Science in a democratic society

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The questions this conference poses are very important ones.

In our world, the gap between science and citizens is growing. Even well-informed scientists cannot keep up with the rate at which new knowledge is generated; and as Bernard Schiele pointed out recently:

> *This explosion of knowledge means we no longer have a shared culture of S&T, and this position is going to worsen in the future.*

If Schiele is correct in claiming that the knowledge gaps are growing wider as science expands and ordinary citizens cannot keep up, then how can a modern democratic society function?

Our society is guided by the views and the votes of the citizens. The functioning of our democracies depends on them considering the choices the country faces. We need people to have a basic understanding of the issues - and the implications of these issues, even if they are difficult to understand, so they can vote in a rational way at the ballot box.

Let us examine one difficult issue, climate change. The experts say we have a problem, and need to reduce the burning of fossil fuel. The accepted way to reduce carbon emissions is to put a price on it, so the industries that generate carbon dioxide are encouraged to find a cleaner way of conducting their business.

Governments find it hard to act on these matters. Science says one thing, but they know the public is confused about climate change. They also know there will be strong opposition from “interest groups, who will attack any new policies at every opportunity.

They will say that similar climate shifts have happened before, and any action would be a big (and expensive) risk. They will find fault with the models and attack the scientists, quoting a few highly selective facts. And the ‘experts’ will appear on national television talk shows, and always they look so plausible, so believable.

Governments can see the political risks. It is easier for the opposition to make the case *against* action than it is for the government to sell the need for a new policy on carbon. Any policies to reduce carbon emissions would cause the price of electricity to increase sharply, a most unpopular side effect.

In Australia last year, when the government began to frame policies on a carbon reduction scheme, opposition grew. Doubts over the science were raised, and vested interests mounted a vigorous campaign to water down the proposed changes. In the end the government walked away from the issue – it all became too hard.

There will be other difficult decisions, many of them on science-based issues: water, energy, GMOs, the environment. Will governments also walk away from these decisions? Or will they tackle the problem head on, by involving, discussing and educating the citizens? Is there any other solution?

This a challenging task. Most people are impatient, they want simple answers from scientists, and not long detailed papers. They say: "Well *you* are the experts. You tell me what the answer is!"

Scientists cannot always provide this simple unqualified answer. On climate change, the best they can say is: "well, all the evidence, all our models support the idea that the world is going to get hotter and also dryer in some parts. It seems likely that this has been caused by the actions of people."

People find these qualified answers frustrating.

Today I want to divide my talk into three parts. The first part will deal with a growing recognition of the importance of science communication. Fifty years ago the term 'science communication' was never used. Today, conferences, societies and journals are devoted to this field. Courses are taught and research is undertaken at universities, and I will explore how 'science communication' has established its place.

The second point I will make is that the natural sciences by themselves cannot solve all the problems. We need to involve the humanities and the social sciences: the important issues I mentioned earlier depend as much on economics, law, cultural views and values as they do on the evidence provided by the natural sciences.

I will discuss how the natural sciences can work with the social sciences and humanities, and the sorts of issues where collaboration can be useful. I also want to touch on the problems of working across research cultures, and why these cross-disciplinary research teams need a little more patience and a little more time to develop. We conducted a big research report on this in Australia 5 years ago and I will talk about that.

The third point tackles the issue of responsibility. Who will encourage citizens to participate in science? To be truly successful all elements of society have a role: the citizens, the scientific community, the media, the leaders of the country. I will talk about what scientist can do, and look at the ways I have worked to help scientists communicate.

Before I start, I should say what a great pleasure it is to return to Seoul after the great success of the PCST Conference here in 2006. I should like to thank KOFAC and its partners STEPI and KISTEC for their invitation.

1. The place of 'science communication' in the world today

If questions on 'participation' and 'communication about the future' are to be managed, we need a mechanism which is recognised and accepted.

In researching a journal article recently, I looked at the emergence of the term 'science communication'. Where did it come from, how well is it established, and has it achieved the

legitimacy and authority to handle the questions posed by this Conference? I need to acknowledge the assistance of colleagues (including Bernard Schiele) in this research.

Science communication has established an identity over the last 50 years. In the aftermath of WW2, governments increasingly regarded science as important. At the same time they recognised their own lack of skills, so appointed special advisors to lead presidents and politicians through science-based issues, performing a classic communication role of translating the significance of research results for a lay audience. Science communication now had a political imperative.

With this convergence of science, the economy and policy, there was a corresponding convergence of questions related to science and society, science in the media, and the role of science journalists. By 1970, a new research area was emerging to address these questions.

The 1970s marked the start of informal exchanges which grew into symposia, formal conferences, peer-reviewed journals and associations at a national and international level. The international PCST network was conceived in the 1980s, and held its first conference in 1989. Since then it has held 10 formal international conferences from Madrid and Montreal, to Cape Town and Seoul. Registrants are evenly balanced between those coming from a university background and involved in research and training, and those from practice: writing, editing, or working as 'communication managers' for research institutes.

