Scientists engaging with the public

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In a nutshell

In an ideal world, communication should be a natural part of the scientific process. But in the practical world we all inhabit, it's clear that some aspects of the communication process take a special effort by scientists and research organizations. The most difficult element in the communication process is dealing the public, and this is often regarded by scientists as an extra task which interferes with the real work of research.

Scientists are comfortable communicating, but only to some audiences. They spend much time writing papers for publication, giving seminars, attending conferences and symposia, and emailing and meeting with colleagues from home and abroad. All these activities are forms of communication, and scientists do them willingly—partly because they like doing them, and partly because their advancement in science depends on it.

The audience they are least comfortable dealing with is the public. The public is unpredictable. Members of the public may have views, prejudices and attitudes founded on a poor understanding of the situation. They have unrealistic expectations about what scientists can do and how long it will take. They have little appreciation of the scientific method, or the way scientists conduct research and debate results. Scientists fear that dealing directly with the public can cause them to lose credibility with their colleagues, because it requires a degree of simplification and because they may be accused of publicity seeking.

The public bears some responsibility for these communication difficulties. Instinctively they steer away from science, because they don't understand it, because they think it's difficult, because they have bad memories of science lessons at high school, or because they're alienated from science. People tend to think that scientists are somehow 'different', and not from the ordinary world. When scientists are portrayed in fiction—in films, for instance—they're often painted as strange creatures. Cartoon scientists are old men with weird hair, working in isolated and ramshackle laboratories. Their experiments are characterized by explosions, failures and bad smells, and their language is incomprehensible. They're often portrayed in negative terms, as misguided or evil, or as mad, bad and dangerous to know. Occasionally they save the world, but more often their reckless experiments bring it to the edge of disaster.

In her paper at the Beijing Symposium, Metcalfe and Gascoigne suggested that both sides were aware of this view of science:

> The scientific and media communities appear to be aware of the sorts of stereotypes that exist about themselves. For example, scientists participating in focus group discussions felt that the public saw them as 'boring men in white coats in a world of their own, people whose actions and motives are to be regarded with suspicion or distaste'.

These prevailing cultural attitudes allow people to accept placidly their lack of understanding of science. Many are quite willing to laugh away their lack of numeracy or science skills ('I never could do maths or science at school!') but would be very embarrassed to admit they couldn't read or write.

In the views of some scientists, it's unfortunate that funding for science and the acceptable boundaries for science are controlled by this same public. Scientific research is generally managed by government, and governments are elected by people. Governments determine budgets and allocate funding; they set research priorities, and limits on how far science can go (for example, in stem cell research or genetically modified crops). So, if scientists want to increase research funding or influence legislation, they need to sell their case to the public—a public split between admiration, bewilderment and suspicion.

Scientists have another reason for working with the public. Some research will have direct implications for the general population and affect the way people live their lives. When this research is put into practice, people may need to change their behaviour. Scientists need to explain what they've found out and the implications of these findings for ordinary citizens. This can result in warnings or advice to the public: eat less fatty food, reduce water consumption, don't drive after drinking alcohol, change farming practices to increase crop yields, preserve a threatened plant or animal species, don't tip raw sewage into a river or the sea, prepare for global climate change. Other research will come up with new and better ways of doing things, and the public needs to adapt to these new technologies to take advantage of scientific advances. Examples include the mobile phone, inoculation against disease, electronic banking and the internet.

This introduction to this part is in two sections. First is a straightforward presentation of the papers in this part of the book. This is followed by a discussion of the issues identified in these papers, in the context of a detailed description of 'Science meets Parliament'. This Australian event brings working scientists into one-on-one meetings with members of the national parliament, and brings into question the capacity of governments to assess the impact of science on society and the needs of the public. The second is a discussion of 'Science meets Parliament'.

The papers

The 16 papers in this section of the Beijing Symposium dealt with the various ways research organizations and individuals met the challenge of discussing their work with the public. The papers fell into three broad categories. The first discussed ways that scientists might be trained to meet this challenge: how to talk or write about their work in a way that the public could understand. The second category started not with the scientist, but the public—a more challenging approach that begins with the question: 'How can we, the scientists, help you?' The third category described ways of presenting issues to the public, using the internet, a cadre of retired scientists or popular television programmes.

