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Abstract

Framing 'science and society' as a conflict has diverted us from more important problems. Our economic environment urges the commercialisation and social acceptance of new technologies, and science communicators and their publics contribute work to these ends. These activities neglect existing, uncontroversial technologies that, in a collaboration between responsible scientists and their publics, could be deployed to address global problems.

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Keywords

Science communication, public engagement, commercialisation, innovation, responsibility

Introduction

Underlying much discussion about science communication is the common sense of a problem: a conflict or rift between science and society. Underlying much of what is done in the name of science communication is the conviction that this problem can be resolved by engagement between scientists and the public. In our recent thinking about what form this engagement should take, we have neglected the more traditional kinds of dissemination, in favour of conversations between many partners, of equivalent status, where everyone has a contribution to make, and we all speak as well as listen. We call this 'dialogue', and it has become the politically privileged and academically dominant model of science communication. Dialogue has become a ubiquitous feature of science policy-making, and is delivered by professional specialists. At the same time, there is a parallel discourse about its failings, and science studies scholars participate in both roles, delivering and contributing to dialogic public engagement about science, as well as criticising it.

In the essay I consider how the focus on dialogue, with its dynamics of authority, power and participation, has drawn us away from the knowledge content of science. An ethos of commercialisation promotes research into new technologies and focuses our attention on them, at the expense of other useful and interesting knowledge. In an innovation economy, new technologies make money only once they have settled into society, and science communication of all kinds helps that to happen, to the financial benefit of investors. However, if it is public engagement professionals who undertake this communication on behalf of scientists, then the scientists themselves may be side-stepping their own social responsibility. They will also not be around to explain the knowledge content of their work, limiting its uses to the ideas of an elite group. Drawing on the writing of members of the 'social responsibility in science' movement of the 1970s, I consider what our emphasis on the commercialisation of new technology has meant for the global problems that scientists and the public could solve together.

The emergence of dialogue

A long historical perspective on science communication shows a story of ebb and flow (Bauer, 2012). Power appears to roll back and forth in variable, often low-frequency waves between experts (however labelled) and laypeople (however labelled), as conditions and events become significant and then recede. For example, in the late eighteenth and early nineteenth centuries in the UK, when reading became a non-elite capability, and a public emerged for literature about nature, the educated elite generated non-elite literatures not only as a marketing opportunity but also in order to guide lay readers into particular ways of knowing and areas of knowledge (Bowler, 2009; Fyffe and Lightman, 2007). The elite thus maintained the exclusivity of their literatures and knowledges by swamping the market at the cheaper end with material more suited, in their eyes, to the public, and which were intended to guide the new readers into particular political and career paths. The newspapers, for most of their history, were deemed to express public opinion; but with the establishment of the popular press in the early twentieth century, the lens of public opinion became the opinion poll, conducted by agencies in the pay of elites. Similarly, when the public started to engage in further education, the elites did not open the universities to them; instead, new colleges and classes were provided that, while they offered advancement, also attempted to guide workers in certain intellectual and practical directions and divert them from others (Billinge, 1982; Porter, 1990). In each of these cases, what looks like an 'opening up' is mitigated by the extension of, and responsive innovation in, forms of elite control and management. To use Bourdieu's terms, what might look like an activation of the public serves instead to discipline them (Bourdieu, 1984). And chafing under this discipline, the public finds new forms of activity for resisting it.

As the twentieth century passed, the distance between elites and laypeople was replaced by a fluidity in many dimensions – wealth, education, mobility, political agency – and the opportunities increased for the less powerful to sidestep control from higher up (Giddens, 1998; Castells, 2000). Together, now, they tussle for liberation and control, activation and discipline: the experts share some knowledge with the laypeople, the laypeople select from it, reconstruct it, and exploit it in unexpected ways; thus altered, the knowledge is deemed by elites to have been devalued, and they say so; the laypeople lose respect for elites, who suffer this devaluation in return and attempt to regain status by sharing something new they consider of value, and the cycle continues. In the contemporary world of multiple expertises, multiple audiences, multiple channels and timeless time, the tussle becomes a frenzy, and then blurs.

One clear event, though, is the emergence of public engagement as a mode of science communication in the UK, and its fall-out elsewhere (Lock, 2009). By public engagement, I mean managed dialogues between experts, of some kind, and non-experts, or activities with a dialogical element (for a useful discussion of definitions, see Escobar, 2011). In the new professional community of science communication in the UK, public engagement quickly became the 'gold standard', and more traditional forms of communication such as lectures and museums of objects were disparaged as oppressive and undemocratic (Gregory and Lock, 2008). The past, and the alternatives, were swept away and squeezed out by policy-orientated funding decisions. Public engagement looks like an opening up, but can instead be understood as a managerial phase in the history of science communication: in the science communication boom of the 1980s onwards, the opening-up of the scientific culture generated resistance as well as support; the disquiet of the elites was expressed as concern about a lack of trust for expertise; and the time had come to clamp down. The public now were to become scientific citizens: they should participate, learn, discuss and debate (for further discussion, see Stirling, 2008; Durodie, 2009).

