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What does it mean to say that science is value-laden?

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Abstract: The literature on values in science contains countless claims to the effect that a particular type of scientific choice is or is not value-laden. This chapter exposes an ambiguity in the notion of a value-laden choice. In the first half, I distinguish four ways a choice can be said to be value-laden. In the second half, I illustrate the usefulness of this taxonomy by assessing arguments about whether the value-ladenness of science is inevitable. I focus on the "randomizer reply," which claims that, in principle, scientists could always avoid value-laden choices by flipping a coin.

> *"'Value' is one of those weasel words that slip in and out of the nets of the philosopher. We shall have to try to catch it first, or else what we have to say about the role of values in science may be of small use."*
> *Ernan McMullin (1982), "Values in Science"*

1. Introduction

The claim that science involves non-epistemic values is, in one sense, fairly trivial. Science is an activity we pursue for the sake of both epistemic and non-epistemic ends. We care about producing knowledge or understanding, but we also want to promote human health, develop commercially lucrative products, and achieve public policy goals. Decisions about which scientific projects to pursue – what research is deserving of our finite resources – are shaped by non-epistemic judgments of practical importance. We devote more money to studying diseases that affect humans than diseases that affect koalas, and rightly so. Science is also subject to constraints from non-epistemic values, such as in the design of research, where requirements to safeguard the well-being of human or animal subjects can trump the demand for new knowledge.

Locating non-trivial claims about the role of values in science requires a finer grain of analysis. Rather than considering science as a whole, interesting philosophical questions arise when we ask which scientific choices involve non-epistemic values and how such choices should be handled. This chapter focuses on claims of the former sort, which state that a particular type of scientific choice is value-laden (or not).[1] Over the decades philosophers have put forward many such claims. Recently, for example, Elabbar (2023) has argued that the curation of evidence in scientific assessments is value-laden, and Dethier and Fletcher (2024) have contended that the selection of an estimator in classical statistical inference is value-laden.

[1] Following widespread usage, when discussing values in science I take a "value-laden" choice to be one that involves *non-epistemic* values.

There is often a hidden complexity in claims of this sort, arising from ambiguity in what it means for a choice to be "value-laden." My aim in this chapter is to provide a disambiguation of value-ladenness and offer a novel demonstration of its usefulness. In Sections 2–3, I distinguish four ways a choice can be said to be value-laden. Section 4 discusses the relationship between this taxonomy and recent work on the ontology of values. In Sections 5–6, I show that the taxonomy provides tools for a nuanced assessment of the "randomizer reply" to arguments for the inevitability of value-laden choices in science.

2. The Space of Reasons and the Space of Causes

In his essay "Empiricism and the Philosophy of Mind," Wilfrid Sellars introduces a now well-known philosophical dichotomy. "In characterizing an episode or state as one of knowing," he writes, "we are not giving an empirical description of that episode or state: we are playing in the logical space of reasons, of justifying and being able to justify what one says" (Sellars 1956, 298-9). Later commentators, including Rorty (1979), McDowell (1996), and Brandom (1998), elaborated on Sellars' notion of the space of reasons as the arena in which our actions or attitudes are normatively evaluated. The space of reasons is distinct from the space of causes, which is delivered by the sciences and contains descriptions and explanations of worldly phenomena. Understanding the relationship between the space of reasons and the space of causes is a central project for philosophers interested in naturalism and normativity (Pollard 2005).

The notion of "value" at play in work on values in science is notoriously slippery. Although many definitions have been offered, none has been entirely satisfying nor widely adopted. McMullin (1982), quoted in the epigraph, points out that this is a problem. How can we determine the (proper) role of values in science if we do not have a grasp of values themselves? In Ward (2021), I aimed to put the literature on a firmer footing by analyzing how values bear on choices. The first step of this analysis can be put in Sellarsian terms.

On some ways of thinking about values, they play a role in the space of reasons. Values often justify our actions – as when, for example, the value of pleasure justifies my choice of morning coffee. On other ways of thinking about values, they play a role in the space of causes. We talk about values causing things – as in your unconscious value for attracting attention causing you to buy a particular car. The notion of a value thus seems to admit of different interpretations in different contexts. Philosophers of science have overlooked this variability to their peril, leading to cross-talk and misunderstanding.

