The value-free ideal of science: a useful fiction?
A review of non-epistemic reasons for the research integrity community

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Abstract

Even if the "value-free ideal of science" (VFI) were an unattainable goal, one could ask: can it be a useful fiction, one that is beneficial for the research community and society? This question is particularly crucial for scholars and institutions concerned with research integrity (RI), as one cannot offer normative guidance to researchers without making some assumptions about what ideal scientific research looks like. Despite the insofar little interaction between scholars studying RI and those working on values in science, the overlap of topics and interests make collaboration between the two fields promising for understanding research and its ethics.

Here, we identify—for the use of RI scholars—the non-epistemic reasons (societal, political, professional) for and against the VFI considered in the literature. All of these are concerned with the beneficial or detrimental consequences that endorsing the VFI would have on society, policy-making, or the scientific community, with some authors appealing to the same principles to argue for opposite positions. Though most of the reviewed articles do not endorse the VFI, it is generally agreed that some constraints have to be put on the use of non-epistemic values. Disagreement on the utility of the VFI lies both on the different epistemic-descriptive positions taken by different authors, and on the scarcity of relevant empirical studies. Engaging critically with the reasons here identified and more in general with the values in science debate will help the RI community decide whether the VFI should be included in future codes of conduct.

Introduction

Background

In just a few decades, the scholarly community has produced a voluminous and highly fragmented academic literature on research integrity (RI). The empirical data and reflections so produced have contributed to inform the many codes of conduct that have been published. These codes spell out the values that should guide research, and give guidance to researchers on how to stay true to those values, especially in cases where other interests may be at stake. In addition to the RI scholarly community, also philosophers of science have been increasingly debating which values should guide research, which ones should be avoided, and, more in general, what should be our ideal of research and scientific community. Particular attention has been paid to the so-called "value-free ideal" of science (VFI), according to which during the epistemic phases (data analysis, inference, theory assessment, etc.) of research, scientists should not be guided by "non-epistemic values", i.e. moral, cultural, commercial, or political values[1]. This means that scientific decisions, whether about how to collect and analyze data or what conclusions to draw from them, should only be influenced by "epistemic values" such as simplicity, broadness of scope, accuracy, consistency, or fruitfulness (Kuhn, 1977)[2].

Should the VFI be endorsed? Even a cursory inspection reveals this question to be complex and many-faceted. On the one hand, an oft-cited reason for endorsing the VFI is the distorting influence of commercial interests. Such distortion does not necessarily involve overt falsification or fabrication, but can lead to a corporation's scientists to prioritize certain research questions over others, or avoiding publication of unfavorable results (Smith, 2005). On the other hand, it has been argued that scientific research, in practice, cannot be entirely independent of non-epistemic values. The most well-known of these arguments is the one from inductive risk: when drawing a conclusion from data, the scientists must evaluate the costs of being wrong, and this

[1] There are many different interpretations of the VFI. The one we employ here comes very close to Heather Douglas' (Douglas, 2009).

[2] The very distinction underpinning the VFI, that between epistemic and non-epistemic values, has been criticized by authors like Phyllis Rooney and Helen Longino (Longino, 1996; Rooney, 1992, 2017). However, scholars involved in the debate have been keeping using this distinction, or similar ones. As we aim at offering an overview of the debate, we keep using it in our study, with no pretentions to vindicate it.

evaluation cannot but be based on non-epistemic values (Douglas, 2000; Rudner, 1953).

Despite the overlap of themes, concerns, and aims, only little collaboration between the scholars studying RI and those studying values in science has taken place to the present day. We believe—together with Kevin Elliott and David Resnik (2019)—that our general understanding of research, its values, and ethics, will benefit from the collaboration of these two academic communities.

Rationale and objectives

In this article, we take a first step towards this collaboration by offering to the RI community an overview of the reasons discussed by philosophers of science for and against the VFI. Given the aims of RI, instead of focusing on whether the VFI describes a real state of affairs or not, we focus on its normative dimension. Even if the actual practice of scientific research were unavoidably influenced by non-epistemic values, it may be still desirable to endorse the VFI for the beneficial consequences it may have for the research community and society in general. Affirming the VFI as a community-wide norm may be beneficial for public trust in science, or it may encourage scientists to refrain from conflicts of interest. In other words, even if the VFI were a fiction, not accurately describing the reality of scientific research, to what extent could it still be considered a "useful fiction"?

To shed light on this, we investigate some of the main non-epistemic reasons both for and against endorsing the VFI as a community-wide norm. By non-epistemic reasons we mean all those reasons that are not primarily concerned with epistemic desiderata (objectivity, accuracy, consistency, etc.), but are grounded on political, social, moral, and other non-epistemic considerations. Does endorsing the VFI enhance public trust or the integrous behavior of scientists—or conversely, does it discourage scientists from being engaged with their communities? We aim to map the most important benefits and downsides that can be expected from an endorsement of or a distancing from the VFI.

Part of the relevance of our research question resides in the collaboration between the two fields we aim to foster. In particular, it is important to consider the implications that an endorsement of the VFI both at the individual and institutional level has for the values and norms that should govern research.

Methods

We follow the PRISMA guidelines (Page et al., 2021) to report our review of reasons (Sofaer & Strech, 2012; Strech & Sofaer, 2012).

