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Epistemic Priority or Aims of Research? A Critique of Lexical Priority of Truth in Regulatory Science

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A general criterion for distinguishing between epistemic and non-epistemic values is that the former promotes the attainment of truth whereas the latter does not. Daniel Steel (2010, 2016) is a proponent of this criterion, although it was initially proposed by McMullin (1983). There are at least two consequences of this criterion; (i) it always prioritizes epistemic values over non-epistemic values in scientific research, and (ii) it overlooks the diverse aims of science, especially the aims of regulatory or policy-oriented science. This criterion assumes the lexical priority of truth or lexical priority of evidence. This paper attempts to show a few inadequacies of this assumption. The paper also demonstrates why epistemic priority over non-epistemic values is a problematic stance and how constraining the role of non-epistemic values as 'tiebreakers' may undermine the diverse aims of science.

Keywords: Science and values; epistemic values; lexical priority of truth; non-epistemic values; aims of science.

1. *Introduction*

Recently, the science and values debate has drawn the attention of many philosophers of science, scientists and policymakers. The ideal of value-free science suggests that non-epistemic values such as social,

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political, moral or economic values should be kept away, or these values have no legitimate roles to play in scientific inference. This ideal has been criticized from different perspectives. Argument from inductive risk is the most significant challenge against the value-free ideal of science. Rudner (1953) argued that since no scientific hypothesis is completely verified, there is always a risk element in accepting or rejecting a hypothesis based on the available evidence. So, value judgments are relevant in weighing the consequences of the mistakes scientists might make when accepting a hypothesis. This line of argument has been further developed by Cranor (1993) and (Douglas 2000, 2009). The gap argument or argument from underdetermination is another critique that is raised against the value-free ideal. The argument states a gap between evidence and a theory (Longino 2002, 2004, 2008). In other words, evidence alone does not determine which hypothesis is true, and the proponents of a value-laden account of science argue that this gap can be bridged by appealing to non-epistemic values (Anderson 2004; Intemann 2005; Biddle 2013; Brown 2013). Similarly, the value-free ideal of science has been criticized by many philosophers of science by arguing that a clear boundary between epistemic and non-epistemic values is necessary to uphold the value-free ideal of science. But drawing a boundary between epistemic and non-epistemic values is not very plausible. So, the defenders of the value-laden account of science put forth a challenge known as the boundary challenge that states that a clear-cut distinction between epistemic and non-epistemic values is not possible (Rooney 1992, 2017; Longino 1995, 1996; Steel 2010; Douglas 2016). The reason is that values such as simplicity, novelty, and ontological heterogeneity might act as both epistemic and non-epistemic values depending on the research contexts. Since a distinction between epistemic and non-epistemic values is not possible, maintaining value-free ideal is also not very plausible in scientific research.

Values in science debate mainly revolve around a very significant question, i.e., how to identify and incorporate a legitimate set of non-epistemic values and eschew the illegitimate influence of such values in scientific inference. Different philosophers of science put forth many suggestions. Douglas (2009) proposes that one should consider the direct and indirect roles of values and these roles will help one evaluate the influence of non-epistemic values. Elliott and McKaughan (2014) argue that when non-epistemic values are involved in scientific research, scientists should be explicit about the role values played in that particular research context. That is to say, the influence of non-epistemic values should be acknowledged and stated as transparent as possible. Intemann (2015) argues that the legitimacy of non-epistemic values can be evaluated by checking whether a particular value or set of values promotes democratically endorsed epistemological and social aims of the research. Steel (2010) argues that all those kinds of influence of non-epistemic values are illegitimate in scientific reasoning when the influence of such values impedes or obstructs the attainment of truth. Steel (2010) and Steel and Whyte (2012) further argue that non-epistemic values should play the role of "tiebreakers" when methodological approaches or two conclusions are equally well defended by epistemic values. In other words, Steel's account allows the "lexical priority of truth/evidence" or "epistemic priority". Two important points follow this principle. Firstly, the epistemic values are characterized in terms of their relationship with truth, and secondly, non-epistemic values should not obstruct the attainment of truth in any scientific inquiry under any circumstances, and if at all they influence scientific inference, their influence must be defended on epistemic terms.

