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THE ROLE OF VALUES IN EXPERT REASONING

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INTRODUCTION

The importance of scientific expertise in American public life has steadily grown over the past century.[1] From the days when a member of Congress could publicly declare he wasn't sure what a physicist was,[2] to the days when scientific testimony is a regular feature in front of Congressional Committees, the scientific expert has become a staple of public decision-making. How to think of such expertise philosophically has been largely neglected, at least since John Dewey's 1927 *The Public and Its Problems*, until more recent work has brought the philosophical examination of expertise back to the fore.

The recent literature on expert knowledge has focused on the problem of trust in experts, a literature that links directly to debates in epistemology over the role of testimony in knowledge.[3] Whether one can know something through testimony, and how one is to evaluate testimony from others, is a thriving area of discourse.[4] If we take experts to be one species of a testifier, such work may help us determine which experts to rely upon and under what circumstances.[5]

What is missing in much of this discourse is a discussion of how experts should (or should not) decide upon and present their knowledge claims. This paper will address this issue, focusing on the domain of scientific expertise, although some of the insights gleaned here may be applicable to other expert domains. Scientific expertise warrants particular attention both because of its increasing importance in the public domain and because philosophy of science has been absent from any discussion concerning the nature and norms surrounding expertise.[6] This paper brings debates in philosophy of science proper back into conversation with debates over the role of experts in public life. Such a recombination has some startling consequences for standard philosophy of science. In particular, it is argued that the "value-free ideal" for science, which has been a staple in philosophy of science, should be abandoned. But lest this raise a sense of alarm for the integrity of science, the paper argues that a different ideal can serve to protect what we value

about scientific reasoning among experts. Indeed, the ideal presented here could improve public debate concerning knowledge-based policy issues.

The Authority of Experts

From the perspective of the public, the key feature of the scientific expert is the epistemic authority s/he wields, i.e., the notion that when an expert makes a claim, it should generally be believed. We desire scientific expertise because we want predictively reliable accounts of the world on which to base our decisions, that is, accounts such that if we act on that basis, we are likely to get the predicted results of our actions. That desired reliability is generally best served by seeking advice from those with specialized experience and knowledge in a particular area. With this specialized knowledge comes important aspects of expertise, such as a more detailed knowledge base, greater experience in the area of expertise, and familiarity with the intricacies of a subject matter, all of which enhance the expert's ability to make judgments concerning the subject. With the experience and knowledge in hand, the expert is less likely to overlook something crucial, or to misunderstand something essential. This is not to say that what an expert proclaims is always true, in the sense of really getting the world right. Indeed, even if things go as the expert predicts, what they said to generate the prediction may not have been true. After all is said and done, we can't actually tell if an expert judgment has gotten it right, or was just close enough. If we act on expert judgment, and things go well, the experts look as though they did get it right. But they may have just gotten lucky.

Despite this lack of complete assurance, listening to and following expert advice is generally a good bet. And so expert pronouncements carry with them a certain weight, the weight of epistemic authority. We would be foolish not to at least listen to experts, and we would be wise to take the claims made seriously, and to use them as a basis for decisions. In at least one context, the modern administrative bureaucracy, the expert has gained increasing significance as someone whose views must support the policy decisions if they are to go forward.[7] While experts may be merely talking heads, who are not politically accountable through the democratic system, they are talking heads whose statements carry enormous importance, talking heads that can shape the direction of economic activity and human welfare. The example of expert statements about global climate change, one example among many, demonstrates the potential significance of experts making empirical claims. Expert bodies like the International Panel on Climate Change and the National Academy of Sciences are essential to understanding the complex issue of how our climate works and how we might be changing it. Without advice from these expert bodies, we would be forced to grapple with the complex data sets of temperature records, tree ring records, ice core samplings, sun intensity measurements, and so on, ourselves. With the advice of these expert bodies, we are forced to grapple with the potential implications of anthropo-

genic climate change, including sea level rise, drought, shifts in agriculture, the problems of reducing fossil fuel use, and threats to economic stability. Expert pronouncements often require us to deal with issues we would rather ignore, but this ability to get our attention and our action on certain issues is an invaluable aspect of expertise.

The question before us is what we should expect and demand of our experts, given the societal importance of expertise. If experts cannot be expected to speak actual truth, but nevertheless can be expected to be listened to, and have their statements acted upon, what norms should govern the realm of scientific experts? It is argued here that a general need for judgment, arising from ineliminable uncertainties, creates a complex problem of how expert judgment should proceed. On the one hand, we have expertise in part because of the expert's focus on their subject matter, a focus driven by the need to know and understand their subject, a focus shaped by the truth-seeking quality of experts. To undermine the concern for truth among our experts would be a grave mistake, and would undermine a central reason we value expertise. We want experts to attempt to speak the truth as they know it, even if it is unpopular. On the other hand, experts must be responsible in the claims that they make, responsible to the epistemic authority they wield. We need an account of expertise that recognizes experts don't actually produce known truth, although they seek it. It is more accurate to say that experts produce the best available empirical judgments. These judgments are rife with uncertainties, and the uncertainties cannot all be made visible for public examination. Experts must be responsible to the public in how they handle the uncertainties and weighty judgments that are part of their exercise of expertise. The difficult task is how to manage both the need for truth-seeking and the need for responsible judgment at the same time.