Eligibility criteria

We include publications satisfying the following criteria:

1. *Publication type*: peer-reviewed; journal article; written in English; published after the year 2000 (included).

This excludes books, contributions to books, non-research articles (e.g. book reviews), articles published before 2000, and articles not written in English. Though books are still very influential in the philosophical literature, a great deal of the most influential contributions to the debate are mainly focused on epistemic and descriptive arguments against the VFI. For instance, Heather Douglas' work is based on the descriptive observation that, because of inductive risk, scientific inferences requires non-epistemic value judgments (Douglas, 2009), and Helen Longino's work is largely based on the descriptive observation that scientific theories are underdetermined by the evidence (Longino, 1990). Further discussion on this is offered in the limitations section.

2. *Publication content*: one or more non-epistemic reasons for or against the VFI; concerns science in general, not just a specific scientific domain.

This excludes articles containing solely descriptive claims about the VFI (e.g. science is value-free), or epistemic reasons (e.g. if not value-free, science is not objective). Moreover, it excludes articles that highlight the role of values in a specific science by contrasting it to other sciences (e.g. taxonomy—*unlike* molecular biology—is not value-free).

Information sources and search strategy

First, we searched *Web of Science Core Collection* and *Philosopher's Index* using combinations of keywords related to four core concepts: non-epistemic values, epistemic values, values in science, and value-free science (the full search strings are available online). Then, we used the snowball method, and ran a related search on Google Scholar. The databases were last searched on April 20, 2021.

Selection process

After we had agreed on the eligibility criteria, the records (title, abstracts, and other publication data) were screened. We discarded articles dealing with values in non-scientific contexts (e.g. articles on how different kinds of values influence customer choice, as Assarut & Eiamkanchanalai, 2015). We also discarded any articles not matching the desired publication type that were returned notwithstanding our search-filters. Remaining articles were fully read. In this phase, the selection was made on the basis of content-related considerations. We included articles offering at least one non-epistemic reason for or against the VFI. For instance: we should endorse the VFI because it increases public trust; or: we should reject it because science should pursue social values. We excluded articles that, in evaluating the VFI, considered epistemic reasons only, such as objectivity or accuracy. For instance, though it deals with non-epistemic values and the VFI, Ludwig, 2016 was eventually excluded because we were not able to identify a single non-epistemic reason in it.

Data collection and extraction process

We considered all the reasons in the reviewed articles, regardless of the weight they were given by the authors. We first identified reason mentions, i.e. specific passages of a text mentioning a reason. As long as a passage explicitly stated a reason, we counted it as a reason mention, no matter its length. After collecting all reason mentions, we clustered them into thematic areas. Within each thematic area, we grouped reason mentions into reason types according to the principle or value they appealed to. Next, we categorized each reason mention according to whether the author claimed it counted for or against the VFI.

Given that different authors use different definitions of the VFI, and not all authors use the term "value-free", we employed two minimal criteria to identify it. First, whenever the term "value-free ideal" was explicitly employed, we took it as an instance of the VFI. Second, when the term "value-free ideal" was not explicitly employed, we took any ideal implying at least that non-epistemic values should not influence epistemic phases of science (data analysis, inference, theory assessment, etc.) as an instance of the VFI. For example, we counted as an instance of the VFI the view discussed by Inmaculada de Melo-Martin and Kristen Intemann according to which "scientists need not, and should not, endorse non-epistemic values related to their research, as doing so may

bias their assessment of what the evidence is" (de Melo-Martin & Intemann, 2012, p. 60), even though they do not use the term "value-free ideal".

