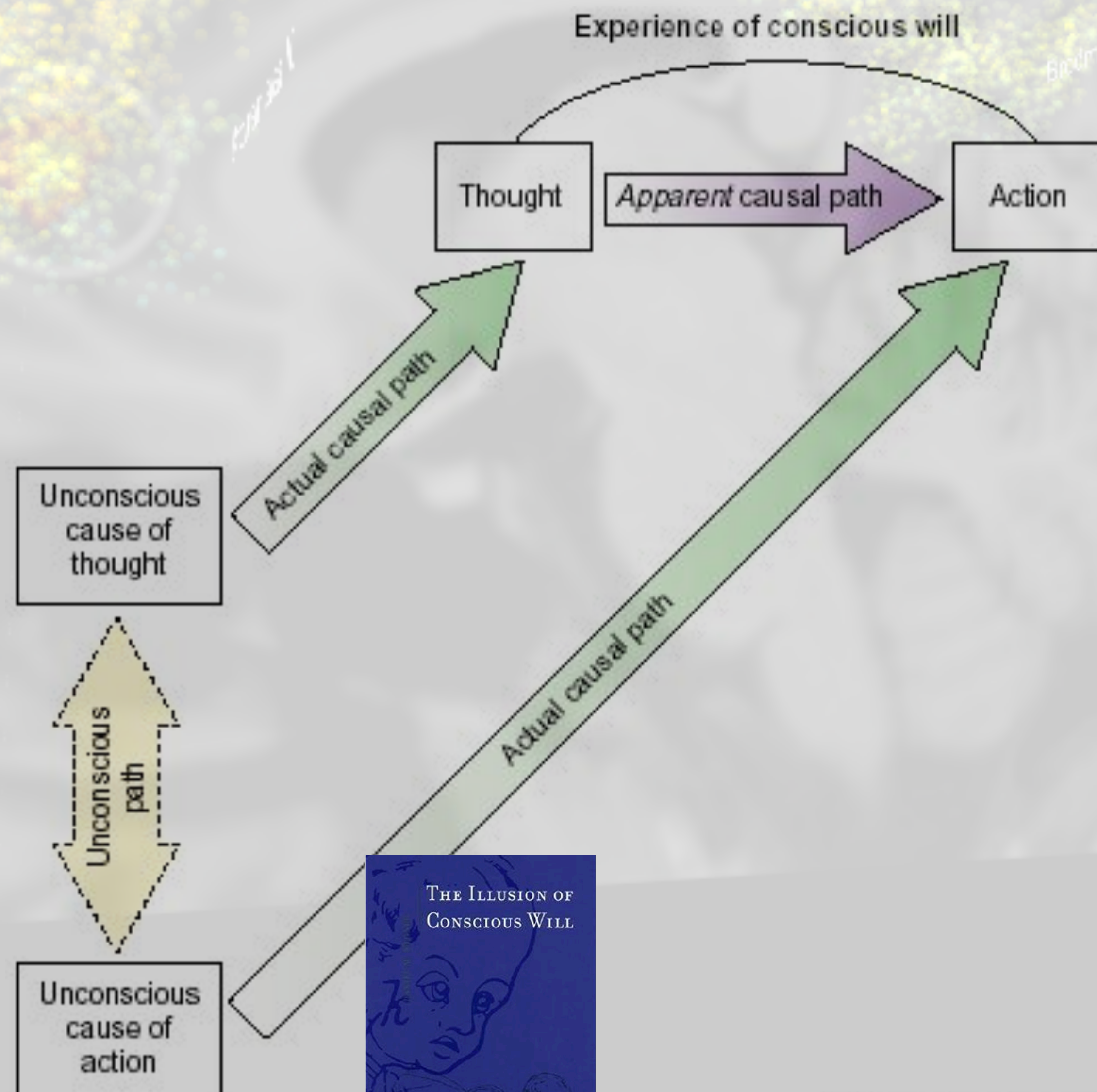


3 The response options for the numbers in frames 1 and 2 were randomly presented in the four corners of the subsequent stimulus frame (frame 3): the correct addition answer, the correct subtraction answer, and two incorrect response options. Participants selected the correct answer for the chosen task by pressing one of four corresponding buttons, thereby revealing the content of their abstract decision.

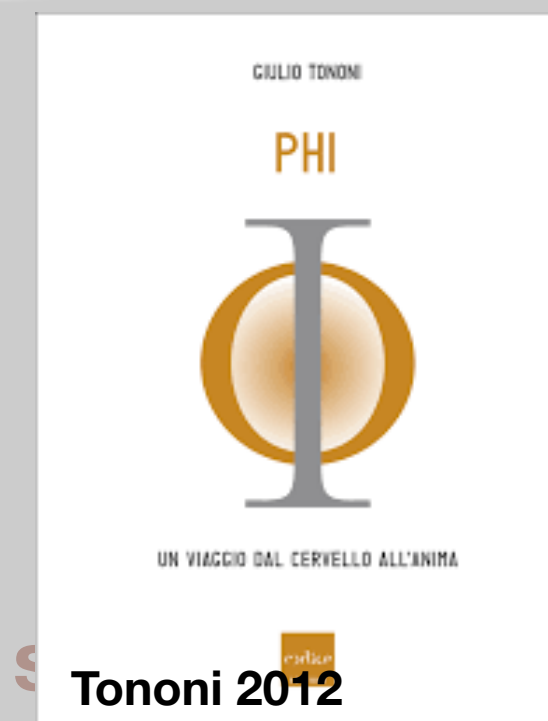
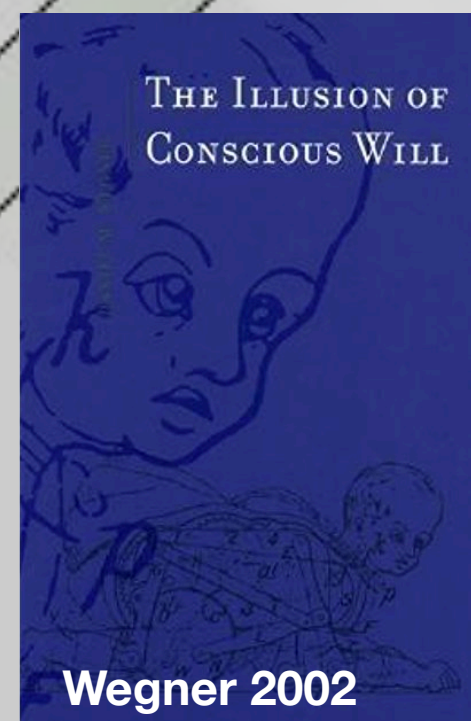
Decoding Content of Abstract Decisions



Is *free will* un-operational



5.0



**Who / What
decides?**

The “**HARD**” problem of consciousness

Chalmers

The explanatory **GAP**

Levine

To explain the “raw feel” of experience?

Nagel: “Something it is like to be”

