Эпистемология и философия науки
2025. Т. 62. № 2. С. 68–88
УДК 167.7

Epistemology & Philosophy of Science
2025, vol. 62, no. 2, pp. 68–88
DOI: https://doi.org/10.5840/eps202562223

META-PROBLEMS FOR THE VALUES IN SCIENCE THESIS

Robert Hudson – Professor. Department of Philosophy, University of Saskatchewan. Saskatoon, SK S7N 5A5, Canada;
e-mail: r.hudson@usask.ca

There is in the science and values literature a core set of arguments that reject the value-free ideal at the inferential core of scientific investigation. They are usefully summarized in Kevin Elliott's *Values in Science* (2022) under the following headings: 1) the gap argument; 2) the error argument; 3) the aims argument; and 4) the conceptual argument. I examine each of these arguments from a 'meta' perspective, wherein the arguments are turned on themselves. This is a possibility since each of these arguments is partially based various historical case studies that exemplify, for 'values in science' philosophers, scientific reasoning. This meta-investigation has a surprising result, that proponents of the value-ladenness of science are committed to a form of the value-free ideal in terms of the assumptions each of the above four arguments are required to make. A defense of the value-free ideal precipitates from this situation.

Keywords: value-free ideal, Kevin Elliott, Heather Douglas, inductive risk, the values in science thesis, meta-problems in philosophy

МЕТАПРОБЛЕМЫ ТЕЗИСА О ЦЕННОСТЯХ В НАУКЕ

Роберт Хадсон – доктор философии, профессор. Кафедра философии, Университет Саскатчевана. Саскатун, Саскатчеван S7N 5A5, Канада;
e-mail: r.hudson@usask.ca

В литературе, посвященной вопросам науки и ценностей, существует ряд ключевых аргументов, отвергающих идеал свободы от ценностей в контексте логического ядра научного исследования. Эти аргументы систематизированы Кевином Эллиотом в работе *Values in Science* (2022) под следующими рубриками: 1) аргумент лакуны; 2) аргумент об ошибке; 3) аргумент о целях; и 4) концептуальный аргумент. В данной статье каждый из этих аргументов рассматривается с «мета»-перспективы, т.е. сами аргументы становятся объектом критического анализа. Такое рассмотрение возможно, поскольку каждый из них частично опирается на различные исторические ситуационные исследования, которые, с точки зрения сторонников «ценностей в науке», иллюстрируют научное рассуждение. Данный метаанализ приводит к неожиданному результату: оказывается, что сторонники тезиса о ценностной нагруженности науки неявно придерживаются одной из форм идеала свободы от ценностей, поскольку вынуждены опираться на определенные допущения при формулировке каждого из четырех аргументов. Это, в свою очередь, позволяет усилить защиту идеала свободы от ценностей.

Ключевые слова: идеал свободы от ценностей, Кевин Эллиот, Хизер Дуглас, индуктивный риск, тезис о ценностях в науке, метапроблемы в философии

1. Introduction

Whereas it is commonly accepted that non-epistemic values ('values', for short) play a role both descriptively and normatively in some areas of scientific work, such as in the choice of research topics or the strategies for scientific communication, there is resistance to viewing values as relevant to science in its internal stages, those areas of science involving reasoning or inference and the epistemic justification of scientific conclusions. In response to this resistance, one finds in the values in science literature a standard set of arguments for the (non-epistemic) value-laden nature of science, a set usefully summarized by Kevin Elliott under the following headings: 1) the gap argument; 2) the error argument; 3) the aims argument; 4) the conceptual argument. These arguments Elliott describes as 'normative': they are "about whether values *ought* to influence scientific reasoning" [Elliott, 2022, p. 16, his italics]. It is as normative that we understand them here.

The four listed arguments aim to show that values play an ineliminable role in scientific reasoning. Rational, scientific judgment cannot proceed without values. The working assumption of this paper is that what's good for scientific judgment is also good for the philosophical appraisal of scientific judgment. That is, if one adopts a 'meta' perspective on scientific reasoning, reasoning philosophically about scientific reasoning, then if scientific reasoning is normatively value-laden, correlatively philosophical reasoning about scientific reasoning is normatively value-laden, as well. Arguably, philosophical reasoning is even more value-laden than scientific reasoning as it is typically not empirically testable and so more prone to subjective evaluation.

What then results if, for each of the above arguments, one looks at each of them in a philosophically reflective way – if one turns each argument on itself? Each of the arguments is based loosely on empirical facts. They are presented in the literature in the context of case studies in science, studies that suggest the occurrence of value-ladenness in empirical, scientific investigation. As these arguments are empirically based, one would expect that they could be self-applied, and that their self-application would suggest the further occurrence of value-ladenness. As such, their self-application should not cause a problem for the defense of the value-ladenness of science. Or so one would think. The argument in this paper is that the self-application of these arguments is problematic for the cogency of these arguments and so problematic for the values in science thesis.

After systematically describing these meta-problems for each of these arguments, I reflect on the epistemic status of these arguments, and conclude that each works only by assuming a fundamental basis of value-free judgements. The values in science thesis is defensible only assuming

a series of basic, value-free judgements. I then review the status of two attempts at defending the value-freedom of science, a Betz-style hedging approach and a Levi-style conventionalist approach. Both approaches are problematic for reasons discussed in the literature. I argue, alternatively, that neither approach is needed nor useful in responding to the values in science thesis given the meta-problems I have introduced. Subsequently I turn to a problem for defenders of the values in science thesis, the problem of 'deviant' values, values that lie outside moral, political, or social norms, and which, if they influence scientific reasoning, disrupt the trust we have in scientists. It has been argued that the public can regain this trust if we require scientists be transparent about their values and subject these revealed values to democratic endorsement. I argue that these initiatives are irrelevant to the epistemic appraisal of the values in science thesis, however significant they are from a moral, political or social perspective.