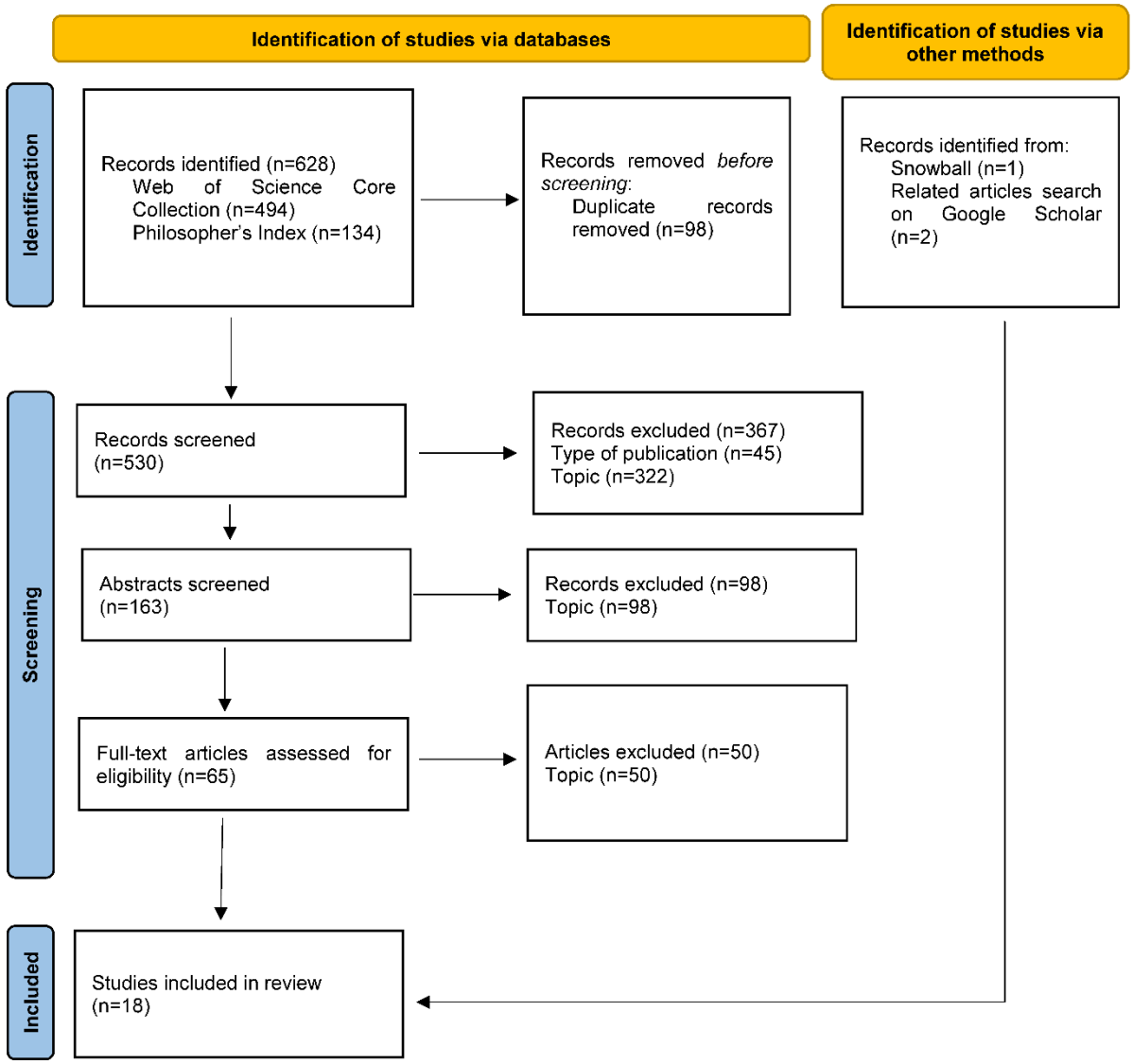

Figure 1 PRISMA flow chart of the selection process

Results

Study selection and characteristics

The database search yielded 530 articles, duplicates excluded. Of these, 15 were eligible for inclusion. We added 3 more articles retrieved via other methods. The total number of included articles is 18 (see **table 1**).

In this section, we present our findings by describing the definitions of the VFI addressed in the reviewed articles, their general stance towards it, and the reasons for and against it that they consider, sorted by thematic area.

Table 1 Reviewed articles arranged by year, including journal, number of reasons mentions, and general stance towards the value-free ideal (VFI). N.B. Reason mentions in an article do not necessarily represent the view of its authors (they may be the report of someone else's view). Moreover, though they may play a role in the reasoning behind the general stance assumed by the reviewed authors, epistemic reasons were not coded, and therefore not included in the count of reason mentions. This is why, for instance, de Melo-Martin & Intemann (2016) have only reasons for the VFI, but nonetheless do not endorse it.

Reference	Journal	Number of reason mentions		General stance towards the VFI
		Pro VFI	Against VFI	
Koertge, 2000	*Philosophy of Science*	1	1	Endorsing
Rottschaefer, 2003	*Behavior and Philosophy*	1	2	Not endorsing
Koertge, 2004	*Philosophy of Science*	1	1	Endorsing
Drenth, 2006	*Science and Engineering Ethics*	///	1	Not endorsing
Douglas, 2008	*Public Affairs Quarterly*	3	3	Not endorsing
Lekka-Kowalik, 2010	*Science and Engineering Ethics*	///	2	Not endorsing
de Melo-Martin & Intemann, 2012	*Perspectives in Biology and Medicine*	///	2	Not endorsing
Betz, 2013	*European Journal for Philosophy of Science*	2	///	Endorsing
Bueter, 2015	*Studies in History and Philosophy of Science*	///	1	Not endorsing
John, 2015a	*Synthese*	2	///	Endorsing
John, 2015b	*European Journal for Philosophy of Science*	3	2	Endorsing
de Melo-Martin & Intemann, 2016	*Philosophy of Science*	2	///	Not endorsing
Hudson, 2016	*Perspectives on Science*	3	2	Endorsing
Resnik & Elliott, 2016	*Accountability in Research Policies and Quality Assurance*	2	3	Not endorsing
Bright, 2018	*Synthese*	3	///	Endorsing
John, 2019	*Studies in History and Philosophy of Science*	2	///	Not endorsing
Resnik & Elliott, 2019	*Studies in History and Philosophy of Science*	2	///	Not endorsing
Ahn, 2020	*Studies in History and Philosophy of Science*	1	1	Not endorsing

Definitions of the VFI, and general stances

While all the definitions of the VFI used in the reviewed articles match our minimal criteria, some of them are stated in a weaker form, e.g. “whereas a hypothesis may

contingently be held for valuational reasons, it is epistemically preferable if it is held for evidential reasons" (Hudson, 2016, p.168), and some in a stronger form, e.g. "science is not entitled to formulate value-judgments in which any non-cognitive values are taken into account" (Lekka-Kowalik, 2010, pp. 33-34)[3]. The former definition proposes the VFI as an ideal to strive for, while admitting that sometimes non-epistemic values do affect scientific reasoning. By contrast, the latter maintains that non-epistemic values cannot ever be considered.

