



Douglas on values: From indirect roles to multiple goals



Kevin C. Elliott

Department of Philosophy, Byrnes Building, University of South Carolina, Columbia, SC 29208, United States

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ABSTRACT

In recent papers and a book, Heather Douglas has expanded on the well-known argument from inductive risk, thereby launching an influential contemporary critique of the value-free ideal for science. This paper distills Douglas's critique into four major claims. The first three claims provide a significant challenge to the value-free ideal for science. However, the fourth claim, which delineates her positive proposal to regulate values in science by distinguishing direct and indirect roles for values, is ambiguous between two interpretations, and both have weaknesses. Fortunately, two elements of Douglas's work that have previously received much less emphasis (namely, her comments about the goals of scientific activity and the ethics of communicating about values) provide resources for developing a more promising approach for regulating values in science.

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1. Introduction

Over the past fifteen years, Heather Douglas has published a series of influential pieces that challenge the “value-free” ideal for scientific reasoning (see e.g., 2000, 2003, 2008, 2009). In the process, she has stimulated a wave of interest in the argument from inductive risk (e.g., Biddle & Winsberg, 2010; Brown, 2013; Elliott, 2011a, 2011b; Steel, 2010; Steel & Whyte, 2012; Steele, 2012; Wilholt, 2009; Winsberg, 2012). According to this argument, scientists are forced to make value judgments when choosing the standards of evidence required for accepting hypotheses (Churchman, 1948; Rudner, 1953). While it is relatively uncontroversial that values can legitimately influence many aspects of science (e.g., decisions about what research projects to pursue or how to apply scientific findings), the inductive-risk argument goes further by showing that even the appraisal of hypotheses should not be value-free.¹

Douglas contextualizes the inductive risk argument in a broader framework. First, she emphasizes that scientific practice is permeated by numerous small-scale decisions that must be made under

inductive risk (see e.g., Douglas, 2000). Second, she argues that scientists have ethical responsibilities to avoid causing negligent harm to others as a result of the way they make these decisions (Douglas, 2009). Finally, she insists that while scientists ought to consider the harmful consequences of making erroneous decisions (an “indirect” role for values), they should not slant their reasoning with the goal of bringing about consequences that they find appealing (a “direct” role for values) (Douglas, 2009).

The next section of the paper distills this framework into four major claims. Section 3 then introduces an important problem with Douglas's account. Namely, her distinction between direct and indirect roles for values, which is an important element of her approach to regulating values in science while rejecting the value-free ideal, is ambiguous between two interpretations. Section 4 argues that both interpretations have significant weaknesses. Fortunately, Section 5 shows that two elements of her account that have previously received much less emphasis (namely, her comments about the goals of science and the ethics of expertise) provide resources for developing a promising new account of values in science.

E-mail address: ke@sc.edu

¹ To be precise, the inductive-risk argument shows that the appraisal of hypotheses should not be free of *non-epistemic* values (i.e., values that do not consistently promote science's truth-seeking goals). As Douglas (2009) herself emphasizes, the notion that *epistemic* values such as predictive accuracy or internal consistency can legitimately influence the appraisal of hypotheses is already assumed.

2. Douglas's four major claims

In recent papers (e.g., 2000, 2003, 2008) and a book (2009), Douglas has developed a prominent challenge to the ideal of value-free science, together with a positive account of how values can be incorporated in science while maintaining scientific integrity. This section distills the major elements of her account into four important claims. These claims do not exhaust all the features of her account, but they do capture most of its crucial components. By analyzing these four claims we can identify the most important strengths and weaknesses of her position, as well as its most significant ramifications. Let us consider each claim in turn.

Douglas's first claim is drawn from a major debate about values in science from the middle of the twentieth century:

Inductive Risk: Scientists need to incorporate value judgments in their reasoning, insofar as they must weigh the importance of making various sorts of mistakes when deciding how much evidence to demand for accepting or rejecting hypotheses (Douglas, 2000, 2009).

In making this claim, Douglas appeals to the work of Rudner (1953) and Churchman (1948), who famously argued that scientists have to incorporate value judgments in their work insofar as they need to accept or reject hypotheses. They insisted that, while it would be inappropriate to accept a claim merely because it accords with one's ethical or political preferences, these sorts of social values do become relevant when deciding how much evidence to demand in order to accept a hypothesis. They drew their arguments from the practice of statistical testing, where one must choose acceptance and rejection regions for a test while recognizing that if one lessens the chance of making a false positive error one increases the chance of making a false negative error. In cases where the consequences of making a mistake are significant (e.g., when one is testing a potentially toxic chemical that could harm public health if it is erroneously accepted as safe), they insisted that it is important to take ethical and social values into account when setting evidential standards for accepting hypotheses.

Whereas Douglas's Inductive Risk claim was developed previously by other figures, her second claim adds a distinctive twist:

Value Permeation: The value judgments that scientists need to make because of Inductive Risk permeate scientific practice and include decisions about what methodologies to employ, how to characterize evidence, and how to interpret evidence (Douglas, 2000, 2009, p. 103).

One of the most significant elements of Douglas's (2000) paper was her point that the value judgments associated with inductive risk cannot be isolated to the decision at the end of a study to accept or reject a hypothesis. Instead, she emphasized that decisions made throughout a study can be mistaken, with resulting social consequences that scientists need to consider (Douglas, 2000, p. 565). One of her most interesting examples concerns the interpretation of slides mounted with tissues taken from animals that are part of chemical toxicity studies (Douglas, 2000, pp. 569–572). She notes that it can be difficult to determine whether the slides exhibit signs of tumor growth, and it can also be difficult to distinguish benign tumors from malignant ones. These decisions about how to characterize the evidence are important, because they can influence whether the chemicals under study are ultimately labeled as carcinogenic and at what dose levels they are considered to be harmful. Thus, she notes that toxicologists ought to consider the social consequences of drawing erroneous conclusions as they engage in the

process of data characterization or other methodological decisions throughout their studies.

