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Prospects for 'a rhetoric of science'

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A most sobering prospect for a rhetoric of science is that it should become an established field of study. I (the first author) remember the pre-field excitement in cultural studies, TV criticism, film criticism, ideology criticism, movement studies, political communication, as well as in what is now being called 'the' rhetoric of science. What 'pre-field' refers to here is the moment before graduate courses, textbooks and 'authorities' are appointed to evaluate journal submissions. In this moment, one does not take stock of all that has gone before. What is more, the controversial stuff is still tolerated. Scholarship has not yet become, often because it is the only game in town, one-sided, disputatious, subjective or some other kind of professional embarrassment.[1]

Happily, this, what Kenneth Burke once called the 'bureaucratization of the imaginative', has not yet caught up with the rhetoric of science.[2] The truth of this lies in the fact that we have been invited to comment on a debate which is pregnant with the future not of a field of study but of life on the planet. Even so, despite our reluctance, we may stand accused of supporting a new field of study because of our conviction that talking critically about science by scientists and non-scientists alike is a worthwhile activity and should be encouraged.

Our focus, however, is not on 'the' rhetoric of science, but on those multiple situations and audiences where rhetoric and science interact toward some end. There will be, in our response to the debate, no surveys of the literature, lengthy discussions of method, or muted concerns over whether or not the 'field' will be or ought to be taught in Ivy League schools. Whether it will be well received by scientists, philosophers, or the *Chronicle of Higher Education* is beside the point. The issues are too important to be concerned about what others might think. In this spirit, we dwell on that most unprofessional and potentially disorienting question—the question of purpose: why a rhetoric of science?

What makes this question of purpose so seemingly 'un' or even 'anti' professional?[3] Unlike 'aim' (which presupposes an existing target), or 'goal' (which moves between game and achievement), or 'intent' (which muddles its way into autobiography and clinical psychology), 'purpose' asserts a personal dimension. A profession, a 'field of study', presupposes boundaries, a difference from and (more often than not) superiority to other fields of study, and an agenda designed to direct and define 'professional behavior'. Professionalism—an uncritical belief in the ideals and practices of one's profession—subordinates purpose to 'field', which carries in its train current practise, established guidelines, canons and lines of research.

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Purpose, in an established, institutional context, gives way to thinner forms of commitment. It flattens out into 'aim', for example, as in 'the aim of this essay'. Purpose, by way of contrast, recalls a personal stake. It would be odd to say that this work is 'aimed'. But to say that it is 'purposeful' signals that a deeper form of personal commitment motivates the 'intellectual' work effort and that the author is willing to think through and redeem such commitment through deliberation with others.

Purpose reveals itself through intellectual integrity—raising the important issues, taking them deeper and writing and speaking about them in ways that are helpful. However much we applaud such talk, it does not translate easily into criteria. It cannot be thematized, appropriated and applied—did the authors work through the issues honestly, was their language helpful? Such questions are better understood as questions lived. Questions we ask of ourselves. They enter into the spirit of the work, the process of working and not the content, form, or success of the final product.

Our purpose in calling attention to spiritual matters is not to further the prospect of rhetoric of science as an interest area in history, philosophy or communication studies, or as a field in and of itself. Rather, we seek to examine the potential for this line of scholarship to encourage good work. Thus we ask the question: can it lend vitality to or concentrate our attention on issues like the future of life on the planet?

The essay is divided into three parts, each offers a different sort of answer to the questions raised above. Part one offers a personal answer: it pulls back the veil on an early work in the rhetoric of science to discuss the personal stake involved and the larger historical context in which it began to make sense. Part two provides a pragmatic answer: it critiques the debate before us over global warming and asks of you the reader: is this useful? Does this make a difference? It also suggests some modest reforms. Part three outlines a programmatic answer: it suggests alternative approaches to and topics for research in rhetorics of science.[4]

In a concluding note, we take up the 'audience catastrophe' in rhetorics of science brought on by questions such as, what are the audiences for such work? How, in a practical sense, can they be reached? What actions are appropriate and who is to engage in them? Asking and answering these questions helps us to get beyond the enchantments of theory. It recalls the practical business at hand, the reason for doing theory. It recovers the link between theory and practice in practical matters; a link that may be set aside when talking about literature and confining one's remarks (and their implications) to 'texts'.

1. *Recalling an early 'rhetoric of science'*

> A rhetorical investigation into science is not desirable in and of itself, and if all it represents is an entree into the bickering between scientists and humanists, or a new field within which to display professional skills, then I have not said what I intended to say.
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> (Wander 1976).

The first time I used the phrase, 'The Rhetoric of Science' was in the title of the essay quoted above, published twenty-five years ago. It set out a modest programme for research that did not require a student of public argument (i.e. rhetoric) to be an academic philosopher or an expert in science. This was not the result of a seminar I took in graduate school (there were none at the time), and it did not come from intensive reading (there was next to nothing to read under this term). It was a practical necessity and it was job-related.

I introduce an autobiographical note into talk about the rhetoric of science to locate myself as a person in time and place (rather than presenting myself, as scholarly prose demands, as an ideal observer). I do it also to complicate, personalize and 'muddy up' the notion of purpose and to suggest a more integrated approach to theorizing projects in rhetorics of science.

1.1. *Historical context / personal stake*

For twenty years, in my department, I fought a political struggle over hiring, retention, promotion, travel funds, etc., having to do with science and the future. It was not, strictly speaking, a personality clash; I did not dislike my antagonists. We explored our differences over coffee as well as in faculty meetings. We were friends who agreed to disagree.

It was an ideological conflict, reflecting profound differences in what we valued, how we lived and the futures we envisioned for our department and our society. My antagonists spoke eloquently for science, but they were not, strictly speaking, scientists. Rather, though I never publicly used the term, they were, recalling Thomas Kuhn's characterization of those who advocate but do not do primary research, cheerleaders for science.[5]

At times they cheered 'behavioural science', 'quantitative research', 'experimentalism' and 'the scientific method'. At other times they cheered 'logical positivism', 'logical empiricism', and 'symbolic logic'. Whatever the idiom, it was uttered in hushed and reverential tones. The way Christians talk about revelation was the way my colleagues over the decades talked about the 'findings of science'.

Through the years, their zeal did not abate, but their project—what they actually did beyond propagating the faith—underwent radical change. Early on (in the 1960s), it was 'pure research'—discovering 'the laws of human behaviour'. After a decade or so, this effort was transformed into applied research (though they did not use the term). Toward the end (in the 1980s), it had to do with enabling Fortune 500 companies to gain the compliance of workers and consumers. As part of this latter movement, my colleagues once trooped into the chair's office to recommend the department give up the required general education course in public speaking and support itself through extramural funding (of which they, collectively, had not secured over $1000 at the time).[6]

Throughout, my colleagues remained secure in the belief that they were about 'objective research' and that, whatever they were actually doing, this was 'the wave of the future'. As their hope of building theory and doing groundbreaking research faded, they turned increasingly to the rigors of method and the need to maintain standards. 'The' scientific method existed; it could be derived from the natural sciences, mathematics and the philosophy of science, and, with slight adjustment, it could be applied to communication phenomena. High standards insured that this was properly taught. Such were the arguments consistently put forth in committee and faculty meetings.

Put into practise this meant a sequence of required courses with a minimum of distraction from traditional, non-sensical courses and interest areas, which they periodically proposed to eliminate, and professors, whom they tried to remove and, through job descriptions, tried not to hire. Undistracted students properly introduced to the scientific method were prepared to go on to 'the' major PhD programme in the country, which as one they declared could be found not in Berkeley or Boston but in East Lansing, Michigan.[7] Here or rather there in the late 1960s, our students could learn how

to add to the sum of valid, reliable, statistically demonstrated, 'objective' knowledge. After which, they would go into the field to witness to their faith, spread their learning and presumably reproduce themselves.

