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IS SCIENCE REALLY VALUE FREE AND OBJECTIVE?

From Objectivity to Scientific Integrity

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Objectivity and the Value-Free Ideal

Particle physicists must decide how much evidence to collect before announcing the discovery of a new particle like the Higgs Boson, balancing reasonable caution about premature or erroneous discovery claims against the value of a successful discovery claim (Staley 2017). Regulatory scientists assessing the potential toxicity of a chemical must determine thresholds of evidence in ways that balance the risk of falsely certifying a chemical as safe (thus increasing health risks) against the risk of falsely attributing toxicity (thus encouraging unnecessary regulation) (Douglas 2000, 2009). Social scientists must determine how to define value-laden terms like "rape" or "violence" (Dupré 2007) or "well-being" (Alexandrova 2017). Such decisions are at the heart of scientific inquiry, and yet they each require carefully weighing values. Is it possible for scientific knowledge to be objective, if scientists must make value judgments in the course of scientific inquiry?

Many have held that scientific objectivity requires that the parts of scientific inquiry concerned with weighing evidence and making empirical claims be value free. Of course, values ought to guide us in protecting human research subjects, and they might motivate scientists to work on certain problems over others, or even inspire scientists to suggest certain hypotheses or theories. But further into the core of scientific inquiry, where data is collected, evidence analyzed, hypotheses evaluated, and empirical claims judged and asserted, values can only lead science into bias, subjectivity, wishful thinking, and politicization.

On such a view, values are understood as intrinsically subjective and biasing factors. What sort of world we wish to live in is relevant to determining how we should treat each other, or what kinds of things it would be useful or interesting to know about, but is irrelevant to how the world really is. Anything more would be an unacceptable sort of wishful thinking, claiming that something is the case because one wishes it were the case. For instance, feminist science has been accused of sliding from "women should be equal to men" as a political value to "women and men are equal" as a descriptive claim about, say, intelligence or capability (Haack 1993; Anderson 1995; Hicks and Elliott 2018). Call this "the problem of wishful thinking" (Brown 2013). Objectivity is taken to be the opposite of wishful thinking.

In this chapter I argue that this way of thinking is wrongheaded. Science is necessarily value-laden, and scientists must make value judgments in order to do science responsibly, with integrity. Whether value-laden science is objective is a vexed question, because there are so many different things we might mean by "objectivity." There are some accounts of objectivity which are compatible with value-ladenness, or by which we might even accord value judgments a kind of objectivity. Values are not inherently biasing in the way the views mentioned presuppose. However, one legitimate sense of "objective" is simply being value free. Objectivity is, in any case, too vexed and problematic a notion to be of any use in guiding science or philosophy of science. We should abandon it in favor of providing an account of scientific integrity, which involves both epistemic and ethical responsibilities, and answers concerns about trustworthiness which capture the important concern behind calls for objectivity.

The Need for Values in Science

The value-ladenness of science is unavoidable. The closest scientists can get to doing work that is value free is to either ignore the consequences of their work, or to do work that has few consequences for things that we care about. Far from realizing a scientific ideal, both of these approaches amount to massive irresponsibility on the part of the scientists. The first approach amounts to a kind of serious recklessness or negligence (Douglas 2009). The second approach intentionally turns science into an abstruse private pursuit, shirking the significant responsibilities that scientists have to produce knowledge useful to society.

To see why values cannot be avoided in science, we must consider the role of contingency in science in concert with the significant social and ethical consequences of science.[1] From the point of view of the scientific inquirer in the midst of inquiry, there are a number of contingent moments, places where reasonable inquirers could proceed in different ways. They must decide what to investigate and how to investigate it. They must choose concepts to use, hypotheses to pose, techniques for characterizing data. They must decide how much evidence would be sufficient to accept and publish their results.

I describe these contingencies as decisions, but this is something of an idealization. In fact, these contingencies might be settled by habit, custom, or convention. Only one option may occur to an inquirer, in which case it may not seem that there is a decision to be made. These are contingent moments in a normative and counterfactual sense – other inquirers faced with the same decision *could reasonably* go in a different direction. While they are not necessarily actual decisions, they are *decision-points*.

The pervasiveness of contingency can be seen in the significant role that controversy plays in scientific progress. Science studies have made much of controversy in science (Collins 1981; Latour 1987; Pinch 2015). Science studies scholars have sometimes gone too far in the conclusion that they draw from such controversies, including arguments against the rationality of science. A more modest conclusion is that science is difficult, and there is rarely one obviously right choice in significant moments of scientific inquiry. The main lesson I take from the contingency of science is that inquirers are decision makers, that is, that they have options for how to proceed. This lesson must be considered in light of the significant social consequences of science in order to see the need for values in science.