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The recent past

In science communication studies in the last thirty years, we have moved from understandings that were sufficiently expressed in the linear 'transmission' models of early communications studies to a more socialised, critical perspective that is captured in sociologist Stephen Hilgartner's paper on the 'dominant model' – a paper that remains, 26 years on, among the top ten most cited papers published in the leading journal *Social Studies of Science* (Hilgartner, 1990). This model says something about perceived power, and it identifies a mind-set that sees science communication as about scientists handing down knowledge to journalists who use it to remedy the public's knowledge deficit, and is agitated when these latter two groups seem not to be playing their part: journalists changing the stories they were given, and the public persistently scoring poorly on knowledge quizzes about science (Gregory and Lock, 2008).

Hilgartner's model problematised the transmission models and their progeny in practice, and raised the challenge of how we might think instead. One response to this challenge came in 1995 from historian and communication academic Bruce Lewenstein, whose 'web' model and its modifications have proved fruitful in research as well as in practice, and of course prefigure the 'network' models of the end of the century (Lewenstein, 1995; Gregory, 2003). In the web, as in the network, many kinds of actors speak and many listen, and many do both. Lewenstein's paper showed science communication as embedded within the broader complex of public communication, with its established and changing values, professions, traditions and genres.

One reaction to the kind of science communication characterised in Hilgartner's dominant model, during the flurry of interest in the public understanding of science in the mid-1980s in the UK, was a programme of social research, which was published in the mid-1990s. Involving such influential scholars as Alan Irwin, Hilary Rose, Brian Wynne and Steve Yearley, it explored cases where laypeople and experts encountered each other in real-life situations, confronting real-life problems (Irwin and Wynne, 1996). The researchers in this programme consistently found that, in the real world, encounters about science were conversations rather than lectures, and they were broad-ranging conversations in which scientific knowledge jostled with values, expectations, experience and common sense. Nor were these each originating with the usual suspects: all parties had knowledge, values, opinions and facts to share. The case studies showed scientists and non-scientists in face-to-face situations, having conversations about, among other things, the cognitive content of science. The analyses explored how knowledges and expertise are framed and nuanced by institutional relationships and cultural contexts. Emerging from this research programme was an idea known as the contextual model, which expressed that what we know and tell, and how we interact with others' knowledges, depend on our personal, social and institutional contexts.

Classic studies showing this contextual frame included Rose and Lambert (1996) on familial hyperlipidaemia, an inherited condition where people's knowledge – and their ideas about what was worth knowing – came as much from their lived experience as from their doctors. Sociologist Brian Wynne's classic case study records how Cumbrian sheep farmers, in the aftermath of Chernobyl, asserted not only their values and traditions to the influx of health-and-safety experts, but also their detailed and precise knowledge of local weather, soil, animals and rock, which contrasted with the universalised generalisation of the experts; and the apprentices at the Sellafield nuclear power station showed that sometimes it is usefully respectful to knowledgeable colleagues to let them to do the knowing, and maintain one's own ignorance (Wynne 1996).

This work was disruptive: firstly, it problematised the persistent notion that the explanation for the perceived under-valuing of science in British society was that the public knew nothing about science. It also problematised the idea that rejecting or ignoring scientific knowledge was a negative stance – clearly, this could indicate a positive relationship with scientific expertise. At the same time, quantitative data showed that high levels of scientific knowledge did not correlate in any straightforward way with positive attitudes to science (Evans and Durant, 1995; Allum et al, 2008). Knowledge became a non-simple dimension in the science-society relationship; and if it was implicated in poor social relations, it was hard to see clearly how.

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Engaging with engagement

Despite the contextual model's insights into *knowledges*, its influence was about *modes of talk*. It made apparent the possibility of multi-directional communication on a horizontal plane, more like Lewenstein's web than the top-down one-way communication identified in Hilgartner's dominant model. The fact that laypeople may well, after all, have interesting and relevant things to say about the cognitive content of science got lost in the rush towards new modes of communicating, and never mind about what.

