

Institution: University College London		
Unit of Assessment: 4 - Psychology, Psychiatry and Neuroscience		
Title of case study: Raising cultural awareness and understanding of the neurobiology of laughter		
Period when the underpinning research was undertaken: 2005 - 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Sophie Scott	Professor of Cognitive Neuroscience	1998 - Present
Period when the claimed impact occurred: 2013 to 2020		
Is this case study continued from a case study submitted in 2014? No		
1. Summary of the impact <p>Laughter is fundamental to humanity, but its neurobiological aspects have been under-researched and poorly understood. Professor Sophie Scott's research at UCL has helped millions of people to better understand and appreciate how and why we use laughter in our social interactions through appearances on television, podcasts, in national and international newspapers and at public talks, lectures and performances. Scott has influenced the approach of comedy writers, performers and producers both directly through workshops and seminars, and indirectly through her published work and appearances. She has brought neuroscience to new audiences by shedding new light on international news stories involving laughter.</p>		
2. Underpinning research <p>Professor Sophie Scott has been researching the neurobiology of human emotional vocalisations since 1997. In the early 2000s, her research developed to include positive expressions of emotion, such as laughter, which she has studied with functional neuroimaging, experimental and cross-cultural approaches. Research that Scott and colleagues conducted at UCL showed that laughter has a distinct acoustic profile, and they were the first to demonstrate that laughter is robustly recognised across cultures [R1].</p> <p>In terms of neural systems, her research revealed that the perception of laughter primes orofacial mirror systems [R2] and that this effect is reduced in boys at risk of psychopathy [R3]. Her work was the first to show a difference in brain responses to involuntary, spontaneous laughter, and more communicative, controlled laughter [R4]. Scott has developed this into a theoretical model of the social-emotional role of laughter in communication [R5]. In 2019, her rigorous research demonstrated that adding laughter to jokes makes the jokes seem funnier [R6] and that the more spontaneous the laughter, the funnier it makes the joke. This finding has important implications for the experience of comedy in audiences, particularly when the audiences are under isolated COVID-19 conditions. As part of her research process, Scott trained as a stand-up comedian through the Bright Club initiative in 2010 to explore laughter in a performance context and to study the social nature of comedy, the way performers organise laughter, and the role laughter plays in the relationship between comedian and audience.</p> <p>Before this body of research, laughter was conceived of as synonymous with humour and comedy, and not considered a scientific topic of study in its own right. Scott's work has been critical to a cultural shift towards a new public perception of laughter as being a crucial part of human communication and mental health.</p>		

3. References to the research

- [R1] Sauter, D. A., Eisner, F., Ekman, P., & Scott, S. K. (2010). The universality of human emotional vocalisations. *Proceeding of the National Academy of Sciences*, 107(6), 2408-12. doi: [10.1073/pnas.0908239106](https://doi.org/10.1073/pnas.0908239106)
- [R2] Warren, J. E., Sauter, D. A., Eisner, F., Wiland, J., Dresner, M. A., Wise, R. J., Rosen S., & Scott, S. K. (2006). Positive emotions preferentially engage an auditory-motor "mirror" system. *Journal of Neuroscience*, 26(50), 13067-75. doi: [10.1523/JNEUROSCI.3907-06.2006](https://doi.org/10.1523/JNEUROSCI.3907-06.2006)
- [R3] O'Nions, E., Lima, C. F., Scott, S. K., Roberts, R., McCrory, E., & Viding, E. (2017). It's no laughing matter: reduced laughter contagion in boys at risk for psychopathy. *Current Biology*, 27(19), 3049-3055. doi: [10.1016/j.cub.2017.08.062](https://doi.org/10.1016/j.cub.2017.08.062)
- [R4] McGettigan, C., Walsh, E., Jessop, R., Agnew, Z. K., Sauter, D. A., Warren, J. E., & Scott, S. K. (2015). Individual differences in Laughter Perception Reveal Roles for Mentalizing and Sensorimotor Systems in the evaluation of emotional authenticity. *Cerebral Cortex*, 25(1), 246-57. doi: [10.1093/cercor/bht227](https://doi.org/10.1093/cercor/bht227)
- [R5] Scott, S. K., Lavan, N., Chen, S., & McGettigan, C. (2014). The social life of laughter. *Trends in Cognitive Neurosciences*, 18(12), 618-20. doi: [10.1016/j.tics.2014.09.002](https://doi.org/10.1016/j.tics.2014.09.002)
- [R6] Cai, Q., Chen, S., White, S. J., & Scott, S. K. (2019). Modulation of humor ratings of bad jokes by other people's laughter. *Current Biology*, 29(14), R677-R678. doi: [10.1016/j.cub.2019.05.073](https://doi.org/10.1016/j.cub.2019.05.073)