I discuss two important issues in this paper. Firstly, I elaborate and critically analyze Steel's account of values and an underlying assumption that Steel seems to have employed in characterizing the epistemic values. The idea is to demonstrate some of the inadequacies of Steel's characterization of epistemic values as the promoters of truth attainment. This analysis engages with the diverse aims of scientific research, and I attempt to show how these diverse goals provide sufficient place for non-epistemic values to actively participate in different phases of scientific investigations in a legitimate and relevant fashion. Secondly, I will criticize two implications of Steel's proposals: (i) the epistemic values must be characterized in terms of truth and (ii) the influence of non-epistemic values should be limited to only such scenarios in which epistemic values do not completely determine all aspects of scientific reasoning, and when they are involved, they should not conflict with epistemic values. I will argue against these implications and will show that the legitimacy of the influence of non-epistemic values in scientific research need not be always defended in terms of epistemic terms; on the other hand, their influence can be justified in terms of the practical and social relevance of the research.

2. *Values: Characterizations and functions*

A general distinction that is made in science and values debate is between epistemic and non-epistemic values. McMullin (1983) and Steel (2010) argue that epistemic values are acknowledged on the ground that they promote the attainment of truth. McMullin proposes; *"those values that promote the truth-like character of science are epistemic in nature"* (McMullin 1983: 18). Similarly, Steel characterizes epistemic values as that which promotes the attainment of truth or the acquisition of true beliefs (Steel 2010). He further points out; *"Truth should be understood in connection with truth content: a true and very informative belief is more epistemically valuable than a true but trivial belief"* (Steel 2010: 18). However, Steel argues that truth does not necessarily mean true theories.[1]

[1] It seems that Steel is in partial agreement with Catherine Z. Elgin's account of true enough theories. Elgin's claim is that although truth is often considered as a requirement of epistemic acceptability, science and philosophy deploy models,

Non-epistemic values, in general, are such values that are personal, social, economic, moral, religious, or aesthetic in nature.[2] These values are *integral elements in forming the culture and customs of any society, and these values are held to be desirable by different social groups or communities* (Varghese 2021: 237). It is uncontroversial to say that non-epistemic values can function as legitimate determinants in the pre and post epistemic phase of scientific research. But when it comes to the epistemic phase i.e., the justification part of scientific research, there are disputes among philosophers of science regarding the role of non-epistemic values. Some argue that non-epistemic values should be kept away from the epistemic phase of scientific research (Lackey 2007; Sober 2007; Lacey 2010; Betz 2013; Schurz 2013). Douglas (2008, 2009) argues that values can play legitimate roles in scientific inference only if they play indirect roles, for instance, when scientists confront the problem of inductive risk. The argument from inductive risk asserts that scientists are never in a position to have complete certainty about the choice they make in accepting or rejecting a hypothesis (Rudner 1953; Hempel 1965; Douglas 2000, 2009; Wilholt 2009). Inductive risk is the possibility that one may make a mistake in rejecting or accepting a hypothesis that is under study. Douglas makes it very clear that values should not play any direct role in scientific reasoning i.e., they should not *"act as reasons in themselves to accept a claim"* (Douglas, 2009: 96).[3] In general, in the context of inductive risk, non-epistemic values tell us what kind of errors should be preferred and how much evidence is sufficient to make a scientific claim when the claim is likely to bring forth non-epistemic consequences. From an epistemic perspective, accepting a hypothesis when it is wrong is the same error as rejecting a hypothesis when it is true. But ethically speaking, it is not. Here it is also worth discussing how Steel defends the argument from inductive risk. According to Steel, the distinction between epistemic and non-epistemic values can be used to defend the inductive risk argument. Steel starts off by introducing a broad notion of what can be counted as an epistemic value both in an intrinsic and extrinsic manner and further shows how non-epistemic values are worthy candidates to decide upon which kind of error to prefer, that is to say, accepting when a scientific claim is wrong, or rejecting when a claim is right. Steel (2010) argues that Non-epistemic values can influence scientific

idealizations and thought experiments that prescind from truth so that they may achieve other cognitive ends. Elgin's argument is that such felicitous falsehoods function as cognitively useful fictions. They are cognitively useful because they exemplify and afford epistemic access to features they share with the relevant facts (Elgin 2004).

