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Editors' introduction

GORDON R. MITCHELL
and TIMOTHY M. O'DONNELL

The collection of papers in this special issue of *Social Epistemology* grew out of a debate between climate scientists, James E. Hansen and Patrick J. Michaels. This debate took place at the 1998 American Association for Rhetoric of Science and Technology (AARST) meeting, held as part of the National Communication Association (NCA) convention in New York City. In this debate, the inaugural AARST Science Policy Forum (SPF), Hansen and Michaels took up the following question: 'Is there sufficient scientific evidence which proves that we should limit greenhouse gas emissions because of climate change?'. A full transcript of the proceedings appears in this issue, along with reprints of the scientific slides and charts presented by the advocates in the debate.

The debate between Hansen and Michaels can be seen as a specific site of contestation embedded within a larger controversy on climate change, one that is charged with the argumentative energy of many participants, including citizens, climate scientists, economists, botanists, international relations scholars, sociologists, policy-makers and a host of others whose backgrounds burst the boundaries of these neat categories. As this climate change controversy includes such a wide range of different stakeholders, the controversy covers rich ground such as disputes over the proper scope of scientific authority; the role of social, political, economic and rhetorical factors in the manufacture of scientific knowledge; the public face of science in controversy; and the intersection between science and policy-making. Several contributions to this special issue (e.g. O'Donnell, Shackley, Wander and Jaehne) explore how the 1998 SPF featuring Hansen and Michaels relates to this broader controversy on climate change.

Much of our motivation to create this special issue stemmed from our desire to stimulate conversation and critical reflection on the climate change issue, surely one of the most interesting and significant controversies of our time. However, the decision to solicit and organize the contributions featured in this volume was also driven by our desire to contribute to ongoing academic debates about the research trajectories of scholarly projects such as rhetoric of science, Science and Technology Studies (STS), and related initiatives clumped loosely under the 'science studies' rubric. Some contributions to this issue (e.g. Mitchell and Paroske, Wander and Jaehne, Ziman) explore potential synergies and tensions between these research projects and the

Authors: Gordon R. Mitchell is an Assistant Professor and Director of Debate in the Department of Communication at the University of Pittsburgh, Cathedral of Learning 1117, 4200 Fifth Avenue, Pittsburgh, PA 15260, USA. Phone: (412) 624-8531; email: gordonm@pitt.edu. Timothy M. O'Donnell is a Lecturer in the Department of English, Linguistics, and Speech at Mary Washington College, 1301 College Avenue, Fredericksburg, VA 22401. Phone: (540) 654-1252; email: todonnel@mwc.edu.

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tradition of forensic debate, whose roots as a scholarly and political practise date back to ancient Greece. These essays consider the pitfalls and possibilities involved in using a public debate methodology to explore science policy controversies. We feel that such an approach has considerable merit, especially given its productivist orientation to scholarship that generates its own objects of study, and subsequently feeds new primary texts into the streams of academic inquiry and political argument.

1. *A Science Policy Forum: the very idea*

Our project to organize a forum on climate change began one crisp fallday in 1997, when we watched climate scientist S. Fred Singer speak at a press conference from the steps of the US Capitol. During this appearance, Singer challenged the Clinton administration to an 'open debate on the scientific case for global warming'. Declaring that it was 'time to debate this issue publicly', Singer criticized the administration for 'hiding the serious uncertainties and lack of observed evidence' and called on the US Congress to act as a moderator, by setting the 'time and place' for a debate that paired the administration's climate scientists with an equal number 'holding an opposing view' (quoted in Crandall 1997). Singer's explicit references to debate caught our attention, since we had followed the global warming controversy closely for much of the decade, especially in numerous academic debate competitions. Our experience as researchers, teachers and judges in hundreds of these competitions afforded us a window into climate change science and politics, as they played out in the context of academic debates conducted to explore several national intercollegiate and high school policy debate resolutions.

