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Keywords: *science, public, media, risk, trust*

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Understanding 'science and the public'

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Date received (in revised form): 12th September, 2003

Abstract

Public acceptance of the products of biotechnology is an important issue for the industry. This paper looks at relevant academic and policy developments in the field of public understanding of science, which considers the role of science in the public sphere. It traces the interaction of scientists, social scientists and the public in the move from early 'deficit' conceptions of public understanding to more recent positions in which the public are seen as active participants in a variety of contexts for science. These newer conceptualisations could usefully contribute to the biotechnology industry's ongoing task of establishing constructive relations with its various publics.

THE MOVEMENT FOR PUBLIC UNDERSTANDING OF SCIENCE

Relationships between science and its publics have been investigated by academics for many years, latterly under the title of 'public understanding of science'. During this time, thinking in this area has informed some activity in science communication, and might usefully be extended to the biotechnology industry given the heightened public interest in its products.

Science communication is a malleable tool, and serves various ends for both communicators and audiences.[1] Despite its traditional associations with empowerment and enlightenment, most popularisation by scientists has been in some way self-serving: historically, scientists have shared their science with the public at times when they feel that their own enterprise is under threat. Behind most popularisations from science-based institutions, especially in the post-1945 period, one can find a scientist who feels their argument is not being accepted by their peers, an institution that feels its image needs a boost, or a community that believes it is not being afforded sufficient respect and resources. It was in such a context, in 1985, that the Royal Society published a report called 'The Public Understanding of Science'.[2] In the early 1980s, scientists in the UK were feeling the financial squeeze, and many were leaving for jobs abroad. British science felt under threat. According to some scientists, a major factor in this situation was that society simply did not value science because the public did not know much about it. The Royal Society brought together a committee to address the problem, and its report concluded that everyone should have some understanding of science, ideally provided initially at school. It urged parliamentarians to seek advice on scientific issues, and suggested that industrialists needed a better understanding of science if the UK was to remain competitive. The report emphasised the need for more science in the media, and argued that 'scientists must learn to communicate to the public . . . and . . . consider it their duty to do so.'

One result of this report was the formation of COPUS, the Committee on the Public Understanding of Science, which set up projects such as a science book prize, grants for activities that led to public understanding of science, and media training for scientists. A research programme ensued, run by the Economic and Social Research Council and involving researchers from the social

The public has been characterised as suffering from a deficit of information

'Understanding' has been equated with 'knowledge' and 'appreciation'

Telling people about science is as likely to produce protest as support

sciences. One widely publicised piece of research was a survey, undertaken in Britain in 1988, to measure scientific knowledge and attitudes among laypeople. The survey asked about the content and processes of science, and included a 'knowledge quiz' on matters such as whether the Sun goes round the Earth or the Earth round the Sun, whether insects have eight legs, and whether radioactive milk can be made safe by boiling it. The public did not score well on this quiz: 70 per cent believed natural vitamins to be better than synthetic ones; 30 per cent thought that humans and dinosaurs had lived at the same time; and 46 per cent had no idea whether DNA was to do with stars, rocks, computers or living things.[3] The data seemed to confirm the scientists' view that most people had very little idea about science. The public was characterised as suffering from a 'deficit' of scientific information – a deficit that could and should be remedied. This gave empirical support to the Royal Society's earlier recommendations that the solution to the public understanding of science problem lay in the communication of science to non-scientists.

A flurry of reports from various institutions, and further research, appeared in the following years, mostly lamenting public insufficiency and encouraging science communication. All this activity had to be justified, and rationales soon appeared. For example, it was suggested that science is a great cultural achievement of humankind, and we can all enjoy and value it in the same way as we might visit an ancient stone circle or read a great book. It was argued that in a science-based democracy, it is the duty of everyone to understand something of science in order that they might function effectively as citizens. Other arguments were practical: people can use scientific knowledge to solve everyday problems – mending the toaster, or deciding what food to buy.[4] But if such were to be the outcomes, what was the relevance of the kinds of scientific facts against which public competence was being measured in surveys? Very early on, a researcher produced the 1988 survey's 'knowledge quiz' at a conference and challenged delegates to think of cultural, democratic or practical reasons why anyone should know the answers to such questions. Nevertheless, initiatives in public understanding of science have been mainly initiatives in science communication: they have consisted of finding means to deliver scientific information to laypeople, and of training scientists on how to get their messages across.

