# Strategies for improving communication between scientists and the public

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**Abstract** It is believed that a scientifically literate society benefits the national economy by improving the workforce and raising consumer awareness by helping people appreciate and support scientific advancement. Traditionally, communication between scientists and the public has been viewed as unidirectional, with an 'expert' scientist bestowing information on a recipient perceived to be largely passive and unquestioning. Today, however, the white laboratory coat is no longer a symbol of credibility. Several apparent 'blunders', attributed to the misapplication of science, have led to a heightened demand for information, public consultation and transparency surrounding scientific research and policy making.

The current climate of public mistrust of scientists, policy makers and commercially funded research has resulted in a stronger focus on the mechanisms by which science is communicated to and perceived by the general public. Here various strategies for communicating scientific ideas are reviewed, and how they could promote a bidirectional flow of information, thus improving trust and understanding between scientists and non-scientists, is considered. One of the major challenges ahead is to provide suitable opportunities for these exchanges to take place. The next step is to integrate these interactions (and their outcomes) into scientific policy.

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## Introduction

Society as a whole can reap many benefits from individuals who appreciate and understand science, engineering and technology. As noted in the 1993 Government White Paper *Realising our Potential*,[1] such an appreciation is indeed 'fundamental to the fortunes of modern nations.' National economies benefit from being internationally competitive, both commercially and academically, and thanks to the application of new discoveries, the lives of individuals generally have enhanced quality, comfort and longevity.

There are numerous fora in which scientific ideas are communicated to non-specialists; these begin with school science lessons and encompass museums, specialist publications for the lay readership (such as *New Scientist*), and interactive science centres and fairs. It is no longer appropriate, however, simply to 'teach' science to the public, in the hope that people will become more accepting of a new technology or idea. Increasing emphasis is being placed on

encouraging 'dynamic interactions' between scientists and the public.[2] This approach advocates greater consideration of the scientific process of investigation and the resulting ethical issues, as well as the outcome or application.

## 'We're interested, but who can we trust?'

The general public in the UK appears to have a voracious scientific appetite. Over 71 per cent of respondents to a recent UK public survey[3] claim to be interested in new scientific discoveries and around 75 per cent of declared themselves 'amazed' by the achievements of science. In addition, two-thirds agreed that science makes our lives more comfortable and healthier. The same survey also found 80 per cent of people agreeing that Britain needs to develop science and technology to improve its international competitiveness.

Evidence presented to the House of Lords for its recent report on 'Science In Society',[4] however, revealed that people are discerning about whom they trust to give them accurate information about scientific issues, or to make decisions about the regulation of the biological sciences on their behalf. This seems to manifest itself in the perception of scientists who are thought to have a 'vested interest.' For example, a scientist working in a university was deemed most likely to tell the truth about BSE (42 per cent of respondents said they would have the most confidence in this choice). By contrast, only 4.6 per cent of respondents would have most confidence in a scientist working in a government department to tell the truth about BSE. Scientists (as a general group) ranked only 9th out of 21 categories of professions who would be most trusted to make decisions about regulation of biological sciences, appearing below family doctors, environmental groups and veterinarians.

## Understanding each other

For successful dialogue, both groups need to respect and respond to the knowledge, concerns and context of the other. Scientists and non-scientists have very different views of each other and of their roles in society. It is, therefore, instructive to explore these perceptions in more detail.

Traditionally, the so-called 'deficit' model of science communication suggested that the public was simply an empty 'vessel' into which scientific information needed to be poured, in order to secure public acceptance and understanding.[5] Thankfully this view has been rejected by all but a small minority. The need for a 'contextual' approach has been widely accepted, whereby the interaction takes place with regard to the background knowledge and relevance of the topic to the audience.

So, how can one define 'the public?' A recent survey of 1,839 members of the general public identified six attitudinal groups with respect to science.[3] The largest group is represented by 'technophiles' (20 per cent), who are generally well educated in science, are aware of its benefits, and feel they can access accurate information when required. The smallest group identified (13 per cent) are 'concerned'. They have a realistic and positive view to life, but are sceptical of authority. The majority of this group is female, who tend to be home-oriented and accept that science has an important role in life, especially for children. The next smallest group is termed the 'not for me' group, which makes up 15 per cent of the sample. Members of this group tend to be over 65 and are not particularly interested in science, feeling that it is moving too fast for them. However, they recognise the potential benefits of science for our future, particularly for children. The other three groups each contribute 17 per cent to the total sample. These include 'confident believers' who are generally well-off, well-educated, middle-aged and middle class. The majority have an arts or humanities background and are interested in science for the benefits they believe it brings. They also have faith in regulatory systems. Members of the 'supporters' group tend to be younger than the other groups and confident when adapting to change. They are quick to adopt new technologies

and believe the Government has things under control. The final group is 'not sure' who generally have the lowest income and level of education. Members of this group tend not to appreciate the benefits of science and technology, and, perhaps crucially, do not meet scientists in their daily lives. Thus their perception of scientists is perhaps likely to be coloured by media or film portrayal.