While the previous two claims highlight the fact that value judgments are necessary when scientists are faced with inductive risk, they do not specify which values in particular should play a role in these decisions. Douglas's third claim remedies this deficiency:

Ethical Responsibility: Scientists have ethical responsibilities not to cause reckless or negligent harm to others when making choices that have foreseeable consequences (Douglas, 2003, 2009, p. 71).

Douglas devotes a chapter of her 2009 book to exploring scientists' moral obligations toward society. In order to be as uncontroversial as possible, she starts with responsibilities that all moral agents have. One of these duties is to refrain from engaging in reckless or negligent actions that cause foreseeable harm to others. She notes that when scientists are performing policy-relevant science and making methodological decisions in the face of inductive risk, it is often fairly clear how they will cause harm to others if they draw erroneous conclusions. Moreover, she rejects efforts by some thinkers to exempt scientists from these responsibilities based on the notion that scientists have special social roles with diminished moral responsibilities (2009, pp. 72–79). Thus, Douglas insists that scientists have ethical responsibilities to weigh the consequences of error when making socially relevant methodological decisions.

Whereas Douglas's first three claims tear down the value-free ideal for science, her fourth claim clarifies how to regulate values while allowing them to influence scientific reasoning:

Direct and Indirect Roles: Values of any sort can appropriately influence scientific reasoning as long as they play only an indirect role; in contrast, values should play a direct role only in the early stages of scientific activity, before deciding what to believe or what empirical claims to make (Douglas, 2008, 2009, pp. 94–112).

The distinction between direct and indirect roles for values is particularly central to Douglas's recent book (2009). She rejects the notion that scientists or philosophers can reliably distinguish epistemic values (i.e., those that are indicative of truth) from non-epistemic values (Douglas, 2009, pp. 90–94). Thus, she does not think that scientists can preserve their integrity by allowing epistemic values to influence them while shunning non-epistemic values. Instead, she insists that scientists ought to constrain the *roles* that values play in their work.² The distinction between direct and indirect roles is irrelevant to the early stages of scientific reasoning (because non-epistemic values are directly relevant to those early stages), but the distinction applies once scientists are making judgments that influence their appraisal of hypotheses.

Building on the earlier work of Rudner (1953), Churchman (1948) and Hempel (1965), Douglas argues that values play an *indirect* role when they reflect concerns about inductive risk, i.e., when scientists are considering the consequences of making erroneous claims (2009, pp. 96–97). We have already seen that she thinks scientists have a moral responsibility to incorporate values into their reasoning in this indirect role. In contrast, she argues that values play a *direct* role when they “act as reasons in themselves to accept a claim” (Douglas, 2009, p. 96). She insists that values should not play a direct role when scientists are evaluating what empirical claims to accept, because it would amount to something like wishful thinking—scientists would be treating their ethical, political, or religious values as if they were evidence in support of their claims (2009, p. 96).

² In her most recent work, Douglas shifts toward the view that some values can be reliably classified as epistemic, but this does not affect her central focus on using the distinction between direct and indirect roles as a fundamental criterion for distinguishing acceptable and unacceptable value influences (see Douglas, *in press*).

3. Direct and indirect roles: the problem of ambiguity

While the four claims identified in Section 2 provide a systematic and innovative approach for regulating values in policy-relevant science, they ultimately face a significant difficulty. The problem is that the Direct and Indirect Roles claim, which serves as an important element of Douglas's approach to regulating values in the assessment of hypotheses while rejecting the value-free ideal (2008, p. 11; 2009, p. 149), is problematic. This section highlights the fact that the distinction between direct and indirect roles is ambiguous. The next section raises a further difficulty, which is that the two major ways of interpreting the distinction both turn out to have significant weaknesses.

The first problem is that Douglas describes the distinction in somewhat different ways throughout her work (Elliott, 2011a, pp. 307–308). Sometimes, she asserts that values acting in the direct role provide “warrant or reasons to accept a claim” (2009, p. 96). In contrast, she claims that values operate in the indirect role when they “act to weigh the importance of uncertainty, helping to decide what should count as *sufficient*” evidence for a choice (2009, p. 96, emphasis in original). Let us call this the “logical” interpretation of the distinction, insofar as it is based on Hempel's (1965) point that social and ethical values are logically irrelevant to evaluating the evidence for scientific hypotheses but are logically relevant to choosing how much evidence to demand in order to accept hypotheses:

Logical Direct/Indirect Roles: Values act in a direct role when they are treated as warrant or evidence for a claim; they act in an indirect role when they influence decisions about how much evidence is sufficient to accept a claim.

But Douglas sometimes seems to develop a different interpretation of the distinction. She asserts that values act in a direct role when scientists accept a claim because it will help to bring about “some intended option or outcome” (2009, p. 96). In contrast, values act in an indirect role when they influence scientists' choices based on *unintended* consequences associated with mistakes that they want to avoid (2009, p. 96; Douglas, 2000, pp. 564–565). Let us call this the “consequential” interpretation:

Consequential Direct/Indirect Roles: Values act in a direct role when they influence scientists' choices based on intended outcomes that they want to bring about by accepting a claim; they act in an indirect role when they influence scientists' choices based on unintended consequences associated with mistakes that they want to avoid.

There are other subtly different ways that Douglas may formulate the distinction between direct and indirect roles (Elliott, 2011a), but they do not differ significantly from the logical and consequential interpretations.³

These two interpretations are importantly different. Specifically, the logical interpretation provides a more expansive formulation of the indirect role for values, insofar as values could play an indirect role under the logical interpretation while playing either a direct or an indirect role according to the consequential interpretation. For example, suppose that a scientist were deciding which model to use for extrapolating the toxic effects of a chemical from high doses down to low doses. Suppose also that she had characterized the state of the available evidence and found that it was inadequate to determine which of two models would yield

the most accurate predictions—for the sake of simplicity, we can assume that the evidence for the two models was equal. If social values then influenced how she weighed the resulting uncertainty and chose a model, they would be playing an indirect role *according to the logical interpretation*.⁴ However, suppose that as she weighed the uncertainty, she decided that it would be best to intentionally choose the model most likely to benefit the chemical industry because that model would help to create jobs and other economic benefits. This would be a direct role for values *according to the consequential interpretation*.