2. The Gap Argument

The gap argument for the value-ladenness of science begins with the realization that the support of a theoretical hypothesis by empirical data is underdetermined. The move from data to justifying a hypothesis involves an inductive leap that requires the stipulation of background assumptions in order to be effective. From here the claim is made that the relevant background assumptions are informed by values. Various case studies are presented to this illustrate this point, such as Longino's citation of anthropological theories of human evolution implicitly informed by androcentric assumptions, leading to androcentric conclusions (see [Longino, 1990], discussed by [Elliott, 2017, p. 68–71] and [Elliott, 2022, p. 19–20]). It is additionally claimed that, even where the value-ladenness of their assumptions isn't acknowledged by scientists, they are compelled to espouse values anyways, given their social position as advisors to the public, and so should be pro-active in making their values explicit (see [Ibid., p. 21–22], and [ChoGlueck, 2018, p. 708–711], citing [Kourany, 2003]).

As such, the structure of the gap argument has two alternative forms. Either (1) various case studies are presented showing how values influence actual scientific work, or (2) case studies are presented showing how values *should* influence actual scientific work. Either way, we conclude that scientific inference and reasoning is value-laden. Arguments (1) and (2) can work in tandem. If values negatively influence scientific work, then it can be inferred that a different set of values should influence this work. In tandem or not, either argument involves further inductive gaps. First of all, there is the question of the case studies themselves, whether they have been accurately portrayed. For example, in the anthropology of human evolution, the participant scientists never openly espouse

androcentric values. It is inferred that they did on the basis of their inferences that, presumably, could only have been compelling as underwritten by androcentric values. Accordingly, appealing to the fact that values inform the assumptions underlying scientific reasoning requires, itself, an empirical investigation into the various sorts of inferences scientists make, inferences of all kinds from various fields, inferences often obscured by the hiddenness of relevant valuational assumptions, utilizing a limited set of empirical data given the enormous scope of the inquiry. Here, we have many further inductive leaps each needing background assumptions to fill the relevant inductive gaps. With our limited evidence that scientists draw conclusions as informed by value judgments, inferring the conclusion that scientists are committed to background valuational assumptions is only supportable by presupposing, now at the meta-level, yet more background assumptions.

Alternatively, arguing that scientific inference *should* be informed by values, whether or not they are, given the social or political location of scientists, also involves an inference for which there is a gap between the data and the theoretical hypothesis under consideration. One can present cases where adopting different valuational assumptions would have led to better scientific work. This is what we find in the anthropology of human evolution where androcentric assumptions lead us to misunderstand the past. There are, on the other hand, cases where adopting different valuational assumptions would have led to mistaken inferences and scientists would have done better to have not made such assumptions in the first place. Also, one finds cases where the social or political impact of a scientific assumption is unclear, or where there is debate itself about what valuational impacts are viable to consider. So, generally speaking, whether a scientific inference should be informed by values, or not, or by which values, is often an empirical question that needs research and study. It is, furthermore, a form of empirical research that does not in any way determine its conclusion, and thus requires further background assumptions if one is to pass judgement on the necessity for a scientist to be pro-active in making explicit their values.

A possible third option here is to suppose that value assumptions are tacit in any empirical investigation, even if scientists aren't aware of them. It is sometimes said that various assumptions are built into their mindsets of scientists through their training, or built into the institutional background, or implicit in scientific apparatus. These sorts of tacit background assumptions are cited by Eric Winsberg in his discussion of the creation of climate models, the sheer computational complexity of which requires the input of valuational background assumptions at various junctures in the creation of these models, assumptions subsequently unnoticed by climate scientists as they are hidden in the models' "nooks and crannies" [Winsberg, 2018, p. 401]. P.D. Magnus [2022] cites a similar phenomenon in discussing the black-boxing of scientific, inferential procedures.

"Black-boxed instruments", he says, "exhibit value inertia" (23), remnants of the value assumptions made by preceding "epistemic institutions", such as scientific instrument-makers or theorizers. Again, the question whether there are hidden, tacit, inert valuations is an empirical matter, one for which there is little evidence. Both Winsberg and Magnus present their conjectures as speculations, not as empirically informed judgments about climate models or epistemic institutions, which is to be expected given the difficulty in observing these valuational influences (again, they are in located in the "nooks and crannies" of models or in past "epistemic institutions"). There are, to be sure, empirical data relevant to the identification of these influences. The data are inevitably piecemeal, and so we are faced once more with inductive gaps, which means arguments for the presence of these influences are underdetermined and depend for their cogency on their own set of background assumptions.

We see, then, that the gap argument itself suffers from gaps that needs to be supplemented by background assumptions. Moreover, these are substantive background assumptions in so far as the inferences we are speaking of at the meta-level are relatively weak by comparison to the empirically-based inferences in science that are the subject matter of the gap argument. Any inductive inference formulated in philosophy that is based on case studies is bound to be very weak. Thus, the weakness of the gap argument for the value-ladenness of science is no special reason to reject the argument, *qua* philosophical argument. Instead, the concern is that the background assumptions needed for the gap argument are of two sorts: either these background assumptions are valuational or not. If the former, we have the prospect of an unusual situation where in ensuring the value-ladenness of scientific activity we need to assume the value-ladenness of a form of philosophical assessment, a value-ladenness that likely will involve values of a different sort at the meta-level than at the scientific level. It is unlikely that proponents of the gap argument inferring the value-ladenness of an anthropological thesis about human evolution are going to be themselves committed to values of a same sort. Longino, for example, likely isn't committed to androcentrism when by means of the gap argument she argues for the androcentric nature of anthropology. So we have an unusual situation where we are inferring the presence of values in a scientific activity by means of a philosophical argument that itself likely assumes a different set of values. Why should a commitment to values of one sort rely on a commitment to values of an entirely different sort? Even if this is not a problem, there will of course be further gap arguments justifying value assumptions at the philosophical level, which themselves need empirical support. In philosophical modesty, we don't presume an a priori knowledge of values.

The question is how one stops this regress of (empirical) support and the need for further background assumptions. The answer is that some assumptions are simply assumed by us to be true and require no support,

be they valuational or not. This is likely how Longino views her assessment of androcentric anthropology, how Winsberg sees values hidden in the "nooks and crannies" of computational climate models, and how Magnus understands value inertia wrought by "epistemic institutions" – as objective facts being reported. Making these intellectual moves is respectable philosophy. They are the sorts of intellectual starting points we all rely on. They are not value judgements. They are expressions of facts about the occurrence of values and other states of the world. The gap argument only works with such value-free starting points.