That science has significant social consequences should not be particularly controversial. Scientific knowledge affects education, policymaking, court cases, individual decisions about things like diet and health care, as well as our conception of ourselves and of our place in the universe. Science can reinforce or undermine the most contemptible social stereotypes and prejudices as well as the highest human ideals. The decisions made in the course of scientific inquiry are thus actions with social, ethical, or political implications and consequences for what we value.

One might hope to deny these consequences by drawing some distinction, such as the distinction between scientific research and expert advising, or between science and technology. All such distinctions fail to reflect the reality of science as a social institution. First, the consequential sides of these dichotomies (advising, technology) are shaped by decisions on the "pure" side. Second, scientific research itself has a direct impact – scientific results are published where anyone can read them if they have the right access, through libraries or purchasing of articles or journal subscriptions. The results are frequently reported on in the popular press, blogs, and social media, making them even more widely available.[2] Third, the advisor or educator is often also the researcher, and these roles are blurred in their own lives. These distinctions do not and could not amount to practical divisions, and thus they cannot block the concern about consequences.

Everyone has the responsibility to consider the consequences of their actions. This is not a special responsibility that scientists have in their role as scientists, but one of their general responsibilities as moral agents. What's more, there are no special role responsibilities that scientists have that could screen them from this general responsibility. Science does not have professional exceptions to general responsibilities in the way that lawyers (attorney-client privilege) or doctors (patient confidentiality) do. Nor would we want them to (Douglas 2009, pp. 71–79).

Call the argument I have laid out here "the contingency argument." It can be summarized in this way:

1. Scientific inquiry has many contingent moments.
2. Each contingent moment is a decision point, a potential decision among multiple options.[3]
3. These decisions often have ethical and social consequences, or consequences for values generally.
4. Value judgments should settle choices that affect values.
5. Thus, scientists should make value judgments in settling scientific contingencies.

Identifying contingencies, alternative options, stakeholders, and values takes a significant amount of sensitivity and moral imagination. It may also require research, consultation, and epistemic humility.

Consider some of the examples mentioned at the opening of this chapter. The physicists looking for the Higgs boson had to decide when their evidence merited announcing the discovery of the particle, and they used a standard of 5-sigma. "5-sigma" means that the data taken to indicate the existence of the Higgs boon is five standard deviations above the mean of a normal distribution of data given the null hypothesis, that is, assuming that the Higgs boson does not really exist. In standard null-hypothesis statistical testing terms, this amounts to a p-value of 3×10^{-7} or 1 in 3.5 million (Lamb 2012). The p-value is the probability that, given some statistical assumptions, if the null hypothesis were true, we might observe data at least as extreme as the data in fact observed. A low p-value means that probability is low, which gives us some very conditional reasons to think that the null hypothesis should rejected. Physicists could have used a less extreme standard, such as 3- or 4-sigma, which would have increased their likelihood of mistakenly announcing a discovery, but would have also decreased the time and expense required before announcing the claim. 3-sigma is a rather high standard of evidence from the point of view of many fields of research (close to a p-value of 0.001 or 0.1%). On the other hand, the scientists could have raised the bar to 6- or 7-sigma, incurring much greater expense, keeping the relevant scientific communities waiting longer for this much-anticipated knowledge, and even decreasing the chance that a discovery would ever be announced. On the other hand, this standard would also decrease the chance that a false discovery claim would be made.

Value-laden scientific concepts present another example of the contingency argument at work. For instance, John Dupré (2007, pp. 28–30) briefly described social science work on *violence*. That "violence" has a (negative) evaluative connotation is obvious. But violence is also the sort of thing that sociologists may wish to construct a measure of, perhaps combining statistics on things like murder rates, frequency of crimes involving assault or deadly weapons, reports of domestic violence, and so on. A claim like "The United States is a violent country" or "Sam is a violent child" might reflect both an evaluation and a report of a measurement. It is not that these claims are ambiguous between a descriptive and an evaluative claim that should be clearly disambiguated. Rather, the connection between the evaluative and descriptive elements of the concept are what connect scientific work to our goals and reasons for action, and it permits us to adequately evaluate competing ways of operationalizing the concept (Dupré 2007, pp. 30–31). In a similar vein, Anna Alexandrova (2017) considered scientific claims about *well-being*, and argued that such claims are "mixed claims" (descriptive and evaluative). Mixed claims should be retained, and not disambiguated, because the normative element of a concept like "well-being" is crucial to the normative decisions that must be made throughout the scientific process (Alexandrova 2017, p. 91).

As may already be apparent from the examples, "contingency" doesn't mean that anything goes. There are genuine contingencies where there is room for reasonable disagreement among experts about the options at hand. This is a normative matter; whether the experts agree or disagree can be a reason to think that the matter is a contingent, but cannot decide the case – for example, there might be closed-mindedness about certain options, or certain unconceived alternatives, generating hasty consensus. Values should not, for example, replace evidence wholesale. Values should guide the decision between reasonable interpretations of that evidence, or should help evaluate the reliability and relevance of evidence. Values should not short-circuit inquiry, and they have no role to play where there is no alternative courses of action open to inquirers.