CRITICAL RESPONSES

Such activity soon became the subject of critical scholarship. Some of the criticism was fundamental: some scholars were not convinced that the public understanding of science needed improving, and were not sure who, if anyone, would benefit if it were. Researchers also argued that 'understanding' of science had clearly, if tacitly, been equated with 'knowledge' – factual knowledge of the content of science.[5] Understanding was also tacitly equated with 'appreciation' – of the scientific enterprise, and of particular innovations.[6] Thus scientific knowledge was seen to lead to a welcoming attitude to science and technology. It became clear that many in the scientific and policy communities in the UK who wanted to further the public understanding of science were really concerned with increasing the public's appreciation of science, and thought they could do this by communicating scientific facts to the public.

Nevertheless, research on how people's knowledge informs their attitudes suggested that while people with very low levels of factual knowledge tend to become more positive about science when they learn a little more about it, once they gain more knowledge still they tend to start thinking more critically. The more knowledgeable people are about science, the wider the range of attitudes that may be found among them.[7] Thus telling people more about the science of a particular innovation is as likely to produce protest as support. If we are trying to enhance democracy this is surely a good thing: an efficient opposition is essential. If, on the other hand, we are trying to sell genetically modified crops by teaching people genetics, we may be disappointed.

In the UK, there is evidence to suggest that people acquire, or are prepared to accept, only the information they need for their own particular circumstances, and little more.[8] Laypeople's understanding often remains specific to the circumstances that produced it, and is not transferred to other situations. Thus lay expertise tends to be specific or concrete rather than general or abstract – the opposite of how scientists see their knowledge of science. But the expertise of scientists, who work with general laws, may be inappropriate in specific circumstances. After the Chernobyl nuclear disaster, farming restrictions imposed in northern England were based on what scientists thought was the universal behaviour of caesium in soil, but the research had been done on clay soil, whereas the local soil was peaty.[9] Local people could have helped scientists plan appropriate measures; instead, they felt that the 'experts' were dismissive of local knowledge based on particular experience rather than on general scientific principles, to such an extent that some local people felt that their way of life was under threat. Studies such as this have led to a 'contextual' approach to public understanding of science. This suggests that instead of dispensing factual prescriptions, scientists should listen to and work with the particular problems and expertises of the people, and tailor their advice accordingly – the task is less one of propaganda or education, and more one of negotiation. This is clearly a more difficult task, and not one that is easily accommodated within a traditional PR strategy.[10,11]

Knowledge and trust are intimately intertwined

The 'contextual' approach suggests negotiation rather than propaganda or education

In a world where we cannot all know everything, we have divided up responsibility for knowing. Plumbers know about plumbing, farmers know about farming, and scientists know about science. Because scientists know about science, the rest of us do not have to know about it for ourselves. Where we trust the scientists to make decisions on our behalf, we do not need to know much about what they choose to do. Even people working in highly complex (and potentially dangerous) technological environments learn only what they need to fulfil their responsibilities, and they trust their colleagues' expertise in the rest of the process (see the case studies in Irwin and Wynne[11]). Acquiring knowledge in such circumstances could undermine the trust relations on which all institutions rely, and so ignorance has great social utility. This brings us to what seems now to be the heart of the matter: knowledge and trust are intimately intertwined. Where knowledge is lacking, trust is essential. Where trust is lacking, knowledge is essential. When people clamour to know more about the science in contemporary Britain, it is invariably because the scientists, their institutions or their paymasters are not trusted. Problems of trust are much more difficult to solve than problems of knowledge (see Chapters 4 and 7 in Gregory and Miller[1]).

SCIENCE AND THE MEDIA

The public understanding of science movement in the UK has had an uneasy relationship with the mass media. On the one hand, the media are seen as a powerful force in the dissemination of scientific knowledge, but on the other, media practitioners have been characterised as prejudiced against science, ignorant of it, and enthusiastically peddling caricatures and travesties. The many calls for 'more' science in the media seem to have been based on two misapprehensions. The first is that there is very little science in the UK media, and the second is that the impact of media science would be greater if there were more of it. Scientists have argued for more column inches as if that would necessarily lead to a greater dissemination of knowledge (and so to more positive attitudes). This is ironic given that scientists were also complaining about the poor quality of science reporting, but it also shows a rather naive conception of media effect – a phenomenon that has been resisting the efforts of media researchers for decades, and has been malleable in the hands of those with a political agenda.

