Institution: University of Bristol

Unit of Assessment: 4 – Psychology, Psychiatry and Neuroscience

Title of case study: The 2011 Royal Institution Christmas Lectures: changing the public's understanding of the mind and brain

1. Summary of the impact

Public understanding of the brain and key concepts in cognitive development was improved through the Royal Institution (RI) Christmas Lecture series, "*Meet Your Brain*", which was delivered in 2011 by Bruce Hood, Professor of Developmental Psychology in Society at the University of Bristol and was based on research conducted at the Bristol Cognitive Development Centre. The series was broadcast twice in the UK on the BBC, reaching 4 million viewers in total. The success of the series subsequently led to Hood giving invited lectures in Asia in 2012 and 2013, which were broadcast on national television, reaching over 7 million viewers over the two years.

In 2012, young people between the ages of 9 and 14 participated in a live version of the lecture series and were tested on their knowledge before and after the series; average test score went from 40% to 75%, showing an increased understanding and further testing showed a 73% retention rate of this knowledge 2 months after the lecture.

The content of Hood's lectures forms the basis of *The Brain Bank* - a website about basic cognitive neuroscience, which provides tools and resources for educators. The website is distributed through the RI, Society of Biology, and UK Association for Science Centres and has received over 22,000 visits since its launch in January 2013.

2. Underpinning research

Hood joined the School of Experimental Psychology, University of Bristol in 1999, leaving Harvard to establish the Bristol Cognitive Development Centre (BCDC) for the study of cognitive development across childhood. The centre has provided research infrastructure and facilities for Hood and a team of PIs: Dr Josie Briscoe (Lecturer 2005-current), Norman Freeman (Professor of Cognitive Development 2000-current, now Emeritus), Christopher Jarrold (Professor in Cognitive Development (2009-current); Reader (2003-2009); Lecturer (1998-2003)) and Dr. Liz Pellicano (Lecturer 2007-2009). The BCDC has received over £2M in research funding to support its work from a range of funders including the Medical Research Council (MRC), the Economic and Social Research Council (ESRC) and charity.

There are three main research themes within the BCDC:

I. The mechanisms and development of social cueing including the processing of facial information

II. The development of inhibitory control

III. Children's capacity to navigate in space

All three research areas are the basis of the material that was presented in the RI lectures and subsequent, related activities.

Social Cueing

Since establishing the BCDC, Hood has continued to build on seminal research he conducted on social cueing. In 1998, while at Harvard, he was the first to demonstrate that infants perceive the direction of adults' gaze and that this perception triggers corresponding shifts of their own attention. Hood developed this further at Bristol by examining children's ability to use mutual eye gaze as a cue to friendships in others, finding that by age 6 children reliably detected and justified mutual gaze as a cue to friendship [1]

Inhibitory Control

Most complicated human acts require coordination and the use of inhibitory control to regulate

between competing demands. This capacity is mediated by the developing frontal lobes of the brain. This provides one explanation of why young children can be impulsive. Work published by the BCDC in 2011 has shown that the child's ability to suppress pre-potent thoughts and actions predicts their performance of search tasks that tap into physical reasoning [2].

Attention during Navigation

Brains evolved only in animals that need to navigate and predict their environments, so the generation of useful actions may be the primary driver for neural processing. Surprisingly little research has been conducted on children's spatial navigation; however, over the last ten years the BCDC has developed and installed the first large-scale, computer controlled search environment that enables measurement and modelling of children's search efficiency as an indicator of spatial cognition [3-4].

The three research themes of social cueing, inhibition and attention, as well as the broader research carried out within the School of Experimental Psychology formed the basis of the 2011 Royal Institution Christmas Lectures, "*Meet Your Brain*" and subsequent spin-off activities described in Section 4.

3. References to the research

Outputs

[1] Nurmsoo, E., Einav, S. & Hood, B.M. (2012) 'Best friends: children use mutual gaze to identify friendships in others', *Developmental Science*, 15: 417-425. DOI: 10.1111/j.1467-7687.2012.01143.x

[2] Baker, S.T., Gjersoe, N.L., Sibielska-Woch, K., Leslie, A.M. & Hood, B.M. (2011) 'Inhibitory control interacts with core knowledge in toddlers' manual search for an occluded object', *Developmental Science*, 14: 270-279. DOI: 10.1111/j.1467-7687.2010.00972.x

[3] Smith, A.D., Gilchrist, I.D., Cater, K., Ikram, N., Nott, K. & Hood, B.M. (2008) 'Reorientation in the real world: the development of landmark use and integration in a natural environment', *Cognition*, 107: 1102-1111. DOI: 10.1016/j.cognition.2007.10.008

[4] Pellicano, E., Smith, A. D., Cristino, F. Hood, B. M., Briscoe, J. & Gilchrist, I. D. (2011) 'Children with autism are neither systematic nor optimal foragers', *Proceedings of the National Academy of Sciences*, 108: 421-426. DOI: 10.1073/pnas.1014076108

Grants

[5] Hood (2008-2011) *Developing dynamic gaze processing,* MRC, £543,000.

[6] Hood (2007-2010) *Conceptual change as the combination of domain-specific and domain-general mechanisms*, ESRC, £408,000.

[7] Hood & Gilchrist (2005-2008) *The development of strategies for searching and navigating through space*, MRC, £165,000.

[8] Hood & Gilchrist (2003-2004) *Human search behaviour as a measure of foraging*, BBSRC, £40,000.

4. Details of the impact

Initiated by Michael Faraday, the Christmas Lectures were first held by the Royal Institution in 1825. Ever since, lecturers have sought to present scientific subjects to a general audience – particularly young people – in an informative and entertaining manner. Since 1966, the BBC has broadcast the annual lectures nationally as a three-part series of 1 hour programmes. Some of the more notable lecturers have included Sir David Attenborough, Richard Dawkins, Carl Sagan and the psychologists Sir Frederick Bartlett and Richard Gregory.

