PSYC 10009: INTRODUCTION TO BIOLOGICAL PSYCHOLOGY

The first 6 lectures

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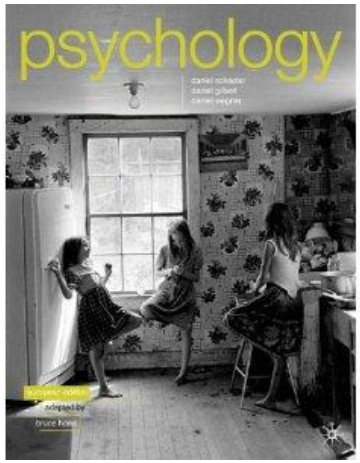
Unit coordinator

Office hours: 10-11 am on Wed 11th & 18th March

3d19 Psychology (12a Priory Rd)

1. Biological Psychology – major issues
2. Nerve cells and nerve impulses
3. Synapses and neurotransmission
4. Anatomy of the Nervous System
5. Investigating the brain
6. Audition

Main sources for the first 6 lectures



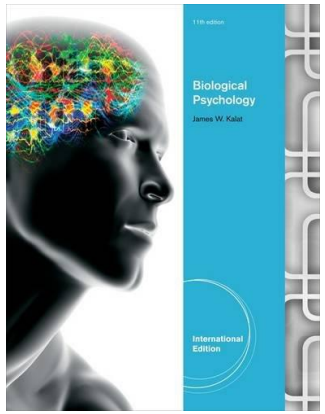
Core reading – REQUIRED:

- Schacter, D., Gilbert, D.T., Wegner, D. M. (2012). *Psychology*. European Edition. Palgrave Macmillan. [SGW]
- Chapter 3 (Neuroscience and Behaviour)
- Chapter 4 (Sensation and Perception) – sections on the Auditory system (pp.152-156)

Recommended reading :

- Kalat, James W. (2013). *Biological psychology*. 11th ed., International student ed.

  or any other edition
- Chapters 1-4 (lectures 1-3)
- Chapter 7, module 7.1 on Hearing (lecture 5)



Lecture 1:
What is Biological Psychology?

Overview

- Define *Biological Psychology*
- Biological explanations of behaviour
- The mind vs. brain relationship
- The issue of consciousness

Biological Psychology

- Relates biology to issues of psychology => much is devoted to studying brain functioning
- *Aka* psychobiology, behavioural neuroscience, behavioural physiology

- The study of the physiological, evolutionary and developmental mechanisms of behaviour and experience (Kalat, 2007, p.2)

- Next: an example of a behaviour

Common shrew's selective diet (Barnard, 2004)

Example: common shrew's selective diet (Barnard, 2004)

When given a choice, shrews bias their intake towards energetically most rewarding items (Barnard & Brown, 1981), why?

- in order to maximise its foraging efficiency
- less discriminating ancestors foraged inefficiently, thus less likely to survive and reproduce (natural selection)
- shrew's early foraging experience taught it which types of prey are easy to locate
- shrew's tactile & visual senses are most responsive to large, active (hence most nutritious) prey

Biological Explanations of Behaviour (Tinbergen, 1963)

- Functional (what is the behaviour for?)
  - *Why* a structure or a behaviour exists in its current form?
- Evolutionary (where has the behaviour come from?)
  - reconstructs the evolutionary history of a structure/behaviour
- Ontogenetic (how does the behaviour develop?)
  - describes the development of a structure/behaviour
- Physiological (how is the behaviour achieved?)
  - relates a behaviour to the activity of the brain and other organs

Another example: birdsong

- Functional – in order to attract females and warn other males during reproductive season
- Evolutionary – there is resemblance in song between related species => implicates a common ancestor
- Ontogenetic – develops as a result of a young bird listening to an adult bird
- Physiological – develops once a specific area in the male bird grows under the influence of testosterone

Brain vs. Mind/Conscious experience

- What is the relationship between the brain and the mind?

