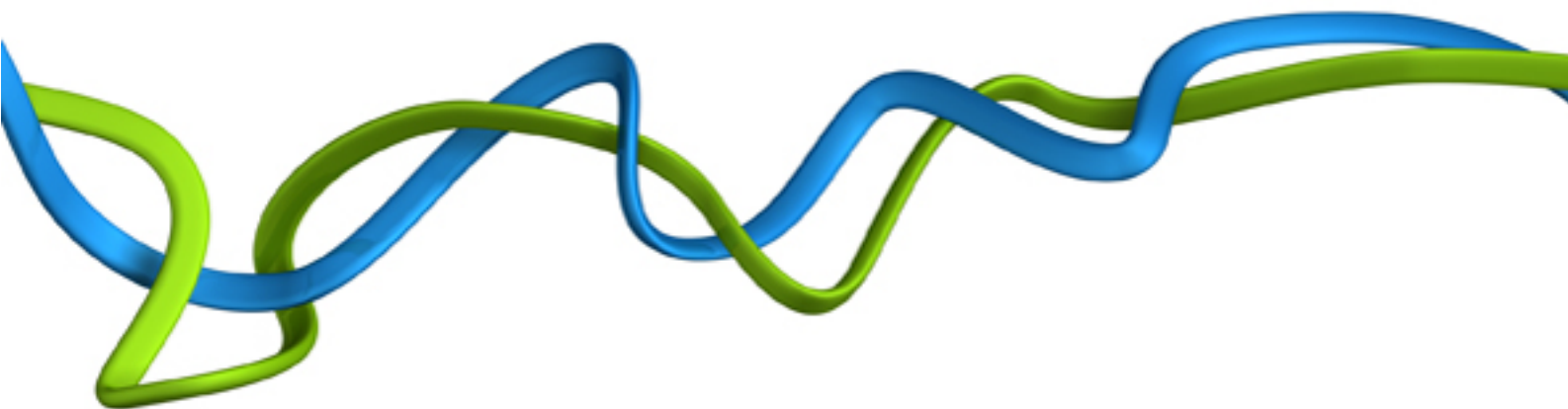


Science communication

House of Commons Science and Technology Committee inquiry into science communication

Submission from the Royal Academy of Engineering

6 May 2016



About the Royal Academy of Engineering

As the UK's national academy for engineering, we bring together the most successful and talented engineers for a shared purpose: to advance and promote excellence in engineering.

House of Commons Science and Technology Committee inquiry into science communication

Introduction

The Royal Academy of Engineering welcomes the opportunity to respond to the House of Commons Science and Technology Committee's inquiry into science communication.

This response was compiled with input from the Academy's Fellows and members of its External Affairs Committee.

The trends in attitudes to science, and public engagement with science

- 1.1 The Royal Academy of Engineering engages the public with a threefold purpose: to excite and inspire people about engineering; to promote exchange of views about the implications of engineering in society; and to ascertain the public's views on new and controversial matters.
- 1.2 Engineering faces its own, distinct challenges in engaging the public. This arises in part because of the way that engineering is so pervasive in the economy and society, underpinning energy, utilities, the food chain, healthcare, transport and communications. Engineering is everywhere and yet, paradoxically, the public, at least in the UK, finds engineering hard to identify and define.
- 1.3 Engineering is inextricably linked to science, enabling the practical manifestation of scientific ideas and discoveries. "Engineers help build the world around us. They use science to solve problems," according to the BBC programme *Nina and the Neurons*. Engineering is a creative, practical activity. It is underpinned by design and uses computing and technological advances to solve increasingly challenging problems.¹ However, Engineering is not science and ideally should not be included in the generic term "science", which adds to confusion about the nature of engineering. This response focuses on engineering communication, reflecting the specific experience of this Academy.
- 1.4 Public attitudes to engineering in this country tend to be characterised by low awareness or a misunderstanding of what engineers are and do. This is borne out by as yet unpublished research commissioned by the Royal Academy of Engineering on perceptions of engineering among young people, their teachers and parents, which shows generally very low awareness of the breadth and variety of modern engineering.² Those who are aware of engineering tend to think in terms of such sectors as civil engineering and traditional heavy industries. The general use of the term 'engineer' to describe roles such as car mechanic or washing machine repair technician may also affect perceptions.

