

Neutrality, Relevance, Prescription, and the IPCC¹

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Abstract

The Intergovernmental Panel on Climate Change (IPCC) states that its assessment reports are “policy-relevant and yet policy-neutral, never policy-prescriptive.” Here we investigate the meaning of that statement. Far from being a mere philosophical exercise, our investigation reveals that at least one of the components within the statement—the claim to policy-neutrality—is extremely misleading.

Misunderstandings of this neutrality claim have resulted in real harm to the IPCC’s efforts and image. In an effort to assist the IPCC in its endeavors, and to help restore its credibility, we explore possible interpretations of the term “neutrality,” expose past sources of misunderstanding, and suggest a plausible way of interpreting the term which is both defensible as a goal and fits with the actual activities of the IPCC. We suggest that the IPCC at minimum endorse this understanding of the “neutrality” term. Future science advising efforts should carefully choose how they present their aims, to avoid the potential confusions created by misleading connotations of “neutrality.”

Introduction

Climate change presents a singularly difficult challenge for science, for politics, and especially for the ways in which science informs politics and policymaking. The Intergovernmental Panel on Climate Change (IPCC) is the primary body producing comprehensive reports on the state of climate science, on the potential impacts of climate change on natural and socioeconomic systems, and on possible policy measures (with the support of the United Nations and the World Meteorological Organization). In its organizational statement, the IPCC makes the following declaration about its work:

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.²

In this paper, we analyze what this combination of claims—to policy-relevance, and to policy-neutrality, but never policy-prescription—could possibly mean. Our analysis reveals that, given what is clearly meant by the terms “relevance” and “prescription” in this context, many candidate senses of the term “neutrality”

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

² Available here: <http://www.ipcc.ch/organization/organization.shtml>

cannot in fact apply to the IPCC's organizational statement. We suggest a plausible interpretation of the "neutrality" term, one that is compatible with both of the other terms in the organizational statement ("relevance" and "prescription"), and we recommend that, going forward, the IPCC either clearly adopt this sense of the term "neutrality," or revise their organizational statement, due to the confusion and harm wrought by its ambiguity.

Far from being a mere philosophical quibble, common misconceptions about the IPCC's claim to policy-neutrality have threatened the ability of the IPCC to both make credible claims (to the public) and give effective advice (to governments). With regard to public credibility: a variety of journalists, policy-makers, skeptics, and deniers have focused on the IPCC's claim to policy-neutrality, along with its supposed failures to uphold neutrality, as reasons to distrust the IPCC. For instance, Mark Lynas, in a commentary in *Nature Climate Change* (2011), lambasts the IPCC for failing to uphold its own neutrality standards, because of the role of environmental activists in contributing to the report—as if that constituted an illicit conflict of interest. A right-wing news site made use of the "policy-neutral" language to lambast the IPCC chairman for appealing to "grassroots action" on climate change—as if advocating for democratic participation in addressing the very real problems of climate change were some form of inappropriate political advocacy (Goodenough, 2010). And climate change denier blogs regularly make reference to the IPCC's language of neutrality—contrasting this "ideal" with whatever actions they imagine to be non-neutral interventions by the IPCC in the policy realm (e.g., Laframboise 2013). Misunderstandings of what is meant by the IPCC's claim to policy-neutrality are a serious threat to the organization's public credibility.

As for scientific advice to governments: mistaken expectations about what is meant by "policy-neutrality" have contributed (along with other factors) to widespread difficulty in translating the scientific contents of the IPCC's reports into recommendations for policy-makers. This difficulty is evidenced by the convoluted, controversial process by which each IPCC working group generates its reports, and especially its "Summary for Policymakers" (SPM). The IPCC reports go through multiple drafts, and at each stage these reports accrue comments made not only by scientific experts, but also by appointees, consultants, and other representatives of governments. John Broome (2014) highlights the SPMs as subject to an especially political process, one that involves a so-called "Approval Session" where "every single sentence of the SPM has to be either approved or rejected by delegates from governments." Appeals to the need for consensus and to the legal status of the IPCC reports can spur delegates to suggest various changes to the IPCC reports (Broome 2014). Many scientists involved find the process frustrating, arguing that it is tainted by conflicts of interest that violate neutrality, and that it dilutes the scientific content of the summaries; others argue that the process lends the IPCC reports credibility ("Inside the sausage factory," 2014). It is apparent that different parties to

the negotiation are working with different conceptions of: what is required for proper consensus; what the legal status of the IPCC reports will be; what counts as a conflict of interest; what the outcome in terms of scientific content of the IPCC reports should be; what generates credibility; and what satisfies the IPCC's claim to neutrality—among others. Though we cannot hope to address all of the competing (mis)conceptions here, we will attempt to conclusively resolve the neutrality issue.

In what follows, we initially assess how to interpret the IPCC's bipartite claim to policy-relevance without policy-prescription. This is a good place to start because straightforward senses of the terms "relevance" and "prescription" are readily suggested by the context of the IPCC's organizational statement, and by what is implied in their use of all three terms together ("neutrality," "relevance," and "prescription"). The hard part is in deducing what could possibly be meant by "neutrality," given what is apparently meant by "relevance" and "prescription." So, next we explore all plausible interpretations of the claim to policy-neutrality, uncovering various sources of the harmful misunderstandings detailed above along the way. Finally, we settle on an interpretation of the "neutrality" term—one that works well with the conjoined claims about relevance and prescription, while also clarifying what does and does not violate the IPCC's claim to neutrality in this sense. On this interpretation, the IPCC's actions fit well with the description in the original statement. This usage is not entirely obvious; the existence of a defensible interpretation does not vindicate the original phrase as a good explanation of what it is the IPCC aims to do. Clarifying their aims along the lines we suggest here can only go so far to mitigate the misleading and problematic interpretations of the term "policy-neutral." The IPCC may, for political reasons, be unable to revise their organizational statement to clarify its meaning, so we recommend that the IPCC at least strongly and consistently endorse this interpretation of "neutrality" in its future reports and statements, while other future science advising and assessment efforts adopt less problematic language.