For the purposes of this paper, the focus will be on expertise in the natural sciences. Social scientists and other experts dealing with inherently social categories raise additional complexities. In the realm of the social, we can construct procedural systems or rigid categories that reduce the need for expert judgment, a technique that serves us well in many cases.[8] On the other hand, the existence of some social categories can change the very human behaviors we are attempting to understand with the categories.[9] These complexities cause me to set them aside for now. While the natural world is happily far less reactive to our knowledge claims about it, it is also less amenable to imposed categories or artificial rigidity. It contains complexities that continually surprise us, and which create an ongoing need for expertise and expert judgment.

The Need for Judgment

The need for judgment arises from the endemic uncertainty in any natural science enterprise. The sources of uncertainty are many layered, from Hume's problem of induction and whether there are regularities to be found, to Mill's

concern over how to pick out regularities (assuming they are there), to Duhem's concern over whether a falsified result really falsifies the tested hypothesis, to whether statistical methods are capturing the known sources of uncertainty in a test.[10] All these sources of uncertainty cast doubt on our empirical knowledge, doubt with which both we and the experts generally live. We cannot escape these uncertainties completely, and thus judgment over their acceptability and importance is always a task of the expert. The expert must formulate what is to be said, and this decision always involves some assessment of which uncertainties surrounding a claim are insignificant, which are potentially significant but acceptable, and which are not acceptable. This assessment is an essential feature of expert judgment.[11]

How should experts make the needed judgments? What should be considered? One answer to this question is that experts should consider solely the norms of their discipline for acceptable work. Under this view, scientific experts should only consider norms that arise from within their disciplinary framework, norms about what the accepted practices and concerns are within their science, norms that focus attention on particular areas, norms about the dangers of accepting new theories too readily, norms about what kinds of evidence should be given more weight than others. An inherent conservatism lies in such a view, as scientists generally require more evidence to accept a claim that challenges the status quo, in part from fear of sending research down the wrong path.[12] In addition to this general conservatism, the values that should shape scientific judgment under this view arise from within science, and include such concerns as the classic "cognitive values" like explanatory power, scope, and simplicity.[13] Different disciplines within science will have different norms for some of the specific areas, and this is why some experts will disagree with others across disciplines. And even within a discipline, scientists can disagree over the emphasis on a particular cognitive value, such as whether the simplicity of a theory is more important than its scope.[14] Under this regime for expertise, experts should consider only these internal matters when making pronouncements as experts.

Although this answer to the question of how experts should make judgments protects the apparent purity of expertise, it is argued here that this answer should be rejected. It should be rejected for two reasons. First, it fails to take into account the responsibilities experts carry because of the epistemic authority of their pronouncements. Second, the concerns over any move away from the purity of expertise either are not the serious objections they appear to be or can be met with an alternative set of norms for experts.

The alternative to the purity of expertise begins with the realization that experts are more than just purveyors of an arcane disciplinary perspective. Such disciplinary work is embedded in a broader society that cultivates expertise for useful knowledge. And we expect experts to help inform crucial decisions, decisions that will affect millions (or billions) of people. Experts cannot take

on the societal perks of expertise (such as ample public funding of research and the status accorded experts in society) and not take on the responsibilities that arise from having a real impact on society. Even if one rejects the idea that such responsibilities stem from benefits experts gain, i.e., that these responsibilities arise as particular professional responsibilities of expertise, such responsibilities can be grounded in the general responsibilities we all share to consider carefully the potential consequences of our actions.[15] To not consider readily foreseeable consequences of our actions is to be reckless or negligent, and to fail to act in a responsible manner.

Actions that require such reflection include the making of empirical claims. Consider the claim that there is a fire in a building. One does not make such a claim, shouting "Fire!," unless one is reasonably sure there is such a fire, because of the attendant risks of getting it wrong—people are often hurt in attempting to escape from the building. Alternatively, one should not wait too long before making the claim. A judicious weighing of the evidence is needed, a weighing that includes considering the risks of making the wrong claim. An expert that makes a claim about the world does not escape the responsibilities we all share, and thus should consider the potential social and ethical consequences of making a mistake. Any expert, because of their special status *vis-à-vis* their area of expertise, should be considered to be like a person shouting "fire." They should expect actions to result from their public claims. To not consider the consequences of error, even if such consequences fall outside the standard disciplinary boundaries, would be reckless or negligent.

Although this basic responsibility of experts is weighty, arguments against this view center on concerns about the purity of expertise. If we are to adopt the view that experts cannot escape some external responsibility considerations simply by being experts, these concerns must be carefully considered. There are two worries here, one about the source of the authority of experts and one about the politicization of experts. The first worry is overblown, and the second more serious. Let us consider each in turn.

The first worry is that experts derive their epistemic authority first and foremost from the internal disciplinary standards which should guide their decision-making. Under this view, only expert judgments uncontaminated by external considerations are worthy of trust, because the disciplinary strictures that should govern expert judgment keep out the social and ethical values. In this sense, expertise is "value-free" and thus trustworthy. Yet one should be skeptical that this is in fact the source of much of the public authority of experts. Few members of the public have much sense of the supposed disciplinary integrity of experts (although in some arenas such as accounting and engineering, with clear and public standards for how to make judgments, disciplinary integrity weighs more heavily). Rather, experts are trusted and relied upon because so often they help guide us to success-

ful action. Following their advice works, and it is on the basis of this predictive success that so much of the prestige of expertise rests.

