The Disconnect Problem, Scientific Authority, and Climate Policy[1]

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The disconnect problem arises wherever there is ongoing and severe discordance between the scientific assessment of a politically relevant issue, and the politics and legislation of said issue. Here, we focus on the disconnect problem as it arises in the case of climate change, diagnosing a failure to respect the necessary tradeoff between authority and autonomy within a public institution like science. After assessing the problematic deployment of scientific authority in this arena, we offer suggestions for how to mitigate climate change's particular disconnect problem, as well as more general proposals for reforming science advising.

1. Introduction

In this paper, we diagnose and explore one instance of a general phenomenon that we hereby dub "the disconnect problem." Instances of the disconnect problem arise wherever there is ongoing and severe discordance between the scientific assessment of a politically relevant issue, and the politics and legislation of said issue. Because the disconnect problem involves significant conceptual, epistemic, and ethical discord, it is an especially relevant problem for socially responsible philosophers of science (Kourany 2010; Fehr and Plaisance 2010). Here, we focus on the disconnect problem as it arises in the case of anthropogenic global climate change—a place where the problem is a particularly pernicious one.

In the case of climate change, the disconnect problem is reflected in the fact that, although the degree of consensus amongst climate scientists is truly impressive (see Cook et al. 2013), both the content and the authority of climate science are hotly disputed in the political sphere (see Boykoff

1. Authorship is joint; the authors are listed alphabetically.

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and Boykoff 2004; Oreskes 2007). On the one hand, climate scientists overwhelmingly agree that anthropogenic global climate change is happening, and that there will be dire consequences for much of life on Earth if we do nothing to stop it. The degree of this consensus amongst climate scientists is especially impressive given the complexity of the subject matter and the methodological difficulties involved (see Oreskes 2004). On the other hand, policy-makers responding to and acting on the issue of climate change show no such agreement. Some unqualifiedly accept the scientific consensus while yet others vehemently deny it, and many policy-makers fall somewhere in between, accepting some portion but not all of the scientific assessment of the issue and the need for taking action on it.

It is worth noting that even amongst those who agree that climate change is happening and that something needs to be done about it (climate scientists and climate policy-makers alike), there is much less consensus about what action to take—as in, about how to proceed in mitigating or adapting to climate change—or what the consequences of any course of action will be. It is also worth noting that there is not a simple parallel divide within climate policy, between those who appeal to scientific authority and accept the scientific consensus about climate change on the one side, and those who dismiss science in general as well as deny the consensus of climate science on the other. In other words, both climate skeptics and climate activists in the political sphere tend to make appeals to scientific authority in defending their positions on climate change—and on either side, these appeals can be sincere or merely rhetorical.[2] All kinds of policy-makers addressing anthropogenic global climate change point to "experts" to support their position (i.e., McCright and Dunlap 2003; Oreskes and Conway 2010). All sides hurl accusations of "junk" science (i.e., Pielke 2007, p. 116; Douglas 2009, p. 11).

The material point here is that there is an utter lack of consensus with regard to how to weigh and incorporate climate science in climate policy, and this lack of consensus is not simply a product of straightforward acceptance or rejection of scientific authority writ large. Many policy-makers who are climate skeptics still make appeals to scientific authority (whether rhetorical or otherwise); so, the problem is much more nuanced than a simple "erosion of scientific authority" (*contra* Kitcher 2011). Prompted by this nuanced and only partial rejection of the authority of climate science, here we explore how scientific authority is deployed by all sides in the space of interaction between climate science and climate

2. Thanks to an anonymous reviewer for drawing our attention to the rhetorical dimension of these appeals.

policy. We think that the complex deployment of scientific authority is a significant contributor to the disconnect problem as it arises in the case of climate change, and we suggest ways to mitigate this aspect of the problem based on an understanding of how scientific authority currently is and might alternatively be wielded, in this and other instances of the disconnect problem.

This is obviously a philosophically interesting issue—among other things, the complex deployment of scientific authority should ensure the attention of philosophers of science. But it is also an issue of extreme social relevance—because the impact of the disconnect problem as it arises and endures in the case of climate change is likely to be felt across the globe and throughout many cultures, in the development (or lack thereof) of relevant legislation. Policy proposals generated under these conditions of severe discordance are likely to be half-measures at best, and could be unfair, damaging impositions at worst. There is also the risk, especially in a climate of uncertain scientific authority and purportedly value-free scientific practice, of undue appropriation of that practice by competing interests—scientific, political, or otherwise—with under-studied and under-supported aims and values, potentially for unjust ends and with grave results.

The matter of our changing global climate is a complex and scientific subject, and it will be difficult to design and implement effective, scientifically-supported policy without some sort of agreement among policy-makers with respect to the role of science in understanding and acting on the issue. This does not mean that policy cannot proceed until agreement is reached on all the relevant factual questions, but rather that the role of scientific assessment within policy-making must be at least somewhat agreed upon, lest it become a perpetual impediment to taking legislative action. Perhaps the right role for science is minimal, as Sarewitz (2004) and Pielke (2007) seem to argue. Alternatively, rationally evaluating the options of adaptation and mitigation by technological fix, deindustrialization, geoengineering, or otherwise might require significant scientific input on the relevant natural, social, and technological processes and possibilities. But as long as the role of science itself in the policy-making process is a matter of ongoing controversy, it will be difficult to move forward. We hope to address this difficulty and progress the debate.

