Learning outcome: 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)*.

Command term: Discuss-*offer a considered and balanced review that includes a range of arguments, factors or hypotheses. Conclusions should be presented clearly and supported by evidence.*

Investigating cognitive processes

* Originally, the only way to study cognitive processes was by inferring them through non-invasive methods like observations or experiments, OR by invasive methods such as psycho surgery and post mortems where actual brain tissue was examined.
* Experimental methods have problems of ecological validity due to their artificial nature.
* Surgical techniques may harm participants.

Neuroimaging techniques

* These non-invasive techniques allow psychologists to study the physical brain structures underpinning cognitive processes in a safer and more ethically desirable manner.

What are the techniques?

* Magnetic resonance imaging (MRI)
* Functional magnetic resonance imaging (fMRI)
* Positron emission tomography (PET)

What exam questions could be asked?

* This could be an SAQ or and ERQ

You have to be prepared to answer this about one process i.e. memory. For example:

“Discuss the use of technology in investigating one cognitive process”.

OR you could be asked: “Discuss the use of technology in investigating cognitive processes”.

If you were asked this you should mention memory and another cognitive process.

What to include for an ERQ-*according to the May 2012 mark scheme*

* The focus of the response should be on the use of technology in investigating cognitive processes. You should not simply evaluate studies in which technology has been used.
* Discussion may include, but is not limited to: ethical considerations of the use of technology, efficacy of technology in measuring cognitive processes, cost/benefit analysis, issue of reductionism, comparison of technologies.
* The studies have to be focused on cognitive functioning rather than biological mechanisms.

So why use these techniques? –Strengths

Reason 1

* Cognition always involves neuron activity in the brain and scanning techniques can be used to study cognitive processes while they are taking place.
* Example: Maguire et al’s (2000) use of MRI to help clarify the role of the hippocampus in “route recall” or visual-spatial memory in taxi drivers.

Reason 2

* Provides insight into the complexity of the activity of the brain’s neural network and show which regions interact.
* Example: Corkin 1997 used MRI to study HM. Found damage to the medial temporal lobes and in particular the hippocampus. This provided evidence that the hippocampus plays a critical role in transforming short-term memories into long-term memories-particularly episodic and semantic memories (explicit).

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Reason 3

* Scans can reveal areas of damage or illness. For example it can be used to detect Alzheimer’s disease and the extent of stoke damage.
* Example 1: Schwindt and Black (2009) did a meta-analysis of fMRI studies of episodic memory and concluded that AD patients show decreased activation of the medial temporal lobe.
* Example 2: Researchers from the New York University school of medicine have developed a brain-scan based computer program that quickly and accurately measures metabolic activity in the hippocampus. Using PET scans and the computer program, the researchers showed that in the early stages of Alzheimer’s disease, there is a reduction in brain metabolism in the hippocampus. In a longitudinal study the researchers monitored 53 normal ppt’s (using PET scans) between 9 and 24 years. It was found that individuals who showed early signs of reduced metabolism in the hippocampus were associated with later development of Alzheimer’s disease, Mosconi (2005).

Limitations of using technology

* Scanning takes place in a highly artificial environment and some scanners are extremely noisy. This affects the ecological validity.
* Scanner studies can map brain areas involved in various processes but it is not yet possible to say anything definite about what these pictures actually mean. What is established by scanner studies are correlations between phenomena at the psychological level and some neural activation patterns.
* Scanning procedures are time-consuming and many individuals find them very uncomfortable. Potential participants should always be fully briefed so they can give informed consent.

What can we conclude?

Although there are limitations, the information that scanning technology can provide about cognitive functioning is invaluable. As the technology continues to be advanced and improved, so too will our understanding about which parts of the brain are involved in cognitive processes.