A slightly different version of this first worry arises if one is concerned with preserving an essential aspect of the culture of science, i.e., that requiring experts to consider their claims in the context of society with the lens of broadly based responsibility could undermine the culture of science essential to the very nature of scientific expertise. If, for example, one views cognitive values as constitutive of scientific expertise, then perhaps only those values should play a role in science. However, one should be dubious of such claims. As recently as 1942, in Robert Merton's famed essay on the ethos of science, no mention is made of cognitive values and their role in scientific reasoning.[16] Scientists are described has holding the ideals of communal property in scientific knowledge, of a lack of interest in the nationality of scientists, of reliance on the communal scrutiny of beliefs and skepticism, and of "disinterestedness," which encompasses a ban on fraud and of not adopting views because they attract you—a point characterized below as a ban on a direct role for values in science. The emphasis on cognitive values appears to be of fairly recent vintage, and thus it is doubtful it is essential to the culture of science.[17] And even if this particular view has recently embedded itself firmly in science, this paper does not suggest that cognitive values be banished from expert reasoning, but only that they are not sufficient.

The second worry, that of the politicization of expertise, is more weighty. Would the external considerations, the social and ethical consequences of error, undermine the truth-seeking focus of experts? Would it politicize expertise? It is argued in the next section that this need not be the case, that we can have fully responsible expertise, responsible to the virtue of truth-seeking and responsible to the public that places such weight on expert claims. But there is a genuine worry about the politicization of expertise here. If experts become too focused on the potential consequences of their claims beyond disciplinary boundaries, this focus could distort or censor the claims experts are willing to make. Experts may avoid making claims that might be politically unpopular, or even worse, be punished for doing so. The classic examples of Galileo (who was placed under house arrest for inflammatory claims about astronomy[18]) and Lysenko (where Darwinian biologists were punished for going against a politically popular theory of the heritability of acquired characteristics in Stalin's USSR[19]) warn us against undue pressures placed on experts to produce desired outcomes. Such pressures undermine the very reason we place such value in expertise, to tell us things about the world that we *need* to know. We need to hear unpleasant news from experts, even if we would prefer it were otherwise, even if taking seriously the expert advice complicates our lives.

However, if concerns about undesirable politicization can be overcome (as will be suggested they can in the next section), we might realize the value of having experts responsive and responsible to ethical and societal concerns. Before

turning to developing an alternative ideal for expertise, let us examine some of the potential benefits of shifting to an expertise responsible to its claims. Recall that one of the reasons we value expert knowledge is precisely because we cannot fully grapple with the complexities of expert knowledge ourselves. There is simply too much one needs to know—thus the necessity for experts. But there is also endemic uncertainty in the knowledge, as discussed above. How are we to assess the way in which disciplines weigh the importance of uncertainty from outside the discipline? How are we to assess the way in which internal values place the emphasis on various evidence, to the neglect of other evidential considerations? If experts consider solely internal criteria, which are largely opaque to the outside public, and then make expert pronouncements to be trusted and used by the public, what assurance does the public have that concerns about the consequences of error, about the importance of uncertainty, have been properly assessed in the making of a claim? It would be preferable to have the expert make an explicit and open weighing of such considerations, so that when we hear the claims of the expert, we know how uncertainty and the consequences of error have been considered. Crucial to this is the inclusion not just of the disciplinary concerns the expert might have (e.g., what will happen to the field's trajectory if one makes an authoritative but incorrect claim), but also of the consequences of concern to the non-expert, that lie outside of the expert's discipline, such as what happens when society acts on the basis of an incorrect claim. Only an explicit expert weighing of such considerations can bridge the gap between disciplinary and public concerns.

Indeed, in many areas of expert judgment, internal disciplinary concerns are either irrelevant or unhelpful for a judgment. Consider, for example, the judgment over how to interpret data in toxicology studies.[20] Should one fit the data to a dose-response curve that incorporates a threshold, or should one assume a linear, non-threshold model? Cognitive values internal to science are of little help here. Neither curve is clearly more simple or has more explanatory power or scope than the other. Both models are simple—one having a cut-off below which no adverse effects are expected, and one having a straight line through the origin of the graph. Both curves can be motivated by biochemical considerations, thus meeting concerns about coherence. On the one hand, the idea of a threshold has a long tradition in toxicology, as exemplified by the old saying "the dose determines the poison." The body has various defense mechanisms, which can defend against toxic insults, to a certain point, and then these mechanisms will be overwhelmed. But the linear model has some biochemical explanatory underpinnings as well. When one considers large populations, the variability among individuals, and all the other stressors individuals are under, the issue is not whether an individual would normally have the defenses up and ready for the toxic insult, but whether there are individuals at a particular time that won't. It just takes one hit of a carcinogen on a bad day for a cancer to get started. Tra-

ditional internal disciplinary concerns and values don't differentiate in any clear way between these two choices.