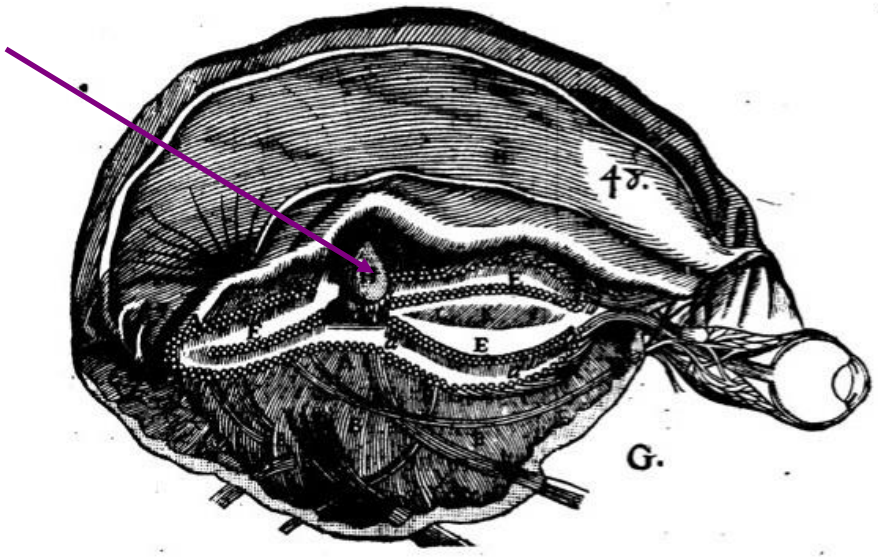
- An emotion: fear
  - result of perceived threat (psychological)
  - result of increased amygdala activity (biological)

- Issue raised by biological explanations of behaviour: what's the relationship between the amygdala activity and the sensation of fear (the mind-brain relation)?

Brain vs. Mind: Dualism

- Rene Descartes (1596-1650), French philosopher & mathematician
- Mind/consciousness and body are different kinds of substance (mental "thinking substance" vs. physical)
  - There is a great difference between the mind and the body, inasmuch as the body is by its very nature always divisible, while the mind is utterly indivisible….This one argument would be enough to show me that **the mind is completely different from the body**, even if I did not already know as much from other considerations *(Cottingham 1966, p. 9)*

- Question: how could a mental mind influences a physical brain?
- Proposed answer: the two interact at a single point in space (the pineal body = 'the third eye')



Critique of Dualism

- Gilbert Ryle, *The Concept of Mind* (1949):
- Dualism is "Descartes' Myth", "the dogma of the Ghost in the Machine" and a "category mistake.“
- The University Tour example:
  - Someone is on a campus visit of a university. He receives a full tour, visiting the classroom buildings, the library, and the dormitories. At the end of the tour, the visitor then asks, "But where is the university?" He has mistakenly assumed that the university is some separate entity existing apart from all of its constituents.

Brain vs. Mind: Monism

- Variants:
  - Materialism: everything that exists is material, the ultimate reality is physical matter
    - what's the physical matter of thought?
  - Mentalism: the physical world could not exist unless some mind were aware of it
    - difficult to test…
  - The identity position: there is only one kind of substance that includes both material and mental aspects. Every mental experience is a brain **activity** or "the mind is what the brain does" (Minsky, 1986)