Meeting after meeting, day after day, year after year, I faced arguments based on 'science'. Then one day in the early 1970s, after about five years of struggle, it dawned on me that what I was hearing was not science. The arguments were not about science; they did not have science as their purpose. They were about hiring, retention, tenure, promotion, chair elections, travel funds, etc. My colleagues' arguments were not based on scientifically validated facts or methods. They were based on probability, speculations about the future, social hierarchy, anecdotal evidence, analogies, metaphors, precedent, etc. The same as mine!

At times their arguments followed 'findings' in source credibility and compliance gaining (I read the research because it was interesting and because it helped me to predict their moves). But this line of research had to do with getting others to do what you wanted them to do, not with being scientific. In the final analysis, their efforts, like mine, were attempts to persuade an opposed, reluctant, ignorant, sometimes amused, generally interested audience in a here and now of policy deliberations. These efforts had less to do with science (however much it got praised in the process) than with resource allocation.

It took me five years to discover the nose on my face. Why had I not seen this right away? Why, because, in some fundamental sense, their arguments were persuasive. I went to high school during the height of the Cold War. At that time, it was not computer science (for there were no computers) but physics, chemistry and mathematics that were the prestige subjects. Students who excelled in these areas could get prizes (at science fairs, etc) and money (through the National Defence Education Act) to go to college.

Those who did not did not and I was one of those. I played the trumpet in the band and orchestra, debated, played baseball, read history, poetry and philosophy on my own. Yet, I had been socialized in the belief that science was not merely valuable and essential for national defense, it was also a measure of intelligence. In brief, I was the product of a system that, through grades, punished one for not doing well in science, and rewarded one, in quite tangible ways, for excelling. My conditioning had been subtle and systematic, and it influenced my behavior and how I responded to arguments.

Humbled as a student, I was, as a faculty member, arguing against science as a determinant of policy. I taught 'traditional' courses (argumentation and debate, rhetorical criticism, contemporary rhetorical theory), worried about 'old-fashioned' issues (history, politics, democratic practise), practised 'mere rhetoric' (sought to persuade rather than announce the truths of science). Recalling A. J. Ayer's three-part division of knowledge into science, mathematics and non-sense, I learned that what I did was at best 'pre-scientific' and at worst akin to music, mysticism and superstition.

I began to read works in the philosophy and history of science (Kuhn, Imre Lakatos, Paul Feyerabend, etc) and in critical theory (Max Horkheimer's distinction between traditional and critical science was a revelation[8]). I subscribed to the *Bulletin of the Atomic Scientists*. I encountered authors talking about arguments in and about science. I began to take heart and reflect on the fact that science was something done and something talked about. I was not prepared to talk about 'doing physics', since I was not a physicist, but I could talk about the role the physics analogue played in our deliberations.

1.2. *A larger purpose*

Why did I write about a 'rhetoric of science' in 1976? I could not, of course, write about my little departmental war in an academic journal. In this sense, what I wrote in some way misrepresented my experience and more importantly my purpose. This is a limit of most academic writing, in fact a rule for doing and a sign that what one is reading is academic writing. Writing this essay and other essays, pulling the issues together, helped me to refine my arguments in departmental meetings (see Wander 1989).[9] I tried them out over the years not merely to win a vote, but to see how they worked. My colleagues—my antagonists and the uncommitted who actually listened to the deliberations—served as a small public who cared about and voted on the issues.[10]

Science in my department looked and sounded a great deal like social psychology (though this was never proclaimed, since it would sound too much like poaching). Science in the university (and in academe in general) was mathematics and physics (sounds odd now, in a period valourizing computer science and engineering). Science in the public space (Big Science) had to do with theorizing, building and deploying nuclear weapons and protecting the country from nuclear weapons. What I had stumbled upon in my political struggles, inside and outside the department, was a much larger issue: what President Eisenhower, uttering words written for him by one of his speech writers, Emmett John Hughes, had called a 'military industrial complex'.[11] This complex of interlocking military, industry and political interests still politicizes science and infuses the academic study of science with political significance. The presence of military related research and laboratory complexes on college campuses (like Lawrence Livermore at U. C. Berkeley) brings this significance closer to home.

The rhetoric of science compassed a broad range of issues. For me it included debates about the future of my department and my field, and debates over the future of humankind. At the level of political theory, it called into question the efficacy of the democratic process. In my department and in the larger society, technical language seemed to me to be shutting down debate over a host of important issues:

> Public deliberation tends increasingly to technical language and to statistical computation: the 'input', 'output', and 'feedback' of computer technology, 'infrastructure', 'debriefing', megadeath estimates of the loss of human life in a nuclear war, the proportion of the work force unemployed, quantity of energy reserves in the United States and the projected demand, predicted gross national product and the rate of inflation. This is a mode of discourse. . . . Reliance on technical language in public debate is rhetorically significant, for in a democracy, whatever its practical imperfections, the people have a right, on the important issues, to know the relevant social and economic facts as well as the policy conclusions to be drawn from them.
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> (Wander 1976, p. 227).

Real issues were and are being debated then and they are being debated now. Science (and the technical jargon of science) is still being called upon to advance, oppose and modify the allocation of our national resources. The rhetoric/s of science (for there are many specialized areas and various specialized languages) exist and they continue to impact public deliberation.

The issues involving science and public policy reach well beyond the arms race. They also precede it. Scientific 'research' 'justified' enslaving the 'Negro race' in the 19th century and the domination and slaughter of 'inferior races' well into the 20th century (culminating in Hitler's 'final solution' to the problem of 'race purity'). Scientific research in the 19th and 20th centuries, much of it from medical journals, 'justified' the continued subjection of women and medical experimentation on adult male Negroes (Solomon 1985). Scientific research also 'evidenced' the destruction of our natural

environment, spelling out the dangers of DDT in the 1960s; the dangers of nuclear power in the 1970s; the proliferation of dangers to air, water and soil from manifold toxic hazards in the 1980s; and most recently the dangers of biotechnology in plants and animals.

There is a place for 'objective research' in public deliberation. In truth, today's complex policy world requires science to guarantee the soundness of public decisions. Because science—a methodical, systematic effort to establish valid and reliable 'facts'—appeals to people in so many groups, it stands to provide a momentary platform on which to debate other matters.[12] It can and has clarified life and death issues. The accumulation of evidence in the debate over smoking cigarettes is a case in point.

Scientism, however, an uncritical belief in the miracles of science and technology is, as my father (who grew up on a farm) used to say, a horse of a different colour. The fact that scientists in the employ of the tobacco industry for years predictably produced counter-facts is a case in point. Scientism takes on different meanings in various personal, institutional and historical contexts.

We should respect religion and science, and for that matter the corporate state, but keep them at a distance. We are not made for them, they are made for us and they should be made to serve *human* needs. This becomes all the more crucial as our understanding of human needs is redefined in an emerging ecological context. This is because eco-logic radically alters our notions of time, space, and consequence. Eco-logic points to worldwide problems reaching a thousand years into the future. This expansion of space and time challenges a civic humanism grounded in nation-states and operating on the basis of quarterly reports, periodic figures on inflation, unemployment, balance of payments, and Gross Domestic Product, yearly debates over the federal budget, and bi-annual elections (see Wander and Jaehne 1994). There is an acute need in modern and modernizing societies for continued research in areas where science enters into arguments over public issues.