In this climate, the results of a large-scale content analysis of science in British newspapers took many by surprise. There is a great deal of science in the British newspapers – indeed, it is hard to see how space could be found for much more.[12] Science pervades many types of coverage, amounting to 5 per cent of British newsprint. Different technologies have dominated coverage in the post-1945 period: space in the 1960s and IT in the 1980s, for example. More recently, the dominant technology in media coverage of science has been biotechnology. Given that our newspapers are traditionally organs of domestic politics, and that science is not intrinsically well equipped to fight for news space, we should perhaps be puzzled by how much, rather than how little, science is in the UK news.

The dominant technology in recent media coverage has been biotechnology

The media are often accused of publishing scare stories that stir up controversies, inhibit scientific research and compromise markets for new products. However, some media research suggests that controversies play a useful role in establishing a new technology in society. Media coverage confers salience – it tells us not what to think, but what to think about. In a post-industrial society such as the UK, this 'thinking about' is likely to be critical, and is more likely to happen with those better equipped, socially or intellectually, to find and use knowledge. Thus media coverage opens a gap between the informed and the less well informed. However, if all else is equal, controversy will stimulate the flow of information and reduce this gap. So controversy has an important democratic function: it speeds up the circulation of knowledge, and stimulates and maintains the involvement of citizens in the issue. Controversy can also widen the scope of an issue: for example it might alert the churches or the judiciary to express a view; and it can expose traditional values, so that they can be adapted to new contexts. The mass media are vital to these processes. So although this situation is a complex one, it may be that controversy is a useful engine for, and perhaps even a necessary precursor to, the accommodation of a new technology.[13]

Controversies play a useful role in establishing a new technology in society

RISK

Another early misapprehension in thinking about the public understanding of science was the idea that knowledge necessarily implies particular behaviour, especially in situations of risk. It was considered a very satisfactory result in the UK that, in 1988, the vast majority of survey respondents knew that sunbathing could cause skin cancer: the inference was that people would therefore protect themselves from the sun. But a research group who repeated the UK survey in China were surprised to find that the Chinese, a nation of smokers, were very well aware that smoking can cause lung cancer and heart disease.[14] This raised the question: if the people know this, why do so many of them smoke? But the majority of Chinese live in rural poverty and die young by Western standards: why would they worry about the long-term risks from a cheap and enjoyable cigarette? Such results not only teach us that knowledge does not necessarily imply behaviour, but also reinforce the idea that understanding the context in which knowledge is used is vital to understanding what difference it will make, if any, in people's lives.

Knowledge does not necessarily imply behaviour

When the public are more (or less) concerned than scientists think they ought to be about a particular risk, poor understanding of the mathematics of probability is often held responsible (see pages 16 and 18 in Royal Society[2]). However, researchers have found that lay

Lay risk assessments draw on a broad range of data

risk analyses are rather different from scientific ones, in that they draw on a much wider range of data. So while a scientific risk assessment might state only a probability of a particular effect on a particular population, lay assessments would also include information about who will be affected, who will benefit, what the alternatives are, who is providing the information that is being used in decision-making, what measures are in place should things go wrong, who would be responsible, and what impact the possible effect would have on the social fabric and moral climate as well as on people.[15] It is often the absence of such factors from scientific assessments that can make them unacceptable to the public.

THE PUBLIC

A recurring theme has been the idea that informedness is necessary for decision making

There have been some changes in how the word 'public' is used in recent years. In many discussions of the public understanding of science, the public is some mysterious 'other' about whom one can generalise on the basis of very little evidence. Whoever the public are, they are not like us, and they are somewhere else. However, one trend has been to pluralise the public, and to classify different groups in regards to their relation to science. One scheme separated the 'interested' from the 'attentive' public, for example, who are respectively those who take note of science if it catches their eye and those who actively seek it out.[16] Another scheme produced groups including 'confident believers', 'not sure' and 'not for me'.[17] Some science communicators find these categorisations useful when targeting their activities, but such schemes have been subject to much criticism. For example, it seems unlikely to some sociologists that something as complex as the public's relationship with science can be reduced to such a few categories; and if these categories are real, they are surely very fluid: someone merely interested in GM food today may be attentive tomorrow, and a 'confident believer' in regard to their cancer treatment may be 'not sure' about the space programme.