Social and ethical values, however, do differentiate between the two. In the face of substantial uncertainty, the linear extrapolation model is generally more protective of public health than the threshold model, while the threshold model generally protects against over-regulation. Thus, if one is more concerned about the potential for under-regulation of involuntary chemical exposure, a linear extrapolation model is generally more protective against this kind of error. On the other hand, if one is more concerned about over-regulation and the burdensome economic costs such over-regulation imposes on certain sectors of the economy, then a threshold model is more likely to protect against this kind of error. And if one is worried equally about both kinds of error, one can argue for an intermediary model, in which one uses thresholds with multiple safety factors to better ensure public protection. If the available data and theory cannot decide between the two approaches to interpreting studies, our concerns about the consequences of error can.

Having experts explicitly consider the consequences of error outside of a standard disciplinary approach could be of great benefit for public discourse on such expert-dependent issues as the toxicity of a new chemical. But the burden of argument must still be borne by the full responsibility, externalist approach to expertise. Can we have norms for expert reasoning that allow experts to consider the possible consequences of error, that at the same time protect the epistemic integrity of experts from overt politicization?

Norms for Expert Judgment

Given that judgment, particularly judgment in the face of uncertainty, is a necessary part of the exercise of expertise, we are faced with the question of how that judgment should be informed. In particular, we are faced with the question of how values should (or should not) inform the judgment of experts, particularly values that are not part of the traditional disciplinary matrix for the expert. How ought social and ethical values play a role in expert reasoning? When experts are making judgments about what should be said, about what claims to make, how should values be part of those judgments?

In this section, it is argued that values must be constrained in how they influence expert reasoning. It is suggested that values should only be used to weigh the importance of uncertainty, by considering the consequences of error. This role is in contrast to a more direct role for values, namely that values could be taken as reasons in themselves to accept or reject an empirical claim. It is this direct role for values that raises the double specter of self-deception among experts and the politicization of expertise. Constraining values to the "indirect" role allows one to maintain the integrity of expert reasoning, while allowing experts to behave responsibly towards their dependent public.

The distinction in roles for values in reasoning is crucial to the normative claim that values should play only one kind of role, and not another, in expert judgment. So first the distinction between direct and indirect roles for values in judgment must be clarified. The distinction is hinted at in the general epistemology literature, where deciding what to believe involves the distinction between a direct role for values, where values are a reason to accept a belief, and an indirect role, where the values instead serve to set the standard of evidence to be considered sufficient. While considering values in the direct role, John Heil argued in his 1983 essay "Believing What One Ought" that values should not play a direct role in empirical reasoning, noting that motives or incentives for accepting empirical claims should not be conflated with reasons that provide "epistemic *support*" for those claims, such as empirical evidence.[21] In other words, values should not be construed as providing epistemic support for a claim. Values are not the same kind of thing as evidence, and thus should not provide warrant for a claim. Providing warrant or epistemic support is what is meant here by a direct role for values in empirical reasoning.

Yet we can and do have legitimate motives for shifting the level of what counts as *sufficient* warrant for an empirical claim. Even as Heil warned against the self-deceptive use of values in support of empirical claims, he noted that

> [t]here are many ways in which moral or prudential considerations can play a role in the factual conclusions one is likely to draw or the scientific pronouncements one may feel entitled to issue. We regard it as reasonable to require that a drug possessing an undetermined potential for harm pass rather more stringent tests than, for example, a new variety of hair tonic, before it is unleashed on the public. In such cases, however, we seem not be tampering with ordinary evidential norms, but simply exercising reasonable caution in issuing judgments of safety.[22]

A footnote in Heil's essay elaborates this point:

> One checks the oil and water in one's automobile with special care before setting out on a long journey. This is not because one needs more evidence about one's automobile in such cases than in cases in which one is merely driving across town. It is rather that there is a vast difference in the consequences of one's being wrong.[23]

Values play a legitimate role in determining what level of uncertainty is acceptable on a case by case basis, helping to establish what constitutes sufficient warrant in a particular case, given concerns over the consequences of error. It is in weighing the importance of uncertainty that values, including social and ethical values, have a legitimate role to play in shaping our beliefs. This is what is meant here by an indirect role for values in expert reasoning.[24]

The potential implications of adopting a direct role for values in empirical reasoning would be devastating. Our preferences for the world have no direct bearing on the way it actually is, a point reinforced by the continual surprises

experience throws at us. If our empirical reasoning were guided by such wishful thinking, we would have little chance of allowing the world to surprise us (except when our house of cards woefully came tumbling down). To allow values (motives) to act as reasons is to allow values to supplant evidence. If motives (or preferences for a claim) are reasons to accept a claim, why would one need evidence for that claim? Why couldn't one reject evidence against the claim, simply because one didn't like the evidence? The values could act as evidence, and perhaps sufficient evidence, all by themselves. If values, such as a preference for a particular claim, are allowed to serve as a reason to accept the claim (or to make the claim), the basic virtue of truth-seeking is fundamentally undermined. It is because we care about truth (even if we can not be sure when we actually have it) that wishful thinking, allowing values to act as reasons for empirical claims, is not acceptable reasoning. This norm is particularly pertinent for experts, on whose judgment we rely.