The paper proceeds as follows: in section 2, we use details from the case of climate change to identify and describe the disconnect problem as it arises in this instance. Next, in section 3, we pay special attention to the portion of climate change's disconnect problem that arises from the problematic deployment of scientific authority. In section 4, we discuss the undue political appropriation of the chief scientific advisory body on climate change—aka, the Intergovernmental Panel on Climate Change

(IPCC). Then, in section 5, we offer principled yet practical suggestions for how to solve this and other aspects of the disconnect problem as it arises in the case of climate change—again, paying special attention to issues of scientific authority, but not only to those issues. We offer concrete, applicable suggestions for improved interaction throughout climate science and policy. In section 6, we extrapolate from several of these particular suggestions in order to articulate systematic and general suggestions to address an evidently significant component of the disconnect problem: namely, the lack of a suitable model of science advising. In sum, we outline an alternative, feminist-pragmatist model of science-policy interaction, arguing that (a) scientific investigation should be reconceived according to a pragmatist model of inquiry, supplemented by feminist work in philosophy of science on science and values; and (b) correspondingly, political processes should be reformed according to feminist and pragmatist notions of equality, justice, and democracy. Finally, in section 7, we conclude by listing what we consider to be some possible first steps to take towards realizing the suggested changes we have advocated for throughout the paper. We also briefly reflect on the value of doing this kind of socially relevant philosophy of science, despite its breadth and challenges.

2. The Disconnect Problem

The disconnect problem arises wherever there is ongoing and severe discordance between the scientific assessment of a politically relevant issue, and the politics and legislation of said issue. In the case of climate change, this discord is a result of both the scientific complexity of the phenomenon of anthropogenic global climate change, and the political difficulty of addressing the phenomenon.

In terms of scientific complexity, climate science has several special methodological problems. For instance, climate systems are complex and often difficult to access. Relevant data is often difficult to collect, combine, and analyze, as it involves tracking variables over long periods or across large geographical areas. When they are conducted at all, experiments—usually a staple of scientific investigation—rarely speak directly to central problems, as it is nigh impossible to run controlled experiments at climate scales. Models are most commonly used, but there are many on offer—and they are complicated, highly idealized, and variable in their inputs, outputs, and basic assumptions. At least partly because of these problems, the precise specification and reliability of the methods of climate science are still a matter of philosophical debate (Oreskes et al. 1994; Petersen 2000; Parker 2006, 2011; Lloyd 2010; Lenhard and Winsberg 2010). Unsurprisingly, it can be difficult for a non-expert to understand whether or why the methods of climate science produce reliable knowledge.

Nevertheless, despite the complexities of both conducting and communicating the science of climate change, an impressive degree of consensus exists within the community of climate scientists. Consensus particularly prevails around certain basic features of the current situation, such as the existence and anthropogenic source of global warming (Oreskes 2007; Cook et al. 2013). But again, climate science is complicated, and about other features there is less certainty, especially the crucial task of predicting specific impacts of climate change (Schneider 2002; Pielke 2010, pp. 30, 61).

So much for the *scientific* problems surrounding climate change. In a basic sense, the *political* problem of climate change is what to do about it, given the scientific presentation of the facts. This simplification belies an underlying complexity: as with the science, the politics of climate change has a number of special methodological problems. The problem of climate change has widely distributed effects, but also variable impacts, affecting some areas more than others. In addition, the problem has developed gradually, so the distribution of effects will not be even across all those who have contributed to the problem (i.e., many of the contributors are now dead, or will be before serious impacts are felt). Climate change also has causes and effects invisible to most lay people—they can only be perceived with the help of scientific instruments, theories, and models.[3] Finally, the climate crisis requires extensive collective action—global cooperation will be necessary to accomplish whatever mitigation and adaptation strategies are needed. These features are well-known sources of political intractability (for an in-depth discussion of these issues, see Gardiner 2001; Jamieson 2007).

Climate change is thus a serious issue, the recognition of which by the international political community—to say nothing of the response—is impeded by the fact that it is difficult to specify who is responsible, who will be impacted, and when and how the impacts will be felt, by the relatively undetectable but rapidly advancing crisis. Add the overwhelming scientific complexity of the assorted relevant phenomena to these political difficulties, and it quickly becomes apparent how the disconnect problem might arise despite a strong scientific consensus about the existence of anthropogenic global climate change.

3. Scientific Authority

It is in this climate of high-stakes scientific complexity and political intractability that appeals to scientific authority have come to have such

3. There is a fundamental distinction between weather, which we can directly observe, and climate, which we cannot, because it is widely distributed over space and time, and the relationship between climate change and extreme weather events is one of those areas of greater uncertainty.

widespread application and political influence. The deployment of such appeals on all sides of the issue adds another layer to the disconnect problem as it arises for the case of anthropogenic global climate change. In other words, this is a place where the deployment of scientific authority is highly problematized, and this problematic deployment contributes to and exacerbates the disconnect problem for climate change.

In this section, we will discuss three ways scientific authority is problematically deployed around the issue of climate change. First, contradictory appeals to scientific authority confuse the public on this issue and undermine scientific authority in general. Second, a particular kind of gulf between those with scientific authority (the "experts") and everyone else undermines both the relevance and the acceptability of scientific advising, in this case and elsewhere. Third, the dominant models of science advising—models which depend upon and endorse a certain depiction of objective, value-free scientific authority—mask undue appropriation by political (and other) forces, in a manner akin to the way in which regulatory capture by special interests can distort other legislative processes. We can clearly illustrate how the political manipulation of science advising has worked in the case of climate policy—because of the prevalence of these models of science-policy interaction, we suspect other cases are susceptible to similar distortion.

On the first point: advocates on all sides of the debate about climate change appeal to scientific authority by relying on the published and otherwise stated opinions of "experts," purportedly on the basis of their scientific credentials. As a result, scientific experts have some of the most powerful voices in the political arena. Many of those policy-makers in favor of designing and implementing some sort of policy response to the problem of climate change rely on a set of scientific experts to establish the existence and urgency of the problem. And while some politicians express a sort of blanket skepticism about scientific expertise, most of those opposing the package of anthropogenic climate change and carbon mitigation appeal to alternate "experts," providing putative evidence against the factual basis for the climate change and mitigation package.

Because of apparent contradiction among the "experts," the public now lacks faith in and respect for scientific expertise on both sides of the debate about climate change—and mainstream climate scientists face a challenge with public trust (Jasanoff, quoted in Broder 2010). This erosion of trust is a natural response to the barrage of conflicting proclamations about the problem, all being made by supposed scientific "experts" in the study of climate science. Whether the appeals to experts are sincere or rhetorical in nature, the effect on the public seems to be the same.