Douglas seems to conflate these two interpretations; they are intertwined throughout her book. For example, she claims that values can legitimately influence a scientist's claims “only through the weighing of uncertainty. The scientist should not think about the potential consequences of making an accurate empirical claim and slant their advice accordingly” (2009, p. 81; see also 2009, p. 96). Here and throughout the book, Douglas seems to assume that if scientists consider consequences that they would intentionally like to bring about, they cannot merely be weighing uncertainty—consideration of these consequences is bound to corrupt their evaluation of the evidence. This possibility that scientists will misinterpret or ignore evidence does indeed seem to be her central concern about the direct role for values. For example, she claims:

A direct role for values in the interpretation of evidence would allow values to have equal or more weight than the evidence itself, and scientists could select an interpretation of the evidence because they preferred it cognitively or socially, even if the evidence itself did not support such an interpretation. And if values were allowed to play a direct role in the acceptance or rejection of scientific theories, an unpalatable theory could be rejected regardless of the evidence supporting it. (Douglas, 2009, p. 102)

Douglas is clearly correct that values should not influence scientists in this manner, but it is crucial to recognize that these examples involve values acting in a direct role *under the logical interpretation*; values acting in a direct role *under the consequential interpretation* need not be so egregious, as we will see below.

4. Direct and indirect roles: a dilemma

4.1. The consequential interpretation

Not only is Douglas's distinction between direct and indirect roles ambiguous, but it also faces a dilemma: both the logical and the consequential interpretations have significant weaknesses. Let us first consider the consequential interpretation, because it represents Douglas's own unique way of interpreting the distinction. Recall that when she discusses the indirect role for values, she frequently emphasizes not only that scientists should weigh uncertainty but that they should focus only on the unintentional harm that they could cause if they make erroneous claims (2009, p. 81). It is the latter point that makes Douglas's approach distinctive. Unfortunately, this consequential form of the distinction appears to allow value influences that are unacceptable and prohibit value influences that are acceptable.

First, Steel and Whyte (2012) have argued, in contrast to Douglas's position, that values can play an illegitimate role in assessing hypotheses even if they are acting in an indirect role (interpreted according to the consequential form of the distinction). For

³ In a previous paper (Elliott, 2011a), I distinguished several different ways of drawing the direct/indirect roles distinction, and I ultimately argued that Douglas seemed to be accepting what this paper calls the consequential interpretation.

⁴ This paper uses the phrase “weighing uncertainty” in the same way that Douglas (2009) does, as a way of referring to the process of setting standards of evidence for accepting or rejecting a claim. Like Douglas, I will assume that scientists can incorporate values in a decision about what standards of evidence to demand while not allowing those values to influence their assessment of the status of the evidence.

example, they point to cases in which pharmaceutical companies have failed to publish results indicating that their products are problematic. Steel and Whyte note that this activity could be the result of values acting in an indirect role, insofar as the pharmaceutical companies could be motivated by the consequences of error. For example, they might be worried about the harmful consequences of erroneously publishing negative information about their own drugs; patients might hastily stop taking the drugs and experience harmful effects on their health (and the drug companies might suffer economic harm as well). Nevertheless, Steel and Whyte argue that the failure to publish negative results is unacceptable, given that it prevents subsequent meta-analyses of the drugs from providing “severe” tests. Douglas herself agrees that it is “unacceptable” for scientists to suppress unwelcome research findings, although she assumes that this suppression would be caused only by values acting in a direct role (Douglas, 2009, p. 113).⁵

The consequential interpretation of the direct/indirect roles distinction also appears to prohibit value influences that are appropriate. It is not surprising that Douglas regards direct roles for values under the consequential interpretation to be inappropriate, because she seems to think that if scientists consider the intended, beneficial consequences of accepting a claim, they will not evaluate the evidence fairly. But this is mistaken. Scientists can consider intended consequences of accepting a claim as part of their analysis of how to respond to uncertainty, and this analysis need not corrupt their evaluation of the evidence.

Let us return, for example, to a scenario in which toxicologists are deciding what model to use for extrapolating the effects of toxic substances from high doses down to lower doses. Let us suppose that they try to be fair and to consider all the available evidence, but it leaves them with significant leeway about which of two models to choose.⁶ Let us suppose that they then consider all the consequences—good and bad—of accepting the model that will produce lower toxicity predictions and that will therefore be more beneficial to the chemical industry. On one hand, if they are correct in choosing this model, it will have the good, intended consequences of helping to preserve chemical manufacturers’ profits, maintaining jobs and economic benefits, and promoting the continued use of chemicals to serve beneficial purposes. It will also have bad consequences, such as strengthening the power of an industry that produces a number of harmful products and that often inhibits the development of more sustainable alternatives. On the other hand, if they are incorrect in choosing the model that yields lower toxicity predictions, it will have the harmful, unintended consequence of exposing humans and the environment to dangerous chemicals.⁷ But it will still have the good consequence of allowing the chemical manufacturers to continue to make profits and promoting economic development (although the economic costs of dealing with human and environmental harms might ultimately outweigh the economic benefits associated with using the chemical).

Based on this example, it should be clear that toxicologists could weigh the complete range of intended and unintended consequences of adopting a particular model without disregarding any available evidence. For example, they could offer an entirely unbiased assessment of the evidence and conclude, say, that the models

are equally plausible. Then, when deciding which model to accept, they could consider all of the good and bad consequences associated with choosing each model. Of course, industry-friendly scientists could, in principle, allow themselves to be corrupted by their desire to help the chemical manufacturers and start ignoring evidence. But left-leaning scientists could just as well become corrupted by their desire to avoid making the mistake of exonerating harmful chemicals and start ignoring evidence. Either way, this would be an unnecessary mistake. From a conceptual perspective, it is entirely possible for scientists to incorporate values in the direct role under the consequential interpretation without ignoring or corrupting the available evidence.

