

Institution: University of Cambridge
Unit of Assessment: 35 (Music, Drama, Dance and Performing Arts)
Title of case study: Music, Evolution and Communication: Research by Ian Cross
<p>1. Summary of the impact</p> <p>Research by Professor Ian Cross and his co-workers in the Centre for Music and Science (CMS) investigates the evolutionary foundations of human musicality especially in respect of relationships between music and language. It has had impact in the domain of public engagement with science through frequent media representation and active outreach. It has also helped to shape public discourse concerning the nature of music and its role in contemporary society, as reflected in the assimilation of ideas deriving from CMS research into the treatment of music from scientific perspectives in print, broadcast and digital media.</p>
<p>2. Underpinning research</p> <p>Cross is Director of the Centre for Music and Science, which was founded in 2003 within the Faculty of Music in the University of Cambridge. From 2003 to 2011 Cross was the sole permanent member of staff; he was joined in 2011 by Professor Sarah Hawkins (an employee of the University of Cambridge since 1986), whose background is in experimental psychology and phonetics. The Centre is also a focus for postdoctoral and graduate research, with fifteen graduate students at the census date, its own programme of specialist seminars, and regular visits by scholars based outside the UK.</p> <p>Cross's research explores music from a range of perspectives, including acoustics, archaeology, cognitive science, computer science and linguistics; at its core is theoretical and experimental research concerned with understanding music as an interactive medium. This work has resulted in a research focus within the CMS on the exploration of the commonalities and differences between music and language, a focus strengthened by the arrival of Hawkins. Her expertise is engaged with the underpinning of collaborative experimental and theoretical work exploring music and speech as primary components of a broad human communicative toolkit, as well as intelligibility of sung texts.</p> <p>In over fifty publications (peer-reviewed journal articles, book chapters and conference proceedings, from 1999 to the present) that have generated considerable media interest, Cross has drawn on ethnomusicological, cognitive-behavioural and neuroscientific evidence. He has worked with numerous international collaborators to suggest that music and language constitute complementary components of the human communicative toolkit (see Section 3a). Additionally, he has developed and explored the idea that music, across cultures, exhibits common features that are likely to have been evolutionarily adaptive. This work has led him to the view that these features suggest that music is best interpreted as a communicative medium optimised for the management of situations of social uncertainty (Section 3b), in part because of the potential of participatory music-making to enhance a sense of group solidarity.</p> <p>Development of this theoretical framework underpins ongoing research in the CMS, investigating speech and music in action (Section 3c) as well as undertaking empirical studies which explore the ways in which engagement with others in music-making can influence the cognitive, affective and social capacities of participants. For example, a year-long study on music-making by children</p>

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between the ages of 8 and 11 has provided strong indicative evidence that interacting through music in small groups on a regular basis greatly improves a child's ability to empathise with others (Section 3d).

Cross has been commissioned by Oxford University Press to publish research on the state of the art in the interdisciplinary study of language and music (Section 3e); on current thinking on music and evolution within the framework of theories of communication (Section 3f); and on the empirical and theoretical foundations of the neuroscience of music (Section 3g).

The Centre has hosted international conferences and workshops on the topic, including *Language and Music as Cognitive Systems*, in 2007, *SysMus10* (International Conference of Students of Systematic Musicology) in 2010, and a series of seminars sponsored by the *British Psychological Society* on music and language in 2010-11.

3. References to the research

- a) Cross, I. (2007). Music and cognitive evolution. In Robin Dunbar & Louise Barrett (Eds.) *Oxford Handbook of Evolutionary Psychology*, (pp649-667), Oxford, Oxford University Press.
- b) Cross, I., Fitch, W. T., Aboitiz, F., Iriki, A., Jarvis, E. D., Lewis, J., Liebal, K., Merker, B., Stout, D., and Trehub, S. E. (2013). Culture and evolution. In Michael Arbib (Ed.) *Language, Music and the Brain*, (pp541-562), Strüngmann Forum Reports, Vol. 10, Cambridge, MA, MIT Press.
- c) Hawkins, S., Cross, I., Ogden, R. (2013). Communicative interaction in spontaneous music and speech. In Martin Orwin, Christine Howes, and Ruth Kempson (Eds.) *Language, Music and Interaction* (Communication, Mind and Language, Vol.3, pp285-329), London: College Publications.
- d) Rabinowitch, T.-C., Cross, I. and Burnard, P. (2012). Long-term musical group interaction has a positive influence on empathy in children. *Psychology of Music* (doi: 10.1177/0305735612440609), 1-15.
- e) Rebuschat, P., Rohrmeier, M., Hawkins, J. and Cross, I. (Eds.) (2012). *Language and Music as Cognitive Systems*. Oxford, Oxford University Press, 383 pp.
- f) Cross, I. & Morley, I. (2009). The evolution of music: theories, definitions and the nature of the evidence. In Stephen Malloch and Colwyn Trevarthen (Eds.) *Communicative Musicality* (pp61-82), Oxford, Oxford University Press.
- g) Cross, I. (2003). Music, cognition, culture and evolution. In Robert Zatorre and Isabelle Peretz (Eds) *The Cognitive Neuroscience of Music* (pp42-56), Oxford, Oxford University Press.

All outputs can be supplied by the University of Cambridge on request.

4. Details of the impact

The research undertaken at the Centre for Music and Science has had impact since 2008 well beyond academia, embracing direct outreach, media representation, and influences on public discourse concerning music in society, as well as impact on specific industrial working practices.

