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When scientists politicize science: making sense of controversy over *The Skeptical Environmentalist*☆

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Abstract

Scholars of science and society have long understood that in all but the most trivial of cases science cannot compel specific political outcomes. Rather, scientific understandings are frequently either intrinsically uncertain or diverse enough to be used to justify a range of competing political agendas. This paper argues that despite these understandings the use of science by scientists as a means of negotiating for desired political outcomes – the politicization of science by scientists – threatens the development of effective policies in contested issues. By tying themselves to politics, rather than policy, scientists necessarily restrict their value and the value of their science. The essay proceeds in four parts. It first discusses why the politicization of science by scientists might be worth our concern. Second, it reviews the debate over the publication of *The Skeptical Environmentalist*. Third, it suggests that arguments that embraces a "linear model" (i.e., get the facts right, then act) of science's relationship with policy encourage the politicization of science. The fourth section discusses a range of perspectives on the politicization of science by scientists, and the paper concludes with a discussion of an alternative way to think about the relationship between science, politics and policy.

Keywords: Politicization of science; Politics; Policy; Environment; Lomborg

1. Introduction

In recent years, combatants on opposing sides of highly contentious debates related to the environment, medicine and even national security have frequently asserted that science compels their favored political perspective. Whether the subject is global warming, estrogen therapy, or even the existence of weapons of mass destruction, it is not surprising to observe advocates selectively using and misusing information that supports their firmly held positions. What perhaps is surprising, at least to some observers of the scientific enterprise, is that scientists increasingly seem to be equating particular scientific findings with political and ideological perspectives.

When a 2003 paper in the journal *Climate Research* argued that 20th century climate variations were unexceptional in millennial perspective, advocacy groups opposed to the Kyoto Protocol predictably hailed the research as "sound science," while advocacy groups in support of the Protocol called the paper "junk science" (Regalado, 2003). In this case, more troubling than the "cherry picking" of scientific results by advocates is that many scientist's evaluations of the *scientific merit* of the *Climate Research* paper correlated perfectly with their public expressions of support or opposition to the Kyoto Protocol. Acceptance of the paper's conclusions was equated with opposition to Kyoto, and correspondingly, rejection of the paper's findings was equated with support for Kyoto. For example, one prominent climate scientist (on record supporting Kyoto) suggested in testimony before the U.S. Congress that the paper must be bad science because the editor who oversaw its publication had been critical of the Intergovernmental Panel on Climate Change and the Kyoto Protocol (Collins, 2003). And the editor (a social scientist who is on record opposing Kyoto) of a different journal that published a second version of the controversial paper commented, "I'm following my political agenda—a bit, anyway, but isn't that the right of the editor?" (Monastersky, 2003).

If scientists evaluate the research findings of their peers on the basis of political perspectives, then "scientific" debate among academics risks morphing into political debates. From the perspective of the public or policy makers, scientific debate and political debate on many environmental

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issues already have become indistinguishable, and such cases of conflation limit the role of science in the development of creative and feasible policy options. In many instances science, particularly environmental science, has become little more than a mechanism of marketing competing political agendas, and scientists have become leading members of the advertising campaigns.

No recent example of this dynamic has received the amount of attention among the mainstream media as controversy over the publication of *The Skeptical Environmentalist* (Lomborg, 2001a; hereafter TSE) by Bjørn Lomborg. Heated debate and controversy are rather the norm insofar as environmental issues are concerned, but reaction to TSE spilled over from the environmental community onto pages of leading newspapers and magazines around the world, and has thus come to occupy the attention of scholars who study science in its broader societal setting.

Why does the politicization of science matter? Consider the following controversy over science, policy, and politics. In October 2002, a number of scientists expressed concern that President Bush appeared to be "stacking" health advisory panels with scientists chosen more for their political views than their scientific credentials. A group of scientists writing in *Science* magazine explained that,

> instead of grappling with scientific ambiguity and shaping public policy using the best available evidence (the fundamental principle underlying public health and environmental regulation), we can now expect these committees to emphasize the uncertainties of health and environmental risks, supporting the administration's antiregulatory views. And in those areas where there are deeply held conflicts in values, we can expect only silence (Michaels et al., 2002).

In other words, rather than seeking to understand significance of science in the context of specific policy alternatives, these committees would instead focus on the political challenge of bolstering support for decisions already made, presumably based on factors other than science, e.g., ideology. Few would disagree with the premise that scientific outcomes should not be predetermined by political perspectives. Why? The result, invariably, would be bad science and most likely bad policy. But what about reversing the direction of causality? Do scientific perspectives determine political outcomes? In the case of TSE many scientists acted as if science does in fact compel certain political outcomes.

This paper argues that in its extreme forms the use of science by scientists as a means of negotiating for desired political outcomes – the politicization of science by scientists – threatens the development of effective policies in contested issues. Such politicization occurs in spite of the development by the science and technology studies community of considerable expertise in and understanding of the broader social and political context of science, including the causes and consequences of the politicization of science in political settings (e.g., Rayner, 2003; Kitcher, 2001; Jasanoff and Wynne, 1998; Sarewitz, 1996; Jasanoff, 1987). This paper focuses on the politicization of science by scientists themselves, a topic that has received by contrast somewhat less attention than the politicization of science by politicians and issue advocates.[1] It first reviews the debate over the publication of *The Skeptical Environmentalist*. In this context it suggests that the politicization of science by scientists is rooted in a "linear model" – get the facts right, then act – of science's relation to society. Second, it discusses how aspects of the Lomborg affair can be understood as consequences of the linear model. The next section discusses a range of perspectives on the politicization of science by scientists, and the paper concludes with a discussion of an alternative way to think about the relationship of science, politics and policy.