3. The Error Argument

The error argument for the value-ladenness of science starts at the same place as the gap argument. With scientific judgment there is typically a lack of determinate evidence, and so there is a perennial risk of error regarding the conclusions drawn, how empirical data are characterized, one's choice of methodology, what alternate hypotheses should be considered, and so on (see [Elliott, 2022, p. 22], citing [Douglas, 2000; 2009]). In addition to this context of epistemic uncertainty, scientists as well as everyone else are faced with moral, political, social and other valuational demands for which it is one's duty to respond adequately. This opens up for a scientist a spectrum of choices, to draw one conclusion or another, to characterize the evidence in one way or another, a variety of options that, given one's choice, could amplify or diminish one's valuational obligations. Here it is important that a scientist not commit a valuational error. In an off-cited case, Douglas discusses judgments about how to characterize tissue slides from a rat's kidney that may, or may not, exhibit the presence of a tumor resulting from exposure to the poison dioxin ([Douglas, 2000], discussed by [Elliott, 2022, p. 22–23], and [ChoGluek, 2018, p. 713]). Scientists could adopt a strict standard in this case, one that demands strong evidence for the conclusion that a tumor is present, or a weak standard, one that is more liberal in concluding that a tumor is present [Elliott, 2017, p. 96]. Which choice should be made by a scientist is determined by which choice minimizes valuational error. For example, a scientist may judge the hazard, or error, of underplaying dangers significant enough to warrant a more liberal standard regarding the presence of dioxin-induced tumors.

As with the gap argument, the error argument is based on an examination of case studies. Douglas' [Douglas, 2000] original argument focused on the identification of tumors in rat liver slides. A useful extension of Douglas' reasoning has recently been formulated by Harvard and Winsberg [2022]. Douglas' original argument concerns the problem of 'inductive risk', drawing an inductive conclusion on the basis of

limited evidence that runs the risk of valuational harm. Harvard and Winsberg extend this notion to 'representational risk', the risk of representing a phenomenon that is not adequate to the purpose of this representation ([Harvard, Winsberg, 2022, p. 2]; see [Elliott, 2022, p. 24–25]. Harvard and Winsberg [2022] examine representational decisions in clinical trials involving pharmaceuticals. Clearly, in any case study, there are a multitude of inductive and representational risks. Here is a sampling of possible risks, focusing for convenience on Douglas' case: risks arising from (1) rat liver pathologists basing their work on preceding and fallible scientific decisions, each of which has an impact on their current decision (for example, citing previous studies that either confirm or disconfirm their current conclusions); (2) pathologists prioritizing the severity of inductive errors, for example, weighing economic harm against the harm of poisoning, in a unjustifiably presumptive manner; (3) pathologists judging how likely it is decision makers will follow their conclusions (for example, they fallibly estimate the likelihood that their conclusions will be ignored); (4) focusing solely on the danger of dioxin poisoning, ignoring what alternate chemicals might be used as a replacement for dioxin and the toxicity of these alternate chemicals. This is a small listing of the various inductive and representational errors that are possible. Generally speaking, any case study will contain the potential for innumerable valuational errors.

Let us then look at the error argument itself. We proceed from looking at one or more case studies, to the conclusion that science is value-laden and that scientists should embrace their moral, political, and other valuational duties, which we acknowledge does not violate their epistemic duties given that the epistemic situation is inherently uncertain. We now see that the risk of error in this argument is extensive. The case studies are highly uncertain in terms of our judgments about what scientists should or should not do. It follows that the inference to the value-ladenness of science contains a variety of inductive and representational risks. If the error argument is to be followed, these risks are formidable as we are counseling scientists to embrace their valuational duties, and it is highly uncertain whether doing this is beneficial to society. Thus, if we were to follow the error argument at the meta-level, our conclusion might be to refrain from inferring that scientists have an obligation to pass judgments on the basis of their values. Note that the problem here is not just the personally-held values of scientists. The same problem arises if we are considering the democratically endorsed values of society, since there is a representational risk in judging what these democratically endorsed values are. For example, there are different kinds of democratic decision procedures we might consider, and so uncertainty about the democratic procedure to which a scientist should defer. There is also inductive risk as we move from piece-meal evidence about the result of a democratic process to a judgment about what is the actual democratically endorsed

view of members of society. These risks, by the error argument, counsel us to refrain from concluding that science is value-laden, if the risks are severe enough.

Analogously to how we addressed the meta-problem for the gap argument, the question is how one can defend the error argument without it turning on itself. The answer is that the depictions of the case studies on which the error argument is based need to be accurate, along with accurate judgments about what values we should be considering and the state of their democratic endorsement. Moreover, these accurate judgments need to hold independently of our value judgments. For example, with dioxin-induced rat liver tumors, we assert that it is believed by scientists, and it is true, that the underreporting the occurrence of tumors leads to the underregulation of dioxin and increased harm to the health of people, and contrarily, that the overreporting of tumors leads to the overregulation of dioxin and increased economic harm. We further suppose that rat pathologists are aware of, and right about, the disvalue of these negative impacts on health as compared to the contrary negative economic impacts. These are facts that we suppose are known to be true and not in any way impacted by valuational judgments. Otherwise, with a different set of values, our judgments could change and our counsel to scientists might vary. Such facts are then the sorts of intellectual starting points we rely on in committing to the error argument. They cannot be value judgements since that will disrupt the effectiveness of the error argument and leave it open to speculative revisions based on our values. Rather, they are expressions of facts about what the scientists are doing, what their values are, what the democratically endorsed values are, and a host of other claims made at the meta-level. From these starting points it is inferred that scientists have an obligation to express value judgments on the toxicity of dioxin, as per the error argument. In other words, the error argument only works with such value-free starting points.