3. Four Senses of Value-Ladenness

Values can either act as reasons for choice or interact causally with choices. Within each of these categories, a further distinction can be made, yielding a four-way taxonomy:

Values in the Space of Reasons

1. *Rational interpretation* (values act as justifying reasons):
   A choice is value-laden when it is justified by non-epistemic values.
2. *Motivational interpretation* (values act as motivating reasons):
   A choice is value-laden when it is motivated by non-epistemic values.

Values in the Space of Causes

3. *Causal interpretation* (values act as causal effectors):
   A choice is value-laden when it is causally influenced by the possession of certain non-epistemic values.
4. *Objectual interpretation* (values act as affected goods):
   A choice is value-laden when it causally promotes or impedes a non-epistemic value.

Let's unpack each interpretation with a few examples. Philosophers of action distinguish between two sorts of reasons: motivating reasons and justifying reasons (Baier 1958, Bond 1974). The former motivate a person while the latter justify what they do. The two sorts of reasons are not always the same. For instance, imagine that Peter decides to become vegetarian. There are plausibly several reasons that justify Peter's decision: cutting meat out of his diet reduces his carbon footprint, prevents animal suffering, and helps him fit in with his vegetarian friends. As it happens, only the last reason actually motivates Peter; it is because of his desire to fit in that he becomes vegetarian. Some of the justifying reasons for his choice are thus not its motivating reason.

Non-epistemic values often act as motivating and/or justifying reasons. Indeed, the same example can also be characterized using the language of values: Peter's choice is motivated by a value for social acceptance, although it is also justified by values for the environment and animal welfare. There are two corresponding ways in which a choice can be said to be value-laden. The first is when non-epistemic values act as justifying reasons for the choice. The second is when non-epistemic values (consciously or unconsciously) act as motivating reasons for the choice. These are the *rational* and *motivational interpretations* of value-ladenness.

Decisions about which scientific research projects to fund are arguably value-laden in a rational sense, since they are justified, at least in part, by non-epistemic values. A project that aims to estimate the number of ants in my backyard and a project that aims to understand which genetic mutations affect the shape of the COVID-19 spike protein would both produce new knowledge. It's not because of an epistemic difference between the projects, but rather a practical and moral difference, that the decision to fund the latter but not the former is justified (Kitcher 2001). Note that claims about rational value-ladenness require there to actually be a justificatory relationship between the value and choice in question. The decision to fund research on the COVID-19 spike protein is rationally value-laden because the value of human health does indeed justify undertaking such research (though the justification is only *pro tanto*; see Ward 2021).

Meanwhile, many scientists' individual decisions about what research to pursue are value-laden in the motivational sense. Consider a parasitologist who decides to specialize in the fungus *Cryphonectria parasitica*, commonly known as chestnut blight, because of its devastating impact on her historic hometown and her hope that scientific advances can protect against future invasive pathogens. The parasitologist's choice of specialization is value-laden in that ecological and social values serve as motivating reasons for her. (As is true for each example in this section, the choice might be value-laden in other senses as well.)

In addition to playing these roles in the space of reasons, values can also operate in the space of causes. Here too there is a natural bifurcation: values can be understood to play the role of either cause or effect. That is, the possession of a value can affect a choice, or a choice can have an impact on goods in the world. On the first, *causal interpretation* of value-ladenness, a choice is value-laden when someone's (or some group's) possession of a particular non-epistemic value influences the choice. Imagine that Keira's family is getting a dog. Wanting to economize, Keira selects the ten dogs which would be cheapest to adopt from the local animal shelter. She gives this list of ten dogs to her son Randall, who looks at their photos and chooses the cutest. Randall's choice of dog is influenced by Keira's possession of the value of frugality, and so is causally value-laden, even though frugality is not among his motivations. Frugality plays a causal but not a motivational role with respect to Randall's choice.

There are countless scientific choices that are analogously value-laden in a causal sense. In 2015, decision-makers at the National Institutes of Health (NIH), concerned about the historical exclusion of female organisms from biomedical research, adopted a policy encouraging researchers to collect data on and disaggregate their data by sex. This "sex as a biological variable" guidance has shaped a huge number of scientific choices in the years since – choices about project selection, data collection, statistical analysis, and presentation of findings. Such choices, impacted as they are by the NIH's possession of a value for gender equality, are value-laden in a causal sense. This is so even when scientists are not themselves motivated by a concern for equality or even aware of the values that shaped the guidelines they are following.

