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IB Higher Level Psychology
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The 23rd of April, 2012

Cognitive Level of Analysis - Cognitive Process

The Learning Outcome #32:

Discuss the use of **technology** in investigating **cognitive processes** [for example, MRI [magnetic resonance imaging], scans in memory research, fMRI scans in decision-making research].

22 mark - EAQ.

The Use of Modern Technologies:

- The use of advancing technology in research on cognitive processes provides insight into the complexity in cognitive processes that underpin behavior.
- Cognition always involves neuronal activity in the brain - modern technology, for example, EEG [electroencephalography] and fMRI [functional magnetic resonance imaging], can be used to study cognitive processes while they are taking place [such as in traditional cognitive research on memory but also in research on neuro-economics and neuro-marketing].
- Neuroimaging, such as fMRI, can register changes in blood flow in the active brain [oxygen and glucose consumption in the brain] - the researchers can then make a map of areas in the brain related to specific cognitive processes.
- Neuroimaging has revealed that cognitive processes are mediated by a network of distributed interacting brain regions and each area makes specific contributions.

EEG [Electroencephalography]:

- EEG [electroencephalography] refers to the recording of the brain's electrical signals [i.e., the firing of the many neurons in the cortex of the brain].
- Electrodes are places on the scalp to register what parts of the brain are active and in what ways.
- EEG can be used to record electrical activity for research purposes [for example, what areas are active when a child listens to a mother's voice].

MEG [Magnetoencephalography]:

- MEG [magnetoencephalography] is a technique used to record magnetic fields produced by the natural electrical activity in the brain.

Palva et al., 2010 - "The Working Memory Experiment":

#1. The Aim:

- [Palva et al. \[2010\]](#).
- The aim of this experiment is to investigate the interaction of neuronal networks in the cerebral cortex in relations to visual working memory.

#2. The Procedure:

- Data from EEG and MEG was used to identify patterns of interaction between the neurons [neuronal synchrony] in the cerebral cortex during visual tasks.

#3. The Results:

- The results showed synchronization of neuronal activity in different brain areas related to the maintenance and contents of working memory.
- Specific networks interacted [for example, different areas of the brain's frontal and parietal lobes played a central role in coordinating attention and action in working memory].
- Handling and maintaining sensory information about visual stimuli showed activity in networks in the occipital lobe.

#4. The Evaluation:

Critical Thinking:

#1. Environmental Influences:

- While this experiment was very controlled as it was done in a laboratory with specialized brain imaging technologies, there could have been environmental influences that could have changed the results [such as distractions: noise, lights].
- As a result, the findings of this cannot be generalized, as the results may be different if they were to be done again.

Links to the Question:

#1. [Alan Baddeley \[1974\]](#) - Model of Working Memory:

- The findings support [Alan Baddeley's](#) model of working memory [for example, the central executive could be linked to the activity in the frontal and parietal lobes].
- The activity in the networks in the occipital lobe could be linked to the visuo-spatial sketchpad.
- The neuroimaging technologies were significant to detect specific brain areas involved in cognitive processing; this could not be done otherwise.

#2. Neuroimaging Technologies:

- In this study, the neuroimaging technologies were important to detect specific brain areas involved in cognitive processing - this could not have been done otherwise.

MRI [Magnetic Resonance Imaging]:

- MRI [magnetic resonance imaging] produces three-dimensional images of brain structures. It is used to detect structural changes in the brain in cases of brain damage or illness.

Links to the Question:

#1. Neuroplasticity

- Neuroplasticity can be shown in the brain through the use of MRI [changes are due to environment and social factors].

#2. Multi-Store Model:

- When looking at memory, some parts of the brain are activated; this activity can be seen in MRI scanning which can prove the existence of the multi-store model.

Corkin et al., 1997 - The Case of H.M.:

- H.M. suffered from amnesia and was not able to form new explicit memories.
- This case study demonstrated that explicit memory processes are dependent on the hippocampus and adjacent cortical structures, but the exact damage to H.M.'s brain was not known before researchers could use brain imaging.
- [Corkin et al. \[1997\]](#) used MRI to study H.M.'s lesion in the first attempt to use modern technology to study his brain.
- The results of the MRI scan confirmed a relationship between damage to the medial temporal lobes [including the hippocampus] and H.M.'s amnesia.
- Although, a tiny part of the hippocampus remained it was not enough to support normal memory function.

An Evaluation of the Use of Modern Technology:

The Strengths of Using Modern Technology:

- It provides the opportunity to see inside the working brain as it operates by mapping active brain areas; it is also possible to see synchronization between various brain areas involved in cognitive processes.
- It is useful in diagnosing brain disease or damage that causes problems in cognitive functioning [for example, memory problems in Alzheimer's].

The Limitations of Using Modern Technology:

- The scanning takes place in a highly artificial environment [some scanners are extremely noisy] which affects the ecological validity.
- Scanner studies can map brain areas involved in various cognitive processes but it is not yet possible to say anything definite about what these pictures actually mean.

Links to the Question:

#1. Localization of Function of the Brain:

- Deficiency and localization of brain function [[Roger Sperry](#)].