Such a recognition of different needs and backgrounds within society will be crucial in helping science communicators tailor their approaches according to the context of their audience. However, it must also be remembered that certain groups may contain individuals who are more vociferous in public fora than others, thus potentially skewing the apparent attitudinal ratios in an audience.

Just as science communicators must respond to heterogeneity within 'the public', similar disparity must be acknowledged within the scientific community. Not all scientists have undergone the same specialist training – an astronomer may know little of the workings of a fruit fly, for example. The impression that a 'science' training allows one to be an authority on all matters 'scientific' is a misconception that should be corrected by more specific descriptions of professionals in the various scientific disciplines.

Crucially, we must also remember that scientists are consumers too; they are as concerned about the future of their children and the environment as non-scientists. Yet films, literature and to some extent the media have made unhelpful contributions to the public perception of scientists. These have resulted in scientists being viewed as those who could lose control of their discovery in the case of Dr Frankenstein,[6] as medieval alchemists attempting to transcend Man's limitations by creating life from matter, or as creators of a Brave New, and generally unfavourable, World.[7] As Boulter points out,[8] Romantic literature tended to portray the scientist as one who set aside his personal morals, friends and family in the pursuit of knowledge. To a non-scientist, these perceptions have done little to promote the image of a scientist as a trustworthy, socially aware member of society.

But how do scientists view 'the public' and the integration of their own role in society? A recent MORI (Market and Opinion Research International) poll[9] revealed that 69 per cent of scientists believe that the major responsibility for engaging the public in social and ethical debate about science lay with scientists themselves. Over 90 per cent of respondents agreed that the public should know about these issues, yet one-third felt inadequately equipped to discuss such issues publicly in the context of their own research. In addition, the fact that the perceived integrity of scientific data often depends on the source of funding for the research[4] makes many scientists wary of communicating openly.

## Communication in crisis?

Almost by definition, scientific language and processes do not lend themselves well to straightforward communication with non-scientists. Descriptions of the scientific world often involve technical jargon and eschew anthropomorphism. Science papers are largely forensic in their nature, stating facts, with a slight deliberative element making sense of these facts. By contrast, most people, including those in the popular media, communicate in an immediate and active way.[5]

The fundamental basis of the scientific approach is generally poorly understood by the public. It can be somewhat counter-intuitive, in that it requires experimental design to gather evidence with which to test a hypothesis. This leads to guarded language and inherent caution on the part of scientists who will be prepared to alter their hypothesis, should the evidence be suitably compelling. Such caution has led to inadequate public communication of the concept of risk and uncertainty, as was exemplified in the case of the safety of genetically modified (GM) food.

Consequently, there can be a reluctance among the scientific community to discuss potentially contentious issues with certain

groups of the public, for fear of harassment by a minority of extremists.[9] This, as nearly one-third of the scientists recently surveyed pointed out, is a potential barrier to effective communication.

## The media: friend or foe?

Most adults cite newspapers and television as their main source of scientific information.[3,4] Indeed, the media have become a crucial conduit through which new scientific discoveries are communicated. Quantification of the impact of the media on science stories is near impossible, but known to be significant.[10] Yet many science stories are not written by science journalists, particularly if there are political implications. A case in point is the UK press coverage in early 1999, resulting from a feeding study of GM potatoes to laboratory rats. During several weeks of intense coverage, none of the news articles and only 17 per cent of the feature articles were written by science journalists.[4]

It should also be remembered that the media are often selective in their choice of science stories, meaning that the majority of scientific discoveries go unreported. This can give the impression of an unbalanced effort, which does not reflect the true breadth of scientific research. Also, while there may be serious science behind an apparently frivolous piece of newsworthy research, the reporting can too often give the impression that the 'aim' of the research was to a light-hearted end. This, understandably, leads to questions being raised about appropriate use of scientists' skills and funds.

The media are often criticised for a non-constructive, even sensationalist approach to science reporting.[4] While it is sometimes difficult to argue with this contention, science does not lend itself well to the 'soundbite' approach, on which the media depend. The caveats and caution exercised by scientists during interviews are inevitably lost in the pursuit of a snappy story, tight deadlines or shortage of print space. This is a source of vexation to scientists, but the fault does not lie entirely with the journalist. When asked how well the scientific community understood the workings of the media,[10] 17 out of 31 science journalists replied 'not well at all' while 4 considered that scientists 'hadn't a clue.' Furthermore, 25 considered scientists to be 'ineffective' at getting their message across. As the majority of scientists do not encounter members of the media, it is unsurprising that the outcomes of discussions between scientists and journalists are often unsatisfactory.

