JCOM

HISTORY OF SCIENCE COMMUNICATION

The emergence of modern science communication in Australia

Toss Gascoigne and Jenni Metcalfe

Abstract

Modern science communication has emerged over the last 60 years as a field of study, a body of practice and a profession. This period has seen the birth of interactive science centres, the first university courses to teach the theory and practice of science communication, the first university departments conducting research into science communication, and a sharp growth in employment of science communicators by research institutions, universities, museums, science centres and industry.
This chapter charts the emergence of modern science communication in Australia, against an international background.

Keywords

History of public communication of science

Background

Science was one area heavily affected by the Second World War. As it was ending, US President Roosevelt wrote to Vannevar Bush, Director of the US Office of Scientific Research and Development. The question he posed was simple: we have seen what science can do for us in war, but what can science do in times of peace?

Bush's response, *The Endless Frontier*, set out a vision of modern life:

> Advances in science when put to practical use mean more jobs, higher wages, shorter hours, more abundant crops, more leisure for recreation, for study.... Advances in science will also bring higher standards of living, will lead to the prevention or cure of diseases, will promote conservation of our limited national resources, and will assure means of defense against aggression [Bush, 1945].

The war changed everything. In Australia, as in other countries, new industries emerged, the focus of employment shifted, and people moved to the cities. Employment in rural industries dropped from 24.2% of the workforce in 1901 to under 3% in 2011 [Abjorensen and Docherty, 2015, p. 438]. Agricultural jobs based on manual drudgery morphed into city work requiring a different set of skills, and increasingly, an educated workforce.

Vannevar Bush's vision of the substantial benefits that national economies could gain from investing in research was respected by governments around the world, and set the tone of a public love affair with science in the immediate post-war years.

Attitudes to science changed over time

In Australia, as in overseas countries, the love affair went through phases: fascination at the machines of war; awe mixed with revulsion at the atomic bomb; and wonder and optimism at Sputnik in the 1950s. Moon landings, the home computer and kidney dialysis added to the excitement.

But concerns at the power of science began to emerge in the 1960s, with Rachel Carson's *Silent Spring* in 1962 and news of the devastating effects of napalm and Agent Orange in the Vietnam War. The potential of new science-based technologies to place downward pressure on employment was a potent political issue: the mechanisation of wharves, the effect of computers in banking and office work. In subsequent decades, concerns were raised as science pushed up against ethical boundaries. GM tomatoes, Dolly the Sheep, nanotechnology and stem cell research fuelled public suspicion: was science out of control?

Stephen Hill charts the path of science through this period in *The Future for Sale* [Hill, 1993]. Science was a source of "international prestige and emancipation" in the 1960s but that soured in the 1970s when people saw the potential downside. There was "a shift in public consciousness towards disenchantment with science's intrinsic promise."

The arguments of Vannevar Bush for unfettered scientific research as the source of economic growth were questioned. Memories of the contribution of science to the war effort were fading in the face of post-war concerns: generating jobs, restoring damaged societies, kick-starting the economy and finding environmental solutions. There was a public relations challenge, as well as a demand for science to be more effectively organised and mobilised to produce solutions.

The public relations challenge was complicated by bureaucratic demands that scientists restrict discussion of their results.

The first restriction was military. Scientists generally considered themselves internationalists and wanted to exchange ideas freely with their peers, but military secrets (such as radar and the atomic bomb) were regarded as vital to national security. The most prominent scientist in Australia before and after the war was David Rivett, head of the national research organisation the Council for Scientific and Industrial Research (CSIR). He viewed any limitations on pure and fundamental inquiry and the free exchange of ideas as "the demise of the ethos of science".

In an address to students of Canberra University College, he exhorted them to be "unrestricted, passionate and fearless" and to maintain the tradition of pure and fundamental inquiry" [Rouse, 2002, p. 166]. This position was not popular with some politicians and Rivett was attacked in the Australian Parliament for his stance. Scientists were not always regarded as 'reliable'.

The second restriction was on who set the research agenda, with implications for communication. In pre-war Australia, politicians had been content to allow scientists to make decisions about science. But post-war governments had growing expectations of public benefit: job creation and problem solving. They were not willing to hand over a blank cheque, and wanted a voice in setting research priorities and directing science.

Governments were willing to invest more public money in scientific research, and rapidly increased the number of scientists they employed. In the 1930s, Australia had five universities and about 800 scientists: post-war, these numbers expanded rapidly. CSIR's staff levels and budget increased six-fold in the decade from 1938 [Rouse, 2002, p. 166]. The increase in science expenditure created new demands on communication: for accountability, for awareness, and for education so the population could take advantage of new opportunities.

The third restriction was commercial. Research was of growing importance to the financial success of companies and nations, so should scientists be allowed to make their results freely available? Commercial considerations and the national advantage should be taken into account.

There was another factor affecting communication. Research was shifting into unfamiliar territory. Before the war, most research related to agriculture, important to Australia's agriculture-based economy and familiar to its citizens: diseases and pests affecting animals and plants, food, forest products and fuel [Rivett, 1972, p. 88]. To governments and the Australian public, these choices were logical. But in the years after 1945 other less familiar research areas emerged: computers, aeronautics, electronics, antibiotics. Science was increasingly outside the everyday experience of Australians, and the comprehension gap between scientists and the rest of the population grew.