3 articles (de Melo-Martin & Intemann, 2012; Koertge, 2000, 2004) do not employ the phrase "value-free ideal", nor similar ones, but discuss ideals of science matching our minimal criteria for the VFI. Similarly, Rottschaefer (2003) talks of "value-neutrality", but defines it in a way matching our criteria. Therefore, we consider these 4 articles on a par with those explicitly addressing the VFI.

11 of the articles reviewed do not endorse the VFI, 7 do. After criticizing and acknowledging the shortcomings of its traditional formulations, 3 of the articles not endorsing the VFI propose what we will call "value-limiting ideals" (VLIs) which do not reject all non-epistemic values in science but only some and in certain contexts. The three proposed versions of VLIs in the reviewed articles are:

- Non-epistemic values should not be used in place of evidence (direct role), but only to determine the standards for sufficient evidence (indirect role) (Douglas, 2008).
- The justification of findings should not be based on non-epistemic values that are incompatible with the values of the intended public. Instead, scientists should endorse a "value-apt ideal", according to which the communication of their findings should be guided by values shared with the intended public (John, 2019).
- Whenever complete value-neutrality is not possible, scientists can be influenced by non-epistemic values as they make this influence explicit—i.e. they are transparent about it (Resnik & Elliott, 2016).

The complete list the various definitions of the VFI and VLI used in the reviewed articles is available in the online supplementary material.

[3] In the literature the terms "cognitive" and "non-epistemic" are sometimes used interchangeably. See for instance Douglas, 2013 and Rooney, 1992.

Thematic areas, reason types, and alleged implications

We identified three thematic areas – societal, political, and professional– reflecting the groups affected by the endorsement of the VFI: society, politics, and the scientific community itself. We grouped different reason mentions in 10 reasons types, each of which appeal to a different principle to argue for or against the VFI. 2 are reasons against the VFI, 4 are reasons for the VFI, and 4 have been used to argue both ways. **Table 2** displays reason types, including for each of them a synthetic description, the number of articles mentioning them, and the bibliographic references.

Table 2 Overview of the reasons for and against the value-free ideal (VFI). The table includes: thematic areas (societal, political, and professional); reason types with a brief explication; alleged implications (for or against the VFI) with the number of articles mentioning them; bibliographic references.

Societal reasons		
Public trust		
Abandoning the VFI would impair public trust, because the main reason why the public trusts scientists is that their claims are deemed objective and independent of personal preferences.	For (n=5)	(Bright, 2018, p. 2228, 2243), (Douglas, 2008, p. 5), (Hudson, 2016, p. 180, 182), (John, 2015b, p. 9), (Koertge, 2000, p. 54)
Holding the VFI even though science cannot be value-free would be detrimental for public trust. It is better to acknowledge the full range of values involved in scientific research in a transparent way, rather than maintaining a false appearance of complete value-neutrality.	Against (n=2)	(Douglas, 2008 p. 7; Resnik & Elliott, 2016 pp. 35-36)
Social responsibility		
Holding the VFI could discourage scientists pursuing their responsibilities towards society. Since they are moral agents who receive public funding, scientists should actively tackle urgent issues and consider the broad societal consequences of their research.	Against (n=6)	(Bueter, 2015, p. 22), (Drenth, 2006, p. 15), (Hudson, 2016, p. 187), (Lekka-Kowalik, 2010, p. 39), (Resnik & Elliott, 2016, p. 36, pp. 36-37), (Rottschaefer, 2003, p. 244)
Personal autonomy		
Keeping scientific claims value-free preserves the personal autonomy of members of the public. Otherwise, the general public would rely on knowledge based on values they may not share.	For (n=3)	(Betz, 2013, p. 207), (John, 2015a, p. 80), (John, 2019, p.69)
Social progress		

Holding the VFI would make science less discriminatory, because non-epistemic values could distort scientific findings, making them sexist or androcentric.	For (n=1)	(Rottschaefer, 2003, p. 227)
Holding the VFI would reinforce discrimination, because it would make it easier for undesirable values to go unnoticed. We should better actively inject politically progressive values in science instead.	Against (n=3)	(Koertge, 2000, pp. 49-50), (Koertge, 2004, p. 870), (Rottschaefer, 2003, p. 228)
Political reasons		
Public intervention		
By holding the VFI, and thus avoiding value judgments, scientists can prioritize giving useful information to policymakers. By contrast, including political values within science would rule out some possible solutions to public problems based on principle.	For (n=5)	(Bright, 2018, p. 2228), (de Melo-Martin & Intemann, 2016, p. 503), (John, 2015b, p. 5), (Koertge, 2004, p. 874), (Resnik & Elliott, 2016, p. 36)
Holding the VFI would make scientific claims useless to policymakers. Attempting to strip scientific claims of any value assumption would make their scope less broad, thus reducing the possible applications of scientific knowledge to policy.	Against (n=4)	(Ahn, 2020, p. 63), (de Melo-Martin & Intemann, 2012, p. 67), (Douglas, 2008, p. 7), (John, 2015b, p. 9, p. 12)
Democratic principles		
Abandoning the VFI would infringe basic democratic principles. As scientific knowledge is used to determine the political route of democratic societies, it should not be influenced by the value-judgments of unelected scientists.	For (n=4)	(Betz, 2013, p. 207), (de Melo-Martin & Intemann, 2016, p. 503), (John, 2015a, p. 93), (John, 2015b, p. 5)
Professional reasons		
Research integrity		