Scientists' lack of understanding of the media, and an inability to communicate effectively with journalists must be addressed if the media are to fulfil their considerable potential in improving communication between scientists and the public.

## Where are we now?

Numerous initiatives, such as the UK's national Science, Engineering and Technology Week, and UK Science Year (from September 2001), as well as local community-based events, provide crucial opportunities for the public and scientists to meet and communicate. Hands-on exhibits, staffed by accessible scientists, are probably among the most effective vehicles for these interactions. These exhibits are generally based at science centres, some museums and science fairs (such as that held annually in Edinburgh). Such events, however, attract only those sections of the public who are inherently interested from the outset. The challenge is to engage those groups termed 'not for me' and 'not sure'[3] who might be less likely to attend. Increasingly there must be community-based science events that engage the public in non-scientific contexts, for example in shopping malls, local pubs and railway stations.

Funding bodies such as the Biotechnology and Biological Sciences Research Council (BBSRC), the Engineering and Physical Sciences Research Council (EPSRC), the Wellcome Trust and others not mentioned here provide a selection of excellent publications free of charge and

available on the Internet. The Internet obviously provides a huge opportunity to communicate science, although discretion is needed to 'sift out' the false or inaccurate material. For a non-scientist, exercising such discretion is sometimes difficult. In addition, with some exceptions, Internet-based communications tend to be a one-way learning experience, without the benefits of interacting in person with a 'real' scientist. Some sites enable people to submit questions, which are then answered by scientists. While this considerably enhances the value of the scientific experience, it is no substitute for a live discussion.

An exciting new forum to help scientists and the public communicate involves the use of drama and theatre. A few theatre groups specialise in productions addressing not just the scientific facts, but also the ethics surrounding issues such as xenotransplantation and genetic modification. In some productions, the actors remain 'in character' and participate in a floor debate with the audience. The actors are fully briefed beforehand and present their arguments as their character, while a scientist is on hand to answer any technical questions and to provide additional facts. It is hoped that the quest for new opportunities for interactive communication will lead to an increased integration of good science and exciting theatre.

## The way forward

The current consensus is that greater emphasis should be placed on two-way communication between scientists and the public.[2,4] Yet the challenge remains to find the appropriate forum in which these interactions can take place, with the less interested groups of society fully engaged. Action is needed at local levels, as well as a more strategic national approach to integrate science into society, rather than reinforcing the outdated concept that the aim is simply to 'make the public understand.'

### Recognising mutual responsibilities

Scientists, the media, funding bodies as well as the public must take responsibility for ensuring fruitful dialogue. This means that more scientists should endeavour to interact and communicate with the public, demonstrating respect of the opinions in the audience and hopefully earning respect in return. These communications must be non-technical, establish trust and realistically address issues of concern and potential risk.[8] They must also honestly acknowledge the limitations of science. Many funding bodies have specific criteria to ensure that their grant-holders participate in public awareness exercises.[4] Yet it is important to recognise that some scientists are uncomfortable dealing with a non-specialist audience. So the drive to show that 'scientists are real people too' must be judicious in order to succeed. Scientists who can communicate comfortably without jargon, in an appropriate context will surely be the best ambassadors for the profession. Research organisations need to develop relationships of trust with local community groups; this can be promoted by hosting site visits and encouraging outreach activities by its scientists. Local horticultural societies, self-help groups, the Women's Institute and Rotary Club provide excellent opportunities to encourage such relationships within the local community.

In addition, the House of Lords report recommends that the scientific community becomes more familiar with the workings of the media, and to encourage a wider range of scientists to interact with the media.[4] For those who are wary of dealing with such situations, written guidelines are available from the Royal Society, as well as a range of excellent training courses, often run by journalists themselves.

The media must also recognise their pivotal role at the interface between scientists and the public. Here again, the Royal Society has issued guidelines to help the media prevent unnecessary 'scaremongering' and to gain access to credible, accessible scientific experts. There has also been a call for more research into

the impact of the media (including the Internet) on science communication, and experimentation on new forms of 'plain speech' translation in these fora.[10]

## Better opportunities for dialogue

The provision of suitable opportunities to engage the public in two-way dialogues with scientists and policy makers is crucial. A current funding drive worth £1bn for science centres has been described as 'the single largest investment in science communication ever to take place in the UK'.[4] Skilled design and staffing of interactive exhibits will clearly be an essential prerequisite to ensure they are aesthetic, invite participation and have a clear, satisfying result at the end of the activity.[11] However, it is important that these skills are also used to take such exhibits 'on the road' to help engage those who would not normally go to science centres. Stands at supermarkets, posters on public transport, and talks or workshops in local pubs and cafés are several examples of ways to bring science to members of the 'not for me' sectors.[12] It is important, however, that these exhibits also provide an opportunity to discuss not just the facts, but the ethics and implications in a social context.