There is also a need for critical appraisals of a science which, through opinion polling and focus groups, guides the ways in which politicians, corporations, and lobbyists target citizens, consumers and mass audiences (more about this in part three). There is more than enough work to be done by students of public argument inside and outside academe. On the inside, however, it makes little difference whether they are called philosophers of science, rhetorical critics, critics of rhetoric, social critics, literary critics, physicists, engineers or environmental scientists. As citizens and human beings, each has a stake in the outcomes of policy debate or in the continued possibilities for policy debate. As professionals, many of us have a stake in how our 'subject' is used and abused during the course of policy debates undertaken by non-specialists trying to persuade audiences of non-scientists.

We search for names that allow for purposeful work. The 'rhetoric of science' is one of those names. Hard to make a living and, at the same time, take on the great issues. The rhetoric of science enables scholars to address socially important issues, issues having as their subject the future of life on the planet. Because these issues are controversial, there are few jobs devoted to working on them and precious little 'extra-mural funding' from government, multi-national corporations, or large foundations to pursue them, especially to pursue them critically.

2. *Global warming, debate methodology and the audience catastrophe*

Part one summed up an approach to the rhetoric of science outlined twenty-five years ago and the personal stake it represented and the multiple purposes served by research and publication. Part two takes on the 'debate' before us over global warming, assumptions made about debate as a method for arriving at truth, and the problem of shifting notions of audience revealed in this debate.

This is admittedly a rough-and-ready take on the debate and on the project of the Science Policy Forum (SPF). Neither of us was present at the live debate. We are reacting to a sedimented text of once living discourse. The reproduced graphics, some 18 months after the event, no longer 'speak' in the way they did at the moment of presentation. The non-verbal cues from the speakers or the audience to carry our attention along, to guide our interpretations, to point out contradictions have vanished. Where we carp now may have made little sense then. Hopefully, our carping will be redeemed by some suggestions for programmatic reform in this and in the final section of this paper.

2.1. *The Science Policy Forum's disciplinary focus*

SPF sponsored and staged a global warming debate between two prominent climate scientists before a live audience. Though it seems on the surface to be a helpful attempt to educate the public about global warming, there are, in fact, multiple purposes to the event. At one level, there is the hope, shared by many, that the two scientists will clarify some of the public confusion around the general global warming questions: is global warming real? Is it caused by humans? Do we need to take corrective actions? If so, what actions make sense? How drastic should they be?

At another level, there is the sponsors' hope that the SPF will prove a success in a university setting where funding, promotion and professional recognition are bound to play a part. Beyond this, the debate also serves as an object of study in the 'rhetoric of science'. The disciplinary focus of the SPF project—because of its place in communication studies in general and rhetorical studies in particular—is in argumentation and debate. Part of what is at stake here, professionally speaking, is public debate as a methodology for clarifying and resolving issues.

How useful is it to stage debates in hopes of coming to know? Specifically, how well does it advance public understanding of science and global warming science? Professor Mitchell expresses concerns about the relevance and viability of the American Association for the Rhetoric of Science and Technology (AARST) in his introductory remarks. He begins by saying, 'this evening will forestall doubts about the rhetoric of science enterprise' being a 'rarefied and detached scholarly project, of little relevance to contemporary science policy discussion'. He worries that people working in AARST circles are seen as 'nothing more than a bunch of covert neo-Aristotelians blowing hot air'. The forum on global warming is designed to be 'a performative exhibition of the potential for rhetoric of science scholars'.

Eschewing both the 'zealous pursuit of partisan politics', and 'hunkering down as partisan advocates', Mitchell introduces the speakers as long-standing partisan combatants, referencing their Capitol Hill experience and their partisan histories and affiliations much more thoroughly than their scientific credentials or contributions. The way Mitchell attempted to enlist participants—'the task of trying to recruit an advocate from the Clinton administration to defend the scientific basis of their global warming

policy'—affirms a strongly partisan (and policy) motivation, rather than a purely scientific one.

There's nothing inherently wrong with this, of course, and given the policy implications of the global warming debate it may even prove useful, but the institutional context enveloping SPF does tend to present a case for mixed motives. To this extent, it is not at all clear what the audience (or audiences, and here we include ourselves) is supposed to walk away with. Or, for that matter, what we are likely to walk away with, given the way the event shaped up.

2.2. *The audience catastrophe*

Several goals motivate the SPF approach to airing the issues, though it is not clear that they are necessarily compatible goals. This event attempts to be a 'tool for exploring scientific controversies'. It is also a strategy for improving 'public understanding of science'. Questions arise: who explores scientific controversies? Are scientific controversies inherently an internal scientific matter—i.e., they are controversies because scientists doing science disagree about the science—or are they controversies because the public can't make policy decisions in the face of uncertain, incomplete, or conflicting scientific warranting?

This distinction between scientists and the public matters, because so much hinges on the nature and role of the audience in scientific debates. (Who should and is able to decide the controversy?) Can the public decide that a scientific controversy is now over? It can certainly vote with its public (and private) funding decisions. Furthermore, how do we, whoever 'we' are in this split between scientists and the public, know when the controversy is effectively over?

'We' as scientists or 'we' as a public—these are not merely grammatical distinctions. When we speak with our colleagues on campus—economists, meteorologists, chemists, geographers, professionals who pay some attention to the climate science of this particular debate—they tell us there was controversy, but the controversy is over. Let's move on to something significant, they say; the earth is clearly warming, human activities are major contributors, the underlying causal models, though imperfect, are generally correct—it's now up to the policy makers. Let's move on to something else, something more interesting, where we're not sure what's going on, where future outcomes are murky.

They do not say that we know all we possibly can or must about global warming, only that the controversial issues have been largely decided and that better (more focused, more refined) modelling and measurement will ultimately work out the details. It is less of a frontier. The controversy, for them, is political, not scientific.

But if the controversy is political, the scientific part is no less controversial. It is just a question where science fits into the resolution. We understand the rhetoric of science to mean not simply the discourse of scientists doing science among themselves, but also the public use of scientific fact and discourse by advocates (whether or not those advocates also be scientists), for a policy making audience (that may or may not include scientists). Here, the ground rules of the discourse change because science alone can never prove what we should or shouldn't do; it can only support or bolster our confidence about the probable outcomes of different policy choices that rest on moral, ethical, health or economic grounds.

So, given this 'public debate methodology', is the public's understanding of science improved by watching two scientists duke it out? We choose the fisticuffs metaphor

intentionally, since this particular public event seemed, at least from the transcript, to have a bit in common with a boxing match. There were the promoters, and the story about the difficult time matching up the appropriate combatants (i.e. matchmaking). There were ground rules to govern the contest, a referee of sorts in the moderator, even a succession of 'rounds'. There was an audience and a judge-commentator. There was an entertainment factor. Will the public be led to learn about science through such quasi-pugilistic entertainment or will they simply look for a clear winner or loser? Global warming by technical knockout!

This is further complicated by how we define 'public'. For example, if by 'public' we mean the mass audience, an aggregate of people defined by what opinion polls can reach, then to speak of 'the public' makes sense. And 'public opinion' can be reduced to statistics. If, however, drawing on democratic political theory, we take 'public' to mean groups of people joined together to influence their representatives or to foment revolution, then 'the public' in public opinion polls is too monolithic. There are many publics.

A public may be composed of plumbers, dental assistants or scientists. The American Association for the Advancement of Science among other things lobbies for tax dollars for particular projects, 'scientific' projects. The Union of Concerned Scientists brings relevant specialists into the public space to influence non-scientists (citizens, representatives, voters, etc.) on what they see as bad policy. They are composed of interested citizens. They meet to discuss the issues and try to influence public policy. They too are publics.

