The relationship between the brain and behaviour using the case

In this assignment I intend to explain what we can learn about the relationship between the brain and behaviour using the case of Phineas Gage to highlight their connections. I will then continue by describing methods such as invasive and non-invasive techniques used by psychologists to supplement our knowledge of this relationship. Brain damage or lesion to a particular region of the brain has provided psychologists a major source of evidence on establishing a relationship between the brain and behaviour.

Phineas Gage was an American railroad construction foreman now remembered for his improbable survival of an accident in which a large iron rod was driven completely through his head, destroying much of his brain's left frontal lobe, and for that injury's reported effects on his personality and behavior, see figure 1. Phineas Gage influenced 19th-century discussion about the brain and was perhaps the first case suggesting that damage to specific regions of the brain might affect personality and behavior.

It was the very nature of his condition after the accident that sparked a debate that the usual function of the brain had been disturbed. Noted changes in his normal behavior had occurred. According to sources after his accident he became obstinate, egocentric and capricious, and he also started to use foul language (Macmillan, 1986 as cited in Toates, 2007). The damage to the left frontal lobe led to suggestions that this part of the brain functions as an inhibitor of emotional expression.

By looking at the behaviour of someone with brain-damage after an accident and comparing behaviour of someone without that damage allowed early

psychologists to theorise what functions certain regions of the brain perform and it is now known that the prefrontal cortex does indeed play a role in using memories in the inhibition of behaviour (Toates, 2007). This kind of theorising does have merits but in actual scientific terms may not be conclusive to what regions of the brain control certain behaviour.

Accidents resulting in brain damage are usually one-off and uncontrolled, and will usually affect several areas at the same time. In the case of Phineas Gage there was no matched control group to compare the result of his brain damage. Additionally most noted changes for his behaviour would have come from the accounts of friends, acquaintances and work colleagues after the event. His injuries may have altered the observations of others causing them to over-exaggerate his apparent new found personality. Perhaps the behaviour present after the accident was already there.

It should also be considered that his experience of the accident, causing obvious physical disability and impairment, was a trigger for adapting to a new identity of self, if taking a social-constructionist point of view. Turning attention back to biological psychology, which attempts to look at behaviour on larger scales rather than physiological individual differences, then what can be done scientifically to prove theories that show there is a link between the brain and behaviour in both human and non-human animals and what processes can be linked within species?

Individual cases such as Phineas Gage has led to the investigation of such a relationship between brain and behaviour, and our development in technology has allowed techniques to be developed to further try and prove

this. Controversially, scientists have purposely damaged selected parts of non-human animal’s brains to see what effect this would have. In this experimental group, a clearly defined part of the brain would be given an experimental lesion and the effect of behaviour observed.

A control group of the same sex and age received sham lesions (cutting of skin and anaesthetic to mimic the experimental group) and the results were compared (Toates, 2007). Obviously this raises ethical questions but has proven informative about synaptic functions and how the brain can create new neural pathways after such trauma to maintain its function. It has also helped our understanding that damage to specific regions may not be as important as are the functions of the rest of the brain that is revealed after damage, also illustrating its adaptive capabilities.

In the past few decades there have been major advances and technological breakthroughs for non-invasive techniques in the form of capturing scans and imaging of the human brain. Most notably the Positron Emission Tomography (PET) scan that allows images of brain activity in subjects to be viewed by means of injecting a tracer that will be visible on a scan showing where blood flow is heading within the brain displaying which part is active.

Doing this has enabled researchers to map parts of the brain such as auditory and motor functions while participants perform different tasks; this enables researchers to hypothesise the relationship between brain functions. Medically speaking, this type of scan can benefit physicians to map motor functions before and after a major surgery to fix a defect in the brain. It can also be of benefit in understanding the effect of major trauma by showing

parts of the brain with lower activity when compared to a control group; whilst also monitoring any improvement in brain functions after trauma through accident or surgery.

With regards to behaviour it has also been useful in control experiments using violent criminals as participants to see whether there are differences in that of a control group for comparison. It has shown that regions of the brain, notably the frontal lobes that exert control on actions, indeed appear to be underactive in violent criminals therefore affecting their behaviour and impulses (Raine, Buchsbaum and LaCasse as cited in Toates, 2007).

This essay has highlighted what difficulties are faced when using a single case of accidental brain trauma to establish a correlation between physiology and psychological behaviour, but has also shown what can be learned from it. Understanding this kind of brain trauma has encouraged other types of controlled testing to help establish a connection between brain and behaviour.

The non-invasive technique of a PET scan would have proved extremely useful in the case of Phineas Gage because even to this day there is debate and conjecture surrounding the accounts and details of the study. However, without such cases occurring it may never have triggered our curiosity to understand and push for the development of modern day techniques that have taken our understanding to new levels. It is certain, though, that debate will still surround the issue of biology explaining our behaviour for some time.