More generally, the role of values in scientific inquiry is to guide decision-making about genuine contingencies. What counts as a *genuine* contingency is determined by what is reasonable given the state of scientific practice at a time, the available and relevant evidence, the track record of theoretical explanations and experimental techniques, the course of the specific inquiry up to this point, and so on. The guiding role for values takes two major forms: first, values determine and promote the *aims* of the particular inquiry (Elliott 2013; Hicks 2014; Intemann 2015). Some inquiries may have more epistemic or cognitive aims, like providing a simple, comprehensive explanation of a body of phenomena that generates novel predictions.[4] Biomedical inquiries aim at health, while environmental risk assessments might aim at both human safety and ecosystem integrity. Second, values may act as side constraints, even when they might tend to frustrate inquiry. Protections of the rights and welfare of human research subjects must always be a constraint on inquiry. Avoiding other kinds of social harms, as might be caused by assertions of racial or gender difference in abilities, might likewise serve as a general constraint on inquiry, limited by the genuine contingencies of the situation.

Objectivity without Epistemic Purity

The first point nearly every philosopher of science makes about the concept of "objectivity" is that it is complex, ill-defined, difficult to characterize, "essentially contested" (Harding 1995), and attributed to a great variety of different things – individuals, groups, knowledge claims, methods, processes, practices, observations, measurements, and so on. Objectivity is taken to mean true or real, based in (observed) facts, done according to specified rules or criteria, unbiased, impartial, or value free, or a view from nowhere, independent of human perspectives. Those who hold that science is and ought to be value-laden have generally argued that out of this mess, a perfectly good sense of "objectivity" can be found that still applies. Value-laden science can still be objective; objectivity does not require epistemic purity.

A useful framework for understanding these appeals to objectivity can be found in the work of Heather Douglas (2004, 2009). First, Douglas divided up different sorts of *processes* whose objectivity are at issue. The *products* of science (knowledge claims) are objective insofar as they are produced by objective processes (Douglas 2004, 454, 2009, pp. 116–117). This makes sense, as it is not possible for us to read objectivity off of a knowledge claim directly. (But note, this already rules out the equation of "objective" with true or real.) Second, within each type of process, there are different senses in which that process could be objective.

The three types of process that Douglas distinguished are (1) human interactions with the world, as in experimental and observational processes, (2) individual reasoning and thought processes, and (3) social processes, such as peer review, criticism, and consensus-formation. The first operationalizes the idea that objectivity has to do with capturing or being guided by "facts," and includes experimental manipulation and robustness or concordance of different types of experiments. The second concerns individuals being unbiased and impartial. The third concerns whether a community of experts and its processes and structures are objective, and has been the type of objectivity feminist philosophers of science have often hoped to (re)claim.

The second type of objectivity has been the most problematic for the critics of the ideal of value-free science. At a first pass, for an individual's reasoning to be objective just seems to mean for it to be unbiased, neutral, impartial, or value-free. This seems to put us between the rock of shirking the responsibilities entailed by the contingency argument and the hard place of failing to be objective. Rather than give up on this form of objectivity, and focus solely on the other two, Douglas attempted to distinguish between difference senses of individual objectivity.

One sense of individual objectivity is what Douglas called "detached objectivity." Here, the prohibition is on taking values or preferences as a *reason* to make a knowledge claim in a way that is resistant to or in conflict with the evidence. When someone denies that climate change exists because they value a lack of regulations, they fail to be detached. Similarly, the inventor of a theory who continues to defend it in the face of mounting evidence to the contrary may have our sympathy, but we would not call them objective in this matter.

Detached objectivity is not the same as value-free objectivity. The latter forbids *any* role for values in science. The equation of *objective* and *value-free* depends on the idea that all values are biasing or subjective, and by playing a role in science, as Douglas put it, they "contaminate it" (2004, p. 459). Such arguments are doubly mistaken. First, it is not true that values are themselves necessarily biasing or subjective. Second, the "contamination" claim is groundless, due to a simplistic, structureless notion of inquiry.

Values are not necessarily subjective in any meaningful sense, and they need not have a biasing effect on science. The position that values are wholly subjective is both a controversial opinion within ethics[5] and difficult to square with ordinary moral practice. We tend to treat disputes about some values as substantive disagreements rather than differences in taste. Furthermore, we readily distinguish between values stated unreflectively or habitually, and those that are the product of careful value judgment. The claim that values are necessarily biasing is similarly problematic. A common narrative about the influence of feminist values in late twentieth century science is that they tended to remove, rather than create, misleading biases in science (Harding, 1995). Inclusivity, fairness, and respect for marginalized persons are values that might decrease rather than increase bias.