During the 1990s, the public culture of science became a matter of public policy in the UK, and the locus of oversight and commentary moved from the learned societies and professional agencies and into the ministries (Gregory and Lock, 2008). Widespread in British political culture was the belief that the public did not trust the authorities in any field, including science; and given that the electorate seemed not to be empty-headed about science after all, it was becoming apparent that the perceived lack of trust could not be explained by a presumed public ignorance of science. Knowledge was therefore irrelevant to the political problem of science and society, and in a milestone report of 2000, the British parliament's House of Lords foregrounded trust in science as all about institutional relationships, with knowledge barely mentioned (House of Lords, 2000). Crucially, these institutional relationships were, henceforth, to be dialogical, and conducted through public engagement, irrespective of what they were about. Public engagement would, it was claimed, better inform policy-making, build social aspirations into the planning of possible futures, and energise the democratic contributions of a broad section of citizens. Notice that these aims are political and social; they could be about schools or parks or art. And where before, natural scientists had been speaking truth to power in Whitehall about science and society, now it was the social scientists (Lock, 2009). Not only was there suddenly a wealth of public funding for social scientists to engage the public with science, but also public money for science soon came with strings attached: it became obligatory to enrol social scientists in scientific research projects, where they would handle policy and engagement (see, for example, Calvert and Martin, 2009).

The turn to dialogue appeared to be a sharp one, but like every revolution, this one drew on changes that were already happening. A word-search for 'engagement' in the Open University library catalogue returns 2,000 entries published during the 1990s, and 42,000 during the 2000s, on a wide range of topics (searched in 2013). The western world was becoming more dialogical, and more participatory, and this was a consequence not of the decisions of committees of scientists or Lords in historic institutions in London. The context for understanding science communication since the 1980s is not the intrinsic qualities and capacities of public engagement itself, but of the space around it, in which profound world transformations were being wrought. Two qualities of the 'space around' that are important for this story are the transition to neo-liberal economics, and the introduction of the PC.

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Science in the 'network society'

The transition in science communication from deficit to dialogue (and from knowledge to policy) was rapid because the rest of industrialised society had already entered a new phase that privileged dialogic interaction among individuals, and the form of the interaction was more important than its content. Computer-based, networked communication had a great deal to do with that. Statistics for the uptake of PCs in westernised societies usually start around 1985 or 1986. But this is no ordinary 'new media' story about a new site for new kinds of messages. When Manuel Castells proposed his 'network society' thesis in 2000 (Castells, 2000), he was not just talking about communication: he was arguing that networked computers have produced a profound change in the fundamental modes of structuring, organising and transacting social life. Networks flatten hierarchies, which promotes equality, and makes it difficult to know who is in charge. Hierarchies give way to horizontal networks that are adaptable, and to units of action which can be small. Individual people gain autonomy, and are free, for better or worse, to connect with whomsoever they choose. In the network society instability is a way of life, as links break and reform, and individuals make new connections and discard the old. This instability makes the network resistant to external governance: responsibility lies with the individual user. People at their computer screen feel free to speak as well as listen, as equals, and to enter and walk away from conversations that are momentous and trivial. Their communication is, very often, phatic: it carries no information other than what it expresses about the relationship among the communicators. The network society, with its flattened hierarchies and unstable bonds among equals, is essentially dialogic, and never mind what about.

Theorists of the network society are quite clear that the reason why a computer appeared in every home and individuals became

networked is the deregulation of national economies during the 1980s. In these latter days of capitalism, the deregulated economies can no longer thrive on turning raw materials into useful objects; as well, they deal in knowledge-products and services. The shoe business once consisted of a shoe-maker making shoes and selling them to someone who needed to protect their feet; shoes then became an industrialised mass-product made in factories and bought in shops; and now the making and selling of shoes are only small parts of a shoe industry that markets not only shoes but also ideas about shoes and their wearers, images of shoes, discussions about trends in shoes, celebrations of shoe designers and exhibitions of their work, films and TV shows in which shoes play significant roles, and shoes that reduce obesity and combat climate change. Much of this 'about-shoes' industry is transacted via networked home computers, alongside advertisements for actual shoes, which still sometimes serve to protect our feet. In the early twenty-first century, the average woman in the West owns thirty pairs of shoes, though she wears only four pairs of them.