Three broad groups had an interest in science communication:

- Governments, to justify increased expenditure on science, because lack of public support potentially posed political risks.
- Research organisations and scientists, to explain the benefits of their work, prepare people for impending changes — and pitch for funding.
- The public, to be assured that funds were being spent wisely, that ethical sensitivities were respected, and to satisfy their curiosity.

The United Kingdom's Bodmer Report of 1985 was a watershed, not just for the UK but other countries. It recommended actions for scientists, for educators, the media, industry, government and the museums, aiming to increase overall awareness of science and technology and the way they pervade modern life. The language, actions and approaches of the Report continue to influence modern discussions internationally:

> "Science and technology play a major role in most aspects of our daily lives both at home and at work. Our industry and thus our national prosperity depend on them. Almost all public policy issues have scientific or technological implications. Everybody, therefore, needs some understanding of science, its accomplishments and its limitations" [Royal Society, 1985].

Changes in technology, in society and employment in the 40 years since the World War 2 came together with Bodmer, and triggered demand for the science explainer, a person who could translate the complexities of science into language for a layperson.

Historical endeavours

The earliest drivers of recorded science communication in Australia were to meet the needs of European settlers on their arrival from 1788. Australia was a harsh country, with poor soil, a difficult climate, strange animals and crops that stubbornly refused to grow in seasonal conditions the reverse of the northern hemisphere.

Orthia documents the new colony's fascination with science in a study of Sydney's mass media and popular culture, revealing an unexpected and unexplored richness particularly of a visual or oral nature [Orthia, 2016]. In retrospect this is hardly surprising, given that every eighteenth and nineteenth century expedition included a person with scientific interests, who documented and charted the land and plant and animal life.

> Those traditions of scientific inquiry were extended into urban life in the nineteenth century by the formation of mechanics institutes,[1] botanic gardens, learned societies, museums, public libraries and universities. . . .
>
> By the 1870s it was clear that the programme that had unfolded in these [learned] societies was one largely committed to the collection, description and classification of Australian natural history, phenomena and resources, combined with a discussion of practical matters involved in colonial development. This reflected the mood of the times, which had little patience with abstract theorizing [Home, 1989].

As Home remarks, it was not an enterprise conducted in "a rarefied and scholarly atmosphere": in 1870, 60% of the membership of the Royal Society of New South Wales had no scientific background or involvement. From the very beginning, the demands of establishing a settlement in an environment often hostile to European approaches to farming and the environment shaped the discourse of science.

Cultural and scientific institutions began to appear 40 or 50 years after white settlement of Australia: in 1821 the Philosophical Society was formed, and the first public museum opened in 1827 (the Australian Museum in Sydney), closely followed by museums in other regions (colonies) of Australia.

Colonial Governments made appointments: Charles Fraser as the first Superintendent of Sydney's Botanic Gardens in 1816; Charles Rumker as Government Astronomer in 1822; and Richard Daintree as Chief Geologist in northern Queensland. The Rev William Branwhite Clarke was a highly influential writer, correspondent and President of the Royal Society. All these professional (or semi-professional) scientists had a role in public communication of science.

In 1829 the Van Diemen's Land Scientific Society was one of the early regional societies, preceding the formation of similar societies in other regions:

> . . . its chief objects are intended to be the collection of useful information regarding the island and its productions . . . [and] the establishment of what has been called an Economic or Experimental Garden, or the cultivation of a piece

[1] The objective of the typical Mechanics Institute was 'the diffusion of scientific, literary and other useful knowledge among its members and the community generally and particularly among the young as well as the operative classes.' R. W. E. Wilmot, quoted in Home [1989].

> of ground set apart for eliciting and discovering the properties and uses to which the vegetable production of the island may be applied, and to ascertain the improvements which may be adopted in their cultivation [Piesse, 1913].

Lady Jane Franklin, wife of Governor Sir John Franklin, was an indefatigable fixture in the intellectual life of Van Diemen's Land:[2] building a museum, buying land for a botanical garden, supporting regular scientific conversations and a journal. Her remarkable life is covered in several biographies.[3]

The first Australian newspapers appeared in 1803. At first science stories were primarily lifted from American and British publications and often covered agricultural topics.[4] But there was input from domestic journalists, including the Reverend W. B. Clarke and James S. Bray.

Clarke arrived in Australia in 1839, a clergyman and geologist. For 40 years he was the centre of scientific activity in the colony. He met Darwin, corresponded with Huxley, befriended explorers Ludwig Leichhardt and Edmund Kennedy, and wrote as science correspondent for the *Sydney Morning Herald*. His extraordinary life, culminating in his election as President of the Royal Society of NSW, is documented by Anne Moyal [Moyal, 2014].

James Bray, writing in the late nineteenth century, described himself as a 'science journalist', perhaps the first to use this term in Australia. He wrote for the *Sydney Morning Herald* and other antipodean journals:

> The season, popularly known as the 'snake season' for 1894–95 has passed away. There is little chance of any person being bitten by a reptile, in a state of nature, for the next five months to come. All our venomous reptiles have already retired, or are about to retire, into their winter quarters [Bray, 1895].

Bray searched NSW Government records 'for recorded instances of deaths and bites from venomous reptiles", and noted where on the body victims were bitten (most often on the finger); the most dangerous snake (black snake); and popular treatments (strychnine, scarifying, ligature and sucking the wound).

