

ECAP6004 – Biological and Cognitive Neuroscience

Dr Stuart Jones.



Introduction.

Dr Stuart Jones.

Room CJ214

Email: s.a.jones@uwtsd.ac.uk

Telephone: 01267 676697



Aims

- # To enable students to critically evaluate the contribution new technologies have made to our understanding of human behaviour and cognition.

Learning Outcomes.

- # demonstrate a critical understanding of conceptual and historical issues relating to Biological and Cognitive Psychology;
 - # demonstrating a critical understanding of how drugs and hormones influence brain activity and subsequent behaviours, examining empirical research involving neuroimaging techniques in this field;
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Learning Outcomes

- # demonstrate a critical understanding of how approaches in Neuroscience have contributed to the development of the field of Cognitive Psychology (e.g. attention, the study of perception, learning, memory, thinking and language);
 - # take responsibility for their own learning and skill development; including effective personal planning, self-reflection and project management skills.
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Content.

- # Examination of the dynamic development of biological and cognitive neuroscience in the last two decades.
 - # Examination of the benefits and limitations of evidence derived from neuroscientific research with particular reference to learning and cognition.
 - # Examination of the biological basis of behaviour and the impact of neuroimaging techniques in relation to the understanding in this field.
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Content.

- # Exploration of the impact neuroscientific research may have on traditional empirical evidence within Biological and Cognitive Psychology.
 - # Exploration of a range of approaches developed within neuroscience used to enhance our understanding of relating to disorders of attention, perception, learning, memory, thinking and language.
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Recommended Reading

- # Bear, M.F., Connors, B.W. & Paradiso, M.A. (2007). Neuroscience: Exploring the Brain (3rd Ed), New York: Lippincott Williams and Wilkins.
 - # Gazzaniga, M.S. & Heatherton, T.F. (2012). Psychological Science (4th Ed). New York: W W Norton & Co.
 - # Gazzaniga, M., Ivry, R.B., & Mangun, G. R. (2013). Cognitive Neuroscience: The Biology of the Mind. New York: W W Norton.
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Recommended Reading List

- # Purves, D., Brannon, E., Cabeza, R. & Huettel S.A. (2008). Principles of Cognitive Neuroscience. New York: Sinauer Associates.
 - # Kalat, J.W. (2012). Biological Psychology (12thEd). New York: Cengage Publishing.
 - # Kolb, B. and Whishaw I.Q. (2009). An Introduction to Brain and Behaviour (3rd Edition). New York: Worth Publishers
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Module Breakdown.

Please see “Module Descriptor” on Moodle.

Assessments

ASSESSMENT

Assessment Component 1 Exam (2.5 hours) 50%

Individual Presentation (15 minutes) 50%

Coursework - Assignment.

- # Exam – 2.5 hours.
 - # Students must choose TWO of the four questions to answer during the scheduled examination.
 - # Date –TBC – EXAM PERIOD.
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Assignments

- # Individual Presentation (15 minutes) 50%
 - # Critically review ONE of the journal articles selected in the field of Cognitive Neuroscience
 - # For exact title and date please see Moodle.
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What is Neuroscience?

What is Neuroscience???

What is Neuroscience?

- # Neuroscience – The scientific study of the nervous system.
 - # Seen as a branch of Biology.
 - # Interdisciplinary.
 - Psychology, Maths, Physics, Computer Science.
-

Terminology.

- # Neuroscience and Neurobiology.

- # Used interchangeably

- # Are they the same?

Other terminology.

Biological Psychology.

Biopsychology.

Psychobiology

Neuropsychology

Cognitive Neuroscience.

- # Term identified by Gazzaniga and Miller.
 - # Late 1970's.
 - # **Cognitive neuroscience** is concerned with the scientific study of biological substrates underlying cognition.
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Cognitive Neuroscience.

- # Attempts to discover how mental activities are executed in the brain.
 - # Provides hypotheses about specific cognitive capacities – supplies proposals about how specific functions might be executed in the brain.
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Cognitive Neuroscience.