As Elliott notes, Helen Longino [1996] and Phyllis Rooney [1992] disclaim the view that one can so easily separate the epistemic from the non-epistemic [Elliott, 2022, p. 21–22]. They would disclaim the view that judging a rat liver slide to reveal a tumor is a pure factual judgment without a valuational, or normative component. By comparison, Douglas reaffirms the descriptive/normative distinction: she suggests that those who fail to see the distinction can never make sense of the value-free ideal [Douglas, 2021, p. 12]. We are justifying the same point here. If one fails to draw the descriptive/normative distinction at the meta-level, one undermines the error argument since absent this distinction the error argument is epistemically insufficient, and one must refrain from drawing its conclusion due to potential inductive and representational risks – or else continue to endorse this argument dependent on one's values, leaving the argument vulnerable to refutation since people don't consistently support the same set of values.

4. The Aims Argument

The aims argument for the value-ladenness of scientific reasoning recognizes that theories or theoretical models "have non-epistemic aims that go beyond merely arriving at true or reliable information about the world" [Elliott, 2022, p. 29]. For instance, climate models are used and evaluated on the basis of their ability to make predictions addressing specific policy aims or purposes. For instance, the goal of such modeling may be to predict long-term precipitation amounts in a certain geographical area, a goal dictated by the values of policymakers. This modeling will involve employing various modelling idealizations that misrepresent the climate in some respects, sometimes for the simple reason of timely expedience. Still, a successful prediction speaks to the epistemic merit of this model. On the other hand, the same model, with the same idealizations, may be unsuccessful with other, unrelated predictions that are demanded by a different policy objective. From this policy viewpoint the model has an epistemic demerit. Thus, the epistemic value of a model is contingent on the aims, or purposes, of the model. Reasoning in support of the epistemic quality of a model thus incorporates the presence of values: whether one has good evidence for a model, or theory, depends on the non-epistemic purposes or aims for which the model is constructed.

The aims approach is defended in Elliott and McKaughan [2014] and Intemann [2015]. It is also defended in Parker and Winsberg [2018] as a "purposes and priorities" approach, and in Parker [2020] as the "adequacy-for-purpose" view. In each instance, the aims or purposes of an inquiry inform the epistemic evaluation of a model used in this inquiry. A model is 'adequate for (an epistemic) purpose' dependent on the values for which the model is created.

Again, the aims argument is based on the fact that theories and models are formulated for non-epistemic reasons. Without a doubt, the same applies to philosophical theories, such as theories at the meta-level examining the epistemology of model and theoretical evaluation. Defenders of the aims argument have an aim, or purpose, or goal in adopting this approach in defending the value-ladenness of scientific reasoning. Presumably the goal is philosophical as these defenders are philosophers. Presumably, then, their goal is to arrive at the truth about the sort of knowledge one gets by means of model and theoretical evaluation. It would be difficult to say that philosophers seek anything less. I take it that, when a philosopher says that scientific reasoning using models is value-laden, and aims to justify this point by means of the aims argument, she takes herself to be speaking the truth. She makes this pronouncement with the purpose of speaking the truth, on the basis of an argument that has as its sole value the speaking of the truth.

It may be that I'm too optimistic about philosophers. It may be that, like the scientists about whom they speak, philosophers employ modeling idealizations, here an idealized argument about scientific reasoning, that misrepresents scientific reasoning in some respects, simply as a matter of timely expedience. They make predictions about the reasoning of some scientists that are correct, and that confirm their theoretical models. About other scientists their predictions are unsuccessful, scientists for example who disclaim the value of a climate model that predicts precipitation amounts correctly in one geographical area while making incorrect predictions elsewhere. These predictive differences to which philosophers are prone might be due to non-epistemic values. Some philosophers might consider the views of some scientists to be inherently more valuable or interesting or pertinent than the views of other scientists, just as climate modelers might regard long-term precipitation amounts in certain geographical areas to be more valuable or interesting or pertinent, by comparison to other potential climate predictions, which they then get wrong. Our judgement in such a case would be that the philosopher lacks a thorough understanding of the epistemology of science. They successfully predict the value-laden knowledge of some scientists, and unsuccessfully predict the non-value-laden (or differently value-laden) knowledge of other scientists. We'd say their understanding of scientists lacks sufficient scope. By analogy, we should say the same about a climate modeler, that the modeler's knowledge of the climate is incomplete and insufficient if she correctly predicts climate events in one case, and doesn't correctly predict climate events in a different case.

For the purposes of expressing the relevant meta-problem for the aims argument, this digression on philosophical aims is ultimately unnecessary. For the aims argument to work, one needs a correct view on how epistemic standards relating to climate models vary with the aims of climate scientists. If what counts as a correct view varies with the aims or values of the arguer, so that with different aims or values it turns out that the epistemic standards relating to climate models do not vary with the aims or values of climate scientists, then the aims argument will be weak. One could dismiss it simply because one has different aims or values when it comes to epistemic standards. For instance, someone with the aim of promoting value-free, epistemic standards would reject the view that epistemic standards relating to climate models vary with the aims or values of climate scientists, and so would reject the subsequent inference to the value-ladenness of science. It follows that, for the aims argument to work, the judgement that epistemic standards relating to climate models vary with the aims or values of climate scientists must itself be invariant with the aims of the arguer. We must deny the thesis of value-ladenness at the meta-level.

The same point can be made in terms of an adequacy-for-purpose view. When a model is said to be adequate-for-purpose, say, to represent

some state of affairs, the modeler has in mind some state of affairs, some purpose, and in this case, some sort of representational capacity. If any of these factors change, then the model is not adequate for purpose in the same sense. It would be adequate for another purpose, or adequate in a different way for the same purpose. Suppose then that values were to impinge upon the adequacy for purpose account. Assuming, as seems reasonable, that one has choice as to one's values, value-ladenness in one's interpretation of adequacy-for-purpose will affect what counts as 'adequacy-for-purpose' and so affect whether a model is ultimately adequate-for-purpose. Thus, to have an adequacy for purpose account that is consistent, we need value-free facts of the matter as regards the elements that make up adequacy-for-purpose, such as what counts as a purpose, what makes for a representation (if representation is the goal), what counts as an adequate representation, and so on.

