

# Ontological Choices and the Value-Free Ideal

David Ludwig<sup>1</sup> 

Received: 24 May 2015 / Accepted: 19 November 2015 / Published online: 14 December 2015  
© The Author(s) 2015. This article is published with open access at Springerlink.com

**Abstract** The aim of this article is to argue that ontological choices in scientific practice undermine common formulations of the value-free ideal in science. First, I argue that the truth values of scientific statements depend on ontological choices. For example, statements about entities such as species, race, memory, intelligence, depression, or obesity are true or false relative to the choice of a biological, psychological, or medical ontology. Second, I show that ontological choices often depend on non-epistemic values. On the basis of these premises, I argue that it is often neither possible nor desirable to evaluate scientific statements independently of non-epistemic values. Finally, I suggest that considerations of ontological choices do not only challenge the value-free ideal but also help to specify positive roles of non-epistemic values in an often neglected area of scientific practice.

## 1 Introduction

Values are ubiquitous in scientific practice and play an important role in research from the early planning stage to the dissemination of final results. Proponents of the Value-Free Ideal (VFI) do not endorse the highly implausible claim that values should be eliminated from science altogether but rather more specific claims about the illegitimacy of non-epistemic values in the evaluation or justification of scientific theories (e.g. Betz 2013; Hudson 2015; Lacey 2010; Schurz 2013; Sober 2007). Although there is not one authoritative formulation of VFI, the general idea can be motivated by a distinction between value questions and fact questions. For example, consider Max Weber's classical defense of VFI in the social sciences

---

✉ David Ludwig  
d.j.ludwig@vu.nl; davidundludwig@gmail.com

<sup>1</sup> Vrije Universiteit Amsterdam, De Boelelaan 1105, 1081 HV Amsterdam, The Netherlands

(Weber 1917). Weber offers a detailed description of the ubiquity of values in academia but still insists that we have to understand scientific inquiry in terms of a distinction between two fundamentally different types of questions:

1. fact questions: what is the case in the world?
2. value questions: what should be the case in the world?

Even if scientific practice is obviously entangled with values in numerous ways, it still remains plausible to separate fact questions and value questions in the sense of (1) and (2). It seems to be only a small step from this distinction between fact questions and value questions to the ideal of VFI. If science is concerned with facts in the sense of (1) while values in the sense of (2) have no bearing on what is the case in the world, then the “epistemic integrity of science” (Ruphy 2006) seems to require that we avoid non-epistemic values in the evaluation and justification of scientific theories.

Far from endorsing the highly implausible claim that values can be eliminated from science altogether, proponents of VFI subscribe to the far more specific idea that non-epistemic values should play no role in evaluating or justifying scientific theories (cf. Elliott and McKaughan 2014; Büter 2015). There are at least four common arguments that are directed against VFI in this more narrow sense. The *first argument* is based on the general assumption that the underdetermination of theories by evidence leaves room for non-epistemic values in theory choice (e.g. Longino 2002; cf. Brown 2013). The *second argument* challenges VFI by pointing out that scientific inferences often involve a high degree of uncertainty and by suggesting that an evaluation of the “inductive risk” in theory choice requires non-epistemic values (e.g. Douglas 2009; John 2015). The *third argument* questions the very distinction between epistemic or non-epistemic values. While philosophers of science have often assumed that only the former are legitimate in theory choice because they “promote the attainment of truth” (Steel 2010, p. 17), a breakdown of the distinction would undermine VFI (Rooney 1992; Longino 1996; Machamer and Douglas 1999). According to the *fourth argument*, scientists often have to employ “thick ethical concepts” in which factual and normative components are inextricably entangled (e.g. Putnam 2002). If it is not possible to separate these aspects, then it is neither possible to evaluate or justify scientific theories independently of values.

The aim of this article is to develop a different argument against VFI that is based on a specification of the roles of non-epistemic values in scientific ontologies. In a first step, I argue that the truth values of scientific statements depend on ontological choices. For example, statements about entities such as species, race, memory, intelligence, depression, or obesity are true or false relative to the choice of a biological, psychological, or medical ontology (Sects. 2, 3). In a second step, I argue that ontological choices often depend on non-epistemic values (Sect. 4). These two steps imply that the truth values of scientific statements often depend on non-epistemic values. In a third step, I try to show that this value-dependency of the truth values of scientific statements undermines VFI (Sect. 5) as it is not possible to avoid value-laden ontological commitments (Sect. 6). Finally (Sect. 7), I suggest

that a consideration of non-epistemic values in scientific ontologies does not only provide a negative argument against VFI but also makes more constructive suggestions about legitimate roles of non-epistemic values in scientific theories.