A decisive difference between public as a mass and publics as groups of politically motivated citizens lies in the fact that the mass never meets and is only joined together through numerical summary. This public does not and cannot deliberate. Publics, as groups of people, meet and deliberate, and their views may change over time and in relation to new information, a change in membership, or altered circumstance. How we conceive of public, therefore, shapes our notions of audience. Conversely, if we approach the subject with a mass audience in mind, we can easily translate this into a non-deliberating mass public.

Still, separating science and scientists from the 'lay audience' also makes sense. There are 'scientists' and there are 'lay persons'. Professor Mitchell as moderator, shifting to this latter view, builds the tension and raises the stakes. He is 'humbled to note that right now in this room, we may have two of the most established and accomplished scientific authorities... in the entire world'. There's a rhetorical breathlessness here, a playing to the crowd, an invocation of and appeal to the public understanding of celebrity culture.

Scientists presumably arrive at truths through method, procedural rigour, measurements and the data reduction instruments, review and consensus of peers. Truth is not determined by status but by rigour. Yet, when famous, leading, or celebrated scientists disagree, who can sort out the confusion? Who is in a position to sort out the celebrity from the science or, for that matter, the appearance of science from real science, the use of extra-scientific sorts of persuasion from persuasion respectful of the findings and procedures respected in the relevant scientific communities? Hence the distinction between a scientific audience and a public, mass, or lay audience becomes important.

2.3. *Where's the science?*

Although Professor Mitchell wanted to 'highlight some of the aspects of the global warming controversy', the introduction makes no reference to the matters of science that might be in dispute. This may reflect his modesty in relation to the topic. Like Mitchell, we are not experts on global warming or even the public arguments over global warming. Yet, this may be an area for improving debates in the future—offering a summary of the present state of the controversy (among scientists or among those who argue over policy implications).

Mitchell rightfully refers to the partisanship of the disputants and why it was so difficult to put the event together. The 'dispute over scientific facts about global warming is shot through with *enormous* political, economic and social significance'. The political stakes are 'immense' and the professional stakes are 'huge'; for citizens, the stakes are 'incredible'. We don't disagree with this assessment. What it suggests is that global warming is now primarily a public policy debate, not a scientific one.

In this matter, we are witnessing how policy discourse uses science for political ends. We are not witnessing scientists coming to scientific conclusions. Even where strictly scientific issues are under debate (for example, when Michaels infers that Hansen has offered a 'statistically significant' conclusion and they differ on whether one can claim an effect if it is not statistically significant) they play them rhetorically: 'you said ... I didn't ... you had to have meant ... a scientist can only say ... I disagree ...'

There will always be severe constraints on the scientific value and even the public policy value of the debate when partisan scientists engage in rhetorical conflict before a live audience of non-scientists. Though it may be that as the debate continues, through the use of critics for example, some of the technical stuff can be explained and resolved by specialists operating like native-informants for lay audiences.

The most a public of non-scientists can hope to understand is talk about policy—what are the alternatives, the impact on ordinary people, how much will it cost, etc. The emphasis on policy may not be a bad thing even for scientists, because it is when science leaves the laboratory to determine the allocation of resources that the public interest is fully engaged. Yet, it must be said, that debates like the one sponsored by SPF are more likely to improve a non-scientific public's understanding of how policy uses science and how scientists use policy forums, than to improve their understanding of science, climate science or the scientific status of the issues.

The issues here are a bit complicated. Policy-makers bring science and scientists into policy debate to take the heat for unpopular decisions. Out of the unknowable and unknown are born fictitious necessities. The closer such decisions come to certainty, the less policy is seen as a matter of caprice and the less vulnerable policy makers are to criticism.

Policy-makers also bring science and scientists into policy debate when evidence does in truth support a certain course of action. If, as in the case of global warming, there is a reasonably firm consensus among scientists—at least those who are not paid partisans of non-scientific interest groups—staging a debate may confuse rather than clarify decision making. This is because debate, by its very nature, affirms conflict and uncertainty. It dramatizes this 'fact'.

When a real consensus obtains among qualified experts, those invested in the status quo (both economically and ideologically) prolong their hegemony by creating the illusion of uncertainty. SPF cannot turn its face away from the enormous financial stakes for companies who are not compelled to submit to regulatory regimes for yet another

year. Uncertainty may be made to appear innocent and public debate staged by lay people may contribute to this illusion. And this may persist even in the face of blue ribbon panels who suggest otherwise, because melodrama is a more popular form of entertainment than a conclusionary panel report.[13]

The upshot here is that SPF's choice of topic is important. Why? Because the willingness of celebrity scientists to volunteer may have less to do with concerns about scientific disagreement and more to do with corporate interest in promoting more profitable takes on 'science' and prolonging the moment of 'debate'.

This does not invalidate the SPF project and, in fact, public debate may even highlight the existence of special interests and the propagation of questionable science. But we do want to call attention to the ideological potential of debate as debate, a relevant consideration for SPF's project. And to encourage SPF and its audience to take courage and, at some point, follow the money in flaps over 'science'.

2.4. *Framing the proposition, placing the burden of proof*

In staging a public debate, SPF must pay close attention not only to the topic (and the interests involved) but also how the topic is framed. For example, the clash over global warming was framed around the question: 'Is there sufficient scientific evidence proving that we should limit greenhouse gas emissions because of climate change?'. This is, of course, clearly a policy question, not a purely scientific question. It calls for a policy conclusion ('we should [or should not] limit emissions'), which, as we claim above, cannot be answered by science, even though scientists themselves have strong opinions about what would and would not be appropriate policy.

Yet, the way the policy question is framed (and the 'experts' featured in the debate) assumes that there is (or can be) *proof* that we should act: 'sufficient scientific evidence to prove'. For whom should the evidence be sufficient—other scientists, the public or policy makers?

Proof is a harsh, positivist, logico-mathematical word. It may be right at home in some science discourse, but as used in the proposition above, it refers to policy makers, not scientists. Should the existing scientific evidence be considered as 'proof' enough for policy makers that action should be taken? (Note that we cannot consider this evidence in its entirety—we can consider only the partial selections of the partisans, both of whom show themselves adept at public rhetoric.)

If we ask scientists about proof in relation to science and public policy, we ask them to step outside of their discursive frameworks of provisional and probabilistic knowledge and to make a pronouncement of policy certitude. We ask them, in effect, to become policy makers. But haven't we been taught (and doesn't democratic political theory teach us) that when scientists offer policy pronouncements, they speak only as concerned citizens, given the differences between the two discourses and their rules of knowledge and certainty? Do policy makers rely on proof or merely on probability, preponderance of evidence, consensus, risk or other calculations of costs and benefits?

If this debate-framing question is relevant, then someone must define the 'proof threshold'. At what point does the evidence say unambiguously that we have tripped the proof trigger? Does anyone know the answer to this? Can it be reduced to a set value for 'p'? Ideally, someone would know this answer, or at least how to define it. More likely, there are multiple possible answers depending upon how one constitutes 'proof' in what context and in relation to which audience.

The framing problem reveals itself early on in SPF's debate. Hansen begins by saying he will interpret this as a scientific question. Further, he doesn't 'want to get involved in political discussion'. But he knows, and his testimony repeatedly shows, that he is speaking in a political (policy) debate, not a scientific one. Indeed, within 100 words of not wanting to get involved in policy discussion he concludes that 'it makes sense to begin to take common sense steps that help limit future climate change', a fairly overt policy recommendation and, as it turns out, his rhetorical goal.

