Written evidence submitted by UCL's Department of Science and Technology Studies (COM0027)

Summary/key points

- Enabling citizens to participate in informed discussions around science and technology will be essential for a fully functioning democracy in the 21st Century

- The British public is broadly supportive of science and technology, but have specific attitudes to particular technologies, depending on how particular science and technologies are used and situated, and on the values and experiences of the individuals.

- Where there are controversies, this tends to be a reflection of the problematic or contested nature of the science and technology in question, as well as legitimate issues around governance arrangements. In these instances, controversy or disquiet is unlikely to be remedied by more information or better science communication, but by opening up discussion around the kind of future being created with these technologies and who benefits.

- Initiatives such as the National Coordinating Centre for Public Engagement, along with their 'Beacons' programme, and ScienceWise, have helped embed public engagement in university activities and policymaking, as well as raise the quality of practice. More can be done to increase their impact and developing truly inclusive and 'public' science represents a significant challenge to the future of science communication.

- Most science communication still takes place within the education and learning (formal and informal) space, which remains a diverse field of practice that lacks systems wide thinking but at the same time creates innovative practices.

- We recommend that:
    - In the future, research funding bodies (such as the ESRC) should fund **a programme of research that specifically investigates the ongoing relationships between the public, science and technology**.
    - Alongside this, **ensuring the continuation of the Public Attitudes to Science Survey is vital**.
    - **Scientists need to be better trained to communicate their science, but also to understand the public's perspectives better** and to reflect on their own values that are embedded in their research.
    - There should be **continued support for science communication practice** to complement and support scientists' own efforts, as well as for the UK's network of science communication professionals.

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Introduction

1. Science and technology is increasingly shaping our lives and rapid development in areas like robotics and genomics mean we are set to see a further step change in the way technologies affect our lives. Communicating these developments and enabling citizens to participate in informed discussions will be essential for a fully functioning democracy and for the full exploitation of scientific advancement in the 21st Century.

Public attitudes to science

2. Over the past 20 or more years, there has been considerable research into science communication and public attitudes to science and technology. As a result we have a growing understanding of how the public perceive and come to know innovations in science. Large-scale surveys such as the Eurobarometer (European Commission, 2005, 2010), the UK Government's Public Attitudes Survey (ipsos Mori, 2104) and the Wellcome Trust's Monitor ("Wellcome Trust Monitor," 2014), as well as smaller but deeper qualitative studies have shown that the British public are largely positive about science and technology and that trust in science and scientists is relatively high – particularly in comparison to other professions and disciplines like journalism and politics (Ipsos Mori, 2015). Such work has also established an important dataset and benchmark against which future developments can be measured. While there is currently little cause for concern, it is vital that we continue to monitor attitudes and build such longitudinal data. **We would therefore urge the Committee to recommend that the BIS funded Public Attitude to Science Surveys are continued into the future**.

Complexity and diversity of public attitudes to science

3. Research in public attitudes has also revealed the high level of sophistication of public perspectives. Beyond being simply 'for' or 'against' science, the research has shown that people have specific attitudes to particular technologies and that these views also depend on how particular science and technologies are used and situated – for instance people feel more positive about biomedical applications of genetic modification technologies than they do about agricultural applications (Gaskell & Bauer, 2001). Existing technologies and cultural frames of reference – that is, interests, values, previous experience and ways of responding to and interpreting the world - also shape people's evaluations of technologies. For example, we have found that people's views of carbon capture and storage technologies (CCS) are strongly shaped by comparisons to nuclear and wind energy, and by trade-offs between particular energy futures (Lock, Smallman, Lee, & Rydin, 2014); and that a sense of 'naturalness' strongly affects views on the limits that should be put upon research (Smallman, 2016).

4. Importantly, we have also learned how different sectors of society respond differently to different technologies. Indeed while science and technology are important features of contemporary life in the UK, serious questions remain about how accessible, inclusive and equitable science, public science resources and science communication is. Attitudes towards science and technology vary as a result. For example, the Ipsos MORI analysis of the Public Attitudes to Science surveys suggests that people from low-income backgrounds, minority ethnic groups and women are disproportionately represented in the segment they termed "disengaged skeptics" (Ipsos MORI, 2014, p. 134). This group of the public were framed as less involved in public science activities, less likely to get involved in policy consultations and more sceptical about science and technology in general.