This brings us to our second, related problem for scientific authority on climate issues: diminishment or dissolution of trust is also a natural response to a sense of alienation from science. As John Dewey warned, experts can become a specialized class with private interests, cut off from the interests of the masses. He wrote that:

> A class of experts is inevitably so removed from common interests as to become a class with private interests and private knowledge … No government by experts in which the masses do not have the chance to inform the experts as to their needs can be anything but an oligarchy managed in the interests of the few … (Dewey 1927, pp. 364–65)

The currently elevated and isolated status of scientific experts in our society means that science advising on political responses to the problem of climate change is overwhelmingly being done by persons dissociated from the majority of those likely to be highly negatively impacted by the crisis. Like inadequate representation among advocates, this disassociation from the public by the experts risks generating undemocratic policies.[4]

Some key features of scientific accreditation and expertise need to be worked out, in general and in the particular case of climate change. It is worth noting here that there have been several attempts already made—attempts to establish the credibility of the scientists supporting mainstream conclusions about anthropogenic climate change (e.g., Oreskes 2004; Anderegg et al. 2010). Unfortunately, these attempts do not seem to have had much uptake in the public sphere; so, the challenge is to generate measures of credibility that the public can trust and endorse.[5]

Finally, we come to our third point about the problematic deployment of scientific authority on the issue climate change: the dominant models of science advising are subject to a form of undue appropriation, akin to regulatory capture, which subsumes the sheen of supposedly objective scientific authority for processes that are, in actuality, laden with values—scientific,

4. Related to this lack of adequate representation of the interests of the public, science itself has its own problems of inadequate representation of the general population, e.g., with respect to race or gender. This leads to further iterations of the problem of expert disassociation from the public: for instance, women are underrepresented in science, but are globally more negatively affected than men by environmental disasters such as climate change, even suffering higher mortality rates from such disasters (Neumayer and Plümper 2007; Dankelman 2010, pp. 13–4).

5. Perhaps one problem is that these sorts of attempts are often published in scientific journals (in this case, *Science* and *PNAS*, respectively)—the very bastions of the isolated expertise currently subject to public doubt. (We do appreciate the irony of putting this point in yet another academic paper.)

political, and otherwise. A worrying degree of this sort of appropriation has already occurred within the principal body for science advising on climate change. Since susceptibility to this sort of appropriation is largely a result of the flawed structure of the dominant models of science advising, we'll discuss those general models briefly before turning to the details of how science advising on the problem of climate change in particular has been unduly appropriated, in this case by covert rather than openly democratic political forces.

Science advising is conceived and practiced according to two dominant models: the linear model of science advising and that of evidence-based policy. Both models treat science and policy as remarkably distinct domains. Caricaturing these models a bit, both present science as the domain of objectivity, facts, and instrumental efficacy, while policy is the domain of values, social justice, and legislative action; policy defers to scientific expertise in terms of describing the relevant phenomena and possible responses, while policy makes decisions about how to act on the basis of that scientific information.

The linear model presupposes that science develops from basic research, to applied science, to policy solutions and technological innovations. On this model, the most policy can do to shape science is to encourage the development of research that can create policy solutions, including pushing for basic research with anticipated relevance to downstream policy applications. Moreover, according to this model, policy should not shape the actual processes or outcomes of science. But the general inadequacy of the linear model is well known amongst science studies scholars, and increasingly so amongst science-policy experts. As Roger Pielke Jr. argues, the linear model could only work in situations where the science is relatively certain and values are shared (Pielke 2007, pp. 19–20, 70–4). This is obviously not the case with regard to the problem of climate change.

The model of evidence-based policy presupposes that certain kinds of scientific evidence are better than others, regardless of context. Randomized controlled trials (RCTs), or meta-analyses of RCTs, are the "gold standard" of scientific evidence for policy proposals. By definition, RCTs indiscriminately test interventions among an experimental population under strict controls. This is obviously not a style of research methodology likely to have much useful application in the arena of global climate policy.

In addition to the inadequacy of these two models in the particular realm of science advising on global climate policy, both have significant theoretical difficulties already well chronicled by philosophers of science. For instance: many philosophers of science, science studies scholars, and science-policy experts regard the linear model as philosophically and practically inadequate (Stern and Fineberg 1996; Pielke 2007; Douglas 2009;

M. B. Brown 2009). Still others have pointed out serious flaws in the model of evidence-based policy (e.g., Cartwright 2007, 2009; Worrall 2007a, 2007b). Yet, despite their obvious inadequacy, these are still the two most widely adopted models of science-based policy, as evidenced by the fact that prominent science-policy advising organizations like the IPCC still adopt them. Traditionally the IPCC (which was founded in 1988) has adhered to something like the linear model, although some architects of certain portions of the IPCC reports have recently been incorporating tactics that seem to draw from the model of evidence-based policy and other sources of inspiration.[6]

This brings us to our most significant and novel objection to the role that these models play in science advising, on climate change and elsewhere. The preceding objections to both the linear model and that of evidence-based policy have to do with properties of the models and their lack of fit with the context of their applications. In contrast, the principal concern we outline here has to do with what the models presume, or what assumptions act as preconditions for their construction and application. The problem is this: both the linear model and that of evidence-based policy assume that science is simultaneously *autonomous from* and *authoritative for* policy—creating a deep tension for democracy (Douglas 2009, pp. 7–8; M. J. Brown 2013b). Generally, autonomous pursuits in democratic societies are those in the *private* sphere that ought to be free from interference by social or political institutions, like private clubs or religious institutions. In contrast, social institutions such as legislatures or the police are *publicly* authoritative but have restricted autonomy; in democratic societies the legitimacy of such authority depends on whether that authority is representative, authorized, and accountable to the public (M. B. Brown 2009)—and these forces all act as restrictions on the autonomy of such institutions.