Five papers were presented on the broad theme of training scientists. They were presented by Nicholas Hillier, Jenni Metcalfe, Jan Dook, Rod Lamberts and Marie-Claud Roland; the papers by Hillier and Metcalfe and Gascoigne are shown in full.

The second category included Henk Mulder and Caspar De Bok's paper on science shops, where the discussion is begun by the public rather than scientists. Sonja Gruber's paper also had elements of this approach. Mulder and De Bok's paper is here.

Nine papers described different methods scientists used to communicate with the public. They were presented by Tina Phillips et al, Jing Ouyang, Hidelisa de Chevaz, Lui Lam, Mikkel Bohm, Liuqing Yang, Xiao Yun and Lawrence Griffing. The papers by Phillips et al. and Ouyang are reproduced here.

The papers put forward interesting and useful experiences from round the world, and demonstrated the generosity of people in sharing good ideas. De Chavez described a three-volume, 675-page book on agricultural biodiversity. Aimed at less developed economies, it 'sought to gather, distil, repackage and simplify technical information on conservation and sustainable use of agricultural biodiversity'. The task fell into two parts: gathering the information from diverse sources, and then making it available to the people who would use it. Devising the best way to enable people to use the information in such a book—for example, poor and possibly illiterate farmers—would not be a trivial task.

Bohm's paper analysed science events in Europe, with advice on the best ways to fund, organize, market and promote these events. This 'best practice' guide is based on years of European experience in devising and running science communication events, and will be very useful to those starting new ventures. The idea of making the collective experience of event organizers available more widely is squarely in keeping with the aims of the symposium. Bohm also addresses the issue of evaluation and the difficulties of working out a method of establishing the effect of science events on the public attitude to science.

Lamberts described an approach to training scientists in the art of public communication. His workshops cover a range of skills—writing, presenting, and working with the media—and aim to work with scientists at all levels of experience. The programme he runs is so obviously useful to the scientists that one could reasonably come to the conclusion that these skills should be part of the formal degree programme for every scientist, rather than being left to a post-graduation workshop for the few who opt in.

Lui Lam demonstrated how one energetic and committed individual can make a difference. He talks about science to all sorts of audiences, and puts forward six recommendations for others interested in following his path. His energy is commendable, and so is his personal commitment to the cause of communication. The question his paper raises is, 'How transferable is the model?' Does this activity require a special kind of scientist with a charismatic personality, or could any scientist be encouraged to follow Lam's path?

Dook worked at two ends of the spectrum. She trained a cadre of science communicators by asking them to interview notable scientists, and publishing the results in various forms. Did her programme awaken the curiosity of the scientists being interviewed, and change their attitudes to working with the public? Even if it did, the first line of her abstract recites a depressingly familiar case and returns us to the reality of the world of the researcher:

> Many research scientists put a low priority on public communication about their scientific research because of reservations about others' interest in their work, reluctance to speak to the media or busy schedules with little time available for fitting in things that are considered 'extras'.

Yang's paper showed that not all publicity is good publicity. When the extensive coverage on pandas in the China's *People's Daily* was examined and analysed, it showed significant distortions and biases. Yang concluded that greater participation by scientists and research organizations would be needed for a more balanced conservation message to reach the public.

Roland's paper outlined a process to enhance the contextualization of science, in which research projects must take into account societal issues and a multidisciplinary approach is encouraged.

Alvarez made the point that, although science is universal, it still needs to be seen through the prism of a local perspective. Cuba runs a popular science programme on Sunday evenings. It uses sophisticated foreign footage to provide high-quality visuals, but uses Cuban scientists to provide a local context.

Gruber described an Austrian process which sought public involvement in commenting on and developing a new view of democracy. The European political unit is steadily expanding, and this is a process for examining the stresses and strains when a wider range of cultures is folded into one community.

Xiao presented an account of virtual science museums and their role, in China, of providing basic information. This paper put the proposition that science will serve society better when the general population has enough knowledge and confidence to challenge the assumptions of science.