5. However, such framing overlooks the profoundly unequal patterns of access to and inclusion in public science resources, not least information about science and technology. Indeed, research suggests that minoritized groups are sufficiently disillusioned about their

access to voice and power, that the idea that they might participate consultations about science and technology seemed ridiculous to them (Dawson, 2014b). We therefore need to be careful in considering particular publics as being insufficiently knowledgeable about science or insufficiently involved in public science activities, given the unequal playing field they are operating on (Dawson, 2014c). **Different opinions about science and technology are to be expected in the face of limited political voice and access to resources. We believe this is a valuable area for further exploration**, especially as developments in digital technologies have the potential to reinforce social divisions further.

6. Where there are controversies and technologies that appear to lack public support – for example around GM crops or 'fracking' - this has historically tended to be a reflection of the problematic or contested nature of the science and technology in question, as well as legitimate issues around governance arrangements (Wilsdon & Willis, 2004). In these instances, **controversy or disquiet is unlikely to be remedied by more information or better science communication.** Instead, questions need to be considered around the purposes to which these technologies are being put; how they are being governed; and the kind of future being created about them, as well as who is set to benefit, need to be considered – issues that the public themselves generally have much to contribute to, but are rarely asked to decide upon (Stilgoe, Lock, & Wilsdon, 2014).

Developments in science communication and public engagement

7. Alongside our deeper understanding of public attitudes, practice in science communication has moved on considerably in last 20 years. In UK universities, the National Coordinating Centre for Public Engagement, along with their 'Beacons' programme, has helped embed public engagement in university activities and raise the quality of practice. UCL's own Public Engagement Unit, created in 2008 as one of the 6 national Beacons, has won awards from the National Centre for its innovative approaches, including Bright Club – where researchers perform stand-up comedy on their work - and Focus on the Positive – where researchers 'pitch' their ideas to a public audience which awards funding to the winning idea. It has supported over 750 engagement projects, awarded £630,000 in funding and contributed to events attended by over 20,000 visitors. The unit has achieved a culture change at UCL, emphasising the ethical, political and business case for public engagement and contributing engagement expertise to over £82 million of research and education grants.

8. The REF and the impact agenda has strengthened this further, with evidence that public engagement is being considered an important part of impact (Terama, Smallman, Lock, Johnson, & Austwick, 2016).The REF process is however likely to under-quantify the amount of public engagement work taking place in UK universities as it does not consider any public engagement activity that is not directly related to research.

Dialogues with publics

9. Reflecting this understanding that the relationship between knowledge of and attitudes to science is complex, since the 2000 House of Lords report (House of Lords Science and Technology Select Committee, 2000), we have seen a 'move from deficit to dialogue'. The public has been involved in discussions around new and emerging technologies, and, through activities such as ScienceWise, the UK has become a leading authority on participatory democratic techniques, pushing forward methodologies and thinking in this area at an International level. Such dialogues have also provided a rich source of insight into how the public talk about and come to know new science and technologies. Policymakers involved also report that these dialogues have also been

important in their thinking in the run up to a policy decision – for instance, in shaping the questions they put to the scientific experts who advise their decision making.

10. They are however yet to have their full potential impact on policy, largely because public views arising from such dialogues are yet to be valued as a form of expertise in the policy making process and because nuanced discussions (as we have described above) get misheard as oppositional (Smallman, 2016). We believe that such activities will continue to provide useful insight into the public mood towards science and technology. **They could however have much greater impact if they were given more power and resources** – empowering participants or a member of the project team to meet with policymakers and politicians to present their findings, for example.

11. Moves by the European Commission and UK based agencies such as the EPSRC, to develop the concept of 'Responsible Research and Innovation' (RRI) have the potential to deepen this connection between science and society. UCL is currently the host of the first UK 'Hub' for RRI. Funded through the European Commission RRI Tools project (http://www.rri-tools.eu), we are one of 22 countries working to develop tools and training for stakeholders - including researchers, policymakers and industry – to help ensure that science and innovation addresses societal challenges and involves citizens in the process. Researchers in the department have also worked with the EPSRC to help them develop and introduce a framework for Responsible Research Innovation (https://www.epsrc.ac.uk/research/framework/).

