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Behind the scenes of scientific debating

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In analysing a scientific debate, there are at least two types of relevant information. One is the debate itself, experienced first hand or via a transcript. Another is what can be called backstage information, which includes the debaters' preparations, plans, notes, thinking and reservoir of arguments and responses. Familiarity with backstage information can provide insights for understanding the dynamics of the debate.

Often, the only individuals with much backstage information are the debaters themselves, plus perhaps one or two advisers or close friends. An observer of the debate seldom has access to backstage information. The next best thing, then, is generalizations based on backstage experience with debates of a similar nature.

Before I read the transcript of the climate change debate between James E. Hansen and Patrick J. Michaels, I wrote down various generalizations based on my knowledge of the backstage dynamics involved in such debates. In this paper, I present these backstage generalizations, discuss dimensions of asymmetry present in scientific debates, analyse the AARST Science Policy Forum and conclude with observations about the potential and limitations of such debates to inform political discussion about controversies featuring a mixture of science and policy elements.

1. *Backstage insights about scientific debates*

Although I have participated in only a few formal scientific debates, over the years I have learned quite a bit about them. During the Australian controversy over nuclear power and uranium mining from the mid-1970s to the mid-1980s, I gave dozens of anti-nuclear talks to public meetings, community groups, school classes and political party branches. While these were not formal debates, they included questions from the audience, often in a debate-type atmosphere due to the passions aroused by the issue. Often I was part of a two or three-person panel of speakers, necessitating considerable discussion to co-ordinate our arguments. I ran a number of workshops for anti-nuclear speakers. Finally, I acted as an informal adviser and sounding board for one of Australia's foremost anti-nuclear debaters, Dr. Mark Diesendorf. In addition to this experience with the spoken side of the nuclear debate, I was heavily involved in written debates with leading pro-nuclear experts, especially in the correspondence columns of *The Canberra Times* (Martin 1980), a process involving extensive consultation with similarities to preparation for verbal duels.

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In relation to the fluoridation debate, I was not involved as a partisan but learned a lot about backstage thinking through interviews with partisans on both sides (Martin, 1991a). In relation to the debate about the origin of AIDS from polio vaccines, I learned about the backstage through my role as intervenor (Martin 1996a). Finally, as a result of writing about disputes involving scientific expertise (Martin 1991b, 1996b), I have been contacted by a range of individuals with further relevant information.

On the basis of this and other experiences, I have extracted a number of generalizations or insights about the dynamics of public scientific debates, which might also be thought of as provisional hypotheses. I am aware of how dependent this assessment is on my own experiences, but although the idea of backstage behaviour is well known (for example, Goffman 1959, Meyrowitz 1985), there appears to be little in print that draws systematically on backstage insights about scientific debates. That is understandable, since most partisans are reluctant to reveal their weaknesses, uncertainties, contingency plans, heresies or anything else that might be used to discredit them. Sometimes close friends or debating allies may be privy to a debater's doubts and pretences, but sometimes no one at all is informed.

1.1. *Debates are staged*

Scientific debates are an artificial process of acting rather than a spontaneous exchange of ideas. Protagonists carefully rehearse their arguments, often by trying them out on friends or advisers, exploring possible lines of argument and rejecting those that don't work well in public forums. The aim in a debate is to 'win', namely to be recognized as having superior arguments, rather than to open a dialogue, explore commonalities or modify one's position. Weaknesses are hidden. Complexities are simplified to make supporting points or exaggerated to counter an opponent's point. Analogies are chosen to persuade, with illumination a desirable but optional extra. Assumptions are submerged, especially when they are not resonant with popular beliefs. In all of this, backstage discourse is hidden.

1.2. *Debaters' viewpoints are coherent*

Most debaters (and other leading partisans) argue for a position in a totally coherent fashion: they support the position with arguments of all sorts, whether scientific, political or ethical. When the issue is highly polarised, this coherency of viewpoint is especially striking (Martin 1991a). A debater is unlikely, for example, to support scientific arguments for a position but support ethical arguments against it. A coherency of viewpoint often reflects a deep commitment to the position supported—something widespread in science, especially among elite scientists (Mitroff 1974)—and is fostered by the process of debating itself, which penalises those who make concessions.