The politicization of science by scientists is an issue worth addressing because at risk are the positive contributions science offers to politics and policy. More fundamentally, in its extreme forms the politicization of science by scientists presents a threat to the institutions of science and democracy. Because science, politics, and policy are inextricably intertwined, a challenge exists for developing practical strategies for decision makers to use science effectively. Utopian views of cleanly separating science from politics, facts from values are not helpful.

An alternative to the linear, get-the-facts-then-act model would start with the scientific community itself assuming a greater responsibility for addressing the significance for policy of scientific results (for further discussion, see Pielke, 2003). Addressing the significance of science for decision making requires an ability to clearly distinguish policy from politics. For science, a *policy perspective* implies increasing or elucidating the range of alternatives available to decision makers by clearly associating the existing state of scientific knowledge with a range of choices. The goal is to enhance freedom of choice. By contrast, a *political perspective* seeks to decrease the range of alternatives (often to a single preferred option) available to policy makers, i.e., to limit the scope of choice, for example, support of, or opposition to, the Kyoto Protocol. Because scientific results always have some degree of uncertainty and a range of means is typically available to achieve particular objectives, the task of political advocacy necessarily involves considerations that go well beyond science. This is one reason why the linear model is not just simplistic but detrimental to science itself. Science never compels just one political outcome. The world is not that simple.

[1] For example, the reports of Congressman Henry Waxman (2003) and the Union of Concerned Scientists (UCS, 2004) focus on the politicization of science by elected and appointed officials, and not the politicization of science by scientists.

2. Controversy over *The Skeptical Environmentalist*: political battle not policy debate

A focus on the intersection of politics and science is not new and has been studied for decades (see, e.g., Jasanoff and Wynne, 1998, and references therein). What may be new, or at least more meaningful than in the past, is the degree to which scientists themselves encourage political conflict through science. Examples abound in areas as diverse as international whaling (Aron et al., 2002), cloning (Nature Publishing Group, 2002), sex education (Clymer, 2002), history of firearms (Postel, 2002), and North American archeology (Custred, 2002), to list just a few. The debate that followed publication of TSE (and continues seemingly without end), saw an unprecedented mobilization of not just environmental groups but many scientists against the book, its author, and publisher.

In TSE Bjørn Lomborg, a Danish statistician by training and a self-described environmentalist, advances a view popularized by Julian Simon, the late economist, that environmental problems are not as severe as advertised by environmental groups, and that some combination of business-as-usual and incremental change will be sufficient for children born today to "get more food, a better education, a higher standard of living, more leisure time and far more possibilities—without the global environment being destroyed."[2] Reaction to the book was both quick and diverse. The Economist (2001) wrote "This is one of the most valuable books on public policy – not merely on environmental policy – to have been written for the intelligent reader in the past ten years." *Rolling Stone* (Goodell, 2001) gave a similarly positive review, "Lomborg pulls off the remarkable feat of welding the techno-optimism of the Internet age with a lefty's concern for the fate of the planet." In contrast, *Scientific American* (Rennie, 2002) wrote "The book is a failure," and *Grist Magazine* (Schultz, 2001) concluded "The Skeptical Environmentalist is C-minus stuff, as straight-forward and lackluster as a 10th-grade term paper."

In light of its favorable reception in some quarters, for many environmental advocates, TSE must have seemed like a declaration of war. Environmental groups such as the World Resources Institute and Union of Concerned Scientists began an aggressive public campaign seeking to discredit Lomborg and Cambridge University Press.[3] Lisa Sorensen (Woodard, 2001) of the Union of Concerned Scientists justified the offensive as a preemptive political strategy: "this book is going to be misused terribly by interests opposed to a clean energy policy." It is not a surprise to see an organized campaign among environmental groups to advance their own causes by discrediting the book and to a lesser degree, organized support of TSE by economic interests who favor the book's message. As self-identified special interests it is the job of these groups to push their agenda. The attention with which TSE was greeted provided a convenient resource for advocates to hitch their agendas to—using TSE in both positive and negative fashion.[4]

In this context a number of respected scientists saw fit to enter the political fray over TSE, and largely in support of environmental advocates. It would be easy to dismiss the politicization of science by scientists as the province of industry-supported scientists-*cum*-consultants whose credentials support their "hired-gun" role in issue advocacy. But the case of TSE shows this caricature to be too simplistic.

That some scientists engage in political activities is neither new nor problematic; they are after all citizens. A problem exists when, in the case of their opposition to TSE, scientists implicitly or explicitly equate scientific arguments with political arguments, and in the process reinforce a simplistic and misleading view of how science supports policy. In the process they damage the potential positive contributions of their own special expertise to effective decision making. Scientists seeking political victories through science may find this strategy expedient in the short term, but over the long run it may diminish the constructive role that scientific expertise can play in the policy process.

It is crucial to observe that the debate over TSE focused not on specific policy alternatives, but instead on the overarching political implications putatively compelled by TSE. In other words, the debate over TSE focused on the advantages or disadvantages the book putatively lent to opposing political perspectives, with only a rare nod toward the particular policy recommendations associated with those perspectives. The absence of policy debate related to TSE is troubling because science alone cannot determine who wins and who loses in political battle (in addition to the literature reviewed in Jasanoff and Wynne, 1998; cf., Oreskes, 2004; Sarewitz, 2004 in this volume).

In the case of TSE, scientists politicized science when they claimed that Lomborg has gotten his "science" wrong, and because he has his science wrong then necessarily those who accept his views of "science" should lose out in political battle. Such politicization is problematic if scientific proof is "overrated" in political debate (Oreskes, 2004 in this volume) or if science in fact makes environmental controversies more intractable (Sarewitz, 2004 in this volume). At a minimum, the politicization of science by scientists runs contrary to understandings held by the science and technology studies community about the nuanced, protean, and complex interface of science and decision making in which science is "co-produced" by various sectors of society, and separation of "facts" and "values" cannot be achieved (e.g., Jasanoff, 1990).

