Institution: The University of Edinburgh

Unit of Assessment: 4

Title of case study: L: Enhancing public understanding of human cognition

1. Summary of the impact (indicative maximum 100 words)

Impact: Public engagement: interactive demonstrations of human cognition on BBC web pages completed by 251,757 people since 2008.

Significance: The involvement of massive numbers of the public who, by successfully completing on-line tests, acquired an understanding of cognition and memory.

Beneficiaries: The public.

Attribution: As a result of his published research on human cognition at the University of Edinburgh from 2004, the BBC invited Professor Robert Logie to develop interactive demonstrations for the public.

Reach: Worldwide: 251,757 people from 150 countries. Media coverage, two Reader's Digest books (2011 and 2012) and exhibits in a major new science exhibition, launched 2013.

2. Underpinning research (indicative maximum 500 words)

Research since 2004 on human working memory by Professors Robert Logie and Sergio Della Sala (Professors of Human Cognitive Neuroscience at the University of Edinburgh, both 2004–present), led to the identification of different kinds of memory and an understanding of how each form of memory is differentially affected by age.

In particular, the research demonstrated the conditions under which younger and older healthy people can perform two memory tasks at the same time, with no drop in their ability compared with performing the memory tasks one at a time [3.1]. This same approach was successful in demonstrating that memory for sequences of movements or pathways is much more demanding than is memory for remembering the pathways as single visual patterns [3.2]. The research also demonstrated [3.3] that some forms of brain damage result in a problem in translating a verbal description of a scene or a sequence of movements into a mental picture of what is described, in contrast to other forms of brain damage that affect the ability to describe a scene that is in full view. These findings suggest that different networks in the brain are responsible for each different kind of memory ability.

The research [3.4] showed that memory ability for visual patterns tends to start declining when healthy adults are in their early 20s, and further declines throughout the lifespan. In contrast, verbal memory ability tends to improve slightly in early adulthood, and only starts to decline when people are reaching their late 60s. Crucially, that same research showed that tests used for assessing cognitive ability in young people might not be measuring the same cognitive abilities when they are used to assess older people. Further, the research [3.5] found that ability to remember to carry out intended tasks (known as prospective memory) tends to decline throughout adulthood, whereas the ability to remember events experienced in the past (known as retrospective memory) tends to improve during adulthood until levelling off in the late 40s. The research was designed also to address aspects of working memory in everyday life, and to develop tests of memory that could be used by the public [3.4–3.6].

3. References to the research (indicative maximum of six references)

3.1 Logie R, Cocchini G, Della Sala S, Baddeley A. Is there a specific executive capacity for dual task co-ordination? Evidence from Alzheimer's disease. Neuropsychology. 2004;18:504–13. DOI:

10.1037/0894-4105.18.3.504.

3.2 Rudkin S, Pearson D, Logie R. Executive processes in visual and spatial working memory tasks. Q J Exp Psychol. 2007;60:79–100. DOI:10.1080/17470210600587976.

3.3 Logie R, Beschin N, Della Sala S, Denis M. Dissociating mental transformations and visuo-spatial storage in working memory. Evidence from representational neglect. Memory. 2005;13:430–4. DOI: 10.1080/09658210344000431.

3.4 Johnson W, Logie R, Brockmole J. Working memory tasks differ in factor structure across age cohorts: implications for dedifferentiation. Intelligence. 2010;38:513–28. DOI:10.1016/j.intell.2010.06.005.

3.5 Maylor E, Logie R. A large-scale comparison of prospective and retrospective memory development from childhood to middle-age. Q J Exp Psychol. 2010;63:442–51. DOI: 10.1080/17470210903469872.

3.6 Logie R, Maylor, E. An internet study of prospective memory across adulthood. Psychol Aging. 2009;24:767–774. DOI: 10.1037/a0015479.