The idea that values inherently "contaminate" inquiry is likewise a highly problematic view. We can see this from two directions. First, there are several uncontroversial restrictions on inquiry by ethical values, for example, protections for human subjects. The influence of values may slow or halt certain lines of inquiry when those lines of inquiry would require unethical treatment of human subjects. The results of inquiry that is undertaken instead are not therefore "contaminated" by the value of respect for persons or concern for human welfare. Second, where values are guiding decisions about *genuine* contingencies in the sense discussed above, there is no sense in which leaving value judgments out of those decisions makes them more reasonable or more "objective." If anything, the failure to consider relevant factors to the decision makes the process not only reckless but also irrational. So, value freedom is not a type of individual objectivity worth having.[6]

As mentioned earlier, feminist philosophers of science and others denying the value-free ideal have tended to focus on the social mode of objectivity. The most prominent such account is Helen Longino's critical contextual empiricism, according to which, "A method of inquiry is objective to the degree that it permits *transformative* criticism" (Longino 1990, p. 76). Douglas called this "interactive objectivity" (Douglas 2004, p. 463). That is, objectivity requires that the inquiry be subjected to critical discourse by the relevant scientific community that follows certain norms, including uptake of criticism and equality of intellectual authority among qualified practitioners. "Method of inquiry" refers neither to individual reasoning processes, nor to procedures followed in the laboratory, but rather to social processes of discourse, assessment, and criticism. According to Longino, a scientific community that follows her four norms for critical discourse, with sufficient diversity within the community to ensure that important assumptions are not so universally shared as to be free from scrutiny, will be objective.

Another influential social account of objectivity, not mentioned in Douglas's typology, is Sandra Harding's theory of "strong objectivity." Harding focused on diversity, taking it not in a liberal pluralist direction, as Longino did, but rather in the direction of feminist standpoint epistemology. According to Harding's program, inquiry should begin from the position of socially marginalized people (e.g., women) in order to uncover biases and expose them to scrutiny. Because the values, interests, and assumptions of the dominant members of a hierarchically structured society tend to become naturalized and implicit, starting from the position of the marginalized tends to increase, rather than reduce, scrutiny of bias. This approach, which she labeled "strong objectivity," strengthens objectivity more so than any form of impartiality or attempt to transcend perspectives or subject-positions.

The various notions canvassed in this section have good call to be regarded as virtues of scientific inquiries, inquirers, and communities. What may seem questionable is whether they really capture what is meant by "scientific objectivity," which seems to many essentially linked to inquiry that is value-free. What's more, there is cause to ask whether in all this diversity of norms and criteria there is sufficient unity justifying the use of the single term, "objectivity." The next section considers arguments against retaining the focus on objectivity in science.

Against Objectivity

One might be tempted to think that "objectivity" is a merely honorific term, an "empty compliment" paid to good ideas or procedures.[7] Another way to put it is that "objectivity" serves the rhetorical purpose of lumping together a variety of virtues for scientific theories, ideas, methods, or techniques. "Objective" here is just a highfalutin way of saying that something is epistemically good. The things called "objective" are good in very different ways: they are empirically grounded, reliable, trustworthy, detached, open-minded, rigorous, or critically engaged. These specific terms better capture the relevant scientific or epistemic virtues than the general lumping term "objectivity." In the context of the arguments for the ideal of value-free science that depend on the unprincipled lumping of value-freedom with these other virtues, the usage becomes positively vicious.

Ian Hacking (2015) has a related set of concerns. According to Hacking, there are two main concerns about talk of "objectivity." First, it is an abstraction from a variety of "ground-level" concerns that have little if anything to do with each other. Trying to figure out what objectivity is, or providing a theory of objectivity, distracts from these ground-level concerns (Hacking 2015, p. 20). Second, to call something "objective" is to say that it lacks one or more epistemic vices, rather than to attribute some epistemic virtue to it (Hacking 2015, pp. 24–26). So objectivity doubly lacks content: it is abstracted from the details that really matter, and it has no positive content of its own.

Jack Wright (2018) has responded to Hacking in two ways. First, he argued that despite being an abstraction, the concept of "objectivity" can nonetheless help address "ground-level" concerns. It does so because it is a "relational category," i.e., because it serves to relate diverse practices to one another and to various goals and ideals. In bringing them into relation, practitioners can compare, assess, refine, and justify practices in ways that help deal with difficult questions. This proposal bears significant resemblance to a point made by Douglas: "Even with eight senses, objectivity is conceptually coherent … there are conceptual links across the senses, but no one sense fully captures the meaning of objectivity" (Douglas 2004, p. 467). The ways in which the different senses of objectivity connect and "evoke each other" (p. 468) is one of the more suggestive features of Douglas's account.