Relevance and Prescription

It's easy to understand how policy-irrelevant work might seem policy-neutral and non-prescriptive. For instance, we might say that the study of gravity waves or cystic fibrosis is work that is clearly neutral and non-prescriptive with respect to global climate policy—as such work is (presumably) totally irrelevant to such policy. It's similarly easy to understand how certain kinds of policy-relevant work might appear non-neutral and policy-prescriptive. For instance, various failed attempts to engineer nuclear or solar power plants in particular ways might be obviously relevant to global climate policy—but the analysis of the failure obviously directly involves ruling those attempts out as available policy options (which non-neutrally prescribes against them). The challenge is in properly characterizing the policy-relevant work that is (a) done by the IPCC and (b) neutrally non-prescriptive.

Regarding (a), the IPCC was founded in 1988, in order to “provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts” (another quote from the IPCC’s organizational statement). Since its founding, the IPCC has released a series of reports that have changed somewhat in nature and number with each reporting cycle. The fifth cycle of reports (AR5) was completed in 2014, and its reports can be divided into four distinct clusters. There are three major working groups (WG) within the IPCC: WGI, which focuses on the “physical science basis” for climate change; WGII, which focuses on “impacts, adaptation, and vulnerability”; and WGIII, which focuses on “mitigation.” During the fifth cycle of reporting, WGI and WGIII each produced one comprehensive report (1,552 and 1,454 pages, respectively), while WGII divided their report into two parts: Part A (“Global and Sectoral Aspects,” 1,150 pages) and Part B (“Regional Aspects,” 696 pages). Along with these four volumes, a condensed “Summary for Policymakers” (SPM) was produced for each of the three working groups (I: 28 pages; II: 34 pages; and III: 32 pages).³ Finally, a “Synthesis Report” (80 pages) was also produced, which (unsurprisingly) synthesized the information presented in the reports by working groups I, II, and III—and a condensed version of that synthesis was presented in one final SPM (32 pages). All in all, the IPCC produced five volumes and four SPMs in its latest reporting cycle, totaling just over 5,000 pages of unique material. Planning for the sixth assessment cycle of reporting (AR6) has already begun; completion of the AR6 “Synthesis Report” is scheduled for 2022.

Obviously, the IPCC does a lot of work, and this work is of many different kinds. And yet it is made very clear that the IPCC “does not conduct any research nor does it monitor climate related data or parameters” (one final quote from the organizational statement). So just what kind of presumably relevant-yet-neutral, never prescriptive work does the IPCC do? Well, here is a pair of quotes from the AR5 Synthesis Report (not its Summary for Policymakers):

Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems. (IPCC 2014d, 40)

Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen. (ibid.)

And here is a quote from the AR5 WGI report (not its SPM):

While the first IPCC assessment depended primarily on observed changes in surface temperature and climate model analyses, more recent

³ Each working group’s SPM is also included in each major report produced by that working group.

assessments include multiple lines of evidence for climate change. (IPCC 2013, 129).

According to the Foreword to both Parts A and B of the WGII main report (not SPM), this particular (combined) volume...

...addresses impacts that have already occurred and risks of future impacts, especially the way those risks change with the amount of climate change that occurs and with investments in adaptation to climate changes that cannot be avoided. For both past and future impacts, a core focus of the assessment is characterizing knowledge about vulnerability, the characteristics and interactions that make some events devastating, while other pass with little notice. (IPCC 2014a/b, vii)

Finally, the WGIII main report (not SPM) declares that:

Throughout [this report], the focus is on the implications of its findings for policy, without being prescriptive about the particular policies that governments and other important participants in the policy process should adopt. In light of the IPCC's mandate, authors in WGIII were guided by several principles when assembling this assessment: (1) to be explicit about mitigation options, (2) to be explicit about their costs and about their risks and opportunities vis-à-vis other development priorities, (3) and to be explicit about the underlying criteria, concepts, and methods for evaluating alternative policies. (IPCC 2014c, 38)

This is merely a handful of quotes from an extremely large body of recent work by the IPCC, but even just this set of statements showcases a wide variety of interestingly different kinds of work being done. This work apparently includes: unequivocally establishing the existence of anthropogenic climate change and of its impacts on humans as well as the natural world; establishing multiple lines of scientific evidence for this phenomenon and for its effects; characterizing past and future impacts of climate change in terms of both their consequences and risks; evaluating the nature of these impacts, both felt and unnoticed; assembling options for response to the phenomenon and its impacts; evaluating the nature of these options; and being explicit about the character of that evaluation.

Surveying the IPCC's work in this way reveals that it is an organization dedicated to characterizing the phenomenon of climate change, its ongoing impacts, and what actions are available with respect to that phenomenon and its impacts. This suggests an obvious interpretation of the IPCC's claim to policy-relevance: the IPCC provides information about and evidence of the phenomenon of climate change and its effects, which could be useful to policy-makers, should they choose to try and design some course of (in)action with respect to the phenomenon and its effects. The relevance of the IPCC's work comes from its capacity to inform the ongoing understanding of and response to climate change and its impacts.

The funny thing about information and evidence is that it often implies constraints on the resulting array of plausible interpretations of the phenomenon under study and of feasible courses of action with respect to it. This is important for

appreciating how the IPCC's policy-relevant work could and could not also be (b) neutrally non-prescriptive. In light of the relevant information and evidence provided by the IPCC, some interpretations of the phenomenon of climate change (e.g., the atmosphere has warmed by 10°C; the atmosphere has warmed by .85°C; the atmosphere has not warmed at all; the atmosphere has cooled by 1°C) will be more plausible than others. Similarly, some courses of action with respect to climate change (e.g., clapping our hands twice in order to cool the atmosphere by 1°C; designing a working traveling wave reactor to boost nuclear power capabilities; imposing a just global carbon tax; encouraging individuals to carpool to work) will be more feasible than others. Still other actions are entirely unavailable, even to try (e.g., putting the Earth in a giant refrigerator for just a few minutes to cool off). The gist of all this is that, given the informational and evidential character of the policy-relevant work being done by the IPCC, different interpretations of the phenomenon of climate change by policy-makers will not all be equally plausible, and different courses of action designed by policy-makers to respond to climate change will not all be equally feasible. Some might even be impossible. So the claim that the IPCC's work is "policy-neutral" simply cannot mean anything like "equal with respect to all policy," and the corresponding claim that the IPCC's work is "never policy-prescriptive" cannot mean that no policies are ever ruled out.