One question which arises from reading this series of ideas and approaches is about sustainability. Do these programmes only work because of the dedication and imagination of a talented individual or a committed organization? Will they always have to rely on goodwill and special funding support, sometimes from a hosting organization and sometimes from an external agent (such as a government department)? Or are they regarded (and funded) as a fundamental part of the science process, built in at the beginning of a project rather than added as an afterthought or tacked on at the end as fringe activities?

The activities presented in these papers often had dual objectives. They aimed to inform or engage the public on a single project—pandas, or bluebirds, or physics—but at the same time they wanted to build up a greater understanding of the science process. It’s as though a failure of the formal education system has been left to science communicators to fix: to explain to the public how scientists devise and conduct their experiments, how they publish their results, and why they debate these results.

It’s clearly a source of some confusion to the public that they hear conflicting ideas from science. If science is precise and exact, why doesn’t it come up with simple answers and perfect solutions? Why is there so much debate within the science community? This irritation with science emerged with one particular audience, members of the Australian Parliament, described in another paper presented at the symposium by the present author.

Science meets Parliament in Australia

The national Parliament House in Australia has an annual one-day visit from scientists, called ‘Science meets Parliament’ Day (SmP) and modelled on a similar (though perhaps less ambitious) programme in the US called ‘Congressional Visits Day’. Individual meetings are organized, each between one member of parliament (MP) and a pair of scientists. At the first of these events in 1999, both sides were surprised to find they enjoyed the meetings: the scientists found MPs interested in their work; and the MPs were delighted (and relieved) to discover that many scientists have potential solutions to problems in the environment, energy, transport, health and agriculture.

In some ways, these annual events are a microcosm of all the problems science communicators face when they try to interest the public or engage with it on the work of a research organization.

In the Australian Parliament, only about 5% of the 227 MPs have tertiary qualifications in science. This lack of scientific expertise can become a problem when Parliament discusses big issues like water, energy, greenhouse, genetic engineering, waste disposal or the environment. All these issues are strongly bound up in science. Solutions and the possibility of new industries or new jobs will have a basis in science and technology.

Their lack of expertise forces parliaments—not just in Australia but in most countries—to rely on the views of the bureaucracies advising them, or a few chosen outside experts. It makes parliamentarians vulnerable to pressure from interest groups (such as industry lobbies, and religious or environmental organizations), or to ideas that sound plausible but have little scientific validity.

This is one side of the problem. Just as parliamentarians understand little about science, scientists have little appreciation of the work of an MP. Scientists don’t have a clear idea of the political processes. They don’t appreciate the pressures (from many different sources) on an MP. They don’t appreciate the timescales, the need for information *now*, because new legislation is to be voted on *today*. The political process will happen, and political decisions will be made, whether or not the scientists have had time to do their experiments, accumulate their results, and test them through publication in the international journals.

The gap between parliamentarians and science applies to all areas of research, and the uneasy relationship between the two is general. Parliamentarians are often irritated by what they see as the protected and privileged world of the universities and other research organizations, and the inability of this sector to provide the advice they need when they need it. There can also be a gap between the apparent promise and actual delivery: the weekly media stories headed ‘cancer breakthrough’ are not always due to scientists exaggerating their work, but parliamentarians and public alike can become cynical about science as a result of all those ‘breakthrough’ stories.

A number of papers presented at the Beijing Symposium described programmes that aimed to increase the public understanding of the process of science. A greater understanding of the possibilities and limitations of science, and of the approach science takes, would help the public in countries all over the world (and policy makers in the Australian Parliament) to have a more realistic view of science. Phillips set out the rationale for this:

> The definition of scientific literacy has evolved over the past 50 years, reflecting the predominant images of science and the revolutionary changes occurring in society (Hurd 1998). For the purpose of this paper, we refer to Lederman’s (1998) definition of scientific literacy (sometimes also referred to as ‘civic scientific literacy’) as ‘the ability to use scientific knowledge to make informed personal and societal decisions’. According to this definition, societies that invest in a scientifically literate population produce critical thinkers and creative habits of mind among citizens, which benefit the overall society. It should be emphasized that scientific literacy is distinct from ‘science knowledge’, which focuses on the accrual of technical or scientific facts.