Excluded publics

12. Work in both practice and research around excluded groups, 'non-publics' and 'new audiences' for science communication has developed in recent years. While this is not the first wave of attention to issues of equity, inclusion and access to public science resources, a better research base has developed to support efforts to understand and address problems of exclusion and inaccessibility. UK wide research suggests the more enfranchised groups of our society make greater use of public science resources, from visiting science museums and to after-school science clubs, to consuming science related products in the mass media (Falk et al., 2015).

13. Indeed, research into science museums, science centres and other everyday science learning and communication settings, including the mass media has found that exclusion appears to be embedded in science communication practices (Dawson, 2014a, 2014b; Dawson, Seakins, Archer, Calabrese Barton, & Dierking, 2015). Meeting the needs of minoritized groups and taking seriously the need to develop truly inclusive and 'public' science represents a significant challenge to the future of science communication.

14. Work is also being done to improve the representation of women in science – and of female scientists' public visibility. This is a topic of particular interest to our postgraduate students, who have recently set up a 'feminist science and technology studies' reading group to increase the profile of female academics and viewpoints in our department's work, as research has found that women's contributions to fields including science, medicine and social science are often ignored or overlooked (Knobloch-Westerwick, Johnson, Silver, & Westerwick, 2015; Lincoln, Pincus, Koster, & Leboy, 2012; Rossiter, 1993). Activities setting out to help female scientists raise their public profiles also include Soapbox Science, established to raise awareness of Women in Science across the UK, and now internationally (see http://soapboxscience.org); and the Science Grrl blog (http://sciencegrrl.co.uk).

Risk communication

15. Even in the case of risk, many factors other than scientific knowledge or probability calculations - such as values, context and experience - go into shaping people's perceptions (Pidgeon & Kasperson, 2003; Slovic & Peters, 1998; Slovic, 2010). Research over the last 20 years has identified problems in communicating uncertainty in science in particular: Using absolute versus relative risk; appreciating differing risk perceptions; clearly explaining the uncertainties in test processes and results; and accounting for contingency (Spiegelhalter 2014). While there are a number of exemplary risk communication practices and guidelines on best practices (for example Gigerenzer (2014), this learning has been slow to filter into practice. Training to support scientists to communicate more effectively in these circumstances (particularly in helping them understand and take account of public perspectives in their communication activities), as well as work to deepen our understanding of how different audiences come to understand risk and how that affects their behaviour, will be important in the future.

16. Capacity of scientists: climate science as an example

A good example of the challenges of communicating risk and uncertainty is Climate Science. *A*s this Committee's previous report noted, there is an urgent need for improved efforts to accurately communicate climate science and to engage the public in meaningful dialogue. The ambitions of the international climate agreement from the COP 21 meeting, and the subsequent 'Mission Innovation' to accelerate the development, financing and deployment of 'green and clean' energy technologies will require widespread public support, or at least tolerance, of the actions and policies involved if they are to be successfully met. Although more than half of the public of 40 nations worldwide believe that climate change is a very serious problem, and some 85% agree that it is a somewhat serious problem, the vast majority consistently place it last amongst the issues that give them concern. (Stokes et al, 2015; United Nations, 2015) This indicates that the nature, scale and urgency of the necessary response to climate change is unappreciated.

17. To address this, UCL's Professor Chris Rapley has proposed a "Mission Conversation" - to attract, engage, inform and let people make up their own minds about the need for urgent action. This will require members of the climate science community to adjust their priorities and acquire new skills enabling more effective dialogue in the public square – as noted in the UCL Policy Commission on the Communication of Climate Science, chaired by Professor Rapley (who gave evidence to the Committee's previous inquiry), which highlighted the need for training and development of climate scientists to develop their communication and engagement skills and strengthen the degree of public participation within the climate science process (see also Rapley and De Meyer, 2014). Professor Rapley is currently chairing a multi-institutional and multi-sectoral team working on a proposal to develop the capacity and skills of climate scientists to enhance the public discourse on climate change, in response to interest from the Department for Energy and Climate Change, Department for Food and Rural Affairs, the Natural Environment Research Council, the British Academy, the Royal Society, the Wellcome Trust and others.