The trade-off between authority and autonomy—or, public power and public accountability—is an important one to maintain. Any institution with both significant authority and autonomy is a dangerous institution: institutions in democratic societies cannot compel both respect and compliance without also being influenced by or responsible to anything beyond their own internal norms. Violation of these constraints on authority and autonomy can lead to serious problems, and these constraints apply to scientific institutions as much as to any other kind. For one, the troubling

6. See the recent attempts by Ottmar Edenhofer, current leader of the IPCC's Working Group III, to offer in the latest report a range of scenarios in climate change mitigation for policy-makers to choose from (discussed in, e.g., Edenhofer and Kowarsch 2015). We comment on this work in greater detail in "Inductive Risk, Deferred Decisions, and Climate Science Advising" (forthcoming).

fact that an autonomous science can wield great authority in the context of policymaking suggests a further cause of the current lack of public trust in and respect for science. The apparent autonomy of science gives rise to doubt that those processes which deploy scientific authority are ones that properly represent a democratic, public interest. As discussed above, scientists under these conditions may become a class of experts forwarding their own interests. For another, there is significant danger inherent in a widely authoritative yet publicly autonomous science: the danger that external, nondemocratic aims will surreptitiously infiltrate an isolated, previously autonomous community. A source of widespread public authority with only internal norms for accountability is a tempting political target.

4. Political Appropriation of Scientific Authority

The IPCC is certainly seen as a source of scientific authority on climate policy; it is also seemingly autonomous from *public* authorization, representation, and accountability. But is it a truly autonomous organization? Here is a quote from the IPCC's organizational statement:

> The IPCC is a *scientific* body … By endorsing the IPCC reports, governments acknowledge the *authority* of their scientific content. The work of the organization is therefore policy-relevant and yet policy-neutral, never policy-prescriptive. (IPCC; emphasis added)[7]

The IPCC certainly stresses its scientific authority, but it also seems to place restrictions on the extent of its authority: the IPCC claims that its work is policy-relevant yet policy-neutral, never policy-prescriptive.

One might ask whether policy-relevant yet policy-neutral work on climate change is even possible.[8] However, we do not really need to consider the possibility claim here. It suffices for our purposes merely to report that the statement itself is the product of political negotiation, purportedly designed to limit the degree to which this "scientific" body could influence intergovernmental negotiation of climate policy.[9] So, too, is every other statement publicly released by the IPCC politically negotiated: not just the "Summary for Policymakers" released along with each Working Group Report (I, II, and III), but the Working Group Reports themselves as well as the overall Synthesis Report that accompanies each cycle of work by the IPCC (e.g., the latest Fifth Assessment Report, or AR5).

7. http://www.ipcc.ch/organization/organization.shtml (accessed 29 August 2016)
8. As we do in "Neutrality, Relevance, Prescription, and the IPCC" (under review).
9. According to a source privy to the negotiation process.

Although it has been widely reported that political actors and scientists negotiate the text of each "Summary for Policymakers" line-by-line (see, e.g., Broome 2014), the rest of the material released by the IPCC is not usually presented in this way. For example, just last year the *New York Times* (NYT) reported on the release of a draft of a new statement on climate change by the IPCC:

> An international panel of scientists has found with near certainty that human activity is the cause of most of the temperature increases of recent decades, and warns that sea levels could conceivably rise by more than three feet by the end of the century if emissions continue at a runaway pace. The scientists, whose findings are reported in a draft summary of the next big United Nations climate report, largely dismiss a recent slowdown in the pace of global warming, which is often cited by climate change doubters, attributing it most likely to short-term factors. …The draft comes from the Intergovernmental Panel on Climate Change, a body of several hundred scientists that won the Nobel Peace Prize in 2007, along with Al Gore. Its summaries, published every five or six years, are considered the definitive assessment of the risks of climate change, and they influence the actions of governments around the world. Hundreds of billions of dollars are being spent on efforts to reduce greenhouse emissions, for instance, largely on the basis of the group's findings. (Gillis 2013)

It is utterly commonplace to present the IPCC reports, as the NYT does here, as containing scientific "findings" and as "coming from" a body of scientists. However, this representation of the IPCC process is misleading. The IPCC reports certainly draw from an extensive library of peer-reviewed publications containing scientific findings, and scientists are involved in the process of drafting each report. However, they are by no means the only ones involved in the process of authoring the reports. Governments and observer organizations are involved from the very beginning of each IPCC reporting cycle—for example, in the structuring of each Working Group. These governments and observer organizations are also the ones to nominate the "experts" who act as the Coordinating Lead Authors, Lead Authors, Review Editors, Expert Reviewers, and Government Reviewers of the IPCC reports, and these nominees are certainly not all scientists themselves.[10]

10. For lists of authors, etc. to the latest (AR5) reports, see: Working Group I: http://www.climatechange2013.org/images/uploads/WG1AR5_CLAsLAsREsAnnexEditors_FINAL.pdf;

Delegates directly appointed by the governments themselves, for instance, conduct government review of the reports. These people are often civil servants and trained negotiators from agencies like the U.S. State Department, and every word in every IPCC document must pass government review. Generally, the text of each segment of each IPCC Working Group Report, as well as each Summary for Policy Makers and each overall Assessment Report, is the result of line-by-line negotiation held between IPCC scientists, assorted "experts," governmental delegates, and trained negotiators.

The IPCC makes information about this process—about the way each IPCC report is generated—public and widely available. (See, for example, the "IPCC Process" interactive graphic available on the Working Group I's current website[11]). But somehow, this is not how the IPCC is widely reported on and publically perceived. In a sense, there is another source of troubling disconnect here: between how the process of generating the IPCC reports on climate change actually proceeds, and how that process is presented and perceived.

There is a remarkable contrast between the widespread perception of the IPCC reports as stemming from a traditionally scientific process, and what the IPCC openly says about their process: "It is important that Reports describe different (possibly controversial) scientific, technical, and socio-economic views on a subject, particularly if they are relevant to the policy debate" (IPCC Working Group I 2013). In addition, here is something that an author recently said publicly, about the process of revising a Summary for Policymakers: "To achieve consensus, the text of the SPM was made vaguer in many places, and its content diluted to the extent that in some places not much substance remained" (Broome 2014). In light of all this, it seems quite a stretch to view the IPCC as an autonomous scientific organization, free from the burdens of public representation, authorization, and accountability. Instead, the IPCC seems rather to be quite politically accountable—but to semi-clandestine political forces rather than openly democratic or traditionally scientific ones.