Still, the quote from WGIII provided above demonstrates that the authors of the IPCC do take their "mandate" seriously—insisting on doing their policy-relevant work "without being prescriptive about the particular policies that governments and other important participants in the policy process should adopt" (IPCC 2014c, 38). This quote, in the context of the above survey and ongoing analysis of the IPCC's work, suggests an obvious interpretation of the IPCC's claim to never do policy-prescriptive work. In short, when the IPCC says that their policy-relevant work is also non-prescriptive, they mean that they never decisively recommend for or against a policy option—*amongst the available courses of action*. This does not mean that their work does not sometimes rule out certain courses of action, and thereby any policies that presuppose the availability of those actions. Nor does it mean that their work does not sometimes make it apparent that certain courses of action are more feasible than others, along with any attendant policies. Indeed, technical, scientific judgment in concert with ethical and political value judgment can powerfully narrow the range of available options, and provide feasibility estimates for the available ones.

But how should we understand the claim of neutrality? At first glance, it seems like the fact that the IPCC's work is policy-relevant as well as informational and evidential in character just means that this work makes certain policy-laden interpretations of the phenomenon of climate change more plausible than others, and certain policy options more feasible than others. In other words, the matter of the IPCC doing policy-relevant work looks precisely like the IPCC being non-

neutral about certain policies. In the next section of the paper, we consider as many candidate conceptions of neutrality as we can, in order to determine in what precise way the IPCC's work could possibly be policy-neutral, given what we have already deduced about what it means for their work to be policy-relevant without being policy-prescriptive.

Candidate Conceptions of Neutrality

The term "neutrality" has many different connotations. For example, to be neutral can mean to be basic, colorless, detached, equivalent, impartial, indifferent, objective, unbiased, or undifferentiated. The context of the IPCC's work rules out some commonsense associations with neutrality (like colorless). We have already ruled out the possibility that, for the IPCC at least, the term "policy-neutral" could mean anything like equal, equivalent, indifferent, or undifferentiated with respect to climate-change-related policy-making. That leaves a cluster of connotations having to do with notions of being basic, detached, impartial, objective, and free from bias.

Philosophers of science have already done a lot of valuable work on the relationship between these sorts of conceptions of neutrality and science in various contexts. So we will now use that work to seek out the right conception of neutrality with which to understand the IPCC's claim to do policy-neutral work. Along the way, we will identify various points at which obvious sources of misunderstanding about the IPCC's claim to neutrality have likely arisen.

Neutrality as Basic Science

One initial way to conceive of what the IPCC might mean by "policy-neutral" work is as basic rather than applied science—a distinction that employs the classically linear model of science, innovation, and policy.

The contemporary notion of basic science and its central role via the linear model owes much to the work of Vannevar Bush (1945). According to the linear model, the core scientific process—the metaphorical "motor" of innovation and application—is unfettered and undirected or "pure" research. Such basic research produces a store of knowledge that allows the prediction and explanation of various natural phenomena, pursued in a fashion that is epistemically insulated—free from considerations of social value, application, or policy. In contrast, it is applied science that takes the information produced by basic research and applies it to various uses—e.g., the creation of technology or the development of a policy. So one way to interpret a claim to be doing "policy-neutral" work might be as a claim to be doing "basic" rather than "applied" research.

But there are many problems with this idea—problems that make this proposed way of understanding the IPCC's "neutrality" term completely untenable. For one, there are widely acknowledged problems with the linear model (e.g., Stern & Fineberg 1996; Brown 2009; Douglas 2009). For another, many have argued that

the supposed distinction between basic and applied research is highly suspect in many contexts (e.g., Shapin 2008; Douglas 2014). Where the distinction fails, there can be no “policy-neutral” science in that context—not in the sense of wholly basic or pure science. And speaking of context, it has also been argued that the linear model is inadequate for describing science-policy interactions in cases that are politically contentious and highly uncertain—as is the case with climate science (Pielke 2007).

And yet perhaps the most obvious and important problem with this idea is simply that much of the IPCC’s work simply doesn’t fit the definition of basic research—even adopting the flawed model, accepting the contested distinction, and ignoring the relevant context. As we have already pointed out, the IPCC itself emphatically states that the organization “does not conduct any research.” But also consider all of the work on adaptation and mitigation being done by working groups II and III: much if not all of it has to do with issues of adaptive technologies, applied mitigation strategies, contrasting policy options, and value trade-offs. This sort of policy-relevant work by the IPCC is obviously not basic scientific research in this linear-model-laden sense of the term. So when the IPCC claims that their policy-relevant work is also policy-neutral, they aren’t saying that the policy-relevant work that they are doing is all basic science.

Neutrality as Value-Freedom

Another familiar way of understanding what it might mean for a scientific process or product to be policy-neutral might be for it to be value-free—that is, to think that value judgments play no role in producing the relevant scientific information, which must remain value-neutral.⁴ This is a likely candidate for many misunderstandings of the IPCC’s claim to policy-neutrality, so the idea is well worth consideration here.

Heather Douglas traces the rise of the contemporary form of the value-free ideal⁵ for science to debates in philosophy of science in the 1950s, during the start of the Cold War, and argues that it was a highly contested view until about 1960 (2009, 45ff.). Some of the key figures who forged the midcentury consensus around the value-free ideal were Reichenbach (1951), Jeffrey (1956), Levi (1960, 1962), and Kuhn (1962). If having a role for values is the major distinction between the scientific process—which aims at accurate description—and the policy process—which decides what to aim for and how to achieve it—then value-freedom is a

⁴ Here the term “value-free” refers exclusively to non-epistemic values—like aesthetic, cognitive, ethical, political, and social values. Epistemic values—like accuracy, explanatory scope, precision, and predictive power—are generally allowed in science, even by the value-free ideal.

⁵ The value-free ideal is also called the “ideal of epistemic purity” by Justin Biddle (2013) and “the value of impartiality” by Hugh Lacey (1995, 2005).

good candidate for interpreting policy-neutrality. Thus understood, the IPCC's work is policy-neutral if values play no role whatsoever in the reasoning processes of the IPCC. This relatively straightforward interpretation is one of the most popular yet least tenable, unfortunately.