5. The Conceptual Argument

The basis to the conceptual argument is the recognition that some concepts, particularly in the social sciences, contain normative elements, along with being descriptive. Such concepts are sometimes called 'thick', or as Alexandrova [2018] calls them, 'mixed'. The example of a mixed concept that Alexandrova uses, and that Elliott also uses following her [Elliott, 2022, p. 31], is 'well-being'. What constitutes well-being is not straightforwardly described since it is a notion to which people attach normative value, a normative value that varies from person to person and is highly interpretive. Mixed claims involving mixed concepts are inherently value-laden and are the subject of much social scientific research. According to the conceptual argument, science is value-laden in so far as it involves mixed concepts.

Without stopping to reflect on the extent of mixed concepts in the sciences (Elliott considers the extent to be quite broad; see [Elliott, 2022, p. 34]), let's consider the conceptual argument from a meta-perspective. The claim, "well-being is a mixed concept", is itself, arguably, a mixed claim. The concept of a mixed concept is, arguably, a mixed concept. This is because a mixed concept has both normative and descriptive elements, and so the concept of a mixed concept has both normative and descriptive elements. Since the concept of well-being has normative and descriptive elements, the claim, "well-being is a mixed concept", contains both normative and descriptive elements and so is a mixed claim. If this argument is compelling, whether it is the case that "well-being is a mixed concept" is subject to interpretation. The claim contains a normative element so whether it is endorsed depends on the meaning one ascribes to the concept of a 'mixed claim', just as what constitutes well-being is

subject to interpretation and depends on the meaning one gives to 'well-being'. Thus, there is flexibility in terms of whether one wishes to endorse the claim that "well-being as a mixed concept", a flexibility that inheres in every concept that is posited as a mixed concept. It is up to whoever is reviewing the conceptual argument to accept this claim, or not, dependent on how they value, or interpret, well-being. It follows that the premise to the conceptual argument, that well-being (and most any scientific concept, if we follow Elliott) is a mixed concept, is itself a value-claim. There being no descriptive fact to the matter as to whether a scientific concept is mixed, we could just as well reject the premise, and so reject the conceptual argument, should we decide that, for example, "well-being is a mixed concept" is not a mixed claim, or is otherwise unusable as a mixed claim since it presumes the wrong sorts of values.

Alternatively, for the conceptual argument to work, there needs to be a descriptive, non-value-laden fact of the matter about whether the premise holds, whether well-being (or some other reputed mixed concept) is a mixed concept. Such a strategy has traditionally been maligned by proponents of the values in science thesis. It is akin to the strategy proposed by Ernest Nagel [1961] who suggests that we limit value judgements to an 'estimating' role, maintaining a descriptive orientation, and eschewing an 'appraising' or endorsive attitude towards value judgements (see [Alexandrova, 2018, p. 429] for review). As Alexandrova explains, an estimating value judgement could either 1) defer to community standards as descriptively authoritative, or 2) be expressed as a conditional claim relativized to multiple communities, or 3) be designed to exclusively cover only the descriptive component of a mixed claim, relegating the labor of appraising value judgments to others better situated disciplinarily. After dismissing 1) and 2) as tacitly normative, Alexandrova ironically disputes the third option by asserting that scientists, due to their extensive experience with (descriptive) facts, acquire over time "hard earned normative knowledge" [Ibid., p. 432]. This mirrors the claim made above in the meta-evaluation of the conceptual argument for the value-ladenness of science, that to avoid begging the question one needs to start with descriptive, value-free facts. It turns out that Nagel's appraisal/estimation distinction applies, after all.

6. Overview of the Above Problems for the Values in Science Thesis

Each of the above arguments suffers from the same problem: each has a basis in factual, value-free judgments if their cogency is to be maintained. In effect, these arguments for the value-ladenness of science rely on prior factual, value-free judgments. With the gap argument, the philosopher has

in her mind a conception of what the world is like, for example, a conception about what values scientists endorse, or should endorse, or a conception of how computational models are constructed or what epistemic institutions there are. With the error argument, one needs to be aware of what risks there are in some scientific investigations, or how policy-makers will respond when presented with these risks, or even more basically whether scientists have accurate views on the nature of toxic chemicals and their potential impact on tumor growth and related scientific matters. Similarly, with the aims argument, one needs to be aware of how epistemic standards (such as relating to climate models) vary with the aims of climate scientists, and related to this, an accurate view of what the aims of scientists are. With the conceptual argument, one needs a prior understanding that some concepts are mixed or contain normative elements, or even more basically, an understanding of what concepts are properly considered 'mixed' or 'thick'. If one's comprehension or awareness of any of these facts is value-dependent, that is, if the relevant meta-issues are subject to value judgements, this negatively affects the acceptability of these arguments since disputes about the premises of the argument would emanate from differences in these value judgements. There would be no value-independent, philosophical facts of the matter to work with as starting points, and so no resolution of the philosophical question at issue, to wit, the question whether scientific reasoning, reasoning in the internal stages of science, is value-laden or value-free. A philosopher, confronted with a repudiation of her view, can simply retort that she values something different as a scientific, philosophical or logical fact.

That sort of response is not endorsed by those who are advancing the above arguments for the value-ladenness of science. They take themselves to be offering straightforward philosophical, scientific, or logical truths that lead them to infer the value-ladenness of science. How else could they convince their audiences of the rightness of their views, other than by assuming the value-freedom of their premises? To illustrate this tendency by philosophers to demur on value-ladenness when it comes to their own philosophical argumentation, consider de Melo-Martin and Intemann's [2018] discussion of potential sources of what they call 'normatively inappropriate dissent' (p. 4), cases where people dispute the received scientific consensus on topics such as anthropogenic climate change, the absence of a link between vaccines and autism, and HIV as a cause of AIDS. On their view, the scientific evidence on these issues is "overwhelming" and "substantial". They are examples of "our best scientific knowledge" (p. 144). Dissent on these topics is not only mistaken – it is "dissent that fails to promote or that hinders scientific progress" (p. 146). De Melo-Martin and Intemann's point is that one should not rely on a "deficit model" (p. 144) in explaining normatively inappropriate dissent, as though climate change deniers, anti-vaxxers and HIV skeptics just need more education, or that we just need more evidence for these

claims to convince these dissenters. For de Melo-Martin and Intemann, the science is established and the evidence is there. Instead, we should view the relevant dissent as "about values, not about facts". The fruitful way to handle dissent is to "[engage] in discussions with all relevant parties about the values at stake, rather than the truth of particular scientific claims" (p. 151).