¹ The Universe of Engineering: a call to action. Royal Academy of Engineering, October 2014

² Engineering Talent Project – qualitative analysis of public perceptions. As yet unpublished. Royal Academy of Engineering

- 1.5 This lack of awareness matters for a number of reasons. It has an impact on people's ability, as informed citizens, to engage with and debate the implications of engineering in society. It also has the potential to prevent young people from aspiring to a career in engineering. The UK is facing a serious engineering skills crisis at all levels of the profession. Analysis by Engineering UK projects a shortage of some 69,000 advanced technicians and engineers each year for the next 10 years.³ An ageing workforce means that hundreds of thousands of skilled technician and professional engineering roles will need replacing over the next 10 years.
- 1.6 This low awareness and appreciation may be compounded by a tendency in the media to describe the work of engineers as 'science', 'technology' or 'innovation'. Engineering is a broad profession taking in a diverse range of specialisms, from computer coding and software development (often referred to as 'tech') through to biomedical engineering (more typically associated with 'medical science'). Young people can only aspire to what they know about: if great feats of engineering go by another name, their potential value to inspire and excite young people into exploring a career in engineering is lost.
- 1.7 There is a long-standing view in the engineering profession that engineers are diffident about engaging the public in their work. Since 2006, the Academy has run *Ingenious*, a scheme funded by BIS that aims to build capacity and confidence in public engagement in the engineering profession. The scheme has funded 193 projects over its lifetime that have provided opportunities for over 2,000 engineers and engineering communicators to share their expertise and passion with some 1.75 million people of all ages in a range of settings all around the UK. The portfolio of projects aims to promote the diversity and impact of engineering. In a long term tracking study, 69% of the engineers involved in the scheme said that they developed or took part in other public engagement activities following their experience in the scheme. This year the selection panel, chaired by Professor Mark Miodownik FEng, awarded funding to 23 projects across the UK.
- 1.8 The Academy deploys traditional media, meetings, events, workshops and publications to gather evidence and promote its positions and work. However, in recent years, we have begun to focus on social media platforms to showcase engineering news and Academy initiatives to a wider audience. The Academy now reaches audiences of over 13,000 on Twitter, for example. Similarly, through the RAEng.tv website, video is also an important aspect of the way in which the Academy broadcasts lectures, awards, and profiles.

The balance of effort needed to increase public engagement in science by 'new audiences' and by the 'already interested'

- 2.1 Only around 8% of UK professional engineers are female.⁴ Among women and other under-represented groups in the profession, such as black and minority ethnic (BAME) communities, low awareness of what a career in engineering could offer is likely to act as a barrier to increasing participation. The Academy's Diversity and Inclusion programme aims to address this by galvanising employers, professional engineering

³ Engineering UK *State of Engineering 2016* report

⁴ ONS Dataset EMP04, Employment by occupation, published 12 August 2015, 212 Engineering Professionals. Of 428,000 Engineering Professionals, 42,000 are female.

institutions and other key stakeholders by stimulating cultural change to improve diversity and inclusion.

- 2.2 The Institution of Mechanical Engineers *Five Tribes* report investigates the five broad categories into which adolescents divide themselves, as determined by their reactions to engineering as a subject and as a potential career.⁵ The report suggests that those who are already interested in engineering are likely to engage with any effort that aims to increase engagement with the discipline. This implies that the harder task of engaging new audiences will require more resources than maintaining the interest of the already engaged.
- 2.3 The Academy is a participant in the National Forum for Public Engagement, which was established and is part-funded by BIS and hosted by the Wellcome Trust. Members of the Forum are agreed that reaching audiences under-served by engineering outreach is a major challenge for public engagement practitioners and awarding organisations alike. There is agreement among members of the Forum that the definition of under-served audiences is wide, and that further exploration should be undertaken to identify a model of best practice for reaching such audiences.