On the final, *objectual interpretation* of value-ladenness, a choice is value-laden if it has an impact on non-epistemic goods in the world – goods that we sometimes call "values." Imagine that a group of city commissioners decides to have pickleball courts built in a city park. As it turns out, the building of the courts inflames old rivalries. The city's factions start fighting bitterly about line calls and court time, disputes that bleed into other areas of life. In this scenario, the decision to build the pickleball courts is objectually value-laden because it (negatively) affects the value of community cohesion, a non-epistemic good.

Since our choices often have non-epistemic impacts, objectually value-laden choices are common in everyday life and in science. Consider a team of meteorologists who develop a complex weather model to predict storm surge along a densely populated coastline. Their model becomes the basis for many local governments' evacuation orders. Choices during model development that influence its outputs, and thereby local governments' policies, are value-laden in the objectual sense: they affect non-epistemic goods in the world such as the preservation of human life.

I make no claim to the exhaustiveness of this taxonomy, nor the mutual exclusivity of its four categories. A choice can easily be value-laden in multiple senses at once. For instance, it is plausible that the city commissioners' decision to build pickleball courts is motivationally as well as objectually value-laden; the parasitologist's choice to study *C. parasitica* is both rationally and motivationally value-laden; and Peter's becoming vegetarian is value-laden in all four senses.

The taxonomy also leaves open a number of contested questions in action theory and moral philosophy. For instance, philosophers of action disagree about whether a person's motivating reasons are causes of their actions (Davidson 1963). If they are, then motivational claims about value-ladenness are also causal claims about value-ladenness. Some would argue, for example, that because the parasitologist's choice is motivated by non-epistemic values, it is causally value-laden as well. (As the examples above show, the reverse does not hold: someone's possession of a value can causally influence a downstream choice without being a motivating reason for that choice.)

A related question is whether values that act as motivating reasons really operate in the space of reasons. If one believes that motivating reasons are causes, then motivational claims about value-ladenness concern the space of causes. Here too I wish to remain agnostic, as I am more committed to the taxonomy's four lower-level categories than its overarching bipartite division. Depending on one's other commitments, one may take there to be just one sense of value-ladenness associated with the space of reasons (the rational interpretation).

4. Value-Ladenness and the Ontology of Values

My taxonomy is noncommittal about the ontology of values, focusing instead on how values bear on choices. Ward (2021) did float a more "metaphysically ambitious" view, on which "there are not only several different relationships between values and choices, but several distinct kinds of things we call values… [V]alues are not one sort of entity, but four" (57). Such an account mirrors the view in philosophy of action that, instead of reasons merely playing two different "roles," motivating reasons and justifying reasons are really two "quite different sorts of thing" (Bond 1974, 333). Perhaps values, too, are four quite different sorts of thing. Instead of characterizing values merely in terms of the roles they play, one might claim that values *just are* justifying values, motivating values, causal effectors, or affected goods.

The ontology of values has recently received direct attention from philosophers working on values in science (Biddle 2013, Brown 2020, Hilligardt 2022). In "Values in Science: What Are Values, Anyway?", Elliott and Korf (2024) distinguish "four ways of conceptualizing values" (4). First, they argue, some authors follow Kuhn (1977) in conceiving of values as "criteria or standards for choice." Kuhn was concerned with criteria of theory choice, but others think of values more expansively as "criteria for evaluating a broader array of entities" (Elliott and Korf 2024, 4-5). Second, values can be thought of as "factors that causally influence scientists' choices, habits, and practices" (5). They remain agnostic about whether such factors are all psychological. Third, values are sometimes taken to be "beliefs or attitudes about what is desirable" (6). They suggest

that there is overlap between the second and third conceptions of values: some causal factors are beliefs or attitudes about what is desirable. Fourth, values can be seen as "desirable things themselves" (6). Like Ward (2021), Elliott and Korf argue that, because different authors operate with different value concepts, the literature on values in science is less unified than is commonly thought.

How does Elliott and Korf's taxonomy compare to mine? As I see it, there is a close correspondence between our categories. Recall that the causal interpretation of value-ladenness concerns values in their role as causal effectors, whose possession influences scientific choices. The objectual interpretation of value-ladenness concerns values conceived of as non-epistemic goods in the world which can be promoted or impeded. Elliott and Korf's concepts of values as causal factors and desirable things straightforwardly map on to these two interpretations.