When Michaels counters, the passion of his argument is not that the science doesn't warrant it, but that government is bad, regulation is bad, markets work best and we shouldn't prematurely stifle unknown technological breakthroughs. Though he poses his scientific data as refuting or raising doubts about Hansen's global warming science claims, Michaels doesn't rely on this data to ground his policy argument.

Michaels doesn't seem to believe that his audience will be persuaded by whatever scientific doubts he has raised. Or more accurately, Michaels is targeting a non-scientific audience and public. 'The government has an atrocious record in encouraging technology', he says, in response to an audience question. Here he invokes political values and attitudes about the role of governments, markets, property values and the sturdy virtues of de-regulation. He may do so sincerely, but it must be noted that promoting such values and attitudes is happily consistent with his employers, the petro-chemical companies, when it comes to global warming and the wisdom of government intervention.

In future debates, SPF might want to involve the live audience in different ways. After the debate, groups from the audience might adjourn to pick up the policy-science, technical-public and multiple audience questions and talk them through. This process would transform the audience into deliberative groups which, like juries and after the manner of publics, could then reason through the issues collectively. Rather than polling isolated individuals on who won or lost the debate, SPF would be creating active speakers out of passive listeners. The capacity of lay juries to recall and make sense of technical legal cases provides some encouragement here.

A variation on this would be to videotape the debate and then show it to focus groups drawn up with scientists and non-scientists, interested publics and potentially impacted peoples included. This could occur at different universities where SPF-friendly people are in a position to organize small groups to view and respond to the taped debate.

We perceived glimmers of audience interest from SPF's debate. The live audience in the global warming debate posed eight questions. This is good, but the questions come from isolated individuals and the deliberation was often truncated. The first question asked for a definition of global warming in 'short, plain English'. This is both common sense and, of course, deeply philosophical. The value of such a debate flows from a common understanding of terms. But the stress on 'short, plain English' affirms and re-inscribes the tension between scientific discourse and ordinary language. It seems implicit for this questioner that the scientific data cannot answer a policy question about a phenomenon that cannot be described in ordinary language. A complete answer to the question implies an understanding as well of the meaning, role, and value of the many technical variables the scientists raised (e.g., 'climate sensitivity', 'negative and positive feedbacks', 'radiation balance' and 'temperature variability').

Note, too, that the answers offered did not resolve even this most basic question, as they left the question of 'time periods' dangling. So long as the two scientists cannot agree upon the definition of the problem, we remain confident that scientific uncertainty will result. Further deliberation (with focus groups for example) may transform this

uncertainty into a call for more refined definitions and further debate, a call that may inspire scientists as well non-scientists and may have implications even for future work performed by scientists as scientists.

The second question from the audience seemed idiosyncratic: is the greening of the planet a good thing? Maybe yes, within limits, but that doesn't relate directly to the other, negative implications of warming: heat extremes, climate shifts, sea level rises and redistribution of resources such as arable land.

The third question, about Michaels' free market values, was a political, perhaps ideological question and didn't deal with the climate science at all. This question might have opened the link between vested interests and in-house science or the hiring of scientists as 'consultants', but there was no follow up. This is a touchy question; one that needs to be nurtured along, not simply blurted out to a stunned speaker or in front of an uncomfortable audience.

Question four, about Michaels' North/South Hemisphere distinctions, went to the heart of scientific controversy and suggested a person struggling to make sense of the possibility of a scientifically compelling answer. Did Michaels punch an important hole in Hansen's global warming claims? As with question three, this warranted extended deliberation.

We are left to wonder about the motives of Michaels hammering his 95 % figure that, it turned out, was later revised to 78 %. As we read the correction in the footnotes of the transcript nearly 18 months after the event, we're reminded of the common Hollywood trope of the judge instructing the jury to disregard the suggestive emotional outburst they've just heard. The fact that the statistic had been trumpeted as truth during the debate by an 'expert' who then later admitted a major error in his calculations calls if not his expertise (in terms of education) then his credibility (as an unbiased witness) into question.

A fifth question echoed the third, about Michaels' free market values. There was an issue building here that was not brought out fully in the debate and could not be effectively developed by the 'live' audience. But, as we have suggested, it bores directly into policy implications over who stands to gain and who stands to lose in the process.

Question six related directly to SPF's project. An audience member asked whether the policy question could be answered by science alone, or whether 'societal consequences' must be considered. Both advocates admitted that the societal consequences must be considered. Again this warrants more deliberation.

Question seven asked for clarification of a technical point about the amount of warming. This led into the unresolved competing suggestions about the impacts of sea level rise, which became the subject of the final question. Again, this shifting back and forth between technical science and policy implication creates momentary confusion through a shifting from one audience to another. Translation might help. Audience specification might clarify. Groups talking about the debate afterward might pick this up, but it is important.

Taken together, these questions probe the political as well as the scientific underpinnings of the policy choice. They suggest that some audience members indeed responded to scientific disagreements or challenges. Others responded purely to policy issues. Without knowing anything about audience composition, we sense they were pretty sophisticated and that the event did in fact help them to frame intelligent, relevant questions.

Yet, it is also true that there was no mechanism to put the divergent answers in perspective, except perhaps for the meta-question that allowed both scientists to agree

that the social consequences, the public values, were crucial for deciding the policy outcome.

The attention to framing, closure, evaluation and promotion of audience response would be a place to improve in future debates. Letting available 'scientists' weigh in on policy questions opens up the forum to a wide terrain of potential data presentations, and refutations, which may have little relevance, even on technical issues, to the debate as it stands today within the scientific community.

Such framing might even help scientists, non-scientists and policy makers decide where a proof standard can be, has to be, or ought to be set, whether that standard had been met, and, in general, whether the debate met the challenge. While there are no neutral observers there are probably some quasi-objective journalistic modes of discourse that could summarize for the audience 'the story thus far' and identify the structure of the arguments, the places where consensus exists and the points of difference.

SPF might call on a practising scientist (one involved in the area under discussion) to lay out the technical issues before the debate. That is to say where his or her technical community as a group sees the agreements and the clash. If this smacked too much of pre-judging the debate, SPF can, as we have already suggested, enable the audience afterwards to break into groups to deliberate the issues themselves or use video tapes and set up focus groups to refine the issues. They can also do all three, since they are not mutually exclusive.

2.5. *Thin grounds for audience judgment.*

Both approaches—an introduction to the debate that summed up whatever scientific consensus existed and/or post-debate focus group discussions—would help the audience and ultimately the speakers to make sense. Make sense of whether data challenges such as Michaels offers represent serious threats to the integrity of the models, data and predictions offered, or merely calibration effects, measurement irregularities, squabbles about where to place instruments or what to count. These variables are certainly significant in science and need to be accounted for. But there needs to be a burden of proof and a presumption stated up front for the audience or times set aside for the audience to mull it over afterward.

Do the challenges meet burdens of proof that would, if true, overcome the presumptions of the consensus of IPCC scientists for global warming? Is there at this time a broad consensus of climate scientists, as evidenced by the IPCC reports, and as reaffirmed in the newest IPCC report (see note above)? Such framing is never neutral and unbiased, even when it is asked after the debate is over, as we are asking them now. However, it may be possible to make the attempt in such a way as to more closely approach a neutral problem and history statement than the current interested parties produce.[14] The SPF project is in a position to work through these problems not only through making research available before hand but also by refining and reforming the processes through which communication about science takes place.

Failure to frame the debate or subject it to audience deliberation allowed Hansen to wade in wherever he wanted to and Michaels to respond to whatever he wanted to. Note Michaels' response to Hansen's opening. His 'question' consisted of a two-slide data presentation of his own work, with a concluding question whether it's Hansen's 'opinion as to whether that's wrong'. Interestingly, Hansen opened with 13 slides, seven of which

were graphs that plot ascending lines. We don't know if the audience understood what these graphs were actually charting, but upward trend lines are consistent and unmistakable.