Philosophically speaking, a variety of arguments have shown that science is not and cannot be value-free, nor should we desire to have a science that is value-free. For instance, epistemic value-ladenness shows that the research on which the IPCC bases its reports, as well as the reasoning processes used in compiling evidence for the reports, necessarily involves value judgments. One of the most important and powerful arguments for epistemic value-ladenness is the argument from inductive risk (Douglas 2000),⁶ which proceeds as follows: the scientific process is full of uncertain decisions, such as how to characterize data and whether there is enough evidence to accept or reject a hypothesis; sometimes these decisions have foreseeable consequences for society; if so, scientists have a moral responsibility to weigh social values in making those decisions; as such, value judgment is both epistemically and ethically necessary (see also Rudner 1953; Douglas 2000, 2009).

Additionally, semantic value-ladenness shows that the conceptual-linguistic choices made in reporting policy-relevant information necessarily involve value judgments. At least some of the concepts of policy-relevant science are going to be so-called "thick concepts" that contain both descriptive and evaluative content (Williams 1985; Putnam 2002; Dupré 2007). Because such concepts reflect our interests and have consequences for our actions, the exercise of value judgments in their use is as important as the exercise of empirical rigor.

So the value-ladenness of science is philosophically well-established—though there are still those who would defend the value-free ideal. Sandra Mitchell (2004) and Gregor Betz (2013), for instance, both argue that scientists need not accept hypotheses, but need only describe the probability or degree of certainty of each hypothesis and defer the decision about which hypotheses to accept to the decision-makers who must determine how to act on that information. This style of response presumes that such statements about probabilities or degrees of certainty are somehow exempt from the value-ladenness of the decisions about the acceptance (or rejection) of hypotheses that they seek to avoid.⁷ They are not exempt, as is well demonstrated by the argument from inductive risk (again, see Douglas 2000, 2009).

⁶ Also known as "the error argument" (e.g., Elliott 2011; Brown 2013).

⁷ This is precisely the style of response attempted by the IPCC when, in the transition between assessment cycles three (which produced the Third Assessment Report, or TAR) and four (producing the AR4), they adopted the infamous "Treatment of Uncertainty" statement. The approach has been about as helpful as the claim to neutrality has been—in other words, not very (see, e.g., Curry and Webster 2011). But this is a separate topic for another time.

Finally, there are some philosophers of science who accept the general arguments about the value-ladenness of science, but nonetheless hold that there are special parts of scientific reasoning that are value-free—parts such as the final decision to accept a theory as a solid part of our public knowledge, or those parts relevant to the purposes of pure belief rather than acceptance for the purposes of action (e.g., Lacey 1999; Elliott & Willmes 2013). Regardless of whether these exemptions to the value-ladenness of science are tenable, the IPCC’s policy-relevant work clearly does not fit the description of these specially-exempt supposedly value-free parts of scientific reasoning. Climate science includes many uncertainties and is often subject to rapid change, and the IPCC’s policy-relevant work on this topic is rarely if ever a matter of making a “final” decision to accept or reject some abstract scientific theory. Much of the IPCC’s policy-relevant work is about an ongoing phenomenon that is inherently dynamic. As the phenomenon changes so will the scientific reporting about it. Any so-called “final decisions” will have to be subject to revision, if and when necessary. And when it comes to policy-relevant work like that of the IPCC, the goal is clearly acceptance of hypotheses for the purposes of action, not merely belief or knowledge as such, if such a separation even makes sense.

Setting aside the philosophical debate, there is also an obvious practical reason to think that the IPCC’s claim to do policy-relevant yet policy-neutral work is not a claim about value-freedom. Here is a quote from the part of the WGIII’s latest report—not its SPM⁸—known as the “Technical Summary”:

Judgements of value (valuations) are called for, not just here, but at almost every turn in decision making about climate change. For example, setting a target for mitigation involves judging the value of losses to people’s well-being in the future, and comparing it with the value of benefits enjoyed now. Choosing whether to site wind turbines on land or at sea requires a judgment of the value of landscape in comparison with the extra cost of marine turbines. To estimate the social cost of carbon is to value the harm that GHG emissions do. (2014c, 37)

Not all of the choices described here are the sort made by the IPCC; but some of them are. Offering a selection of mitigation targets to policy-makers, for instance, includes offering an array of the probable costs and benefits associated with each target. In order to estimate the likelihood of such outcomes, and to present such outcomes as costs and benefits, value judgments (valuations) must be made. Estimating likelihoods under uncertainty requires considering consequences of possible error, and that requires value judgment. So does translating straightforward outcomes into value-laden effects with costs (like harms) and benefits (like goods).

⁸ There are very good reasons to rely on the IPCC’s full reports rather than on the SPMs. We elaborate on those reasons elsewhere (Brown and Havstad 2017).

The IPCC does this sort of work; this sort of work is blatantly policy-relevant; ergo, the IPCC does policy-relevant work that is not value-free.

In sum, the IPCC openly acknowledges the value-laden nature of much of its policy-relevant work (see also Edenhofer & Kowarsch 2015); so when the IPCC claims that its policy-relevant work is also policy neutral, it cannot mean that said work is value-free.

Neutrality as Evenhandedness

Whereas the thesis of value-free science concerns the grounds for accepting scientific concepts and hypotheses, another possible sense of the term “neutrality” (advocated by Hugh Lacey) concerns the consequences of accepting a hypothesis or theory.⁹ On this account, research is value-neutral if it is consistent with any set of values and useful in application regardless of one’s values and goals:

Each viable value-outlook is such that (in principle) there are soundly accepted theories that can be significant to some extent for it, and applications of soundly accepted theories can be made *evenhandedly*, so that overall (in principle) there are no viable value-outlooks for which the body of theories should have special significance. (Lacey 2005, 25–6, emphasis added)

In other words, “neutrality expresses the value that science does not play moral favorites” (ibid., 26). “Policy-neutral” science, by analogy, would be “evenhanded” science that can usefully inform any policy, based on any goals or value systems, whatsoever.

Lacey (2005) argues not only that contemporary science often fails to manifest neutrality (in his sense), but also that there is no evidence of any movement in the direction of further neutrality. Still, he argues that neutrality is valuable because it furthers the scope of science, offering the possibility of disentangling science from a value-outlook that he regards as deeply dysfunctional: “the modern valuation of control” or the MVC (Lacey 2005, 4), with associated research strategies that Lacey calls “materialist strategies” (ibid.). Either of two things may be going on here: there may be a concern that science should not produce evidence that bears in favor of some systems of values over others; or there may be a concern with epistemologies of ignorance, which systematically fail to produce knowledge that would be useful to certain value-outlooks while producing epistemic boons for others.