[2] A similar thesis has been presented by Ronald Bailey (1993) and Greg Easterbrook (1995).

[3] See, e.g., WRI (2001) and UCS (2003).

[4] To be sure the challenge of special interests for democracy in the United States has been a concern since at least James Madison, writing in *Federalist* 10. This paper does not take on this general challenge focusing instead on the politicization of science by scientists as a particular instance of the politics of interests (see, e.g., Petracca, 1992).

Some scientists in opposition to Lomborg lent their credibility and stature to interest groups who then used the scientists as the basis for making a political claim. For instance, several scientists prepared essays, at the request of the Union of Concerned Scientists (UCS), a self-described environmental advocacy group, which avoided any explicit discussion of politics and simply took issue with claims made within TSE. The UCS justified their engagement of scientists against Lomborg in political, not policy, terms: "groups with anti-environmental agendas use these works to promote their objectives .... Like the Hare, Lomborg's lie has raced out in front of the truth. With the help of these careful scientific peer reviews, UCS hopes that the truth, like the Tortoise, will catch up and emerge the ultimate victor (UCS, 2003)."[5] And it is clear in this instance that "truth" manifests itself not simply in knowledge, but in political victory.

Other scientists were more forthcoming about their political motivations for attacking TSE. Consider the following three examples.

- Peter Raven, the director of the Missouri Botanical Garden and president of the American Association for the Advancement of Science, joined with a number of colleagues to lobby Cambridge University Press, the book's publisher, to cease its publication (Goldstein, 2002). In response to a question asking why he is focusing attention on TSE, Raven hints at policy but does not discuss specific alternatives, and instead expresses concern that the perspective presented in TSE might enhance the political power of those in opposition to his own political perspective.

  "It either can be very expensive to change the bases of whole economies on fossil fuels to avoid global warming, which is something that makes governments extremely nervous and for very understandable reasons or, on the other hand, one can believe those who say that the development of alternative energy modes, hydrogen fuel, nuclear fusion, wind power and so forth will provide the basis of whole new industries and will end up enriching economies and making them better off in the not very distant future. Making the transition though is hugely disruptive, and I think it's against that background that one can understand that, if somebody comes along and says: aside from the moon being made of blue cheese there is really no environmental problem, everything is getting better, and a lot of people have said a lot of things over the years and some of them are not true and probably not true now and blah, blah, blah—they will be warmly received by those who wish to win exemptions from the need to do anything."[6]
- Stuart Pimm (2003), a professor of ecology at Duke University, justifies his opposition to TSE in terms of a metaphor, "when you are sick, please go to a professional physician and not a quack for help." Or in other words, Pimm does not invoke specific policies, but instead focuses on a political outcome: who gets a voice in environmental controversies. Presumably, Pimm equates Lomborg with the "quack" and those scientists who share his views in opposition to Lomborg with the "physician." The patient is presumably the policy maker looking to make a decision.
- And the scientists who served on the Danish Committee on Scientific Dishonesty, which was convened to investigate allegations of scientific fraud in *The Skeptical Environmentalist* made by environmental scientists critical of TSE, concluded that "the many, particularly American researchers, who have received Bjørn Lomborg's book with great gusto, even in a specifically negative fashion, are unlikely to have even given the book the time of day unless it had received such overwhelmingly positive write-ups in leading American newspapers and in The Economist. The USA is the society with the highest energy consumption in the world, and there are powerful interests in the USA bound up with increasing energy consumption and with the belief in free market forces" (Danish Committee on Scientific Dishonesty, 2003).

The placement of these various perspectives in the popular media and on the internet, rather than in technical journals, shows very clearly that many of the scientists who vehemently criticized TSE and Cambridge University Press perceived the stakes to be not simply a battle over findings, methods, epistemology, or disciplines that often characterize scientific debates within the academic enterprise. Instead, the debate initiated by scientists over TSE was about who should have authority and power to decide what sort of world we collectively wish to live in. The debate was about politics, not policy.

3. The linear model

The perspectives of the scientists who have argued that because the science of TSE is wrong, a certain set of political views must also be wrong, reinforce, reflect, and derive from an ontological and epistemological view of the role of science in society that assumes that science can and should compel political outcomes. This view of the relation of science and politics has been called "the linear model" because it is based on first getting the science "right" as a necessary, if not sufficient, basis for decision making (cf.

[5] For several examples see the white papers prepared for the Union of Concern Scientists, an advocacy group, by Peter Gleick, of the Pacific Institute for Studies in Development, Environment, and Security, and Jerry Mahlman, former director of the U.S. government's Geophysical Fluid Dynamics Laboratory (UCS, 2003).

[6] Transcript of The Science Show on Australian Radio National, Robyn Williams, Bjørn Lomborg, and Peter Raven (Radio National, 2002).

Oreskes, 2004; Sarewitz, 2004 in this volume). If the linear model is indeed an accurate reflection of how the world works then battles over science and how people interpret the significance of science are necessarily of critical importance because certain political outcomes can be made more or less likely through shaping public or policy maker perspectives on the science that putatively supports one agenda or another. However, the linear model has long been understood to be an inaccurate characterization of and even an undesirable approach to the relation of science and decision making because of the ample evidence showing that policy does not simply emerge from scientific understandings (see Oreskes, 2004 in this volume; Sarewitz, 2004 in this volume; Jasanoff, 1987; Wynne, 1991). Consequently, when scientists reinforce the linear model it has potential to create pathologies in decision making.