This is a problem; so is the dissonance between the perception of the IPCC Reports as the product of a scientific organization (recall the gloss of the IPCC as composed of "several hundred scientists" (Gillis 2013), and their actual authorship (by thousands of scientists, nominees, representatives, delegates, and negotiators—many appointed by governments). For surely, much of the praise for and authority of the IPCC comes from the

Working Group II: http://ipcc-wg2.gov/AR5/images/uploads/WGII-AR5_Authors.pdf; and Working Group III: http://mitigation2014.org/contributor/all-authors

11. http://www.climatechange2013.org/ipcc-process/

presentation of the IPCC as a *scientific* organization, with all the attendant authority and autonomy.[12] Whether reasonable or not (and we have suggested it is not), much of the public's acceptance of scientific authority comes from a parallel perception of scientific autonomy—of the freedom of science from certain kinds of influences, such as undue political influence. By infiltrating a supposedly scientific organization, unwarranted political forces have been able to shape a supposedly scientific product, retaining its scientific authority for their own creation. In other words, science advising is subject to a form of undue political appropriation—akin to regulatory capture—which subsumes the sheen of scientific authority for predominately non-scientific processes, especially when done according to models that assume science is simultaneously *autonomous from* and *authoritative for* policy.

Let us be clear. The problem is not that the IPCC process is (at least partially) a political process, or that political representatives are participants in the IPCC process (scientific or otherwise). Insofar as science generally and science advising especially are deeply value-laden enterprises, such processes are unavoidably political. As we will discuss later on, an ideal science advising process would ensure cooperation between scientists and policymakers. Rather, the problems are: the widespread misrepresentation of the IPCC process as one that is value-free and apolitical; the misguided use of the supposed (but nonexistent) autonomy of the process to justify its scientific authority; and the concomitant inability of the public or their political representatives to hold the IPCC accountable to the public interests, as opposed to merely epistemic norms.[13]

In this manner and others, the disconnect problem in climate change has been amplified and sustained—allowing for ongoing political inaction, for instance, despite remarkable scientific consensus. In the next section we offer concrete solutions to various dimensions of this manifestation of the disconnect problem, particularly as relate to the problematic deployment of scientific authority in the case of climate change.

5. Reducing the Disconnect

As philosophers of science we do not expect to be able to make the scientific models of climate change, say, any less complicated or more certain; nor do we expect to be able to provide an abstract solution to the massive collective action problem that looms over the politics of climate change. We will leave that to the scientists and the ethicists, respectively. What

12. Recall that the IPCC was awarded the Nobel Peace Prize in 2007 (with Al Gore).

13. Hence, opponents routinely critique the IPCC or climate scientists for doing "junk science" or for being "biased"—but rarely, if ever, for failing to act in the public interest.

we will try to do here, however, is to offer concrete solutions to those aspects of the problem generating severe and persistent disconnect between climate science and policy resulting from the problematic deployment of scientific authority.

The issues relating to scientific authority outlined in sections 3 and 4 involved contradictory appeals, disassociated experts, and inadequate models of science advising with attendant susceptibility to unduly appropriated processes. We address each issue in turn. First, on contradictory appeals: this is the area that has been best addressed in already existing scholarship—namely, the scholarship addressing the problems of conflicting experts, accusations of "junk" science, and so on. Science studies scholars are writing book-length exposés of the ways in which industry and special interests manufacture "scientific" uncertainty with respect to public health and environmental issues like secondhand smoke and climate change (Michaels 2008; Oreskes and Conway 2010). Philosophers, scientists, and legal scholars are exploring and publicizing the ways in which industry, politically founded organizations, private foundations, and think tanks are interfering with science by using tactics like ghostwriting, intimidation, lobbying, selective funding initiatives, and suppression of negative experimental results (Golomb 2007, 2009; McGarity and Wagner 2008; McHenry 2010). Philosophers of science are also developing detailed, actionable theories of expertise, dissent, risk, and uncertainty—theories that should be able to help mediate cases where there is legitimate debate about the issues to be had (Cranor 1990; Solomon 2006; Douglas 2008).

The more we pursue these sorts of efforts academically and the more we present them *publically*, the harder it should be for nonscientific influence to be packaged as credible scientific authority. This work will help inform the public with a more realistic understanding of science, though the problem is not merely a deficit of knowledge on the part of the public.[14] Rather, this sort of work can help address the issue of dissociated experts. Raising awareness about the role of values in science puts the onus on scientists to be more engaged with the interests of the public, while giving the public the right and responsibility to call scientists to account as representatives of those interests.

Scientific experts have too long been distanced from the public interests they supposedly serve, with grave results in many cases—as with the case of climate science. With regard to the role of values in research decisions being made by scientists and pertaining to climate change, the error

14. Thanks to an anonymous reviewer for pressing us to differentiate this problem from the deficit model.

argument[15] forcefully applies. According to the error argument, scientific research is endemically uncertain, and yet scientists must choose to accept or reject hypotheses in the face of those uncertainties. Sometimes, as in the case of climate change, the decision to accept or reject is socially consequential and politically high-stakes; policy makers and other nonscientists trying to craft (or frustrate) policy solutions can potentially take up any results. Under such conditions, scientists are obligated to consider the consequences of erring in either rejecting or accepting their hypotheses—as shown by Douglas (2000). The social consequences of error require climate scientists to take into account the bearing of values on their research decisions, in order to be upfront and socially responsible. Under such conditions, not taking values into account while doing climate research—by not considering the foreseeable social consequences of the research—amounts to a kind of negligence with respect to the social consequences of the research by the scientists conducting it (Douglas 2009, pp. 68–70).