Specialist journals and other organisations emerged. *The Australasian Journal of Science* was launched in 1938 "to publish news, articles and views on scientific topics of general interest" [Fenner, 2005, p. 2]. It has evolved into the monthly *Australasian Science*.

The Australasian Association for the Advancement of Science (AAAS, later joining with New Zealand to become ANZAAS) was inaugurated in 1888 as a meeting place for scientists and the public, with the task "of making science more widely understood, more generously and wisely supported, more directly beneficial to the nation, and more accountable to the public interest" [MacLeod, 1988, p. xi]. ANZAAS conferences rotated through the regional cities of Australia and later

[2] Van Diemen's Land became self-governing in 1856, and was re-named Tasmania.
[3] See Alexander [2013] for an account of her life.
[4] Burns has documented this. See Burns [2014].

New Zealand, attracting large crowds and acting over its first 30 years as the "only national forum for science" in Australia [Fenner, 2005, p. 2].

ANZAAS was eventually overtaken by time. It had dual purposes: to enable scientists of all disciplines to meet; and to provide a venue for more specialised meetings. But after 109 years, as science splintered and divided into disciplines and sub-disciplines, scientists found less value in general discussions, and preferred specialised meetings. Numbers declined rapidly through the 1980s, from several thousand to the low hundreds, and in December 1997 ANZAAS voted to dissolve itself as a national institution.

Formal studies on topics most closely related to science communication, the history and philosophy of science, began at the University of Sydney (1945) and the University of Melbourne when they established the Department of General Science and Scientific Method in 1946. These universities were among the first in the world to tackle such subjects. Originally offering a series of lectures to science students, they pre-empted many of the questions of subsequent concern to science communication researchers.

Towards the modern era of science communication

The impetus gathered strength through the 1960s, 70s and 80s with the formation of the Australian Broadcasting Corporation's (ABC) Radio Science Unit; the accelerated engagement of communication staff by the Commonwealth Scientific and Industrial Research Organisation (CSIRO, Australia's largest research organisation);[5] and the construction of the National Science and Technology Centre and other science centres.

Television was introduced to Australia in 1956. The most memorable science-based program was '*Why is it so?* where the dynamic Julius Sumner Miller demonstrated principles of physics. The program ran for 20 years and is remembered with affection by many older Australians.

In 1964, the ABC Radio Science Unit was formed at Australia's national public broadcasting organisation with Peter Pockley as founding Head of Science Programs. Robyn Williams joined soon after to broadcast the first *Science Show* program, which he continues to present today.

The first science centre, the National Science Centre (Questacon) was the brainchild of Australian National University (ANU) physicist Dr Michael Gore, and inspired by Frank Oppenheimer's *Exploratorium* in San Francisco. It began modestly. "[It] opened on a shoestring budget, and every science organisation in Canberra helped build the displays. Based in an old inner-city infants' school, it grew and began to attract private sponsorship" [Gascoigne and Metcalfe, 1994].

With tenacity and determination, Gore piloted his home-grown science centre into an institution of national significance. He was aided in this by a bicentennial grant from the Japanese Government which paid for half the cost of a new building in central Canberra. The Australian Government paid the rest, and continues to support the Centre. Questacon aimed to change science museums from "dusty,

[5]CSIR was re-badged and re-named CSIRO in 1949.

static, even dead emporia of esoteric mysteries . . . [they] started to come alive, to involve and question their millions of visitors; they started to explain, entertain and educate" [Sharp, 1984, p. 226].

The first government national program to fund science communication had a number of causal factors (including an OECD report of 1986) and was hastened by a political imperative. In 1989, just prior to the election and urged by his polymath Science Minister Barry O. Jones,[6] Prime Minister Bob Hawke delivered the *Clever Country* speech, a campaign address that set out new expectations of science: "No longer content to be just the lucky country, Australia must become the clever country" [Hawke, 1990]. He unveiled spending measures and a new rhetoric for science, and formalised a change in the way science was regarded.

But science continues to be under-represented and under-appreciated by national Parliamentarians. The lack of scientific knowledge is apparent when Parliament discusses science-based issues like water, energy and genetic engineering, and one result has been a long-running and rancorous debate on climate change.

If science is to be embedded in Australian culture, it was considered important that researchers and policy-makers understand the possibilities and limitations of science. The Australian approach is 'Science meets Parliament' (SmP), which brings 150 scientists to Parliament to meet MPs and talk persuasively about science and its benefits. This is an important event, where audience and intent was carefully considered, and messages appropriately honed.[7]

In many ways the development of science communication in Australia followed a pattern evident in other countries. There are variations in activities and dates, but the sequence is familiar. An international comparison of national programs of science communication shows a common rationale:

- We want a modern, knowledge-based economy
- Only this sort of economy will deliver the satisfying, high-pay, sustainable jobs that will ensure our national prosperity
- We believe it would assist us to achieve this sort of economy if we had a population which understands and appreciates science
- We need a population which understands health and safety issues, like AIDS
- We also want to ensure the next generation of scientists and technologists, and to stimulate students to do science at school and university, particularly in the 'hard' sciences like mathematics, physics and chemistry [Gascoigne and Metcalfe, 2001]

The remainder of this paper will look at four stages in the emergence of modern science communication in Australia, and the drivers behind them.