4. Details of the impact

By its very nature, Scott's work on laughter can deliver powerful impact among a broad demographic. In the words of Jimmy Carr, "*Laughter is at the very heart of what it is to be human - our superpowers as a species are communication & co-operation & laughter is central to both. Laughter is the glue that holds families, tribes & societies together. Sophie Scott's work is though provoking, rigorous & brilliant. She's not only finding answers, she's asking questions that reveal so much about our minds & our humanity*" [S1]. Scott's in-depth scientific understanding of the neurobiological basis for laughter, and the insights this offers into our social communications, has a broad inherent public interest. Scott's engagement activities use her understanding of people's own involuntary responses to open up discussions about humour, language, communication, brain systems, voices, mental health and evolution. Her talks give audiences a new and lasting appreciation for something they used to see as commonplace, bringing neuroscience to the public in an accessible way. Her work on the relationship between comedy, audience and laughter has a more specific interest for those involved in producing, performing or consuming comedy.

Laughter as communication

Scott was invited to speak at the main TED meeting in Vancouver in 2015 [S2]. Her TED talk 'Why We Laugh' has since been viewed over 4 million times via the TED site and a further 522,000 times on YouTube. In this talk, Scott built on her findings of how the brain processes laughter to explore the complex ways that humans use laughter in communication and emotion regulation. Her talk has been translated into 35 different languages and is used as English language teaching materials in Japan. TED organiser Chris Anderson (in his book, *TED talks: the official guide to public speaking*) identifies the talk as an exemplary case of how to present a new idea (that laughter is a form of communication). He describes the impact on audiences: "*By the end of [her talk], everyone was basking in the warm glow of a deeply pleasurable experience. But there was something else. None of us would ever think of laughter in quite the same way again. Sophie's core idea about laughter – that its evolutionary purpose is to convert social stress into pleasurable alignment – had somehow entered our heads. And now, whenever I see a group of people laughing, I see the phenomenon through new eyes. Yes, I feel the joy, I feel the urge to join in. But I also see social bonding, and a strange and ancient biological phenomenon at work that makes the whole thing seem even more wondrous*" [S3]. The talk was selected as one of the 5 best TED talks that bring us joy in the Covid pandemic: indeed, it was presented as "*the most needed talk of all*" [S4].

The Royal Institution of Great Britain (RI) selected Scott to deliver their 2017 Christmas Lectures, the UK's prestigious flagship children's science lectures aimed at 10-18 year olds. She had previously contributed a Friday Night Discourse [S5] about laughter for the RI in July 2014 (over 25,000 views). Her research into laughter was used as the opening into the first of the three Christmas lectures (on the theme of 'language of life'). These lectures were broadcast on BBC4 (1.3 million viewers over all broadcasts [S6]) and subsequently recorded and filmed in Singapore as the annual Star Lecture (broadcast in October 2018, 125,000 viewers [S6]) and delivered live in Hong Kong and Tokyo. They are now available on the Royal Institution website [S5] where they have accumulated a further 11k views [S6].

In 2017 Scott was invited to give a plenary lecture in Week Six of prominent lifelong learning establishment the Chautauqua Educational Institution's residential summer programme [S7] (approx. 7,500 residents per day). The weeklong event on Comedy and the Human Condition was organised jointly with the National Comedy Center, the USA's first cultural institution and national-scale visitor experience dedicated to the art of comedy. Scott was the only academic among famous comedy professionals who gave plenary talks, including stand-up comedians/TV personalities Lewis Black and W Kamau Bell, and director David Steinberg (Seinfeld, Curb Your Enthusiasm).

In January 2020, Scott gave a lecture on *Why is laughter contagious?* to world leaders and senior policymakers at the World Economic Forum in Davos [S5]. Historian Mary Beard (who has cited Scott's work in her writings on the Romans and Comedy) described the session as the highlight of the meeting [S4]. The stress and difficulty of life under lockdown has led to an increased interest in the importance of laughter as a social tool and its role in relieving stress. Scott appeared in a variety of broadcasts to discuss her research on laughter in the context of COVID-19, including the BBC's emergency COVID programming (HealthCheck UK Live [S5], 4th April 2020, [TEXT REDACTED FOR PUBLICATION] [S8]) and the Talks at Google *Happiness Festival* (25th July 2020) [S5].