- 'Resolved: That the Federal Government should adopt an energy policy which substantially reduces the non-military consumption of fossil fuels in the United States' (1989–1990 national intercollegiate policy debate topic).
- 'Resolved: That the United States government should reduce worldwide pollution through its trade and/or aid policies' (1992–1993 national high school policy debate topic).
- 'Resolved: That the United States Federal Government should increase regulations requiring industries to decrease substantially the domestic production and/or emission of environmental pollutants' (1996–1997 national intercollegiate policy debate topic).
- 'Resolved: That the federal government should establish a policy to substantially increase renewable energy use in the United States' (1997–1998 national high school policy debate topic).

In the process of exploring these resolutions, we learned much about how the technical and political dimensions of the global warming controversy unfold in the controlled setting of scholarly academic debate.[1] In addition, one of us (O'Donnell) also had previous experience in organizing a public debate on global warming.[2]

Thus, one might imagine that as debate scholars, our interest was piqued by Singer's call for an 'open public debate' on climate change. Although we thought it unlikely that the US Congress would take up his call to 'set the time and place' for such a debate, we filed away the press clippings from Singer's press conference and waited to see what would happen next. Surprisingly, the next important episode in the chain of events included us. At the 1997 NCA convention in Chicago, IL, Professor Michael Hyde of Wake Forest University made stirring remarks to an AARST gathering, calling on the group to think of ways to produce 'measurable outcomes' in rhetoric of science scholarship that would extend beyond the usual publication of scholarly articles.[3] Sitting in the audience, we realized a synergistic connection between Hyde's appeal for scholarly engagement and Singer's call for public debate on global warming—it

dawned on us that if AARST were to host Singer's debate, this might contribute to the policy discussion and yield important 'measurable outcomes' for the rhetoric of science project in the process. Over lunch, we drafted quickly a preliminary proposal that was presented at the evening session of the conference and when other AARST members expressed enthusiasm for the concept, plans for an inaugural Science Policy Forum followed shortly thereafter.

We began our organizational efforts by extending invitations to Singer and Regina Bierbaum, the Clinton administration's Associate Director for the Environment at the Office of Science and Technology Policy, to appear at the 1998 NCA Conference in New York City. Our idea to hold the debate at an academic conference was derived from our belief that it would be interesting to present such a forum to an audience composed of AARST scholars, many who have research interests touch on issues that receive dynamic expression in global warming discussions.[4]

2. *A backstage pass*

In high profile public debates, the path from initial idea to ultimate execution is often a long and winding road, and our experience with organizing the SPF was no exception. We cycled through 11 possible advocates and four different debate questions before settling on the final topic wording and the eventual Hansen–Michaels advocate pairing. The following list of preliminary debate propositions provides some sense of how the dynamics of the event changed over time from February 1998 to October 1998:

- Proposition 1: 'Global warming: Scientific fact of manufactured fiction?' (12 February 1998).
- Proposition 2: 'Does credible scientific evidence on global warming exist to justify urgent reductions in greenhouse gas emissions?' (9 October 1998).
- Proposition 3: 'Does credible scientific evidence exist on global warming to justify stabilizing greenhouse gas concentrations in the atmosphere?' (19 October 1998).
- Proposition 4 (final): 'Is there sufficient scientific evidence which proves we should limit greenhouse gas emissions because of climate change?' (30 October 1998).

Brian Martin's paper in this issue argues that some of the most interesting aspects of public debates on scientific matters occur in the 'backstage', where participants hash out the details relating to formats, topics and ground rules. A look at some of the backstage activity that took place during organization of the inaugural SPF yields insight into how propositions for the debate evolved, as well as how this evolution was coloured by the interests of advocates being recruited to participate. For example, at one point in early October 1998, the debate was tentatively slated to center on proposition 2, with Stuart Gaffin (climate scientist at the Environmental Defense Fund) taking the affirmative and Ned Leonard (Communications Director at the Western Fuels Association) negating. But during negotiations, Gaffin (1998a) questioned the 'urgent reductions' phrase in question 2, because he was concerned that Leonard would use such language to focus the debate primarily on economic issues. To steer the debate back to 'climate science itself' Gaffin (1998a) offered proposition 3, inserting the more technical phrase 'stabilizing greenhouse gas concentrations' into the topic (Gaffin 1998a). Leonard accepted this amendment, yet it became a moot point when both Gaffin and Leonard (for different reasons) ultimately did not attend the event.