CMS research has been represented widely in the media, including internet, print, radio and television. Interviews with Cross and representations of his research have appeared in the magazines *Archaeology* (2008) and *Science* (2010), on BBC R3 and R4 (in 2008, 2009, and most recently in the May-June 2013 series *The Science of Music*; see Section 5a) and in numerous independent radio productions, on film (*Music of the brain*, 2009, Screen Australia/f-reel pty Ltd) and on the web (e.g., *Guardian* podcast in 2008, *Pacific Standard* webzine, 2012, *Naked Scientist* podcast, April 2013), while CMS researchers have contributed to television programmes for BBC1 and most recently More4 (*What makes a masterpiece?*, broadcast in January 2012).

The strands of research within the CMS that have elicited the most media interest are those concerned with music, evolution and communication, including the impact on empathy. Ideas and findings from CMS publications have been widely cited, and have been disseminated through published or broadcast interviews and via secondary sources that have drawn on CMS publications; this has led to the incorporation of ideas derived from CMS research into media debates concerning the role and value of music in society in a wide range of internet sources (Section 5b, dating from January 2012 to February 2013) and in newspapers and magazines (such as *Science News*, Section 5c, dated 14.VIII.10).

They are also represented in a popular science book, *The World in Six Songs* (Section 5d, 2008), of which a reviewer wrote in *New Scientist*: ‘... a fantastic ride. Along the way, you’ll hang out with Sting, Joni Mitchell and Oliver Sacks, as well as people you likely won’t have heard of but will be equally interested to meet, like music theorist Ian Cross’ (Section 5e, dated 20.VIII.08). These reflections of CMS research in popular media have helped to place science as a significant element in public discourse concerning the nature of music and its role in society, and have enhanced societal understandings of music as embedded in both biology and culture.

Another direct impact of CMS research on the social (empathic) effects of joint music-making has been on work practices in the oil and gas industry. Senior executives from the BG Group encountered Cross’s ideas and research at a seminar in Pembroke College on 20.VII.12 and realised that joint music-making might provide an excellent means of team bonding to enhance health and safety in the field, an approach that they have found to be efficacious: in the words of BG’s Executive Vice President for HR, ‘I cannot thank the Cambridge team and Professor Cross enough, the application of the theories discussed at Pembroke will help us to ensure that people working for BG remain free from injury and are able to go home to their friends and family each and every day’ (Section 5f, dated 19.VI.13).

Cross has also brought his research to wider attention through extensive public engagement activities. He has contributed to events organised by the Wellcome Trust and the Royal Society, in both cases aimed at public dissemination of recent thinking and research on music from scientific perspectives (e.g., participating in *Beautiful Noise*, held at the South Bank Centre London in June 2010, and presenting as part of the *Pint of Science* festival in Cambridge in May 2013, this latter attended by around 170 members of the public). He was guest speaker at the 46th *Academia Film Olomouc* in the Czech Republic, discussing three documentary films on scientific research into music for public audiences of around 250 for each film. CMS members contributed to the University’s Science Museum’s *Science Live* event in 2011, and all members of the Centre have also been closely involved in the Faculty of Music’s outreach programme, holding a *CMS Family Day* in 2011 and a day-long event *The Mind Behind the Music* for the Cambridge Festival of Ideas in 2012, at both of which children (mainly teenagers), teachers and parents encountered music and science through discussion with CMS members and by participating in experiments (each event

involved some 150 participants). CMS members also wrote, organised and presented *Good Vibrations*, a musical show about music and maths designed for primary school-age children, which filled the Faculty's Concert Hall (with a capacity of 500) for both of its performances at the University's Festival of Ideas in 2010 and 2011.

5. Sources to corroborate the impact

- a) Cross's most recent media contribution is to the series *The Science of Music*, four programmes broadcast in May-June 2013 on BBC Radio 4: <http://www.bbc.co.uk/programmes/b01sk5xs>
- b) <http://funmusicco.com/general/why-music-education-is-so-important/> (webpage of commercial music education company, referencing Cross's early ideas concerning music's evolutionary significance)

<http://www.psmag.com/culture/making-music-together-increases-kids-empathy-41627/>,
<http://healthland.time.com/2012/05/16/want-a-less-fussy-easier-to-soothe-kinder-child-make-music/> (media accounts of research by Rabinowitch and Cross on relationships between group music-making and children's empathic capacities, dated 23.IV.12 and 16.V.12)

<http://biologos.org/blog/he-who-has-ears-music-neuroscience-and-evolution-part-3>,
<http://saintrafe.blogspot.co.uk/2013/02/neurobiology-and-traditional-liturgy.html>,
<http://gracereactor.wordpress.com/2012/02/03/> (theological blogs drawing on media reports of Cross's conceptualisations of music as a communicative medium to reflect on the value of traditional liturgy in collective worship, dated 22.I.12, 19.II.13, 3.II.12)
- c) http://www.sciencenews.org/view/generic/id/61610/title/Comment_Whatever_music_is_it_s_a_basic_part_of_being_human
- d) *The World in Six Songs* (Dan Levitin, Dutton, 2008): popular science text, in which a chapter is devoted to Cross's ideas on music and evolution
- e) Review of Dan Levitin, *The World in Six Songs*, *New Scientist*, 20.VIII.08
- f) Email of 19.VI.13 to the Corporate Partnership Programme Co-ordinator, Pembroke College, Cambridge, from BG's Executive Vice President for HR, concerning the impact of Cross's ideas on BG's working practices in the oil and gas extraction industry.