Monism

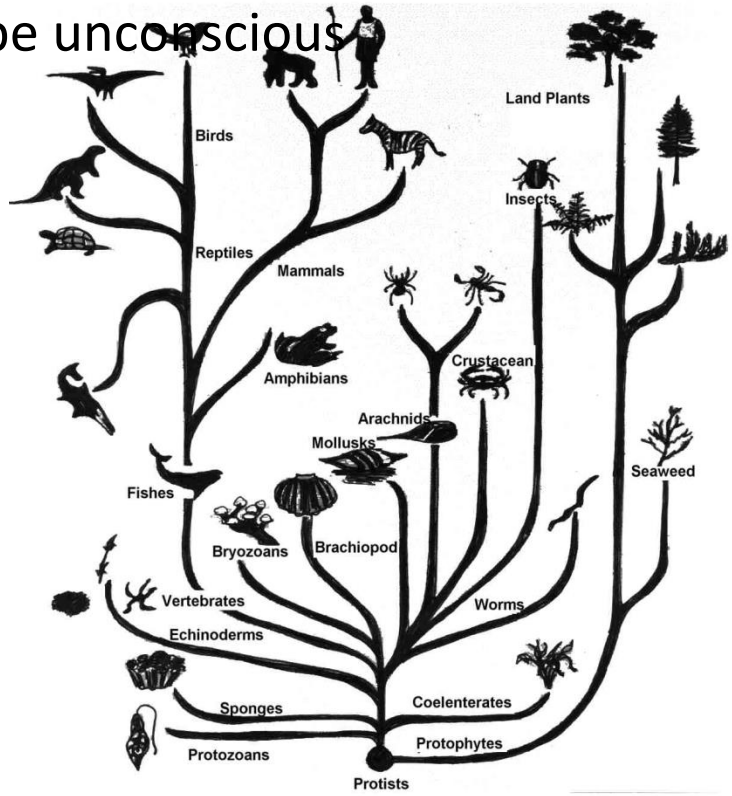
- Hippocrates (c. 460 BC – c. 370 BC), an ancient Greek physician

And men ought to know that from nothing else but thence [from the brain] come joys, delights, laughter and sports, and sorrows, griefs, despondency, and lamentations. And by this, in an especial manner, we acquire wisdom and knowledge, and see and hear, and know what are foul and hat are fair, what are bad and what are good, what are sweet, and what unsavory... And by the same organ we become mad and delirious, and fears and terrors assail us... All these things we endure from the brain, when it is not healthy... In these ways **I am of the opinion that the brain exercises the greatest power in the man.**

The Genuine Works of Hippocrates, trans. Francis Adams (1886), Vol. 2, 344-5

Consciousness

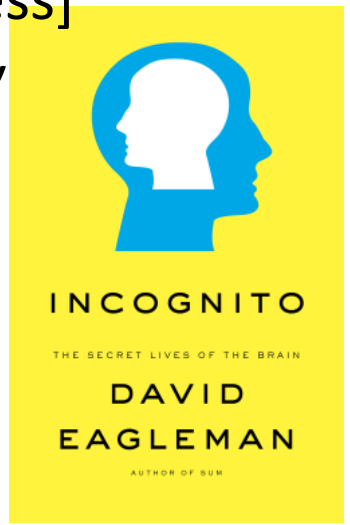
- What is the function of consciousness?
  - Why doesn't all this information-processing go on 'in the dark', free of any feel? (Chalmers, 1995, p.203)
- Why is consciousness a property of brain activity?
  - Computers/robots are considered to be unconscious
  - Which organisms are conscious?



Why Consciousness?

- People's reports of the strategies used to make simple economic decisions differed from the rules they actually used
  - → unconscious processes can be smart
  - → conscious explanations were formed post-hoc & without access to the decision-making process

- "Consciousness developed [in the evolutionary process] because it was advantageous, *but advantageous only in limited amounts*. Our conscious minds are limited representations of the activity in our heads."



Phi-phenomenon illustrating that consciousness is late:
http://www.yorku.ca/eye/balls.htm