Michaels, in response, quickly put up two slides with descending lines, though of course he was measuring different variables. Was the visual metaphoric contrast of the upward and downward sloping lines powerful for the audience? Did they understand the downward slope as a refutation to the upward slope? Did they know whether it measures anything relevant to the issues in the debate? Michaels' slides were apparently based on 'a mathematical measure of temperature variability within years, and between years'. He had published them 'earlier this year'. What did they measure? What do they mean? Is this a critical distinction? Do they undermine Hansen's conclusions?

How did the audience perceive the relationship between Michaels' data and Hansen's data and, more broadly, the overall data set that supports (or challenges) the global warming hypothesis? A trained climate scientist presumably knows how to 'fit' new data, new measurements, into the existing base of knowledge. But did the immediate audience; does the lay audience? The trend lines are going down and Michaels is moving on. It seems clear that Hansen's opinion will be that it is wrong. It seems like Michaels poses a rhetorical question but that Hansen offers a literal answer. The audience is left on its own to make sense of this. If we conclude that such is always the case, then what is the public debate contributing and how can it be improved?

An important point of data comparison is apparently raised: 'variability of temperature' versus 'increased climate extremes'. Are these apples and oranges? Does the distinction matter? If Michaels is on to something, is Hansen evasive? Or is Michaels using technical mumbo jumbo to obfuscate and confuse the issue, putting up a 'true' (?) data image of a meaningful (?) downward trend line that graphically refutes all of the upward trending warming graphs? Who will help us sort this out? If this is not sorted out, of what value will it be to the audience or what effect(s) might it have on them?

Michaels is not much help here. After his second, and similar question, Hansen responds, in effect, that he is measuring the wrong thing. What is the relevance of the Lins and Slack paper in which they look at 'stream flow in unimpounded catchments?' Hansen's answer seems to make a coherent effort to contextualize the measurement that Michaels introduced. But it also looks rather more like a defensive response than a contextualizing. How did the immediate audience take it?

Finally, there is Michaels' high tech rhetorical baiting game on 'statistically significant increase'. He 'quotes' Hansen, but then admits the quotation was rhetorical. He then puts words in Hansen's mouth ('you had to have meant'), raising at least *our* own suspicion that Michaels is playing for audience impact and is not much interested in resolving or exploring scientific conflict.

Note that Michaels' opening data slide is parody and that it charts the newspaper stories claiming that global warming is a serious problem, calibrated to the date of Hansen's 'famous testimony'. Even here, while he characterizes the data as stories 'saying that global warming is a serious problem', the title of the slide he shows indicates that the measure is of stories 'containing the phrase' global warming, a potentially seriously misleading conflation. Overall, Michaels' testimony gives the impression of being the rhetorical equivalent of the missile defense system that scatters a cloud of decoy flakes to confuse the incoming missile's homing and guidance systems. At the least, these rhetorical manoeuvers raise doubts about his ethos.

2.6. *Procedural issues/audience response*

The SPF is concerned about the format and efficacy of this debate. For example, is the adversarial format effective? As we've suggested, the adversarial format moves the event significantly toward a verbal and pugilistic public entertainment, with ground rules covering only equal distribution of speaking time. The referee function at this point is severely attenuated. There is no one (moderator or audience members) to identify a low blow and/or assess a penalty. In such a circumstance, while we cannot say that the more rhetorically sophisticated performer necessarily wins, it seems clear that that person is permitted to create a lot of mayhem in front of an innocent and perhaps naïve audience—all without 'official' feedback from any 'regulatory' source. The result gets inscribed into transcripts, articles, books, etc.

AARST might want to spend some time thinking about the referee function. In this instance, however, the referee would be necessary to protect the audience, not the combatants themselves. Policy discussions are traditionally deliberative. The introduction of competing scientific data and evidence claims, however, adds a forensic dimension to the debate and so hybridizes the rhetorical event, calling for new structures. We're trying to deliberate a policy via the same rhetorical process that is putting truth on trial.

2.7. *Symmetries and underdogs*

The formal symmetry of time allocation in traditional debate formats raises an interesting point. Each party gets equal time, and we are not suggesting that it should be otherwise. But buried within this assumption is a further assumption that each of the speakers is equal, and we have no brief to make here. Still deeper, however, is the assumption that their positions on the issue are of equal value. This works well with human rights issues—equal opportunity, equal protection under the law. For one thing, it dramatizes the equality being sought.

In the case of global warming, however, these assumptions may be questioned. In this instance, Hansen lays out the affirmative case with evidence that coheres and convinces. Michaels, however, could play the role of rhetorical guerilla, sniping wherever he chooses, gaining whatever advantage, stirring up whatever dust he can.

Now, as we have indicated earlier, outside the arena Michaels represents a minority position among climate scientists (a majority position among scientists employed by corporations adversely affected by a re-allocation of energy resources). He does not have to present a coherent and compelling case. Much as the defence lawyer in a jury trial, he just has to find and exploit a 'reasonable doubt'. That doubt can be grounded in climate science or tricked up visual aids. It would appear that the 'neutral' format favours the 'underdog' in this case. He gets equal time, has less responsibility and gets paid to boot.

This ironic imbalance growing out of the debate format places Hansen on the defensive. He finds his numbers mis-stated, his articles misquoted and his data sets truncated by his opponent. He has to respond, but the impression may be that his position is full of holes. Just look at the number of attacks and places to attack.

The referee function we spoke of above comes into play here, and to some extent, the critical respondent, Professor Hingstman, assumed it. Hingstman's response was, in its way, perhaps the most systematically informative presentation of all, perhaps because it was synoptic and more clearly purposed. Though it might have helped to have a

similar framing at the beginning, it was certainly useful to have him treat the discourse as discourse at the end. He does subtly support the claim that there are two legitimate sides to the issue, which we find questionable, but he lays out a series of questions and criteria that would be useful for considering the differences and tensions between scientific and political discussion.

Hingstman suggests that these scientists have veered considerably into political advocacy, a view we share. So he is careful to pull back the focus from advocacy to essentially scientific questions about standards of evidence. Overall, his questions offer the promise of a fruitful research agenda for exploring this and other controversies, particularly as they are played out through discursive advocacy.

Though we suggest several possible extensions of the SPF's public debate methodology in our conclusion that follows, let us suggest here that the present historical moment is rife with the kinds of controversies that could use the structured and critical attention of future SPF projects. We mention the human genome project, but that opens up the larger question of genetic engineering, cloning and genetic modification (GM) of parts of our world. The controversy over genetically modified foods has generated more urgency in Europe than in the USA at the moment, but the US debate is gathering steam.

The polarity of the argument is a bit different from the climate issues. Global warming policy essentially moves toward restraint of the economy (or at least this is argued), toward limitation of practises. Genetically modified food policy seeks to restrain the science and the technology as against its advocates' desire to expand the applications and markets for it; that is, the movement is toward expansion of practises. Though interesting in its own right, the GM foods controversy would also be useful as a comparison case with global warming. In one case science says there are effects and they are fearful; in the GM foods case, science says there is nothing to fear, the effects are (or will be) economically positive.

Another issue worthy of SPF's attention is the range of ethical decisions that flow from the increased sophistication and range of our medical and pharmaceutical technologies. Predictive technologies make eugenic policies seem feasible. Reproductive technologies, laboratory testing, transplants, trans-species transplants—all put science in the midst of public policy decisions. These public controversies are in urgent need of critical attention that will help clarify issues for public decisions. We turn, in conclusion, to various venues for extending the scope and reach of SPF's efforts to improve public understanding of science.