Australia has tried to bridge this gap with parliamentarians by devising SmP as a new channel of dialogue. About 200 scientists fly into Canberra, the national capital, for the event. They may be nominated by their university or research organization, or they may be self-nominated.

SmP is self-funding (through a registration fee for participants and sponsorship) and runs over a day and a half. The first day is Briefing Day, devoted to strategy, tactics and issues. Briefing Day features a range of speakers including senior parliamentarians and bureaucrats, journalists and successful lobbyists from other groups. The purpose of this day is to discuss ideas and to advise participants on the best way to approach MPs. What are some of the mistakes people make when meeting MPs? How should scientists prepare for the meetings?

Panel discussions are part of the day. Three MPs, one from each of the major parties, will be on one panel. A journalist will chair the session, and ask them questions about the different approaches of their parties to science and technology issues and the most prominent concerns of their colleagues. The purpose of Briefing Day is to encourage the scientists to think from another person’s perspective: What do MPs want to know? How much science do they understand? What are their timeframes? What do they need from scientists in order to do their job effectively?

Another panel consists of people who work in parliamentarians’ offices. These people normally take notes at meetings involving their MP; at SmP, they advise registrants on how to prepare for such meetings. Should they bring anything? How long will the meeting last? What's the best way to start the conversation? What will the MP want to get from the meeting?

Top-level bureaucrats also attend the Briefing Day sessions to explain their role in advising the government and then implementing the government's policy decisions. How can scientists contribute to this advisory process?

The organizers train participants to give simple and direct explanations of their work, in language a lay audience (MPs) can understand. Volunteers stand at the front of the room and explain, in 60 seconds, what their work is and why it's important, after which a gong is struck and they must sit down whether they have finished or not. Then the expert panel—a staff member from a politician's office, a journalist and a professional lobbyist—comments on the speaker and gives general advice on how to approach meetings with MPs.

Training is considered a vital part of the process, reflecting the general importance different authors placed on training in presenting papers at the Beijing Symposium. They claimed that scientists need training to talk to the public, training to handle the media, training to write, training to design posters, and even training to frame their research questions. This raises a question about the content of science degrees at both undergraduate and postgraduate levels. Should these degrees include training in communication techniques and approaches? Should they incorporate from the start the expectation that communication is a responsibility and a normal part of every scientist's job?

Should this responsibility be reinforced by the funding bodies, by making it mandatory for all grant recipients to incorporate a communication plan and a communication budget in their research proposal? And should it be reinforced by research organizations, by properly recognizing and rewarding scientists who involve themselves in a discussion with the public about their work?

Ouyang raised the question of the quality of formal education. She described CAS-ASPIRE, a programme that recruits retired scientists to give travelling lectures in western China, where the school education system is less developed. In eight years, 25 retired scientists have given 2200 lectures. Ouyang explained their approach:

> Science education in Chinese schools often places heavy emphasis on memorizing information, and fails to give students a taste of the excitement science can offer. Therefore, CAS-ASPIRE is designed to give children a sense of the 'scientific spirit' and imbue them with enthusiasm for the field …
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> Unlike traditional science popularization with its overemphasis on scientific facts, CAS-ASPIRE stresses the passing on of the scientific method and spirit. And they also introduce students to their own research work, exemplifying the painstaking and persevering spirit underlying their pursuit of scientific innovation generally. This is intended to lead the student listeners to build for themselves a healthy and progressive outlook on life. They do not overemphasize the systematization and theorization of

> science, or infuse it into the children in a force-feeding style, but try to draw the interest out of the children. Many students discover their interest in science for the first time.

The second day of SmP is devoted to the meetings between pairs of scientists and individual MPs. These meetings normally last about 20–40 minutes, although some have stretched out to two hours. The meetings take place in the office of the MP, usually with four people present: the MP, a member of their staff, and the two scientists.

