Main approaches studying human cognition psychology essay

Human cognition has been scientifically approached by the Cognitive Science as its main target and Experimental Cognitive Psychology is the first approach of Cognitive Science to get evaluated in this essay. It started focussing in cognitive processes with the systematic and scientific approach of Behaviourism but in contrast to it taking into account internal processes (Leahey, 2004). Also it provided most theories upon which the other approaches build-up their research with its flexible application to many cognitive task, i. e. Psychophysical methods (subjective judgement and discrimination methods), reaction and processing times methods (to measure mental events and components) while answering simple questions (Pollatsek & Rayner, 1998). Unfortunately there are some intrinsic limitations like the complexity of cognitive processes that makes it difficult to the researcher to be sure that is measuring the correct processes and no others are involved. Also all the evidence of internal processes is indirect, not to mention blurred theories difficult to disprove, paradigm specificity and lack of a unified theory. All these limitations do not undermine the value of the approach, which still is widely used, but they need to be considered before jumping into conclusions about research.

The second important approach to human cognition is Cognitive neuropsychology. It is a bit misleading to say it came after experimental cognitive Psychology because its main characteristic, the study of people with brain damage, started as early as 1891 when Broca identified a brain area involved in verbal expression. However, was unable to become a full discipline due to the lack of the proper technology (Frith, 1998). It could be said that the main strength of Neuropsychology is a technique called ‘

Double Dissociation' which will be explained in more detail later on by this essay, but let just say it allows establishing associations between brain processing modules and cognitive behaviour. Other strengths of Neuropsychology is that causation can be shown when a particular brain damage produce certain loss of cognitive performance, that it has greatly improve memory research and is the logical methodological bridge between Experimental Cognitive Psychology and Neuroscience. Nonetheless, there are limitations to be aware of, mostly related to the exponential complexity of human cognition, i. e. the compensatory shortcuts patients use that no healthy individual would use. Another issue is brain damage not being perfectly located in a single module but randomly spread in an irregular area which makes difficult to measure individual modules´ functions. Not to mention how difficult if not impossible is to control confound variables in patients with different ages, gender and brain damage located at different places. Finally, the last critic made to Neuropsychology is its focus in particular cognitive functions but not in more general ones (Eysenck & Keane, 2005). All the same, as long as the limitations are not forgotten is one of the more innovative and promising areas of research.

Computational Cognitive Science is the next approach covered by this essay. Obviously the development of this approach was linked to computers innovations. No so obvious is that its focus is not directly on human cognition but in producing models and computers systems capable of resembling intelligence or more commonly called A. I. (Artificial Intelligence). There are two paradigms: The Symbolic, which thinks that A. I. will be reached through models using symbol processing, and Connectionist, which focus on

extensive parallel processing in order to manage huge amounts of data whilst providing flexibility (Sun, 1998). As an approach uses the findings of Neuroscience and because parallel processing is well supported by Neuroimaging, it produces detailed theories and comprehensive cognitive architectures. Also the idea of distributed knowledge (knowledge is not found in single locations) has empirical support although Bowers (2002), showed it is incompatible with connectionism. As negative points should be said that most models do not make new predictions, they ignore motivation and emotion and, although they use data from Neuroimaging, their similarity with neural systems can not be probed (Sun, 1998). In any case is an approach with great future perspectives due to the continuous developing of computer technologies and the growing industrial demand of more intelligent robots but not as relevant as other approaches for the brain-cognitive behaviour issue.

Neuroscience is the last approach to evaluate. As scientists become increasingly curious about the biological basis of human cognition and coinciding with the development of non-invasive techniques that made possible to look inside the brain whilst performing tasks, Neuroscience became alive. Such non-invasive techniques are usually called Neuroimaging (Buckner & Petersen, 1998), which includes: PET (Positron Emission Tomography), MRI (Magnetic Resonance Imaging), fMRI (Functional MRI), ERPs (Event-related Potential) and TMS (Transcraneal Magnetic Stimulation). These techniques give either good temporal resolution or good spatial resolution and TMS even allows casual relations to be done. Consequently, when they are combined in the proper way Neuroimaging techniques are a

strong approach to study human cognition. About Neuroscience weaknesses it is well known that but for TMS technique, all the rest can only provide correlational associations. Poor ecologic validity is other typical problem due to the natural limit to the tasks that can be performed inside the little space of one of these big scanners or in the best possible scenario, in a lab, in contrast with everyday common processes. At the same time, the only technique that provides casual associations, TMS, has not well understood effects in the brain, probably affecting more areas than it is intended to and therefore affecting the validity (is measuring what it is suppose to measure) of the studies (Eysenck & Keane, 2005).