[2] There is a criticism against treating all these values as a uniform group. However, I am not discussing the criticism here since that is beyond the scope of this paper. See Rooney (2017) for the details of the criticism.

[3] This view has been criticized by Elliott and he has given a reformulated version of Douglas's account. See Elliott (2013) for details.

inferences in all those research contexts where epistemic values alone do not decide the activities in different phases of particular research. According to him, the role of non-epistemic values is limited to "tie-breaking" situations. Moreover, Steel emphasizes that the influence of non-epistemic values should not obstruct the attainment of truth.

3. *Steel's characterization of epistemic values*

In what follows, I elaborate on how Steel characterizes epistemic values and in what way Steel's account allows non-epistemic values to play legitimate roles in scientific inferences. Let us start off with Steel's characterization of epistemic values.

3.1 *Values that promote the attainment of truth intrinsically or extrinsically*

Steel distinguishes epistemic values into two categories; intrinsic epistemic values and extrinsic epistemic values. He fleshes out the distinction between them as follows:

> [A] value is intrinsically epistemic if exemplifying that value either constitutes attainment of truth or is a necessary condition for a statement to be true… Epistemic values are extrinsic when they promote the attainment of truth without themselves being indicators or requirements of truth. (Steel 2010: 18)

He suggests that epistemic values can be manifested in different ways, such as through methods, social practices, and community structures, along with theories and hypotheses. One of the most significant features of Steel's theory is his definition of truth. He emphasizes that truth should always be cognized in terms of truth content.

Let us consider Steel's distinction of intrinsic and extrinsic epistemic values. Values like internal consistency and predictive accuracy are intrinsic epistemic values because these values refer to an absence of contradictions or predictions which are true or approximately true. That is to say, these values are the necessary condition for truth. Intrinsic epistemic values are such values that are very robust in the sense of being epistemic in almost any setting. On the other hand, simplicity is an extrinsic epistemic value. The reason is that the world is not so simple and hence, simplicity cannot be considered as a necessary condition for truth. But yet, simplicity promotes the attainment of truth and hence, an epistemic value. For instance, Steel argues;

> Whether external consistency is an epistemic value, however, depends on the truthfulness of the accepted background beliefs … (and) … External consistency might fail to be an epistemic value in a period in which background beliefs are seriously mistaken but become an epistemic value at a later time when the quality of background beliefs has improved. (Steel 2010: 20)

In other words, extrinsic epistemic values such as external consistency are contextual in nature because such values can promote the attainment of truth in a particular context in which they occur. A very significant implication of Steel's intrinsic/extrinsic distinction is that it makes a range of what might count as an epistemic value rather broad. That is to say, many values that are traditionally considered as non-epistemic values can be categorized as epistemic by being extrinsic.

After elaborating the features and the nature of epistemic values, Steel moves on to state the role of non-epistemic values. Non-epistemic values are such values which are not truth-promoting (Steel 2017). According to him, non-epistemic values can play legitimate roles in scientific inferences in scenarios in which epistemic values alone do not fully determine all aspects of scientific investigation. Such scenarios include the choice of methodology, the evidence characterization or the interpretation of data.

Many philosophers of science agree that inductive risk is considerably prevalent in different phases of scientific inquiries (Rudner 1953; Hempel 1965; Douglas 2009; Wilholt 2009). So, the general argument is that non-epistemic values can legitimately influence in assessing which errors are bad and which are worse. The problem that might pop up here is that although non-epistemic values might be necessary to tackle the problem of inductive risk, it might be the case that the set of non-epistemic values which are employed for overcoming this difficulty may not always be legitimate. It is quite possible that the non-epistemic values which may be employed for settling down the issues of inductive risk and underdetermination[4] could be inappropriate in particular research settings. These kinds of inappropriate encroachment of non-epistemic values should be prevented in order to avoid corrupted scientific research, and there should be a criterion to detect whether the influence of a particular set of non-epistemic values is legitimate or not. The principle that Steel suggests as a criterion to distinguish the legitimate influence of non-epistemic values from illegitimate is *the influence principle*.[5] The principle states that non-epistemic values can influence scientific inference epistemically badly if those values act as obstructions in the acquisition of truth. In other words, the influence of non-epistemic values in scientific inference should be in such a way that their influence should not compromise with the epistemic aims. Generally, prediction, explanation and understanding are often depicted as the principal epistemic aims of science. Most importantly, all these aims, in one way or the other, are related to truth or evidence. However, it is not often the case in the context of regulatory science, which is policy-oriented. Regulatory science aims at supporting policy decisions. Pinto and Hicks argue; "*when the goal of conclusive evidence*