[6] Jones is an extraordinary figure, a member of all four Academies in Australia, prolific author and visionary for science.

[7] For a description of the event, see: Gascoigne [2007].

4.1 The birth of Australian Science Communicators

In the early 1990s, science communicators were isolated. This is despite earlier attempts to network and motivate science communicators: an association of sorts was formed in about 1987 (with Peter Pockley[8] playing a lead role); and Questacon and the Australian Government[9] convened a national conference of science communicators in 1990.

Every science research organisation, every museum and each of the 37 divisions of CSIRO had at least one science communicator. This term — science communicator — was not yet in popular use and staff worked under a variety of titles and on work ranging from writing and editing, organising events and tours, training and mounting exhibitions, to preparing annual reports for publication.

The impetus to form an association came to a head 1993, when the authors were asked to present a paper at the Public Communication of Science and Technology (PCST) Conference in Montreal. The paper was to be a summary: who was communicating science in Australia, what were they doing, and how much were they spending?

We collected information by asking science-based organisations in Australia for a copy of their annual report and interviewing their communication staff. It was clear that people in these roles felt isolated. There was little opportunity to share experiences or exchange ideas with colleagues. Tertiary courses in science communication were at an embryonic stage. Publishing articles on science communication was a fanciful idea, and attending international meetings to discuss professional issues was almost unknown. The internet as a means of communication was in its infancy.

Clearly there was a need for an association. A meeting at the National Press Club in Canberra in February 1994 was the first step. Twenty-three people attended: from the science media, research organisations, science-based institutions and government departments. Alison Leigh, executive producer of the ABC's national television science show, chaired the meeting; and the only contentious discussion was whether membership should be limited to working journalists or open to anyone prepared to pay the subscription fee. The latter view prevailed.

An inaugural general meeting was called to vote on a draft constitution, but first a general invitation was issued to all interested in science communication to register as Foundation Members. Three hundred and seventy-five people paid the subscription of $AU25, and these funds together with donations from organisations including the Academy of Science, the Institution of Engineers, CSIRO and the Government Department of Science provided Australian Science Communicators with its working capital.

The inaugural annual general meeting was held at the ANZAAS Conference in Geelong on 22 September 1994, and the meeting elected science journalists Julian

[8] Pockley, science journalist, creator of the ABC Science Unit and winner of the Science Academy's Medal, was a leading figure in his analysis of science policy and science communication for many years.

[9] STAP, the Government's Science and Technology Awareness Program, was the Government program co-hosting this event. STAP was established in 1989.

Cribb (*The Australian* newspaper) and Ian Anderson (Australasian editor of *New Scientist*) as president and vice-president.

The major achievement of ASC has been to create a network where none existed before. Individuals isolated within their organisation have discovered colleagues and common interests, which in turn helped the organisation of events such as National Science Week. ASC has a website and an email discussion list. It hosted the PCST conference in 1996 and the World Conference of Science Journalists in 2007, and runs regular national conferences and a newsletter. The participation of Australians in international science communication conferences has increased significantly through the community it has created.

ASC was the first of its type. There were earlier groups for science writers — the American National Association of Science Writers was formed in 1934 and incorporated in 1955, but they did not have the same broad membership base. The ASC model has been applied by both South Africa and New Zealand.

4.2 University courses in science communication

A survey in Australia in 1996, shortly after ASC was formed, recorded 16 universities offering or planning to offer courses in science communication.

> This initial focus of university science communication courses was on training scientists rather than catering to the newly-emerging profession of 'science communicators', and many of the teachers of science communication had scientific rather than communication qualifications and experience [Metcalfe and Gascoigne, 2012].

The first universities offering masters courses in science communication were the University of Southern Queensland in 1993, and the ANU in 1996. Emeritus Professor Lesley Warner cast widely in designing the USQ course in 1992:

> The idea to offer the courses came from my contacts with Chris Bryant and others at Questacon in the early 1990's and I went to the . . . workshop on media skills that you[10] offered in Rockhampton in August 1992 (I value my attendance certificate most highly). I was looking for niche market courses that could be offered in the external mode, and at the time we thought there was an opportunity going begging. The interest in sc comm was developing and there were no post grad courses in Australia. I also found an interesting initiative that was being offered across Universities in Belfast and Dublin so I met with them as well. Basically though the final format was put together by an interdisciplinary group across the university . . . There was no model to follow.[11]

The ANU course had a similar organic birth. It grew out of Questacon's[12] Science Circus, a year-long program begun in 1985 for science graduates to take

[10] The authors.
[11] Emeritus Professor Lesley Warner, personal communication, 20 February 2014.
[12] Questacon is also known as the National Science and Technology Centre, Canberra.

demonstrations of science to remote areas of Australia. The following year, Questacon Director Mike Gore asked ANU Dean of Science Chris Bryant if the ANU could provide theoretical training and a formal qualification to back up the practical aspect. The graduate certificate program began in 1988 and was converted into a graduate diploma in 1990.[13] Demand grew, and Sue Stocklmayer was appointed as lecturer in science communication — possibly the first such appointment in the world — and masters and PhD programs followed in due course.