Although Gaffin and Leonard did not appear as advocates, they were kind enough to support the SPF project by providing contact information for suitable replacements. In this vein, Gaffin (1998b) recommended New York-based scientists George Kukla

(Lamont-Doherty Laboratory), Cynthia Rosenzweig (NASA), David Rind (NASA), and James Hansen (NASA). As possible replacements for his side, Leonard (1998) suggested Jonathan Adler (Competitive Enterprise Institute) and Patrick J. Michaels (University of Virginia). When Hansen and Michaels emerged as the most feasible candidates from these two lists, discussion of an appropriate proposition to frame a debate between them began with consideration of proposition 3. However, Michaels (1998) expressed concern about the ability of proposition 3 to generate sufficient clash, observing that 'even I could go affirmative' on such a question. In an attempt to reframe the debate as one that would focus primarily on the credibility of scientific models as the basis for policy change, Michaels (1998) recommended proposition 4, which emerged as the final proposition after negotiations with Hansen.

3. *From spoken word to written text*

In the months following the 1998 NCA convention, we consulted the video and audio recordings of the SPF to generate a written transcript of the proceedings. After generating an initial draft, we enlisted the help of Hansen and Michaels in editing the transcript for publication. We sent copies of the draft to both advocates, requesting that they clarify ambiguous phrases that were difficult to discern from the recordings. Hansen and Michaels gave this process considerable attention, which improved greatly the accuracy and readability of the final text, as it appears it in this issue.

In a cover letter included with his proposed changes to the transcript, Hansen explained that he 'read through the transcript and made minor corrections … for example, punctuation and a few wrong words' (Hansen 1999). Additionally, Hansen noted that 'The debate covers a lot of ground and if you can get your publication … out before congressional discussions get serious, it may be circulated broadly and prove to be very useful'. In a similar vein, Michaels (1999) indicated in a cover letter that his changes 'are largely cosmetic and my intent is to preserve as much as possible the rhetorical style [of the debate]'. However, in addition to proposing cosmetic editorial changes (such as replacing 'polarized ice caps' with 'Polar ice caps', and correcting the erroneous reference 'NCAR's CCM3' by adding the accurate acronym, 'NRCCM III'), Michaels (1999) also requested a much more significant alteration to the text:

> There is one problem that Hansen and I have discussed and come to an agreement on. Several times I cite a '95 %' figure for the percent of total half-year warming that is confined to the coldest air masses. Upon review for publication in the refereed literature, my staff discovered a miscalculation, and the figure is 78 %. This does not substantively change the argument—it is still much more than was predicted by global warming models—but it is a much lower number. Jim [Hansen] and I agreed that a footnote would be appropriate, and that the footnote should be referenced every time the 95 % figure appears in the text.

Here was an interesting moment of slippage that had emerged in the interstice between spoken and written word. Written transcripts of oral speeches are often thought of as iconic imprints that represent verbal performances verbatim. However, in the time lapse separating an original speech from publication of a written transcript, there is the possibility that advocates may seek to modify their comments. What are editors to do in such situations? In subsequent correspondence with us, Hansen explained that he supported Michaels' proposed footnote, although he wanted to make clear that such support should not be taken as evidence of his agreement with the downwardly revised 78 % figure.

As the finished text attests, we ultimately agreed to accept Michaels' proposed footnote, keeping the original 95 % figure intact, then adding a footnote of clarification (note 6) containing Michaels' explanation of the new figure. This clarification is subsequently referenced each of the three additional times that Michaels cites the 95 % figure for the portion of total half-year warming that is confined to the coldest air masses.