[4] In a crude way, one can say that underdetermination involves the idea that models and hypotheses in any particular domain of science are underdetermined by logic and the evidence which are currently available for the models and hypotheses (Longino 1990, 2002; Kourany 2003).

[5] Hicks (2014) terms Steel's principle as *influence principle*. From here on wards, I will also use the same term for further discussion.

conflicts with the practical requirements of regulatory science, regulatory science could legitimately abandon the conclusive evidence standard" (Pinto and Hicks 2019: 3). In what follows, I make an attempt to show that Steel's account is somehow insensitive to non-epistemic goals because of his characterization of epistemic values in terms of truth which assumes the lexical priority of evidence. I will start the analysis of Steel's theory with an assumption which Steel seems to have employed in characterizing the epistemic values as the promoters of truth attainment.

3.2 *Assumption underlying steel's epistemic/non-epistemic characterization and distinction*

Steel's epistemic non-epistemic distinction is construed on the notion of truth. He states that truth should be cognized in relation to truth content and underlines that epistemic values must be characterized in terms of their connection with truth. That is to say, these values should act as the promoters of attainment of truth either intrinsically or extrinsically. It should also be noted that the influence of non-epistemic values is legitimate in only such cases where their influence does not obstruct the attainment of truths which precisely is the influence principle. An implication of the principle is that the influence of non-epistemic values should be justified strictly in epistemic terms which are truth conducive. Hence, it is quite reasonable to think that there is an assumption with which Steel makes the characterization of epistemic and non-epistemic values and their distinction. The assumption can be formulated as follows:

> Assumption (A1): *The aim of science is to provide truth, to be more specific, true beliefs. Epistemically speaking, a belief which has the property of being true is better than a belief that is not true or trivially true, considering all other things equal. Moreover, the value of epistemic justification somehow correlates with truth.*

This assumption is grounded on the idea that truth is the principal epistemic value. This would imply that the ultimate and primary epistemic goal is truth. This assumption appears to be promising in such cases where the ultimate goal of science is always the attainment of truth because; the assumption clearly implies that the ultimate aim of scientific activities is to achieve truth. Moreover, the justification for the acceptance or the choice of a particular model or theory is somehow related to truth. In what follows, I focus on the main problem of Steel's account i.e., the truth-conduciveness in Steel's account, which is committed to a problematic "lexical priority of evidence". The problem becomes more serious when the commitment to truth-conduciveness might lead to the negligence of aims approaches in establishing the role of non-epistemic values in the evaluation of scientific hypotheses or models. In what follows, I present certain possible worries that might follow from allowing the lexical priority of truth or evidence while science deals with multiple aims and attainment of truth might be just one among many aims.

4. *Lexical priority of evidence: Some responses*

I have already outlined the assumption that has been invoked in Steel's characterization of epistemic values. The implications of this assumption call attention to a number of issues that can be raised against Steel's account of values. A very important criticism that is posed against defining epistemic values as the promoters of attainment of truth is the problem regarding the lexical priority of truth. Lexical priority of truth considers truth as the only aim of science and *truth as the absolute value*.[6] Lexical priority of truth eventually leads to the priority of evidence since it is the scientific evidence that will guarantee the objectivity of the scientific research.[7] One of the main reasons why the priority is argued for is because it is said to preserve scientific objectivity intact. However, Brown (2013) shows the necessity of a more nuanced approach when one makes an attempt to show that it is the objectivity that is at stake. The reason is that underdetermination and inductive risk arguments show that there is no values-objectivity conflict. This assertion will put the defender of the value-laden account of science into trouble because, on the one side, they are attracted to the lexical priority of evidence, and on the other hand, underdetermination and inductive risk arguments show that there is no values-objectivity conflict. For instance, Anderson (2004) and Douglas (2009) argue that lexical priority might save scientists from the problem of wishful thinking. Especially for Douglas, the role of values is restricted in assessing the adequacy of available evidence and values, in no way, can be considered as reasons to believe anything.