But even if allowing values to play a direct role under the consequential interpretation need not cause scientists to disregard evidence, there may be other reasons why it would be problematic to consider the beneficial, intended consequences of drawing a conclusion when weighing uncertainty. For example, one could argue that scientists have strict ethical responsibilities to avoid causing harm but not to bring about benefits for society (Elliott, 2011a). Based on this argument, one could insist that scientists have ethical duties to consider whether they will unintentionally harm others by making mistakes, but they do not have ethical responsibilities to consider any other effects of their actions. But there are two problems with this argument. First, even if it were correct, it would show only that scientists are not *obligated* to consider the beneficial consequences associated with accepting particular claims; it would not show that they are ethically *prohibited* from doing so. But the consequential interpretation of Douglas’s direct/indirect roles distinction is premised on the notion that it is *unacceptable* for scientists to be motivated by the beneficial consequences of accepting particular claims. A second problem is that it is highly doubtful that scientists have obligations only to avoid causing harm and not to benefit society. Given that they are being asked to generate information that can be useful for policy makers, it seems surprising that they should blind themselves to all consequences of their actions other than the harm that they could cause if they are mistaken.

So far, we have just been rejecting arguments offered on behalf of the consequential interpretation of the direct/indirect roles distinction, but this fact (namely, that scientists are often expected to provide socially helpful information to decision makers) provides the basis for a positive argument that the distinction excludes appropriate value influences. In particular, if scientists are asked to provide information to assist policy makers, they arguably have a responsibility to try to consider the same range of consequences as these decision makers. And, unless some legal statute artificially narrows their focus, policy makers are typically expected to be as comprehensive as possible—considering both the good and bad consequences of being correct or mistaken—when considering the social consequences of their decisions.

One might respond that scientists and policy makers have very different social roles and that scientists should leave all consideration of social consequences to policy makers. But this position is precisely what Douglas has been at pains to reject, especially in her Value Permeation claim (see e.g., Douglas, 2000, 2003). She insists that throughout their work, scientists have to make

⁵ As Douglas has pointed out in personal correspondence, she could presumably reject the pharmaceutical companies’ activities by arguing that they are appealing to inappropriate values. But Steel and Whyte would presumably argue that even if the companies were appealing to legitimate concerns about preventing harm to the people taking their drugs, those values would be having an epistemically problematic impact on science by preventing subsequent analysts from developing accurate meta-analyses of drug safety and quality. Thus, while these epistemic and non-epistemic considerations would have to be weighed against each other in specific cases to decide which should take priority, Steel and Whyte seem to be correct that non-epistemic values can have epistemically problematic impacts on science even if they are playing only an indirect role.

⁶ For the sake of simplicity, we can assume that both models appear to be equally plausible, so the “weighing of uncertainty” in this case is just a matter of deciding which of the two equally plausible models to accept. In other cases, the evidence for one model might be stronger than the evidence for another, but scientists would still have to decide whether the evidence for the stronger model is adequate to accept it or not.

⁷ This paper follows Douglas in claiming that the harmful consequences of choosing a mistaken model are unintended. But deciding whether these consequences are truly unintended (especially considering that they are foreseen and factored into the scientists’ ethical reasoning) is a complicated matter that deserves more scrutiny.

value-laden methodological decisions that affect their likelihood of accepting or rejecting hypotheses, so they cannot leave all consideration of social values to policy makers. Thus, if scientists are forced to take on some of the policy makers' responsibilities to consider social values, they should arguably try to consider the same range of social consequences (and perhaps even the same weighing of those consequences) as the policy makers. The consequential interpretation of the direct/indirect roles distinction therefore appears to inappropriately narrow the scope of consequences that scientists can consider.

Finally, it is worth noting that this entire discussion of the consequential interpretation of the direct/indirect roles distinction has been premised on the assumption that there is indeed a clear conceptual distinction between the consequences that a scientist is considering when thinking about the unintended effects of making mistaken claims, as opposed to the intended effects of accepting correct claims. But this may not always be the case. Consider again the example of deciding what model to use for extrapolating the high-dose effects of toxic chemicals down to lower doses. Suppose that the available evidence indicates that there are two particularly plausible models; one tends to predict less toxicity than the other, but it is not clear which model is correct. In a case like this one, the desire to avoid a set of undesirable consequences may be at issue whether one is thinking about the unintended consequences of mistakenly choosing one model or the intended consequences of correctly choosing the other model.

For example, a crucial reason for not mistakenly choosing the model that predicts more toxicity is that it will harm the chemical industry and the economy; but one of the most important intended consequences of choosing the model that predicts less toxicity is the avoidance of these harms. On the flip side, an important reason for not mistakenly choosing the model that predicts less toxicity is that it will cause harm to humans and the environment; but one of the important intended consequences of choosing the model that predicts more toxicity is the avoidance of these threats. It would be surprising if it were legitimate for the desire to avoid particular threats to count as a reason *not* to choose one model, while at the same time that desire could not legitimately count as a reason *for* choosing the alternative model. These sorts of scenarios may provide further reasons for thinking that the consequential form of the direct/indirect roles distinction inappropriately forbids scientists from considering consequences that are acceptable to consider.

4.2. The logical interpretation

Given that the consequential interpretation appears to be problematic, one might be inclined to employ the logical interpretation of the direct/indirect roles distinction as a standard for regulating values in science. On this view, values should not play the role of evidence, but they can play the role of guiding the standards of evidence for accepting hypotheses in the face of uncertainty. This is not very different from a traditional view about values that McMullin (1983) influentially expressed and that Steel (2010) has recently extended. McMullin (1983) made a distinction between epistemic values (i.e., those that are indicative of truth) and non-epistemic values (e.g., ethical or political preferences). He insisted that non-epistemic values should not influence scientists' evaluation of the evidence for their hypotheses, although they could influence policy decisions about what claims to accept as a basis for action (see also Giere, 2003; Mitchell, 2004). The logical interpretation of the direct/indirect roles distinction essentially recapitulates McMullin's position, except for two differences. First, McMullin seems to think that scientists should focus only on assessing the epistemic status of their hypotheses and that they should leave decisions about what claims to accept under

uncertainty to policy makers. In contrast, Douglas argues that scientists themselves often have to make these decisions (because of the Value Permeation claim). Second, in at least some of her work, Douglas has been more suspicious than McMullin about the attempt to classify values as either epistemic or non-epistemic (see Douglas, 2009). In her most recent work, however, she seems to hold out more hope for classifying some values as being epistemic (see Douglas, *in press*). Therefore, she would presumably now formulate the logical form of the direct/indirect roles distinction as the claim that *non-epistemic* values should count only toward deciding how to weigh uncertainty, whereas *epistemic* values can play an evidential role.