These moves do not seem to me, however, to save the concept of objectivity from the charge of incoherence. If one sees "objectivity" as a word covering for a broad collection of virtues (or absence of vices), then even if there is no coherent core to the collection, it would not be surprising to find relations between them. We cannot reduce honesty to kindness or vice versa, but it is not much of a surprise to find the two traits often going together. This does not mean they are two different aspects or species of the same abstract virtue. Likewise, that following impersonal rules and being detached may often go together, or convergence of multiple lines of evidence might frequently go along with increasing consensus on some conclusion does not require that these all be instances of some abstract category of objectivity.

Pluralism is not really a solution here, either. Wright attempted to compare his defense of the concept of objectivity to Ingo Brigandt's (2003) defense of the species concept in the face of calls for species eliminativism. Brigandt rightfully pointed out that "species" occupies a place in general theoretical accounts, and that each version of the species concept adequately fills that role. "Objectivity" is different, however. There seems to be no such unified account, no such functional role for the different concepts of objectivity to play.[8] All that the different forms of objectivity have in common is that they are good things for some element of science to have (or the lack of something it is bad for them to have).

Wright went beyond a pluralist approach and attributed a core concept that provides unity to the category of objectivity. The core idea Wright adopted is that objectivity involves a "stepping back" from some aspect of the context of inquiry or assertion, an idea Wright attributed to Thomas Nagel (Nagel 1986). This stepping back is goal-directed. Stated more precisely: "A knowledge claim is objective to the extent that it is produced in a way that steps back from features of the context in which it was produced relevant to meet a goal" (Wright 2018). Objectivity-ascriptions, then, involve a relation between two different contexts: the context of use, which sets the goal, and the context of production, from which the knowledge claim "steps back."

Consider the case of regulatory science mentioned above. One goal of such research is to protect the health of citizens and ecosystems. According to this goal, we might call regulatory research "objective" if it steps back from the interests of the companies that produce the relevant chemicals. Those are features of the context of inquiry that might influence the research in a way that that hampers the goal.

This account of objectivity has much in common with the so-called "aims approach" to values in science, according to which the use of values in science is legitimate insofar as that use contributes to the aims of the research (Elliott 2013; Hicks 2014; Intemann 2015; Steel 2017). The comparison raises two concerns about Wright's account, however. First, the aims approach typically does not worry about "objectivity," and focuses instead on what contributes to or detracts from the aim of the research. The addition of the word "objectivity" does not seem to add much to those accounts. Second, a concern has been raised that the aims approach focuses only on issues of instrumental rationality but gives us no tools to evaluate the aims of inquiry. If the goal of regulatory science is reconceived by the chemical companies as freedom from burdensome regulation, an inquiry that "steps back" from concerns about health and safety may be regarded as legitimate (by the aims approach) or objective (by Wright). More generally, it is not clear that what Wright identified as objective is generally a good thing. Sometimes stepping back from features of a context that help one meet a goal is still undesirable, as when it causes us to lose track of the harms done by the research.

Once we acknowledge that science is and must be value-laden, and we question the assumption that values are inherently subjective or biasing, it becomes difficult to pinpoint what the contrast class for "objectivity" is, such that objectivity is generally a good thing and the opposite is generally to be avoided. If that's so, this reinforces the idea that "objectivity" is an empty honorific paid to various ways of doing science regarded as good.

Here is what I mean in saying that objectivity has no meaningful contrast. Two candidate contrast terms come to mind: *subjectivity* and *bias*. What could be "subjective" in the context of scientific knowledge? Even if it makes sense to talk about certain perceptions or beliefs as subjective, the stock and trade of science is not belief but public knowledge claims. Even two different interpretations of the same data, supporting competing claims, are typically based on articulable and often articulated methodological, modeling, or theoretical assumptions. Scientific knowledge claims are found in published articles, in discourse, at conferences, in textbooks. As they are publicly accessible, they are publicly assessable. They might be poorly supported, or controversial, but those aren't the same as being subjective.

Two cases in which we might want to call knowledge claims "subjective" are, on the one hand, cases of mere opinion and, on the other hand, claims based on tacit knowledge. First, unsurprisingly, someone will occasionally try to pass off mere opinion as scientific knowledge. But such moves are easily spotted, even by non-experts, and more precisely called "ungrounded," "wrong," or "propaganda posing as science" than "subjective." The second case, claims based on tacit or implicit knowledge, are trickier. We might point to skills learned in the laboratory, or long experience in clinical practice, as examples of tacit knowledge relevant to scientific (or medical) knowledge claims. But note that claims are never based *entirely* on tacit knowledge – the laboratory scientist also provides evidence, measurements, descriptions of methods. Your physician provides not only their judgment, but information about, for example, possible treatments, their success rates and side effects, based on published research. What's more, there are ways of publicly assessing tacit knowledge, even if they are indirect, for example, by examining credentials, by appealing to the reliability or success rate of the practitioner, through observation by another skilled expert, and so on. Tacit knowledge is thus not genuinely subjective, since it is publicly assessable.