Any further steps needed by the media and broadcasters to improve the quality, accessibility and balance of their science coverage; and science coverage in broadcasters' programme-making

- 3.1 There are some excellent examples of engineering stories, technologies and projects covered by print and broadcast media. However, they are not always clearly signposted to the public as 'engineering'; rather, they are presented under the banner of 'science'. Engineering and science are of course clearly heavily-linked disciplines: engineering uses scientific principles and knowledge to address challenges and solve problems in the real world. But they are different, and the Academy believes that this lack of visibility of engineering that is labelled 'engineering' inhibits public appreciation of the role of engineering across society. Often, great feats of engineering endeavour are described as accomplishments of science. For example, the Rosetta mission was presented as a science story. Another example is the name of Jim Al-Khalili's excellent BBC Radio 4 series, *The Life Scientific*, which regularly features leading engineers talking about their work. Does this matter? The Academy believes that if engineering is not explicitly present in the national conversation, if the profile of engineering is eclipsed by conflation with science, there is the potential to inhibit recruitment into the engineering profession. The *Create the future* report published by the Queen Elizabeth Prize for Engineering notes that there is a marked distinction, particularly among UK teenagers, between the very positive perceptions of technology and its link to the broader field of engineering as a whole and as a career option.⁶
- 3.2 Engineers themselves need to be more proactive in engaging the public with their profession through the media, using accessible language and explaining engineering in a way that the public will understand. There are some excellent role models. Professor Danielle George gave the 2014 Royal Institution Christmas Lecture and remains focused on public engagement, including touring the country with a robot orchestra. Dr Hugh Hunt, who won the Academy's 2015 Rooke Award for Public Engagement, has made

⁵ [Institution of Mechanical Engineers Five Tribes report](#)

⁶ *Create the Future: an international report into perceptions of engineering*

award-winning television programmes, including on the engineering behind the bouncing bomb and recreating the planned WWII escape from Colditz Castle (Windfall Films for C4) as well as the recent *Wall of Death* programme with Guy Martin (North One TV for C4). Professor Mark Miodownik FREng, materials scientist, engineer, writer and broadcaster, has won several prizes for his writing and recently won the AAAS Prize for Public Engagement with Science (“awarded... to scientists or engineers... who have contributed substantially to the public’s engagement with science or technology”).

- 3.3 The Academy considers the establishment of the Science Media Centre (SMC) to have been a very positive development. The Academy is an active supporter of the SMC and commends it for the way in which it undertakes its role, organising proactive and reactive briefings for journalists, encouraging researchers to talk to the media about their work, and providing a setting in which expert engineers and scientists can discuss complex issues and nuanced positions with journalists. This has done much to improve the quality, accessibility and balance of engineering and science coverage across the media.
- 3.4 Recognition and celebration are valuable ways of engaging the public with engineering. The Academy awards a number of prizes to raise the profile of engineering innovation and celebrate the achievements of engineers at every stage of their careers. The MacRobert Award is the premier award for UK innovation in engineering and has identified many inventions that have gone on to become mainstream. The Academy works hard to ensure that the finalists obtain a good media profile – but is aware that not all media have journalists who are focused on engineering stories. While many UK media have science correspondents, we are not aware that any have engineering correspondents. All the national papers and broadcasters have industry and business correspondents and editors, technology correspondents, and one has a manufacturing correspondent, each with specific remits. The Queen Elizabeth Prize for Engineering was established in 2011 with the aim of inspiring young people through the recognition of engineers whose work has had a global impact on humanity. The prize has been awarded twice and an international programme has been run to engage people through the media, a network of ambassadors and a programme of events across the world. The prize now has a global reach of 1.25 billion people.

