postnote

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DEBATING SCIENCE

Recent years have seen an increased awareness of the importance of public engagement with science and technology (S&T). The science to be funded, how it should be carried out and how it should be used and regulated are all debated questions. But what is meant by public engagement? Can public engagement in policy be effectively achieved without a wider dialogue between scientists and the public? How have methods of public engagement developed, and at what stage in the S&T process are they best applied? How do policy-makers take into account public opinion when using and regulating S&T?

Background

What is public engagement with science?
The term 'public engagement with science' has different meanings for different people and organisations. It is used both in a broad context to mean public awareness of science, science communication, scientific literacy, and general involvement with science and its processes, through activities, debates and the like. Many organisations have this remit as a whole or part of their core activities (Box 1). Increasingly, however, 'public engagement with science' has come to imply involving the public in policy decisions and in setting research priorities. In this context, engagement means information, public opinion research, consultation and participation.

This POSTnote will focus on the latter definition. However, many argue that effective public engagement with S&T policy and funding can only be achieved in the context of more widespread dialogue between the public and scientists. Developing science education is also key.

Attitudes to science and consultation
The UK population is generally supportive of S&T. A survey in 2005 for the Office of Science and Technology (OST) shows that most people think science makes a good contribution to society (86%) and that science will make our lives easier (82%)[1]. A clear majority also agree that the benefits of science outweigh the risks. In the

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Box 1. Who engages the public with S&T?
Governmental
- The Office of Science and Technology (OST)'s Science and Society programme (part of the Department of Trade and Industry) aims to achieve greater public involvement in the debate about the place of science in society. It builds capacity for and funds public dialogue projects through its ScienceWise programme.
- Research Councils canvas public opinion on research directions through advisory panels, respond to policy consultations and support their researchers in engagement activities.

Non-governmental
- The British Association for the Advancement of Science (the BA), runs events for members of the public, scientists, young people and others, including National Science Week, the Festival of Science and regional activities.
- Museums and science centres, including the National Museum of Science and Industry, the Natural History Museum, Techniquest and @Bristol
- The Royal Institution (RI) runs events, lectures and a Young Person's Programme to inform people about how science affects their daily lives. It also hosts the Science Media Centre, which provides in-depth information on science-related issues.
- The Royal Society (RS) is the UK's independent scientific academy. Its Science and Society programme aims to stimulate informed dialogue about science. The MP-Scientist Pairing Scheme fosters connections between researchers and UK parliamentarians. The Science Policy programme provides advice to policy-makers on issues with a scientific aspect.
- Think tanks such as Demos and the Institute for Public Policy Research
- The Wellcome Trust supports research and activities to promote learning, stimulate informed debate and inform research and policy. Programmes focus on education, science and art, science and theatre, biomedical ethics, exhibitions and public consultation.

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same survey, the vast majority of those polled felt they knew nothing or not very much about public consultation on science, despite 81% feeling that the public should be consulted on decisions about scientific developments.

Most people felt that there should be 'a fair amount', rather than 'a great deal' of consultation on S&T issues.

However, few felt the Government listens to or acts on, the outcomes from public consultation on science (or on other issues). These feelings were echoed by the finding that more people (50%) felt that public consultation events were just public relations activities and did not make any difference to policy; only 17% felt consultations had an impact on policy. Similarly, such events were often viewed as unrepresentative of public opinion. Nevertheless, a huge percentage of those polled wanted to participate on issues of S&T.

Attitudes to political engagement
In 2003, the Hansard Society (whose aim is to promote effective parliamentary democracy) and the Electoral Commission carried out an audit to see how many people are currently engaged in political processes[2]. The survey shows that on the one hand, people express an interest in public engagement (three-quarters felt that 'they want to have a say in how the country is run' and two in five have discussed politics). On the other hand, only one in three felt that getting involved can change the way the UK is run and just one in seven had actually taken part in some form of political engagement (for example signing a petition or going to a meeting).

Issues
The value of public engagement in policy-making
Traditionally, national policy decisions are determined by elected or nominated representatives, supported by advisers, civil servants and committees. The influence of public opinion is thus often limited to election time. Locally, meetings with MPs can influence decision-making. Enthusiasm for increased deliberative democracy and public engagement is growing in all policy circles (not just science). For example, the Department of Constitutional Affairs and the Home Office are looking at ways to improve engagement between citizens and their democratic institutions.

For science, the Council for Science and Technology[3] and the Government have emphasised the need for public engagement with science to be embedded in wider moves to broaden citizen participation in policy. Engagement with S&T may present unique characteristics and/or insights into wider processes of engagement. The Århus convention (POSTnote 256) addresses some of the drivers for public participation.

Models of public engagement
In recent years, theories about public engagement with science have moved from the 'deficit model' (simply informing people about science will make them understand and accept it) to more two-way models and to notions of 'upstream' public engagement (see below). These theories resonate with the House of Lords Science and Technology Committee's report (2000)[4] which recommended that direct dialogue with the public should become a "normal and integral" part of science-based policy-making and research activities.

