Institution: University of Glasgow

Unit of Assessment: Unit 4; Psychology, Psychiatry and Neuroscience

Title of case study: Expertise in visual injury processes help shape stroke training resource

1. Summary of the impact

Up to 10% of stroke patients experience persistent hemispatial neglect, a lack of perception of space in one half of their visual field, despite their eyesight functioning properly. University of Glasgow researcher Dr. Monika Harvey has led the development of a vision rehabilitation method that was implemented by German stroke units (2011) and applied to over 60 stroke patients. In July 2011 Harvey formulated content for an advanced training module called 'Vision after Stroke', a Scottish Government supported online training resource for stroke healthcare professionals provided by the Stroke Training and Awareness Resources (STARs) Project. In just eight months since launch (December 2012) the module series has had 17 473 unique visitors nationally and internationally with 'Vision after Stroke' the second most popular module in Scotland. To date, 152 healthcare professionals have successfully completed the 'Vision after Stroke' module certificate.

2. Underpinning research

Defining vision control mechanisms

Through an interdisciplinary research team of neuropsychologists and clinical stroke specialists, the University of Glasgow's Dr. Monika Harvey has led a research programme that has furthered our understanding of the vision-control mechanisms.[1]

It has long been known that the neural processes involved in vision comprise two parallel streams – ventral and dorsal – that control vision processes involved in perception and action, respectively. The University of Glasgow led team assessed the relative role of these streams in hemispatial neglect by testing the ability of nine neglect patients (as well as healthy and right hemisphere no neglect control groups) to reach immediately towards a target placed in their left central and right locations (an immediate action) compared with reaching towards a 'delayed target' (where the target was illuminated but the participant had to refrain from reaching towards it, for a further 5 seconds – a delayed action). Neglect patients showed no accuracy impairments when asked to perform an immediate action; conversely, when performing a delayed action (one that required memory of the visual target), they markedly overshoot the target or failed to initiate a reach altogether.[2]

In a subsequent study Harvey and team compared the visuomotor performance of 11 patients with neglect after right hemisphere stroke with those of 19 age-matched controls. This time, participants were asked to point either directly towards targets or halfway between two stimuli, both with and without visual feedback during the movement. Again they did not find any neglect-specific reaching impairments and argued that neglect patients are in fact able to use visual and spatial information for action accurately.[3]

Finally, the team tested 11 patients with left visual neglect (and 21 controls) by asking participants to either point directly towards the side in which the target was presented (pro-pointing) or to the opposite mirror position of the target (i.e. when the target was presented on the right, the participant had to point to the [estimated] mirror location on the left; anti-pointing). Compared to controls, neglect patients showed reduced accuracy when anti-pointing, but, consistent with the previous studies, normal behaviour for pro-pointing. Lesion-behaviour mapping from magnetic resonance images taken from these patients revealed that the areas critically associated with the deficits in anti-pointing, were located in 2 distinct brain locations (the temporal [middle and superior] and parahippocampal gyri). Harvey and colleagues argued that neglect patients present specific deficits only when the visuomotor task taps into more perceptual representations thought to rely on ventral visual stream processing.[4]

This body of work determined, for the first time, that patients with hemispatial neglect are relatively unimpaired at performing target-directed tasks even towards stimuli located in their 'neglected' field.[3,4] The rationale taken from these studies was that actions such as reaching and grasping might allow neglect patients to access visual information not available during perceptual judgements (i.e. perceiving an object on one side of their body). In other words, performing actions may improve the patients' perceptual ability via a 'dorsal-to-ventral' stream recalibration, thus enabling action to ameliorate perception.[1,4,5]

Development of a visuomotor action training rehabilitation technique

As part of a collaborative research project conducted with Profs Robertson and Hood (University of Bristol) between 1999 and 2003, Harvey led the development of a novel rod-lifting rehabilitation programme called visuomotor action training. Over 10 days for 2 sessions a day, patients were asked to grasp and lift rods of varying sizes, placed in different spatial locations in the centre. If the central grasp was not achieved, the rod would tilt and patients were then encouraged to adjust their grasp (until the rod was straight). Chronic neglect patients showed significant recovery (46% improvement) on standard neglect tests compared to those who did not receive the rehabilitation. This was the first demonstration that neglect patients could show significant reductions in symptoms up to one month after treatment.[5]