From the perspective of the linear model science not only plays a (if not the) central role in political battle; but because scientific understandings are supposed to motivate political action, winning a scientific debate leads to a privileged position in political battle. Consequently, scientific debates *are* in effect political debates because resolving scientific debates will resolve political conflicts. Science thus becomes a convenient and necessary means for removing certain options from a debate without explicitly dealing with disputes over values. But because the linear model in fact fails to accurately describe the relationship between science and political outcomes, it may simply mask normative disputes in the language of science, to the possible detriment of both science and policy.

A perfect example of the linear model can be found in debate over global climate change. Within this debate studies that show meaningful connections between greenhouse gas emissions and actual or projected climate changes are interpreted to be supportive of action to reduce emissions, and thus climate change as well, whereas studies that cast doubt on the significance of such connections are interpreted as casting doubt on the need for such action (Pielke, 2004). Action is typically narrowly defined as the Kyoto Protocol and the political stakes are victory in either securing or denying its implementation. Under the linear model both sides argue about science as a proxy for actually discussing the worth and practicality of possible alternative courses of action, of which the Kyoto Protocol is but one of many. On the climate debate many assume that victory in debate on scientific issues, as perceived by the public, ought to compel victory in political debate, hence we see arguments in the popular media and the internet over many individual studies that are released (notable examples of recent years include the temperature record of the past 1000 years and surface versus tropospheric temperature trends). Missed in this enterprise are policy alternatives that are robust with respect to the scientific disagreements (Lempert, 2000; Rayner and Malone, 1998; Sarewitz and Pielke, 2000). The linear model brings scientific debates to the fore as a prerequisite to other action, and encourages the mapping of political agendas onto scientific findings.

3.1. How scientists used the linear model in debate over TSE

In order to take advantage of the logic of the linear model, Lomborg's critics argued that his science is wrong, and therefore the politics (and crucially, not policies, because policies largely were not discussed in TSE or by its critics) of those who accept his scientific arguments must also be wrong. This of course is the same logic that underlies frequent invocations of "junk science" and "sound science" in contemporary debates involving science (Herrick and Jamieson, 2000). Under the linear model, invoking the phrase "junk science" means that one believes that political agendas following from that science must be ill conceived and not deserving of support. Invoking the phrase "sound science" means that one believes that political agendas following from that science are right, just, and deserving of support. Battles take place over whether science is sound or junk instead of debating the value or practicality of specific policy alternatives.

Followers of the linear model would likely argue that it really does matter for policy whether or not the information presented in TSE is "junk" or "sound" science. Two examples from TSE show why this line of argument cannot succeed. First, consider the issue of forests. On this issue Lomborg and the World Resources Institute (WRI) and World Wildlife Fund (WWF) engaged in a lengthy debate over various scientific matters covered in TSE, as well as the credentials of Lomborg to even discuss forests.[7] Missing from this debate was the fact that of the forest policy alternatives mentioned in TSE most were simultaneously advocated also by WRI, WWF, or both (cf. WRI, 1997)—among them: in developing countries, plant quick-growing trees to provide fuel, use cheap metal and ceramic stoves to increase efficiency and reduce indoor pollution, reduce poverty and increase growth, and in developed countries, pay developing countries for preservation, e.g., debt for nature swaps, increase plantations, institute a global certification system for green forest products (Lomborg, 2001a, pp. 114–117).[8] And none of the forest policy options discussed in TSE was objected to by WRI/WWA in their critique.

In this case a vigorous debate over science was completely irrelevant to the course of action recommended by either side, as they were largely in agreement on policy options. Thus, from the perspective of policy, it simply did not matter whether the scientific arguments of WRI/WWA or Lomborg are closer to the truth. The recommended actions were apparently robust to disagreements of the science of forests.

[7] On this see the charges leveled by WRI and Lomborg's response (Lomborg, 2001b).

[8] Compare also the World Bank/WWF Forest Alliance (World Bank Group, 2003).

Of course, from the perspective of politics the outcome of the scientific debate may determine who has a voice in forest policy making and who does not. The WRI/WWF debate with Lomborg over forests was putatively about science, but really was about politics.

Consider the issue of climate change. TSE's chapter on climate change recognizes the authority of the Intergovernmental Panel on Climate Change as the leading body of expertise on climate science. But even with this acceptance Lomborg judges the Kyoto Protocol to be too expensive for the benefits that result. TSE's scientist-critics (e.g., Schneider, 2002; WRI, 2001) have come to a different conclusion, and judge the Kyoto Protocol's benefits to exceed its costs. In this instance, evaluating TSE's presentation of climate science as "junk" or "sound" is irrelevant to understanding the course of action recommended by either side because judgments of the value of costs versus benefits is a highly subjective, value-laden calculation. In this case Lomborg and his critics basically agree on the science – global warming is real, it will have impacts on people and the environmental, and there will be more "losers" than "winners" from climate change – but differ a great deal on what the science signifies for action. Despite such general agreement on science, TSE's scientist-critics focused on critiquing minor differences about the science in TSE rather than discussing broader issues of policy (e.g., Mahlman, 2001). Again, from the perspective of politics the outcome of this putatively scientific debate may determine who has a voice in climate policy making and who does not.

Under the linear model science supposedly matters because it dictates what policies make sense and which do not. But reality does not conform to the linear model, as shown from the examples of debate over forests and climate in TSE. Disagreement on science does not preclude consensus on action, and general agreement on science does not preclude opposing views on action. But even in the face of ample evidence that the linear model cannot explain the relationship of science and policy (see, e.g., Oreskes, 2004; Sarewitz, 2004 in this volume for such evidence), it continues to shape discussion and debate on science-related issues, arguably because it is convenient in political debate.

The linear model was the explicit basis for or subtext of many of the claims made by environmental scientists against TSE. Examples of various explicit and implicit invocations of the linear model include Thomas Lovejoy, of the World Bank, writing in *Scientific American* against TSE, explaining to Lomborg how the world actually works.