1.3. *Debaters hide their interests*

Since having an interest in the issue at stake can suggest bias, debaters usually attempt to hide their interests, whether they are financial interests, career interests or psychological interests. If interests cannot be hidden, they are downplayed as irrelevant to the facts and arguments. On the other hand, interests and nonscientific motives are commonly attributed to the opponent.

1.4. *Debaters are atypical of most advocates for a position*

The participants selected for debates are usually highly experienced, articulate and quick thinking. Furthermore, debate organizers tend to avoid including advocates whose positions are not easily characterized (e.g., as for or against a given proposition). Hence, an impressive debater may or may not reflect the quality and depth of support for the debater's position: judging an issue by its most talented advocates is like judging a population's fitness by its top athletes.

1.5. *The style of the debate is affected by the audience*

Speakers learn how to pitch their arguments in different ways. If the audience is knowledgeable about the issue, debaters will be more careful and rigorous. If the audience is largely sympathetic to one side, the debater on that side can take the offensive more easily, not having to counter so many objections, especially during question time. If the debate is being recorded, speakers will be much more careful about what they say.

1.6. *The issues covered in debates re ect the priorities of public debate*

Issues debated only partially overlap with priorities in scientific research. A point given attention in the scientific literature may be too complex or esoteric for a public forum, whereas some points that are scientifically trivial arouse public passion. A formal scientific debate is likely to occupy a middle ground, in terms of content, between issues covered in casual conversations and in scientific papers.

1.7. *Audience members can't easily undermine a speaker*

It is extremely difficult, though not impossible, for audience members to seriously challenge or expose a speaker. Experienced speakers have heard nearly every question many times before and rehearsed their responses. Furthermore, they have the authority of being the speaker, with a presumption of more time to speak and having the last word. Occasionally, though, a speaker may lose a joust with an audience member, usually by being caught off guard or ill prepared by someone who is extremely knowledgeable and well prepared.

1.8. *Judging when a speaker is fudging requires independent knowledge*

Only someone independently familiar with the evidence, arguments, publications and authority system in the field can reliably judge when a speaker is evading, fudging or lying. Whether debaters consciously withhold relevant information or tell untruths is debatable, but in any case few people can consistently detect lying just through observation of a person (Ekman 1985).

2. *Asymmetries*

In a scientific debate, there are various potential asymmetries worthy of note, since such imbalances can have a strong influence on debate dynamics. This influence can be pronounced, even in cases where the ostensible balance of the debate format appears to provide symmetry between advocates.

Some asymmetries involve a cognitive dimension and are related to the power of the scientific arguments available to the different sides. Cognitive asymmetry might be judged, for example, by asking putative 'independent scientists' which side they think has the stronger scientific arguments. Whether cognitive asymmetry can be independently determined is questionable; relativists would see cognitive judgements as an outcome of social processes in the wider scientific community rather than inherent in the arguments themselves.

Typically there are differences in the social values—such as security, economy, risk aversion, adventure, justice or participation—appealed to by the different sides. Values are commonly intertwined with scientific arguments, creating debating opportunities that might involve appealing to the values of audience members or questioning the opponent's value orientations.

The level of support available to each side constitutes another potential dimension of asymmetry in scientific debates. One type of support deserving consideration in this regard is scientific community support, namely the extent and intensity of support for the different sides from scientists in relevant fields. Advocates who enjoy a large measure of support from the scientific community are able to present an array of citations supporting their positions, while advocates lacking such support are vulnerable to charges that their positions are eccentric or outside the mainstream of scientific opinion.