Therefore, we suggest that one very important way to address this aspect of the climate change disconnect problem is to wholeheartedly integrate social values into climate science. The idea here, of course, is not to entirely replace the traditional epistemic values of science with social ones; rather, it is to find a way to openly and explicitly integrate both epistemic and social values in climate science. This will require broad reform throughout the field: climate scientists will have to solicit and integrate public opinion on candidate values; stakeholders might need to get directly or representationally involved in the scientific process; and scientists will have to find ways to incorporate these value judgments into their research. They might even need to ask social scientists for help with this project.

Not only would climate scientists need to make value judgments throughout the course of their research, but they would also need to make these judgments explicit when reporting their findings (Douglas 2009, pp. 153–55). In fact, following Douglas, we recommend that climate scientists consider, in their scientific publications, openly and explicitly acknowledging not only the role of values in making research decisions, but also the personal and public aims of research projects, and the potential political and social consequences of scientific findings.[16] One substantial benefit

15. This is the name given by Elliott (2011) as well as M. J. Brown (2013a). Douglas (2000, 2009), who is primarily responsible for bringing the attention of contemporary philosophers of science to this argument, refers to it as the argument from inductive risk.

16. One might think that requiring this sort of disclosure would be unduly burdensome on scientists, or that it would unnecessarily erode scientific authority. There are substantive concerns to discuss here, but for now we will simply point out that similar objections were raised when it was initially suggested that scientists ought to begin acknowledging their

to incorporating public value judgments in climate science is that more research could focus explicitly on particular policy proposals, which already have a measure of support, for climate mitigation and adaptation. This sort of research would have to be packaged in ways that are maximally perspicuous to non-experts, and usable in a variety of contexts. Relevance for use and policy is earned, not given—and careful packaging of results would help to encourage collaborative efforts between climate scientists and policy experts in finding policy solutions.

This proposed integration of climate science with public interest also suggests a parallel integration of scientific method with policy implementation. Policies are themselves a kind of hypothesis: they are a prediction that certain interventions will lead to a more desirable future. However and whenever policymakers come to a decision about what policies to implement, we suggest that they treat the implementation of these policies as scientific tests of the hypothesis that such policies are effective. The ultimate test of a climate policy is the consequences of its implementation, something that ought to be monitored and, if necessary, adjusted over time. Moreover, just as climate scientists must collaborate with the public and with policy experts, policy experts could rely on policy-prescriptive climate research to indirectly test policy proposals before acting. This work would require cooperation between (at least) three distinct types of experts—climatologists, social scientists, and policymakers—as well as the public, in the form of large-scale interdisciplinary inquiry. Our hope is that this way of construction, experimentation, and testing of hypothetical policies will help mitigate paternalistic, top-down elements in their current design, and to suggest empowering, bottom-up policies instead—ultimately narrowing the gap between all sorts of experts and the public, re-associating the classes.

In sum, we advise abandoning any pretense or presentation of the value-free ideal in this context, for both climate science and policy. As powerful as this ideal has been in many arenas, it simply is not working in this context. Climate skeptics and advocates alike understand that climate scientists, policymakers, and just about everyone else involved has a stake in this global matter. Our proposed reforms to climate science and policy are an opportunity to restore public faith in science and policy more generally.

This brings us to the third and final aspect of the disconnect problem for climate change that we will discuss here: models of science advising and unduly appropriated processes. Another major source of the problem for public trust of climate science derives from the tension between the

conflicts of interest when publishing, and yet making this sort of acknowledgement has rather rapidly and uncontroversially become standard practice.

perceived authority of climate science over policy, along with its simultaneous autonomy from democratic representation, authorization, and accountability. Even worse, this sort of autonomy from public interest is extremely fragile—as we have seen, it creates an opportunity for organizational or institutional appropriation of scientific processes by non-scientific interests, such as undue political ones. We suggest that one first step is to try to change the perception of the IPCC as an autonomous scientific organization (and we hope to contribute to that effort with this paper, among other things). This should mitigate the problem of lending undiluted scientific authority to an indisputably political product.

Another step is to encourage scholars, reporters, and the public to focus on the publicly-available but oft-overlooked original materials—such as the Underlying Scientific/Technical Assessments and Supporting Materials[17]—on which the more widely-disseminated IPCC reports—such as the Summaries for Policymakers[18] and the overall Synthesis Report—are based. The IPCC, to their credit, now makes available documents which track the changes made to (for instance) the Working Group Reports as a result of political intervention on the corresponding Summaries for Policymakers.[19] In other words, it is possible to look at each IPCC report and to see how earlier versions initially drafted mostly by scientists are diluted and "made vaguer" through the intervention of delegates and negotiators. Unless and until a more publically responsible mechanism for coordinating science with social values is put in place, we advocate the use of those early, more scientific drafts, as well as the original source material, rather than the later, highly politicized products—and we especially recommend avoiding the extremely heavily negotiated Summary for Policymakers for the AR5's overall Synthesis Report.

Yet another step could be to foster alternative scientific organizations for policy advising on this matter. Any such competitor with the IPCC should be

17. Supporting materials available here: https://www.ipcc.ch/publications_and_data/publications_and_data_supporting_material.shtml

18. There is now, upon completion of the IPCC's Fifth Assessment Report (AR5), a "Summary for Policymakers" for each component of the report—all three Working Group Reports, as well as the overall Synthesis Report. It is worth comparing each summary with its full version, in all four cases.

19. Changes to the Underlying Scientific/Technical Assessment for Working Group I available here: http://www.ipcc.ch/meetings/session36/p36_doc4_changes_underlying_assessment.pdf

For Working Group II: http://www.ipcc.ch/apps/eventmanager/documents/7/030420140913-Doc.%204,%20Corr.2%20-%20Changes%20to%20the%20Underlying%20Scientific-Technical%20Assessment%20-%20Copy.pdf

For Working Group III: http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/drafts/fgd/ipcc_wg3_ar5_final-draft_postplenary_tricklebacks.pdf

All such materials linked from: http://www.ipcc.ch/report/ar5/syr/

well aware of the danger of undue political appropriation—and could limit the opportunity for this sort of capture by incorporating warranted public (rather than unwarranted political) restrictions on their autonomy from the outset. This could be done, for example, by finding ways to make the organization openly and publicly representative, authoritative, and accountable. The potential cost of this suggestion is that we would, again, have to deal with a multitude of potentially conflicting scientific advice; we believe it is nonetheless an improvement over a false sense of scientifically authoritative agreement attributed to a politically negotiated product.