Unfortunately, there are two problems with the logical interpretation of the direct/indirect roles distinction. The first problem is that it is very difficult to employ the distinction in practice, so it provides an unreliable method for regulating values in science. Part of the problem with employing the distinction is that it is extremely difficult to distinguish values that are epistemic from those that are non-epistemic. For one thing, various figures disagree about which values are in fact epistemic; for example, Longino (1996) has suggested a set of cognitive values (novelty, ontological heterogeneity, mutuality of interaction, applicability to current human needs, and diffusion of power) that differ from those in typical lists. While these values might appear to be pragmatic and political rather than purely epistemic, Longino and others have argued that the ways scientists interpret more traditional epistemic values also reflect non-epistemic preferences (Douglas, 2009; Longino, 1996; Rooney, 1992). Determining how to weigh the importance of various epistemic values when they conflict raises further difficulties and further opportunities for non-epistemic values to play an implicit role in scientific reasoning.

Steel (2010) partially addresses this problem by arguing that there are intrinsic and extrinsic epistemic values. Values are intrinsically epistemic "if exemplifying that value either constitutes an attainment of truth or is a necessary condition for a statement to be true," whereas they are extrinsically epistemic "when they promote the attainment of truth without themselves being indicators or requirements of truth" (Steel, 2010, p. 18). He argues that a wide range of values can be extrinsically epistemic in some contexts but not in others. However, the price that Steel pays for his solution is that it becomes very difficult to determine in any particular context which values are in fact epistemic. For example, scientists may know that external consistency acts as an epistemic value when their other theories and background beliefs are correct, but in any particular case they will not know until much later whether their other theories and background beliefs are in fact correct. Therefore, there are likely to be significant disagreements among scientists about which values are in fact epistemic and how to weigh them.

One might object that even if these problems make it difficult to criticize other scientists for incorporating unjustified values in their work, they might be less serious from the perspective of an individual scientist (see Elliott, 2011a). For example, even if various scientists disagree about which values are genuinely epistemic and how to weigh them in a particular context, an individual scientist could commit herself to incorporating only values that she *perceives* to be epistemic, unless she *perceives* that she faces a choice between two options that are equally epistemically compelling. This approach might rescue the direct/indirect roles distinction as an ideal for individual scientists to pursue (see Elliott, 2011a), but there are at least two reasons why it does not rescue the distinction as a tool for regulating values in science. First, it depends on individual scientists' potentially idiosyncratic judgments about how to identify and weigh epistemic values. Second, it is doubtful that scientists can reliably identify the values that are actually influencing themselves (Elliott, 2011a). For example, when

weighing a highly complex body of evidence, it is likely to be very difficult for a scientist to discern the precise considerations that incline him toward one hypothesis rather than another. While he might think that he is influenced solely by epistemic considerations, subtle non-epistemic values might also be playing a role.

But it is important to recognize the limits of this first challenge to the logical interpretation of the direct/indirect roles distinction.⁸ It does not impugn the effort to use the logical interpretation to distinguish at a conceptual level between values that are appropriate and inappropriate in scientific reasoning. Rather, it shows that this approach to distinguishing between appropriate and inappropriate values is difficult to follow in practice. If scientists cannot reliably recognize whether they are appealing to legitimate evidential considerations or not, then one needs to provide them with guidance that moves beyond merely trying to exclude non-epistemic values from their reasoning.

The logical interpretation of the direct/indirect roles distinction does fall prey to a further problem, however, which more directly challenges the coherence of the distinction as a guide to acceptable and unacceptable value influences. Namely, it fails to apply whenever scientists are engaged in practical appraisals of hypotheses or theories on the basis of goals that are not purely epistemic.⁹ While one might initially assume that scientists are always focused solely on the aim of achieving truths, the situation is arguably much more complex. For example, various philosophers of science have argued that scientists frequently aim to assess hypotheses with an eye toward determining whether they are worthy of further pursuit or whether they can serve as an appropriate basis for action or whether they adequately simplify reasoning in a particular context (see e.g., Elliott & Willmes, *in press*; Laudan, 1981; Steel, 2011). Once one recognizes that scientists appraise hypotheses and models based on other goals besides merely arriving at truths, it becomes clear that the logical form of the direct/indirect roles distinction fails to apply whenever non-epistemic values are directly relevant to achieving the aims that are in play.

Consider, for example, the decision whether or not to accept a model for the purposes of performing risk assessments of potentially carcinogenic compounds. In a context like this one, scientists and regulators might adopt the goal of minimizing the social costs associated with over- or under-regulating carcinogens. If that were their goal, then they would need to choose from among the available models not only based on their predictive accuracy but also based on the speed with which they could generate results (Cranor, 1995). In fact, they might even need to choose a model with *less* predictive accuracy than others for the sake of obtaining quicker results. The importance of speed arises from the fact that in countries like the United States many worrisome chemicals are allowed to remain on the market until risk assessments have been completed. Therefore, the use of slow risk assessment models allows harmful substances to remain in commerce for extended periods of time and to generate significant social costs due to under-regulation. Once one clarifies the aims of assessing hypotheses or models in contexts like this one, it becomes clear that the direct/indirect roles distinction would inappropriately prevent scientists

from incorporating non-epistemic values (such as concerns about speed) in their reasoning.