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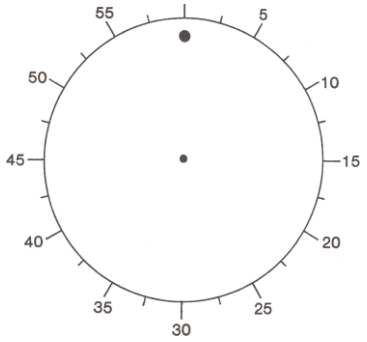
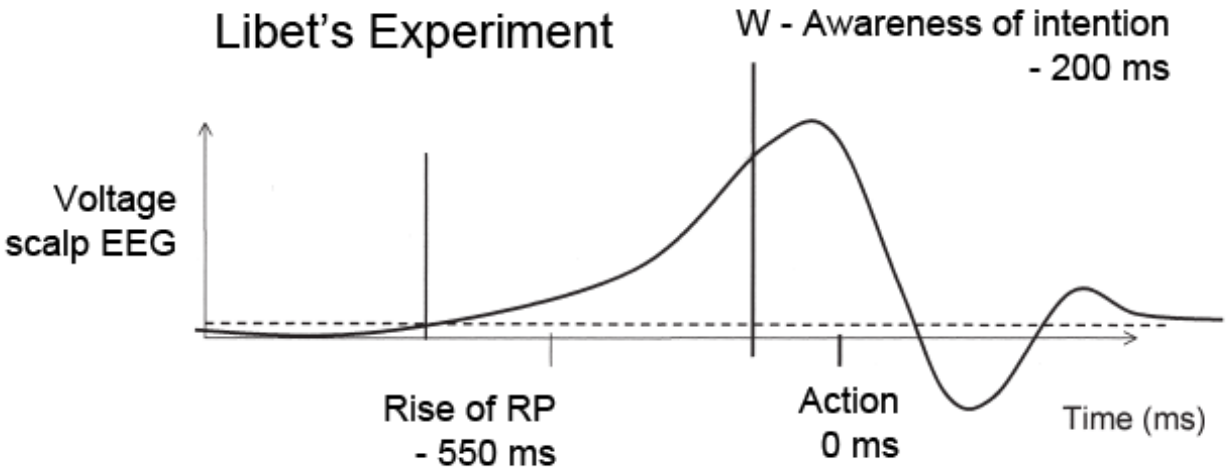
- How can consciousness be properly defined?
- An operational definition of consciousness:
  - The person's subjective experience of the world and the mind (SGW, p.294)
  - (at least and more than) experiences that can be overtly reported

How can consciousness be studied?

- Benjamin Libet's 1983 experiment
  - Subjects asked to move a wrist at an arbitrary time and report when they made the decision to move(by noticing the position of a dot circling a clock face)
  - Brain activity also recorded ('readiness potential' = RP)
  - brain activity started 350 ms before the decision → conscious wish is the outcome of unconscious activity ?

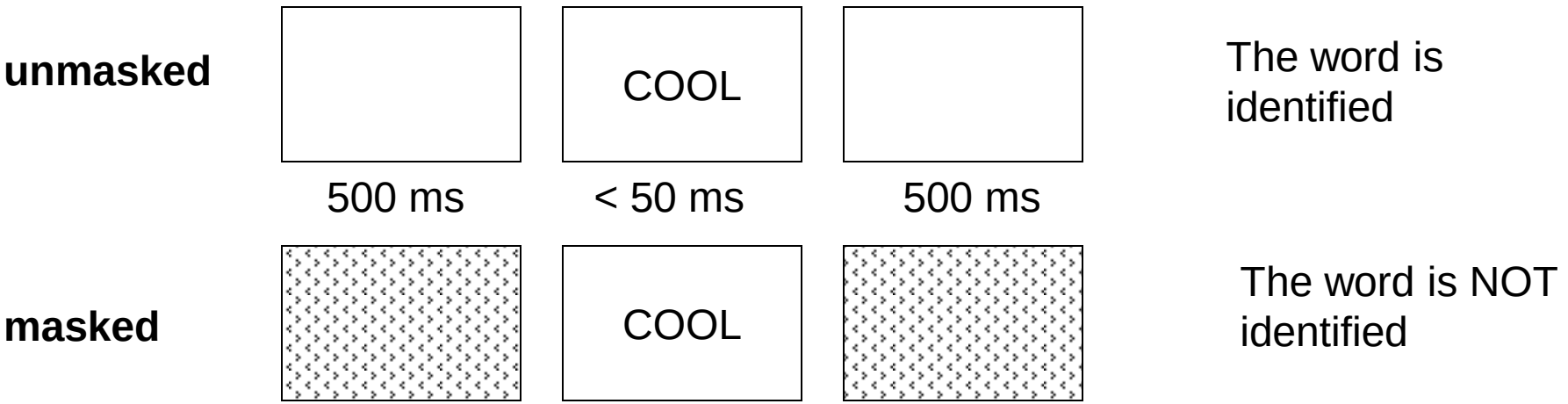




http://www.informationphilosopher.com/solutions/scientists/libet/clock.html

How can consciousness be studied?