Our second candidate for the opposite of "objective" is being biased; one fails to be objective if one is biased in favor of one "side" over the other. This sort of concern is at work when we worry about having an objective trial judge or dispute mediator. There are several problems with the notion of "bias" in science. First, in science, there are not often "sides" the same way as in a court case, where the goals of the parties are diametrically opposed. Scientists are primarily engaged in inquiry in order to solve problems about their subject of research. Sometimes they collaborate, and sometimes they engage in a bit of competition to see who can solve the problem first or best. Of course, they sometimes act as partisans for or against their favored theories or approaches, but even then, their competition takes place within a background of shared goals. More often, scientists work on different problems or aspects of problems.

Second, even in a court case, it is widely recognized that complete impartiality is not always appropriate. In criminal cases, the burden of proof is very different for the defendant and the prosecution. While we may want judge and jury to be unbiased in the sense of not having any preconceptions about the case, we do not want them to apply the same standards to both sides. A more general concern with the topic of "bias" is that it is often equated with value-ladenness; according to this common view, to be objective merely is to be value free, which is the view we're trying to avoid.

As we have seen, being value-free is not generally a virtue, and indeed, it can amount to being irresponsible. Of course, if one reaches conclusions entirely on the basis of values instead of doing inquiry (a failure of detachment, in Douglas's terms), one is doing something illegitimate. But the sin here is greater than "bias," it is to cloak propaganda in the vestments of science. When values are used to manage genuine contingencies, however, this can be a virtuous thing. As such, "objectivity" and "bias" in these senses are poor tools for guiding the interaction of values and science.

While most of the things called "objective" in the previous section are virtuous in one way or another, there seems little that is useful in lumping them together under one philosophically fraught term. What's more, it is not always the case that the absence of these virtues is necessarily vicious. Communities structured differently from Longino's ideal still seem able to produce some scientific knowledge. Tenacious defense of a favored hypothesis has a role to play in the scientific process, even though it is a failure of detachment. Sciences where manipulation or convergence are unachievable are not somehow defective.

The concept of "objectivity" seems not to get us what we want in a normative account of scientific knowledge. Nothing holds the different meanings of "objectivity together." The concept, such as it is, has no clear contrast class. And it continues to carry the normative baggage of the untenable value-free ideal. In the next section, I argue that what we need instead is a good account of scientific integrity.

From Objectivity to Scientific Integrity

We want to know which theories, which results, which cases of scientific consensus, which expert advice we can trust. Hacking (2015) referenced Theodore Porter (1995) and Naomi Scheman (2001), both of whom closely connected trust to objectivity; indeed, on Scheman's account, objectivity *is* trustworthiness. I see the move from objectivity as discussed previously to trust as a positive shift; but when can we trust an expert, a result, a theory?

According to Scheman, the need for trust arises from what she calls our "epistemic dependency," the fact that it is not possible in practice (perhaps not in principle) to assess every knowledge claim for ourselves (Scheman 2001, p. 30). We rely on the testimony of others and in particular on the judgments and claims of experts. Scheman sees trustworthiness as having two components – competence and integrity (Scheman 2001, p. 33). The competence of an expert, a method, or a study can be evaluated in familiar epistemic terms. Integrity, on the other hand, is a partly social and partly ethical notion. Given that science is value-laden, what we really want to know (beyond whether it is done competently) is whether it is done with integrity. This question captures what is valuable about objectivity.

What are some familiar moments when scientists act without integrity? One example is when scientists speak with authority well outside of the area of their expertise, as when scientists distant from the field of climate science challenge the expert consensus on anthropogenic climate change. Another example is when scientists present claims as more certain or less controversial than they really are. Other failures include close-mindedness, a failure to consider all aspects of a problem, failing to question problematic assumptions, or shutting down inquiry prematurely.

In positive terms, what does scientific integrity involve? I posit three core components: critical sensitivity, responsibility, and humility. Each of these components involves elements that are typically classified as *epistemic* and *social*, though those elements are not necessarily extricable from one another.[9]

Critical sensitivity is an awareness of the potential issues that arise in inquiry, a sensitivity to the contingencies that arise in the scientific process, and a recognition that value judgments must be made as part of settling those contingencies. Critical sensitivity involves being relatively less likely to rely on habit and convention, when doing so could have harmful consequences. It is a protection against negligence and recklessness in scientific inquiry. It can be cultivated by periodic questioning of decisions in the scientific process.[10] Critical sensitivity sometimes requires creativity and imagination, in identifying or creating alternatives and empathizing with potential stakeholders in order to make the relevant value judgments.

The responsible scientist is careful, open-minded, methodical; they do not rush to judgment or make hasty assumptions. They are sensitive to both the epistemic and social consequences of their decisions, and they consider the relevant reasons and the interests of the relevant parties carefully. They make value judgments where needed, and they take care to make those value judgments well.