What sorts of issues are discussed? There are three broad areas the conversation can cover. The first is nominated by the MP. When the invitations to meet a scientist are sent out to the MPs, the organizers include a list of about 15 possible topics—like a menu—and ask parliamentarians to nominate issues they'd like to discuss. A typical list of natural science issues follows, with the number indicating how many MPs nominated each topic (they could choose more than one):

37	Water quality and salinity
26	Energy sources of the future
26	Education and training—school, university and industry
24	Commercialization, innovation, industry research
23	Climate, climate change and greenhouse
19	Broadband access in rural areas
19	Agriculture and agribusiness
18	Health and medical issues
18	Environment and biodiversity
17	Sustainability and the triple bottom line
16	Defence science and biosecurity
15	Stem cells and tissue engineering
14	Emerging technologies: nanotechnology, photonics, bioinformatics
14	Medical and agricultural biotechnology: benefits and risks
10	Nuclear power, and storage and disposal of radioactive waste
10	Mining and resource industries and exploration
10	Brain drain, recruiting

10 Oceans

9 Feral animals, noxious weeds and quarantine

When scientists register for SmP, they too have to nominate which topics from this list they are expert in and would like to discuss with MPs. An earlier version of the list included the topic ‘Funding for science and research’. This was very popular with scientists, but hardly any MPs nominated it as a topic for the meetings. The topic was dropped from the list at future events. If scientists are to be successful communicators, they need to talk about issues of interest to ‘the other party’ (in this case, parliamentarians), rather than issues that interest them.

A second topic of conversation is the research interests of the scientists attending the meeting, and the third is an agenda prepared by the organizing body. This agenda will focus on a big issue, such as the level of the national investment in science and research.

The SmP event is surprisingly popular with MPs. They don’t have to participate—it’s an optional activity for them in a busy day—but about 60% of all MPs usually agree to meetings, including some members of Cabinet.

One reason for the success of this event is that the participating scientists have to be prepared to move out of their familiar territory, into the territory of the parliamentarians. This is a crucial step: so many science communication activities are within the comfort zone of the scientist, where the discussion uses scientific language and the audience has to make all the concessions to understand. So many of them talk to the converted—they attract audiences of people already interested in science and already comfortable with it. This can diminish the value of the communication activity.

Reaching new audiences

If scientists are to be successful in their aims, they need to reach out to a different audience, one not currently interested in science. Phillips explains the problem in her paper. She describes how 5000 individuals across the US register in a programme to track and record the movement of birds:

> All ages and backgrounds are welcome to participate in [the Birdhouse Network project], but the majority of participants reflect a relatively homogeneous group of Caucasian, well-educated, middle-aged participants. This demographic distribution is similar to that of audiences that typically visit science museums and participate in other [informal science education] programs.

Almost all science communication activities are initiated from the science side, by scientists or their colleagues who handle communication. One exception to this is the science shops, described in Mulder’s paper. Here the public, the non-experts, set the agenda—they raise the problems, they set the boundaries of their concerns, and it’s up to scientists to turn these concerns into tasks that can be explored in scientific terms.

As Mulder puts it:

> The original motivation to form science shops in the Netherlands was the big gap that existed between science and society. The university was an ivory tower and theoretical, monodisciplinary knowledge prevailed. There was no direct link to daily problems in society, where some of the side effects of technological development then became visible.

It's as though scientists have forgotten how far their expertise outstrips that of the ordinary population. This gap is another barrier between science and the public, and a barrier excluding the ordinary citizen from any say in helping to set the research agenda. It goes some way to explaining why, when citizens get some say about the limits of scientific experimentation (for example, in genetically modified crops), they often react negatively, almost as though they want to punish the science community for getting ahead of everyone else.

Scientists who make a special effort to communicate with the public can be surprised by the results. The first surprise is that they enjoy it. They enjoy talking about their work with the public, and they enjoy the public profile that media coverage can bring. Some scientists become self-confessed 'media tarts', willing and available to comment in the media on any issue even distantly related to their work. They can become very good at it and provide a valuable service to science (even though some colleagues will complain about them 'cheapening science').

