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Laterality and Interhemispheric Transfer in Schizophrenia

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2004

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A thesis presented to the University of Auckland in partial fulfilment of the requirements for the degree of Doctor of Philosophy (PhD)
Abstract

There is a plethora of research describing dysfunction of a single hemisphere (usually the left) in schizophrenia, while there is less evidence to suggest right-hemisphere dysfunction. There is also much evidence to suggest that individuals with schizophrenia have difficulties integrating information between the two cerebral hemispheres or transferring information between the hemispheres. The aim of this thesis was to investigate lateralized and interhemispheric information processing in males with predominantly negative-symptom schizophrenia. This thesis employs behavioural (i.e. computer-based reaction-time tasks), neuropsychological (i.e. the line-bisection task) and electrophysiological (i.e. electroencephalogram) measures to assess laterality and interhemispheric processing in schizophrenia relative to matched controls. In Experiment 1, the Poffenberger (1912) paradigm was used to compare the difference between “crossed” (stimuli and motor response areas are contralateral) and “uncrossed” (stimuli and motor response areas are ipsilateral) conditions to estimate interhemispheric transfer time. Simple reaction time (RT) was recorded to stimuli presented unilaterally or bilaterally in participants who responded using either the left or right hand. While the results provide no evidence for differences between the groups in information transfer or integration between the hemispheres, the schizophrenia group was significantly slower to respond to LVF stimuli, suggesting right-hemisphere dysfunction. In Experiment 2, bilateral gain was assessed using a lexical-decision task where word or non-word judgments were made to letter strings presented in the LVF, RVF, or BVF. The schizophrenia group showed normal lateralization of language to the left hemisphere, but unlike controls who showed a bilateral gain (decrease in RT), they were actually disadvantaged when two stimuli
were presented simultaneously to both hemispheres. In Experiment 3, the line-
bisection task (see Appendix A) was used to estimate right-hemisphere visuospatial
processing. The schizophrenia group showed a rightward bias under certain
conditions, for example when lines were positioned on the right side of the page,
when the right hand was used, and when a right-to-left scan was adopted suggesting a
deficit in the transfer of visuospatial information. In Experiment 4, interhemispheric
transfer was investigated using 128-channel EEG as a direct measure. Evoked
potentials (EPs) were obtained while participants performed the Poffenberger task.
The N160 was measured from homologous occipital sites to assess transfer latency in
milliseconds. While controls had faster information transfer from the right
hemisphere to the left hemisphere, this asymmetry of transfer was absent in the
schizophrenia group who had similar transfer speeds in both directions, i.e. ‘symmetry
of transfer’. Similarly, in Experiment 5, the schizophrenia group failed to show faster
transfer of linguistic information (words and non-words) from the right hemisphere to
the left. In both EEG tasks the schizophrenia group showed a concomitant decrease
in the amplitude of the N160 that was marked over the right hemisphere. This
suggests that right-hemisphere dysfunction, rather than callosal dysfunction may
better explain interhemispheric deficits in schizophrenia. Results are discussed with
reference to Miller’s (1996) hypothesis regarding differences in cerebral hemispheric
specialization and axonal conduction delays. These findings suggest that right-
hemisphere dysfunction may be associated with negative symptoms in males with
schizophrenia.
Acknowledgements

Firstly I would like to thank my supervisors Dr Ian Kirk and Professor Michael Corballis for their brilliant supervision, unrelenting support and good humour throughout the research and writing of this thesis. Special thanks also go to Professor Robert Miller for his support and helpful comments and Dr Tony Fernando for his supply of participants. Much thanks also goes to the many participants who were subjected to various computer-based experiments, neuropsychological tests and a good few hours under EEG nets.

I would like to thank the following organisations that provided the financial support and travel grants to make this thesis possible:

- New Zealand Federation of Graduate Women – The University of Auckland
- The Schizophrenia Fellowship of New Zealand
- The Neurological Foundation of New Zealand
- The Royal Society of New Zealand
- Graduate Research Fund – The University of Auckland
- Research Centre for Cognitive Neuroscience – The University of Auckland
- The Vivian Smith Advanced Studies Institute of the International Neuropsychological Society

Finally thanks to my family who never thought it would end! (David, Jan, Nicola, Jenna and new Kyan) … and of course the best bunch of Cognitive Neuroscientists in the world – Suzi Q, Scooter, all those Matts, Dr Kirkensteins bride, Dr Aguilera, Dr Hamster and bride, Branka, Tom Konjaleftski, Markus, Mel, Guki, young Nick, Karen T, Snipes, Phillipo, Suresh, Paul, Dr Milne, Tom D, Antje, Tony, Lynette – and my many other friends who have put up with me all this time (esp Katherine, Alia, Destin, Corrie, Andréa, Katy-did and the rest of the Blenheimer gang).
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