

Cognitive neuropsychology essay sample



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Cognitive neuropsychology saw its birth in the second half of the nineteenth century when neurologists began studying damaged brains with an aim to diagnose. Inferences began to be made regarding which part of the brain contributed to a particular cognitive ability, with the assumption that the altered cognitive abilities of a brain damaged person could be compared with that of a person of normal cognition. Over time and with the development of more accurate techniques, a universal framework of normal cognitive processes were built, aided by the more effective research paradigms contributed by cognitive psychology.

This has not only increased the accuracy in diagnosis of brain injuries but increased our understanding of cognitive processing. However, as a branch of cognitive psychology (Caramazza & Coltheart, 2006, p. 4), cognitive neuropsychology has raised questions regarding its differences in methodology. The classic use of group experimentation is not possible studying single patient symptoms, so how representative of the population is a single brain damaged person?

Is it fair to infer the brain-damaged person was “ normal” to begin with?

Lesions are rarely identical in size and shape, affecting the symptoms displayed; how “ universal” can the data collected from a single person be?

The purpose of this discussion is to critically evaluate these important questions and provide a sufficient account of how cognitive neuropsychology, using single patient case studies, have overcome these limitations to be considered a discipline in its own right.

It will also be noted how the contribution of single patient case studies have influenced our increased understanding of normal human behaviour by examining the significance of particular case studies involving patients with brain damage, in cognitive processing. The classic methodology of experimentation within cognitive psychology typically tests groups of participants in order to achieve generalisation across populations.

However, when a single brain damaged patient appears it is impractical to wait until another person appears with the same injury or biological defect as some cases are extremely rare (for example, Capgras Syndrome, whereby a patient believes their family have been replaced with imposters (Pike & Brace, 2010, p. 137)). Nor would it achieve the desired uniformity of classic experimentation as a damaged brain is irregular, whereby a lesion will never be exact in size, or housed in the exact same brain, or within the exact same place in the brain (Jansari, 2010, p. 3).

The main goal for neuropsychology is to focus on investigating the single impaired symptoms of a patient, to advance understanding in normal cognition (Caramazza & Coltheart, 2006, p. 4). Patient DF, a 35 year old woman who suffered irreversible brain damage after carbon monoxide intoxication, was diagnosed with visual form agnosia (an inability to recognize objects), this particular case helped to create a distinction between perception of form, used for object recognition and the perception of form, used for calibration and orientation toward an object.

This type of finding is known as a dissociation, whereby one cognitive ability is impaired whilst leaving another intact, suggesting separate cognitive

processes. In this case, the visual processing underlying conscious perceptual judgments operates separately from the underlying automatic visuomotor guidance of skilled actions of the hand and limb (Goodale et al. , 1991). Single patient case study findings like this one, have lead the way to creating more accurate functional models of cognitive ability.

Early functional models of face processing have been made obsolete by combining experimental work on normal individuals with findings from brain damaged patient case studies (Jansari, 2010 p. 77). This is evident in the Bruce and Young model (1986) (as cited in Pike & Brace, 2010) and then later in the IAC model (Burton et al. , 1990, as cited in Pike & Brace, 2010), a connectionist model of face recognition, able to reproduce or ‘simulate’ certain aspects of human behaviour. The IAC model is a perfect example of how single patient case studies have helped increase our understanding of cognitive processes.

One hypothesis the model proposes is that facial identification is independent of emotional expression (Pike & Brace, 2010, p. 136). Young et al (1993), looking into prosopagnosia (the inability to recognise faces whilst still able to recognise objects), tested patients with unilateral brain injuries for familiar face recognition, unfamiliar face matching and an analysis of emotional facial expressions (Pike & Brace, 2010, p. 136). It was indeed found that identification of expression was independent from facial identification but also that facial recognition and the awareness of facial recognition may also be independent of each other.

In summary, single patient case studies are a more credible methodological approach for cognitive neuropsychology which have aided in creating accurate functional models within cognitive psychology. Single patient case studies do have their limitations, they have no authority in correlational design studies as the implication in relationships between two variables needs more than one subject, however, they do still advocate support to previously modelled or hypothesised theories which gives additional support to any given cognitive processing theory.

This is not only displayed in the IAC model but also in Marr and Nishihara's (1978) theory of object recognition (as cited in Pike & Brace, 2010, p. 123). Their 3D model theory of object recognition (recognition of an object from many angles which is hierarchal, and based on creating an axis for each component, allowing both recognition of the entire object but the more detailed information within it), was very difficult to study but gained some support from Lawson and Humphrey's (1996) (as cited in Pike & Brace, 2010, p. 23), who tested group participants with normal cognition but further, more persuasive support, came from a neuropsychological case study, whereby Warrington and Taylor (1978) studied patients with right hemispheric damage and found that they could only recognise objects when presented in a typical view. If they were presented in an unusual view they could not recognise it nor could they recognise the same object in two photographs if it were presented in an unusual view.