This knowledge-and-service orientation, in our 'post-industrial' society, arose from the economic and social crises of the 1970s and 1980s. Now, economies aim for national competitiveness in the global market by promoting innovation, and by providing the social and economic conditions for innovation. 'Innovation' in the twenty-first century tends to mean new technology. Technologies are often material artefacts, like shoes, but, like the shoes of the twenty-first century, they have attached to them less tangible social meanings (such as hope for a better future), which are an important aspect of their value (Thorpe and Gregory, 2010). These meanings are constructed and shared through communicative action which is therefore a form of work, adding value to goods beyond that of their material being and ostensible purpose (which accounts for the 26 pairs of shoes under my bed that I never wear, and so have no value as shoes). This work to construct and share the meaning of new or prospective technologies is an important form of production, because innovations will thrive only if society accepts them. In the past, individual scientists have talked about how science – usually their own research – will contribute to national prosperity, and politicians have made similar arguments about science, talking about new products for us to buy and sell, and new ways of making them; but now the public communication of science – in and of itself – contributes to national prosperity. What will make us – the nation, but also individual entrepreneurs – rich is not just 'science' itself, nor even just 'the products of science', but also 'talk' about science and its products, which becomes a good in itself. And, unlike the dwindling resources of the post-industrial age, 'talk' is a non-rival good, because you can sell it and still have it, to sell again.

Charles Thorpe and I have explored the implications of the commodification of talk about science elsewhere (Thorpe and Gregory, 2010). But it is important here to understand public engagement about science as economically productive. Firstly, like traditional science communication, it constructs a public that knows how to be knowledge-workers and consumers. Secondly, and unlike traditional science communication, public engagement mobilises this public in the work of creating and shaping the meaning or image of science and its products. Notice that this productivity arises from the dialogical activity itself; it is not about what is done with the outcomes of the dialogue (which may be, as its critics note, nothing at all). It is also a form of productivity that can be set in train far in advance of the technology itself (which may even never happen), creating meaning and value untrammelled by real-world constraints (in which context, the nanoparticles that eventually gave us stain-resistant trousers were a disappointment). That is what science communication does in the late-capitalist economies of the twenty-first century.

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Critiques of public engagement

Public engagement with science has been attributed with many qualities and capacities, all of them admirable in principle. It is open and inclusive, develops democratic capacity, and produces socially valid policy outcomes. It generates intelligence about public aspirations for the future, protects us from costly (financial and other) mistakes in the implementation of new technologies or strategies for existing technologies, and it helps us to understand each other, whether we are scientists or not. But at the same time, as a growing literature clearly identifies, some public engagement has served as a means for limiting the range of technological choices and legitimating particular interventions in decision-making (Elam and Bertilsson, 2003), and for delegitimating opposition (Levidow, 2007). Public engagement can also be used to generate a familiarity that can serve as a substitute for trust, and it is sometimes driven by, and limited by, an ideology of innovation that privileges particular technologies, usually those with economic potential. And as Lezaun and Soneryd (2007) argue, inclusivity is compromised when public engagement marginalises the opinionated citizen – such as members of activist groups – and engages instead with the

'quiet citizen', who is 'the only constituency weightless enough to be moved by the kinds of consultation exercises and deliberative processes that governments and their consultants dream up'. Inclusivity can become paralysing: in 2012, the London-based consultancy Involve, who are, according to their own publicity, 'experts in public participation', appointed an internal panel of lay advisors. Are we, with a nod to Harry Collins, falling into an 'engager's regress'?

In 2002 Collins and Evans pointed to the limitations of inclusivity, and brought knowledge back into the picture: they asked how does one judge the social value of the advice of a small number of people who, by virtue of their training and experience in institutions that we as a society support and respect, know what they are talking about, as compared to inclusive democratic input from many laypeople who may know little of the science in question and have no opinions about it? This they summarise as 'the tension between the problem of legitimacy and the problem of extension' (Collins and Evans, 2002). This tension is nowhere clearer than in the health service in the UK, in which, at precisely the point where technical experts inevitably encounter laypeople – that is, in clinical situations – the dialogical culture has made very little impact, and policy-makers and ethicists, as well as clinicians, struggle to find space for meaningful and productive patient participation (Ocloo and Mathews, 2016).

In response to Collins and Evans, Darren Durant suggested separating the *deliberative* aspects of public engagement, which can be extensive, and involve many people, from *decision-making*, which requires legitimated expertise and so falls to the qualified few (Durant, 2010). Escobar explores these various definitions, pluralising engagement and urging sensitivity in the search for the right engagement tool for the job (Escobar, 2011). Sometimes, the right tool looks very like traditional science communication, packed with the ideas, stories, images and signs that show us new perspectives on our natural world. This may be its salvation in our profoundly mediatised world, because, as a form of science communication, deliberative public engagement is poor media fodder. Dialogue events have no visual appeal; they are too egalitarian to be personalised and there is no scope for celebrity. The issues – especially those discussed prior to the implementation of a new technology – invariably lack currency and salience. Any attempt to mediatise immediately destroys the essential character of engagement, and produces traditional science communication. Replace a media-friendly communicative form with a non-mediatisable one and it is in effect shut down in the public sphere.