Upstream public engagement
This refers to involving people in the more strategic stages of S&T research and development, rather than at later project stages[5]. It moves the public engagement agenda away from risk-focused questions posed at particular stages of research towards questions about the values, visions and interests that motivate S&T research and development. It stresses that public engagement should be early and ongoing, to enable continual and open reflection on science in society (Box 2).

An example of early engagement dates back to 1994, when a consensus conference funded by the BBSRC and held at the Science Museum anticipated issues surrounding genetic modification (GM) of plants. The conference made practical recommendations but these were not taken up by policy-makers. Conversely, in 2003, the GMNation? debate, funded by Government and addressing many of the same issues as the consensus conference, was seen as being "too little, too late", and thus too 'downstream'. The UK Government's 10 year strategy for science and innovation wants "to enable debate to take place 'upstream' in the development process, and not 'downstream' where technologies are waiting to be exploited but may be held back by public scepticism brought about through poor engagement and dialogue on issues of concern"[6].

Box 2. Examples of upstream public engagement
Quality Research into Dementia (QRD)
QRD is the research grants programme of the Alzheimer's Society. The QRD Advisory Network is composed of 150 carers, former carers and people with dementia who:
- set the strategy for research;
- comment on the prioritisation of grants;
- select applications for funding;
- monitor on-going projects being funded by the Society.

Nanotechnologies
In response to a report by the Royal Society and the Royal Academy of Engineering[7] (commissioned by the Better Regulation Taskforce), the Government outlined a programme of participatory processes and research projects, in partnership with other organisations around the use of nanotechnologies. The Nanotechnology Engagement Group:
- supports a coherent programme of public dialogue in this area; and
- aims to understand upstream engagement and transfer this learning to wider S&T arenas.

It inputs to the Nanotechnology Issues Development Group, the policy body that coordinates Government activities on nanotechnology. The Government expects the outcomes of the dialogue to help policy-makers in setting the research agenda, shaping the regulation of nanotechnologies, and inform, rather than directly determine, policy decisions.

Is early engagement justified?
Some suggest that the upstream model is over-simplified when considering the complexities of the research process. Thinking within the Wellcome Trust[8] considers that, for biomedical research, public engagement can be beneficial to inform what research to carry out and how the outcomes of research should be used. It is also important to engage[5] the public regarding the techniques and processes of research - especially where ethical

issues are involved. However, it is less clear how public engagement can be employed when considering basic and blue-skies scientific research.

In another model, proposed by the BA, small scale deliberations would focus on research in its early stages, where such research is often complex and involves a high degree of uncertainty; mass participation methods would become more relevant when applications of S&T become more evident[9]. Ideally such models would operate against a backdrop of general scientific awareness. For this to be achieved, many argue that fundamental changes need to occur at an even earlier stage, in the teaching of science in schools, and that engagement with S&T issues should continue to occur in its broadest sense.

Recently, a workshop convened by the Agriculture and Environment Biotechnology Commission (now disbanded) reported that public involvement is necessary to ground the scientific process in 'common sense' and add independence[10]. After much deliberation and some resistance, especially from scientists, a role for public involvement in setting research agendas was established. This was agreed to be most appropriate at a strategic, long-term level rather than at an individual project level. However one critic suggests that dialogue processes may patronise the public by only giving them a semblance of power in the policy process, and may elevate dubious new voices to the status of 'expert'[11].

Processes of public engagement
Methods
The methods used in any engagement exercise will vary according to the questions asked, the audiences consulted and the outcomes expected from the engagement. Several organisations, including the OST and Research Councils UK, have elaborated practical guidelines for engagement activities with science.

Traditional methods of public engagement with policy-making include referenda and consultations, on which interested parties can comment. Online consultation methods, citizens' juries, and consensus conferences, in which members of the public are provided with balanced information, debate an issue and provide recommendations, are other methods. Recently, NanoJuryUK launched the findings of its citizens' jury on nanotechnologies. Innovatively, it used a 'two-way street' method: jurors first explored a topic of their own choosing (youth crime) before debating the more abstract subject of nanotechnology.

Information and communication technologies, such as mobile phones, could increasingly be used for consultation purposes in the future. Consultations carried out with these technologies have the potential for instantaneous (and perhaps less considered) responses. Hence the results they present will pose particular challenges for interpretation. The Hansard Society is carrying out a pilot study on the use of mobile technologies for consultation.

Participation, inclusiveness and representation
Critics of public engagement have argued that dialogues are not representative or inclusive enough of different audiences, and may become hijacked by minority groups with specific agendas. However, some engagement exercises may not require a fully representative audience. Participation methods can be narrow and deep (for example citizens' juries) or more broad and large scale (for example GMNation?). Their use will depend on the engagement circumstance.

However, there is still concern that some sectors of society are not included on issues of S&T. The Delivering Inclusion in Science Communication initiative targets ethnic minority groups to enable greater participation in science. Involving other groups, for example refugee or transient populations, presents particular challenges.

Speaking a common language?
NanoJuryUK, although widely perceived as a successful process, has highlighted the continued difficulty of language. Many jurors reported difficulty with the technical language used by the witnesses, even after in-depth and lengthy deliberations. By dealing with technologies not yet fully developed, this engagement exercise had few reference points in everyday life. The abstract and unfamiliar notions covered presented challenges for the jurors.