Brown (2013) further makes a detailed analysis of the problems of priority. He argues that presupposing lexical priority of evidence is not required to argue for underdetermination and inductive risks. The reason is that evidence can turn out to be unreliable or bad sometimes, and in such cases, the priority might lead scientists astray. Moreover, there is no reason to hold the view that when evidence and values pull in opposite directions, we should always follow the evidence if *value judgments are really judgments—adopted for good reasons, subject to certain sorts of tests* (Brown 2013: 837).

[6] As I mentioned earlier, the notion of truth as the absolute value leads to Steel's endorsement of a monist approach which is presented in his influence principle. He fervently argues that the influence of non-epistemic values is legitimate only in such cases where their influence does not impede the attainment of truth.

[7] In a strict sense there is a difference in the lexical priority of truth and lexical priority of evidence. However, in the context of this paper I use them interchangeably for convenience.

5. *Truth as the absolute value: An objection*

This section further explores another objection against the assumption (A1) I mentioned earlier which also presupposes the lexical priority of evidence/truth. I substantiate my arguments based on the aims approach which defends the view that science has got multiple aims and attainment of truth is just one among those many aims. Aims approach also suggest that illegitimate influence of non-epistemic values in scientific inferences can be eliminated by scientists being as much transparent as possible about the goals of their assessments and the roles non-epistemic values played in the assessments as a result (Elliott and McKaughan 2014: 15). Similarly, Intemann (2015) argues that incorporating non-epistemic values should be done in such a way that those values may *promote democratically endorsed epistemological and social aims of research* (2015: 218).

The way scientific investigations are taken up today shows that scientific inquiries are concerned with theoretical aims and pragmatic aims. Theoretical aims focus on extending our knowledge and understanding of the form and contents of the universe. On the other hand, pragmatic aims prioritize the protection of human health and the environment, regulation of chemicals and therapies, informing democratic deliberation, advising policy on climate change, and promoting the capacities of environmental justice and Indigenous communities. Pinto and Hicks (2019) point out that traditionally it was considered that science has just one goal which is *'produce evidences for or against a hypotheses'*. However, regulatory science is policy-related and its goal is not to produce conclusive evidence but to support policy-related decisions. Similarly, Giere (2004, 2006) and Bas van Fraassen (2008) argue that scientific representations can be evaluated in different ways. It can be through the relations that they bear to the world, and sometimes it is in connection with the several uses to which they are put. Since the representations can be evaluated in different dimensions, it is very much plausible to think that the decisions regarding the acceptance of a theory or a model depend on various considerations and truth is only one among the several factors influencing such decisions. Elliott and McKaughan (2014) illustrate this idea very clearly. They say:

> There is an importance of explicitly incorporating a role for agents or users (as well as their goals and purposes) as a crucial component of any adequate analysis. According to this schema, the representational success of models can be evaluated not only in terms of their fit with the world but also in terms of their suitability to the needs and goals of their users. (Elliott and McKaughan 2014: 4)

Here Elliott and McKaughan argue that any object or proposition that is used to represent something else can be analyzed both in correspondence with its fit with the object to be represented and with regard to its fit with the pragmatic functions for which it is employed. In other words, they emphasize the multiple aims of science. An eventual outcome of thinking more carefully about the multiple goals which scientists have when they choose scientific representations is that it enables us to understand how scientists can legitimately prioritize non-epistemic concerns over epistemic ones in certain cases. This prioritization can be seen in various phases of scientific research, such as the choice of the methodology (Varghese 2018) or the assessment of evidential sufficiency (Douglas 2003, 2009). That is to say, scientific models and theories are put to use to represent the world for specific purposes, and it is entirely legitimate to grant that if these models or theories can fulfil those commitments best by forfeiting certain epistemic features for the sake of attaining some of the non-epistemic considerations.

