Single Case Studies as Seeds: Brain Models That Matter

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ABSTRACT

Single case studies are research studies of single participants. They explore new ideas and can suggest extensions in methods and for treatment (Yin, 1984). In this article the case study refers only to conditions observed and is limited to what was observed from these comparisons between normal function and patterns of specific conditions. This does not reflect the theory of a formal case study but rather it is an attempt to show the case study and simple computer modelling as learning tools in a complex environment. Critics of case study methodology cite small case numbers as not having grounds for establishing reliability or generalization of findings and that the intensity of exposure needed for thorough case studies could bias the research findings subtracting from researcher objectivity. Early computer models were used to simulate the function of the brain and provide partial answers. They provided insight into the understanding of complex function. In recent history, computer models and case studies have been cast aside in favor of live brain imaging and complex biochemical reactions. It is good to remember that these tools brought us to the place of knowledge we enjoy today and have enlarged diagnostic and treatment choices. They are still valuable and inexpensive methods that can impact the imaginations of neuroscientists and kindle their passions to solve the complexities of the human mind one problem at a time. Greater rigor can be easily maintained by adopting a format whereby a patient would be assessed by a fully standardized neuropsychological battery and the performance then compared to large sample of normative data. The formal study is important for generalization of findings across conditions and can be applied once normative data has been collected as a basis for comparison.

Keywords: Brain Training, Case Series, Case Studies, Cognitive Rehabilitation, Connectionist Modeling, Dyslexia, Neurogenesis, Neuroplasticity, Picks Disease, Self Regulation, Stroke, Traumatic Brain Injury

BACKGROUND OF CASE STUDY EXPOSURE

Single case studies and connectionist modelling can give uncommon insight into human behaviour and rehabilitation after neurological insult. In this article a strong focus is given to the art of reading as it serves as a pivotal focus for observing dysfunction and rehabilitative potential Naish (2000) states “Reading employs symbols of symbols and the processing required to link the written word with the original concept has been considered by some to be so complex that if we could understand fully how it took place we would effectively understand the whole of human cognition” Excerpts by Cohen, Johnston and Plunkett (2000) and Parkin (1996) refer to reading and cognition issues associated with the use of single studies to generate theories and relate they have had immense exploratory value.

A single case study may reveal patterns that generate an insight. When this pattern is compared to similar conditions research strategies can emerge. As single case studies

DOI: 10.4018/ijudh.2014040105
are combined with similar case studies, double disassociations, cognitive modelling and neuron imaging the resulting data sets can produce a robust model. The increase of computer based communication makes it possible for scientists to collaborate internationally on single case studies, evolving case series or computer based data that represents models of human behaviour during neurodegenerative insult.

Greenhalgh (1997) refers to single case studies as the quick and dirty method for extracting research information and lists their inclusion at the bottom of the research hierarchy in regards to evidence. She later qualifies this statement, stating that when single case studies are well done they can yield superior detail generally lost in larger studies (Greenhalgh, 1997).

Single case studies are crucial when an observation requires rapid attention even though methodological links are weak. For example three children at school go out to play before reading class and one child dares the other two to eat ‘mushrooms’ on the playground, they are poisonous but taste fine and the two children continue to play but later show a loss of balance, hallucinations and inability to read in class. Knowledge based on a single case study on mushroom poisoning could result in recognizing the progression of circumstances and taking appropriate action to save the children’s lives. Large randomized double blind studies could determine correlation factors and average rate of poison over time; however the available single case study information is appropriate for immediate intervention.

Rather than focusing solely on the value of single case studies or that of connectionist models they will be seen as seeds of research. How this seed is tended determines its core qualities and its capacity to reproduce in the field of research. It is good to bear in mind that without an initial ‘seed’ the likelihood of a major double blind clinical trial is slim. Likewise, undue emphasis on finding disassociations and grouping deficits into convenient “syndromes” can mask individual differences and invoke dichotomies.

The value of single case studies hinge on circumstances surrounding reports, the skill with which they are presented and ways they are integrated with other research. Using dysfunctional models to illuminate normal function is risky in that the dysfunctional component can influence the working areas surrounding it and so confound the model (Cohen, 2000). Case studies may be thought to lack credibility as they are not sufficient to determine the development of generalizable results. Although this work uses the case studies as a teaching tool there are more rigorous forms of single case study methods developed within this field that have greatly added to the scientific method and contain the potential for validating the areas of interest for more detailed scientific exploration (Crawford, 2011) There is an excellent resource for adopting case studies into clinical practice at http://homepages.abdn.ac.uk/j.crawford/pages/ dept/SingleCaseMethodology.htm.

EXEMPLAR BRAIN CASE STUDIES

Clive Wearing

In memory research archives we find Clive Wearing who was the basis of a well-known single case study. Everyday is literally a new day for him because he remembers nothing consciously from the day before and yet he is still able to preserve some function. His amnesia, memory deficits and history as a former orchestra conductor are presented at conferences, displayed on you tube and written up as segments in the memory research of famed scientists. Wearing apparently maintains reading ability and plays the piano, however available research fails to address how well he reads to comprehend or conceptualize new materials (Posner & Rothbart, 2007; Wearing, 2005). Individuals other than Wearing sustain similar assaults from conditions such as herpes encephalitis (Patel, 2009) but Clive was popular in UK society when scientists were exploring the frontiers of working memory and his plight captured the imagination of the public (Wearing, 2005).
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