With her University of Glasgow team, Harvey further refined and optimised the neglect rehabilitation programme (2003 to present) – the number of training sessions was reduced from 2 to 1 a day, rod lifts were reduced from 70 to 50, and long term outcomes were assessed. In addition, possible positive transfer of the training to the patients' quality of life and their ability to perform daily activities were assessed. The optimised programme offered comparable improvements in neglect symptoms which lasted as long as 4 months after treatment. Crucially, a significant increase in the patients' quality of life and ability to perform everyday tasks was demonstrated.[6] With conventional neglect intervention approaches routinely failing to show any improvement in quality of life, Harvey's rehabilitation programme has proved to be unique.[6]

Key University of Glasgow researchers: Monika Harvey (Reader in Psychology [2001-present]), Keith Muir (Senior clinical lecturer [2001-2009], SINAPSE Chair of Clinical Imaging [2009-present]) and his associated clinical team (Southern General Hospital, Glasgow).
Key external collaborators: Dr. Paresh Malhotra (Imperial College London) validated imaging data.[3,4] Professor Ian Robertson (Trinity College Dublin) and Professor Bruce Hood (University of Bristol) – the visuomotor action-training method was initially developed whilst Dr. Harvey was at the University of Bristol (1999-2001) along with Robertson and Hood both of whom contributed to study design.[5] Dr. Stephanie Rossit (Western University (Canada), now University of East Anglia)[1,2,3,4,6.]

3. References to the research.

1. Harvey, M. and Rossit, S. Visuospatial neglect in action. *Neuropsychologia,* 50*,* 1018-1028 (2012). doi: 10.1016/j.neuropsychologia.2011.09.030
2. Rossit, S. *et al.* Immediate and delayed reaching in hemispatial neglect. *Neuropsychologia*; 47, 1563-1572 (2009) doi: 10.1016/j.neuropsychologia.2008.08.00.
3. Rossit, S. *et al*. No neglect-specific deficits in reaching tasks. *Cereb. Cortex* 19, 2616-2624 (2009) doi: 10.1093/cercor/bhp016.
4. Rossit, S. *et al.* The role of right temporal lobe structures in off-line action: evidence from lesion-behaviour mapping in stroke patients. *Cereb. Cortex* 21, 2751-2761 (2011). doi: 10.1093/cercor/bhr073.
5. Harvey, M. *et al.* The effects of visuomotor feedback training on the recovery of hemispatial neglect symptoms: assessment of a 2-week and follow-up intervention. *Neuropsychologia* 41, 886-893 (2003) doi: 10.1016/S0028-3932(03)00003-4.
6. Harvey, M. *et al*. Long term improvements in activities of daily living in patients with hemispatial neglect. *Behav. Neurol.* **23**, 237-239 (2010) doi: 10.3233/BEN-2010-0304.

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SFRH/BD/23230/2005. 01/2006–05/2009, €138,410.

4. Details of the impact

Context

Stroke is the most common cause of severe adult disability and a key healthcare issue in the UK. Every year, 120,000 people in the UK have their first stroke and a further 30,000 people have a subsequent stroke. More than 10% of these stroke patients are left with chronic hemispatial neglect syndrome (neglect) – they are unable to process or perceive objects on one side of their body – even if their sight has been unaffected by the stroke. This syndrome is commonly linked to poor stroke recovery. Individuals with neglect (regardless of severity) typically require additional weeks in hospital (118 days versus 78 days), needing nearly twice as many hours of physiotherapy and occupational therapy, and are more prone to falls and persistent urinary incontinence. Post discharge, patients with neglect are more likely to require ambulatory assistance and long-term institutionalisation or assisted living. University of Glasgow researcher Dr. Monika Harvey has extensive research expertise in the underlying cognitive neuroscience of visual perception, and has successfully used this to train stroke healthcare professionals and help stroke patients with vision disorders.

STARs 'Vision after Stroke' – a training resource for stroke healthcare professionals

In July 2011, as a direct result of her work on neglect rehabilitation and vision-control mechanisms, Dr. Harvey was recruited as an expert advisor in the development of an advanced vision module for the Stroke Training and Awareness Resources (STARs) Project.[a,b] STARs is a freely available, Scottish-Government-backed online training resource for health and social care staff who work with people affected by stroke. Its goal is to equip health professionals with the core competencies outlined in the Scottish Government's Coronary Heart Disease and Stroke Strategy action plan (2002). The approach provides an engaging and interactive learning resource encompassing patient scenarios in a series of video clips and animations with supporting reference materials.