One might object that allowing scientists to appraise hypotheses or models based on practical goals violates the epistemic standards of science. But this objection fails to take account of the fact that scientists can adopt a variety of different cognitive attitudes toward their work, and not all of them require focusing solely on epistemic goals. A cognitive attitude is an evaluative response (e.g., entertaining, conjecturing, accepting, or believing) that one takes toward a particular body of content such as a hypothesis or theory or model. One can symbolize cognitive attitudes using the form “S A that p,” where A stands for the attitude that an agent, S, takes toward some content, p (see Elliott & Willmes, *in press*; McKaughan, 2007; Schwitzgebel, 2010). For example, one can define the cognitive attitude of belief such that S believes that p iff S regards p as true. A number of scholars have recently attempted to characterize an alternative cognitive attitude, acceptance (see e.g., Bratman, 1999; Cohen, 1992; van Fraassen, 1980).¹⁰ According to Jonathan Cohen, one accepts a proposition if one includes it “among one’s premisses for deciding what to do or think in a particular context” (Cohen, 1992, p. 4). While one might initially assume that scientists are always in the business of believing their theories or models to be true, many figures have argued that acceptance is actually a central cognitive attitude in science (e.g., Cohen, 1992; Elliott & Willmes, *in press*; McKaughan, 2007; Wray, 2007). Importantly, scientists can legitimately accept theories or hypotheses based on their ability to meet practical goals (Cohen, 1992; Elliott & Willmes, *in press*).

Defenders of the epistemic purity of science might still object that allowing non-epistemic values to influence scientists’ appraisals of models or hypotheses could be problematic even if the scientists adopt cognitive attitudes other than belief. One way to develop this objection would be to point out that cognitive attitudes such as entertaining or conjecturing or accepting often play a preliminary role in the path that scientists take toward ultimately believing something. Therefore, if non-epistemic values influence these other cognitive attitudes, it could corrupt the scientists’ eventual beliefs.¹¹ This is an important issue to explore in further studies of cognitive attitudes and values in science, but two preliminary responses are available. First, this problem can be addressed in many cases by being explicit about the precise goals at play in particular contexts. For example, if everyone understands that a particular model is being accepted because it minimizes social costs in a regulatory environment and not because it is the most accurate model, then it is unlikely that scientists will inappropriately end up believing that the model is true.

When this first solution is insufficient, another way to prevent non-epistemic values from having inappropriate influences is to clearly prioritize among the multiple goals at play in a particular context. For example, suppose that a scientist aims to avoid challenging his religious commitments, but he also aims to arrive at true beliefs. His desire to avoid challenging his religious commitments might incline him never to entertain particular hypotheses, whereas his goal of eventually arriving at true beliefs might count in favor of entertaining them. This conflict could be settled by

⁸ I thank Daniel Steel for helpful insights on this issue.

⁹ This paper argues that the direct/indirect roles distinction is inapplicable to the practical appraisal of theories or hypotheses, but it does not address the question of whether the direct/indirect roles distinction provides appropriate guidance for regulating values in the case of purely epistemic appraisals (assuming that purely epistemic appraisals are even possible). It does seem plausible that non-epistemic values should be excluded from playing a direct role if scientists are appraising theories or hypotheses from a purely epistemic standpoint, but the difficult question is whether non-epistemic values should be allowed to play an indirect role. It is not clear that non-epistemic considerations should even be allowed to influence one’s standards of evidence when one is focused solely on what to believe (as opposed to when one is considering what to accept as a basis for action). But these issues are set aside for the purposes of this paper.

¹⁰ Although Bas van Fraassen’s work on acceptance has been influential, it raises particularly complicated issues. In particular, van Fraassen’s concept of acceptance incorporates an element of belief, insofar as it involves believing that what a theory says about observable things is true (van Fraassen, 1980). The account of acceptance developed in this paper (and inspired by Cohen, 1992) is more clearly distinct from the concept of belief.

¹¹ I thank a helpful anonymous referee for pushing me to address this objection and suggesting the following example about religious beliefs.

determining which aim is of greater importance to the scientist or to the scientific community and regulating the roles for epistemic and non-epistemic values in order to meet the highest-priority goals. Considering that ultimately pursuing truth is often a high priority in scientific practice, this might sometimes mean that other goals must be overridden. (So, for example, the religious scientist might have to entertain unpalatable hypotheses.) However, this holds only to the extent that the two aims cannot be reconciled. In many cases, scientists can entertain or accept hypotheses for practical reasons without inhibiting their ability to meet their purely epistemic goals as well.

5. Reformulating Douglas's account

If the criticisms of the Direct/Indirect Roles claim in Sections 3 and 4 are convincing, then Douglas's account of values in science needs to be reconsidered. Central to her 2009 book was the claim that the value-free ideal for science could be rejected while maintaining the integrity of science as long as scientists allowed themselves to be influenced by values only in the indirect role and not in the direct role. But if the distinction between direct and indirect roles for values has significant weaknesses under both its consequential and its logical interpretations, this raises doubts about the cogency of her project. Fortunately, by focusing attention back on the four claims elucidated in Section 2, we can gain a clearer sense of Douglas's contributions to the values-in-science literature. Specifically, we find that her attack on the value-free ideal (in her Inductive Risk, Ethical Responsibility, and Value Permeation claims) remains largely unscathed from the criticisms developed in this paper.¹² Moreover, by turning to two elements of her account that have previously received fairly little attention, we can gesture toward a more promising approach for regulating values in science while abandoning the value-free ideal.

Recall that there are two main problems with the logical interpretation of the direct/indirect roles distinction. The first problem is that it can be very difficult to determine which values are epistemic (and can therefore play the role of evidence) and which ones are non-epistemic. The second problem is that, depending on the goals that scientists have when appraising hypotheses, the logical interpretation of the direct/indirect roles distinction sometimes disallows appropriate value influences. Let us address the second problem first. Douglas hints at the solution to this difficulty early in her 2009 book, where she notes that when scientists propound claims as voices of authority, they are not merely engaged in belief; they are performing an action (Douglas, 2009, p. 16). Moreover, she emphasizes that whereas (non-epistemic) values should not dictate belief, they are relevant to deciding what claims to propound. I would suggest that the key to formulating a more successful criterion for distinguishing appropriate and inappropriate values is to follow Douglas's example of distinguishing different scientific goals and the values that are relevant to them.