Even as we exclude values as reasons (the direct role) for accepting or rejecting an empirical claim, we can and should embrace values as guidance in what counts as sufficient warrant (the indirect role). Values do not act as reasons in themselves in the indirect role, but rather as determinants of the strength of evidence we should require for a particular claim. In this indirect role, the value considerations can always be made less significant by more evidence, which reduces uncertainty and thus makes it possible to meet the standard of sufficiency. If more evidence is not available, however, judgments must be made on the basis of the evidence available in hand. This is where expert judgment is most crucial, in weighing complex sets of less than definitive evidence. How much evidence is needed before a claim is sufficiently warranted is a judgment that should involve consideration of the consequences of error, a consideration of what would happen if one made an erroneous claim. Values, particularly social and ethical values, are needed to make this judgment, both so that the judgment is comprehensive, and so that the expert can be responsible in her exercise of expertise. It is this indirect role of values which should be employed by the expert in her reasoning.

If the expert embraces the indirect role, while rejecting the direct role, the expert will be protected from the politicization concerns discussed above, while meeting her responsibilities to the trusting public. The politicization of expertise (as in the cases of Galileo and Lysenko) exemplifies the conflation of reason and motivation, the improper use of values in the direct role. The empirical claims of these men were rejected or accepted (respectively) because the authorities preferred (or did not prefer) the claims being made. The listeners' preferences were taken as reasons to accept or reject the claims, rather than as the mere motivations they were. They were taken as reasons to squelch or valorize the claim. If instead, the authorities had merely claimed that more evidence was needed from Galileo, or that more evidence was needed from Lysenko's detractors, these cases would not be held up as examples of the politicization of science, but rather

as the normal working out of scientific disputes. Instead, the values of those in power were taken to be reasons to accept or reject the empirical claims. Experts should never follow such a reasoning process (and neither should those who rely on experts). To do so would be to reject the virtue of truth-seeking that should guide expert reasoning.

The indirect role for values in expert reasoning poses no such trap. One can be deeply concerned with uncovering and conveying truth, and at the same time be concerned over how much evidence is enough for a claim to be sufficiently warranted. Indeed, differentiating between the direct and indirect role can illuminate both how to differentiate bias from perspective in expertise and recent controversies over the politicization of science.

Bias and Politicization in Science

Bias in expertise clearly damages the trust we place in experts, and bias in experts' claims is a good reason to discount or disregard their claims.[25] But what should count as bias? Mere disagreement among experts, even experts examining the same evidence, is not sufficient for an attribution of bias. Differences in experts' training and experience will give them different perspectives on many issues, including potential pitfalls in evidence and the importance of different cognitive values. We even value such differences of perspective in addressing complex problems. If disagreement does not necessitate the presence of bias, we need a more nuanced account of what should count as bias.

The distinction between values serving in a direct versus indirect role provides such an account. Bias occurs when experts allow values into the direct role, preventing them from seeing evidence clearly when it contravenes their expectations, or when it causes them to place too much confidence in evidence that is weaker than they claim. Such a role for values *should* undermine our trust in the experts, and is a good reason to discount their claims. If we take bias to be allowing values to play this direct role, we also gain resources in detecting bias among experts. Experts whose views don't shift in the face of new evidence, or who cannot articulate evidence that would (if appropriately gathered) convince them of a claim, or who are known to have suppressed unwelcome evidence, can be properly labeled as biased. Values in the direct role, to paraphrase Heil, confuse motivation with warrant, and thus violate fundamental epistemic norms.

The indirect role for values in expert reasoning, on the other hand, should not be taken as a source of damaging bias. Experts must weigh the importance of uncertainty, and there are reasons to include social and ethical concerns in this weighing. Experts have a responsibility to consider the consequences of error outside of their disciplines, and thus need to consider social and ethical values in weighing those consequences, an indirect role for the values. Experts who allow values to play this indirect role can be distinguished from biased experts by the way their views change in the face of new evidence. As new evidence arises and

uncertainties diminish, expert claims should shift, even if the expert still holds certain values strongly. Indeed, by exploring the indirect role for values in setting standards for sufficient warrant, we can better understand both individual expert reasoning and why experts may legitimately disagree.

However, one may still be concerned that any role, even an indirect role for social values, can politicize science. For if expert disagreement rests on divergent views of what evidence is sufficient for a claim, and if social values drive differences in such assessments of sufficiency, has not expertise become politicized? Take, for example, the Union of Concerned Scientists' recent report on science in the Bush administration.[26] In the report, the authors cite examples of suppression of research (a clear manifestation of bias) and distortion of research. In discussing the assessments of climate change research, they write, that despite recent reports by various expert bodies, "Bush administration spokespersons continue to contend that the uncertainties in climate projections and fossil fuel emissions are too great to warrant mandatory action to slow emissions."[27] Does this quote not show how social values politicize science?