There is a strong international interest in research. The PCST conference in Seoul in 2006 attracted 320 abstracts and 264 full papers from 38 countries. Science communication has both books and specialist journals. A Google search "books on 'science communication'" generated 115,000 results and indicates the topic has been well-explored. Journals include the *Journal of Science Communication*; *Public Understanding of Science*; *Science Communication*; and from China *Study on Science Popularisation* and *Public Communication of Science and Technology.*

A new profession has arisen, the science communicator. They may be employed as communication manager for a research organisation or museum, to editing and journalism. This has created a need for formalised training in science communication, and courses are now offered throughout the world.

The Directory of Science Communication Courses and Programs lists 51 courses and programs at 44 separate universities in the USA, generally at undergraduate or postgraduate levels.

What is clear is that 'science communication' as an object of study and research is well-understood throughout the world. The area draws its tools and concepts from sociology, psychology, media studies, statistics and other areas, and has an interdisciplinary approach in common with modern social sciences.

Over the last 50 years science communication has gained recognition. What began with academic discussions emerged from a variety of departments in universities internationally. It swelled spontaneously into a loose international network which filled the need for the

community to meet and discuss approaches. An international association and a series of national associations provided for this community of scholars, educators and practitioners. It became legitimised and defined at the professional level by new job opportunities and the emergence of courses in universities.

When it comes to discussions on national participation in science, the community of science communication offers expertise, training and experience in dealing with these issues.

Now I want to turn to my second point.

2. A collaborative approach: involving the humanities and social sciences as well as the natural sciences

Many people feel alienated by science and mathematics. They found the subjects difficult at school and have no aptitude for them. They are not ashamed to admit they cannot do maths and "never could understand science' and laugh about it, while they would be very embarrassed to admit they can not read or write!

But if science is couched in terms of a problem and a solution, and this has direct bearing on their lives, then they can be both interested and engaged. Most are more interested in the implications – what does this it mean for me? - than the research, which is why, when journalists interview scientists about their work, they focus on the implications rather than the research methods:

Will it mean a cheaper loaf of bread? Better environment? A new clean source of energy? Better treatment for heart disease? Healthy food?

If our aim is to increase the participation of people in discussions about science and how the future might unfold, then we need to think about it from their perspective. A people perspective.

The humanities and the social sciences put a 'human face' on science-based problems. Science is excellent for discovering the answers to technical problems, but many issues have another dimension: cultural, psychological, economic, philosophical, legal. We need people from the social sciences and the humanities, to gain their perspectives, to hear their ideas, because they will help connect to the citizens.

Here is an example. Australia is a dry continent and water is a valuable commodity. Our largest river system flows through a productive agriculture area. Colonies of fish, trees and birdlife live in internationally-significant wetlands along the system. Australia's fifth largest city, Adelaide, is located at the mouth of the river where it reaches the sea.

There is not enough water for everyone, so the problem is: how should the water be shared, between agriculture, the environment and the city?

Science is steadily unlocking the answers to the technical aspects of the problem (salinity, storing water efficiently, creating low-water use crops) but does not help with questions like: what value do we put on the environment? Is it acceptable to recycle sewage to provide a

source of drinking water for Adelaide? Is it more important to protect farming and employment in regional areas, or to protect an area of wetlands?

The humanities and the social sciences can help shape these answers.

Sometimes they will come up with an alternative solution. One aim of our society is to improve the health of its citizens, but is medical research the only way? What about public awareness campaigns to persuade people to eat better, lose weight and lead healthier lives? The humanities and the social sciences again have a role here.

Collaborations are not always easy. There are administrative and funding barriers making it difficult to work across disciplinary boundaries. In 2006 the Australian Government commissioned the organisation I headed (the Council for the Humanities, Arts and Social Sciences) to undertake a research project to investigate cross-sector collaborations, or work that involved both the humanities and social sciences, and the natural sciences.

1600 researchers involved in collaborations were surveyed, to answer the following questions:

What topics do these collaborations tackle? What benefits do they produce? Were there any problems working with colleagues from different disciplines? Do barriers discourage people from collaborating? How can we improve things?

The study uncovered a number of problems:

1. Collaborative work is slower, because researchers need to work out how to operate across the cultures of different disciplines
2. Funding is harder to win, because most funding programs deal with applications based on a single discipline
3. Projects are harder to manage, because the researchers may come from different departments or different institutions with their own administrative systems
4. It is harder to get work published, because the major journals are based on a single discipline.
5. Because it is slower, harder to gain funding and to get published, it is more challenging to gain academic rewards like promotion.

The report made a number of recommendations.

I won't go into these in detail (the report is available online), but generally they addressed three main issues: funding, institutional barriers and training. The report dealt with the first problem – money - by recommending a separate source of funding for cross-sector collaborations, so that such work did not have to compete directly with single-discipline proposals.

It dealt with the second problem by breaking down institutional barriers so it was easier to do business, and with the third problem through training and education.

The report is still working its way through the system, but we were encouraged when the new Minister for Science, Senator Kim Carr said in 2007:

"*By igniting the creative spirit of our people, we will deliver great science and innovation solutions for industry, society and the environment. Now this also applies to the humanities," Carr said. "I am using science not just in a narrow definition, but the European definition, which is knowledge of the world ….*

"There is absolutely no doubt about us adopting a multidisciplinary approach - this is a key concept."