Another interesting backstage development involved public argumentation spinning out of the SPF. During the time that we were preparing the transcript for publication and soliciting papers for this special issue, Hansen made several references to the SPF in his published work. For example, in a book chapter titled 'Climate modeling and the global warming debate', Hansen *et al.* (2000) refer to Hansen's closing arguments made in the SPF. Specifically, Hansen's comments on the differences separating his position from that of the 'global warming skeptics' are referenced as ideas that may 'aid future progress to delineate our fundamental differences of opinion, thus providing a way to pin each other down and a basis to keep tabs on progress in understanding' (Hansen *et al.* 2000, p. 154).

Hansen (1998) also posted a paper online at NASA's Goddard Institute for Space Studies (GISS) website, in which he made similar comments about the importance of 'pinning down' the claims made by 'greenhouse skeptics', who tend to 'subvert the scientific process, ceasing to act as objective scientists, rather presenting only one side, as if they were lawyers hired to defend a particular viewpoint'. Hansen (1998) explained that he decided to participate in the SPF 'after learning that he [Michaels] had used (or misused) a figure of mine in testimony to the United States Congress'.[5] Elsewhere in this same document, one finds another reference to the AARST-sponsored SPF:

> Recently I was asked to debate the well-known greenhouse skeptic Dr. Patrick Michaels of the University of Virginia. I summarize here some key points in the debate, 'A Public Debate on the Science of Global Warming', held at the New York Hilton, Nov. 20, 1998, and organized by the American Association for the Rhetoric of Science and Technology. A copy of my entire contribution may be downloaded as a PDF document (Hansen 1998).

After downloading this document (from http ://www.giss.nasa.gov /edu/gwdebate/), one notices several differences between the GISS website account of the SPF and our transcript of the event (generated from video and audio recordings, then refined by the advocates during a round of editorial review). These differences bear a similarity to the differences between prepared statements and actual testimony given in congressional hearings. For example, the GISS website account contains material that Hansen likely prepared before the event (e.g. his opening and closing statements, and his cross-examination questions to Michaels), but his spontaneous remarks made during the SPF are not included (e.g. his answers to Michaels' cross-examination questions, Michaels' answers to his questions and Hansen's answers to audience questions). Additionally, there is material that appears on the GISS website that Hansen apparently had hoped to present verbally to the live SPF audience, yet was not able to because of time constraints. This material (which appears in italics) is inserted near the end of Hansen's closing statement on the GISS website and is set off from the rest of the text by enclosed brackets.

> I must also mention the need for research on the climate system. It is perplexing that, despite the emergence of climate change as a topic of global strategic importance, support for fundamental research has not increased much, especially for universities. Perhaps there is a feeling that stressing knowledge gaps is detrimental to environmental efforts, or perhaps scientists don't want to appear to be trying to 'feather their nests' But good policies will depend on good understanding. (Hansen 1998)

There are also subtle differences between the GISS website account of the SPF and our transcript of the event. For example, in the final sentence of his closing remarks (recorded on videotape), Hansen refers to Michaels by saying 'he is an excellent debater, and he's honed a number of statements that sound good, but many of them are not going to scientifically pass review'. On the GISS website, this same statement appears as: 'he is a practised debater. He has honed statements that sound good in public debate. But many of them are hollow scientifically'.

Our discussion of word-mincing negotiations over acceptable debate propositions, treatment of the drama behind a single footnote in the SPF transcript and exploration of subtle differences between two written accounts of SPF proceedings may seem trivial. Why dredge up the dialogue surrounding SPF propositions that were never used? Who cares if Michaels cited data that eventually had to be revised? So what if Hansen presented a written account of SPF proceedings that diverged from the transcribed record taken from recordings? Burke's (1966) observation that language 'selects, reflects, and deflects' reality is especially relevant in climate change debates, where the devil is often in the details. Word choices *do* matter, because ambiguous satellite data and temperature trends do not speak for themselves. Rather, such data is brought to life through words spoken and written by scientists, politicians and other advocates. What conclusions can one draw from comparing what Hansen planned to say to what Hansen actually said during the SPF? How much of a rhetorical windfall did Michaels reap when he asserted that 95% of warming is confined to cold air masses during the SPF? In public debate, what does it mean to call your opponent an 'excellent' versus a 'practised' debater? Several of the authors contributing papers to this issue have already explored some of these questions and reached interesting conclusions. We hope that our description of 'backstage' activity in the SPF might enable others to pursue similar studies.