3. *Alternative rhetorics of science*

Part one summed up an approach to the rhetoric of science outlined twenty-five years ago, the personal stake it represented and the purposes served by research and publication. Part two took up the debate over global warming, focused on the public nature of the debate, its assumptions about debate as a method and the disruptions introduced by shifting notions of audience (in the debate and in a critical analysis). It also suggested some reforms—an introductory statement summing up the technical issues; audience deliberation and the creation of focus groups after the debate; and the introduction of a referee. Part three considers alternatives for studying rhetorics of science in the future—a response to existing texts, the creation of texts, the use of electronic media to introduce different processes of communication about science.

3.1. *Critique texts using science to argue public issues*

The new rhetoric of science as exemplified by the SPF manages to break out of the isolated critic commenting on arguments model. Instead of reacting to what appears, it sets about creating something worth reacting to. This is accomplished by staging debates involving trained scientists on important social, political and moral issues.

Staging live debates is difficult to do (costly, time consuming, etc), and it makes those of us whose art lies in words a bit self-conscious. At the same time, it can also make, as the debate before us reveals, those whose art lies in doing science uncomfortable in making their arguments before an audience. But its importance lies in its productivist orientation.

SFP does not wait for scientists, politicians, TV documentaries, the *Bulletin of the Atomic Scientists*, etc, to provide a text for a critic to explicate (after the manner of Biblical commentary). It sets in motion a communication process to create a text. If the debaters and respondents are well chosen, it will likely result in something worth thinking about and writing on.

This pro-active approach has the advantage of generating texts that are not otherwise available. The most controversial issues, the ones involving big money, take a while to make their way into print. The major players have a lot at stake—so they may not want to underwrite it. The politicians may have a lot to lose bringing it up. So they may not want to make it part of their campaigns. Intellectual magazines (*Harper's*, *Atlantic*) find certain issues, especially the more technical ones, do not easily lend themselves to graceful writing. News magazines, like the *Nation*, or newspapers, like the *New York Times*, *Washington Post* and the *Christian Science Monitor*, may note an issue like global warming but do so through journalistic prose making it unpromising territory for a critical response. Whatever the strengths or weaknesses of the global warming debate, SPF has created a worthwhile text and we think this is a real advance in the rhetoric of science project.

3.2. *Create a forum for debates involving the technically trained over public issues*

Many famous scientists are called upon to speak to audiences outside their fields of expertise. They are also invited to do radio, TV and newspaper interviews. They may even get on late night talk shows. Also, we have no doubt that they must, from time to time, communicate with funding agencies dominated by non-scientists or scientists from other fields. Our two debaters were said to testify regularly before congressional committees.

Lure these folks out, get them to debate the issues (not just do monologues in front of lawyers, preachers and used car salesmen in Congress or wealthy ex-comics on talk shows). The global warming debate, hopefully, is just a beginning. Framing the technical side of the debate beforehand, encouraging group discussion afterward and setting up focus groups (perhaps before and after the debate) may refine this process.

3.3. *Create focus groups of or e-mail exchanges among 'experts' to talk through scientific issues of public importance*

Many physicists, environmentalists, chemists, computer scientists and the like, which we have come to know at San Jose State University (often on college and university committees), have proved to be very interested in the great issues. Far from rank

ordering people on the basis of their fields (and sneering at poor old rhetoricians), they have been fascinated by talk associated with the POROI project at Iowa (i.e. the rhetorics of various fields of study) and with the moral and social issues connected with work in their own fields.

They may not know the latest 'rap' about the Enlightenment, or care a fig about Aristotle and Derrida, but they have the advantage of knowing what they are talking about when it comes to science. Watch a TV show together, read congressional testimony, a popular book on global warming, etc, and facilitate a discussion with such 'experts'. Summarize the arguments, circulate them among the group, include the feedback and charge into the academic/public arena with actual deliberation.

Raising the issue of money: how is science affected by government and corporate funding? The issue barely surfaced in the debate over global warming. This despite the fact that one of the debaters works for NASA and the other is a consultant for petrochemical companies whose disinterest in phasing out the internal combustion engine and opposition to improving air quality in cities choked by smog is a matter of public record.[15]

Scientists employed by corporations downplay the dangers of toxic waste, cigarettes, nuclear power, pesticides, insecticides, chemical fertilizers, etc, produced by their employers. Scientists/engineers employed by the defence department faked tests of an anti-missile defence system. A recent scandal involved the *New England Journal of Medicine*, in which an author evaluated findings on the efficacy of drugs produced by a company employing him as a consultant.

What kind of science is funded and what kind is not? What are the implications for both specialized sciences and public policy? What 'experts' in these various areas might say on the problems of self-interested science and the lack of funding for certain kinds of projects could be quite informative. Public opinion surveys could be aimed at the haves and their attitudes toward the have-nots, their inferior education, life expectancy, likelihood to live near toxic waste sites, etc. Where is the funding for such knowledge? Such information could prove useful in political campaigns and movement politics dedicated to social and economic justice. Which foundation or corporation is likely to support such a project? What kinds of projects, on related matters, get supported? Suddenly, the money/power/knowledge nexus presents itself. But it does so in fact not on the basis of inferences drawn from canonical texts in some left-wing corner of academe.

3.4. *Set up focus groups of or e-mail exchanges among people directly affected by what 'experts' are advocating*

At the level of implementation, this could include engineers, social workers and the people who write environmental impact reports (EIRs), for example. What would a small group of such folks, deliberating about some technical report or recommendation, have to say about its likely consequences? What would a group of EIR 'experts' have to say about a report that has just been made public or about a project about to be built? What might native Americans and their EIR experts have to say about proposals to bury toxic wastes on reservation lands? What would a group of tax accountants have to say about proposed changes in the code? What would doctors and nurses say about changes in medical payments and delivery systems (about HMOs or changes in the way HMOs operate)? What would women with children on welfare have to say about current reforms, the difference between that programme and this programme? What

have the women who identified Love Canal years ago to say about it now, since people have been allowed to move back into the homes that lined the canal? What did they think then and now about the 'scientific evidence' produced by consultants for Hooker Chemical? What about the human genome project?

Professor Condit, at the University of Georgia, has spent the last few years, one of them in the lab of the chair of the genetics department at her university and part of another at the National Institutes of Health, studying these issues in the context of doing science. She recently published a book on the subject, *The Meanings of the Gene* (1999). How might geneticists respond to her remarks? What would ordinary citizens make of it and the issues involved? Here is someone who has taken the rhetoric of science way beyond what any of us would require for tenure and promotion. This exchange would open onto life-shaping issues at several different levels and in relation to multiple audiences.

SPF can create opportunities for deliberation by knowledgeable people. Scholars and non-scholars are then in a position to draft a report, circulate it among the participants, redraft it and try to get it into the public space. In this process, Michel Foucault, with his concerns about silencing the victims, and Jürgen Habermas, with his dialectical theories of communicative action, join hands to sanction a theoretically informed communicative practice. It would be nice to get on with what Foucault, Habermas and others recommend in spirit (and action), rather than confining ourselves to textual commentary and suggesting that they and, by implication we, as critics are ideal observers and that the real issues are to be found in hypothetical space.