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The role of science studies in public engagement

The moral 'could' and 'should' of science, about which anyone can talk and to which there are many right answers, inhabit, in public engagement, the novel category of 'elsi'. This is jargon for the bundle of 'ethical, legal and social issues' that social scientists have been working on for decades, but which, with its new label, is now a requirement *within* publicly funded scientific research projects in the UK. Scientists often ask their social-scientist colleagues to handle 'elsi' for them (Calvert and Martin, 2009).

Identifying the problems in public engagement inevitably problematises our engagement with public engagement. For example, UK public funding for encouraging synthetic biology brought many science studies people into scientific networks at an early stage, and they have formed their own networks to ask themselves: having been presented with this unprecedented opportunity to participate in science-world, what are we to do with it? Who wanted something from us, and what did they want? What did we need from this, and were our needs compatible with those of our paymasters and hosts? Calvert and Martin refer to the institutionalisation of social scientists within science research programmes, and have developed a repertoire of possible roles, which they have presented selectively: in the European Molecular Biology Organisation's journal, they rehearsed two of these, contributor and collaborator. A contributor brings bolt-on expertise to fix problems in a particular niche, such as on 'elsi'. A collaborator, on the other hand, is involved in the generation of scientific knowledge, and could, by bringing attention to the social dimensions early on in the research process, influence the kinds of scientific questions that get asked, and how they are answered.

In other forums Calvert, Martin and colleagues have advanced a third 'C' role: the critic. The critic tends to warn about the misuse of science, and of unintended consequences. The science itself passes by even the critic relatively unscathed, reinforcing the idea that only the applications of science are political (Balmer et al, 2012).

It does seem that science itself is untouched by public engagement: we do not question it, and it is one of the givens of science studies that scientists rarely problematise it themselves. As Jurdant pointed out in 1969, one of the problems of science communication is that science is an ideology. It is a complex of 'isms' – materialism, reductionism and empiricism among them – that once were contentious but are now taken as givens, at least in polite public discourse, as the 'science wars' of the 1990s showed (Labinger and Collins, 2001). It is a defining characteristic of ideologies that they are not open to negotiation, and so science itself is unlikely to be responsive to public engagement. Jurdant also proposed more recently that popular science can be understood as the autobiography of science: it is the story science wants to tell about itself (Jurdant, 1993). Science is not up for negotiation, and that is the story that it tells about itself in public, and it is rarely challenged: it remains 'as is'. 'Issues', on the other hand, are anyone's game.

This taking-for-granted of science-as-is has real practical consequences in real practical situations, and our lack of engagement with it narrows down our response to problems of science and society. Is materialism really the only way to understand nature? Those of a more spiritual disposition might not think so. Is reductionism really the best way to understand how biological systems work? The holists and the systems theorists doubt it. And the empiricists who champion evidence-based medicine are thus engaging with every patient who has gone before, but not the one in front of them. I am not arguing for an alternative science, but for an acknowledgement that the science we have is, at its most fundamental, a choice which could have been made otherwise. We are ready to engage on issues and applications, but science itself – its ideas, stories, images and signs – could be up for negotiation, and renew its licence discursively, rather than by proclamation. We could do this if we engaged with scientific knowledge itself, rather than only with science policy.