Steel (2010), while discussing the problem of inductive risk, analyses a case study conducted by Cranor (1993, 1995). Cranor's study is concerned with the risk assessment of toxic chemicals when they are exposed to the public. He analyses two models to test the toxicity of different chemicals, which are advantageous in different ways. The first model is more *accurate* than the other model but slower in comparison with the other. On the other hand, the second model is quicker in assessing the toxicity of the chemicals but less accurate compared to the first one. By employing certain mathematical tools to evaluate the risks involved by the use of any of these two models, Cranor shows that if the aim of the research is to minimize the social cost by mitigating the exposure of toxic chemicals to the public, then it is quite plausible to choose the expedited model which is not very accurate in generating the result in comparison with the traditional model but faster in generating the result. Cranor concludes that during this type of risk assessment program, it is legitimate to incorporate non-epistemic factors while choosing between the models.[8] His theory goes as follows:

> Useful risk assessment not only requires drawing reasonably accurate inferences about toxic effects but also demands that those inferences be drawn in a timely manner… (T)he regulatory challenge is to use presently available, expedited, approximation methods that are nearly as 'accurate' as current risk assessment procedures, but ones which are much faster so that a larger universe of substances can be evaluated. (Cranor 1993: 103)

The study is an excellent example that shows that scientific research often aims at achieving certain pragmatic aims rather than mere attainment of truth. In Cranor's case study, there are two important values that play active functions. The first one is about drawing reasonably accurate results and the second one is concerned with drawing inferences in a timely manner. The way science is practised today indicates that there is a clear involvement of pragmatic aims along with epistemic aims in choosing the theories and models in different contexts according to the requirement. The reason why Steel uses Cranor's study

[8] Since my focus is on the social aims of scientific research, and pragmatic aims of science, at least in some sense, are connected to the social aims or policy making, I have used the terms 'social' and 'pragmatic' interchangeably.

in his paper is to show that uncertainties arising from practical challenges faced by specific scientific fields, such as toxicology or climate science, are more than sufficient for nonepistemic values to operate. Imagine that epistemic values normally do place some genuine restrictions on what could and could not be reasonably inferred in a given scientific setting. In such contexts, nonepistemic values might still have room to operate without obstructing epistemic ends. One example of this is relevant to the argument from inductive risk concerns how long one waits and how much evidence one demands before drawing an inference (Steel 2010). In what follows, I will argue that although Steel allows non-epistemic values to play certain roles in scientific research, there are contexts in which Steel's characterization of epistemic values as the promoters of truth and incorporating epistemic priority thesis can be a problematic stance.

6. *Epistemic priority and callousness to non-epistemic goals*

Steel (2010) points out that the argument from inductive risk is often illustrated by such cases where a pressing non-epistemic value, for instance, the protection of human health, provides a powerful reason to draw inferences more quickly, even at the expense of reliability. In such cases, there is a clash between two competing values. On the one hand, there is a model which is more *accurate* (an epistemic feature) but slow in risk assessment and, on the other hand, there is another model which is *expedited* or *faster* (a non-epistemic feature) but not as accurate as of the former. Steel argues that although the choice of the expedited model over the more accurate model appears like a clear case of non-epistemic values directly influencing the choice, which is not the case. He points out that Cranor's study is an example that shows that without compromising epistemic concerns, non-epistemic values might influence scientific inferences legitimately. From an epistemic perspective, the choice between expedited and slower risk assessment methods is a trade-off: quicker inferences versus a somewhat greater chance of error. Steel suggests that Cranor's study is to show that there needs to be a balance between these two *epistemic concerns*[9] and from a purely epistemic perspective, neither of them takes an advantageous position. But when we are concerned with reducing social costs by protecting human health, the expedited method is superior and the best option too. Hence, here the non-epistemic value, protection of human health and thereby reduction of social cost, seems to be playing the role of a "*tiebreaker*." In other words, ease of use and time sensitivity are epistemic values (Steel 2010, 2016) and non-epistemic values such as protection of health will help in deciding between two epistemic values,