The outright suppression of unwelcome research exhibits clear bias, i.e., utilizing values in the direct role, and is to be roundly condemned. What are we to make, however, of concerns over the extent of uncertainty in climate research? If one holds, as the Bush administration apparently does, that the long term potential consequences of climate change pale in comparison with the economic harms that might be caused by attempting to shift away from our dependency on fossil fuel, we should expect a rather high evidentiary bar to be required. If, on the other hand, one is less concerned with the near-term health of the fossil fuel energy industry and more concerned about the potential long term consequences of climate change, then the evidence available clearly looks sufficient for taking action to mitigate the potential impacts of climate change. Both concerns, the economic health of the fossil fuel industry and the ecological health of the planet, arise from potential impacts, projecting what happens if we do or don't act on the claims that there is anthropogenic climate change. The debate about where the evidentiary bar should be set, what evidence is sufficient, is a debate about values—about with what we should be more concerned. This is indeed a political debate, or rather it is the political debate we *should* be having. Instead, public debate about climate change over the past twenty years has centered on whether or not there is uncertainty, and not on whether evidence is sufficient for action. The politicization in this case arises not from the legitimate and important indirect role for social values, but the conceit that certainty can and should be achieved before we take action, and the attempt to make the debate about achieving that certainty, rather than having a debate about what we should value.

From the examination of this example, we can draw some interesting conclusions. Recognizing and addressing openly the importance of social and ethical values in expert reasoning in the indirect role would likely lessen, rather than

exacerbate, the politicization of science. By moving away from the value-free ideal for experts, and embracing and acknowledging the importance of values in the indirect role, we can regain the proper realm of public debate about the values at stake in these cases, and put less political pressure on scientists to achieve certainty. We need the honest assessments of evidence and uncertainty, of what counts as sufficient evidence and why, if we are to make better informed decisions on the basis of expert knowledge. Experts can help to point us to the value debates we need to have as a society by thinking through for us the potential implications of uncertainty, and airing their use of values in the indirect role.

The key norms for experts are thus 1) to keep values out of the direct role, and 2) to make values in the indirect role explicit.[28] The values, once made explicit, can clarify the sources of disagreement among experts. In cases where the disagreements are stark, the debate can then center on the value disputes, where they should be, rather than on the fact of expert disagreement. This should reduce the political pressure on experts, and thus the politicization of science. Because decisions over the sufficiency of evidence should take into account the consequences of error in making claims, the public needs experts to help clarify what is at issue when relying upon expertise in particular cases. This requires the consideration of the social and ethical consequences of error, consequences which an expert can readily foresee and consider in most cases. (Unforeseeable consequences obviously cannot be weighed.) Considering carefully what constitutes sufficient warrant in particular cases, and making clear how this assessment occurs, can reduce, rather than aggravate, politicization of science. It can make clear the need for public debate about social and ethical values at stake, rather than waiting interminably for certainty to arrive.

Cognitive Values Revisited

Dissecting the problem of expert judgment in this way leaves (at least) one philosophical loose end. What are we to make of cognitive values in the judgment process? Can the instantiation of a cognitive value provide a reason to accept or reject an empirical claim? Should the simplicity or scope of a claim be a reason (not just a motive) to accept it? When stated so baldly, it should be obvious that the answer is *no*. The world may be simple, but it is as often as not less simple than it appears. It may be that broadly scoped claims are more likely to be true, but then again, it may not be. As Larry Laudan has recently argued, it is not at all clear that the traditional cognitive values such as explanatory power, scope, and simplicity, tell us anything about the empirical reliability (or truth) of a claim.[29] Indeed, philosophers of science in defending cognitive values do so not on the basis that theories instantiating such values are more likely to be true, but rather that they are more likely to be fruitful, a clearly internal disciplinary concern. Cognitive values are no more reasons in themselves to accept a claim than social values.

But we can make sense of cognitive values in the indirect role, in concerns about the sufficiency of warrant. Consider more closely the idea that the presence of cognitive values increases the fruitfulness of theories. Perhaps we should take the label "cognitive" more literally. If we consider cognitive values to be values that when present, aid in the thinking of scientists (simple theories are easier to work with; broadly scoped theories have more areas of application; explanatorily powerful theories can be used to develop news predictions from the theories more readily), then we can see cognitive values as an important hedge against error. We may not be sure that we have enough evidence, but if cognitive values are instantiated in a theory, we will have an easier time testing and developing that theory. We will thus find out sooner rather than later the pitfalls, limitations, and problems with the theory. The presence of cognitive values can provide a good reason to relax the stringencies of what would count as sufficient warrant.

This means that cognitive and ethical values may be pitted against each other in some cases. When considering what should count as sufficient warrant for a particular theory at a particular time, cognitive values may suggest that one lower the standards (given one's ability to develop and test the claim further) and ethical values may suggest that one raise the standards (given the possible consequences of making the claim erroneously)—or vice versa.[30] The values may also line up in mutually reinforcing ways. The difficult task of the responsible expert is to recognize the importance of both these kinds of values in this one role, and to take care in weighing them both.

Conclusion

If the arguments here are persuasive, then the "internal disciplinary norms only" ideal for scientific experts is inadequate *as an ideal*. It keeps experts from acting in a fully responsible manner. Because of the public authority of experts, there are usually clearly foreseeable consequences of error for expert claims. Taking these foreseeable consequences into account requires social and ethical values, which then shape what counts as sufficient warrant for the claim in that context. On the other hand, experts should not concern themselves with potentially untoward consequences of making a true claim (as opposed to making a false one). For experts to turn away from a claim because, if true, it would be unpleasant, would be to confuse motives with evidence. We must keep in mind that values do not grant warrant in themselves, but rather help us decide what should count as sufficient warrant.