Of course, this suggestion would also require that any alternative organization abandon the dominant models of science advising, and take up an alternate model instead. As we have said, both the linear model and that of evidence-based policy assume that science is simultaneously authoritative for and autonomous from policy and public interest. By adopting the recommended restrictions on autonomy, in the form of public representation, authorization, and accountability, such an organization would not fit either the linear model or that of evidence-based policy.

Therefore, we need an alternate approach to science advising—and we provide one in the next, penultimate section of the paper.

6. An Alternative Framework for Science Advising

In the previous section we offered a host of concrete suggestions for solving various dimensions of the disconnect problem for climate change. In offering our solutions, we focused especially on those dimensions of the disconnect problem, initially presented in sections 3 and 4, which had to do mainly with the problematic deployment of scientific authority. We suggested that scholarly efforts continue to understand and publicize the manufacturing of scientific doubt and public distrust, the difference between proper and improper science, and the options for navigating dissent, risk, and uncertainty in science. We recommended that climate scientists abandon the value-free ideal in this context, and find ways to incorporate public interest into their work. We advised that they make value judgments explicit in their scientific publications, and that they design more research directly aimed at value-laden proposals for climate mitigation and adaptation. We also recommended that climate policymakers develop a more scientific, hypothesis-driven approach to the implementation of their own legislative proposals. Finally, we advocated for reforms to the IPCC—both in the way that the organization is perceived and in the way that its reports are utilized. We suggested that it might be worth having additional, alternative scientific organizations available for advising on climate policy. And we inferred that, in order to avoid the risks of undue appropriation (such as those which have befallen the IPCC), such alternative

organizations would need to adopt a new model of science advising—a model that does not combine widespread authority with unchecked autonomy.

In this section, we offer just such a model. And though it has been prompted by our review of the disconnect problem in the case of climate change, it is by no means restricted in application to this case. We propose that a significant component of the disconnect problem for science and policy might be addressed, wherever it arises, by replacing either of the dominant models of science advising with our alternative model. Rather than being a unidirectional model of science-based policy, this model provides for an integrative reform of science, policy, and science-policy interaction. It is a model which offers a strong and lasting ground for scientific authority—by matching it with public representation, authorization, and accountability. It is a feminist-pragmatist model of science-policy interaction.

The pragmatist model of inquiry, first proposed by C.S. Peirce (1877) and further developed by John Dewey (1938),[20] is contextual, functionalist, value-laden, and democratic. Our feminist-pragmatist model of science-policy interaction emphasizes these four features from the earlier pragmatist model of inquiry, and updates them with recent feminist work in the philosophy of science:

- Pragmatists treat inquiry as a *contextual* process, where the context is set by a problem to be solved. According to the pragmatist, without a positive reason for doubt there is no call for inquiry; habit and belief carry the day. Genuine doubts or problems arise from disturbances that occur in the course of habitual behavior or established practice, including the beliefs and norms connected with those activities.
- Pragmatists are *functionalists* about inquiry in that the components of inquiry—hypotheses, theories, data, experiments, etc.—are defined functionally. In other words, the methods, evidence, and conclusions of inquiry are endorsed on the basis of the way they function together to resolve problems. The test of suitability of both evidence and theory is one of fitness—they must fit together according to their functional roles in a way that allows for the resolution of the problem.[21]

20. On pragmatist models of inquiry, see Hickman 2007, Dorstewitz 2011, M. J. Brown 2012.

21. As a result of this functionalist contextualism, the methods, evidence, and conclusions of inquiry cannot "plug and play" into inquiries in radically different contexts. One can neither assume that a theory which contributed to the solution of one problem will be fit to resolve another, nor that the evidence suitable in one situation will be suitable in another. Their relevance and adequacy must be established by new inquiry.

- Pragmatists have also long insisted that science is *value-laden*: values play a role in all inquiry, and the dichotomy of fact and value is untenable. Feminist philosophers of science, over the past several decades, have more clearly articulated precisely why and how value judgments play a role (e.g., Longino 1990, 2002; Rooney 1992; Douglas 2000, 2009; Anderson 2004; Kourany 2010).[22] Not only do values play a role in scientific activity in fact; these feminist and pragmatist philosophers make the normative claim that such values ought to or must do so. This raises the important question: whose values ought to play a role? Not just the scientists' values, which feminist research has shown are often biased, e.g., patriarchal and sexist. For similar reasons, the dominant values in the political power structure are unsuitable. While some philosophers might be tempted to retreat to an abstraction—"just use the correct ethical and political values"—feminist pragmatists require an ideal that works in practice. The approach to value judgments that avoids patriarchy and entrenched but unjust power structures is a thoroughly democratic one.
- And though this feminist-pragmatist approach to inquiry is *democratic*, it should by no means devolve into values by majority rule. Democracy requires procedures that involve or represent the voices of all of those who are affected. Feminist democratic theorists have articulated various conceptions of democracy (Fraser 1989; Mouffe 1992; Young 2000), but what they all share is the idea that democracy should be structured to avoid reenacting extant power imbalances. The feminist-pragmatist model of science-policy interaction requires policy-relevant research to follow procedures that involves representation or participation of all stakeholders.[23]

Rather than thinking of science as private and autonomous, on this approach science is seen as a democratically-accountable public institution, with the ethical-political obligations that entails. Science is not only responsible to its own internal, epistemic norms; it must also be socially responsible (Kourany 2010). As an institution with public authority, it

22. Again, one influential line of argument known as the error argument, or the argument from inductive risk, begins from the realization that the process of inquiry involves uncertainty at various stages. Furthermore, the results of many inquiries will have foreseeable social consequences and policy implications. Uncertainty requires judgment and evaluation and thus, under such conditions, consideration of social and ethical values (Douglas 2000, 2009).