4. *Overview of issue contents*

> [W]ith the amount of (sometimes conflicting) historical information on the climate change case growing exponentially, the time has come for some large-scale critical review papers written by those who can synthesize across the many disciplines and policy histories, as well as some structured efforts to use the history to test theories and to provoke focused debates among the key participants. (Victor 1995)

This quotation, from a Senior Fellow at the US Council on Foreign Relations, suggests that with new climate data being churned out by scientists at an exponentially increasing rate, there is a danger that the intellectual climate surrounding the global warming controversy could soon get (indulge us here) too hot to handle. In this condition of information overload, Victor suggests 'focused debates among key participants' as one approach that might help citizens and policy-makers make sense of the controversy. Our efforts to organize the inaugural SPF and publish a transcript of the proceedings share in the spirit of Victor's recommendation.

That said, we are also well aware of the heuristic limitations that constrain the SPF transcript's potential as a pedagogical tool. The arguments advanced by Hansen and Michaels in the inaugural SPF are often technical and complex, and stretches of lightning-quick banter make the arguments difficult to follow at times. Indeed, some live audience members said they felt like they had walked in on the middle of a long-running conversation. To prevent these factors from degenerating into what Wander and Jaehne call an 'audience catastrophe', we asked Dr. David Hingstman, Assistant

Professor of Communication and Director of Debate at the University of Iowa, to serve as a live respondent in the inaugural SPF. We hoped that Hingstman's impressive acumen as a scholar of argumentation, coupled with his wide-ranging topical knowledge (he had conducted extensive scholarly research on global warming), would enable him to cap off the SPF with illuminating commentary. Hingstman did not disappoint. His spontaneous presentation laid out the key themes of the debate, posed challenging questions and suggested fruitful lines of inquiry that Hansen and Michaels opened up in the SPF.

Our satisfaction with Hingstman's remarkable on-the-spot commentary (in fact readers may want to read his comments in the transcript first) was one major factor behind our decision to solicit similar feedback from others. After transcribing the proceedings, we invited a distinguished group of commentators to read the SPF transcript and contribute written responses to this special issue.

The most direct response comes from Professor Simon Shackley, of the Manchester School of Management and Tyndall Center for Climate Change Research at the University of Manchester Institute of Science and Technology. Shackley's paper gives readers insight into how someone intimately involved in the climate change debate on a day-to-day basis views the arguments advanced in the SPF (Shackley is also associate editor of the journal *Climate Research*). Shackley's close reading of the SPF transcript, informed by his extensive background on the dynamics of Global Circulation Models (GCMs), extends Hingstman's commentary in a provocative way, albeit on a more technical level.

Pursuing the question 'Are debatable scientific questions debatable?', John Ziman gives a nuanced treatment of the notion of scientific argumentation. As a Fellow of the British Royal Society and Professor Emeritus of Physics at the University of Bristol, Ziman is positioned well to comment on how the SPF proposal might look through the eyes of a scientist. Given the venerable tradition of argument and debate as the lifeblood of inquiry in scientific circles, one might be surprised to see scientists expressing unease about the prospect of participating in deliberative forums such as the SPF. Ziman explains that such trepidation may reflect the fact that scientists generally understand the notion of scientific argumentation as a process that is distinct in kind from more popular notions of debate, as performed in political forums such as British Parliament. Although scientists may wish to reinforce such distinctions, in order to maintain the epistemological purity of scientific argumentation, Ziman notes that this strategy becomes increasingly untenable in a world where the proliferation of 'transcience' controversies tends to muddy the boundaries separating technical from political argument. As this trend continues, Ziman suggests that scientists will be asked to participate in forums such as the SPF with greater frequency. He concludes his paper with some strategies for 'rhetorical re-education' that might enable scientists responding positively to such invitations to make their 'particular type of knowledge convincing in unfamiliar intellectual and social contexts'.