Language has also been highlighted as a barrier to interpretation of engagement exercises by policy-makers. From the public perspective, critical issues to do with S&T centre on trust, control, responsibility, equity, access, benefits and consent. For example, NanoJuryUK recommended that "nanotechnologies should only be allowed if they develop wealth for everyone". Such aspirational statements are far removed from the nitty-gritty policy world of implementation and regulation.

Outcomes of public engagement
Setting objectives
Public engagement may cover a spectrum of objectives, from promoting awareness through to involving people in a particular policy decision. However, objective-setting has not, until recently, been a cornerstone of engagement exercises. In particular, the GMNation? debate suffered from unclear and contradictory objectives. Early engagement poses another challenge for objective setting as it may be difficult to specify initially what a dialogue should revolve around. It may take time and deliberation to identify pertinent questions and set the agenda; this has the potential to lead to conflict over objectives[12].

Measuring the impact of dialogue
Outcomes of engagement can be either procedural or have a policy-making element. Measuring procedural outcomes – for example, whether the engagement included all stakeholders – is becoming a more integral part of engagement exercises. It is easier to achieve than measuring the impact of consultation on policy-making. However, the latter outcome is more important: if the outputs of engagement have no effect on policy, then

stakeholder cynicism and fatigue may set in. Public engagement practitioners need to devote careful thought to how outcomes are set and assessed, and to manage expectations accordingly. At the same time, policy-makers may need to become more transparent over how they take into consideration public opinion. For example, decision-makers could explain why a dialogue recommendation was not adopted.

Rewarding public engagement
In the broader context, an increasing number of scientists and their collaborators are carrying out engagement activities. Research Councils and other funding agencies may ask or require that public engagement to form a part of a research award and some offer prizes to reward excellence in public engagement. Yet such ventures are not rewarded in any formal manner, even though they are credited with forging new research partnerships and raising the profile of science. Many have called for the Research Assessment Exercise to take into account engagement initiatives, to further stimulate general debate on S&T issues. A report (commissioned by the Royal Society, Research Councils UK, and the Wellcome Trust) on the factors that facilitate or inhibit public engagement among scientists is due in 2006.

A Commission for Emerging Technologies and Society?
The nanotechnologies report (Box 2) recommended "the Chief Scientific Advisor establish a group that brings together representatives of a wide range of stakeholders to look at new and emerging technologies and identify at the earliest possible stage where potential health, safety, environmental, social, ethical and regulatory issues may arise and advise on how these might be addressed". The Government responded by developing a process by which horizon-scanning and public engagement on S&T issues operate in tandem, through the Foresight group (part of OST). It argues that to build a more considered policy culture in relation to S&T, increased dialogue between all the institutions involved in the governance of science needs to occur (rather than establishing a single entity). However this would require these institutions to have extra capacity to enable public dialogue.

Others, including the think tank Demos, see the need for a separate commission to advise on the long-term implications of emerging technologies, including on appropriate ways of engaging the public[13]. Other countries have adopted such a model. The Danish Board of Technology, for example, promotes ongoing discussion about technology, evaluates it and advises the Danish Parliament and other governmental bodies.

Future debates
Enhancing human abilities
The convergence of nanotechnology, biotechnology, information technology and cognitive science (the study of the mind) happens at the smallest scale. It promises to develop tools that will extend physical capabilities – making humans quicker, stronger, smarter – to improve health and to develop human-machine interfaces. Such research raises obvious social, ethical, legal and public

policy challenges and many are calling for these to be debated as early as possible.

Energy Review
The 2003 Energy White Paper included a substantial consultation element. A review of energy policy, including the possibility of new nuclear power stations, is currently underway. The Energy Minister "wants to engage with the public on energy issues"[14]. However, the results of the review are due in Summer 2006, which may not be enough time for meaningful public dialogue to take place.

Overview
- People generally support S&T. Many would like more of a say on certain issues but feel that Government is unlikely to listen to them.
- Engagement with S&T issues is moving 'upstream'. The public is getting involved earlier in debates and beginning to have an input setting research agendas.
- Methods of public engagement are becoming more refined and accessible, although some sectors of society are still not included in debates.
- Effective public engagement with S&T policy should not be divorced from widespread dialogue between the public and scientists.
- Measuring the outcomes of public engagement is essential, but difficult to do and rarely achieved.
- Debate surrounds the desirability and feasibility of setting up a body to examine the implications of emerging technologies for society.

Endnotes
1 http://www.mori.co.uk/polls/2004/pdf/ost.pdf
2 http://www.hansardsociety.org.uk/node/view/143
3 Council for Science and Technology, *Policy through dialogue*, March 2005
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5 *See-through Science* (2004) Demos.
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7 *Nanoscience and nanotechnologies: opportunities and uncertainties* (2004) Royal Society & Royal Academy of Engineering.
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9 Jackson R *et al* (2005) *Crit Rev Int Soc Pol Phil* **8:**349-358
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