In 2011, Hood delivered the Royal Institution Christmas Lectures in a series titled, "*Meet Your Brain*". The first lecture, "*What's inside your head?*", introduced the audience to the structure and functions of the brain. The second lecture, "*Who's in control anyway?*", examined the issue of executive control, including inhibitory control, and attention during tasks such as navigation. The third and final lecture, "*Are you thinking what I'm thinking?*", investigated social brain mechanisms, including social cueing. The content of these lectures drew directly on work carried out at the

BCDC and included demonstrations of navigation, eye-tracking of faces, inhibitory failure, and automatic social cueing of gaze.

Reaching a large UK audience

The BBC4 broadcast of the first lecture of "*Meet Your Brain*" was on Dec 27th at 8pm and was seen by 1.06 million people with the subsequent two lectures reaching over 700 and 800 thousand people respectively [a]. Independent polling analyses carried out for the BBC revealed an audience appreciation index (AI) average of 89% [a]. For comparison, BBC1's premier series "*Dr Who*" averages 86% AI. As a result of the phenomenal success of this BBC4 screening, "*Meet Your Brain*" was re-broadcast on BBC2 between January 24th and 27th, 2011 – a first for the Christmas Lectures.

The "*Meet Your Brain*" lecture series is permanently available on the Royal Institution Channel [b], and as of June 3rd 2013, the lectures have attracted over 57,000 views in total [c]. With over 27,000 views, Lecture 1 of Hood's series is ranked as the most popular video on the RI site [c],

Reaching an international audience

In July 2012, at the request and support of the British Council, Hood travelled to Japan and Singapore to present live versions of the lectures, which were then also broadcast on national television in these countries. It is estimated that an additional 1 million people, in Asia alone, viewed these broadcasts [d]. Hood's Asian tour was so successful that in April 2013 the British Council again invited him to deliver a "Smart Talks" lecture in China (Beijing, Qingdao & Guangzhou) and South Korea (Seoul). These lectures were also broadcast on national television. The British Council estimates that 1,700 students attended this lecture tour in China, and that the associated media reached approximately 6 million people [d].

Improving understanding among youth

On April 25th 2012, Hood delivered the live version lectures to teenagers as part of Bristol University's widening participation scheme, which provides opportunities for potential applicants to find out more about the University of Bristol and higher education in general. Participants ranged in age from 9 to 14 years, with a mean age of 12; there were 42 boys and 64 girls. In order to formally assess the impact of the lecture, children were tested on their knowledge about the brain with specific questions that would be covered in the lecture. This was done at four time points: before the lecture; immediately after the lecture; 2 weeks after the lecture; and 2 months after the lecture. They were also asked whether they had discussed with others about what they had learned in the lecture. Mean correct responses for the group for all questions prior to the lecture were 40% and after the lecture 75%. Overall retention of knowledge was 73% at two months. To put this in perspective, studies have shown that after only 24 hours, the average retention rate of material presented in a lecture is 5% [e].

Furthermore, there was evidence that children had been motivated by the lecture. Immediately after the lecture, 61% had discussed some of the demonstrations with others, but this rose to 82% after two months, indicating that the lecture had left a lasting impact. This quantitative evaluation of the impact of the results has now been published in a peer reviewed journal article [f].

Developing educational tools and resources

Following the evaluation in 2012, "*The Brain Bank*", an on-line teaching and learning resource, was launched as a direct compendium to "*Meet Your Brain".* The website (thebrainbank.org.uk) is designed for the use of teachers and science-centre staff who would like to incorporate demonstrations and activities into their presentations to help students understand concepts about the brain. The Brain Bank re-presents content from the Christmas Lectures including video clips, demonstrations, discussion points, exercises and Key Stage learning objectives for teachers to download. The Brain Bank has been endorsed by the Royal Institution and the Society of Biology, which is the professional body who advise the Government, influence policy, advance education and professional development and engage and encourage public interest in the life sciences. The Brain Bank was featured in the professional magazine of the Association for Psychological Research [g]- the largest body of psychologists with 20,000 members worldwide and distributed through the UK Association for Science Centres. Since its launch in Jan 2013, the Brain Bank has

had 22,230 visits as of June 3rd 2013.

5. Sources to corroborate the impact

[a] Email from Leesa Rumley, Windfall Films Ltd.

This email provides the BBC4 viewing figures and the Audience Appreciation (AI) index for the lectures.

[b] Ri Channel (2011) '*Christmas Lectures 2011 – Meet your Brain'* URL: http://richannel.org/christmas-lectures/2011/meet-your-brain [accessed online 18th Sept 2013].

This is the web location for the permanent repository for the lectures.

[c] Digital Manager, Royal Institution of Great Britain.

This letter provides the access rates for the material available on the RI website.

[d] Education Marketing Officer China, British Council.

This letter provides the viewing figures for the Asian broadcasts of the lectures.

[e] Sousa, D. (2001) *How the Brain Learns.* The University of Michigan: Corwin Press. ISBN 0-7619-7765-1.

Page 95 of this publication provides context for average retention rates for a lecture.

[f] Gjersoe NL, Hood B (2013) Changing Children's Understanding of the Brain: A Longitudinal Study of the Royal Institution Christmas Lectures as a Measure of Public Engagement. PLoS ONE 8(11): e80928. doi:10.1371/journal.pone.0080928

[g] "Psychological Science Gains Currency in the BrainBank", *Observer,* 26 (February 2013) <http://www.psychologicalscience.org/index.php/publications/observer/2013/february-13/psychological-science-gains-currency-in-the-brainbank.html>