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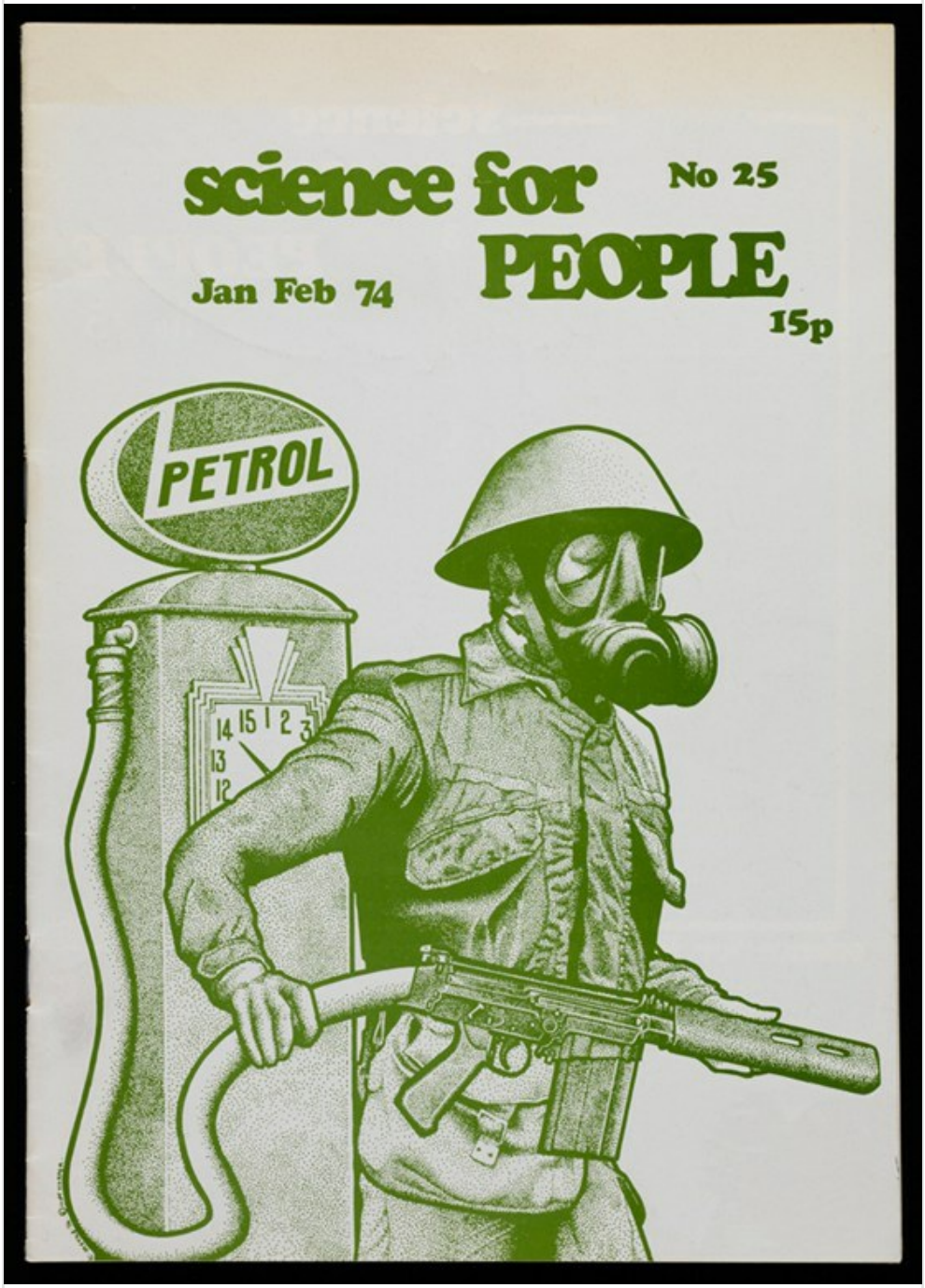
Responsibility

By deferring to their science studies colleague on points of 'elsi', scientists exhibit the kind of neutrality that Shapin calls 'demoralisation' (Shapin, 2008). He shows that the question of whether or not scientists' expertise gives them a privileged position on moral issues is a contingent one, and the answer has shifted with circumstance: scientists deploy the different aspects of their 'special' and 'ordinary' status when it suits them or their paymasters, opting into and out of roles of power, influence and action. Shapin notes Pinker's description of the scientist as a 'moral nerd', with its connotations of childish innocence. During the 'science wars' of the 1990s, scientists blamed the problems they saw in the science-society relationship on the public, on journalists and on academic science studies. I wrote about this briefly then, and argued that if scientists wanted to reshape their relationship with the public, they could start by putting some work in on themselves. The name I gave this work was 'responsibility' (Gregory, 2001). Responsibility is a non-distributed version of ethics: where ethics asks 'What is the right thing to do?', responsibility asks 'What is the right thing for me to do?', and then does it. It differs from the more symmetrical concept of citizenship, which confers rights as well as responsibilities; responsibility, on the other hand, does not ask for recompense. As Wagner (2008) points out, in the network society, scientists are as responsibilised as everyone else: as individuals, they have unprecedented potential to coordinate and publish their research beyond the reach of national governance, and to seek out and interact with new people and communities.

The word 'responsibility' goes in and out of fashion: its currency in the science studies literature of its formative years, the 1970s, declined in the 1980s and disappeared in the 1990s. Now it is creeping back into our vocabulary, most obviously in the professionalised and esoteric form 'RRI', which stands for 'responsible research and innovation' – a social research agenda that is being heavily funded by the European Commission (an organisation – as the British have recently been painfully reminded – that is primarily an economic consortium). But 'responsible science' has a much longer history, and scientists' explicit commitment to it has emerged usually at times of crisis (Rose and Rose, 1969; Beckwith and Huang, 2005). After the Second World War, because of the Bomb, the atomic scientists took the lead, and the professional organisations in the USA, in particular the National Science Foundation (NSF) and the American Association for the Advancement of Science (AAAS), encouraged the discussion; and in the late 1960s, Vietnam, *Silent Spring*, and recombinant DNA mobilised scientists in the UK into less formal groupings, such as the British Society for Social Responsibility in Science (BSSRS) (Wilkins, 2003). BSSRS's journal, *Science for People*, looks like many of the pamphlets and fanzines of the new social movements that were proliferating at that time; and, indeed, many of the topics the scientists in BSSRS were tackling – pollution, energy, war – were also taken up

as causes by those movements.