Their concept of values as beliefs or attitudes about desirability corresponds in a looser way to the motivational interpretation, which treats values as motivating reasons. The reasons that motivate our actions are often grounded in our beliefs or attitudes about what is desirable. Fourth and finally, the rational interpretation of value-ladenness takes values to act as justifying reasons, "reasons for or against doing a thing" which are "tied to the world beyond" rather than to a person's motivations (Bond 1983, 30). Elliott and Korf's concept of values as criteria or standards for choice, which they also call "*reasons* for choice," evokes this rational interpretation (6; my italics). In addition to emphasizing our shared language of "reasons," I suggest that criteria or standards for choice are things "tied to the world" in Bond's sense, rather than to an individual's psychology. Standards and criteria justify or rationalize choices; and this, of course, is exactly what justifying reasons do.

Given these mappings between the categories in our taxonomies, I take Elliott and Korf to be identifying the typical *realizers* of my four *roles* for values. That is, they are pointing to the entities that often play each of the roles distinguished here and in Ward (2021). For example, those things which fulfill the role of justifying choice are often standards and criteria; what fulfills the role of causally influencing choices are (somewhat trivially) causal factors; and so on. Elliott and Korf too note some of the similarities between our taxonomies but argue that the concept of value that one deploys is dissociable from what role the value plays. For example, a belief or attitude about what is desirable could serve as a causal effector, justifying reason, or motivating reason.[2] Evaluating such claims would take us too deep into debates about the ontology of reasons. (Do beliefs and attitudes justify? Can criteria or standards be causes, or do they belong solely to the space of reasons?) But note that their claim is compatible with the view that their four "concepts" are at least the typical realizers of values' four roles.

[2] Elsewhere Elliott and Korf seem more amenable to the idea that the ontology and roles of values are closely related: "Perhaps attention to these differences [between value concepts] could help to clarify different functional roles that values can play. For example, one could distinguish values that play the functional role of serving as criteria for theory choice from values that serve the functional role of serving as outcomes that would be desirable to achieve" (22).

5. Inevitability Arguments and the Randomizer Reply

Philosophers' failure to distinguish different senses of value-ladenness has led to spurious disagreements. One author will argue that a particular scientific choice is value-laden and another will deny that it is value-laden. But their disagreement is merely apparent because they mean different things by "value-laden." Since scientific choices can be value-laden in one sense but not another, both authors can be right. For example, a choice may be value-laden in the objectual sense but not the motivational sense: plenty of scientific choices affect goods in the world even though the people making them are not motivated by non-epistemic considerations. Other scientific choices are value-laden in the causal sense but not the motivational sense: someone's possession of non-epistemic values has a causal effect on a later decision without the decision-maker herself being motivated by those values. Many debates about values in science could therefore be clarified or dissolved by paying closer attention to the notions of value-ladenness at play.

I'll close this chapter with an extended illustration involving a family of what I'll call "inevitability arguments." Inevitability arguments assert that a certain scientific choice *must be* value-laden (in a non-moral sense), i.e., that the choice inevitably implicates non-epistemic values. Proponents of inevitability arguments begin by identifying a scientific choice that is not fully determined by evidence or epistemic values alone: there is a gap between what epistemic considerations dictate, and what a scientist must eventually decide.[3] They then claim that non-epistemic values are inevitably involved when scientists face such "unforced" choices (Winsberg 2012). Since epistemic values underdetermine the choice, non-epistemic values are necessarily implicated in selecting among the epistemically acceptable options.

The conclusion of inevitability arguments is quite strong: they insist that values *have to be* involved in the scientific choice under discussion (not that they *may* or *should be* involved). At the same time, inevitability arguments encompass a variety of ways of arguing for the value-ladenness of science. The following are all inevitability arguments:

- versions of the argument from inductive risk which claim that non-epistemic values have to be involved in setting the threshold for when the evidence is sufficient to accept a hypothesis (Rudner 1953, Biddle and Kukla 2017)
- feminist underdetermination arguments which hold that, because there are multiple background assumptions one could use to assess evidential relevance, non-epistemic values must be invoked to choose between them (Longino 1990)
- arguments which claim that, because epistemic values must be interpreted and traded off against one another, the deployment of epistemic values has to involve non-epistemic values (Rooney 1992, Hoyningen-Huene 1992; cf. Ward 2024)

[3] One can think of inevitability arguments as a species of what others have called "gap arguments" (Intemann 2005, Elliott 2011, Brown 2013). However, while these authors often contrast gap arguments with "error arguments," my characterization of inevitability arguments includes versions of both.