We have already mentioned some of the themes of Brian Martin's paper. Martin, a Professor of Science, Technology, and Society at the University of Wollongong, brings a wealth of experience as an activist STS scholar to a discussion of the 'backstage' dynamics involved in public debates featuring scientific matters. Martin's numerous personal interventions into science policy controversies over issues such as water fluoridation, nuclear power and uranium mining, enable him to draw lucid generalizations about the public debate process. Folding these generalizations back into an analysis of the SPF transcript, Martin concludes with an important cautionary note

regarding the dangers of 'scientizing' public controversies. He argues that SPF-like forums risk reducing complex and variegated social issues into technical disagreements to be hashed out by scientific experts, an outcome that risks undercutting debate's democratic potential.

According to Harris (1997), Philip C. Wander's (1976) paper, 'A rhetoric of science', was 'the first to string together our key terms in a defining way' (p. xvii). In a summary essay, Harris points out how Wander 'notices that the increasing importance of science to contemporary public policy "obliges" rhetoricians to concern themselves with science' (p. xvii). In this issue, Wander joins with co-author Dennis Jaehne (both are Professors of Communication at San Jose State University), to revisit some of the themes raised in his 'landmark' 1976 article. Together, they pose basic questions about the *purpose* of the SPF both as a scholarly project and a productivist intervention into a contemporary political controversy. They also interrogate the SPF's format, proposition, moderating strategies, as well as the role of the audience. Although Wander and Jaehne pull no punches with these observations, their critical points are complemented by a constructive turn that suggests several strategies for extending the political and pedagogical potential of future SPF-like forums.

These four essays are positioned in this issue after the SPF transcript, in order to highlight their orientation as direct responses to the arguments advanced by Hansen and Michaels in the SPF. Some readers familiar with the climate change controversy may want to skip directly to the SPF transcript, then focus on the replies. Others new to the global warming controversy or more interested in epistemological aspects of the debate process may want to consult two introductory papers before reading the SPF transcript. In one introductory paper, Gordon R. Mitchell and Marcus Paroske elucidate the theoretical rationale for the SPF project, locate the project within a variety of scholarly literatures and describe how a public debate methodology can work as an approach to the study of science policy controversies. Mitchell and Paroske (both from the Department of Communication at the University of Pittsburgh) explore how the SPF process enacts a hermeneutic in which scholars *create* subjects of study, thus opening up new avenues of interpretive criticism and recuperating the activist tradition of rhetoric as a productve art. The second introductory paper, by Timothy M. O'Donnell, is designed as a primer for readers seeking to improve their grasp of key issues in the global warming controversy. O'Donnell, of Mary Washington College, tracks the long-range history of the global warming controversy, then observes how the fascinating threads connecting Hansen and Michaels as key players are woven through the layers of this controversy as it has played out in the pages of scientific journals, congressional hearings and popular publications.

The assistance of several persons made the completion of this project possible. James Hansen and Patrick Michaels generously gave their time and energy throughout all stages of the project. Alan Gross provided early support by accepting our proposal for AARST to host the inaugural SPF. Steve Fuller and Joan Leach made it possible to add extra layers of reflection by enabling commentaries to appear in the pages of this journal. Their support was also instrumental in helping us share the SPF concept with a wider audience. Natalie Alongi worked hard on the transcript. Finally, Marcus Paroske provided tireless editorial assistance during preparation of this issue. Preliminary plans have been laid for a second SPF to be held at the 2000 NCA conference in Seattle, WA. We invite feedback and correspondence from readers, recognizing that the vitality of future SPF forums may depend on the ability of the project to stimulate debate about itself.