Figure 1



Science for People shows scientists publicly engaging with politics and economics, in the style of the activist movements of the time.

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The short life of BSSRS was attributed by one leading member to its having been eclipsed by more competent lay activism (Wilkins, 2003). Geneticists Beckwith and Huang (2005) note that 'events, not the education of the scientist, were the "educational moment" that generated social responsibility among scientists'. It takes an imminent global catastrophe to responsibilise scientists, and, as Beckwith and Huang remark, 'Waiting for such crises will not do'. In any case, it seems that, in

1970s Britain, society preferred to rest its hopes with the activists rather than with the nerds.

There are some lessons for science from the discussion about social responsibility of scientists in the 1970s. Richard C Atkinson, psychologist and Director of the US National Science Foundation, saw responsibility in instrumental terms, as a way of retaining control of research in the face of intensifying regulation and policy:

> A large measure of freedom is essential to the pursuit of science…scientists can best preserve that freedom by exercising a large measure of social responsibility. […] Scientists must be prepared to exercise self-regulation when appropriate, or join with non-scientists in monitoring external controls if necessary. (Atkinson, 1978)

Atkinson's advice acknowledges that preserving a special, elite status for scientists may mean not cutting themselves off from the social, but combining forces with non-scientists. Rip and Boeker (1975), writing from the Netherlands, also highlighted the tensions between the elite and the socialised, by identifying not only dilemmas of focus and outcome, such as those of academic research versus military or industrial research, but also the tensions of an elite, technocratic orientation in a social-democratic society.

Two central themes emerge from the discussion within the scientific community at this time. The first is about communication: *scientists themselves have a responsibility to tell others what is going on in science*. They should do this *in order to facilitate the political process*. (This is different from communicating science to have fun, make money, become famous, make science look good, or recruit future scientists.) The second theme is that *scientists themselves have a responsibility to speculate about the future, and to improve their own understanding of the potential of their work*. Rose and Rose (1969) sum these up:

> The special responsibility that falls upon the scientist…must be that of both interpreting current science, and in helping to assess its consequences. This is a role that only he can fill. (p 247)

Rose and Rose contend, however, that scientists are not adventurous when tackling possible futures, and they do not enjoy it: their speculations tend to be conservative and bound to very particular values. Nearly thirty years on, Beckwith and Huang argue that scientists lack the education to undertake this important task; which perhaps explains why, in public engagement and RRI, science studies people are recruited for this work. Because science studies people take on this role and this responsibility, the scientists do not have to learn how. Scientists remain 'as is'.

Among the young scientists involved in the responsibility movement of the 1970s was physics student Brian Martin, and it inspired him to pursue a career in science studies. However, by 1993 he was disappointed: he argued that the academic form of the critique of science had distanced science studies from social problems. In the 1970s, he wrote, 'a critique of science was seen as a critique of society' (Martin, 1993). Martin recalls his excitement as he worked his way through the activist-academics such as Bob Young, Rose and Rose, Jerry Ravetz and David Dickson, and then explored the knowledge-theorists Kuhn, Barnes, Bloor and Mulkay. But the more sophisticated these critiques became, and the more professionalised and institutionalised science studies became, the more the scholarship lost touch with what Martin calls 'the flesh and blood struggles in and over science':

> …the radical activists are fast adrift from the discipline in the mainstream quest for job security and status which are achieved through professionalization and specialisation. Just as politics has become the study of government and economics has become the study of capitalism, so science studies has become the study of science as it is serving society as it is.

Martin argues that the increasing sophistication of science studies makes it less useful, especially when the theoretical trend is towards the analysis of the analyst. The professional work of science studies had become:

> …a process of taking over the insights of the radical critics, recasting them in an academic and sanitized mould, and pursuing the dilemmas *internal* to the resulting intellectual terrain. [my emphasis]

This rings true not only about science studies, but also about the microcosm of public engagement, where first, we argued that public engagement would be a good way to tackle problems in science and society; then we neglected the problems themselves while we thought about democracy, governance, process and relationships; and now we reflect on our own involvement in public engagement.

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What can be done about this?

While science communication reinvents itself in public engagement, and all the resources are committed to dialogue about innovations with highly selected participants and producing its unmediatisable products, scientists are reclaiming the public sphere, where one-way communication remains the 'common sense'. While, traditionally, scientists have branded as sensationalist the image of the mushroom cloud and the vivisected dog, in the post-industrial society, scientists are asking us to experience the image to feel good about the future: the happy blue-sky and green-leaf images of synthetic biology are examples (see Wilson Center, 2016).