[9] Here the two epistemic concerns are quicker inferences and a somewhat greater chance of error.

speed and accuracy. However, I would like to analyze this case from a different perspective in which the social aims of the research may legitimately influence the choice of a model for conducting socially relevant research (Intemann and de Melo-Martín 2010; Varghese 2018, 2019). I will make an attempt to show that Steel's focus on truth is problematic because his account is callous regarding non-epistemic concerns and goals. The callousness that I am going to discuss may need a little elaboration. Although Steel does care for social goals, his characterization of epistemic values focusing on truth is problematic. In other words, when the focus is on truth and epistemic priority, we are setting a boundary for non-epistemic values to engage in scientific research. I shall discuss why setting a boundary is a problem in the last part of the next section. Coming back to the notion of callousness, here it is concerned with the secondary role non-epistemic values should play as 'tiebreakers' when two conclusions or methodological approaches are equally well supported by epistemic values (Steel 2010; Steel and Whyte 2012). Further, scientific practice often incorporates practical or mixed assessments of scientific representations and it is legitimate to prioritize non-epistemic goals when assessing representations in such contexts. Here, I take the discussion forward and argue that the adoption of the aims approach has more potential in achieving social goals than Steel's approach.

The study of Cranor demonstrated that the expedited model of CEPA[10] is more advantageous than the traditional model in assessing the risk if the goal is set to reduce the social costs. In cases like this, it is entirely legitimate to sacrifice some of the epistemic values for the sake of non-epistemic values, for example, sacrificing accuracy for the sake of generating rapid conclusions (although Steel might argue that both these values are epistemic in nature). On the other hand, if the aims of the research were to find the association between exposure to different chemical and adverse health effects for an academic purpose or for publishing the data in a journal for epistemic purposes, then the researchers would have preferred the model which would generate more accurate data. This scenario suggests that the aims of the research may determine which set of values should be prioritized in different contexts.

7. *Aims approach: Right tool for the job*

In varying research contexts, it is de rigueur that researchers should be very specific about those diverse aims which they aspire to achieve. Some of those aims may be purely epistemic in nature, and some of them may not be. The case of toxicity assessment is an example of such

[10] The Committee on Economic and Professional Affairs (CEPA) is associated with monitoring the requisites of the chemical workforce. In addition to that, CEPA members may be asked to review, or act on different materials or information brought to the committee's notice throughout the year.

a research context where the aim is not purely epistemic. Potochnik (2015) and Pinto and Hicks (2019) point out that although traditionally appreciated aims of science included accurate prediction, explanation and representation, other aims have also drawn attention recently. These aims include policy guidance, action within a short time span and facilitating public uptake of scientific knowledge. Elliott and McKaughan (2014) propose that since scientists often have aims that are not purely epistemic in nature, they might choose a model or a theory that is more viable in achieving the aims, and it is even appropriate that certain non-epistemic considerations might be prioritized over epistemic values. However, a worry that pops up here is about the criteria scientists need to employ for appropriately prioritizing non-epistemic values over epistemic ones. How can illegitimate and biased prioritization of non-epistemic values be eschewed? Elliott and McKaughan (2014) try to address this worry by suggesting that scientists must be very *transparent* about the aims and the roles values play in particular research. The transparency can be achieved with the help of *backtracking*.[11] The point is that the prioritization of non-epistemic values must be granted only to the extent that they may promote the goals associated with the assessments that are in play. Another suggestion to avoid illegitimate influences of non-epistemic values comes from Intemann (2015). She argues that incorporating non-epistemic values should be made in such a way that in doing so may promote democratically endorsed social and epistemic aims of the study.