23. Such as the model of *Understanding Risk* (Stern and Fineberg 1996).

cannot maintain complete autonomy: we must hold it publicly accountable for its values. These values, which play a role in guiding scientific practice, must be in the public interest.

Replacing the linear model of science advising as well as that of evidence-based policy with this feminist-pragmatist model also has implications for the nature and role of scientific expertise—another issue that has concerned us throughout this paper. Since science is a public institution, because values play a role in science, and given the fact that scientific results are contextual, in order to more appropriately configure the connection between science and policy, we must reinterpret the relationship between scientific experts and policymakers.

There is currently an unstable conceptual divide: between the scientists (experts who deal in facts, information, and causal hypotheses) and the policymakers (those who deal in values and ought to represent the public interest). Adopting this distinction, the two groups relate only when policymakers query experts for information needed to evaluate policy options, and then use the scientific response to select options that satisfy public interest. This demarcation of roles is untenable; scientists and policymakers are both experts and representatives, engaged in inquiries with a different focus but the same basic shape.

According to our feminist-pragmatist account, policymaking is itself an inquiry that responds to social problems. Policies are hypotheses for solving those problems, and their implementation should be thought of as provisional experimental tests rather than finalities. This change of perspective encourages the measurement and tracking of consequences and efficacy of adopted policies, and avoids the tendency to use scientific uncertainty as a "dodge" for politically hazardous decisions (Herrick and Sarewitz 2000). If a policy is successful in resolving the problem that spurred it, the policy should remain in place; if not, policymakers should go back to the drawing board.

Accordingly, within our framework policymakers are also "experts"—they are inquirers who organize processes of policy-based hypothesizing and experimentation. Whenever necessary, other kinds of experts (like scientific experts) should weigh in, but not by constructing and delivering pre-packaged knowledge. Rather, they are collaborators in a shared inquiry. Science-policy interaction should proceed, not according to the linear model or that of evidence-based policy, but instead along the lines of any interdisciplinary scientific inquiry (e.g., physical chemistry; biochemistry; biophysics).

And just as science on this account must involve public participation and representation, so too must policy. When the results of science, policy, or any inquiry have consequences for matters of public interest, the

activities of these domains must incorporate value judgments about those consequences for public interest. While only some parts of science are public in this sense, policy is public by definition. In sum, we propose a model of science advising according to which:

- Science and policy are seen as forms of inquiry that are contextual, functionalistic, and value laden.
- Science and policy are conducted according to norms of democratic representation and public accountability.
- Policies are hypotheses for solving social problems, and their implementations are provisional, experimental tests.
- Scientists and policymakers must both become expert inquirers and representatives of the public trust, and science advising must become interdisciplinary inquiry between the two groups of experts.

Of course, the real challenge will be putting such a model into practice.

7. Conclusion

We have articulated and defended an alternative framework for science, politics, and policymaking that is both feminist and pragmatist. This approach affects an integration of science and politics by democratizing science and scientizing politics while retaining the distinctive function and value of each. It is an approach that has emerged from our attempt to concretely address the disconnect problem as it has arisen in the case of anthropogenic global climate change.

We began this paper with a discussion of the disconnect problem, in general and as a particular, significant impediment to addressing climate change. Our scrutiny of the disconnect problem in the context of climate change focused on those parts of the problem which related to the problematic deployment of scientific authority, and led to the suggestion of many reforms of both climate science and climate policy. Some of these suggestions required an alternative model of science advising; and so we offered a feminist-pragmatist account of science-policy interaction. This account contributes to the resolution of the disconnect problem in this instance—reducing the intractability of climate change—and suggests broad reforms to science, politics, and policymaking—which could help to solve the disconnect problem in other instances as well.

We know that some of our suggestions are radical ones, and that it will be difficult to implement all of them and bring about the sort of substantive change to science-policy interaction that we are advising. But it should not be too hard to begin by taking some immediate first steps: by revising the general perception of the IPCC; by dialoging with climate scientists about how values are currently being incorporated into scientific practice, and

how they might be more productively and appropriately incorporated; and by developing a strong alternative to the dominant models of science policy. In the first case, we hope that this very paper (among other things) might help to alter the way science studies scholars, at least, view the IPCC. The second recommendation is also one that we ourselves are currently in the process of pursuing, by engaging with both scientific and political actors privy to the IPCC negotiation process, and publicizing the results of that engagement (in this paper and elsewhere[24]). Finally, as regards the development of an alternative model of science advising, this is again work that we begin here while also pursuing it more exclusively and exhaustively elsewhere (see Brown and Havstad forthcoming). And happily, we are not the only ones developing such alternatives.[25]

One last note about the value of our alternative model of science advising, as well as the overall approach we have adopted throughout this paper: feminism and pragmatism are approaches to philosophy of science that we may profitably call *political* philosophies of science. They urge us to consider science not as a thing apart, but as involved in human lives, and thus laden with ethical and political import. These approaches aim to make philosophy of science "more socially engaged and socially responsible" (Kourany 2010). Recently there have been calls for "Making Philosophy of Science More Socially Relevant" (Plaisance and Fehr 2010),[26] and we endorse these appeals. By adopting a feminist-pragmatist perspective, we are practicing socially relevant philosophy of science. Especially when philosophizing about scientific issues with overwhelming implications for public welfare, as is the case with the problem of anthropogenic global climate change, just such a politically informed and ethically considerate approach is not only warranted but also required.

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24. Such as in our "Neutrality, Relevance, Prescription, and the IPCC" (under review).

25. See recent work by Justin Biddle and Eric Winsberg (2010), Kristen Intemann (2015), and Wendy Parker (2014), among others.

26. See also the 2008 Pacific APA mini-conference and the recently formed Consortium for Socially Relevant Philosophy of/in Science and Engineering (SRPoiSE) at: http://srpoise.org/

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