4. Details of the impact (indicative maximum 750 words)

Pathways to impact

Following an invitation from the BBC in 2006, Professor Logie designed interactive demonstration tests of working memory derived from his research carried out from 2004 at the University of Edinburgh (demonstrations). These interactive demonstrations were then made available on the BBC Science web pages.

Impact on public engagement

Since 2008, approximately 250,000 people [5.1] from 150 countries spontaneously found and engaged with the demonstrations on the BBC web pages via the internet on their own computers. Around 160,000 of these people aged between 8 and 80 chose to complete all the demonstrations. All participants were given feedback on their performance in the demonstrations, along with an explanation of the cognitive ability that each demonstration was intended to test. The recorded performance levels showed that those who completed all the tests clearly understood what they were required to do, in that they generated performance patterns that were similar to those found in controlled laboratory studies using very similar tests. The results from the demonstrations were of sufficiently high scientific quality to meet the standards required for publication in peer-reviewed journals that have exacting standards [see, e.g., 3.4–3.6]. As a result, this large database has been used to address a series of different research questions about changes in cognitive function across age. Seven such papers have been published from the database thus far. Although participants were self-selected as having internet access and sufficient knowledge of English to complete the demonstrations, they represented a much wider range of age, of formal education and of social background than is typical for volunteers in experimental psychology research. Volunteer participants from the public who take part in laboratory studies are typically highly motivated to understand what cognitive tests are measuring. The fact that over 230,000 members of the public from over 150 countries found the demonstrations on the BBC Science web site, and chose to spend up to 30 minutes attempting the demonstrations, is evidence that the demonstrations attracted their interest and engaged commitment of both time and mental activity. The data quality from over half of these individuals indicated that they gained sufficient understanding to complete all the demonstrations successfully.

Further impact arose from the demonstrations being chosen to feature on the BBC daily current affairs programme ‘The One Show’ in April 2009. Over three days, 27,000 viewers of the programme completed all the demonstrations on-line, including the high-profile guests who were interviewed on the programme that week. At the request of the BBC, the scores for the viewers who participated were analysed and placed on ‘The One Show’ web site along with an explanation

of the demonstrations and the results. The BBC controls the availability of the demonstrations on its web pages but, at the time of writing, the tests are still available for completion by members of the public via The One Show web site [5.2]. There are comments on The One Show web page from people who completed the tests.

The highlighting of demonstrations by the BBC, and on The One Show in particular, has resulted in multiple spontaneous requests from both print and broadcast popular media [e.g., 5.3] to Professor Logie for comment and interview on a wide range of questions regarding human memory. Further evidence of the impact of the demonstrations on a broader audience came from Professor Logie being invited to be the main consultant for a 320-page Reader's Digest book on Cognitive Ageing for the public, published in August 2011 [5.4], and the same for a further similar book published by Reader's Digest in August 2012 [5.5]. The demonstrations have now been modified and included in a major new public exhibition, 'Bodyworks', launched in March 2013 at the Glasgow Science Centre (annual footfall >270,000) [5.6]. Acknowledgement of the contribution of the demonstrations from the University of Edinburgh is on display in the exhibition.

5. Sources to corroborate the impact (indicative maximum of 10 references)

5.1 The complete dataset is available to confirm the total number of participants. https://www.psy.ed.ac.uk/ref/ [login details: username - ref, password - 5time+Sea].

5.2 BBC "The One Show" memory test results (2009). http://www.bbc.co.uk/theoneshow/getinvolved/memory_test_results1.shtml.

5.3 MSN news item (2012) reporting the demonstrations and the outcomes and quoting Prof Logie's research. http://style.uk.msn.com/health/memory-masterclass.

5.4 Reader's Digest Association (2011). A Sharp Brain for Life. London: Reader's Digest Association. *[Available on request.]*

5.5 Reader's Digest Association (2012). As Young as You Feel. London: Reader's Digest Association. *[Available on request.]*

5.6 Bodyworks Exhibition at the Glasgow Science Centre (2013). http://www.glasgowsciencecentre.org/bodyworks/my-bodyworks.html.