## 2 Ontological choices

The aim of this section is to develop the idea that the truth values of scientific statements depend on ontological choices. This general claim is best discussed on the basis of more specific examples. Consider the following statements:

- (a) At least forty species of orchids became extinct in Indonesia during the twentieth century.
- (b) There are two different tiger species in the San Diego Zoo.
- (c) The human short-term memory has a capacity of seven plus or minus two units.
- (d) 35.9 % of adults in the US are obese.
- (e) Grief is a natural response to death or loss and therefore not a depression.
- (f) Members of population a are on average more intelligent than members of population b.
- (g) Andy Warhol had an I.Q. of 86.

Although I want to claim that the truth values of all statements (a)–(g) depend on ontological choices, my case is most conveniently illustrated by the biological examples (a) and (b). Consider the question whether there are two different tiger species in the San Diego Zoo. At first, it seems that this question has a pretty straightforward empirical answer that can be determined by a biologist in a value-free manner: she simply has to go to the zoo and look whether there are two tiger species.

Unfortunately, the situation is more complex because tigers raise taxonomic issues that are not always answered in the same way by biologists. Let us assume that there are Bengal Tigers (*Panthera tigris tigris*) and Sumatran Tigers (*Panthera tigris sumatrae*) in the San Diego Zoo. Most biologists assume that there is only one tiger species (*Panthera tigris*) and that the Bengal Tiger and the Sumatran Tiger only qualify as subspecies. According the influential “biological species concept”, two populations belong to the same species if they are able to produce fertile offspring of both sexes (Mayr 1969). Bengal Tigers and Sumatran Tigers are able to produce fertile offspring of both sexes and a biologist who uses the biological species concept will therefore conclude that (b) is false.

However, there are many alternatives to the biological species concept. For example, the so-called “phylogenetic species concept” defines species as “the smallest diagnosable cluster of individual organisms within which there is a parental pattern of ancestry and descent” (Cracraft 1983, p. 170; LaPorte 2009, pp. 70–76). Bengal and Sumatran Tigers are different clusters in this sense and proponents of the phylogenetic species concept will therefore conclude that (b) is true. The truth

value of (b) therefore depends on the account of species that is used in developing a biological ontology.

A similar point can be made with respect to orchids and the statement (a). Orchids constitute a highly diverse biological family of flowering plants with more than 20,000 species. The exact number of orchid species depends on the criteria for species membership. As there is not one universally accepted set of criteria, biologists will disagree on the exact number of orchid species. This disagreement also affects more specific scientific statements. If two biologists use different criteria for species membership of orchids, they may very well also end up disagreeing on the truth value of (a).

The examples of tigers and orchids illustrate my claim that the truth values of scientific statements depend on ontological choices. Different accounts of species imply the existence of different biological kinds and in this sense different biological ontologies. Furthermore, it makes sense to speak of “choice” in this context because scientists have to decide which account they want to work with. While the label “ontological choice” may be controversial in analytic metaphysics, I therefore assume that it refers to a common phenomenon in scientific practice (cf. Ludwig 2015d, chapter 4).

While biological kinds provide convenient examples for the claim that the truth values of scientific statements depend on ontological choices, similar points can be made with respect to other scientific statements including (c)–(g). (c) is one of the most famous results of early cognitive psychology and has been formulated in George Miller’s landmark article “The Magical Number Seven, Plus or Minus Two” (1956). Although Miller’s hypothesis is based on empirical discoveries in experimental psychology, one can still argue that the truth value of (c) depends on ontological choices as (c) presupposes a certain account of short-term memory.

Consider debates about externalist accounts of memory and cognition in general (e.g. Clark and Chalmers 1998). Externalists argue that cognitive processes such as memory can be extended through external devices from paper notebooks to digital media (Ludwig 2015d). Given such an externalist account, it does not make sense to claim that the short-term memory is restricted to seven plus or minus two units. Instead, the capacity of the of short-term memory changes dynamically with the cognitive extensions that are available in the environment. (c) therefore turns out to be true only under the assumption of internalist ontology and should be considered false under the assumption of externalism.

Given my discussion of (a)–(c), it is not hard to see in what sense the truth values of (d)–(g) may also depend on ontological choices. Whether 35.9 % of adults in the US are obese obviously depends on scientists’ accounts of obesity and whether grief (and if so, what kinds of grief) qualifies as depression depends on psychiatrists’ accounts of depression (Intemann 2001; Zachar 2015). The same argument can be made with respect to intelligence and I.Q. One crucial question is what cognitive abilities should be considered relevant for intelligence. Furthermore, psychologists disagree on the question whether we should assume the existence of a general intelligence at all and proponents of multiple intelligences theories have proposed large variety of more specialized intelligences such as “verbal intelligence”, “mathematical intelligence”, or “spatial intelligence” (Ludwig 2014b). Clearly the

truth values of (f) and (g) depend on these issues of psychological ontologies. A psychologist who works with a framework of multiple intelligences will reject both statements on the basis of her rejection of a general intelligence. Furthermore, even psychologists who agree on the assumption of a general intelligence may disagree on the criteria for intelligence and therefore end up disagreeing on the truth values of (f) and (g).