> Researchers identify a potential problem. Scientific examination tests the various hypotheses, understanding of the problem often becomes more complex, researchers suggest remedial policies—then the situation improves (Lovejoy, 2002).

In other words science and scientists drive politics in a sequential, linear manner.

Another vocal critic, John Holdren (2002), of Harvard, invoked the linear model when he explained his motivation for participating in an extensive series of critiques of TSE in the popular press.

> If the issue involves science for policy, moreover, a clear and forceful denunciation has the further purpose of avoiding an extreme and poorly founded interpretation of the relevant science being credited in the policy debate as lying within the range of respectable scientific opinion.[9]

But even as he invokes the notion of policy, Holdren does not discuss specific policies, and instead focuses on the role that science plays in politics for determining which sort of policies are acceptable and which are not. Holdren writes elsewhere of TSE, "To expose this pastiche of errors and misrepresentations was not a political act but a scientific duty" (Holdren, 2003). Under the linear model, it makes perfect sense to conduct scientific debates before the public and policy makers because the linear model holds that getting the science "right" is necessary for effective policy making to occur. Holdren writes,

> [Lomborg] has needlessly muddled public understanding and wasted immense amounts of the time of capable people who have had to take on the task of rebutting him. And he has done so at the particular intersection of science with public policy – environment and the human condition – where public and policy-maker confusion about the realities is more dangerous for the future of society than on any other science-and-policy question excepting, possibly, the dangers from weapons of mass destruction (Holdren, 2002).

But if the linear model fails to accurately represent the relationship of science and decision making, then following it in practice serves mainly to bring politics into science rather than science into policy.

These statements of TSE's scientist-critics reinforce a linear view of science and politics because they suggest that getting the science "right" is either necessary or sufficient (or both) for action. From this perspective certain political outcomes would favored over others based on the resolution of scientific issues. For those with scientific expertise, it consequently makes perfect sense to wage political battles through science, because it necessarily confers to scientists a privileged position in political debate.

Scientific American's framing of its January, 2002 collection of critical responses to Lomborg by scientists and environmentalists is also an invocation of the linear model. The essays were published with the subtitle "Science defends itself against *The Skeptical Environmentalist*," as if

[9] Other factors besides politics motivated critics of TSE. For example, John Holdren wrote of the "anger and, yes, contempt" expressed by some scientists that Lomborg violated of professional norms of conduct (Holdren, 2002). Personality and ego considerations, while certainly real, do not vitiate the argument presented here.

Lomborg's critics were speaking for science itself. Again, this makes perfect sense under an expectation that science dictates political outcomes. From this perspective, because particular scientific results compel certain actions and not others, there is little reason to distinguish science from politics. Consequently, the following subtitle would thus have been synonymous, "Our political perspective defends itself against *The Skeptical Environmentalist*."

And Lomborg himself appears to accept the linear model when he writes in TSE, "Getting the state of the world right is important because it defines humanity's problems and shows us where our actions are most needed" (Lomborg, 2001a). Lomborg further writes, "indeed, there is no other basis for sound political decisions than the best available scientific evidence" (2001a). And, "thus, with this assessment of the state of the world I wish to leave to the individual reader the political judgment as to where we should focus our efforts. Instead, it is my intention to provide the best possible information about how things have progressed and are likely to develop in the future, so that the democratic process is assured the soundest basis for decisions" (2001a). For those who subscribe to the linear model Lomborg could not be any more provocative. For those who reject the linear model, Lomborg may seem to be less threatening as another member of a large set of people and groups from across the political spectrum seeking to advance their agendas selectively using science to make the best possible case in support their arguments (Herrick and Jamieson, 2000; Wynne, 1991; Funtowicz and Ravetz, 1992). This may help to explain why some scientists reacted to TSE with venom and others, who may have also differed with Lomborg's politics, reacted with indifference.

An astute reviewer of an earlier draft of this paper noted that the ample policy credentials of many of the critical scientists indicate that their invocation of the linear model must have been more a matter of political expediency rather than adherence to a misleading worldview. This may or may not be the case; but my argument does not depend upon discerning the motivations behind those scientists who use science to further their political agendas. The consequences of invoking and following a linear model are significant in either case. It is worth noting that those who, like Lomborg himself, suggested TSE compels certain political actions because of its *correctness* also are invoking the linear model.

Students of science and society might object to this line of argument by noting that because the linear model has been largely discredited as descriptive and normative theory of the relations of science and the rest of society (e.g., Stokes, 1997; Guston and Kensiton, 1994; Sarewitz, 1996; Kitcher, 2001), its plausibility as a practical frame within which to wage political battle might be called into question. But despite its critics, within the scientific community the linear model remains a widely held perspective on how science does and should connect with the rest of society (e.g., Sarewitz, 1996; Greenberg, 2001). Moreover, independent of intellectual understandings of the complexity of relationships between science and politics, there are powerful incentives for its adherents to invoke the linear model because action based on the linear model confers mutually reinforcing benefits among scientists, politicians, and interest groups (Pielke, 2002).

3.2. Consequences of the linear model

In the case of TSE, reinforcement of the linear model of science and decision making led to a Catch-22 in the logic of the Danish Panel that was convened to evaluate the book. The Danish Panel was convened to investigate allegations of scientific dishonesty in TSE made by a number of scientists using materials developed for the critiques of TSE published in Scientific American. The Danish Committee on Scientific Dishonesty (2003) grappled with the question of whether or not TSE was in fact a work of science, "Some members do not regard the book as science, but rather as a debate-generating book." If the Danish Committee judged TSE not to be a work of science, they would have removed their basis of authority for their investigation. The Catch-22 was revealed most clearly in the Solomonesque decision by the Danish Panel *not* to pass judgment on whether or not *The Skeptical Environmentalist* is a work of science, and instead to qualify their conclusion:

> *Subject to the proviso that the book is to be evaluated as science*, there has been such perversion of the scientific message in the form of systematically biased representation that the objective criteria for upholding scientific dishonesty have been met (emphasis added, Danish Committee on Scientific Dishonesty, 2003).