We can put the point this way: de Melo-Martin and Intemann are offering a philosophical defense of the values in science thesis on the basis of an established set of value-free, scientific, factual claims. It is a strategy common to defenders of the value-ladenness of science, nor is it a philosophical strategy exclusive to proponents of the value in science thesis. For example, Hugh Lacey in discussing "theories being impartially held of specified sets of phenomena" describes these phenomena as "so well founded and established that [understanding them] needs no further testing". He further provides as examples of such theories "classical mechanical theory… as an account of terrestrial motions" along with those theories found in "textbooks of molecular chemistry and biology, nuclear physics, studies of the viral and bacterial causation of disease", and so on [Lacey, 2017, p. 19].

Is it reasonable for philosophers to defer so completely to established science in defending the values in science thesis? I have been claiming that this deference is a tacit appeal to value-free science. In response, the defender of value-laden science could claim that her deference is itself a value judgment, the value one attaches to established science. Arguing in this way would have the appearance of circular reasoning in a defense of the values in science thesis. Optimistically, we could call it a virtuous circularity, with the endorsement of value-ladenness ranging up and down the corpus of modern science. One concern with taking this strategy is that it ignores the substantive debate in the philosophy of science on the topic of scientific realism, where there are legitimate arguments for scientific anti-realism based on, for example, the pessimistic induction. There have been innumerable times in the history of science where what has seemed to be an obviously true scientific thesis turns out to be mistaken, and there is no reason why this could not be true now, even in the context of seemingly incontrovertible evidence for anthropogenic climate change, the flaws in anti-vax theory, and the causative role of HIV in AIDS. There are even philosophers who doubt the existence of the external world, who are global skeptics. Are these philosophers guilty of normatively inappropriate dissent, and should they be castigated along with climate deniers and anti-vaxxers? The answer, again, may be that the defenders of the values in science thesis are, in their arguments for the value-ladenness of science, working on the basis of value-assumptions. Let's suppose for the sake of argument that the relevant circularity here is virtuous. For that reason, these value-assumptions do not form a compelling basis for an argument on behalf of the internal role

of values in scientific reasoning, even granting that their invocation does not result in a logical fallacy, since we are effectively assuming what we are trying to prove. If the premises of an argument are value-laden, the conclusion of the argument will be value-laden too. A better argument for value-laden science works on the basis of value-free assumptions, with no circularity whatsoever. That is just to say that the defenders of the values in science thesis should work from an assumption of value-free, descriptive facts. They need to be, at least tacitly, defenders of the value-free ideal.

A further response by the proponents of the values in science thesis might adopt a piecemeal approach to value-ladenness. Some hypotheses could be justified on a value-free basis, others justified as value-laden. The values in science thesis is then a matter of where to draw this distinction. This strategy could work: one can draw distinctions in any way one likes. The problem is that defenders of the values in science thesis argue for their claims on the basis of value-free assumptions, and so must draw the distinction between value-free and value-laden claims in such a way as to ensure that these arguments work. Significant effort then must be exerted on identifying a set of appropriate value-free claims, ones that will generate as conclusions the desired set of value-laden claims. Awkwardly, then, defenders of value-laden science have as their primary task the identification and justification of value-free claims. Why then not just support the value-free ideal as a fundamental hypothesis?

7. Alternate Arguments against Value-laden Science

A frequently noted approach to defending value-free science is offered by Gregor Betz [2013] who suggests, in responding to the error argument, that one could 'hedge' the hypotheses subject to test to such a degree that their uncertainty is minimized. Proponents of the gap argument focus on the inductive gap between evidence and a hypothesis subject to evaluation. Where that gap is large enough one is entitled to invoke values in justifying the decision to either accept or refute a hypothesis. Doing so violates no epistemic constraints. Accordingly, if one narrows the gap by diluting the informative value of a hypothesis, one can diminish the need to invoke values, perhaps at the limit justifying a hedged hypothesis in a value-free way.

Betz' strategy has been subject to various critiques (for review, see [Elliott, 2022, p. 26–27]). For example, if one wishes to use scientific hypotheses to guide public policy, hedged hypotheses are not very useful since their degree of certainty is inversely proportional to how much information they contain. It follows that, in providing hedged hypotheses

to policymakers, one defers the responsibility of providing 'informative' policy to the policymakers themselves, given the lack of information contained in the hedged hypotheses. This is problematic since the policymakers are often not themselves scientists and so lack the relevant background knowledge and scientific expertise to properly evaluate these hypotheses.

Another approach to defending value-free science is proposed in Levi [1960] who suggests that science be viewed as containing a number of conventions, some of which license inductive inferences. Stated simply as conventions, the value-ladenness of inductive principles becomes moot. Scientists have to start somewhere in licensing inferences, so they take various inductive principles for granted, at least on a tentative basis. This conventionalist approach has been resuscitated in recent work by Wilholt [2013] and adapted by John [2015] who requires conventions be set according to high standards (for discussion, see [Boulicault and Schroeder, 2021, pp. 3–6]). The conventionalist approach can be objected to on the grounds that conventions are typically proposed on the basis of value-judgments. Scientists don't invent conventions out of the blue. They are thoughtful about these conventions and likely design them to serve non-epistemic purposes.