A rather different approach is to see the public as a communication system, participating in the flow of information and expression of attitudes that bind us as a society.[18,19] A public of this sort is one that anyone is entitled to join or leave, and so it is potentially very large. Because membership is not limited by interest or money (as is a theatre audience) or by qualifications (the legal profession) or by a particular agenda (an environmental organisation), or by any other criterion, it is impossible to define the members of this public. We must therefore assume that it is a lay public. The audience for the mass media might be an example of such a public. The communications that thrive in the mass media are therefore those that reach large numbers of laypeople. This places huge demands on those who would communicate science to the public, and limits the content of their messages.

A recurring theme in public understanding of science has been the idea that informedness is necessary for proper decision-making, and that it is achieved through the communication of information (see, for example, p. 3 of Agricultural Biotechnology Council[20] where 'The argument is about informed debate and understanding, and the purpose of this report is to enable the public and opinion formers to make informed choices about agricultural biotechnology.' Informedness is difficult to achieve when the content of messages must necessarily be limited. Another theme is that irrationality is dangerous and must be cured. For some scientists, irrationality is a threat not only to proper decision-making but also to civilisation itself.[21–25] But this emphasis on informedness and rationality also marks out science from other issues in the public sphere: after all, it is a premise of our democracy that any citizen, whatever they do or do not know or think, can contribute to decision-making in circumstances even where others' fate is in their hands – for example as a juror or

In lay communication systems, the public make moral statements

Expressions of emotion indicate what is and is not acceptable in society

'Science and Society' encouraged scientific institutions to learn, change and cooperate with society

as a voter. Why should decisions about science be any different?

In a large, lay system of public communication, where the content of messages is necessarily limited, the public is all the time making moral statements. It makes these usually in the form of expressions of emotion, from outrage to enthusiasm. These expressions of emotion – deemed irrational by some scientists – are often dismissed as sensationalism or hysteria, but they contain a great deal of data: they indicate what is and is not acceptable in society.[18] This is useful information which is too often wasted, even though it expresses the moral climate of the society in which science and technology must fit to thrive.

RECENT PERSPECTIVES

The evolution of thinking in the field of public understanding of science is reflected in the report of a House of Lords committee, published in 2000.[26] 'Science and Society' was welcomed by many who saw it as setting straight errors of the past. For the first time in a policy document, the key issue was trust – very little space was devoted to what people know. Attitudes and values were considered important. Survey evidence was treated critically. The report took a broad cultural view, and acknowledged that British society is active, questioning and engaged with many social, cultural and political issues, one of which is science. It even questioned the term 'public understanding of science', burdened as it now is with the errors of the past.

'Science and Society' acknowledged that there is a great deal of high-quality science reporting in the newspapers; it dismissed the long-standing but unsupported complaint by many scientists that scientific reporting is dangerously inaccurate; and it admonished scientists for expecting special treatment from journalists – science must earn its place in the headlines, and, like any other institution, take the rough with the smooth in the mass media.

Democracy was important in the House of Lords report. There was great emphasis on what and how the public might contribute to decision-making. It recommended a much greater openness of debate, and suggested a number of means by which the public might become engaged in scientific issues. The report argued that such public engagement should be conducted in good faith: it should be integrated into decision-making practice, and the scope for public contributions should be made clear. It noted that the main function of such input is not to make scientific decisions – the best people to make scientific decisions are scientists – but to inform scientists by making explicit the social context and moral environment in which their decisions must work. The report argued for greater openness and integrity from scientists: if their motive is to sell a product, win a scientific argument, or gain more funding for their project, this should be clear. In summary, unlike earlier reports that instructed the public to learn, change and cooperate with science, this report encouraged scientific institutions to learn, change and cooperate with society.