The Danish Panel's adherence to the linear model led to an odd outcome in which at the same time TSE was both a "work of science" and not a "work of science."

The linear model also helps to explain why TSE received such a vitriolic response from some members of the scientific community as compared to books with a similar thesis, such as by Gregg Easterbrook (1995), Ronald Bailey (1993), and Julian Simon (1996). One biologist suggested that Easterbrook and Simon could be easily dismissed because they were not environmental scientists, "Every few years, someone who's not an environmental scientist announces that there is no environmental crisis, that the state of the Earth is improving, and that the future looks so rosy that our treatment of environmental resources requires – at most – minor adjustments" (Simberloff, 2002). Even though Lomborg's training is in political science and he claims not to be an expert in environmental science, TSE motivated unprecedented reactions from scientific critics. The difference in reaction might be partially explained by a combination of factors including the warm public reception TSE received in major media, its characterization in the media as a scientific work, its publication by the highly respected Cambridge University Press, as well as a trend of increasing politicization of science by scientists.

Invocations of the linear model also help to some degree to explain why attacks on TSE became so personal and focused on Bjørn Lomborg. Under the linear model battles over science are in effect battles over politics, and it is fair game in politics to establish the superiority of your own credentials and demolish those of your opponent to enhance the chances for political victory. Consider the following examples of characterizations of Lomborg made by scientists. None were made in the context of a scientific setting (e.g., in peer-reviewed journals).

- Stephen Schneider contrasted his scientific authority with his views of Lomborg's credentials,

  "For three decades, I have been debating alternative solutions for sustainable development with thousands of fellow scientists and policy analysts—exchanges carried out in myriad articles and formal meetings .... And who is Lomborg, I wondered, and why haven't I come across him at any of the meetings where the usual suspects debate costs, benefits, extinction rates, carrying capacity or cloud feedback? I couldn't recall reading any scientific or policy contributions from him either (Schneider, 2002)."
- Stuart Pimm commented,

  "Here's one guy taking on a whole spectrum of issues who has never written a paper on any of them and is in opposition to absolutely everyone in the field, Nobel Prize-winners and all (Woodard, 2001)."
- John Holdren is similarly dismissive,

  "A critic has no responsibility to identify and explicate all of an author's mistakes. People with the competence needed to do this have better things to do. To explain to nonspecialists all of the mistakes in Lomborg's energy chapter would require replicating a substantial part of the introductory course on energy systems that I taught for 23 years at the University of California, Berkeley, and have now taught for 5 years at Harvard. As badly as Lomborg needs that course, I am not going to provide it for him here (Holdren, 2002)."

Of course, playing the credential card cuts both ways. Lomborg himself, Cambridge University Press, and the media widely publicized the fact that Lomborg was a former member of Greenpeace, perhaps to underscore his environmental credentials. But in contrast to his critics, Lomborg (2001a) downplays his scientific expertise, writing in TSE, "I am not myself an expert as regards environmental problems." And in the title of TSE the author presents himself as a "skeptical environmentalist" and not as a "skeptical scientist."

In places in TSE, Lomborg, unlike his scientist-critics, makes abundantly clear his political perspectives. He writes, for example, "This kind of supercilious attitude is a challenge to our democratic freedom and contests our basic right to decide for ourselves how we lead our lives, so long as doing so does not bring us into collision with others" (Lomborg, 2001a, p. 329). And elsewhere, "We have become richer and richer primarily because of our fundamental organization in a market economy" (2001a, p. 351). Missed in most evaluations of TSE (but not all; see Oreskes, 2004 in this volume) is that the book is a statement about what we should value and how we should evaluate those values.

An irony of debate over TSE is that the fame of TSE owes more to its critics than to any fundamental insights of the book. Consider that sales of TSE quadrupled with the publication of the January 2002 issue of *Scientific American* critical of the book (Harrison, 2004). Surely even if one rejects the critique of the linear model offered here there is a lesson in this experience for the practicality of invoking the linear model in pursuit of political ends.

4. Other perspectives on politicization of science by scientists[10]

The case of debate over TSE is an example of a general problem: through their actions, many scientists encourage the mapping of established interests from across the political spectrum onto science and then use science as a proxy for political battle over these interests. As Herrick and Jamieson (2000) observe, "the imprimatur of science is being smuggled into deliberations that actually deal with values and politics." This is a familiar strategy for undergraduates in Public Policy 101 who make an argument and then seek out scientific references in support of their political views. Most of TSE's critics are more subtle than beginning students because they focus their arguments on "science," even as they must recognize that certain scientific views are associated with certain political outcomes. But when scientists seek political outcomes through science, it can arguably limit the positive contributions that science undoubtedly can and should make to policy development.

To be fair, not all (and perhaps not even most) scientists subscribe to the linear model. Some advocate completely decoupling science from policy, others see a more complicated set of connections. Arthur Kantrowitz (1994) sees danger for scientists when they engage in political battles via the media.

> In the resulting media contest between competing authorities, it is not possible to tell whether science or politics is speaking. We then lose both the power of science and the credibility of democratic process.

Loss of power for science matters only if science, or more accurately the information provided through science, has in some cases a unique role to play in the policy process. For if information does not matter, then distinguishing science and politics would be of little concern.

In 1976, Philip Handler saw consequences for science of scientists taking a leading role in issue advocacy.

[10] The following two sections draw on material first published in Pielke (2003).

> We have learned that the scientist-advocate, on either side of such a debate, is likely to be more advocate than scientist and this has unfavorably altered the public view of both the nature of the scientific endeavor and the personal attributes of scientists (Handler, 1976).

