Editorial

The conceptual nervous system of J.A. Gray: anxiety and neuroticism

This Special Issue is the first of two that honour Professor Jeffrey Gray and were occasioned by his official retirement. The contributors are all people who have worked with Jeffrey and whose work, as evidenced by their papers, has been strongly influenced by him. The content of the Special Issues demonstrates how broadly applicable are the concepts and, more importantly, the theoretical integration developed by Jeffrey. This breadth is indicated in particular by the necessity for two separate issues. The current Special Issue focuses on state and trait aspects of anxiety while the second will focus on state and trait aspects of schizophrenia.

The papers in this Special Issue will speak for themselves and for many detailed aspects and ramifications of Jeffrey’s theory of ‘the neuropsychology of anxiety’: I will not try to summarise them or it here. Rather, I will try to describe what I think may be the touchstone underlying all his work—his ‘conceptual nervous system’.

There is a sense in which Jeffrey’s theory of anxiety, being a living developing entity, could not be summarised in any simple way. The fundamental concepts on which it is based can probably be first seen emerging in 1967 in a paper that uses drugs as a tool to equate psychological concepts of fear and conditioned frustration [3] and these were progressively elaborated in terms of pure behaviour [6, 7, 10], personality theory [5], behavioural pharmacology [11], neuropharmacology [4], behavioural neurophysiology [8] and integration of all these domains [9]. The coalescence of these many related strands culminated in ‘The Neuropsychology of Anxiety’ [12]. This is arguably the most comprehensive integration of data across multiple domains so far attempted in behavioural and cognitive neuroscience.

For all its breadth and depth of integration and its subsequent influence in the academic and clinical communities this book was clearly, for Jeffrey, merely a preliminary step in a massive journey of discovery. In his view [12],

this century’s dark continent is the brain or mind, two names for what, so far as we can at present tell, is one mysterious entity inside our skulls. Like the early explorers of Africa, we know quite a lot about the coastline of our continent: the sensory systems of vision and audition that bring the mind news of what is going on in the outside world, and the motor systems that act upon the world. But we know next to nothing certain about its interior. This book is a preliminary map of one of the most mysterious regions of that interior. In the language of the mind, this region is called ‘anxiety’; in the language of the brain, it is probably located somewhere in the limbic system.

A much further developed version of the same fundamental concepts [13] is also avowedly incomplete and a further development is presented in the current issue.

But, for all the changes of minor detail, the core concepts of the theory remain essentially unchanged. Perhaps, more importantly, the attitude driving both the constancy and the changes has remained firm bedrock. For Jeffrey, following the lead of Donald Hebb, psychology deals with a Conceptual Nervous System (CNS).

[The CNS] is conceptual, because it is based not on data about the real nervous system, but on purely behavioural data; but it is a nervous system, nonetheless, because, if it is correct—i.e., if it correctly describes the way the real organism is constructed and operates—then it is the construction and the operation of the real nervous system which it describes [10].

The correct approach, on this view, is exemplified by Sokolov. He first “developed a conceptual nervous system which appeared to handle the behavioural data; then … he began to investigate the brain directly to see if he could find structures and neural elements which operated in the way that would be expected if his CNS was correct” [10]. This is, of course, the same approach as taken by Hebb in his book ‘The organisation of behaviour: a neuropsychological theory’ [14]. It was also, in principle, the approach taken by Pavlov. In 1964, Jeffrey produced an edited volume ‘Pavlov’s Typology’ that made a clear link between Pavlov’s theory of the ‘Strength of the Nervous System’ and western concepts of neuroticism and trait anxiety. He made clear that the nervous system referred to by Pavlov’s theory was of the conceptual rather than real variety He also, in a chapter in the book, took the critical next step of attempting to link Pavlov’s conceptual level account with
activity in the real nervous system—concluding that “the theory which best bridges the gap between brain and behaviour is still Pavlov’s” [2].

Even now one can argue that Pavlov’s concept of reinforcement is alive and well; as is Hebb’s quite distinct concept of association; and Sokolov’s concept of habituation. Our understanding of the real nervous system phenomena underlying these concepts is still incomplete. Indeed, even whether long-term potentiation (the best studied form of neural plasticity) is truly the neural basis of Hebbian association is still unsettled [15]. Similarly, Jeffrey’s concept of the Behavioural Inhibition System has remained intact since its inception. Modifications to the theory have been in the mapping between the conceptual and real level.

One can argue, then, that the power of Jeffrey’s theorising derives from a belief in the utility of conceptual nervous systems. This requires one to adopt the kind of formalism used by both Russian psychology and Western behaviour analysis and learning theory; and it requires a willingness to map between levels. Behavioural analysis constrains the neural structures searched for. Neural analysis also constrains allowable low level assumptions made by behavioural theory. Jeffrey is someone who, faced with these requirements, has neither fallen into the trap of radical behaviourism (which eschews internal states, mental or neural) nor lost scientific rigor by throwing out behaviourism as the fundamental means by which we can determine cognitive structures [1].

The nervous system is so complex that to attempt to explain mental events starting solely from the neural level seems doomed by the biological equivalent of Heisenberg’s uncertainty principle: one will never be able to gather enough information. At least a cognitive level and a neural level must be assessed in parallel—each mapped to the other. One could even argue that an additional ‘subcognitive’ level may be required to map upwards to the cognitive and downwards to the neural [16]. Such mappings will clearly be most easy when the conceptual nervous system (the cognitive level) is described in neurally realistic terms. Jeffrey Gray’s lasting contribution to modern psychology and neuroscience is to have provided a paradigm example of how this should, and can, be done.

References


Neil McNaughton

Department of Psychology and Neuroscience Research Centre, University of Otago, P. O. Box 56, Dunedin, New Zealand

E-mail address: nmcn@psy.otago.ac.nz

* Tel.: +64-3-479-7634; fax: +64-3-479-8335.