Although such a shift in the understanding of expertise would require a rethinking of much of the work on trust in expert testimony, this more nuanced view could be quite beneficial in the practical management of expertise. First, it clarifies concerns over bias in our evaluation of experts. Mere disagreement need not mean bias is present in an expert. Bias arises when values are allowed to play a direct role in expert judgment, thus undermining the very core of our reasons

for trusting experts. Bias should disqualify the expert from having epistemic authority, for the truth-seeking virtue is missing. We can tell that an expert is so biased when new evidence has no impact on the expert's judgment. However, experts can also disagree because of different standards for what would count as *sufficient* evidence, and reasonably so. This indirect role, once acknowledged and made clear, can help get the values at stake out in the open, for a more thorough airing of the evidence and the crucial values. Too often we conflate these two roles for values (the direct and the indirect), to the detriment of understanding experts and of furthering adequate public debate. Distinguishing these two roles, and distinguishing bias from perspective, allows for a better understanding of the trust we place in experts, and the grounds on which we might challenge their presumed authority.

There is also a potential practical benefit to this view of expertise for public debate in general. In the public realm, we often expect experts to provide definitive and final empirical claims, claims so strong that no debate about the ethical or social values involved in the related policy choices is needed. A richer understanding of both the endemic nature of uncertainty, and the role for values in expert reasoning, could help to motivate the value-based debates we desperately need. Which is more important—being protective of public health or being protective of private industry from over-regulation? Which is more important—economic development now (especially in less developed nations) or the needs of future generations? Expert debates often dance around these issues, attempting to hide them behind debates about the interpretation of data. Getting these debates out of the backrooms of expertise and into the open would be better for both the experts and the public that relies upon them.

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NOTES

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1. For a brief historical account of much of this development, particularly after World War II, see Heather Douglas, "Border Skirmishes Between Science and Policy," in *Science, Values, and Objectivity*, ed. Peter Machamer and Gereon Wolters (Pittsburgh: University of Pittsburgh Press, 2004), pp. 220–244.

2. Daniel Kevles, *The Physicists* (Cambridge, Mass.: Harvard University Press, 1995), p. 96.

3. The locus classicus for this line of thought is most likely John Hardwig, "Epistemic Dependence," *Journal of Philosophy*, vol. 82 (1985). pp. 335–349; and "The Role of Trust in Knowledge," *Journal of Philosophy*, vol. 88 (1991), pp. 693–708.

4. The literature on the epistemology of testimony is robust, including C. A. J. Coady, *Testimony: A Philosophical Study* (Oxford: Clarendon Press, 1992); Elizabeth Fricker, "The Epistemology of Testimony," *Proceedings of the Aristotelian Society* Supplementary vol. 61 (1987), pp. 57–83; and Peter Graham, "The Reliability of Testimony," *Philosophy and Phenomenological Research*, vol. 61 (2000), pp. 695–709.

5. A line of argument found in Alvin Goldman, "Experts: Which Ones Should You Trust?" in *The Philosophy of Expertise*, ed. Evan Sellinger and Robert Crease (New York: Columbia University Press, 2006), pp. 14–38. This collection of essays includes other interesting perspectives on the nature of expertise, the public's evaluation of expertise, and the importance of expertise in society. However, the essays do not address the normative questions at issue in this essay, which center on the responsibilities of experts.

6. The reasons for this neglect in philosophy of science are complex, and cannot be delved into here with any great detail. The brief account is that philosophers of science, in finding arguments for the value-free ideal for scientists critiqued below, came to think of science as a fairly isolated activity, that should take place with little concern for the impact or implications of the work. This view can be found in work as disparate as that of Isaac Levi, "Must the Scientist Make Value Judgments?" *Journal of Philosophy*, vol. 57 (1960), pp. 345–357; and Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962).

7. See Sheila Jasanoff, *The Fifth Branch* (Cambridge, Mass.: Harvard University Press, 1990), for a critical description of the rise of science advisory bodies in the U.S. since 1970.

8. See Theodore Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton, N.J.: Princeton University Press, 1995); and Elijah Millgram, *Hard Truths* (unpublished manuscript), for more details.

9. See Ian Hacking, *The Social Construction of What?* (Cambridge, Mass.: Harvard University Press, 1999), for accounts of such interactivity.

10. David Hume, *Enquiries Concerning Human Understanding and Concerning the Principles of Morals*, ed. L. A. Selby-Bigge (Oxford: Clarendon Press, 1975); John Stuart Mill, *A System of Logic* (London: Longmans, 1941); Pierre Duhem, *The Aim and Structure of Physical Theory* (Princeton, N.J.: Princeton University Press, 1954).

11. We might be able to construct exceptions of the need for judgment in our experts. We could ask an expert to apply a complex but rigid procedure to a pre-specified body of work—that may eliminate the need for judgment for that particular expert (assuming the rigid procedure makes clear the application of the procedure with no gray areas—like applying a specified statistical test to a specified body of data), but presumably some expert judgment was needed to denote both the particular test and the particular body of evidence on which it was to be performed. The problem of judgment is merely moved, not eliminated.