The economic, political and professional resources available to the different sides can also leave an imprint on debates. Strictly speaking, scientific arguments and support from scientists can be classified as resources, so it would be more accurate to call this category 'nonscientific resources'. For example, one side might have support from governments, powerful corporations or professional associations. Such 'non-scientific support' might enable advocates to develop their arguments with the aid of research assistants, secretaries and 'fact checkers', facilitate opportunities for debate through funding for travel and relief from normal duties, and to present their arguments with the aid of capital-intensive media such as computers, advanced projectors, or glossy charts. On the other hand, awareness of the scale of such support could represent a political liability, creating opportunities for opponents to argue that such well-financed advocates have been captured by special interests.

Another dimension of asymmetry worth mentioning involves the scientific status or credibility of the debaters. Debaters are normally introduced with mention of their organizational affiliations, awards, publications, eminence and other indicators of authority, and may refer to these indicators themselves. Such markers of authority help audiences peg the relative credibility of advocates. Finally, a debater's skill, expressed through confidence, experience and speaking style, can also affect audience judgements regarding credibility.

In some debates, one side holds the advantage in all or most of these areas. Consider, for example, the early years of the debate over nuclear power. Major governments and large corporations supported the nuclear option and there were no comparable resources available to the opposition. The overwhelming majority of nuclear scientists and engineers supported nuclear power. Many pro-nuclear partisans were senior nuclear scientists with impressive résumés and great experience in public speaking whereas some of their opponents were young environmental activists. Scientific arguments available to the pro-nuclear side were substantial. Concerning nuclear reactor accidents, for example, proponents could cite the Rasmussen Reactor Safety Study that calculated the risk of a major accident as minuscule (this was before the Three Mile Island and Chernobyl accidents changed perceptions). Only on value issues

did the opponents have a potential edge, finding resonance with popular concerns when discussing the impacts of a nuclear accident, the hazards of long-lived radioactive waste or the risk of proliferation of nuclear weapons.

The nature and balance of asymmetries have a strong influence on scientific debates. A side with overwhelming advantages in resources and scientific community support may decline to debate at all, since there is little to be gained. If an opponent is perceived as, or can be portrayed as, being on the scientific 'fringe', with no mainstream credibility, then it is advantageous to sit on the high ground of a monopoly of credibility; a debate may imply that there is something worth refuting. Some profluoridationists, for example, have advised that debates should be avoided since they only give more credibility to the other side (Martin, 1991a, pp. 60–68).

Asymmetries inform debates that do occur, with each side playing to its strengths. For example, economic investments in a technology or endorsements by professional associations may be touted as reasons to support one side—a rhetorical use of a resource advantage. A side with few resources and little support in the scientific community may rely heavily on a particularly talented speaker who, through long experience and intensive study, becomes more effective than establishment speakers who do not have the same incentive to master the issues and the same opportunities for developing their debating skills.

Finally, debates potentially affect asymmetries, by articulating, refining or modifying arguments (the cognitive dimension), by affirming or challenging social values, by winning over or alienating members of the scientific community, by attracting resources, by augmenting or undermining the authority of the speakers, and by giving them experience.

The most distinctive asymmetries in the debate over global warming are in scientific community support, where proponents have a great advantage, and in economic resources, where critics have support from powerful corporate interests, especially greenhouse gas producers. Because of this difference, it is not sensible to speak of one side being an 'underdog' in an unqualified sense.

3. *The AARST Forum*

The Inaugural AARST Science Policy Forum was a debate organized with particular care, involving speeches, cross-examination, questions from the floor, closing remarks and a respondent. In this, and in being recorded and published, it is atypical of the many talks, meetings and debates that occur as part of a range of controversies. The forum is a good testing ground for the generalizations about scientific debates drawn from the backstage, as outlined earlier. Each of these will be examined without any assumption that this assessment can provide strong proof or disproof of any point, or an overall judgement regarding who 'won' the debate.

3.1. *Debates are staged*

This certainly appears to apply to the AARST Forum. Hansen and Michaels were extremely well prepared and articulate. They offered no hint of their backstage activities. Neither of them offered any real concessions to the other. They appeared to attempt to win every point as well as the overall argument.