This suggests the patients could not transform the unusually viewed object into a 3D model because they could not establish a central axis. This type of patient case study emphasises the important contribution this method has

given to the understanding of cognitive processing. The generalisation of using single patient case studies to reflect population paradigms is also an issue within cognitive neuropsychology, questioning legitimacy (Jansari, 2010 p. 89).

Caramazza (1986) addresses this with the “ universality assumption” (as cited in Caramazza & Coltheart, 2006, p.). It is suggested that not only in cognitive neuropsychology, but also in cognitive psychology, the universality assumption must be made, “ the assumption that there is no qualitative variation across neurologically intact people in the architecture of the cognitive system that these people use to perform in a certain cognitive domain. ” (as cited in Caramazza & Coltheart, 2006, p. 6), implying that before a patient’s brain damage their cognitive systems were all the same and it is from this system that the inferences will be made.

This central assumption does however neglect a very important point; how do we know the brain damaged patient was “ normal” to begin with? The only way it seems to combat this is to take detailed accounts of both quantitative and qualitative data so that it can be compared with other patients exhibiting the same or similar symptoms as well as background information (wherever possible) to build a realistic picture of the impaired patients previous cognitive ability. This is exactly what had been done in the early days of neurology before more sophisticated imaging techniques existed.

Phineas Gage in 1848, had a tamping iron pierce through his skull with very little biological effect however, detailed accounts were taken after of his

behavioural change which led neurologists to believe he had injured the part of the brain used for socially accepted behaviour. This hypothesis could not have been investigated at that time due to the lack of knowledge however, 150 years later patient EVR began exhibiting the same behaviour after brain surgery to remove a tumour.

Using neuroimaging techniques to examine EVR's brain lesion and computer simulated replication of Phineas Gage's injury alongside the detailed account of the two patients behaviour, it was concluded that both had injuries in the same location of the brain (Jansari, 2010 p. 62). This historical example shows that combining methodology can combat the issue with homogeneity to not only help create models to understand cognitive processing but also highlighting how far cognitive neuropsychology has come.

Another more recent example of how far cognitive neuropsychology has come to become distinct is by the careful observation of double dissociations. As discussed earlier a dissociation is where one cognitive ability is impaired whilst leaving another intact, allowing the suggestion that separate cognitive processes exist. A double dissociation is when two related mental processes are shown to function independently of each other, this is evident in memory with long-term memory (LTM) and short-term memory (STM) (Jansari, 2010 p. 9). These models of memory have been supported with neuropsychological patient studies. One example is HM, a patient with amnesia who had impaired LTM but an intact STM and patient KF, who had the reverse. Thorough investigations enabled the implication to be made of two separate memory systems but more importantly was the outcome of

HM, who was found to, after repeating the memory tasks, improve in the tasks day by day, even though he had no recollection of performing them.

This enabled further research by Cohen and Squire (1980) to propose that LTM could be separated further into procedural memory (for facts and events) and declarative memory (for skills) (Jansari, 2010 p. 86). Such findings have aided in practical applications for both cognitive psychology and neuropsychology. Patient JC, after suffering a brain haemorrhage, was left with very little LTM. From models created from using data from previous case studies a set of criteria was formed to enable a prediction for successful rehabilitation.

JC met the criteria and was taught rehabilitation techniques that enabled him to lead an independent life (Jansari, 2010 p. 95). Unfortunately this cannot be the case for all brain injuries due to the nature of the plasticity of the brain, what rehabilitated one patient may not work on another, brain tissue cannot regenerate, but it does adapt and does begin to repair itself both at neuronal and cognitive level (Jansari, 2010 p. 87), which does sound exciting at first glance but does make rehabilitation problematic due to the increasing change in symptoms.

This plasticity and individualism is why it is important to study patients with brain damage case by case and why, due to the depth and volume of information acquired from each case, that cognitive neuropsychology has become a widely accepted branch of cognitive science (Caramazza & Coltheart, 2006, p. 4). In conclusion, this essay has discussed a number of brain damaged patient case studies with regards to contribution of

understanding in cognitive processing and with regards to contribution into the development of the specialty of cognitive neuropsychology.

The limitations of using single patient case studies were also examined as a method of investigation and evaluated with regards to how effective this method has been within cognitive neuropsychology. It is clear from the discussion that many questions arose when deviating from the group experimentation methodology that reigns within the cognitive sciences however, all questions raised were sufficiently represented with support from patient case studies, not only to support the field of neuropsychology but also as reinforcement for experimental functional models of cognitive processing.

The contribution of patient case studies should continue to be used to support cognitive psychological findings however, thorough quantitative and qualitative information should be collected per patient for quality assurance, this also insures the reliability of neuropsychological investigations. As with every field of psychology gaining insight is important but none so much as how it can be practically applied, further research still needs to be applied to the rehabilitation of damaged brains and as has been shown more accurate models can be created when combining methodological techniques.