Whether or not Betz-style or Levi-style responses to the value-ladenness of science succeed, these responses are, in any event, unnecessary from the perspective of the argument for value-freeness defended here. When it is said that arguments for value-ladenness are based on premises advocated as purely factual, and not based on value judgments, these premises could be, and often are, highly informative claims and not hedged. From the above, we cited substantive premises expressing an androcentric approach to the anthropology of human evolution, criteria for tumor identification in rat liver slides, personalized viewpoints about human well-being, and so on. Similarly, the sorts of scientific assumptions proposed by de Melo-Martin and Intemann and Lacy are not hedged. They are substantive and informative, as they must be if they are to be used for scientific investigation, value-laden or not. Similarly, none of these factual claims are set up as conventions. They are scientific theses typically defended, or thought to be defensible, my means of rigorous inductive arguments, and are occasionally overturned by ensuing empirical investigation. As such, not being conventions, they are not conventions as justified by value judgments.

Nevertheless, the value-freeness of these assumptions is ultimately irrelevant to the defense of value-freeness offered here. Let them be defended on the basis of values. Let the relevant substantive premises for arguments for value-ladenness be, themselves, value-laden claims, as either conventions or as hedged claims. We have either way, with these arguments, forms of circular reasoning that should leave us unconvinced, for having assumed value-ladenness to begin with there is no need to use them in justifying the value-ladenness of their conclusions.

How can the defender of the values in science of thesis respond at this stage? Perhaps the question turns on the scope of claims that are value-laden. To avoid circular reasoning, one can assume that some claims are value-free to begin with. From this limited set of value-free claims it follows that the remainder of science is value-laden. The values in science thesis then amounts to the claim that, given a parsimonious beginner set of value-free claims, it turns out that a vast number of value-laden claims follow, many more than we would have expected. The question is what to count as this parsimonious beginner set. An interesting strategy would be to include in this foundational set observational reports of high certainty, along with logical, mathematical and philosophical claims of similar high certainty. We then set the stage for an expansive gap argument showing how the majority of scientific claims are inductive, fallible, and thus value-laden. The problem with such a strategy is the now-established theory-ladenness of observation. There is no longer a core set of highly certain observational reports. The observational basis to science is drawn from experimentation and other sorts of conjectural theoretical interpretations of our sensory experience. That sort of uncertainty is exploited in the error argument as we reviewed it above, such as with determinations of tumor growth in rat liver slides. More generally, as discussed above, the sorts of beginner premises utilized in the arguments for value-ladenness are typically highly theoretical, even philosophically unhedged. So if these premises constitute our starter set, these substantial beginning points raise epistemic concerns for those wishing to argue non-circularly for the values in science thesis, as these starting points are inductive and conjectural.

It follows that the defender of the values of science thesis is left in a dilemma: either make substantive, value-free assumptions from which one infers in select situations further value-laden claims, such as Longino's assertions about androcentric anthropology, Douglas' descriptions of the risky judgements made by rat kidney pathologists, epistemic assessments of aim-dependent climate model predictions and mixed judgments of well-being, or find oneself without a convincing (i.e., non-circular) critique of value-free rationality. This explains why we find, as above, defenders of the value-ladenness making liberal use in their arguments of value-free, descriptive facts.

8. Conclusion: Whither Transparency and Democracy?

It is often claimed that the objectivity of science is guaranteed by its value-freeness. Given value-freedom, good science excludes the importation of non-epistemic biases into scientific inference (see [Schroeder,

2021] for discussion). With the admission that science is value-laden, values of all sorts, even of a deviant kind, could influence scientific reasoning. Accordingly, one finds in the values in science literature debates about how to handle this sort of problem. Sometimes it is suggested that scientists need to be transparent about these values and allow the public to inspect them for approval. Sometimes it is suggested that the values of scientists need to be democratically endorsed set of values. (For support of the transparency approach, see [Intemann, 2024; Schroeder, 2021] defends a democratic approach and rejects the transparency option; Lusk [2021] advocates a deliberative democratic option, whereas Bihan [2024] rejects a democratic strategy as failing to address the problems of polarization and marginalization.)

These are important issues to address if we are going to contend with the presence of values in scientific reasoning. Whether one defends the values in science thesis or the value-free ideal, it is worthwhile having a strategy to handle the occurrence of deviant values influencing scientific investigation. On the other hand, these sorts of issues, and the general issue of how one can restore trust in science given various scientific debacles (such as the Lysenko affair, often alluded to in the values in science literature), can be safely ignored if one is studying in a value-free way the internal processes of scientific reasoning. Scientific reasoning proceeds by means of logical judgments based on apprehended facts, either empirical or theoretical, and in no place does this reasoning defer to the presence of either deviant or non-deviant values. The moral rightness of a scientific hypothesis, the political correctness of observing an event, the social propriety of making a theoretical assumption – these are all issues tangential to issues of logic, statistics, mathematics, experimental strategy, and theoretical justifiedness. Of course, one might stray from value-free scientific investigation, motivated by an interest in values. The point is that one need not stray in this fashion, barring weakness of will. That is, a preoccupation with values is not inevitable, as proponents of value-laden science argue, given the arguments for value-ladenness listed above.

This is not to say that all kinds of values are, ideally, irrelevant to the internal processes of science. There is a rich an important area of scientific reasoning that focuses on the aesthetics of scientific thinking. By the aesthetics of scientific thinking, one means considering issues of theoretical simplicity, the elegance of logical and mathematical reasoning, the significance of patterns in nature, the phenomenon of intuitive understanding, and related topics. None of these sorts of values and their significance for internal, scientific reasoning is contested in this paper. It is acknowledged that the premises involved in scientific reasoning may be compelling because they possess these aesthetic properties. The relation of such aesthetic values to the cogency of scientific reasoning and to a realistic understanding of nature is not denied. It is possible that the nature of the world is such that natural phenomena have just such

aesthetic characters, for example, that the natural world is simple in various respects, the elegance of a form of reasoning is indicative of its representational accuracy, perceived natural patterns are signs of real patterns. In these sorts of ways, aesthetic judgements could be importantly epistemic.

By comparison, none of the normative values of moral, political or social character, once the arguments for the value-ladenness of science as described above are undermined, have any epistemic significance for the internal stages of science. To assert otherwise would be to suppose that the natural world has an inherent moral, political or social character (assuming hypothetically that our focus is not itself morality, politics or sociology). Few suppose the natural world to have a moral compass, a political character, or to exhibit social laws. Atoms and molecules, for example, aren't governed by moral laws, have political systems or social rules. One could view our assessments of the four core arguments for the value-laden of science – the gap, error, aims and conceptual arguments – as based on this realization. The defenders of the values in science thesis in using these arguments are ultimately committed to a substantive basis of value-free claims, claims devoid of moral, political, or social significance. Nothing we have said here rules out the possibility that this substantive basis expresses, alternatively, aesthetic values.