So a partnership between different disciplines is another approach to maximise participation and debates about science.

I have looked at the emergence of science communication, and its new role in research, training and practice. I have outlined the value of collaboration between the major disciplines. Now I want to turn to my third point:

3. The matter of responsibility. Who will encourage citizens to participate in science?

This is a general responsibility, with a role for the scientific community, the media, and the leaders of the country, but I want to talk about scientists, and how they are going to be the front line troops in any discussions involving science.

Scientists have a professional responsibility to discuss their research with the public, partly because the public pays for much of this work; and partly because it is in their own interests. If the public understands what scientists are doing and recognises its value, then it is more likely to support the research.

For the past 18 years, Jenni Metcalfe and I have run hundreds of workshops in Media Skills to train scientists to talk to journalists about their work.

The media is the quickest way to make contact with the maximum number of people. Everyone reads a newspaper, or listens to the radio, or watches TV. If scientists can work with the media, they can get their message out to a wide audience.

But often they are reluctant to use the media. They do not understand the way it operates. They have heard horror stories and do not trust journalists. They think media coverage of science is superficial and inaccurate.

We wanted scientists to meet journalists, to understand the way they worked. Scientists need to tell their stories very simply, without jargon. They need training in how to answer questions – all their scientific training encourages them to give detailed technical answers. This is not what the media wants!

We run the workshops as a private business, paid for by research organisations. They are quite expensive because we have to pay for travel and the journalists, as well as our time. They have been very popular and we have run hundreds of workshops in Australia, and in New Zealand, South Africa, Belgium and the Philippines.

Our workshops are very practical. We bring in three journalists, and each participant will be interviewed three times. We normally have a maximum of 10 participants –more than 10 means the interview process can be rushed.

Scientists really like meeting journalists, to hear what a journalist thinks of their work, and to find out the questions they will ask. We hire journalists from TV, print and radio. Each will be at the workshop about 2 hours.

Some of our journalists are specialist science reporters (mostly from newspapers), and the others are general reporters who write stories on any subject. There are very few journalists with science qualifications in TV or radio news in Australia, so scientists need to get used to talking to non-specialist reporters.

We begin with a discussion on TV. The journalist answers questions about the way he works. What time does he arrive at work? What is his daily routine? How many stories will he do in one day? This conversation goes on for 40 minutes. Our aim is to give the most accurate picture of how journalists think and work.

Then we ask the journalist to interview one scientist in front of the whole group. The questions are usually very simple:

“What is your research about?” “Why are you doing this work?” “When will the research results be complete?” “How does it affect the life of ordinary citizens?” The interview runs for 5 minutes, and then we play the tape back and ask the journalist to comment .

After we have discussed the interview, the journalist and one presenter more to the second room with the camera. Each scientist comes out for an interview and feedback. The rest of the group are working on another topic in the main room.

Then the print media journalist arrives, and we work through the same routine, a discussion followed by individual interviews. After lunch the radio journalist will do the same.

All the journalists give advice on the best way to tell the story. Radio and TV news stories are very short and very simple, so scientists will not be able to explain their work in detail. Instead they should concentrate on making just one or 2 simple points. This sometimes disappoints scientists, who love all the detail!

In the final hour, we talk about answering questions, and how scientists need to think about what they want to say before the interview starts. We discuss media releases, and analyse TV stories.

These workshops equip scientists with the confidence to tell their story to the media. They learn that journalists are not there to attack them, but to tell the story of their work as simply and accurately as possible – and always with a focus on how it will affect the lives of ordinary citizens.

Learning these skills is a good step to making science more accessible to the public, and beginning a process where citizens will become more familiar with the latest research

results. If they have at least some understanding it will encourage them to think about the implications of this work, and the way it might affect their lives as citizens in this community. It is a step on the way to participation, and extends the role of science communication to include the scientists themselves.

Before I conclude, I want to congratulate the organisers of this meeting for promoting such an important discussion. I look forward to the other presentations and the discussion.

I began today by saying that the gap between science and citizens is growing. This is a situation with potential dangers, both for science and our society.

It is compounded by the face that citizens do not understand the process by which scientists try to establish the new facts and theories. When they see scientists arguing and debating, they see divided opinions among the experts, not a relentless probing of the issue to discover the truth. So citizens need to learn about the methods as well as have some appreciation of the basic facts.

The increased profile of science communicators gives us the tools to engage with the community, a process that can be made more effective if science works in collaboration with the social sciences and humanities. And we need to take action within our own community, by making our scientists more effective in their communication role.

It is hard to imagine a truly democratic society in the modern age where citizens do not actively participate in science. So many of the important issues and debates depend heavily on science: climate change, water use, sources of energy, genetically-modified organisms, transplants, managing the environment. We have choices and alternative futures ahead of us, and these need to be discussed openly, the advantages and disadvantages weighed, and the risks assessed before an informed decision can be taken.

Thank you.