Science in the media

18. Our understanding of media audiences has also developed. Audience studies for the past two decades show that they are not passive consumers of media content, but instead actively construct meaning out of media contents, based on their social, cultural, political circumstances (Silverstone, 2005; Bucchi, 2008; Gouyon, 2014). People make sense of the science they encounter in the media through their everyday life experience

(Silverstone, 2005). The idea that increased and more positive coverage of science will make people more supportive of science is therefore misguided as predicting people's responses to media stories is difficult. At the same time, negative public responses to science can't be blamed on negative media coverage – such media coverage could be thought of as a reflection rather than a cause of public misgivings

Science communication and science education

19. Science communication also continues to overlap significantly with work in science education, both in what has been termed 'formal' science education (in schools, colleges and universities) and 'informal' science education (science learning in everyday settings such as clubs, through the mass media, gaming, festivals, at home or in designed spaces including museums, zoos or botanic gardens). Most science communication happens in such educational settings. For instance, the most recent results of the Wellcome Trust Monitor suggest one in every five people visited a science museum in the last year (Ipsos MORI, 2016). Furthermore, the UK has a thriving industry of science centres, science festivals (45 represented by the UK Science Festival Network) and innovative, smaller-scale activities run by organisations such as Guerilla Science, that move science activities into non-science spaces such as music festivals. Similarly, in terms of clubs and school-based enrichment and enhancement, STEMNET (the Science, Technology, Engineering and Mathematics Network), one of the more co-ordinated programmes of 'informal' science education activities across the UK, reaches 600,000 young people a year (Tomei, Dillon, & Dawson, 2014).

20. While activities under the education and learning umbrella are key sites for science communication, this remains a very diverse field of practice, with both negative and positive consequences. A lack of shared practices and system-wide thinking limits the scope of science education and learning practices, resulting in a limited audience research and practices that 'reinvent the wheel'. But the diversity is simultaneously a source of value and resilience, creating innovative practices (Falk et al., 2015).

21. UK universities – including UCL – are also leading the way in science communication training. This is offered as continuing professional development, short courses or modules for undergraduates and postgraduates. Scientists involved in science communication appear to benefit from training and support. Related courses on public engagement and the relationship between science and society also appear to help scientists become more aware of the relevance of views of others and how their own values are enacted in their day-to-day practices. ***We believe that such science communication and public engagement training is vital and should be encouraged for all scientists****.*

Future priorities

22. **Research:** The past 20 years has shown how much progress can be made with practice underpinned by strong academic research. As science and technology impacts on our lives more and more, we believe that such research will become increasingly vital. After investments in the Public Understanding of Science programme and the Science in Society Programme (2001-2007, £5million), funding and direction in this area has been lacking. **Funding bodies such as the ESRC should fund a programme of research that specifically investigates the ongoing relationships between the public, science and technology**; how people come to know and think about it; how attitudes pattern across our society and how these are affected by and in-turn embed diversity

and/or inequalities. Alongside this, **the continued Public Attitudes to Science Survey is vital**.

23. **Training**: Scientists also need to be better trained – to **communicate their science and any associated uncertainties to the public more effectively**, but also to **understand the public's perspectives better and to reflect on their own values that are embedded in their research**. In addition there is scope to draw on expertise from Science and Technology Studies and Communication Studies to develop better and safer types of engagement, supported by robust training and further research.

24. **Continued support for practice**: There is also a need to provide **continued support for science communication practice**. For researchers, this will always be part, not all, of their job and continuing to provide the resources to allow them to do that within their research funding is vital. Importantly however, this practice needs to be informed by research and practice-based learning. **Support for the wider network of science communication professionals**, and projects such as ScienceWise which push and test practice in new directions, is therefore also important if lessons are to be learned and shared and the quality of practice raised in the future.

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