3.2. *Debaters' viewpoints are coherent*

This was certainly the case. Hansen supports both the scientific arguments for the existence of significant climate change and the socio-political arguments for intervening to reduce or prevent this change via promotion of measures such as energy efficiency and renewable energy technologies. In other words, his scientific and socio-political assessments are consistent with the overall position that action needs to be taken concerning greenhouse warming.

Michaels, in contrast, has a coherent viewpoint that no action needs to be taken about greenhouse warming. He argues this on scientific grounds, that there is little evidence that there is any risk from global warming, and on economic grounds, namely that the market will provide the most effective response to any climate change that occurs.

People who have less coherent positions are unlikely to end up debating the question of acting against greenhouse emissions. Imagine, for example, someone who believes that the prospect of climate change from greenhouse emissions is minimal and definitely not proven, but nevertheless believes that active measures should be taken to reduce production of greenhouse gases. Such a person is unlikely to become a prominent figure, being unwelcome among either the believers or sceptics, and is also unlikely to be invited to be a debater, since the debate format assumes (most reasonably) that speakers will have the usual coherent viewpoints.

3.3. *Debaters hide their interests*

This was the case: neither Hansen nor Michaels revealed their own interests in the position they had adopted. On the other hand, in the debate there was very little attribution of motives and interests to the opponent, which may reflect the influence of the audience. The closest thing to attribution of motives was Hansen's statement about Michaels that 'He's an excellent debater, and he's honed a number of statements that sound good, but many of them are not scientifically going to pass review' (p. 173).

3.4. *Debaters are atypical of advocates*

This is hard to show without an assessment of other greenhouse partisans. Certainly Hansen and Michaels appear highly articulate and knowledgeable, with a depth of experience and understanding that relatively few other partisans could rival.

3.5. *The style of the debate is affected by the audience*

The text of the debate seems consistent with the expectation that a knowledgeable audience will promote more rigorous, careful presentations and responses, with less *ad hominem* attack than might occur when the audience is not perceived as so intellectual.

3.6. *The issues covered in debates re ect the priorities of public debate*

A full assessment of this point would require comparison with published papers, which is beyond the scope of this comment.

3.7. *Audience members can't easily undermine a speaker*

None of the questioners came close to successfully challenging a speaker. The closest would be the audience member who asked Michaels for an example of an energy technology that was commercialized without initial government support (p. 165). The length of contributions in the question period suggests the imbalance of power between speakers and audience members. In most cases, the speakers spent far longer responding than the audience member did in presenting a question.

3.8. *Judging when a speaker is fudging requires independent knowledge*

Certainly there seems to be no easy way to assess the technical disagreements between the speakers from the text of the debate itself, without knowing a lot more about the research on which the claims are based.

Thus, the debate, as seen through the transcript, appears largely consistent with the generalizations drawn from backstage observations regarding similar scientific debates, though in some cases further evidence would be needed to check this.

4. *Science and politics*

It is a commonplace in science studies that 'science' and 'politics' are intermixed, with, for example, scientific knowledge being shaped by social factors and social decision-making being influenced by knowledge claims, and even for the conceptual distinction to be rejected. Nevertheless, there is a widespread perception outside science studies that scientific knowledge is largely autonomous of social influences, a perception fostered by ongoing 'boundary work' (Gieryn 1999) through which scientists seek to demarcate 'science' from 'non-science' and to stake claims to exclusive authority over realms of knowledge.

In the context of the science-politics conceptual divide, it is worth asking, 'What is the purpose of a public debate between scientists related to a contentious policy issue?' Scientists generally assume that scientific debate is something that does and should occur via scientific publications and meetings, though in practice scientists sometimes pursue scientific goals through media interventions (Bucchi 1998). Policy makers and social movements are concerned about policy options, for which scientific knowledge is simply one input among many. Natural scientists are seldom seen as experts on policy issues. Yet, on many contentious public issues, technical experts play leading roles. How can this be explained?