Consider the merits of something like the following as a criterion for distinguishing appropriate and inappropriate value influences:

Multiple Goals Criterion: A particular value can appropriately influence a scientist's reasoning in a particular context only to the extent that the value advances the goals that are prioritized in that context.

This criterion is premised on the notion that scientists can legitimately assess hypotheses or models based on practical goals as long

as they adopt appropriate cognitive attitudes toward their conclusions. As we saw in the last section, whereas the attitude of belief is commonly thought to be guided only by the pursuit of truth (Bratman, 1999; Williams, 1973), scientists can legitimately pursue a range of different goals when they are deciding what hypotheses to accept (Bratman, 1999; Elliott & Willmes, *in press*). It is entirely appropriate for a scientist to accept a hypothesis because it is worthy of further investigation in a particular context (Laudan, 1981), or to accept it because it is the best approach to simplifying scientific reasoning for particular purposes (Steel, 2011), or to accept it because it provides the best basis for developing a particular regulatory policy (Elliott, 2011b). Non-epistemic values are often directly relevant when scientists are assessing hypotheses for these practical purposes (Elliott & Willmes, *in press*).

The strength of the Multiple Goals Criterion is that it provides guidance for regulating the roles of values in appraising scientific hypotheses, but (unlike the direct/indirect roles distinction) it allows for non-epistemic values to play a direct role in assessing hypotheses from a practical perspective. The new criterion allows non-epistemic values to count as reasons for accepting a model or hypothesis as long as they promote the goals of the assessment. For example, to return to an earlier example, if a scientist were accepting a particular dose–response model with the goal of minimizing social costs, then ethical and pragmatic considerations about whether the model were sufficiently protective of public health and provided sufficiently rapid results would be relevant and acceptable for a scientist to incorporate in his or her reasoning. However, considerations about which model were most likely to advance the scientist's career would not be relevant to advancing the goal of minimizing social costs, and so they would be excluded by this criterion.

Nevertheless, a skeptic of the Multiple Goals Criterion might worry that despite its apparent ability to regulate values in science, it is likely to be too permissive in practice. In the regulatory context, for example, scientists and regulators often have multiple goals: preserving economic growth, protecting public health, and advancing scientific understanding of toxic chemicals. One might think that virtually any influence of non-epistemic values could be justified by some combination of these goals, and therefore the Multiple Goals Criterion would appear to be “toothless” for regulating these values. But it is crucial to recognize that the criterion evaluates the legitimacy of values based on the goals that are prioritized in a particular context. Thus, the scientific community—in collaboration with regulators and other stakeholders—must decide how important it is to preserve economic growth versus protecting public health or obtaining highly accurate results when accepting models for regulatory purposes. Indeed, one reason why debates about regulatory science are so difficult to resolve is that different stakeholders prioritize these goals differently. But once one specifies which aims are to be prioritized when assessing a model or hypothesis, the influences of non-epistemic values can be criticized for failing to promote those aims.

It is worth considering an additional objection, however, from those who might think that scientists should not adopt so many different goals. For example, one might argue that, in virtue of their social role as sources of relatively impartial information, scientists should limit themselves to propounding claims only if they either believe them to be true or if they can assign them a relatively precise probability of being true. One problem with this objection is that it does not do justice to the complex range of aims that scientists actually have when assessing their work; much of the time

¹² One might still attempt to challenge Douglas's attack on the value-free ideal by arguing that there are a range of contexts in which scientists can either avoid making the decision to accept hypotheses or they can set standards of evidence solely based on considerations internal to the scientific community. These responses to the inductive risk argument go back to the work of Jeffrey (1956) and Levi (1960), and settling them would arguably require more in-depth analyses of the dynamics of interaction between scientists and policy makers. (See Betz, 2013; Elliott, 2011b; Steele, 2012, and Willholt, 2009 for efforts to think about these issues.)

they probably do not regard their models or hypotheses as being true or even as having a precise probability of being true. One thinks, for example, of high-level theories like quantum mechanics and general relativity, which scientists employ even though they are inconsistent. This willingness to accept simplified or idealized or inconsistent representations is arguably even more prevalent when scientists are working with piece-meal models (see e.g., Weisberg, 2007).

The other problem with the objection that scientists should not adopt goals other than purely epistemic ones is that it conflicts with another social expectation for scientists, which is that they should provide useful information for societal decision makers. As we discovered when discussing the distinction between epistemic and non-epistemic values, it is often very difficult to determine which values are genuinely evidentially relevant (i.e., epistemic) or not. Therefore, scientists are either left having little to say beyond offering up a mess of data (often from multiple and conflicting studies) to decision makers, or they have to do their best to interpret this data in a manner that helps meet social objectives (Elliott, 2011b, p. 68). We have seen that these objectives often involve more than just getting the most accurate results; they involve obtaining results in a timely fashion using procedures that can be employed effectively in a regulatory context. In order to fulfill these social expectations, scientists may need to assess their hypotheses and models not solely from an epistemic perspective but also with these practical aims in mind.

Unfortunately, while the Multiple Goals Criterion appears to solve the second problem with the logical interpretation of the direct/indirect roles distinction (i.e., the need to provide a better criterion for distinguishing appropriate and inappropriate values), it does not solve the first problem with the distinction (namely, that it is difficult to follow the criterion in practice). In fact, the Multiple Goals Criterion arguably falls prey to this problem in an even more serious way. Recall that the logical form of the direct/indirect roles distinction runs into the problem that it can be difficult for scientists to identify epistemic values and to decide how to weigh them. Thus, it is difficult for them to actually abide by the criterion. This confusion is likely to be even more serious if scientists attempt to abide by the Multiple Goals Criterion. Under that criterion, they need to be clear not only about whether particular values are epistemic or not but also whether particular values in other categories (e.g., personal, ethical, or political) promote specific goals or aims. Other scientists and citizens could also run into serious confusion if they assume that their colleagues are accepting a hypothesis solely because of its epistemic virtues, whereas in fact the hypothesis has been accepted because of its ability to meet specific practical goals. Therefore, while the Multiple Goals Criterion has great promise for distinguishing appropriate and inappropriate values at a conceptual level, in actual practice it raises significant challenges for individual scientists and for the scientific community.