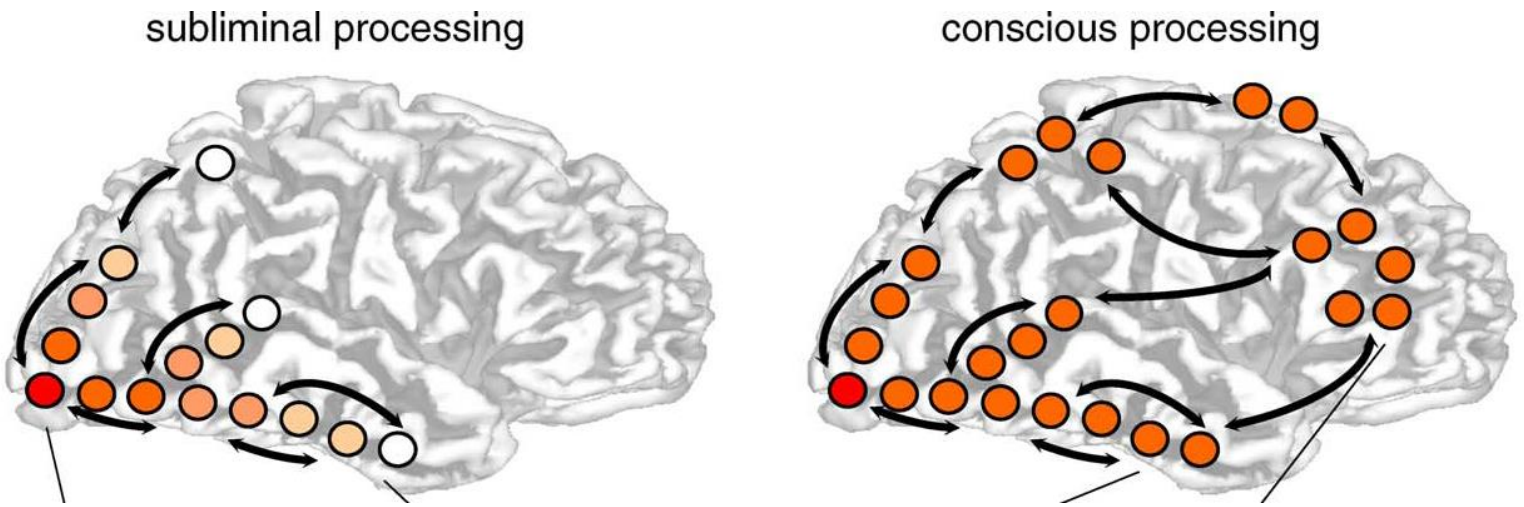
- A researcher's assumption: Conscious reportability implies conscious processing
  - if you can describe something you saw/heard, then you must have been conscious of it
- Stan Dehaene (CNRS, France): unmasked vs. masked priming



- What kind of brain activity gives rise to conscious experiences (estimated as reportability)?

How can consciousness be studied?

A 50 ms threshold for conscious access is associated with the time needed to establish sustained activity in recurrent cortical loops



subliminal processing takes place early on in the occipito-temporal pathway (<250 ms)

a late (>270 ms) and highly distributed fronto-parieto-temporal activation correlates with conscious reportability

Del Cul, Baillet & Dehaene, PLoS Biology, 2007

Summary

- Biological psychology is the study of the physiological, evolutionary and developmental mechanisms of behaviour and experience
- Four types of biological explanations of behaviour: functional, evolutionary, ontogenetic, physiological
- Distinct views on mind vs brain relationship: dualism vs monism
  - The identity view: mind is the brain's activity
- Consciousness – the chief executive of the brain

For the curious
Dualism vs Monism:a historical excursion

- Dualism:
  - Pythagoras (6th century B.C.E.): the soul is immortal and is bound up with the divine soul, to which it may return when "purified" after its separation from its temporary physical house, the body
  - Plato (428–348 B.C.E.): the body is seen as the "prisoner" of the mind or soul, which is the true person
- Monism:
  - Atomism as proposed by Leucippus (c. 5th century B.C.E.) and Democritus (c. 460–360 B.C.E.): all things are composed of indivisible particles of matter (atomoi). The human soul is composed of "soul-atoms"
  - Epicurus (342–270 B.C.E.): death is the dissolution of the soul into its original atoms