Underlying public debates between scientists on greenhouse warming and other issues is an assumption: that scientific knowledge has direct policy implications. This is built into the AARST debate question: 'Is there sufficient scientific evidence which proves that we should limit greenhouse gas emissions because of climate change?' In this case, scientific evidence is seen as necessary and sufficient to result in policy implications.

Both Hansen and Michaels accept this underlying assumption. Hansen states, 'we should invest in clean renewable energy technologies, so that if the evidence continues to mount, we will be in a position to move more expeditiously on our longer term choices of energy sources' (p. 143), assuming a direct link between evidence of climate change and action to mitigate it. Michaels states: 'What do you do about one and a half degrees of warming, primarily in the winter, primarily at night, not the growing season, when

it harms things… the best thing to do, the healthiest thing to do, is to simply do nothing' (p. 160), assuming a link between lack of evidence of serious risk from climate change and the inappropriateness of government action against it.

Neither speaker presents himself as a policy expert. They are scientific experts who, on the basis of their expertise, are able to draw policy conclusions by trading on the commonly accepted assumption that certain policy implications follow from certain scientific conclusions. This assumption can be challenged. It is quite possible to argue that fossil fuel use should be curtailed for reasons quite independent of climate change, including health impacts on coal miners, acid rain, air pollution and associated respiratory disease, promotion of the car and associated health and environmental effects, and the antidemocratic impacts of the immense political and economic power of energy industries, including military coups and war. The adverse health impacts of fossil fuels have long been emphasised by supporters of nuclear power (Beckmann 1976, Cohen 1983), while environmentalists for equally long have referred to a whole range of arguments against fossil fuels (Lovins 1977).

What appears to have happened in the past couple of decades is that the case against fossil fuels has been narrowed and loaded onto climate change. In this process of 'scientization', social and political objections to fossil fuels have been sidelined from the debate and scientific arguments about greenhouse warming brought to the fore. What once was a wider social debate, including everything from lifestyle issues to government subsidies to centralized energy sources, has been restricted to the issue of global warming, in the process excluding many participants without specialist expertise. This has parallels with the nuclear winter debate, which can be interpreted as moving debate about nuclear war from the realm of military policy, involving strategic experts challenged by peace activists, to the realm of science, with leading roles for atmospheric scientists and ecologists (Martin 1988).

Just as it is possible to argue against fossil fuels without needing to invoke climate change, so it is possible to argue for fossil fuels (that is, for lack of government controls on use of fossil fuels) without needing to counter arguments about climate change. The argument is simple: the market will deal with any problems with maximum economic efficiency and sufficient speed. For example, warnings have been made for decades about an impending shortage of oil due to exhaustion of reserves, but the reality has been that oil has remained abundant and relatively cheap due to discovery of new reserves, improvement in extraction techniques and energy-price-stimulated gains in the efficiency of cars and other consumers of oil. Michaels appears to subscribe to this conclusion, for example when he says 'when there is economic incentive to produce more energy at low cost in a form that out-competes the current mix, that's going to take over the system like wildfire' (p. 168).

Thus, one of the curious features of having scientists debate contentious science-policy issues such as climate change is that it is climate change scientists who are considered to be the most appropriate debaters. It is less common to have a debate between a free-market economist and a social scientist expert on non-technical barriers to renewable energy technologies and even less common to have citizens without specialist credentials debating policy options. To narrow the issue to climate change is to make science and scientists into surrogates for wider interest groups and policy issues involving economics, governance, equity and ethics. To have scientists debating science-policy issues is to put an enormous onus on the debaters to deal with policy via science.

There is considerable value in public debates between scientists on contentious scientific issues, since they force into the open issues that seldom are adequately

addressed in scientific journals and meetings or in non-specialist forums. The AARST Forum, with its tightly controlled format, is a model for debates of this sort. Nevertheless, the limitations of such debates should be recognized, especially their reinforcement of the process by which scientific disputes serve as surrogates for social conflicts. A wider understanding of the dynamics of scientific debates, including exposure of insights from the backstage, would aid in maximizing the social benefits of such public encounters between experts.

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