These courses were pioneers. Only China (1989), the UK (1990) and India (1993) [Gascoigne, 2014] record running their first masters or research degrees in science communication earlier. The work of Dr Mike Gore, Professor Chris Bryant and Professor Sue Stocklmayer blazed a trail.[14]

As courses at ANU and other universities matured they responded to job opportunities in science communication. CSIRO employed communicators in each of its 37 divisions: to write articles, issue media releases, organise exhibitions, assist researchers with presentations and papers, and manage relationships with funding bodies and industry. Staff at museums and the new science centres had similar roles, with more focus on educational activities. Managing organisational websites became an important part of a communicator's work.

Initially the courses and training programs were for undergraduate or postgraduate students in science, and undertaken in natural sciences departments. This contrasts with European and American courses likely to be offered in journalism or social sciences contexts.[15]

The normal prerequisite to enter a science communication course in Australia was a degree in science. The ANU established the Centre for the Public Awareness of Science (CPAS) in 1996, and its courses were advertised as allowing "...a new generation of highly qualified scientists to become skilled communicators who can engage people with the science, technology, or medical information that is most relevant to them" [http://libguides.anu.edu.au/c.php?g=465080&p=3179192, visited on 16th December 2016].

Requirements have tended to change over time. University of Queensland's science communication courses were designed "for science graduates, or those with strong science backgrounds, who wish to communicate effectively with scientists and professionals in business, industry, government, and the media," and subsequently modified to "for graduates from disciplines engaging with science" [*University of Queensland*]. The University of Western Australia requires a strong maths background for entrants to the bachelor's degree and a science degree to enter the masters' program.

[13] Personal communication, Emeritus Professor Chris Bryant, 2017.

[14] Gore, Bryant and Stocklmayer worked together to initiate and develop the courses: Gore as founder and first Director of Questacon; Bryant as Dean of Science at ANU, and Stocklmayer became the first Director of the Centre for the Public Awareness of Science, ANU.

[15] See for instance *Directory of Science Communication Courses and Programs* by Sharon Friedman and Sharon Dunwoody et al., published in years from 1978 and listing and describing science communication courses in the USA.

Since 1996, when 16 universities offered courses, there has been a consolidation. The 16 universities are now half a dozen and the ANU's CPAS has emerged as the powerhouse. But this is a volatile area and new courses are liable to rise and fall as personnel, funding and vice-chancellors change.

4.3 Research in science communication

As science communication courses grew and became concentrated in a handful of universities, interest in communication research at a post-graduate level increased.

Post-graduate research in science communication began in 1996 at the ANU's CPAS, and PhD students have increased from three students to about 30 today. CPAS also offers a Masters by coursework with a small research component, and about 30 students are currently enrolled.

Two other universities have had a significant presence in science communication, the University of Queensland and the University of Western Australia. In 2011 they had 10 PhD students and 20 Masters students between them, but the departments offering the courses are relatively small and student numbers have declined recently after the course leaders moved to other institutions.

Publication of articles on science communication was virtually non-existent in Australia before 1990. The reasons were simple: science communication was emerging as a field of study, there were no journals in this new field (although related journals might carry articles), and no culture of publication. Only two Australian articles were found prior to 1990 in a search of 22 journals relevant to science.

One factor which may deflate publication numbers is a division in the field. The beginnings of research in science communication was in departments with names such as 'History and Philosophy of Science', or 'Science and Technology Studies'.

Australia had two strands: those training and teaching in 'science communication' and tending to work from a natural sciences background to deal with more mechanical and descriptive topics; and those working on 'science and society' issues working from a social sciences perspective.

But the trend is upwards: out of a total of 73 articles identified in 2011, 23 appeared in the period 1990–1999, and a further 48 since 2000.[16] In the last five years alone, authors attached to CPAS have published 3 books, 18 book chapters and 40 articles.[17] A recent study of the three international journals devoted to science communication found that Australians were placed fourth in producing peer-reviewed papers, behind the USA, UK and Canada [Guenther and Joubert, 2017].

[16] We discuss the two strands and the way research topics in science communication have evolved quite quickly in Metcalfe, Jenni and Gascoigne, Toss *The evolution of science communication research in Australia*.

[17] A list of publications by all CPAS staff and students is published at: http://cpas.anu.edu.au/research/publications?year[value]=&type=All Downloaded 27 March 2017.

These boundaries between science communication, and HPS and STS appear to be breaking down. For example, the PhD students at ANU's CPAS are now studying more varied topics than previously:

> Topics include everything from mental illness and illicit drugs to climate change and data visualization as well as science and public policy, science communication capacity building and evaluation in multi-national NGOs. . . [there is] also [research into] what makes a science hero, science theatre and performance. . . The change really has been in the sheer volume of work happening, and also in the increased interest in new (particularly social) media [Metcalfe and Gascoigne, 2012].

Our review of science communication documents other trends in publishing over the last 15 years:

- a more interdisciplinary approach
- a greater diversity of topics
- a move in the disciplinary background of researchers, away from natural sciences and towards the humanities/social sciences
- more research into models of science communication, and engagement [Metcalfe and Gascoigne, 2012]

4.4 Government programs to support science communication

It has been a long-standing aim of Australian governments to capture economic, social and environmental benefits from their investment in scientific research. They want new industries, new jobs, and national wealth. Governments believe that only a science-aware community will support this investment and encourage young people to contemplate careers in science to take advantage of the opportunities it creates.