Regular public events based at local research organisations would go far to help the process of two-way dialogue at the community level. These could take the forms of brief lectures, open floor debate and staffed interactive exhibits.[13] Caution is needed, however, to ensure the event is not perceived simply as a public relations exercise for the organisation, which could inhibit the development of trust.

Public input into policy making and scientific strategy is also crucial. Over two-thirds of people recently surveyed think that scientists should listen more to what 'ordinary people' think.[3] To this end, many organisations are now providing opportunities for public consultation. For example, the BBSRC website encourages public input, although it must be made clear that it is not appropriate for public opinion to determine funding for long-term fundamental research.[4] In addition, transparency in the policy-making process is crucial to restore public trust. For example, the UK Agriculture and Environment Biotechnology Commission holds its meetings in an open forum where input from the public is invited, as well as the opportunity to observe evidence-gathering from expert witnesses. Increasingly, minutes of meetings from different organisations are also posted in the Internet.

Transparency of the funding process is also crucial. It is insulting to scientists to imply that the validity of their data should be called into question depending on the source of funding. Declarations of interest and funding sources must be viewed as a mark of openness, not an opportunity to discredit the data. Industrial funding sources should also demonstrate more transparency and lack of bias to improve the public perception of the organisation.

Stakeholder dialogues, focus groups and consensus conferences[4,14] are highly effective, if expensive, ways to facilitate dialogue between scientists and the public. It is again, however, crucial that the participating scientists can communicate clearly and calmly and are not appearing to drive the debate towards a personal or corporate agenda.

## A strategic approach

There are many different initiatives for communicating with the public about science. While all address the universally recognised need for more public engagement in scientific ideas and issues, these initiatives tend to be autonomous and driven by the provider. There has been a recent call for rationalisation of activities[3] in order to identify and respond to new scientific issues, as well as enabling adoption of a broader, more strategic approach. It was recognised, however, that there would be a reluctance to relinquish this autonomy, and that conflicting objectives might impede full cooperation. Yet combining limited resources is

undoubtedly an effective way to gain maximum impact. In particular these resources could focus on improving the communication of the scientific principle, experimental approach, interpretation of data and the concepts of risk and uncertainty.

### Supporting good communicators

Having recognised the central role played by scientists in communicating with the public, it is essential to provide scientists with the appropriate support to help them do this effectively. There have been encouraging developments in training scientists to work in the public forum. For example, the Research Councils offer courses to acquire media skills, and there is increasing emphasis on postgraduate training in science communication. The House of Lords report strongly advocates widening this postgraduate training to help students become aware of the social context and implications of their research.[4] Encouragingly, a recent MORI poll of scientists found that those who had received training were more likely to communicate with the public.[9]

A further disincentive for scientists to participate in public communication exercises is the lack of professional acknowledgement for time spent engaged in these activities. It was pointed out to the House of Lords Select Committee[5] that the Research Assessment Exercise in UK universities gave no credit for publication of popular science books or lectures to the lay public. In addition, staffing a stand at a local science fair takes valuable time otherwise spent applying for research funding, doing experiments or writing scientific papers. The House of Lords Committee rightly recommends that Higher Education Funding Councils consider rewarding outreach activities, perhaps through a separate funding stream.[5]

## Conclusions

Increasing the degree of trust between scientists and the public will take time. Finding opportunities for constructive dialogue, and understanding more about each other's backgrounds and contexts underpins a successful future relationship between the different groups. In addition, a culture of transparency and openness in research will help reduce the public's perception of bias of scientists and their data.

There will always be scientists who are better communicators than others. These people must be recognised by their organisation, and supported and trained to help them do the job better. Their career advancement should also not be compromised because of time spent in public communication.

We have a better understanding than ever of the different components of the rather amorphous body that previously constituted 'the public' in the minds of scientists. This will help with a strategic approach to communication, and different techniques should be employed to engage members of the various attitudinal groups.

Above all, more opportunities need to be provided by organisations to allow their scientists to communicate in person with members of the public. These could take the form of open days, exhibitions or stands at public events. Taking the lead in opening two-way dialogue will go far to help re-establish mutual trust and allow open debate and public consultation about scientific issues.

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