Figure 2

In this example of research institute branding, synthetic biology is brought to life with a visual rhetoric of a better future.

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The discourse of synthetic biology has been described as 'playful' (Calvert, 2013), and two of its leading scientists play themselves in a super-hero style comic (Endy et al, 2005). In the UK, a national dialogue about synthetic biology took place in 2010, but not because it was burning issue: only a few per cent of the UK public had ever even heard of it (Bhattachary et al, 2010).

So while we have moved from top-down communication to a policy of more democratic forms, we are still subject to 'top-down' behaviour in the choice of 'problems' we communicate about. In his 1993 paper, Martin listed the serious problems in the world where science and scientists are or could be players: war; repression; poverty and inequality; and patriarchy (where he notes that, while feminist critiques are one of his field's academic success stories, they seem to have made no difference whatsoever to the problem). Martin also acknowledges that in the areas of environment and health, there has been some

synergy between activism and academic critiques, and suggests there are lessons to be learned there. We might ask, from today's standpoint, whether one of these lessons is that it is the public's knowledge about and interest in health and the environment that has made this difference.

Martin's perspective, from the 1970s to the 1990s, provides a frame for us, a further twenty years on. The unarguable good of democracy that is public engagement's flag of convenience is also served by Martin's suggestion of a simple solution to this problem: first, he argues, 'talk to people to find out whether there is any social analysis of science and technology that they think would be useful'. 'Rather than studying things that are "intellectually interesting"', he writes, 'the aim should be to find out what is intellectually stimulating about things that people consider important.' It is hard to imagine how a public dialogue about synthetic biology could have arisen in such circumstances. On the other hand, it is possible that, for example, sorting out clean water for Africa might be something that people consider important. This is a 150-year-old technology (supplying drinkable water), drawing on scientific insights from 350 and 150 years ago (minuscule beasts live in water, and can make us ill), all of which we learn about as children and experience in our everyday lives.

Figure 3

The science and technology of clean water are long-standing, uncontroversial and robust.

Monster Soup, 1828

Coloured satirical engraving by William Heath (1795–1840), also known by his pseudonym Paul Pry, showing a lady discovering the quality of the Thames water. By the 1820s, public concern was growing at the increasingly polluted water supply taken from the Thames in London. In 1831 and 1832 the city experienced its first outbreaks of cholera.

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In the West we consider clean water a fundamental civil right, and, if the supply is interrupted, we call out the Army, who bring it in bottles and tanks. Clean water could bring greater health benefits in Africa than an AIDS vaccine and a cure for cancer combined, as well as building stable, self-sufficient communities (and, by the way, supporting local and global economies). It is

intellectually fashionable to think about gender inequalities – or, as Martin put it in a less symmetrical era, 'patriarchy' – but the African woman who is raped in the bushes where she has gone to find a private place to pee will be better off with a toilet now than with an academic monograph or a public engagement at any time, or even with a promise of a new technology: the new wonder-stuff graphene, claim the entrepreneurs, will clean our water in a market worth $2.8BN (G2O, 2016). We could already supply clean water using the means we have now, and this might make good sense to the great many people. But we do not do it now. Unfortunately, there is no money in it.

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Conclusion

We should be careful about concentrating intellectual and other resources exclusively in apparently socially orientated dialogues about new technologies, given that they neglect the content of science, serve economic interests rather than responding to public concerns, and let scientists off the hook of their social responsibilities. New technologies are exciting and can be useful, but they are rarely necessary or urgent – except for their investors, who benefit from the work we all do to socialise their ambitions. The great technological innovators of our age have become so wealthy that there is little they can do other than give money away, and philanthropy could be a way to turn the innovation economy towards serving a broader scheme of interests.

While it can be academically productive to turn inwards towards problems between science and the public, there is a bigger 'space around' in which there are serious problems to be addressed. To do this, we need to reorientate our thinking about the words 'problem', 'science' and 'society'. We could abandon the idea of a conflict between science and society, and think instead about collaboration. Instead of focusing on the alleged problems in the relationship between science and society and deploying engagement between scientists and the public to address them, we could instead recognise that there are problems of society that scientists and the public could collaborate to solve, with the tools they already have to hand. It is not by looking for problems in the 'space between' science and the public that the space will be spanned, but by finding common concerns in the 'space around' that science and the public will address together, democratically, and for the common good.

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Tags

- Science and society
- Science dialogue
- Science communication
- Public engagement
- Science in the Media

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