12. See Carl F. Cranor, *Regulating Toxic Substances: A Philosophy of Science and the Law* (New York: Oxford University Press, 1993) for a general discussion of such scientific conservatism, as well as a critique of it for the concerns of expertise in public life.

13. See Hugh Lacey, *Is Science Value-Free? Values and Scientific Understanding* (New York: Routledge, 1999); and Sandra Mitchell, "The Prescribed and Proscribed Values in Science Policy," in Machamer and Wolters, *Science, Values, and Objectivity*, pp. 245–255, for recent defenses of the "cognitive values only" view of scientific reasoning. This view stems from the work of Isaac Levi, "Must the Scientist Make Value Judgments?" and is reflected in the view that "communal values" drive scientific judgment. See Stella Gaon and Stephen Norris, "The Undecidable Grounds of Scientific Expertise," *Journal of Philosophy of Education*, vol. 35 (2001), pp. 187–201, for concerns related to this view. This view is also reflected in the work of scientists such as Lewis Wolpert, *The Unnatural Nature of Science* (Cambridge, Mass.: Harvard University Press, 1992).

14. Thomas Kuhn, "Objectivity, Value Judgment, and Theory Choice," in *The Essential Tension* (Chicago: University of Chicago Press, 1977), pp. 320–333.

15. Heather Douglas, "The Moral Responsibilities of Scientists: Tensions between Autonomy and Responsibility," *American Philosophical Quarterly*, vol. 40, no. 1 (2003), pp. 59–68. In either case, the role responsibilities one has are never a complete account of moral responsibility. See Michael Hardimon, "Role Obligations," *Journal of Philosophy*, vol. 91 (1994), pp. 333–363. Thus one could think of the obligation to consider the impact of one's choices as part of one's role as expert or as an aspect of one's general responsibilities.

16. Robert Merton, "The Normative Structure of Science," in *The Sociology of Science*, ed. Norman Storer (Chicago: University of Chicago Press, 1973), pp. 267–278.

17. One of the earliest lists of cognitive values (as a list of possible decision aids in science) can be found in C. West Churchman's "Science and Decision Making," *Philosophy of Science*, vol. 22 (1956), p. 248. Earlier mentions of cognitive values do not discuss them in these more recent terms. For example, Karl Popper does discuss some aspects of cognitive values in his *Logic of Scientific Discovery* (London: Hutchinson and Co., 1934/1959), when he argues that having more universality, more precision, and more simplicity allows a theory to be more testable, and thus more falsifiable (chaps. 6 and 7, *passim*). However, as late as 1953, Popper asserted that he still held to the "principle of empiricism," which he construed as asserting "that in science, only observation and experiment may decide upon the *acceptance or rejection* of scientific statements, including laws and theories" (emphasis his). See Karl Popper, "Science: Conjectures and Refutations," in *Conjectures and Refutations* (London: Routledge Classics, 2002), p. 71.

18. See Stillman Drake's Preface to his translation of Galileo's *Dialogue Concerning the Two Chief World Systems* (Berkeley: University of California Press, 1967), for a concise account of the Galileo affair.

19. See Loren Graham's *Science, Philosophy, and Human Behavior in the Soviet Union* (New York: Columbia University Press, 1987), pp. 102–150, for a rich account of the Lysenko episode.

20. This kind of example is developed in greater detail in Heather Douglas, "Inductive Risk and Values in Science," *Philosophy of Science*, vol. 67 (2000), pp. 559–579.

21. John Heil, "Believing What One Ought," *Journal of Philosophy*, vol. 80 (1983), p. 755, emphasis his.

22. Ibid., p. 761.

23. Ibid.

24. Similar to this distinction between acting as warrant, or a direct role, and acting to assess sufficient warrant, or an indirect role, is one articulated by Carl Hempel when he argued that values cannot confirm a scientific theory, but they can have an important role in deciding whether to accept a scientific theory. See Hempel, *Aspects of Scientific Explanation* (New York: Free Press, 1965), pp. 91–92.

25. Goldman, "Experts," p. 30.

26. *Scientific Integrity in Policymaking: An Investigation into the Bush Administration's Misuse of Science*, Union of Concerned Scientists, March 2004.

27. Ibid., p. 5.

28. In a recent paper, Kevin Elliott has called for an ethics of expertise drawn from ideals of informed consent in biomedical ethics. The ethic calls for experts to act in ways that would help members of the public make autonomous and informed decisions based on the expert advice. Fully discussing the values in the indirect role would be part of such an ethic. Kevin Elliott, "An Ethics of Expertise Based on Informed Consent," *Science and Engineering Ethics*, vol. 12 (2006), pp. 637–661.

29. Larry Laudan, "The Epistemic, the Cognitive, and the Social," in Machamer and Wolters, *Science, Values, and Objectivity*, pp. 14–23.

30. One could consider the case of diethyl stilbestrol (DES) to be a case where cognitive values supported the acceptance of a view that placed public health at grave risk. The theories that suggested DES would help prevent miscarriages were simple, explanatorily powerful, and with rather broad scope. They were also quite wrong. On the other hand, global climate change theories may lack much by way of cognitive values, being complex and incomplete at this time, but the consequences of error seem to suggest a desired relaxation of sufficient warrant standards.