Lacey apparently values the ideal of evenhandedness in science because for science to achieve neutrality in this sense would entail that the MVC loosen its pernicious grip on modern science. This seems to be a call for pluralism of research

⁹ While Lacey uses the term “neutrality” as discussed in this section, another relevant norm proposed by Lacey is “impartiality.” The latter is simply Lacey’s term for the value-free ideal, however, which has been addressed in the previous section.

strategies and an end to the production of ignorance about the forms of knowledge that would benefit currently marginalized groups, rather than a general call for science to avoid producing evidence that bears on our values. It is rather important that we take evidence into account in making value judgments (see, for instance, Anderson 2004). What's more, it isn't at all clear that we should want to remain "neutral" if some of the values or value-outlooks in question—e.g., the MVC—are pernicious. Furthermore, the science that the IPCC draws on relies heavily on materialist strategies and presupposes the MVC. Thus, Lacey's sense of neutrality as evenhandedness does not apply to the actual work of the IPCC. Whatever the normative status of such evenhandedness, it cannot be what the IPCC means by policy-neutrality.

Additionally, Lacey's account of neutrality as evenhandedness, if it can be used as an interpretation of value neutrality, issues a controversial, non-neutral second-order value judgment—the judgment that all value-outlooks or moral systems should be equally favored by whatever scientific theories we accept. In issuing this value judgment, the account fails to be truly neutral. What's more, this second-order value judgment is wrong-headed. Consider the value-outlook of Hitler's Nazi Party, for example: this is a value-outlook that incorporated presumably biological differences among classes of persons into judgments about the differential moral worth of persons. One of the many reasons we can rule out this value-outlook is that our best scientific theories tell strongly against it. It seems clear we can and should play moral favorites here.

So neutrality in Lacey's sense is inadequate to describe the IPCC's work, potentially incompatible with policy-relevance, and implies a dubious, contentious, potentially self-contradictory, and often undesirable second-order value judgment. It is highly unlikely that this sense of "neutrality" is the right one with which to interpret the IPCC's claim.

Neutrality as Honest Brokerage

A potentially more robust way to understand the idea of policy-neutral science is in terms of Roger Pielke Jr's theory of the science advisor as an honest broker of policy alternatives (Pielke 2007). According to Pielke's account, the role of the science advisor is to multiply options for policy-makers, based on the best information available and given the potential variety of value judgments that policy-makers might make.

We can understand the knowledge so produced conditionally: if you value V_1 , then you should choose policy P_1 ; if V_2 , then choose P_2 ; and so forth. Policy-neutral scientific assessments would thus provide this kind of conditional knowledge without issuing the controversial value judgments. A more concrete example from climate science and policy may make this connection clearer: if you value human life and property along extant coastline, then you should choose to try and *mitigate* the expected rise in sea levels; if you value the preservation of

today's economy (the so-called "business-as-usual" scenario), then prepare to *adapt* to the expected rise in sea levels.¹⁰

This way of thinking about the relationship between an extremely complex science and an extremely open set of policy options is both (i) misleading in principle and (ii) unhelpful in practice. The idea of the honest broker is (i) misleading in principle because, due to the complexity of the science—the difficulty of navigating uncertainty, estimating consequences of probable errors, and generating reliable knowledge claims—it is impossible to isolate all of the value judgments (in the antecedent) and scientific information (in the consequent) in the way that is required for creating the conditionals offered by the "honest broker." Let us elaborate.

This approach to addressing value judgments in science amounts to a deferred-decision style approach to resolving Douglas' argument from inductive risk (2000). The idea is that, since it is not the job of scientists to make controversial value judgments, they should provide the information that leads up to the need to make a value judgment, and then policy-makers, or the public, should insert their values in order to make decisions. For instance, rather than weigh social values in order to determine whether they have enough evidence to accept a hypothesis, scientists should just provide the probabilities for the hypothesis licensed by the data without making any decision about the hypothesis itself.

Simple examples make a deferred-decision-based response seem attractive. In practice, however, it cannot work. Rudner (1953) already anticipated this response and provided a partial answer to it. Even if the scientist withholds judgment about whether to accept or reject the hypothesis, the judgment that there is such-and-such probability of the hypothesis is itself an uncertain claim, open to inductive risks. And the situation is still more complex than even Rudner anticipated. There is a whole series of inductively-risky decisions prior to any evaluation of the probability of the hypothesis—far too many decisions to defer them all. The burden of value judgment cannot be entirely taken out of such science-policy interactions, and in many cases the necessary judgments will be controversial. So in purporting to offer a range of value-conditional scenarios without issuing any controversial value judgments, the supposedly "honest" broker is promising something that cannot be delivered. Although Pielke acknowledges the value-ladenness of science in other parts of his work, when it comes to his account of the science advisor as honest broker of policy alternatives, he (perhaps unwittingly) re-inscribes the value-free ideal.

The idea of the honest broker is (ii) unhelpful in practice because, due to the complexity of the climate system—with its immense array of variables, patterns, negative and positive feedbacks, and frankly unknown elements—as well as the

¹⁰ Where *mitigation* is an attempt to arrest an element of climate change, and *adaptation* is an attempt to adjust to it.

unbelievably diverse set of potential human values, an honest “honest broker” would have to produce a bewildering array of nested conditional statements that would be useless in policymaking, if even articulable.¹¹ Within their reports, the IPCC generally offers only a handful of options with respect to any given decision point—such as offering mitigation targets of overall temperature increases of 1.5°C, 2°C, and 3.5°C. Why those three choices? Why only three? Why think of the mitigation targets in terms of temperature at all? Of course the answers to these questions have to do with a multitude of practical considerations involved in doing helpful, policy-relevant work. But there is no denying that in narrowing down options and presenting available choices as between those discrete and particular ones, value judgments have been made. Even if the deferred-decision style approach to honest brokerage were to make sense in cases of relatively simple science, it is not an approach that is available to the IPCC, given the complexity of the overall phenomenon of global climate change and its range of evolving impacts on humans and the natural world.

Neutrality, Authority, and Objectivity

Yet another entirely natural interpretation of the IPCC’s claim to neutrality might be as a claim to objectivity. Standardly, when we want our science to be policy-neutral, it is because neutral processes are thought to produce objective knowledge, and only objective knowledge carries the weight of scientific authority. Failure to be policy-neutral is to sacrifice objectivity for wishful thinking in favor of one’s preferred policy. This interpretation thus connects the IPCC’s claim to neutrality to an important feature of science that is widely acknowledged and desired.