The apotheosis is too self-serving. Meta-textual talk has little to say to the working class, rainbow students at our school. Unfortunately, however, an academic unable to dilate on matters of theory and method, regardless of how useful or theoretically and methodologically sophisticated the result, risks not being published. In truth, we are not sanguine about getting essays arising out of focus groups or critical meditation on scientific issues published, especially if they prove 'controversial' (which means it might provoke the powerful, however stupid or ignorant they might be). All this can be finessed, even when the topics are touchy. With a dash of advanced theory (whatever fashion dictates) and the use of sanctioned method, one may still hope to secure tenure on the basis of worthwhile work.

4. *A final note*: *communicating 'findings' in rhetorics of science*

When the focus is on existing texts, critical commentaries may reach traditional outlets—scholarly journals, newspapers, popular magazines, etc. When the effort includes creating a text (i.e. a transcript of a debate, an e-mail exchange, etc), the problem involves not only a critical commentary but also making the transcript available. This costs money, too much money for those of us in working class universities and in under-funded fields of study in the humanities and the social sciences.

Contemporary communications technology offers an answer here. It is possible, through an electronic journal, to publish transcripts of any length and make them available to audiences worldwide. This would also enable many people to respond, debate and discuss, some of whom might even be 'experts'.

Based on such transcripts, people can draw together articles highlighting the important issues and submit them to receptive scholarly journals, like *Social Epistemology*, or develop critical electronic journals devoted to analysis (which could then be linked

to the transcripts just as the transcripts could be linked to the articles). Traditional journals are beginning to appear on-line, so footnoting web sites for the location of transcripts has purchase here also. We stress the value of the debates, as they become primary documents or 'data' from which to draw inferences and make 'observations'. Their complexity is open-ended, the critical commentaries becoming part of an expanding text.

Finally, with the text publicly available, critics would be in a position to prepare articles for newspapers and magazines, in short more popular communications media. Some of this has been going on for years: the Pugwash Conferences, reported in the *Bulletin of Atomic Scientists*, come to mind (and ought to be a subject of serious research). But institutionalizing this process and reducing the obstacles of cost and travel through the internet strike us as useful.

The fact that such activity squares with democratic political theory is heartening, but not conclusive. The issues involved in topics such as global warming, given the world-wide nature of the problem, the inability of any one nation-state adequately to respond and the highly technical nature of the reasoning, call the efficacy of democratic government and the nation state into question (see Wander and Jaehne 1994). It is, however, the democratic process, not a particular government or nation state, that commends itself.

Debate, argumentation and criticism are moments in agitation—a beginning in a political process. A rhetoric of science promoting agitation, moderating it through reasonable procedures, and encouraging informed talk performs a service. On-line communication opens up this process to all interested parties. Free, open and vigorous communication over important issues will not resolve them, even if it does not allow cranks, crackpots, consultants and non-academics to muddy it up. With informed commentary, a rhetoric of science can focus and refocus the debate. What this can do is keep the problems and the task of solving them alive for audiences all over the world.

Notes

1. 'In any large organization there are only differing degrees of restraint. And the fact that it is often self-restraint or self-censorship does not make it any less confining' (Galbraith 1981, p. 262). Galbraith is writing about feelings of restraint associated with working for *Fortune*. He contrasts it with the freedoms in academe, but they are, of course, relative. The same holds true for pre-field and field writing.
2. 'A bureaucratic order', writes Burke (1984), 'approaches the stage of alienation in proportion as its 'unintended by-products' become a stronger factor than the original purpose' (p. 226).
3. 'Seemingly' is a pivotal term. Professionals can do purposeful work. 'Pre-professionals' often realize this possibility whose purposes and work coupled with an emergent common interest precipitate an institutional arrangement. It is good not to deaden this into a tradition but to respect it in lived moments through purposeful work. The merely professional is the other-directed, often opportunistic 'quick and dirty' effort that often mocks and sometimes drives out inner-directed, purposeful work. Merely professional/real professional, other-directed/inner directed are better understood not as them and us, but as a struggle going on in each of us.
4. The Introduction, part one and part three are the primary responsibility of Wander. Part two is the primary responsibility of Jaehne. At the same time, we read and commented on each other's work, as well as consulting Professor Wenshu Lee on the entire manuscript. We note this, because the authorial 'I' both shifts and is impossibly complex.
5. There are male and female cheerleaders. With this firmly in view, the sexist undertow of the term can be resisted.
6. One might argue they were far-sighted in this, given the push in many universities to link up with external funding agencies. The problems facing non-PhD granting institutions, where highly skilled, cheap workers (i.e. graduate students) are scarce and do not stay long, are insurmountable. The more serious problem of having one's research agenda driven by moneyed interests we take up in part three of this paper.

7. Michigan State University (MSU) became, in the late 1950s and early 1960s, a boot camp for scientists (i.e. social psychologists) in the field of speech communication. Their graduates went out into the world with letters of recommendation stressing their 'collegiality', their names on a number of 'pubs' generated by their thesis advisors, and an unshakeable belief that adherence to method (as it was taught at MSU) was a sign that one was among the elect. This may be seen in relation to an earlier Iowa school which privileged neo-Aristotelian methods for understanding public speeches and in relation to later schools stressing other methods (i.e. close reading, deconstructionist, etc.) for interpreting 'texts'.
8. For a practical effort to introduce this distinction into communication science, see Allen (1993) and Lee (1993). These are profound essays in that they are not anti-science (Lee actually makes a case for better science) but a call for critical science.
9. *Rethinking Communication, Vol. 1: Paradigm Issues* (Dervin *et al.* 1989a) and *Rethinking Communication, Vol.* 2: *Paradigm Exemplars* (Dervin *et al.* 1989) were designed, to some extent, to break through the methodological grip that neo-positivism, exemplified in the MSU school, had on various of the social sciences and concerted efforts to, among other things, repel the invasion of pseudo-science (i.e. 'qualitative research methods'). A colleague of ours at San Jose State, J. Michael Sproule has situated the struggle between critical-rhetorical and quantitative-scientific work in our field in a much larger and richer historical context. See Sproule (1997), especially pp. 178–249.
10. I recall once in a meeting, one of my colleagues wished for a time when majors in physics would find our courses worthwhile. To which I responded that I longed for a time when our majors could take a course in physics and not have it linked in various ways to the production of genocidal weapons. This sudden reversal of hierarchies met with stunned silence, which, in truth, I thought was the appropriate response.
11. This was an important part of my understanding of US foreign policy. An earlier version of work I was doing on foreign policy in the early 1970s included what became the rhetoric of science (see Wander 1984).
12. In the spirit of 'science', I approached anti-communism during the Cold War by raising their claims about communism to the level of falsifiable predictions (see Wander and Kane 1990).
13. As we write, the newest report of the Intergovernmental Panel on Climate Change is about to be released. Wire services are reporting on an early draft of the 'intently awaited report' and announcing there will be 'no surprises about the prospect of continued global warming'. The new report 'comes to approximately the same major conclusions as its celebrated predecessor five years ago'. That is: 'humans have 'discernibly' influenced the planet's climate and the Earth's surface is likely to warm at least 2 degrees and as much as 9 degrees' by the end of the new century (New climate draft, 2000). In other words, skeptics have not much changed the scientific consensus, but they have protracted the 'uncertainty' by five years and counting.
14. A good journalistic introduction to the global warming debate is found in Gelbspan (1997). Gelbspan painstakingly locates Michaels among the greenhouse sceptics and traces his (and their) various testimonies and organizational activities and linkages. The evidence for industry financial support for much of Michaels' research and publication tends to mitigate his credibility as a disinterested scientist. Oppenheimer and Boyle (1990), now somewhat dated, offer a more objective historical and contextual account of global warming, though it is not helpful on the sceptics.
15. Gelbspan (1997) is useful for understanding the structure of the industrial response.

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