Scientific humility requires recognizing one's limitations as an inquirer. This requires knowing that the scope of one's expertise is relatively limited, and therefore limiting the way one presents oneself. Scientific humility means not presenting one's claims as more certain than they are, not making grandiose claims about what a limited or initial result means or what a research program can do. Scientists drawing deep philosophical claims about, for example, the nature of free will, the existence of god, or the nature of morality based on a limited collection of specific results, are typically overreaching. Finally, humility also requires recognizing our limitations as trustees of public interests or the welfare of stakeholders and taking steps to engage or consult with others to be more socially responsible.[11]

Conclusion

Science is necessarily value-laden, as a result of the endemic contingencies of science coupled with its significant social consequences. The attempt to be value free cannot succeed; it can only amount to irresponsible carelessness about the consequences of the decisions that are made in the course of inquiry. Accounts of objectivity tend to be tied to this mistaken notion that there is a virtuous way of doing value-free science. As I have shown, despite the interesting ideas that have been posed in the attempt to save "objectivity" in the face of the demise of the ideal of value-free science, the concept is not worth saving. The work we wanted to do by appealing to objectivity was to ensure the trustworthiness of science. This should lead us to focus on scientific integrity rather than objectivity. Future work should focus on further (or better) articulating the requirements of scientific integrity, and the conditions that scaffold or inhibit its development, rather than trying to determine the nature of objectivity.

Notes

1 Biddle and Kukla (2017) argue much the same point using the language of "epistemic risk" where I refer to contingencies with significant social and ethical consequences.
2 The quality of this reporting often leaves something to be desired and is subject to a variety of common problems. See Kampourakis, *this volume*.
3 Even if the second option is merely not to proceed with the first option.

4 Though even such aims may be swayed by non-epistemic values. See Rooney (1992) and Longino (1996).

5 Value subjectivism is denied by moral realists, some moral naturalists, divine command theorists, cultural relativists, moral universalists, those who believe in intrinsic values, and many others.

6 A third sense of individual objectivity is what Douglas called "value neutrality" (Douglas 2004, 460, 2009, pp. 123–124). Being value neutral requires taking a middle or compromise position where values are controversial, being fair and balanced among competing positions. In some cases, this is a desirable approach, as when we hope to find an "objective" judge or mediator for a dispute. In other cases, the result is a centrist position that may be far from desirable.

7 Compare Richard Rorty on "accurate representation" as "empty compliment" (Rorty 1979, p. 10)

8 Wright pointed to "methodological generalizations" as an analogue to Brigandt's "theoretical generalizations" to answer this point. This argument seems to backfire to me, however. The account of methodology he points to uses "objectivity" in an unhelpfully vague and indeterminate way. It also contrasts "objectivity" with "interpretive judgment" in a way that makes clear that "objectivity" is not generally a good thing (because interpretive judgment is sometimes a good thing).

9 This account of scientific integrity is thus a form of coupled ethical-epistemic analysis as described by Nancy Tuana (2013).

10 Erik Fisher's Socio-Technical Integration Research program shows that through the intervention of a humanities scholar or social scientist embedded in the laboratory, scientists and engineers can improve their critical sensitivity (though this is not his term). See Fisher (2007); Fisher, Mahajan, and Mitcham (2006); Fisher and Schuurbiers (2013)

11 Sharyn Clough has been emphasizing the importance of "epistemic humility," along with empathy, as crucial to a peace-literacy approach to values in science; for example, in her talk at Southern Methodist University on "Science, Politics, and Peace Literacy" on March 2, 2018.

References

Alexandrova, Anna. 2017. *A Philosophy for the Science of Well-Being*. Oxford: Oxford University Press.

Anderson, Elizabeth. 1995. "Knowledge, Human Interests, and Objectivity in Feminist Epistemology." *Philosophical Topics* 23 (2): 27–58.

Biddle, Justin B, and Rebecca Kukla. 2017. "The Geography of Epistemic Risk." In *Exploring Inductive Risk: Case Studies of Values in Science*, edited by Kevin C. Elliott and Ted Richards, 215–238. New York: Oxford University Press.

Brigandt, Ingo. 2003. "Species Pluralism Does Not Imply Species Eliminativism." *Philosophy of Science* 70 (5): 1305–1316.

Brown, Matthew J. 2013. "Values in Science Beyond Underdetermination and Inductive Risk." *Philosophy of Science* 80 (5): 829–839.

Collins, H. M. 1981. "Introduction: Stages in the Empirical Programme of Relativism." Social Studies of Science 11 (1): 3–10. www.jstor.org/stable/284733.

Douglas, Heather. 2000. "Inductive Risk and Values in Science." *Philosophy of Science* 67 (4): 559–579.

Douglas, Heather. 2004. "The Irreducible Complexity of Objectivity." *Synthese* 138 (3): 453–473.

Douglas, Heather. 2009. *Science, Policy, and the Value-Free Ideal*. Pittsburgh: University of Pittsburgh Press.