The initial problem with this strategy of interpretation is that “objectivity” is a fairly inchoate commitment to an ambiguous and irreducibly complex idea (Douglas 2004, 2009). Decomposing the idea of “objectivity” into various more fine-grained senses of the term reveals that most of these kinds of objectivity are irrelevant to the question of neutrality. For instance, Heather Douglas (2004) divides senses of the general term “objectivity” into three categories: objectivity₁, objectivity₂, and objectivity₃. The categories of objectivity₁ and objectivity₃ have little to do with anything like neutrality. Objectivity₁ focuses on how we relate to and interact with objects; e.g., *manipulable* objectivity₁ is achieved by creating reliable and precise ways of intervening on particular objects or aspects of the world. Whether such interventions are neutral in any significant sense is irrelevant to this type of objectivity. Objectivity₃ deals with the social component of knowledge production; e.g., *concordant* objectivity₃ is achieved by attaining some

¹¹ We elaborate this practical objection to deferred-decision style responses to the value-ladenness of science elsewhere (Havstad and Brown, forthcoming).

measure of intersubjective agreement or consensus. But, of course, we can (sometimes) arrive at policy via consensus, so this is also not connected to our concerns.

But objectivity₂ in Douglas's (2004) taxonomy of objectivity directly concerns the interpretation of neutrality. There are three subtypes of objectivity₂: *value-free* objectivity₂, *value-neutral* objectivity₂, and *detached* objectivity₂. We have already addressed the issue of value-freedom above. We will consider detachment in the following subsection. The rest of this subsection will analyze objectivity as value-neutrality.

When making value judgments, parties who are objective in the sense of value-neutrality remain as neutral as possible where values are controversial, either by avoiding value judgments in that specific instance or by seeking balanced or conciliatory positions within the range of values. This does not reduce to value-freedom in the sense discussed above, but rather attempts to achieve some form of fairness between the sides of an issue, to be what Douglas has called "reflectively centrist":

In situations where values play important roles in making judgments, but there is no clearly "better" value position, taking a value-neutral position allows one to make the necessary judgments without taking a controversial value position, without committing oneself to values that may ignore other important aspects of a problem or that are more extreme than they are supportable. (Douglas 2004, 460)

One deep problem with this sense of objectivity (*value-neutral* objectivity₂) is that, though potentially relevant, it is also unattainable, at least in the context of global climate change.

Most of the values at stake in this debate are controversial, and there is no way to avoid making judgments about them (as argued above); nor is there a way to seek out compromise while preserving neutrality. In this context, merely the act of compromising among certain values is a way of making a non-neutral second-order value judgment—that of judging these values as worthy of inclusion within a compromise, as being compromisable. In other words: to choose to be decidedly and reflectively centrist with respect to climate change, and to the various values being contested, is to make a conclusive and impactful value-judgment in and of itself.

Making this sort of value-judgment therefore violates the very value-neutrality being attempted; it is highly unlikely that the IPCC wants or intends to perform such a contradiction. Still, there is one more potentially relevant sense of objectivity in Douglas' taxonomy. We consider this conception in the next and last subsection of this analysis.

Neutrality as Detachment or Non-Dogmatism

There is one remaining commonsense variation of the term “objectivity” that might capture what the IPCC means when they claim to be doing policy-relevant yet policy-neutral work. By using the term “neutrality,” the IPCC might mean to refer to what Douglas calls “detachment.”

Detachment is about not having a prior commitment to some hypothesis, value judgment, or policy proposal such that it infects the reasoning process. A regrettable lack of detachment causes one to seek the best evidence in support of one’s prior commitments, rather than to seek the hypothesis, value, or policy best supported by the evidence. Douglas (2004) defines detachment as a “prohibition against using values in place of evidence” (459). Presumably, the concern here is with a potentially infectious display of wishful thinking, as opposed to a healthy demonstration of objectivity. In a similar vein, Elizabeth Anderson (2004) recommends that one should be non-dogmatic in pursuing value-laden research, that one should avoid the situation where values “drive inquiry to a pre-determined conclusion” (11).

This sense of “neutrality” is widespread and uncontroversial. To be detached in this way is also an undeniable good when it comes to being the agent of a principled investigation, scientific or otherwise. And yet, we cannot rely on this conception of neutrality as detachment in order to understand the IPCC’s claim to do policy-neutral work. A difficulty arises when we consider this interpretation of the “neutrality” term along with what we have already determined about the IPCC’s corresponding claim to never be policy-prescriptive. If the claim to be policy-neutral means merely to arrive at policy recommendations that have been determined in a detached and objective manner, then this claim concerns prior commitments and their influence on reasoning, and it says nothing about the product of a properly detached inquiry. Detached inquiries can have as their result a judgment for or against certain policies—in other words, they can be policy-prescriptive. But that is explicitly not the kind of work that the IPCC claims to be doing—they claim to be doing work that is “policy-relevant and yet policy-neutral, never policy-prescriptive.”

Another difficulty arises when we consider the IPCC’s particular choice of words here. By using a loaded term (“neutral”) with a nuanced meaning (“detached”) in a compound phrase (“policy-neutral”), some confusion has arisen. The impression has been given that a term that properly applies to only the process of investigation applies in the same way to the product of that investigation (as “policy-detachment”). Critics have therefore been making the (somewhat understandable) mistake of (mis)applying this sense of neutrality-as-detachment to the IPCC’s claim to do policy-neutral work, failing to separate process from product, and thereby concluding that this means that the IPCC’s work should be detached from and carry no entailments for policy. So, there is an important way in which this sense of the term “neutral” (as “process-detachment”) can help us to

understand some of the bewildered and accusatory reactions of various climate bloggers, skeptics, deniers, and more. Even advocating for certain policies amongst various feasible options can count as “neutral” on this interpretation of the IPCC’s claim—but it’s not an activity that will seem well-described as “policy-neutral.”