Thomas Mills goes further and suggests that the politicization of science is unethical and should be viewed in the same way that we view other types of conflict of interests.

> An attempt by the scientist to simultaneously be a science information provider and a position advocate is an inherent conflict of interest. The development of objective science information on the one hand and the value balancing of all considerations in a final decision on the other hand are two different roles that cannot be credibly played by one person. The risk to the credibility of the science component of the decision process is too great. At best, it will further confuse already contentious and complex public debates. At worst, it is an unethical misrepresentation of personal values as if they were science information (Mills, 2000).

Of course, there are cases in which science and information do matter in the process of deciding between particular alternative courses of action. This is simply because "decision making is forward looking, formulating alternative courses of action extending into the future, and selecting among alternatives by expectations about how things will turn out (Lasswell and Kaplan, 1950)." One of the important roles of science in policy making is to inform expectations about "how things will turn out." Yet, as Sarewitz (2000) argues science is rarely a sufficient basis for selecting among alternative courses of action because desired outcomes invariably involve differing conceptions of the sort of world we want in the future. Whether or not avoiding some degree of climate change is desirable, or whether or not the risks of nuclear power or GMOs exceed their benefits are not issues that can be resolved by science alone.

That science alone cannot resolve political debates seems well-appreciated by many scholars, particularly in the community of scholars who study science and society, yet this linear perspective continues to manifest itself in attempts to compel political consensus through science. Daniel Kemmis noted this apparent paradox and its effects in the context of natural resource decision making.

> So why would anyone continue to speak and act as if good science by itself could get to the bottom of these bottomless phenomena and in the process give us "the answer" to difficult natural resource issues? In large part this is simply a holdover of an anachronistic view of how the world works and of what science can tell us about that world. In this sense, the repeated invocation of good science as the key to resolving complex ecosystem problems has itself become bad science. What is infinitely worse is that this bad science is all too readily made the servant of bad government (Kemmis, 2002).

Political decisions involving different interest groups are inherently difficult to resolve, because any adopted action is bound to infringe upon someone's (overt or vested) interests—hence the need for decision processes for resolving various claims of constituents. The process of achieving a legitimate outcome involves bargaining, negotiation and compromise—the essence of "politics." Politics unfettered by science can be messy enough—consider the abortion 'debate' in the United States. But when politics is played out through science with the acquiescence and even facilitation of scientists, the results can serve to foster political gridlock to the detriment of science and policy alike because science alone is incapable of forcing a political consensus (cf. Oreskes, 2004; Sarewitz, 2004 in this volume).

5. Making sense of the Lomborg affair: distinguishing policy from politics

To understand the role of scientists in the Lomborg affair requires understanding not only the role of the linear model as a perspective shaping how some influential scientists apparently view the role of science in society, but also possible alternatives to the linear model. To introduce an alternative, consider a thought experiment. Imagine a world that formalizes the implications of the linear model, in which scientific advice is provided to decision makers only through established political institutions (Pielke, 2002). In the United States scientists would be categorized by whether they belonged to the Democratic or Republican parties, in Great Britain by membership in Labor, Conservative, Liberal Democrat parties, etc. Scientific journals as well (peer-reviewed no doubt) would be published through the party structures, e.g., *Labor's Nature* and *Republican Science*. Public funding for research would be provided to political party organizations, which would then disseminate resources as they saw fit, perhaps relying on traditional peer-review.

Would there be any problem with such a structure? It would be difficult to find any practicing scientist who would advocate structuring the scientific enterprise in such a manner. Indeed the time-honored practices of peer-review and other mechanisms of insulating science from politics seek to avoid the direct influence of politics on science. One reason for the high esteem which science is held is its independence from overt political influence. But ironically, the linear model of science fosters circumstances much more like the imaginary world described above than many would like to admit. The Lomborg affair illustrates how the linear model of science encourages the mapping of political interests onto science, and in the process encourages a morphing of political and scientific debate.

What is missing from the debate over TSE is any notion of *policy*. When decision makers make a commitment to a particular course of action with broad implications, we have a special term for this type of decision: *policy* (Lasswell

and Kaplan, 1950). Of course, in society there are multitude interests and perspectives, thus there is rarely (if ever) consensus on desired outcomes and the means to achieve those outcomes. As a result, whenever there is conflict, we engage in political behavior. *Politics*, in the words of the great twentieth century political scientist Harold Lasswell, is the process of bargaining, negotiation, and compromise that determines "who gets what, when, and how" (Lasswell, 1958).

From this perspective, when science is used in policy it can help to clarify the scope of available options or even help decision makers set their expectations about the consequences associated with different courses of action. The key linkage between science and policy is a specific course (or alternative courses) of action. When science is used in politics it is a resource in the process of bargaining, negotiation, and compromise for desired ends. Of course, policy has politics, because we bargain, negotiate, and compromise on particular courses of action. But politics need not have policy, e.g., as debate over TSE amply illustrates, we can argue about who gets a voice in policy making without discussing the merit of particular policies. And it is in cases where science is used to further political agendas absent consideration of policy alternatives such as occurred in debate over TSE, that the politicization of science by scientists becomes problematic as considerations of policy are lost in the fray.

Of course, recognizing a distinction between policy and politics should not preclude particular scientists from stepping into the political arena in cases where they feel strongly enough. But they should do so in full recognition that there are choices to be made about what role they might play in policy and political processes. What makes the scientific enterprise notable today is the paucity of guidance provided by scientists to policy makers seeking to expand the range of available policy alternatives. Science might defuse political debate (and gridlock) by contributing to identification of choices not seen and paths not taken, rather than just adding ammunition to opposing sides entrenched in political battle. Experience with, for example, ozone depletion and acid rain provides some guidance to how science can beneficially contribute to decision making in highly political contexts (e.g., Pielke and Betsill, 1997; Herrick, 2000).