Each of these arguments points to a particular type of scientific choice – about evidential thresholds, background assumptions, or epistemic values – that it claims is inevitably value-laden because epistemic considerations underdetermine the choice.

One way to resist inevitability arguments is to deploy what Magnus (2018) calls "the randomizer reply." The reply points out that, when faced with an unforced choice, a scientist has the option of selecting randomly among the epistemically acceptable options – say, by rolling a die or flipping a coin. Since there is an alternative to using non-epistemic values to break the underdetermination, inevitability arguments fail to establish that scientific choices are necessarily value-laden. (Note that the randomizer reply does not claim that scientific decisions *should* be made randomly. It only insists that random decision-making is a theoretical possibility, thereby undermining inevitability arguments. One could accept the randomizer reply's contention that unforced scientific choices *need not* be value-laden, while also believing that, as a practical matter, such choices *should be* made by appeal to values.)

Proponents of the randomizer reply include Betz (2013), who rejects the claim that "Scientists inevitably make non-epistemic value judgments when establishing (adopting and communicating) policy-relevant results" (210). A defender of the value-free ideal, Betz argues as follows: "[S]uppose that the scientist, when facing an arbitrary choice, simply rolls a die. It's at least not straightforward which specific, non-epistemic normative assumptions she (implicitly) buys into by doing so" (210). He treats this possibility as a decisive objection. De Melo-Martín and Intemann (2016) note that there is ambiguity in the claim that, as some versions of the argument from inductive risk would have it, non-epistemic values are "necessary" for assessing the consequences of error. One interpretation of this claim invokes logical necessity: it is "logically impossible to derive conclusions about what hypotheses to accept or reject without relying on value judgments" (505). De Melo-Martín and Intemann quickly reject this as implausible, "as there are other logically possible ways to arrive at conclusions, such as flipping a coin" (505).[4]

Others have rejected the randomizer reply (Magnus 2018, Douglas 2021, Havstad 2021). They argue that, instead of avoiding the inevitable involvement of non-epistemic values in science, randomization simply relocates it. This is because the decision to deploy randomization is itself necessarily driven by values. Here is Magnus (2018):

[4] The randomizer reply is sometimes associated with Neurath's (1913) discussion of what one should do when one has to make a choice but there is no way of deciding among the available options on the merits. In such situations many people adopt "pseudorationalism," convincing themselves that one of the options is indeed better than the others (9). Neurath recommends instead embracing "the auxiliary motive," a motive for choosing that does not have to do with the merits of the options. The "purest form" of the auxiliary motive is the drawing of lots (4). Despite this appeal to randomization in the face of underdetermination, it's a mistake to think of Neurath as advocating the randomizer reply. First, he is considering situations in which one has *no reason* to prefer one option to another, not situations in which one has no *epistemic* reason. Moreover, far from adopting randomization as a way of ridding science of values, Neurath was sympathetic to the idea that values play a role in science (Howard 2006). He considered social and political values to be auxiliary motives, and thus saw appeal to such values as a legitimate way of making choices in the face of underdetermination.

> [C]onsider a mundane case in which I cannot decide which of two restaurants to visit for lunch and so flip a coin. My values and practical reasons have no influence over the outcome of the coin toss, of course, and so the selection is value-free to that extent. However, my values and preferences are involved in my decision to use coin-flipping as a way of resolving the choice. I want to go to lunch at one of two places, and I do not want to spend too much time or energy deciding. If someone asks why I went to one restaurant rather than the other, a complete answer would refer not just to the random process but also to the reasons I had for adopting that method. Similarly, deciding to flip a coin in the face of underdetermination would be practical and value-driven. Breaking ties by flipping coins would keep values from directly deciding specific winning hypotheses, but it would not ultimately escape the intrusion of values and practical decisions into theory choice. (416)

This, then, is the current state of play: proponents of inevitability arguments claim that certain scientific choices are inevitably value-laden; advocates of the randomizer reply point out that such choices can in principle be made randomly, without involving values; and defenders of inevitability arguments offer a rejoinder, rejecting the idea that randomization circumvents value-ladenness.

6. A Taxonomy-Guided Assessment

Each move in this debate can be fruitfully assessed by attending to what different authors mean by "value-laden." It turns out that the plausibility of inevitability arguments and the randomizer reply depend on which conception of value-ladenness one adopts.