While responding to Elliott and McKaughan's transparency proposal and Intemann's suggestion for democratically endorsed epistemological and social aims proposal, Steel (2017) argues that both these proposals rely on an assumption—epistemic/non-epistemic distinction. He further points out that both Elliott and McKaughan and Intemann, in their arguments at various places, hint that employing a distinction between epistemic and non-epistemic values in practice is very difficult since they are so deeply intertwined. If this distinction is not viable, their proposals also might fall short and face serious repercussions. Moreover, their proposals might also turn out to be unfeasible in such cases where a political majority in a community may endorse such aims which might be incompatible with the integrity of science.[12] So, the final submission of Steel is that a *qualified or a non-absolutist epistemic priority* is necessary for advancing scientific knowledge and human welfare.

A worrying problem of Steel's epistemic priority is that it puts some serious restrictions on science because it allows scientists to consider certain epistemic standards that might sometimes undermine or com-

[11] Backtracking is a concept Elliott and McKaughan (2014) propose to explain how scientists should be transparent about the major assumptions and values involved in an instance of scientific communication.

[12] For more details, refer to Steel's argument with reference to the situation called 'Ibsen predicament' (Steel 2017: 51)

promise scientists' attempts to do socially relevant and responsible science (Brown 2017; Varghese 2021). In the case of policy-oriented or regulatory science such as risk or toxicity assessment, certain restrictions that might be put on the research due to epistemic priority can lead to irresponsible and sometimes even dangerous ways of doing scientific research. According to the epistemic priority thesis, values may only influence science if, in doing so, they respect basic epistemic standards or criteria for what counts as adequate science. Of course, the epistemic priority view accepts that the value-free ideal is not very plausible, but it puts certain restrictions on the roles non-epistemic values can play in scientific inquiry. It is often the case that any decision scientists take in regulatory science may bring forth various societal consequences. As responsible scientists with social commitments, they should make every effort to think through the possible repercussions of their decisions. However, when there is a conflict between values and epistemic standards, always prioritizing epistemic standards can amount to dangerous and potentially irresponsible claims. In other words, the problem with epistemic priority thesis is that it removes the burden of judgment where values and basic epistemic standards conflict. Removal of the burden of judgment is not a good practice in scientific research, at least in the case of policy-oriented scientific research because value judgments are more pervasive in such research contexts. Moreover, the relationship between values and epistemic standards necessarily is more complicated, and hence, the burden of judgment in regulatory science is far more than epistemic priority thesis can tolerate (Brown 2017). But on the other hand, the aims approach provides room for assimilating both non-epistemic values and epistemic standards. Moreover, when this assimilation of values and epistemic standards is not possible, the aims approach will guide researchers to make the trade-off between epistemic and non-epistemic values by considering various social consequences of their decisions rather than focusing on epistemic priority.

8. *Conclusion*

In this paper, I critically examined Steel's characterization of epistemic values as the promoters of the attainment of truth and the functions of non-epistemic values in scientific investigations. A feature of Steel's characterization of values is that they are always assessed in terms of their ability to promote the attainment of truth and it is grounded on the epistemic priority thesis or lexical priority of evidence. An upshot of his thesis is that the epistemic priority thesis or lexical priority of evidence is insensitive to non-epistemic goals and might even undermine diverse aims of science. I argued against this assumption and demonstrated that scientific inquiries are concerned with diverse aims, and the truth is just one among them. I substantiated my claim by advocating the view that models and theories are put to use to represent the world for specific commitments which are either epistemic or non-epistemic and it is entirely legitimate to sacrifice epistemic priority if these models or theories can attend those commitments best by sacrificing some epistemic features for the sake of specific non-epistemic considerations.

In a nutshell, Steel's characterization of epistemic values and the epistemic priority thesis may obstruct the attainment of certain social goals of scientific research. If we grant epistemic priority, then it may place some serious restrictions on science because it allows scientists to always prioritize certain epistemic standards irrespective of the research contexts which may undermine or compromise scientists' attempts to do socially relevant and responsible science. Moreover, certain restrictions due to epistemic priority might also lead to irresponsible and sometimes even dangerous ways of doing scientific research. Hence, I argued that a blend of both epistemic and non-epistemic considerations will nearly always be relevant to the practical needs of users. Thus, it seems that the aims approach is a more viable candidate than Steel's epistemic priority, at least in regulatory science, since the former might guide researchers in making a trade-off between epistemic and non-epistemic values when these values might conflict.

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