Together these difficulties entail that, although it makes sense to describe detached and objective processes of policy-relevant investigation as “neutral,” it does not make sense to describe such processes as “policy-neutral,” since that is an extremely misleading way of communicating and it does not necessarily follow from process-neutrality that the outcomes of such processes will be detached from and have no implications for policy prescription. Because the IPCC characterizes their work as policy-relevant, never policy-prescriptive, and policy-neutral (in terms of product) rather than simply neutral (in terms of process), interpreting the (product-inclusive) neutrality claim as one about (process-neutral) detachment makes the IPCC’s organizational statement both internally inconsistent and extremely misinterpretable. Thus, while detachment is a philosophically unproblematic and laudable commitment for investigative processes, it is untenable as an interpretation of the IPCC’s claim to produce work that is “policy-relevant and yet policy-neutral, never policy-prescriptive.”

Conclusion

In an effort to deduce the meaning of the IPCC’s so-called “mandate”—to be relevant-yet-neutral, never prescriptive—we have exhausted the space of commonsense interpretations of the term “neutrality,” and found them wanting. Still, our efforts have not been in vain. We have learned that when the IPCC says that their policy-relevant work is also non-prescriptive, they mean that they will never decisively recommend for or against a policy option—*amongst the available courses of action*. This is compatible with the possibility of the IPCC’s policy-relevant, never-prescriptive work ruling out some courses of action, along with any proposed policies that might presuppose those ruled-out actions. It is also compatible with the IPCC sometimes doing work that makes it apparent that certain courses of action are more feasible than others, thereby also bearing on the differential feasibility of any policies that incorporate those actions.

We have also learned that, when the IPCC describes their policy-relevant work as policy-neutral, they are not (or should not be) claiming to do so-called “basic science” (in the linear-model-laden sense of Bush 1945). Nor is the work that they are doing here well understood as value-free (in the sense elaborated by Douglas 2009), or as evenhanded science (Lacey 2005). We have seen that honest brokerage (Pielke 2007), in which value judgments are identified and isolated within the antecedents of material conditionals, is simply not a feasible option to pursue in a situation as complex as that of climate science advising. And we have seen that, although detachment (Douglas 2004) is a fine sense of “neutrality” with

which to characterize various processes of investigation, it is not an appropriate way to characterize “policy-neutrality” as the IPCC uses the phrase.

Does that mean that there is no reasonable way in which to understand the IPCC’s claim to do policy-neutral work? Actually, no. There is one final option, readily suggested by the context in which the term “neutral” appears, along with relevance and non-prescriptiveness. We could infer that, rather than having an independent meaning here, the term “policy-neutral” is actually meant to be understood via its immediate elaboration as “never policy-prescriptive.” In other words, these two components of the tripartite claim are not separate claims, but are in fact meant to be understood together, and significant confusion has likely been caused by attempts to pull “policy-neutral” apart from its context of explanation as “never policy-prescriptive.”

On this reading of the IPCC’s organizational statement, the claim to do work that is “policy-relevant and yet policy-neutral, never policy-prescriptive” should be understood as containing something of a repetition (probably for the sake of emphasis), or a suppressed “that is” (as in “policy-neutral, that is, never policy-prescriptive”). Presumably, the intent was to be clarificatory and emphatic: although the IPCC may do work that bears on climate science policy-making (i.e., the IPCC does work that is policy-relevant), where there is a choice of feasible options with respect to how to respond (or not) to climate change, the IPCC will never decisively recommend one over the other options (i.e., it will not technocratically prescribe a choice of policy). The IPCC will not cast a deciding vote in such matters; they will always remain “neutral” with respect to the available options, and will refrain from advocating among them even when they are differentially feasible (although feasibility estimates may be provided).

The IPCC’s insistence on not becoming technocratic is a noteworthy and laudable position of restraint. Importantly, understanding the neutrality claim in this way (as nonprescriptive amongst available course of action) does not prevent the IPCC from declaring that, for scientific reasons, certain actions are physically impossible or practically infeasible, or that certain interpretations of what is happening with the climate are far more likely than others (though all such judgments are value-laden). Understood in this way, the claim of neutrality is not violated when the IPCC necessarily incorporates careful but value-laden estimations of risk and uncertainty into its projections. It is not even violated when members of the IPCC separately advocate for particular climate policies. The statement merely yet meaningfully declares that the IPCC itself will not take action to decisively settle on the right policy amongst a selection of viable options; as such, the actions of the IPCC thus far are well in accord with its own mandate.

The IPCC may not be able to revise its organizational statement, for political or institutional reasons. Since there is a defensible interpretation of the statement, according to which the IPCC’s actions thus far clearly follow its mandate, the IPCC should, in future communications, clearly endorse the

interpretation of the statement that we have laid out. Still, the existence of one possible interpretation that is defensible and fits with the actions of the IPCC does not therefore vindicate the language of the statement as the best way to explain the organization's aims. The interpretation we present does not fit easily with the common connotations or plain meaning of either "policy-neutral" or "never policy prescriptive." Use of "policy-neutral" has misled many observers, generated confusion about the IPCC's mission, and caused significant harm to the IPCC's credibility. The statement as interpreted is awkward at best, even redundant. If it were possible for the IPCC to make a small revision to the statement, we propose something along these lines:

By endorsing the IPCC reports, governments acknowledge the authority of their scientific content. The work of the organization is therefore policy-relevant and yet never policy-prescriptive—*amongst the available courses of action.*

The IPCC could then, in further statements, clarify that the determination of genuinely "available action" does not mean that the process does not rule out the feasibility of some possibilities while amplifying others. Likewise, it could continue to make clear (as it does in the most recent WGIII report) that the assessment process is not, and cannot be, value free.

There is a cautionary tale here for other science advising efforts. The IPCC, due to its unprecedented scale, its public prominence, and the unquestionable thoroughness and quality of its assessment, is doubtless to serve as a model for future efforts. We have discovered a defensible meaning behind the IPCC's claim to be "policy-relevant and yet policy-neutral, never policy-prescriptive," namely, the avoidance of technocratically mandating a particular policy solution when a range of options are feasible (even if differentially so); yet, the terms "policy-neutral" and "policy-prescriptive" here are definite sources of trouble. Future science advisory and assessment bodies should consider adopting less problematic language that explicitly rejects technocracy, clearly emphasizes the important role public interests and stakeholder consultation play not only in policymaking but also in science advising, and is not associated with unattainable and undesirable connotations of the terms "neutral" and "non-prescriptive."

