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Brain rehabilitation

## Cognitive neuroscience and brain rehabilitation: a promise kept

I H Robertson

Good basic research shows unilateral spatial neglect is treatable

There is nothing so practical as a good theory. Thus we justify the basic research into brain and mind that is cognitive neuroscience. Grant proposals end with phrases such as “these results may have implications for the development of effective treatments...” In the paper by Schindler *et al* (this issue, pp 412–9),<sup>1</sup> we see clear evidence for the value of such promissory notes and the practical clinical benefits of grounding brain rehabilitation research in strong, theoretically driven cognitive neuroscience.

Spatial neglect following right cerebral stroke not only causes patients to behave as if the left half of the world does not exist; more practically it prevents them learning to walk again, renders them heavily dependent on carers, and massively reduces their quality of life. Schindler and his colleagues in Munich have shown that doing something quite implausible—applying a standard electromechanical vibrator to the left neck muscles of patients while they engage in visual search exercises—produces marked and enduring clinical and real life benefits.

This treatment arose out of basic research into the brain mechanisms of sensory integration and higher level perception. Neglect patients were studied because of what their damaged brains revealed about the functional architecture of the intact brain. Neck vibration

was used purely because of its known effects on the body’s normal coordinate frame of reference according to which sensory inputs and motor outputs are integrated. In neglect, not only is this egocentric reference frame biased to the right, but also the neck vibration can temporarily correct this imbalance. What we see in the Munich paper is that, when combined with systematic visual search training, and when systematically applied for 15 treatment sessions over three weeks, temporary effects become long lasting and hence therapeutically important.

Similarly impressive results in neglect rehabilitation have been obtained with another new cognitive neuroscience derived treatment—prism adaptation training<sup>2</sup>—and there are several other counterintuitive but potent interventions emerging from modern cognitive neuroscience. One such example is limb activation training, which induces neglect patients to make small movements with the left side of their body in left hemisphere in order to improve their visual attention to the left<sup>3</sup>: acute neglect patients receiving this minimally labour intensive additional treatment are discharged from hospital on average 28 days earlier than patients who do not receive it.<sup>4</sup>

But is there something special about unilateral neglect? Not at all: neglect was considered untreatable in some standard

textbooks as recently as the 10 years ago. It so happens that the theoretical importance of neglect led to a disproportionate amount of basic research into this phenomenon. We are already seeing similar advances in theoretically derived and effective brain rehabilitation in a raft of other disorders, from aphasia to dyspraxia, and from dysexecutive syndrome to attentional deficits.<sup>5</sup>

As with all advances in health care, these treatments will require funds to be implemented. Rehabilitation has suffered in many parts of the world because it is labour intensive and because its evidence base has been lacking. Yet the costs of not treating the damaged brain in the most scientific and efficient way will be much greater in terms of greater dependency and lowered quality of life, particularly as a worldwide ageing population throws up more of these types of now increasingly ameliorable problems.

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