Others are surprised to find the interaction useful. Hillier's paper describes the way scientists responded to the British Association's Perspectives programme, which trained scientists to design better posters and then stand ready to discuss the ideas in those posters with passers-by. He quotes two participants:

> Speaking to the public was a good experience and allows you to look at your research in a completely different light. They ask questions that you wouldn't normally have considered before, like why are you doing it? And what is it for?
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> I learned a lot from the public, mainly about what they pick up from the media and how scientists come across in newspapers. I also found it helped me see my research topic viewed from a different perspective … I had sometimes underestimated the public.

(These disarmingly frank quotations underline the need for training for scientists. Perhaps the quotation is taken out of context, but had the first respondent never considered why he or she was conducting that research? Or the purpose of the work?)

In her paper, Roland described a training process that addressed the aims and purposes of research projects. Her courses sensitized researchers to consider the needs of the public in framing their proposed projects:

> Scientists need new skills, and must develop the ability to be self-reflective in order to move from a linear model of 'public understanding of science' to a 'democratic' model where they share with non-experts societal and scientific problems. Working on the formulation of research questions is one way to improve scientists' communication skills, to encourage them to be reflective practitioners and to prepare them to be mediators in the process of communicating science.

The programme Roland describes uses linguistics and epistemology to develop the ability of participating scientists to frame research questions.

Metcalfe's 12 years of experience in running media skills workshops for scientists in Australia also demonstrates scientists' misreading of the public. She found scientists surprised by the emphasis of questions from the media. The three journalists who give guest lectures in her one-day workshops always ask the scientists, 'Why are you doing this work?' and 'How will it affect the lives of ordinary people?' Scientists are often disappointed not to be questioned at length on how they came to make their discovery and all the clever science that went into the work they did, but instead to be asked to explain what difference it will make to ordinary people.

How do scientists find the experience when they step outside their normal zone of comfort and engage with the public in discussion on their work? Do they gain value from their participation, or does it confirm their suspicions that communication interferes with valuable research time and should be shunted off to other people to handle?

The scientists who visited parliamentarians in Australia's SmP (and the similar "Humanities, Arts and Social Sciences on the Hill") events were pleased they had come. Feedback from participants has been positive over the eight events of this nature run so far. The organizers ask them to complete an evaluation form, and they regularly score the overall event at about 8.2 out of 10. Here's a sample of their comments:

- 'Very well organised. The impact is becoming obvious.'
- 'I have no doubt that past events have helped put science on the political agenda.'
- 'A valuable experience as a young scientist.'

The changing role of scientists

Two-thirds of Hillier's scientists said the UK's Perspectives programme would make them more likely to engage in further public activities. Hillier emphasized the vital role that training had played in overcoming the reluctance of scientists to engage in these activities:

> 'Perspectives' proves that it's possible to encourage scientists out of their labs to engage in meaningful discussions with members of the public. Participating in the scheme allows young scientists to explore and talk about their research within the wider context of other scientific disciplines and society as a whole. The more opportunities scientists are given to do this, and the more we reward them for doing it, the more likely they are to do so independently. If we, as science communicators, intend to take discussions about the applications and direction of science further 'upstream', and to involve the public in discussions much earlier, it's vital we equip young scientists with the skills to participate in and initiate those discussions.

Ouyang said that the efforts of the 25 retired scientists giving lectures in China provided an inspirational model for other researchers:

> For a long time, Chinese scientists have not been used to undertaking science popularization, paying scant attention to it. Now older-generation scientists are becoming well known, and are setting a good example for other scientists to follow. Soon there will be more and more scientists making science popularization their own responsibility and putting more effort into this great enterprise.

Phillips said that the Birdhouse Network (TBN) offered benefits to both sides, the researchers running the project and the 'citizen-scientists' who participated:

> … a key claim of the 'web' model of science communication is that the public can contribute directly to scientific findings—'public communication' isn't simply 'popularization' from scientists to the public. TBN, as with other citizen-science projects, has demonstrated that this model operates directly in some cases and indirectly in others. To date, TBN volunteers have collected more than 50,000 nesting records on 40 cavity-nesting birds across North America. These data have produced eight scientific papers that have been published in peer-reviewed journals … Findings from these citizen-science collected data are helping scientists to advance ornithological life history theory and adding to the general body of knowledge about birds. In the future, data collected by citizens should allow [Cornell Laboratory of Ornithology] scientists to develop management guidelines for attracting these birds and maintaining their nesting habitats.
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> … These benefits have significant implications for increasing scientific knowledge and environmental awareness in the general public, while also providing scientists with valuable data. Furthermore, the citizen-science model can be exported to other taxa and used by researchers to monitor environmental variables across large scales in a way not possible by any other means.