The rejection of the VFI jeopardizes research integrity, as it is an essential feature of both the ethics and the practice of science to be guided by epistemic values only.	For (n=4)	(Ahn, 2020, p. 57), (Douglas, 2008, p. 6), (Resnik & Elliott, 2016, p. 35), (Resnik & Elliott, 2019, p. 2)
Communication		
Holding the VFI could cause communication breakdowns between scientists: information about the values that underlie judgments are crucial for successful communication between scientists.	Against (n=1)	(de Melo-Martin & Intemann, 2012, p. 67)
Education		
Endorsing the VFI allows ethical consideration to be minimized in science curricula. Were we to abandon the VFI, then ethics would need a more prominent position, and this would mean less attention for learning the science itself.	For (n=1)	(Hudson, 2016, p. 188)
Autonomy of scientists		
Holding the VFI would preserve the autonomy of scientists from political pressure. In fact, were political values to guide scientific research, scientists would censor themselves whenever their findings are in contrast with those values.	For (n=1)	(Douglas, 2008, p. 6)
Holding the VFI would breach the autonomy of scientists. Were scientists to exclude any value-judgment in their work, they would not be free to act ethically, ending up being 'minds to be hired'.	Against (n=3)	(Douglas, 2008, pp. 12-13), (Hudson, 2016, p. 187), (Lekka-Kowalik, 2010, p. 38)

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Societal reasons

Under this label we include reasons based on the consequences of endorsing or not endorsing the VFI for society in general.

Among these reasons, the ones concerned with *public trust* are the most represented, as they are mentioned by 6 articles. It is mostly argued that holding the VFI increases the trustworthiness of science in the eyes of the public, but on two occasions it is argued that openly acknowledging the presence of values in science would be more beneficial than rejecting those values. In particular, one article evaluates public trust both as a reason for and against the VFI. Another well-represented reason type is *social responsibility*, which includes general claims against the VFI based on the responsibilities that scientists have towards society. While the source of these responsibilities may be different, all of these reasons against the VFI imply that scientists should actively acknowledge and address non-epistemic values, rather than misleadingly presenting their work as value-free.

Political reasons

Under this label we include reasons based on the consequences of endorsing or not the VFI for politics. Although there may be some overlap with societal reasons, the two can be distinguished insofar as political reasons focus specifically on society's use of science through political bodies.

Most of the political reasons are concerned with how the VFI impacts *public intervention*: the process of policy-making and its effectiveness. The reasons considered in the reviewed literature were split almost equally between benefits for and challenges to policy-making. Some other political reasons concerned the relation between the VFI and *democratic principles*, which determine policies in democratic societies. These principles were seen as a reason for endorsing the VFI, because the VFI is seen as preventing scientists from assuming technocratic power. In democratic societies policy-makers use scientific knowledge to make decisions on behalf of citizens. They alone, because democratically elected, are allowed to make value-judgments. Therefore, the argument goes, it would be inappropriate if scientific knowledge were already influenced by value-judgments made by unelected people, i.e. scientists.

Professional reasons

Under this label we include reasons based on the consequences of endorsing or not the VFI for the professional life of researchers themselves.

Most of these reasons support the view that abandoning the VFI would jeopardize *research integrity*, which comprises both ethical and epistemic integrity. Therefore, these reasons have also an epistemic component. Nonetheless, they were included, because falling short of epistemic standards is considered detrimental not (only) because it would weaken scientific knowledge, but because it would infringe ethical-professional standards. Another well-represented professional reason type is the one concerned with the *autonomy of scientists*. On the one hand, it is feared that imposing the VFI would make scientists incapable of autonomous moral judgements. On the other, it is feared that were political values to play a role within science, scientists could refrain from making claims not aligned with those values, regardless of the evidence. In both cases, scientists would lose the autonomy and freedom to practice their profession.

Discussion

This review identifies non-epistemic reasons for and against the VFI considered in the literature. While it cannot be used to settle the academic debate, it offers to RI scholars an overview of the possible advantages and disadvantages – for society, politics, and the scientific community – of publicly endorsing the ideal that science should be "value-free". We believe this overview be useful for drafting codes of conduct for RI, as further discussed below.

In this section, we contrast our findings with empirical data and the broader academic literature in order to highlight their relevance to RI and codes of conduct while suggesting possible ways to evaluate them.