Governments came to believe science communication might help achieve these policy objectives: informing, changing behaviours and stimulating interest. Science policy for the Australian Labour Party in 1982, for example, included the intention to:

> . . . initiate a continuous public information campaign in an attempt to demystify scientific processes, to raise levels of community understanding about S&T so that the Australian people and their political representatives can be directly involved in choosing between options and determining priorities [Bhatal, 1985, p. 6].

In 1981, the Minister for Science and Technology, David Thomson urged the scientific community to address itself to the general public with a clarity of language and purpose. Similar calls were made by both his predecessors and his successors, culminating in Minister Barry O. Jones famously calling scientists 'wimps' in 1984. The science budget that year was disastrous, and Jones said part

of the responsibility should be borne by scientists insufficiently active in the public space and not exerting pressure on his Parliamentary colleagues.[18]

But government concerns about science through the 1980s were driven by low investment in R&D by industry, and collapses in the prices of agriculture and mining products. Any government support for science communication was indirect: in 1985 the Government created the Commission for the Future to "stimulate public debate by publishing discussion papers, contributing to TV and radio programs, preparing newspaper and magazine articles and making itself available for direct contact with groups in the community" [*Science and Technology Statement 1984–1985,* 1985, p. 2].

This changed in the late 1980s. In quick succession, the National Science and Technology Centre Science (Questacon) was opened; the Science and Technology Awareness Program (STAP) established; and the Prime Minister signalled a new approach in his 'Clever Country' election speech. A possible incentive to national action was an OECD report critical of Australia's National Science and Technology Policy: this "external international perspective can be strong motivator for action."[19]

The Science and Technology Awareness Program (STAP) was Australia's first national science communication program. Created in 1989, STAP had seven staff and a budget of $AU1.7 million. These were modest resources given that its objective was "to increase understanding of the central role which S&T play in Australia's economic and social well being" [*Science and Technology Budget Statement 1990–1999,* 1990, p. 5].

The program was based on the premise that:

> Society depends more and more on science and technology to supply knowledge and information, to find answers to new and pressing problems and to help maintain the high standard of living we now enjoy. A community which is informed about, and at ease with the subject, is better able to debate and make informed decisions on science and technology issues [Gascoigne and Metcalfe, 1994].

STAP's five target groups were young people and their teachers; women; industry and business leaders; scientists, and journalists. It funded about 40 special projects including briefing forums for the media, an annual register of science communicators,[20] and co-hosting the first national conference for science communicators in August 1990.

But the Government was not satisfied with the results produced by STAP over its 11-year life and its successor programs. The Australian community was not

[18]Barry Jones later denied he had called scientists 'wimps', but had instead accused them of 'wimpish behaviour'. Personal correspondence c. 2002.

[19]Personal communication, Professor Sue Stocklmayer, 2017.

[20]The Register of Australian Science and Technology Communicators was first published in 1990. By the time of the Third Register in 1994, there were 407 individuals listed (70 academia; 72 education; 31 electronic media; 31 print media; 36 government; 5 industry; 47 museums and science centres; 52 research institutions; 44 in service industries and 19 other).

engaged, student numbers in science were falling, and investment by industry in research was among the lowest in the OECD. STAP was modified, reformatted and eventually replaced by *Inspiring Australia*, a new strategy launched in February 2010 by Science Minister Carr:

> If we are serious about giving people a real voice in how we run this high-tech world of ours, we have to be serious about science communication [Carr, 2010].

The Government had lofty aims:

> . . . we must communicate and engage the wider community in science. Australia aspires to an innovative society with a technologically skilled workforce, a scientifically literate community and well informed decision makers. The *'Inspiring Australia'* strategy aims to build a strong, open relationship between science and society, underpinned by effective communication of science and its uses [Inspiring Australia, 2010, p. xiii].

The *Inspiring Australia* strategy included 15 recommendations and one (Recommendation 15) advocates a program of research in science engagement to fill an obvious gap. Specifically, the recommendation called for research such as: "baseline and longitudinal, attitudinal and behavioural studies, activity audits, program evaluations and impact assessments" [Inspiring Australia, 2010, p. xiii].

Inspiring Australia has introduced new approaches: a long-overdue recognition that the humanities and social sciences play a part in science discussions, and greater coordination of national and regional efforts. It established six working groups to examine specific issues: the working group on 'Science and the Media', for instance, produced a 60-page report with 26 recommendations.

The program is a work in progress. It aims to bring a new energy to the sector, and innovative programs are targeting priority groups (youth, industry, women). But the objectives set out in the original strategy are not easy to measure and it is not clear what progress has been made. Changing cultural attitudes is challenging, and limited funding combined with uncertain tools for assessing the value of different activities present significant difficulties.

If science is to be embedded in Australian culture, it was considered important that government policy-makers understand the possibilities and limitations of science. One of the influences on national government in Australia is the 'Science meets Parliament' approach. This initiative, which the Federation of Australian Scientific and Technological Societies (now Science and Technology Australia) began in 1999, brings about 150 scientists to the national Parliament to meet MPs and talk persuasively about science and its benefits.[21] This is an important event, where audience and intent are carefully considered, and messages appropriately honed.[22]

[21] Details of the current program are at https://scienceandtechnologyaustralia.org.au/what-we-do/science-meets-parliament/, Downloaded 10 May 2017.

[22] For a description of the event, see: Gascoigne [2007].