INDUSTRY AND THE PUBLIC UNDERSTANDING OF SCIENCE

'Science and Society' has set the tone for much recent public understanding of science activity, on a variety of scales. One prominent large-scale example is the UK Government's public debate on GM issues, 'GM Nation?', which took place over the summer of 2003 in a series of public meetings run by an independent steering group in collaboration with local groups around the country. The meetings were designed in a variety of formats, starting with workshops that enabled lay participants to set the agenda for subsequent discussions, and materials in a variety of media were made available to engage a range of constituencies and to stimulate discussion. The questions participants raised showed a clear interest not just in the science of GM crops, but

The public bring many valuable qualities to discussions about science

The biotechnology industry is well placed to take advantage of academic research

Much of the tension in the public's relations with science has been in areas where commercial involvement is significant

predominantly in the political and social aspects of GM as a new technology: questions of responsibility, accountability, regulation and trust were high on the public agenda, as were questions about how the outcomes of the meetings themselves would be used in future decision-making.[27]

In its final report on 'GM Nation?', the steering group identified the key messages emerging from the exercise. Some of these reinforce earlier studies on public understanding of science more generally, but others make specific points, among them that there is a widespread unease about GM technology, and little support for early commercialisation. But there was also a strong wish for more research on GM, and more information about its results; and there was enthusiasm and appreciation among the participants for the opportunity to engage with GM experts and with each other, and for the chance both to listen and to be heard. These outcomes are surely both a step and a guide towards strategies for the renegotiation of the relationship between biotechnology and the public.

'GM Nation?' represents an innovation in government consultation on scientific issues, and time will tell us more about how effective it has been in achieving the recommendations of the 'Science and Society' report. But other institutions have been slower to respond to 'Science and Society'. Like other reports before it, and indeed much of the academic research in this area, its influence is difficult to see in the commercial sector.[28] This is a failing of the movement for public understanding of science, because the public's relationship with science is surely constructed as much through commercial products as it is through the ideas of the academy. Similarly, many of the tensions in that relationship in recent years have been in areas such as biotechnology where commercial involvement is significant.

It is also the case that where the commercial potential of a new technology is high, research funding tends to be available: there has been much more academic research on the public understanding of biotechnology, both in the UK and more widely, than there has been on the public understanding of cosmology, for example.[29,30] The biotechnology industry is therefore well placed to take advantage of academic research if it so chooses. At the moment, however, it seems to be finding its feet in just the same way as the academic institutions were in 1985. The Agricultural Biotechnology Council recently announced that that they intended to 'go out of our way to understand and address [public] concerns',[20] thereby making it clear that public concerns are not among their core interests. Companies are still pursuing programmes of education, insisting on informedness as an entry qualification for debate, and highlighting what they see as the public's failings rather than valuing public points of view, irrespective of how they were formed. Many see the risk arena as their primary battleground, and yet they are focusing on their own limited definitions of risk while dismissing lay assessments as hysteria, or as the result of misunderstanding. Instead, they might aim to understand the many factors informing public risk perceptions, which could be seen, for the purposes of the exercise, as 'different' rather than necessarily 'wrong'. The media could be considered not as dangerous scaremongers but as providing an arena that usefully manages the controversies that will clarify the status and function of biotechnology in society. In any case, the media are performing a useful function for individuals and for society by airing the issues, and it would be anti-democratic to deny them this role. Most importantly, some respect for the public could be productive: after all, it is they who decide, both as consumers and as citizens, whether a new product succeeds or fails. Rather than characterise the public by what they lack, some value could be placed on the many qualities that the public bring to discussions about science, not least their ability to see broadly and in many contexts the possible ramifications of a new technology.

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collaboration with the Department of Science & Technology Studies at University College London and directed by Susie Harries of the RSA, provided a rare link between the academic community and the commercial sector on issues in public understanding of science. This project led, in 2003, to the RSA's Enterprise Exchange, which in its first year will focus on science, technology and society. It will bring together technology-based companies with scientists, government, non-governmental organisations, academics, consumer organisations, trade associations, the media, and the insurance and investment communities, with the aim of renegotiating the relationship between business, science and the public. Its immediate objective is to produce a set of guidelines for British business on engaging with public concerns – social and ethical, as well as practical – with the ultimate aim of giving people a greater say in their future as well as improving the climate for the introduction of beneficial new technologies.

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