Implications for research integrity

Codes of conduct for RI, in offering normative guidance to researchers, must per definition make some assumptions about what ideal scientific research looks like. How they deal with non-epistemic values is a crucial part of that ideal. Should codes communicate the norm that scientists should conduct their research in a way that is as value-free as possible? Or should codes acknowledge the importance of societal and political values? Which position is assumed by current codes of conduct? Here it is

interesting to note that in the reviewed articles preserving RI is mentioned only as a reason in favor of the VFI (Ahn, 2020; Douglas, 2008; Resnik & Elliott, 2016, 2019).

However, it should be mentioned that the distinction between "epistemic" and "non-epistemic" values is not one that codes of conduct operate with. These typically refer to both epistemic as well as ethical-professional integrity. For instance, the European Code of Conduct for Research Integrity speaks of the importance of "respect" (ESF-ALLEA, 2017), and the U.S. National Academies refers to "fairness" as a guiding principle for scientists (National Academies of Sciences, Engineering, and Medicine (U.S.), 2017). None of these could pass as a purely epistemic value. Rather, they may be read as moral values, or moral virtues[4].

Moreover, the importance of virtues for RI has been recently highlighted by the work of Robert Pennock (Pennock, 2015; Pennock & O'Rourke, 2017). Pennock's virtue-ethics approach for the ethics of science by no means denies the importance of searching for truths in science. Quite the contrary, it implies that both epistemic soundness and scientists' virtues are necessary in order for science to flourish (Pennock, 2019). Thus, from this perspective, the sharp distinction between epistemic and non-epistemic (in this case, moral) virtues underpinning the VFI does not hold. This is in line with the work of those who have criticized the distinction, and claimed that epistemic and non-epistemic values lie on a spectrum (Longino, 1996; Rooney, 1992, 2017)[5]. According to both perspectives, whether specific values are appropriate or inappropriate in science is not determined by their being epistemic or not.

Does this mean that codes of conduct for RI implicitly reject the VFI? Although they seem incompatible at least with some formulations of it, some of them hint at the VFI in passing. For example, the abovementioned European code states that "research draws on the work of the community of researchers and ideally develops independently of pressure from commissioning parties and from ideological, economic or political

[4] While virtues and values do not – strictly speaking – coincide, they are very much related. For instance, Rik Peels and colleagues claim that some of the principles of codes of conduct such as honesty "can be understood generally as a value—some good-making property that actions, studies, people, events, or instruments can have—or as a virtue, that is, as a moral or intellectual character trait of researchers or perhaps even teams and organizations." (Peels et al., 2019, p. 4). In addition to this, the scope of the values in science debate has been so broad, that Justin Biddle has proposed to talk about "non-epistemic factors" rather than values (Biddle, 2013). Given these considerations, the virtues discussed by Pennock can be considered non-epistemic factors. We thank an anonymous reviewer for pointing to this ambiguity.

[5] See Lacey (2017) and Steel (2010) for defenses of this distinction.

interests."(ESF-ALLEA, 2017, p. 3). It is not difficult to see in this passage the core of the VFI: even if the influence of political or societal values cannot be avoided, in an ideal situation research should not be influenced by them. Moreover, this brief passage matches the expectations of Europeans that economic interests and political agendas should not unduly influence scientific research (European Commission, 2021). Thus, a distinction is made between two different types of non-epistemic value: moral-professional values to be pursued, and economic and political values, which ideally should be avoided.

More research would be needed to identify which precise ideal or ideals underlie current codes of conduct—the VFI or other ideal. Nonetheless, it is still an open question to what extent codes of conduct should openly endorse the role that societal and/or political values can play in scientific research. What long-term impact would that have on the integrity of research? For now, we can suggest that the benefits and downsides of the VFI identified in this article will help future discussion on to what extent the VFI *should* be endorsed by future codes.

Implications for public trust

To foster public trust in science is often considered one of the main aims of policies that foster RI. It is believed that maintaining RI and conveying this state of affairs to society is likely to increase public trust. However, one can separately raise the question on how scientific institutions should convey this state of affairs. Would an official endorsement of the VFI increase public trust in science as claimed by some authors, or would it decrease it as argued by others? As the relations between society, politics, and science have increasingly received attention by researchers and institutions, a wide array of relevant data is now available. These data can be a good starting point for scientific institutions to evaluate whether endorsing the VFI is a useful measure to improve public trust.

To start with, does the public currently trust science? And if so, for what reasons? While scientists tend to believe the public does not trust them (Ceci, 2015; Nature, 2015), recent surveys return a reassuring picture. Both in the UK and the USA, scientists enjoy high levels of public trust, following increasing trends (Ipsos MORI, 2020; Pew Research Center, 2020). Likewise, most Europeans maintain positive views of science and its impact on society, and attribute to scientists the same qualities (intelligence, honesty, reliability…) they think they should have (European Commission, 2021).

However, this image changes when it comes to sensitive topics. For instance, despite their general positive attitude towards scientists and science, 50% of Europeans believe that scientists cannot be trusted about controversial and technological issues, because economic and political interests are involved (European Commission, 2021). These apparently contradictory data show how trust in science is a multidimensional concept: it is topic-dependent, and moreover, the public tends to have high levels of trust in the principles and methods of science, but not in scientific institutions (Achterberg et al., 2017; Aupers, 2012; Huber et al., 2019; Miller, 2004). This seems to support the view that people trust science when its methods and principles are seen as value-free, but tend not to trust scientists and scientific institutions when perceived as guided by non-epistemic interests. At the same time, most Europeans agree that researchers should take account of the needs of everyone within society, especially in the developing of new technologies (European Commission, 2021). This is in line with the reasoning of those who reject the VFI by appealing to the social responsibility of scientists to address socially significant research.