First, consider an objectual interpretation, under which inevitability arguments claim that how one makes an unforced scientific choice has an inevitable effect on non-epistemic goods in the world. This is surely true of at least some choices in consequential areas of science. For such choices, the randomizer reply can be quickly dismissed. If a scientific decision will inevitably have a non-epistemic impact, it makes no difference whether that decision is made randomly. Randomization is thus a dead-end when it comes to rebutting objectual claims about the unavoidable role of values in science.

The randomizer reply is more convincing if inevitability arguments are interpreted in motivational terms. Such arguments claim that, because epistemic considerations fail to dictate a scientist's choice, she must be motivated to select the option she does by non-epistemic values. This argument is undermined by the possibility of randomization. Non-epistemic values need not have been among a scientist's motivations for choosing one option rather than another if she decided between them by flipping a coin. (This is so even if the decision to flip the coin was itself motivated by non-epistemic considerations.) I read Betz (2013) as proposing this (motivational) version of the randomizer reply in his quick dismissal of inevitability arguments.

Under a third, causal interpretation, inevitability arguments claim that the possession of non-epistemic values necessarily influences choices that are underdetermined by evidence or

epistemic considerations. Causally understood, the randomizer reply denies that the possession of non-epistemic values need influence such choices because they can be made randomly. The rejoinder, causally interpreted, points out that even then, the causal impact of non-epistemic values is still felt because the possession of non-epistemic values is what led to the use of randomization in the first place. The choice is still impacted by non-epistemic values, albeit indirectly. The success of this rejoinder to the randomizer reply depends on whether it is true that the decision to randomize is *necessarily* shaped by the possession of non-epistemic values.

Fourth and finally, under a rational interpretation, inevitability arguments claim that non-epistemic values must be involved in the justification of unforced scientific choices. Interpreted in rational terms, the randomizer reply responds that values need not be invoked to defend such choices because they can always be made randomly. (One could read De Melo-Martín and Intemann [2016] as offering something like this version of the randomizer reply.) In my view, this reply succeeds, but only by giving up on justification altogether. A decision made via randomization is one that we have declined to justify (Neurath 1913, Putnam 2002). It is true that randomization obviates appeal to non-epistemic values in defending a choice, but only because to randomize is to give up such a defense.

The rejoinder to the randomizer reply can also be given a rational interpretation. In the passage quoted above, Magnus (2018) seems to concede that there is some sense in which randomization renders a scientific choice not value-laden. But he can be read as arguing that the decision to randomize itself always requires non-epistemic justification. The reasons that speak in favor of flipping a coin to make a decision, he seems to suggest, are always non-epistemic. Whether the rejoinder succeeds under this interpretation depends on the plausibility of the claim that randomization requires non-epistemic justification, or whether there can instead be exclusively epistemic justifying reasons for randomizing a scientific choice.[5]

Let's grant for the sake of argument that one cannot justify the use of randomization without non-epistemic values, so the decision to randomize a scientific choice is always value-laden in a rational sense. Does it follow that any choice made *via* randomization is also value-laden? Do first-order scientific choices made randomly inherit value-ladenness from the decision to randomize itself? Here we face difficult questions about the relationship between the justification of a choice and the justification of a procedure for making the choice. If authors like Magnus (2018) claim that any scientific choice made randomly must be non-epistemically justified, more of an argument is needed to establish that a decision is rationally value-laden whenever the decision procedure by which it is made is rationally value-laden.

This section has declined to offer a general assessment of inevitability arguments or the randomizer reply. This is in part because there turn out to be multiple versions of each, resting on

[5] Note that I have entertained two different interpretations of proponents' rejoinder to the randomizer reply: a causal interpretation on which the adoption of randomization is always *causally influenced* by values and a rational interpretation on which randomization must always be *justified* by appeal to non-epistemic values. I don't think it is clear which of these interpretations Magnus (2018), Douglas (2021), and Havstad (2021) intend.

different senses of value-ladenness. It is also because pulling apart these different versions has surfaced claims that require further argumentation: about whether the decision to randomize is necessarily justified or causally influenced by non-epistemic values, and about how the justification of a choice relates to the justification of the procedure used to make it. Whatever one's position on these issues, I contend that this case study demonstrates the value of the taxonomy characterized above. Developing a sensitivity to different notions of value-ladenness permits a more sophisticated evaluation of claims about value-laden science.

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