Conclusion and challenges

The stages and events above document important influences on the emergence of modern science communication in Australia. It is a selective list and omits for reasons of space other events and organisations: the two Science Academies; the Royal Institute of Australia, Australia's national science channel; the Science Media Centre, the communication efforts of the Cooperative Research Centres and agriculturally-based Research and Development Organisations; the Powerhouse and Australian Museums; the environmental movement from the 1960s; awards including the Eurekas and the Australia Prize; the ABC Science Unit; private consultancies which emerged in the 1990s; and training programs which have given scientists new skills to communicate.

The emergence of modern science communication progressed in four distinct steps. It began with post-war recognition that the driver of economic growth would be the application of science, and only a community sympathetic and informed about science could benefit.

The second step was the creation of new jobs in science communication in research organisations and public institutions. The third was the provision of training for this new cohort; and the final step was conducting research to build an evidence-base to guide communicators to the most effective practices.

Today there is a rich diversity of science communicators in Australia, including those working for research organisations like CSIRO, in state government science departments, for industry and those working in private consultancy businesses. In the last decade we have seen science communication put more emphasis on the need to 'engage' the public. This largely reflects the fact that science, especially climate change, nanotechnology, genetically-modified food and stem cell research, has become more controversial.

Science communication and the context in which it operates is changing at bewildering speed. The world is moving to an 'alternative facts' and 'post-truth' era, where factual accuracy in news is almost optional. This is bad news for science and the work of science communicators, and the challenges are mounting.

Challenge 1. Where people get their information. Twenty years ago people sourced information from radio, television and newspapers. The formats were highly regularised: radio stories on the hour; evening TV bulletins, and the morning newspaper. Journalistic ethics and a sense of responsibility meant most news could be trusted.

Now 9 out of 10 Americans born after 1980 get their news from Facebook [ABC Television, The Media Report, 2016] (and Australia inevitably follows US trends). The quality of news is questionable: Facebook takes no responsibility for what appears on its platform and has no tools for controlling misuse, and thus plays a role in spreading misinformation and 'fake news'.

Challenge 2. Lack of respect for science. The rancorous debate on climate change has divided the Australian community for a decade, and the credibility of science is collateral damage. Science is openly questioned by conservative partisan commentators and self-interested parties. The internet has fuelled issues like the

anti-vaccination campaign by posting 'information' that looks credible but lacks any scientific rigour. The challenge for science communicators is to counter this tide of misinformation, and restore respect for the scientific method and importance of evidence.

Challenge 3. Research to improve science communication practice. Science communication research has yet to answer the big questions for practitioners. What motivates people to change? What will get them to value science, respect scientists, support the government's investment, consider careers in science? How do scientists and various groups engage with each other to explore problems and create new solutions?

Practitioners will continue to use the same approaches and the same activities until research shows a better way.

Challenge 4. Lack of respect for science communication. Science communication has always battled for recognition in Australia. Scientists are rewarded for publication rather than public engagement. Commercial pressures and cuts to public science funding have seen CSIRO and government departments reduce science communication staffing and budgets over the past five years.

Despite these challenges, science communication is a force in Australian society. It is a dynamic area, with both practice and research evolving as the field matures and Australia extends its international contacts. The strength of Australian Science Communicators and the increasing cadre of science communication professionals and academics are leading contributions to cultural changes within our scientific and public institutions.

References

ABC Television, The Media Report (2016). *Perfect storm facing digital news. Episode 20. Broadcast 13 June 2016*. URL: http://www.abc.net.au/mediawatch/transcripts/s4481060.htm (visited on 16th December 2016).

Abjorensen, N. and Docherty, J. C. (2015). Historical Dictionary of Australia. Appendix E. 4th ed. Australia: Rowman and Littlefield.

Alexander, A. (2013). The ambitions of Jane Franklin. Sydney, Australia: Allen and Unwin.

Bhatal, R. S. (1985). 'Science Centres of Science Museums for Australia'. *Journal of Proceedings, Royal Society of NSW* 118.

Bray, J. S. (8th June 1895). 'The Snake Season in New South Wales'. *Supplement to the Evening Post, Wellington (NZ)*. URL: https://paperspast.natlib.govt.nz/imageserver-newspapers/EP18950608.1.5.pdf (visited on 10th March 2017).

Burns, M. (2014). 'A Brief History of Science Communication in Australia'. *Media International Australia* 150 (1), pp. 72–76. DOI: 10.1177/1329878x1415000116.

Bush, V. (1945). Science the endless frontier. Washington, U.S.A.: United States Government Printing Office.

Carr, K. (8th February 2010). *Speech to Australian Science Communicators Conference*. URL: http://archive.industry.gov.au/ministerarchive2011/carr/Speeches/Pages/AUSTRALIANSCIENCECOMMUNICATORSNATIONALCONFERENCE.html (visited on 16th December 2016).