Once again, Douglas gestures in the direction of a partial solution to this difficulty. In addition to claiming that scientists should not allow values to influence their reasoning via direct roles, Douglas proposes an additional strategy for maintaining scientists' ability to provide impartial information to policy makers:

Ethics of Expertise: When values influence their reasoning, scientists should make those influences as explicit as possible (2009, p. 155; Douglas, 2008, p. 13).

She notes that policy-relevant science plays an important role as a source of information for democratic governance. But in order for members of the public and societal decision makers to make

responsible decisions on the basis of scientific information, they need to know how values have influenced scientists' judgments. Thus, Douglas argues that "Scientists should be clear about why they make the judgments they do, why they find evidence sufficiently convincing or not, and whether the reasons are based on perceived flaws in the evidence or concerns about the consequences of error" (Douglas, 2009, p. 155; see also Douglas, 2012, pp. 142–143).

This Ethics of Expertise claim deserves further elaboration as a partial solution to the difficulties involved in properly categorizing values, determining their relevance to particular scientific goals, and preventing confusion about the basis on which hypotheses are being appraised. One way of addressing all these problems is for scientists to be as explicit as possible about which values have influenced their reasoning and in what ways. By doing so, they allow those who disagree with their categorization or weighting of the values to "backtrack" and consider how they would arrive at different conclusions based on their own values (McKaughan & Elliott, 2013). Moreover, by clarifying whether they are appraising a hypothesis from a purely epistemic perspective or with other practical goals in mind, scientists enable others to explore whether they would appraise the hypothesis differently based on their own goals.

Assuming that a central focus of scientific communication should be to promote this ability for information recipients to backtrack and develop alternative conclusions, at least four general principles may help to guide scientists in following the Ethics of Expertise effectively. First, scientists should provide as much information as possible about their raw data and the conditions under which it was generated (McGarity & Wagner, 2008; Michaels, 2008). While raw data are not "value free," having access to them and understanding how they were produced can go a long way toward enabling others to draw their own well-informed conclusions. Second, the process of data interpretation and analysis of evidence should be made as transparent as possible (Douglas, 2012; McCarty, Borgert, & Mihaich, 2012). This should include clarifying the combination of epistemic and practical goals involved in appraising hypotheses in particular contexts. Third, given that the interpretive process can rarely be made fully explicit, scientists should at least try to clarify the general values or tendencies that guide their interpretation. This provides at least part of the motivation behind recent efforts to require scientists to disclose their funding sources. Given the growing empirical evidence indicating that there are strong correlations between funding sources and study outcomes (Bekelman, Lee, & Gross, 2003; Krinsky, 2003; Michaels, 2008), those who read studies should be alerted to the possibility that the interpretive process may be slanted toward the interests of the funders. Fourth, when the values or tendencies underlying data interpretation are particularly "opaque" or difficult to uncover, this should be acknowledged. Again, this allows those receiving information to ask more searching questions and to explore the values and assumptions underlying the interpretive process more deeply.

These principles obviously require a great deal of further elaboration and analysis. Moreover, while the Ethics of Expertise principle provides important guidance for individual scientists, it needs to be supplemented by other social and institutional policies in order to function successfully. For example, in order to provide motivation for following this principle, it is probably necessary to have formal or informal mechanisms in place for censuring those who consistently or egregiously fail to abide by it. It is also valuable to have institutional systems or policies that assist scientists in fulfilling their responsibilities in this regard.¹³ Furthermore, individual

¹³ These institutional systems might include mechanisms for reporting data or interpretations, trial registries for reporting studies, and regulations that mitigate the effects of significant conflicts of interest.

scientists are likely to be blind to many of the value influences on their reasoning, so there need to be adequate venues for scientists to highlight and critique implicit assumptions in each other's reasoning (Longino, 2002). But while these additional strategies are highly important, the focus of this paper is on the narrower issue of delineating the responsibilities of individual scientists for regulating values in their reasoning.

6. Conclusion

This paper has distilled Douglas's influential account of values in science down to four major claims: Inductive Risk, Value Permeation, Ethical Responsibility, and Direct/Indirect Roles. The first three claims provide an important challenge to the traditional value-free ideal for scientific reasoning. However, the Direct/Indirect Roles claim, which has served as an important part of Douglas's approach to regulating values in science while she abandons the value-free ideal, turns out to be problematic. One difficulty is that it is ambiguous between a consequential interpretation and a logical interpretation. A second difficulty is that both interpretations have significant weaknesses.

Fortunately, Douglas's work also includes two elements that have received comparatively little attention but that can contribute to a stronger account of values in science. First, her brief comments about the different activities or goals involved in scientific practice pave the way for a Multiple Goals Criterion, which distinguishes appropriate and inappropriate values based on the extent to which they advance the specific goals involved in appraising hypotheses in a particular context. An intriguing feature of this approach to regulating values in science is that non-epistemic values can sometimes be legitimately prioritized over non-epistemic values when scientists are appraising hypotheses from a practical perspective. Douglas's previous work also suggests an Ethics of Expertise claim, which calls for scientists to be sufficiently transparent about how values influenced their reasoning so that others can backtrack and determine how they might arrive at different conclusions. While a full account of values in science would require further attention to the social and institutional structure of science, the Inductive Risk, Value Permeation, Ethical Responsibility, Multiple Goals Criterion, and Ethics of Expertise claims provide a promising starting point for characterizing the responsibilities of individual scientists for regulating value influences in science.

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