References

- Anderson, Elizabeth. 2004. "Uses of Value Judgments in Science: A General Argument, With Lessons from a Case Study of Feminist Research on Divorce." *Hypatia*, 19(1): 1–24.
- Betz, Gregor. 2013. "In Defense of the Value Free Ideal." *European Journal for Philosophy of Science*, 3(2): 207–220.
- Biddle, Justin. 2013. "State of the Field: Transient Underdetermination and Values in Science." *Studies in History and Philosophy of Science Part A* 44(1): 124–133.

- Broome, John. 2014. "At the IPCC." *London Review of Books Blog*, 8 May 2014.
- Brown, Mark B. 2009. *Science in Democracy: Expertise, Institutions, and Representation*. Cambridge, MA: MIT Press.
- Brown, Matthew J. 2013. "Values in Science beyond Underdetermination and Inductive Risk." *Philosophy of Science* 80(5): 829-839.
- Brown, Matthew J. and Joyce C. Havstad. 2017. "The Disconnect Problem, Scientific Authority, and Climate Policy." *Perspectives on Science*, 25(1): 67-94.
- Bush, Vannevar. 1945. *Science, the Endless Frontier: A Report to the President*. Washington: United States Government Printing Office.
- Curry, Judith A. and Peter J. Webster. 2011. "Climate Science and the Uncertainty Monster." *Bulletin of the American Meteorological Society* 92(12): 1667–1682.
- Douglas, Heather E. 2000. "Inductive Risk and Values in Science." *Philosophy of Science*, 67(4): 559–579.
- Douglas, Heather E. 2004. "The Irreducible Complexity of Objectivity." *Synthese*, 138(3): 453–473.
- Douglas, Heather E. 2009. *Science, Policy, and the Value-Free Ideal*. Pittsburgh: University of Pittsburgh Press.
- Douglas, Heather E. 2014. "Pure Science and the Problem of Progress." *Studies in History and Philosophy of Science A*, 46: 55–63.
- Dupré, John. 2007. "Fact and Value." In *Value-Free Science?: Ideals and illusions*, edited by H. Kincaid, J. Dupré, and A. Wylie, pages 27–41. Oxford: Oxford University Press.
- Edenhofer, Ottmar, and Martin Kowarsch. 2015. "Cartography of Pathways: A New Model for Environmental Policy Assessments." *Environmental Science & Policy* 51: 56–64.
- Elliott, Kevin C. 2011. *Is a Little Pollution Good for You? Incorporating Societal Values in Environmental Research*. New York: Oxford University Press.
- Elliott, Kevin C. and David Willmes. 2013. "Cognitive Attitudes and Values in Science." *Philosophy of Science* 80(5): 807–817.
- Goodenough, Patrick. 2010. "Head of 'Policy-Neutral' IPCC Calls for 'Grassroots Action' in Response to Setbacks on Climate Legislation." *CNSNews.com*, 2 February 2010.
- Havstad, Joyce C. and Matthew J. Brown (forthcoming). "Inductive Risk, Deferred Decisions, and Climate Science Advising." In *Exploring Inductive Risk*, edited by K. C. Elliott and T. Richards. New York: Oxford University Press.
- "Inside the Sausage Factory; Climate Change." 2014. *The Economist*. 10 May 2014: 79(US).
- IPCC. 2013. *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by T. F. Stocker, D. Qin, G.-K. Plattner, M.

- Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley. Cambridge: Cambridge University Press.
- IPCC. 2014a. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by C. B. Field, V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White. Cambridge: Cambridge University Press.
- IPCC. 2014b. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by V. R. Barros, C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White. Cambridge: Cambridge University Press.
- IPCC. 2014c. *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by O. Edenhofer, R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx. Cambridge: Cambridge University Press.
- IPCC. 2014d. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by Core Writing Team, R.K. Pachauri and L.A. Meyer. Geneva: IPCC.
- Jeffrey, Richard. 1956. "Valuation and Acceptance of Scientific Hypotheses." *Philosophy of Science* 22: 237-246.
- Kuhn, Thomas. 1962. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
- Lacey, Hugh. 1999. *Is Science Value Free?: Values and Scientific Understanding*. London: Routledge.
- Lacey, Hugh. 2005. *Values and Objectivity in Science and Current Controversy about Transgenic Crops*. Lanham, Md.: Lexington Books.
- Laframboise, Donna. 2013. "IPCC Officials Keen to Remake the World: UN Climate Panel Leaders Don't Behave in a 'Policy-Neutral, Never Policy-Prescriptive' Manner." *NoFrakkinConsensus* blog, 11 December 2013.
- Levi, Isaac. 1960. "Must the Scientist Make Value Judgments?" *Journal of Philosophy* 57: 345-357.
- Levi, Isaac. 1962. "On the Seriousness of Mistakes." *Philosophy of Science* 29: 47-65.

- Longino, Helen E. 1990. *Science as Social Knowledge: Values and Objectivity in Scientific Inquiry*. Princeton: Princeton University Press.
- Lynas, Mark. 2011. "Conflicted Roles over Renewables." *Nature Climate Change*, 1(5): 228– 229.
- Mitchell, Sandra D. 2004. "The Prescribed and Proscribed Values in Science Policy." In *Science, Values, and Objectivity*, edited by P. Machamer and G. Wolters, pages 245-255. Pittsburgh: University of Pittsburgh Press.
- Pielke, Roger A., Jr. 2007. *The Honest Broker: Making Sense of Science in Policy and Politics*. New York: Cambridge University Press.
- Putnam, Hilary. 2002. *The Collapse of the Fact/Value Dichotomy and Other Essays*. Cambridge, MA: Harvard University Press.
- Reichenbach, Hans. 1951. *The Rise of Scientific Philosophy*. Berkeley and Los Angeles: University of California Press.
- Rudner, Richard. 1953. "The Scientist Qua Scientist Makes Value Judgments." *Philosophy of Science*, 20(1): 1–6.
- Shapin, Steven. 2008. *The Scientific Life: A Moral History of a Late Modern Vocation*. Chicago: University of Chicago Press.
- Stern, Paul C., and Harvey V. Fineberg, eds. 1996. *Understanding Risk: Informing Decisions in a Democratic Society*. Washington, D.C.: National Academies Press.
- Williams, Bernard. 1985. *Ethics and the Limits of Philosophy*. Cambridge, MA: Harvard University Press.