- # Reliance on new techniques for studying the brain of normal participants.
 - As opposed to brain damaged ones.
 - # “Brain in Action”.
 - # E.g. Short term and Long Term memory.
 - (Smith and Jonides, 1994; Squire et al, 1993).
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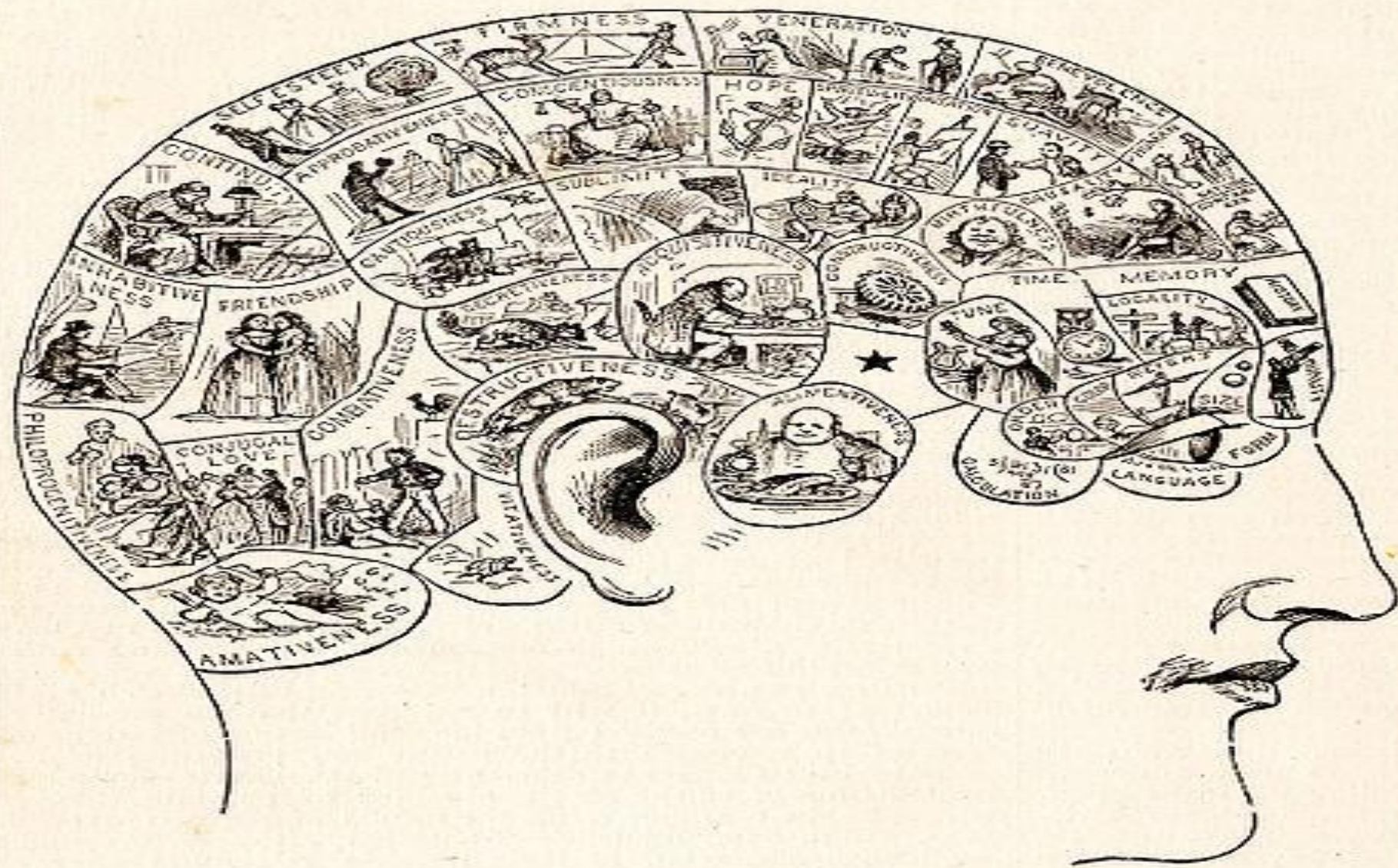
Discussion Point.....

- # What potential ethical issues could the study of the “brain in action” bring.
 - # What are the ethical risks and how might neuroscientists attempt to manage / minimise these risks.
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Origins of Cognitive Neuroscience.

- # Phrenology.

- # 1800's.



Phrenological Chart of the Faculties.

Brain Organs.

- # 1) Reproduction.
 - # 2) Love for ones offspring.
 - # 3) Affection and Friendship.
 - # 4) The instinct of self-defence and courage; the tendency to get into fights.
 - # 5) The carnivorous instinct; the tendency to murder.
 - # 6) Guile; acuteness; cleverness.
 - # 7) The feeling of property; the instinct of stocking up on food (in animals); covetousness; the tendency to steal.
 - # 8) Pride; arrogance; haughtiness; love of authority; loftiness.
 - # 9) Vanity; ambition; love of glory (a quality "beneficent for the individual and for society").
-

Brain Organs

- # 10) Circumspection; forethought.
 - # 11) The memory of things; the memory of facts; educability; perfectibility.
 - # 12) The sense of places; of space proportions, of time.
 - # 13) The memory of people; the sense of people.
 - # 14) The memory of words.
 - # 15) The sense of language; of speech.
 - # 16) The sense of colours.
 - # 17) The sense of sounds; the gift of music.
 - # 18) The sense of connectedness between numbers.
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Brain Organs

- # 19) The sense of mechanics, of construction; the talent for architecture.
 - # 20) Comparative sagacity.
 - # 21) The sense of metaphysics.
 - # 22) The sense of satire; the sense of witticism.
 - # 23) The poetical talent.
 - # 24) Kindness; benevolence; gentleness; compassion; sensitivity; moral sense.
 - # 25) The faculty to imitate; the mimic.
 - # 26) The organ of religion.
 - # 27) The firmness of purpose; constancy; perseverance; obstinacy.
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The Brain

- # Often described as the most complexly organised structure in the Universe (e.g. Ramachandran, 2003).
 - # Just look at the facts that we already know.
-

Neurons.

100 – 150 billion neurons.

Making approximately.....

- 1, 000,000,000,000,000
- 1 quadrillion connections.

Responsible in all humanities achievements.

1 quadrillion.



- # 1 000 000 000 000 000 gallons?
 - # Close to 2.73 times the estimated total earth water reserves !
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1 Quadrillion.

- # 1 000 000 000 000 000 miles?
- # Close to 169 light-years
- # 1.1 millions times the distance between the Sun and the Earth

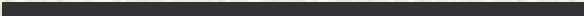




With advancing technology we are becoming more and more aware of how the human brain functions.

Could this be the greatest revolution of all?
(Ramachandran, 2003)

How close are we to fully understanding the brain and its relationship with behaviour?





Insights into the human brain is not just beneficial for scientists.

Bridging the gap between Science and the Arts.

What makes us tick.

Feelings, emotions, thoughts, ambitions, love, beliefs – all related to brain activity.

Recap on Hormones