Fenner, F., ed. (2005). The Australian Academy of Science: The First Fifty Years. Canberra, Australia: The Australian Academy of Science.
Gascoigne, T. H. (2007). 'Science meets Parliament'. In: Communicating European Research 2005. Ed. by M. Claessens. Dordrecht, Netherlands: Springer.
— (2014). 'How did modern science communication emerge in different countries round the world?' *PCST Conference. 5–8 May, Salvador, Brazil.*
Gascoigne, T. H. and Metcalfe, J. E. (1994). 'Public communication of science and technology in Australia'. In: When Science becomes Culture. Ed. by B. Schiele. Boucherville, Quebec, Canada: University of Ottawa Press, p. 400.
— (2001). 'Report: The Evaluation of National Programs of Science Awareness'. *Science Communication* 23 (1), pp. 66–76. DOI: 10.1177/1075547001023001007.
Guenther, L. and Joubert, M. (2017). 'Science communication as a field of research: identifying trends, challenges and gaps by analysing research papers'. *JCOM* 16 (02), A02. URL: https://jcom.sissa.it/archive/16/02/JCOM_1602_2017_A02.
Hawke, R. J. (1990). *Election speech delivered March 8, 1990*. URL: http://electionspeeches.moadoph.gov.au/speeches/1990-bob-hawke (visited on 27th March 2017).
Hill, S. (1993). 'The Future for Sale'. *Search* 24 (3), pp. 63–67.
Home, R. W., ed. (1989). Australian Science in the making. Cambridge, U.K.: Cambridge University Press.
Inspiring Australia: a national strategy for engagement with the sciences (2010). URL: https://industry.gov.au/Science/InspiringAustralia/Documents/InspiringAustraliaReport.pdf (visited on 16th December 2016).
MacLeod, R., ed. (1988). The Commonwealth of Science: ANZAAS and the Scientific Enterprise in Australia 1888–1988. Australia: OUP.
Metcalfe, J. E. and Gascoigne, T. H. (2012). 'The Evolution of Science Communication Research in Australia'. In: Science Communication in the World. Ed. by B. Schiele, M. Claessens and S. Shi. Dordrecht, Netherlands: Springer, pp. 19–32. DOI: 10.1007/978-94-007-4279-6.
Moyal, A. (2014). A Woman of Influence. Perth, Australia: University of Western Australia Publishing.
Orthia, L. A. (2016). '"Laudably Communicating to the World": Science in Sydney's Public Culture, 1788–1821'. *Historical Records of Australian Science* 27 (1), pp. 1–12. DOI: 10.1071/hr15018.
Piesse, E. L. (1913). The Foundation and Early Work of the Society; with some account of earlier institutions and societies in Tasmania. Hobart, Australia: The University of Tasmania EPrints. URL: http://eprints.utas.edu.au/16587/1/1913-Piesse_The_foundation_of_the_society.pdf (visited on 9th March 2017).
Rivett, R. (1972). David Rivett: Fighter for Australian Science. Melbourne, Australi: Rivett.
Rouse, T. (2002). Nugget Coombs: a reforming life. Melbourne, Australia: CUP.
Royal Society (1985). The Public Understanding of Science. London, U.K.: Royal Society. URL: https://royalsociety.org/~/media/Royal_Society_Content/policy/publications/1985/10700.pdf.
Science and Technology Budget Statement 1990–1999, (1990). Science and Technology Budget Statement 1990–1999. Canberra, Australia: Australian Government Publishing Service.
Science and Technology Statement 1984–1985, (1985). Science and Technology Statement 1984–1985. Canberra, Australia: Australian Government Publishing Service.
Sharp, L. (1984). 'The Power House'. *New South Wales Business Review* 16 (Jan.–Apr.).

University of Queensland. *Website of the University of Queensland, Science Communication Field of Study*.
URL: https://www.uq.edu.au/study/plan.html?acad_plan=SCCOMX5334
(visited on 16th December 2016).

Authors

Toss Gascoigne was elected the inaugural President of the Scientific Committee of the Network for the Public Communication of Science and Technology, at the ninth international PCST Conference in Seoul in 2006.
His publications on science communication issues include chapters in publications "When Science becomes Culture" University of Ottowa Press, 1994); "Communicating Science in Social Contexts (Springer, 2008); "Communicating European Research" (Springer, 2007); "At the Human Scale" (Science Press Beijing, 2012); and "Science Communication in the World" (Springer, 2012).
He has written articles for journals, on subjects ranging from "Is science communication a discipline?", to studies on the attitude of scientists to the media, on the way journalists regard scientists, and on the history of science communication in Australia.
Based in Australia, he works at the interface between politics, science and the media. He served as Executive Director for three national organisations over the last 15 years: the Federation of Australian Scientific and Technological Societies (FASTS); the Council for the Humanities, Arts and Social Sciences (CHASS); and Australian Science Innovations (ASI).
He is a Visiting Scholar, Australian National Centre for the Public Awareness of Science at the Australian National University, and continues to write and to train scientists to improve their skills at dealing with the media and public speaking. He has run hundreds of workshops throughout Australia and internationally in conjunction with Jenni Metcalfe.
Toss Gascoigne is a past-President and Life Member of Australian Science Communicators (ASC), an organisation he helped found in 1994.
E-mail: director@tossgascoigne.com.au.

Jenni Metcalfe is Director of Econnect Communication, a science communication consultancy business based in Brisbane, Australia. She is also a PhD student at the Australian National University. She is interested in researching the interactions between the theory and practice of science communication. Jenni has been a member of the International Public Communication of Science & Technology Scientific Committee since 1996, and is former President of Australian Science Communicators. E-mail: jenni@econnect.com.au.

How to cite

Gascoigne, T. and Metcalfe, J. (2017). 'The emergence of modern science communication in Australia'. *JCOM* 16 (03), A01.

ISSN 1824-2049. Published by SISSA Medialab. jcom.sissa.it