Mulder pointed out the benefits as a whole:

> Science shops combine all three missions of the university: education, research and outreach. They have an impact on scientific research (finding interesting research topics, raising the science awareness of the public), on education (giving valuable skills in communication and project work, raising the social awareness of students, curriculum reform) and on civil society (media attention, policy influence, empowerment of civil organisations to better shape their own living environment).

But, despite these benefits, not all universities are committed to the concept. Science shops need resources and a commitment to community outreach, and 'if the institute focuses on large, basic research projects, there is a big problem that could only be solved by allocating separate, external funding sources for science shop projects'. Although the concept of science shops has been picked up in a dozen or so countries and the model works well and performs a useful service, it's clear that it can be regarded as a low-priority activity for research organizations. It also threatens the priorities in a scientist's life: scientists need to produce peer-reviewed articles for publication.

So scientists find value in communication activities. Why, then, is their participation rate in these activities relatively low?

Many demands are made on scientists. They're expected to research, to manage, to find funding partners, and often to help realize the commercial potential of their work. Research projects are continuously measured and weighed, with progressive goals (‘milestones’) mapped out along the way. Scientists work in a hotly competitive environment, and the pressure to produce results is relentless.

Communication activities get some support from researchers, but they rank low in the priorities of many scientists in the face of competing pressures. Scientists are logical beings: they’ll engage in the activities that bring the highest rewards (whether these rewards are in funding, promotion, recognition or personal satisfaction). Leading a discussion on science with the public doesn’t attract these rewards, so it becomes a low priority with them.

Why don’t universities and research organizations reward communication, by promoting researchers at least partly on the basis of their engagement with the public? Is it because the benefits are intangible, or too diffuse, or simply unproven? Would this position change if all communication activities were accompanied by a rigorous process of evaluation, a process that sets out the goals of the particular activity and then charts and documents the changes it brings about?

Approaching the task of evaluation

Evaluation is a recurring issue. Many papers presented at the Beijing?? symposium had some form of evaluation attached, but the evaluations didn’t generally impress as being impartial, systematic or thorough. They often relied on feedback forms completed by participants, or on the collection of anecdotal evidence. For a programme aiming to change public perceptions of science, it’s difficult to isolate the effects of the programme from all the other factors influencing opinion, and then to measure the changes.

The TBN project took a more systematic approach to evaluation:

> Evaluation of TBN has included a mix of qualitative and quantitative research methods. In 1997, participants received a pre-test survey … The researchers used a modified version of an existing instrument—the Attitude Toward Organized Science Scale (ATOSS)—in order to compare collected data with those of national norms. The ATOSS survey enlisted the Dillman (1978) method for designing and conducting pre and post surveys.

But Phillips sees weaknesses in the TBN process:

> Given the complexity of these projects, however, and the inherent errors of measurement to quantify their effectiveness, a mixed-methods approach that incorporates new measurement instruments and in-depth interviews of scientists and participants is needed in order to obtain more robust interpretation of data.

The issue of evaluation is a continuing problem in science communication. There’s a lack of hard evidence to show the effect of communication activities. Are they achieving their aims? Are they doing good? Perhaps the highest priority for advocates of science communication activities is to devise and implement a rigorous process of evaluation.

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Earlier, he held a similar position with a science organization called FASTS. In both roles, he has engaged with the national and regional governments on issues relating to science policy. This included the creation and organization of ‘Science meets Parliament’, an event that enables 200 scientists to meet members of Australia’s Parliament to help communication between science and parliamentarians.

For 12 years, he has run workshops in media and presentation skills for scientists, in Australia, New Zealand, South Africa and the Philippines.

He is a member of the Scientific Committee of the PCST, and has written and spoken on science communication issues internationally.