Notes

1. One way to think about the overlapping interscholastic and intercollegiate academic policy debate communities is that they are the largest, and possibly best-researched policy think tanks in the USA. Each year, the National Forensics League (at the high school level) and the Cross Examination Debate Association (at the college level), draft resolutions that frame the tens of thousands of contest debates that take place each season at policy debate tournaments across the nation. Since competition at these events is often keen, many academic debaters prepare detailed argument briefs that synthesize voluminous research into cogent debate positions. For an example of the research products on global warming yielded by this process, see Prestes 1997. An informative description of academic debate that situates the activity within the historical tradition of rhetoric can be found in Muir 1993. Perhaps the best direct 'portal' into the day-to-day workings of the interscholastic and intercollegiate debate communities is located at the University of Vermont's Debate Central website, online at http://debate.uvm.edu.
2. This debate, "Global Warming, Global Catastrophe?" was held at Wake Forest University in Winston-Salem, NC on 10 July 1997. Participants included Christopher Flavin (Vice-President, Worldwatch Institute), Ned Leonard (Communications Director, Western Fuels Association), high school student debaters (from the Wake Forest University Policy Project), Timothy O'Donnell (organizer), and Ross Smith (moderator). A full transcript is on file with the authors.
3. It should be mentioned that Hyde's reference to 'measurable outcomes' was couched in the context of a larger discussion about the role of academics in the debate over euthanasia. Reflecting on his own field research, conducted in hospital intensive care units, Hyde recalled that he was 'very much struck about how physicians would challenge someone like me, the rhetorician, by saying: what's your measurable outcome in studying all of this? When a physician says that to you, when I'm actually in a hospital doing rounds, it hits you right in the stomach—why? Because you see all these people dying around you … once you get out in the field, it's easier to see how you have to have both sides of research you have to have measurable outcomes, and not lose the person in the process'. For further commentary on this line of thought, see Hyde (2000).
4. A more detailed rationale for pursuing the SPF as an AARST-sponsored project can be found in Mitchell's introductory remarks of the debate, which are printed as part of the SPF transcript on pp. 131–134.
5. This chart is reprinted as figure 9 accompanying the SPF transcript in this volume.

References

Burke, K., 1966. *Language as Symbolic Action: Essays on Life, Literature, and Method* (Berekeley, CA: University of California Press).

Crandall, C., 1997. Physicist S. Fred Singer challenges government scientists to a public debate on global warming. Science and Environmental Policy Project news release. 30 October. Retrieved 9 May 2000 from the World Wide Web at http://www.sepp.org/pressrel/challenge.html

Gaffin, S., 1998a. Personal communication with Gordon Mitchell. 29 October.

Gaffin, S., 1998b. Personal communication with Gordon Mitchell. 19 October.

Harris, R. A. (ed.), 1997. *Landmark Essays on Rhetoric of Science* (Mahwah, NJ: Lawrence Erlbaum and Associates).

Hansen, J. E., 1998. The global warming debate. Written 30 December 1998. Retrieved 10 May 2000 from the World Wide Web at http://www.giss.nasa.gov/edu/gwdebate/

Hansen, J. E., 1999. Letter to Gordon Mitchell. 8 February. Copy on file with the authors.

Hansen, J. E., Ruedy, R., Lacis, A., Sato, M., Nazarenko, L., Tausnev, N., Tegen, I., Koch, D., 2000. Climate modeling in the global warming debate. In D. A. Randall (ed.), *General Circulation Model Development:* (San Diego, CA: Academic Press, Inc.), pp. 127–164.

Hyde, M., 2000. *The Call of Conscience: Heidegger, Levinas, Rhetoric, and the Euthanasia Debate* (Columbia, S. C.: University of South Carolina Press).

Leonard, N., 1998. Personal communication with Timothy O'Donnell. 24 October.

Michaels, P. J., 1998. Personal communication with Gordon Mitchell. 29 October.

Michaels, P. J., 1999. Personal communication with Gordon Mitchell. 4 June.

Muir, S., 1993. A defense of the ethics of contemporary debate. *Philosophy and Rhetoric*, **26**, 277–96.

Prestes, B., ed., 1997. *The Debater's Climate Guide: Wake Forest's Winning Strategies and Evidence.* (Winston-Salem, NC: Wake Forest University). Distributed through Paradigm Research (see http://www.oneparadigm.com/).

Victor, D. G., 1995. On writing good histories of climate change and testing social science theories. *Climatic Change*, **29**, 363–369.

Wander, P. C., 1976. The rhetoric of science. *Western Speech Communication*, **50**, 226–35.