References

Alexandrova, 2018 – Alexandrova, A. "Can the Science of Well-Being Be Objective?", *British Journal for the Philosophy of Science*, 2018, vol. 69, pp. 421–445.

Betz, 2013 – Betz, G. "In Defence of the Value Free Ideal", *European Journal for Philosophy of Science*, 2013, no. 3, pp. 207–220.

Bihan, 2024 – Bihan, S. "How to Not Secure Public Trust in Science: Representative Values Versus Polarization and Marginalization", *Philosophy of Science*, *First View*, 2024, pp. 1–11.

Boulicault and Schroeder, 2021 – Boulicault, M. and A. Schroeder "Public Trust in Science: Exploring the Idiosyncrasy-Free Ideal", in: K. Vallier and M. Weber (eds.) *Social Trust: Foundational and Philosophical Issues*. New York: Routledge, 2021, pp. 102–121.

ChoGlueck, 2018 – ChoGlueck, C. "The Error Is in the Gap: Synthesizing Accounts for Societal Values in Science", *Philosophy of Science*, 2018, no. 85, pp. 704–725.

de Melo-Martín, Intemann, 2018 – de Melo-Martín, I. and K. Intemann. *The Fight against Doubt: How to Bridge the Gap between Scientists and the Public*. New York: Oxford University Press, 2018.

Douglas, 2000 – Douglas, H. "Inductive Risk and Values in Science", *Philosophy of Science*, 2000, no. 67, pp. 559–579.

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

Douglas, 2021 – Douglas, H.; T. Richards (ed.). *The Rightful Place of Science: Science, Values, and Democracy*, *The 2016 Descartes Lectures*. Tempe: Consortium for Science, Policy, and Outcomes, 2021.

Elliott, 2017 – Elliott, K. *A Tapestry of Values: An Introduction to Values in Science*. New York: Oxford University Press, 2017.

Elliott, 2022 – Elliott, K. *Values in Science*, Cambridge: Cambridge University Press, 2022.

Elliott, McKaughan, 2014 – Elliott, K. and D. McKaughan, D. "Nonepistemic Values and the Multiple Goals of Science", *Philosophy of Science*, 2014, no. 81, pp. 1–21.

Harvard, Winsberg, 2021 – Harvard, S. and E. Winsberg, E. "The Epistemic Risk in Representation", *Kennedy Institute of Ethics Journal*, 2021, no. 32, pp. 1–31.

Intemann, 2015 – Intemann, K. "Distinguishing between Legitimate and Illegitimate Values in Climate Modeling", *European Journal for Philosophy of Science*, 2015, no. 5, pp. 217–232.

Intemann, 2024 – Intemann, K. "Value Transparency and Promoting Warranted Trust in Science Communication", *Synthese*, 2024, vol. 203 (2), pp. 1–18.

John, 2015 – John, S. "Inductive Risk and the Contexts of Communication", *Synthese*, 2015, vol. 192 (1), pp. 79–96.

Kourany, 2003 – Kourany, J. "A Philosophy of Science for the Twenty-First Century", *Philosophy of Science,* 2003, vol. 70 (1), pp. 1–14.

Lacey, 2017 – Lacey, H. "Distinguishing between Cognitive and Social Values", in: K. Elliott and D. Steel (eds.), *Current Controversies in Values and Science*. New York: Routledge, 2017, pp. 15–30.

Levi, 1960 – Levi, I. "Must the Scientist Make Value Judgements?", *Journal of Philosophy*, 1960, no. 57, pp. 345–357.

Longino, 1990 – Longino, H. *Science as Social Knowledge*. Princeton: Princeton University Press, 1990.

Longino, 1996 – Longino, H. "Cognitive and Non-Cognitive Values in Science: Rethinking the Dichotomy", in: L. Hankinson Nelson and J. Nelson (eds.), *Feminism, Science, and the Philosophy of Science*, Boston: Kluwer, 1996, pp. 39–58.

Lusk, 2021 – Lusk, G. "Does Democracy Require Value-neutral Science? Analyzing the Legitimacy of Scientific Information in the Political Sphere", *Studies in History and Philosophy of Science*, 2021, no. 90, pp. 102–110.

Magnus, 2022 – Magnus, P. "The Scope of Inductive Risk", *Metaphilosophy*, 2022, no. 53, pp. 17–24.

Nagel, 1961 – Nagel, E. *The Structure of Science: Problems in the Logic of Scientific Explanation*. New York: Harcourt, Brace, and World, 1961.

Parker, 2020 – Parker, W. "Model Evaluation: An Adequacy-for-Purpose View", *Philosophy of Science*, 2020, no. 87, pp. 457–477.

Parker and Winsberg, 2018 – Parker, W. and E. Winsberg. "Values and Evidence: How Models Make a Difference", *European Journal for the Philosophy of Science*, 2018, no. 8, pp. 125–142.

Rooney, 1992 – Rooney, P. "On Values in Science: Is the Epistemic/Non-epistemic Distinction Useful?", in: D. Hull, M. Forbes, and K. Okruhlik (eds.), *Proceedings of the 1992 Biennial Meeting of the Philosophy of Science Association,* vol. 1. East Lansing, MI: Philosophy of Science Association, 1992, pp. 13–22.

Schroeder, 2021 – Schroeder, A. “Democratic Values: A Better Foundation for Public Trust in Science”, *British Journal for the Philosophy of Science*, 2021, no. 72, pp. 511–543.

Wilholt, 2013 – Wilholt, T. “Epistemic Trust in Science”, *British Journal for Philosophy of Science*, 2013, no. 64, pp. 233–253.

Winsberg, 2018 – Winsberg, E. *Philosophy and Climate Science*. New York: Cambridge University Press, 2018.