In Scotland, the latest guidelines on stroke-related neglect (Scottish Intercollegiate Guidelines Network, 2010), recognised that there was a lack of understanding of the hemispatial neglect syndrome thus highlighting an unmet training need. The STARs project aims to improve understanding of the visual control processes underlying patients' impairments, which is a paramount consideration if rehabilitation interventions are to succeed. Hemispatial neglect syndrome affects patients' balance and depth perception so that they have difficulty with basic tasks such as dressing themselves, picking up objects and walking or moving around obstacles safely, increasing their chances of injury. This results in greater dependency on the healthcare system and family members, and can be compounded by post-stroke loss of confidence and depression.

The STARs 'Vision after Stroke'[b] module provides targeted training geared towards identifying and assessing appropriate treatment strategies for stroke patients with visual problems. Dr. Harvey led the design of the hemispatial neglect case study contained within this module, outlining its definition and distinction from visual-field loss, methods of assessment, diagnosis, treatment and follow-up. She also provided expert input into the agnosia (inability to recognise common objects) and eye-movement-disorder case studies. The 'Vision after Stroke' module was launched at the December 2012 UK Stroke Forum in Harrogate, a yearly multidisciplinary stroke event attended by approximately 1,500 practitioners. The relevance of the module to routine rehabilitation practice and awareness raising of visual problems in stroke patients is evident from evaluations of the module at this event[b] reporting that…

> *…'[the module] relates directly to my working practice'*
>
> *…'the subject of visual problems [is] interesting as this is not the first thing people in general look at when people have a stroke, but for the patient it can play a large part in their quality of life'*
>
> *…'Found this very interesting and could associate a lot with many patients in the stroke unit and especially a condition known as Charles Bonnet Syndrome which a patient in our ward*

had recently and staff including myself would have benefit with more information when dealing with his care'

Rapid and wide reaching uptake of the STARs 'Vision after Stroke' module

Following its launch, additional dissemination of the 'Vision after Stroke' module was achieved via mailed information to all 31 Scottish stroke units and 991 GP practices. Consequently, the module has experienced a rapid, wide-reaching uptake. In the 8 months from launch to 31 July 2013, the advancing module series of STARs had 17 473 unique visitors browsing the site (an average of 43 pages viewed per visit); users were located in 113 countries worldwide. Whilst these visitors will have been spread across the range of 16 advancing modules, the 'Vision after Stroke' module was noted as the second most popular of all the advancing modules in Scotland thus highlighting the demand for further information in this area. Over the same period, 152 healthcare practitioners successfully completed the 'Vision after Stroke' test evidencing their learning through the module and obtaining the module training certificate. These practitioners ranged from occupational therapists and physiotherapists to doctors and nurses specialising in rehabilitation with users located both across the UK and internationally (e.g. New Zealand).[b] As a direct result of Harvey's research, STARs has addressed a previously unmet training need, providing invaluable support for a range of healthcare providers.

Implementation of visuomotor action-training in rehabilitation clinics

In 2010, Harvey disseminated her neglect rehabilitation work at the Federation of the European Societies of Neuropsychology Annual Meeting in Amsterdam, Holland to over 500 clinicians and researchers. Further to this, the visuomotor action-training technique has been implemented in 1 German Stroke Rehabilitation Centre and 1 stroke outpatient unit. Since its adoption in October 2011, the approach has been applied to over 60 patients with neglect syndrome. This rehabilitation approach is favoured by the clinics as it is inexpensive (for instance, the wooden rods, required for lifting, can be purchased for less than £20), easy to apply (patient and carer can be trained in a single session), does not rely on the patient understanding his or her condition and has shown enhances life quality.[d,e]

5. Sources to corroborate the impact

a. Supporting statement from STARs Stroke Module/Advanced Vision Module Lead
b. Stroke Training and Awareness Resources (STAR) e-learning resource, with vision module
c. Supporting statement from Project manager, Stroke Training and Awareness Resources (STAR), verifying usage/feedback of STARs vision module
d. Supporting statement from the Lead Clinical Neuropsychologist, Neurological Rehabilitation Centre Leipzig, Germany
e. Supporting statement from Professor of Clinical Neuropsychology, Clinical Neuropsychology Unit, Saarbruecken, Germany