It could be said that the weakest approaches to explain the brain-cognitive behaviour are Experimental Cognitive Psychology and Computational Cognitive Science. In the case of Computational Science this is because although some sources like Eysenck and Keane (2005), classed it as a study of cognitive processes using computational models, other sources like Sun (1998) argument that its aim is to create A. I. by any means available and not only focusing in human cognition. Even though it uses findings of Neuroscience and Neuropsychology, its purpose is not to directly explain the brain-cognitive behaviour relationship unless it is through the brain-computer metaphor which, in some people opinion, is hardly the same thing (Eysenck & Keane 2005). Just to put and example of how much controversy the Computational Cognitive Science provokes, when Alan Turing (1950) wrote his famous ‘ The imitation Game’ which proposed making a computer answer questions, it was not clear if that was a demonstration of A. I. language processing or a probe of how badly humans recognize intelligence.

Therefore, the usefulness of Computational Cognitive Science is highly hypothetical and controversial.

The other weak approach is Experimental Cognitive Psychology. In this case all its behavioural measurements are only indirect evidence of brain processes, and given the complexity and variety of brain modules that cognitive behaviour implies it is very easy to get to wrong or imprecise results. This is why, although for very different reasons, the two approaches (Experimental and Computational) are not the best option if used on their own. On the other side if two or more methods are used to tackle the same problem, the strengths of one covers the limitations of the other providing stronger evidence given than both of them come to the same results. This is called Converging Operations and in case the approaches involved do not get to the same results, then more research will be needed (Eysenck & Keane 2005). In this regard Experimental Cognitive Psychology can be useful in supporting or not other approaches findings.

Following with the other approaches is the turn of Neuropsychology and Neuroscience discussion. One of the most important assumptions of Cognitive Psychology is the existence of different brain modules in charge of different cognitive tasks, and Neuropsychology has a method to support such claim, or at least to differentiate between major modules. It is called double dissociation and a clear example can be found at language research. For Behavioural Psychology, language was a single ability whilst for Experimental Cognitive Psychology it was thought that a single brain module was in charge of language. Those theories were probe to be wrong when Neuropsychologists studied people with damage in Broca´s area (Broca´s

aphasia) or in Wernicke´s area (Wernicke´s aphasia). The former can understand the meaning of words but lacks syntactic functions, the later can produce syntactically correct phrases but they have no sense. Consequently it is suggested the existence of two separated models instead of one. (Orden, Pennington & Stone 2001). This is how the ‘ double dissociation’ works and this is why, in this essay, Neuropsychology is considered the second most useful approach to study the brain-cognitive behaviour relationship.

But none of those approaches focus so much in explaining relationship between brain and cognitive behaviour as Neuroscience does. In the already mentioned example of Broca´s aphasia, which was included later on in the Wernicke-Geschwind model of language processing (Wickens, 2000), the use of modern techniques like fMRI led to a deeper knowledge of brain and grammatical processing, showing that there are more functions being processed at Broca´s area and that grammatical processing function is spread across frontal lobes and both hemispheres (Sahin, Pinker & Halgren, 2006). Even more important is the use of TMS (Transcraneal Magnetic Stimulation) which can produce temporal-reversible lesions in selected parts of the brain in order to establish causation between parts of the brain and cognitive behaviour. Such a tool can be use to clarify how a brain lesion from surgery will affect language processes before is performed (Devlin & Watkins, 2006). None of the other approaches can go that far and hence Neuroscience could be considered the best single approach to explain the brain-cognitive behaviour relationship.

Although Cognitive Neuroscience seems to explain the relationship between brain and cognitive behaviour better, after the evaluation of the different approaches is clear there is no perfect method to do so and that they collaborate providing feedback to each other. Nonetheless, all of them produce valuable data that helps to appreciate the bigger picture instead of focusing on particular processes or theories. Hence, a combination of approaches and their techniques (converging operations) should be used whenever possible, as it will produce the more reliable results in the challenging but exciting task of understanding the brain-cognitive behaviour relationship.