Dupré, John. 2007. "Fact and Value." In *Value-Free Science?: Ideals and Illusions*, edited by Harold Kincaid, John Dupré, and Alison Wylie, 27–41. Oxford: Oxford University Press.

Elliott, Kevin C. 2013. "Douglas on Values: From Indirect Roles to Multiple Goals." *Studies in History and Philosophy of Science Part A* 44 (3): 375–383.

Fisher, Erik. 2007. "Ethnographic Invention: Probing the Capacity of Laboratory Decisions." *NanoEthics* 1 (2): 155–165.

Fisher, Erik, Roop L Mahajan, and Carl Mitcham. 2006. "Midstream Modulation of Technology: Governance from Within." *Bulletin of Science, Technology and Society* 26 (6): 485–496.

Fisher, Erik, and Daan Schuurbiers. 2013. "Socio-Technical Integration Research: Collaborative Inquiry at the Midstream of Research and Development." In *Early Engagement and New Technologies: Opening up the Laboratory*, edited by Neelke Doorn, Daan Schuurbiers, Ibo van de Poel, and Michael E. Gorman, 16:97–110. Philosophy of Engineering and Technology. New York: Springer.

Haack, Susan. 1993. "Epistemological Reflections of an Old Feminist." *Reason Papers* 18: 31–43.

Hacking, Ian. 2015. "Let's Not Talk About Objectivity." In Objectivity in Science, edited by Flavia Padovani, Alan Richardson and Jonathan Y. Tsou, 19–33. Cham: Springer.

Harding, Sandra. 1995. "'Strong Objectivity': A Response to the New Objectivity Question." *Synthese* 104 (3): 331–349.

Hicks, Daniel J. 2014. "A New Direction for Science and Values." *Synthese* 191 (14): 3271–3295.

Hicks, Daniel J, and Kevin C Elliott. 2018. "A Framework for Understanding Wishful Thinking." PhilSci Archive. http://philsci-archive.pitt.edu/14348/.

Intemann, Kristen. 2015. "Distinguishing Between Legitimate and Illegitimate Values in Climate Modeling." *European Journal for Philosophy of Science* 5 (2): 217–232.

Lamb, Evelyn. 2012. "5 Sigma What's That?" Scientific American Observations Blog. https://blogs.scientificamerican.com/observations/five-sigmawhats-that/.

Latour, Bruno. 1987. *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge, MA: Harvard University Press.

Longino, Helen E. 1990. *Science as Social Knowledge: Values and Objectivity in Scientific Inquiry*. Princeton, NJ: Princeton University Press.

Longino, Helen E. 1996. "Cognitive and Non-Cognitive Values in Science: Rethinking the Dichotomy." In *Feminism, Science, and the Philosophy of Science*, edited by Lynn Hankinson Nelson and Jack Nelson, 39–58. Dordrecht: Kluwer Academic Publishers.

Nagel, Thomas. 1986. *The View from Nowhere*. New York: Oxford University Press. www.loc.gov/catdir/enhancements/fy0638/85031002-d.html.

Pinch, Trevor. 2015. "Scientific Controversies." In *International Encyclopedia of the Social and Behavioral Sciences (Second Edition)*, edited by James D. Wright, 281–286. Oxford: Elsevier. https://doi.org/10.1016/B978-0-08-097086-8.85043-6.

Porter, Theodore M. 1995. *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton, NJ: Princeton University Press. www.loc.gov/catdir/description/prin031/94021440.html.

Rooney, Phyllis. 1992. "On Values in Science: Is the Epistemic/Non-Epistemic Distinction Useful?" In *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association*, 1992: 13–22.

Rorty, Richard. 1979. *Philosophy and the Mirror of Nature*. Princeton, NJ: Princeton University Press.

Scheman, Naomi. 2001. "Epistemology Resuscitated: Objectivity as Trustworthiness." In *Engendering Rationalities*, edited by Nancy Tuana and Sandra Morgen, pp. 23–52. Albany: State University of New York Press.

Staley, Kent W. 2017. "Decisions, Decisions: Inductive Risk and the Higgs Boson." In *Exploring Inductive Risk*, edited by Kevin C. Elliott and Ted Richards, 37–55. New York: Oxford University Press.

Steel, Daniel. 2017. "Qualified Epistemic Priority: Comparing Two Approaches to Values in Science." In *Current Controversies in Values and Science*, edited by Kevin Elliott and Daniel Steel, 49–63. New York: Routledge.

Tuana, Nancy. 2013. "Embedding Philosophers in the Practices of Science: Bringing Humanities to the Sciences." *Synthese* 190 (11): 1955–1973.

Wright, Jack. 2018. "Rescuing Objectivity: A Contextualist Proposal." *Philosophy of the Social Sciences*. https://doi.org/10.1177/ 0048393118767089.