Scott has contributed her expertise to discuss international news stories involving laughter, including a Washington Post article about the laughter described by Christine Blasey Ford during the Brett Kavanaugh hearings [S4], and articles for the Guardian and the BBC discussing the laughter at Trump at the UN [S4].

Other media coverage includes articles for the Guardian and Standard Issue [S4], on Radio 4's The Life Scientific [S5] and regularly on Radio 6Music [S5], as well as an appearance on Scandinavia's (and one of Europe's) largest talk shows Skavlan (average audience 2 million) [S5].

Laughter, humour and comedy

The insights of Scott's research into what encourages and prevents laughter and how the complex relationships between comedian and audience can influence it is of particular interest to those involved in producing, performing and 'consuming' comedy. Scott has used her own stand-up performances and collaborations with comedians and comedy writers/producers to inform the work of comedy professionals and help audiences to better understand and appreciate the comedy experience.

She hosted a show at the BBC's Edinburgh Fringe Tent in late summer 2013 where comedians performed and audience laughter was measured and then discussed by a panel on the science of laughter. As a direct result of these activities, her research was included in the training given to new comedy writers at BBC Scotland. Comedian Susan Calman received this training and has used Scott's research to help explain how laughter is contagious (Too Much TV [S4], March 2016, [TEXT REDACTED FOR PUBLICATION] [S8]).

The Fringe format was repeated at another show in May 2019 to mark the reopening of the Bloomsbury Theatre (hosted by comedian Stuart Goldsmith) [S9], which sought to capture and understand the dynamics in the space, breathing, and how laughter spreads. The event was picked

up by BBC One's The One Show [S5] who made a film about the night and then recreated the format live with their own audience and comedian Joe Pasquale.

In September 2016, comedian Jimmy Carr hosted an episode on The Science of Laughter for flagship BBC2 science programme Horizon ([TEXT REDACTED FOR PUBLICATION] over all broadcasts [S8]) in front of a live audience, with Scott at his side throughout [S5]. In May 2017, comedian Russell Brand featured her (as sole guest) on an episode of his podcast Under the Skin comparing the communication styles of Donald Trump, Theresa May and Boris Johnson and the role laughter plays in each [S5].

In December 2019 Scott was interviewed about her research findings (on how other people's laughter makes a joke seem funnier) as part of a workshop about AI and comedy at St Peter's College Oxford, organised by comedy writer Charlie Skelton and Oxford's Head of Computer Science [S10]. The event was aimed at high-level comedy professionals including the BBC's Head of Comedy and comedian Robin Ince [S10] and computer scientists. Scott was the only neuroscientist to present among experts from philosophy, artificial intelligence, Google's DeepMind and linguistics.

In July 2020, the first episode of the BBC show QI to be recorded without a studio audience because of the COVID-19 restrictions featured Scott's findings about how laughter makes jokes seem funnier to explore how the lack of a live audience affected the show. They cited the UCL research and recreated Scott's experiment to demonstrate how laughter affects the perception of humour (QI, Series R, Ridiculous) [S4].

Scott is the leading expert on laughter and comedy science, providing articles such as for BBC Science Focus commissioned by the publicist of the Karl Pilkington Sky TV series 'Sick of It' which addressed why Karl only laughs in his sleep [S4], and being interviewed about laughter and jokes by Sky news and the BBC as part of their coverage of the Edinburgh festival 2018. In recognition of her research and public engagement, in the 2020 Birthday Honours she was appointed Commander of the Order of the British Empire.

5. Sources to corroborate the impact

- [R1] Email from Jimmy Carr, Comedian.
- [R2] Sophie Scott's 2015 TED talk 'Why we laugh'.
https://www.ted.com/talks/sophie_scott_why_we_laugh
- [R3] Anderson, C. (2016) Ted Talks: the official guide to public speaking. Boston, USA: Houghton Mifflin (p11).
- [R4] Collated links to Prof Scott's media articles and mentions of her research in the media.
- [R5] Collated links to lectures and appearances by Prof Scott.
- [R6] Email from Royal Institution containing viewing figures for lectures.
- [R7] Invitation to speak at Chautauqua Educational Institution.
- [R8] BARB viewing data.
- [R9] Review of the 2019 Bloomsbury Theatre show in The Upcoming magazine.
<https://www.theupcoming.co.uk/2019/05/03/the-science-of-laughter-at-bloomsbury-theatre-theatre-review>
- [R10] Invitation to the St Peter's College workshop