From this discussion, there does not seem to be a straightforward answer to the question: does the VFI improve public trust in science? At this point, it is worth reminding that while fostering public trust may seem a worth pursuing goal in itself, trust in science should always be contingent (MacCoun, 2015): people should trust scientists as long as they are trustworthy, i.e., they are reliable and unbiased (Carrier, 2017). To misleadingly present research as value-free and unbiased as a strategy to increase public trust does not seem a morally acceptable option. However, supporters of radical transparency as a way to deal with the presence of values in science need a stronger case. In fact, there is currently not enough evidence to conclude that radical transparency would remedy the loss of public trust, at least when this is lost due to low replicability of research (Wingen et al., 2020). Quite the opposite, a preliminary study suggests that disclosure of value-commitments by researchers has null or negative effect to the trust of people (Elliott et al., 2017).

Implications for scientific expertise and science-based policy

One of the most powerful aspects of research is that the knowledge it produces can have an impact on the whole of society. Whether acting as experts or simply contributing to public knowledge by means of scientific publications, researchers inform the decision-making process of political bodies around the world. And these

decisions, in turn, have a direct impact on the lives of people. This is a crucial point where research and society meet and where endorsing or not the VFI could make a real difference. How should scientific experts behave and communicate? Should they select research questions according to the (non-epistemic) needs of society? Should they merely endeavor to communicate the science, or should they tailor their messages for the needs of society?

This issue is closely related to questions about public trust. For instance, when questions are general and abstract, interviewees tend to report high levels of trust, while when they are about specific politicized topics, distrust emerges (MacCoun, 2015). Particularly striking is the fact that in the USA public trust in science has been growing only among Democrats, while Republicans' trust in science has stayed stable and low (Pew Research Center, 2020). People seem to fear that science could be driven by some political agenda that they do not endorse. Indeed, making sure that scientists, especially when they are acting in capacity of experts, are honest and reliable, and are not skewing their findings in favor of one or another party is a crucial component of RI. Authors appealing to public intervention and democratic principles to argue for the VFI give voice to this worry. According to them, holding the VFI is a promising way towards effective and democratic policy-making. However, this view seems to contrast with 61% of European citizens agreeing that non-scientists should be involved in research as a way to promote the values of society (European Commission, 2021). Furthermore, it does not address the scenario where value-free science is unattainable.

A possible way to maintain democratic principles in this scenario is to make sure that only democratically endorsed values are allowed. If values cannot be removed from science, to include only democratically shared values seems a reasonable second-best alternative to maintain RI within a democratic society. How to practically implement this is far from uncontroversial. Philip Kitcher's ideal of *well-ordered science*—probably the most influential VLI aimed at incorporating democratic values into science (Kitcher, 2001)—has been criticized mainly for the lack of details that would make its implementation impossible. For instance, it has been recently argued that it offers "no identifiable ideal research agenda as a benchmark against which we can assess the research agenda of real-world science" (Philippi, 2020, p. 374). More generally, incorporating democratic values in science may come at a cost for researchers, who may lose autonomy in their choices (Schroeder, 2017).

Charting the disagreement on the VFI

While the reviewed reasons point to the importance of the consequences of endorsing the VFI or alternative VLIs, where does the weight of opinion in the reviewed literature stand on this issue? The results in **Table 1** clearly indicated that the majority of reviewed sources reject the VFI (7 versus 11). However, further details suggest alternative possible interpretations of where the weight of opinion lies.

The first important nuance to bring into this discussion is that those who endorse VLIs define VLIs in very similar ways to the VFI. For instance, compare Betz's definition of the VFI:

> [...] the justification of scientific findings should not be based on non-epistemic (e.g. moral or political) values (Betz, 2013, p. 1)

with Douglas's proposed ban on the direct role for non-epistemic values:

> [...] values should only be used to weigh the importance of uncertainty, by considering the consequences of error. This role is in contrast to a more direct role for values, namely that values could be taken as reasons in themselves to accept or reject an empirical claim (Douglas, 2008, p. 8)

So, while **Table 1** lists Douglas 2008 as "not endorsing" the VFI and Betz 2013 as "endorsing", one can legitimately ask the question just how much these two resources differ on the VFI or "VFI-like" VLIs. Both agree that non-epistemic values should not be used as direct support for accepting or rejecting empirical claims. Hence, one may consider the meaningful distinction to be that between those who endorse a VLI and those who do not (instead of those who do and do not endorse the VFI). Then a very different picture emerges of where the weight of opinion lies: it appears that a majority endorses VLIs (10 endorsing versus 8 not endorsing). For the interpretative details behind this categorization, we refer readers to the online supplementary material.