The communications strategies being taken to encourage young people to study STEM subjects in higher and further education, and to encourage those people towards STEM careers

- 4.1 The engineering profession is widely acknowledged to be facing a critical skills shortage. The profession currently trains, on average, 69,000 fewer entrants each year than will be needed to meet the projected need for engineers between the years 2012 to 2022. Indeed, estimates suggest that the shortfall will result in result in the UK training only 1.13 million new entrants, rather than the 1.82 million needed.⁷ Consequently activity must focus on increasing the number of entrants into the profession.
- 4.2 There are many existing initiatives that aim to promote the study of STEM subjects and encourage young people to consider a career in STEM. Any initiative that aims to increase the diversity of the engineering profession is to be encouraged. However, the individual and collective impact of these initiatives, including programmes such as *Your*

⁷ Engineering UK *State of Engineering 2016* report

Life, a government-funded campaign to address low-participation rates in maths and physics by young women, is unclear. Greater clarity of, and unity in their objectives would be an improvement.

- 4.3 Many engineering engagement outreach activities focus on practical demonstrations. *Engineer Your Future*,⁸ an innovative new exhibition concept at the Science Museum, developed in partnership with the Academy and industry, has proved to be a highly successful outreach activity, with approximately 525,000 people attending in its first year. This was two-thirds greater than the predicted number of attendees. Such activities are a useful tool for encouraging young people to take an interest in engineering; with feedback indicating that activities are well liked and regarded as exciting by young people.⁹ However, further consideration should be given to supporting young people to develop this interest, enabling them to make the transition to programmes of engineering study at higher and further education levels, and onwards to careers in engineering and engineering research.
- 4.4 The Academy is leading the development of a new programme called the Engineering Talent Project, in order to better understand and address the challenge of the engineering skills gap. This programme is being developed at the request of, and in partnership with the engineering industry. The project will comprise a targeted marketing and communications campaign designed to alter perceptions of engineering, and a public affairs programme that will aim to address some of the barriers to greater participation in programmes of study that lead to engineering careers. The Engineering Talent Project is similar to a programme that was successfully developed and implemented in Denmark.¹⁰ This led to a 24% increase in applications to engineering courses, leading ultimately to an increase of 7% in those beginning engineering careers.

The extent to which public dialogue and consultation is being effectively used by Government in science and technology areas of policy-making

- 5.1 Government departments regularly consult on specific areas of an existing or a planned policy, either to identify measures by which the policy can be made more effective or to scrutinise the impact of the policy. Consultation is an important tool to understand the views of relevant stakeholders and, from the Academy's point of view, an effective means by which to provide evidence into policy making. However, respondents are inevitably drawn from a small pool of those organisations with a particular interest in the area being consulted on and who are familiar with the process. This can mean that the consulting government department will generally receive responses from the same respondents, rather than from the full range of stakeholders and from individual citizens who will be affected by the policy. Finding ways to elicit responses from a wider pool of respondents would be beneficial in ensuring that the process is as effective as possible.
- 5.2 The Academy recognises that government consultation takes place within the constraints and tight timetables of the policy making process. However, short consultation periods, of as little as four weeks, are now more common than previously and can seriously affect the range and quality of responses. This is particularly true for

⁸ [Engineer Your Future exhibition](#), Science Museum, 2014-17

⁹ Engineers and Engineering Brand Monitor, Engineering UK, Section 1.4

¹⁰ <http://engineerthefuture.dk/>

organisations such as the Academy that gather input from a large, expert membership that then needs to be compiled and reviewed to ensure quality and clarity. Longer consultation periods of up to 12 weeks, as previously standard practice, allow for more effective expert responses to be sought and compiled.