In thinking about how things might be different it is absolutely critical to differentiate *scientific results* from their *policy significance*. To illustrate the distinction, consider the central conclusion of the Intergovernmental Panel on Climate Change (IPCC): that global average temperature in 2100 will increase anywhere from 1.4 to 5.8 C. This is a scientific result and communication of what it means (i.e., the origins of the estimates, how "global average" is defined, the confidence level of the projection, etc.) to the non-expert may take some effort. But communication of what this result means is not the same as assessment of what it signifies for alternative courses of action. The latter is the essence of policy advice. The IPCC presents statements of trend, condition and projection. Assessment of significance for action depends upon how trends, conditions and projections are related to policy alternatives and their implications for valued outcomes, such as human health and environmental sustainability, as well as economic prosperity, etc. The current state of the scientific enterprise is such that the independent scientific community (i.e., those scientists without close relationships to political advocacy groups, industry, and government) typically eschews explicit discussion of the significance of science. The IPCC for example seeks to be "policy relevant, but policy neutral" (IPCC, 2003). In practice, this means that the IPCC does not consider policy alternatives and instead has institutionalized the linear model. A great irony of the IPCC process is that its institutional organization, selection of participants, and even scientific foci necessarily reflect a non-neutral policy orientation, and hence it is in fact very political (Boehmer-Christiansen, 1994a,b; Argrawala, 1998a,b; Pielke, 2004).

Under the linear model political advocates are delegated the task of interpreting the significance of science for decision makers, and the voices of those seeking to provide guidance on policy advice are difficult for decision makers to distinguish from those seeking to gain political advantage. So if one wishes to answer the question "so what does this particular bit of science mean for action?" in almost any scientific context, with very few exceptions decision makers look to political advocates for the insight to the significance of science for action, in effect creating a world where almost all science is filtered through existing special interests. A better alternative is for the independent scientific community itself to take some responsibility to address the significance for policy of scientific results. This would mean not simply seeking to better "communicate" the results of science to the policy maker, but developing the capability to place science into policy context, i.e., to address the question: what policy alternatives are consistent with and inconsistent with scientific results? If the scientific community indeed wishes to claim independence from partisan politics, then with this comes an obligation to provide independent guidance on the significance of science for a wide scope of policy alternatives (e.g., Rayner and Malone, 1998).

The Lomborg affair is at its heart a normative debate over what kind of world we should live in and the means we should employ to approach the future. Kysar and Saltzman (2003) see the Lomborg controversy as continued interest group politics characteristic of the environmental movement.

> Despite over three decades of modern environmental laws, the proliferation of citizens groups, think tanks, and other organizations concerned with environmental issues, and the maturation of environmental law and policy into distinct fields of study, one still sees basically two warring camps, both politically and ideologically entrenched on opposite ends of the environmental battlefield. In many respects, the Lomborg conflict is simply the most recent example of this sort of staunch 'environmental tribalism' (Kysar and Saltzman, 2003).

And conflict over who should win the war of "environmental tribalism" is fundamentally about values and in democratic systems is resolved through bargaining, negotiation, and compromise, i.e., politics.[11] Science has become the weapon of choice in this war.

6. Conclusion

There is no magic bullet or panacea for the challenges presented by the politicization of science by scientists. And perhaps worst of all would be a withdrawal of the scientific community from involvement in contested political issues, as was historically the case when scientists sought to be "value free" and removed from practical concerns. It makes no sense to try to return to a bygone era when science was thought to be separate from politics. There is a middle ground, where some scientists resist the urge to join the political fray and instead seek through independent, authoritative bodies to provide insight that expands the scope of policy alternatives available to policy makers and the public, perhaps in some cases showing the way past gridlock and political stalemate, and in others offering realism about the limits of science in politics. The current tendency to rely on groups like the IPCC or science advisory panels to "get the facts right" but not consider the significance of those facts for action exacerbates the politicization of science. If the public or policy makers begin to believe that scientific findings are simply an extension of a scientist's political beliefs, then we will find that scientific information will play an increasingly diminishing role in policy making, and a correspondingly larger role in the marketing of particular political agendas. This will be tragic because scientific information often matters for policy making (Jasanoff, 1990).

Not only does the linear model obscure policy, but it also is bad politics. In all but the most trivial of cases science cannot compel specific political outcomes. Rather scientific understandings are frequently either intrinsically uncertain or diverse enough to be used to justify a range of competing political agendas. In such situations the standard response is to call for more scientific research ("sound" or "objective" of course) in hopes that as a result uncertainties will shrink or a political consensus will emerge. In reality, new research frequently increases uncertainties and simultaneously provides a steady replenishment of scientific ammunition for all sides engaged in political conflict. Rather than political consensus, what emerges is typically gridlock.

One way out of this situation is to recognize that often policy makers need new options, not simply more science or more information. Climate change is a visible example of such a need, as political debate over the Kyoto Protocol, however resolved, will leave a remaining policy challenge quite similar in either case. Seeking to expand the options available to decision makers is contrary to the roles that most scientists have sought to play in the policy process. Political advocacy is all about reducing the scope of choice, often ideally to a single preferred vision. And the many scientists who eschew advocacy typically seek to provide information and stay far removed from any explicit discussion of policy or politics, and policy making suffers.

Political advocates will always look to science as a source of authority in support of their agendas. However, the scientific community itself need not view this process as the only mechanism it has for connecting research with decision making. Debate over TSE is an extreme case that provides an opportunity for the scientific community to take a critical look at its own role in society and ask whether it is meeting its potential to contribute useful knowledge both to politics and policy.

[11] Compare, Frodeman (2003), Herrick and Jamieson (2000), Sarewitz (2000).

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