Strengths and Weaknesses Of Methods Adopted By Cognitive Neuroscientists

Discuss the strengths and weaknesses of the research methods adopted by Cognitive Neuroscientists in order to understand the biological bases of behaviour and mental processing.

This essay will be analysing the strengths and weaknesses of four different research methods that have been adopted by Cognitive Neuroscientists. There are a various range of research methods that have been created in order to allow for understanding of brain function and behaviour (Nemeroff and Schlapfer, 2012). Some of the methods that have been developed include functional Magnetic Resonance Imaging, Positron Emission Tomography, Electroencephalography, and Magnetoencephalography. These methods provide Cognitive Neuroscientists insight into how the brain functions allowing for explanations of certain behaviours which could then lead to both diagnosis and treatments (Pinel, 2014).

Functional Magnetic Resonance Imaging (fMRI) identifies the changes in the levels of oxygen in the blood which occurs due to activity in specific areas of the brain (Ulmer & Jansen, 2013). This means that when a brain area is more active, more oxygen is being used resulting in an increase in blood flow to that specific part of the brain. An activation map is then produced which shows a 3D image of the part of the brain which is active. This has been used to identify which parts of the brain are involved in specific mental processes.

A strength of using functional MRI is it allows for Cognitive Neuroscientists to understand mental processing in further detail as it provides both the structural and functional information in the same image (Pinel, 2014). This means that the specific area of the brain responsible for particular mental processes can be viewed which results in understanding the function of a specific brain area. This could be due to the high spatial resolution which allows Cognitive Neuroscientists to distinguish between the different brain areas with good precision. This would then allow for accurate conclusions to be drawn about the role of certain parts of the brain which could result in more accurate explanations of human behaviour.

However, the use of functional MRI can be criticised for a poor temporal resolution due to approximately a three second delay in producing the images (Logothetis, 2008). Temporal resolution refers to the accuracy of the scan with reference to the time. Functional MRI has a poor temporal resolution as it is slow in detecting changes to brain activity which could lead to inaccurate conclusions being drawn about the function of certain brain areas in relation to particular mental processes.

Positron Emission Tomography (PET) involves the injection of radioactive 2-deoxyglucose which has a similar molecular structure to glucose so would be absorbed. From here, it would not be metabolised so instead would build up inside of active neurons. The scan then provides an image of the level of radioactivity within a specific part of the brain after a particular activity has been carried out (Pinel, 2014). This would allow Cognitive Neuroscientists to visually understand the area of the brain responsible for a specific human behaviour.

An advantage of PET is it can be utilised effectively in drug research due to the use of

radioactively labelled molecules. This means that it can be attached to a newly developed drug and tracked to understand the binding of a drug within the brain (Farde, 1996). This would allow for Cognitive Neuroscientists to recognise where the drug will bind to resulting in more accurate and precise drug testing. This is because the images that are produced will show the high levels of radioactivity that are produced which will indicate the presence of the drug.

However, the use of PET can be criticised for being an invasive scanning technique due to the injection of a radioactive tracer. This limits the availability of people who can participate in PET research for example, pregnant or premenopausal women and children due to the radioactivity involved. Therefore, limiting the use of PET when investigating brain function during development (Martin, Carlson & Buskist, 2013). This means that other techniques would need to be used instead such as electroencephalography which may be a more appropriate method.

Electroencephalography is used in order to record electrical impulses within the brain (Martin, Carlson & Buskist, 2013). Electrodes are placed on the scalp which detect small electrical changes as a result of brain cell activity. The electrical signals are graphed over a period of time in order to analyse a person's general brain activity. The use of EEG has allowed for research to be conducted into certain states of conscious or types of cerebral pathology such as epilepsy as particular wave forms are only present during such events (Pinel, 2014).

One benefit of using EEG over other brain scanning techniques is that it has a high temporal resolution meaning that it can provide a measure of a patients or participants brain activity in real time which allows for the association of a particular task and the brain activity to be quite accurate (Martin, Carlson & Buskist, 2013). As a result of this it would allow Cognitive Neuroscientists or researchers to draw more accurate conclusions. This makes it a very useful methods as it is one of the few non-invasive techniques that can produce data within milliseconds.

However, one disadvantage of an EEG is that it has a poor spatial resolution. This is because as EEG is only measuring the brain activity, the recorded activity is a mixture of the different brain areas that are active (Burle et al., 2015). This means that Cognitive Neuroscientists or researchers are unable to draw conclusions about specific brain areas in relation to a particular task, resulting in inferences being made about which areas are activated during the task.

Reference List

1. Burle, B., Spieser, L., Roger, C., Casini, L., Hasbroucq, T., & Vidal, F. (2015). Spatial and temporal resolutions of EEG: Is it really black and white? A scalp current density view. International Journal Of Psychophysiology, 97(3), 210-220. doi: 10.1016/j.ijpsycho.2015.05.004
2. Farde, L. (1996). The advantage of using positron emission tomography in drug research. Trends In Neurosciences, 19(6), 211-214. doi: 10.1016/0166-2236(96)40002-9
3. Logothetis, N. (2008). What we can do and what we cannot do with fMRI. Nature, 453(7197), 869-878. doi: 10.1038/nature06976
4. Martin, G., Carlson, N., & Buskist, W. (2013). Psychology (5th ed., p. 118). Harlow [England]: Pearson.
5. Martin, G., Carlson, N., & Buskist, W. (2013). Psychology (5th ed., pp. 110-111). Harlow [England]: Pearson.

6. Martin, G., Carlson, N., & Buskist, W. (2013). Psychology (5th ed., p. 111). Harlow [England]: Pearson.
7. Nemeroff, C., & Schla?pfer, T. (2012). Neurobiology of psychiatric disorders (p. 75). Edinburgh: Elsevier.
8. Pinel, J. (2014). Biopsychology (8th ed., p. 106). Harlow [England]: Pearson.
9. Pinel, J. (2014). Biopsychology (8th ed., p. 109). Harlow [England]: Pearson.
10. Pinel, J. (2014). Biopsychology (8th ed., p. 108). Harlow [England]: Pearson.
11. Pinel, J. (2014). Biopsychology (8th ed., p. 111). Harlow [England]: Pearson.
12. Ulmer, S., & Jansen, O. (2013). FMRI (2nd ed., p. 3). Kiel: Springer-Verlag.