Moreover, even this analysis may overstate the level of disagreement, since many authors holding different normative positions on the VLIs are nonetheless driven by similar concerns. Only 4 articles (Ahn, 2020; Bueter, 2015; de Melo-Martin & Intemann, 2016; Rottschaefer, 2003) of those not endorsing the VFI explicitly claim that non-epistemic values are epistemically beneficial. These articles claim that at least in some fields value-judgments are fundamental to accomplish the epistemic aims of science (Ahn, 2020; de Melo-Martin & Intemann, 2016; Rottschaefer, 2003), and that

pluralism of values would benefit inquiry by providing more perspectives (Bueter, 2015). In this perspective, the weight of opinion shifts even more in favor of some of the key concerns underlying the VFI: virtually 14 sources endorse not using non-epistemic values for epistemic ends, whereas 4 do.

This suggests caution when the VFI is rejected. Sometimes it can simply entail the descriptive claim science is not and cannot be a "view from nowhere" and that is somehow always influenced by values. In this sense, the rejection of the VFI can be tantamount to saying it is a fiction. However, such a rejection may, ultimately, not entail a normatively different stance on the exclusion of certain types of (non-epistemic) values, for instance concerning the role that political or societal values should play in the process of scientific research. One may still strongly reject, for instance, the extreme view that scientific research is only acceptable when it conforms to a particular political ideology. In this sense, those authors who reject the VFI could still in principle agree that the VFI is a "useful fiction" in helping to prevent such approaches to scientific research.

Another source of confusion is that similar concerns (about non-epistemic values) lead to different conclusions about the VFI. Some authors view maintaining public trust as a reason for endorsing the VFI; for others, the exact same reason is used to reject the VFI, in the assumption that science cannot be value-free and that claiming the opposite would be a form of window-dressing if not blatant deception. Both lines of reasoning have plausibility, and here empirical research may provide some progress. In the preceding discussion we used available data on the relations between society, politics, and science to suggest possible ways to evaluate those reasons; however, it would be helpful if dedicated studies on the impact of the VFI could be designed and carried out.

Limitations

In charting where the major non-epistemic reasons for and against the VFI, the present review is limited by the interpretative decisions inherent to the method of a reasons-based review. The last section discussed how one can draw different lessons from the results according to one's interpretative framework. In this section we would like to point to some other limitations.

The first is related to the necessity of reading the full text of the articles to extract non-epistemic reason mentions. This means that some relevant reasons may have been

present in articles excluded on basis of title and abstract. We minimized this risk by keeping a high number of articles (65) until the last phase of selection, and by retrieving records via other sources.

Another limitation lies in our consideration of journal articles only. In fact, influential contributions in this area have appeared in monographs and collections. Nonetheless, for purposes of this review, namely to offer to scholars working on RI an overview of what is currently debated among philosophers of science, we did not consider this to be a fatal limitation, for several reasons. First, were there any major non-epistemic arguments included in books, we would expect these to be discussed in the journal literature too. Second, not including a non-epistemic reason presented in a book that is never mentioned in recent journal articles would be a good (though non-conclusive) basis to consider that reason less relevant for charting patterns of consensus in the relevant scholarly community. Third, the relatively low number of non-epistemic reasons found in the literature, together with our knowledge of the non-journal literature let us think that we have not missed any major non-epistemic reason.

Finally, questions regarding the value-free ideal of science of course have a long history, going back at least to Max Weber's work (Weber, 1949). However, between the 90s and the early 2000s, seminal contributions in social epistemology and feminist philosophy of science (e.g. Douglas, 2000; Kitcher, 2001; Longino, 1990; Solomon, 2001) revived and reshaped the debate on values in science in such a way that including articles predating them would return a skewed image of what is currently discussed in philosophy of science.

Concluding remarks

Even if science is in fact not value free, does the endorsement of the VFI have beneficial consequences for scientific research? Or do the benefits of rejecting the ideal outweigh the benefits of endorsing it? In bringing attention to these questions, our review charted some of the main non-epistemic reasons for endorsing and rejecting the VFI. While many authors reject the VFI, many do nonetheless hold that political and societal values should not determine whether an empirical claim is accepted or rejected. The review also pointed to the difficulty of taking an unqualified stance on the VFI. The dangers that non-epistemic values pose to the integrity of research are contingent not only on the specific phase of inquiry (research, dissemination…) and the specific science, but also on the kind of values at stake.

To the extent the VFI is a "useful fiction" for the scientific community, it should be possible to empirically test some of the envisioned consequences for society, politics, and the professional ethics of research. This would clear up discussion in the philosophical debate, and at the same time would better inform future decision on whether or not to include the VFI in future codes of conduct. For instance, if empirical research confirmed that presenting science as value-free has a positive effect on the trust of the public, would it be a reason to present science as such? We believe the RI community can find answers to this and similar questions by engaging critically with the reasons here identified and more generally by engaging with scholars involved in the values in science debate.

Our findings and discussion suggest two future research lines where collaboration between scholars working on values in science and those working on RI could prove fruitful. The first is the empirical testing of the non-epistemic effects of endorsing the VFI, in particular as regards public trust and RI. The second would be to investigate systematically to what extent current codes of conduct for RI endorse the VFI or other VLIs. Do they commit to any specific philosophical position or do they manage to do without it? Answers to that question, together with a clearer picture of the effects of endorsing the VFI (and related VLIs) would help show how codes of conduct for RI could be redesigned and made more effective.

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