- 5.3 There is increasing concern from some in the engineering community that government, where it consults, appears to do so reactively and after the fact, rather than proactively and before the fact. Consultation also appears to focus on areas where there may have been less significant public interest and less contention. A notable area on which government did not publicly consult was in relation to its decision in 2014 to limit the future erection of onshore wind turbines, instead preferring that wind turbines be built offshore in future.
- 5.4 In comparison with consultation, public dialogue is the process by which the opinions and views of the public and other stakeholders are systematically and proactively investigated to identify and inform areas of emerging interest and significance. Public dialogue can, and should, be undertaken at any stage of the policy making process but it can be most effective if done early on issues that are likely to become contentious. In such cases, it is vital that policymakers understand the actual concerns of stakeholders as opposed to making assumptions about their concerns. Failure to do so can lead to ineffective policies and ever more entrenched positions. However, proper public dialogue is a time- and cost-intensive process and while public dialogue has been undertaken effectively by organisations such as Sciencewise, in practice, government dialogue has been limited and effective only in a number of instances.
- 5.5 Examples include a review of Nanotechnology that the Academy, working jointly with the Royal Society, was commissioned to undertake. All of the recommendations outlined by this review were adopted and the communications that resulted helped nanotechnology to become a widely accepted technology in the UK.¹¹ Similarly, the Economic and Social Research Council (ESRC) has undertaken notable dialogue on the uses and applications of Big Data, which was well-received. There are also examples of public issues with an engineering dimension where the advantages of early public dialogue would have been clear. Such an issue is hydraulic fracturing techniques, where public views were not appropriately investigated early enough, and where an adequate response to concerns was not forthcoming. As a result, public awareness of methods by which fracking can be undertaken without causing environmental damage is low. Another example is public concern regarding genetically modified food. Public dialogue was not undertaken early enough in this area and, perhaps as a result, the public remains sceptical of the technology. Indeed, perceived failures in this area of research was one of the main catalysts for the establishment of the SMC.¹² To improve public awareness of, and potentially reduce concerns around science and technology areas of policy-making, government may find it effective to review the extent to which it undertakes public dialogue.

¹¹ [Nanoscience and nanotechnologies: opportunities and uncertainties](#) – a Royal of Engineering and Royal Society joint review

¹² <http://www.sciencemediacentre.org/wp-content/uploads/2012/09/Science-Media-Centre-consultation-report.pdf>

The strategies and actions being taken by Government to foster public engagement and trust of science more widely, and high quality reporting of science in the media

- 6.1 The Academy is aware of a number of specific strategies or actions being undertaken by government to foster public engagement and trust of science more widely, or high quality reporting of science in the media. Specific strategies include the work of Sciencewise which was funded by BIS; the National Forum for Public Engagement, also part-funded by BIS; and the Wellcome Trust's Engaging Science funding programme. Specific actions include Ministerial engagement with the research and innovation community, which is appreciated by all.
- 6.2 The Department of Transport is spearheading its own initiative, the 2018 Year of Engineering Celebration, to coincide with the completion of Crossrail. This activity is currently in development but will gain most traction and produce best results if it aligns closely with other initiatives such as the Engineering Talent Project.
- 6.3 There are many non-government initiatives, undertaken by organisations throughout the research and innovation community, that have been largely successful in addressing extant concerns regarding public engagement with, trust in, and high-quality reporting of science and engineering. The SMC in particular, should be acknowledged and commended for its success in addressing concerns in this.
- 6.4 The BBC is leading the *New Age of Wonder*, a new large-scale public multimedia engagement programme being planned with the national academies, museums, libraries and universities. The project – a 10-year commitment – aims to inform, educate and entertain the general public with science and engineering. In doing so it will engage millions of citizen scientists and engineers with world-class science and engineering. This will launch in spring 2017, with an initial campaign structured around 100 big, engaging questions about science and engineering. The programme will aim to reach younger audiences by using digital channels.
- 6.5 In many respects, researchers themselves, including the awardees of National Academy grant programmes, are well placed to undertake public engagement activities and, through these, to promote public trust in engineering. Development of the capacity available to the National Academies to support such programmes would be advantageous, enhancing the number of practitioners and researchers able to promote their work.