To sum up, scientists often have to choose between different accounts of entities such as species, memory, obesity, depression, or intelligence. These different accounts imply different scientific ontologies in the sense that they imply the assumption of different entities. Finally, these different ontologies clearly affect the truth values of statements such as (a)–(g).

### 3 Explanatory Interests and Natural Kinds

In the last section, I argued that scientists often have to choose between different ontologies that imply different attitudes towards scientific statements such as (a)–(g). This claim raises the obvious question of *how* scientists choose between different ontologies. Philosophers of science commonly answer this question by pointing to different explanatory interests that shape ontological choices in scientific practice (e.g. Brigandt 2009; Leonelli 2012; Ruphy 2013; Ludwig 2014a; Danks 2015). Insofar as scientists are concerned with different explanatory projects, they will often find different ontologies useful for their research.

Kitcher's (1984) influential discussion of species pluralism provides a classical illustration of this strategy by discussing the explanatory benefits and limits of different species concepts: One commonly mentioned achievement of Mayr's biological species concept is that it allows to distinguish between two different species of mosquitoes within the *Anopheles* complex and therefore provides an explanation of the distribution of malaria in Europe (e.g. Mayr 1969). This explanation would not be possible in the context of traditional morphological species concepts due to the morphological similarities of mosquitoes within the *Anopheles* complex. While this example illustrates why the biological species concept is preferable in the context of some research projects, there are other areas of biological research that suggest different species concepts. For example, the biological species concept is clearly not an attractive choice for biologists who work on asexual organisms.

The constitutive role of explanatory interests in ontological choices suggests that the truth values of statements such as (a) and (b) depend on explanatory interests of biologists: the truth values of (a) and (b) depend on the choice of a species concept. The choice of a species concept depends on the explanatory interests of biologists. As "dependency" in the present sense is clearly a transitive relation, the truth values of (a) and (b) also depend on the explanatory interests of biologists.

Furthermore, one can extend this claim beyond biological ontologies to statements such as (c)–(g). Recall that (c) will be true in the context of an internalist ontology that restricts the short-term memory to biologically realized processes but false in the context of an externalist ontology that accepts that external

media such as notebooks or cell phones can become part of someone's short-term memory. It seems reasonable to assume that the choice of an externalist or internalist ontology also largely depends on explanatory interests of cognitive scientists. An internalist account of memory as it has been used by Miller (1956) in his formulation of (c) can be justified in the context of many traditional approaches in cognitive psychology that are primarily concerned with the internal machinery of cognition as it is realized by the human brain. Given this research interest in the internal "brainbound" structure of cognition, there is little use for cognitive processes that extend beyond the organism. Although the internalist account has been a defining aspect of cognitive psychology in the second half of the twentieth century, there are also research projects that suggest a different ontological framework. This is most obvious in the case of research on problem solving strategies that is not concerned with properties of internal mechanisms but with human behavior in complex environments. Problem solving usually relies on internal and external resources and humans often use both kinds of resources in surprisingly similar ways. Externalist often motivate their ontological choices by referring to research on problem solving such as Gray and Fu's experiments (2004) that illustrate how little the external-internal distinction matters in the context of many cognitive tasks. It therefore seems reasonable to assume that the choice for a specific account of memory also reflects the explanatory interests of scientists (Pöyhönen 2014; Ludwig 2015c, chapter 4.2).

The case for ontological pluralism in philosophy of science suggests a rather straightforward justification for my claim that the truth values of scientific statements (a)–(g) depend on ontological choices. A statement such as (a) may be true under the assumption of one ontology A but false under the assumption of another ontology B. If we assume that the choice between the ontologies A and B depends on explanatory interests, it seems that we should also accept that the truth values of many scientific statements depends on these epistemically driven choices. Still, one may worry that my endorsement of a pluralist account of scientific ontologies has been too quick as it does not adequately consider that some ontologies may be more successful than others in "carving nature at its joints". Indeed, my claim would become trivial in the light of a philosophical position that considers the boundaries of entities to be conventional constructions and rejects any realism whatsoever. As recent controversies about natural kinds illustrate (e.g. Khalidi 2013; Ludwig 2015b; Slater 2015), however, a general conventionalism about scientific ontologies is highly controversial. Insofar my argument depends on such a conventionalism, it will arguably be considered a non-starter by most proponents of VFI.

While a conventionalist account of scientific ontologies would be indeed sufficient for my claim that truth values of scientific statements depend on ontological choices, conventionalism is by no means necessary. In fact, a pluralist account of ontological choices is compatible with most of the currently popular accounts of natural kinds in philosophy of science. This compatibility is most obvious in the case of "epistemology only" (MacLeod 2010) formulations of natural kinds. The idea that the naturalness of scientific kinds depends on their epistemic relevance introduces at least some non-conventional elements (cf.

Brigandt 2009). The choice between ontologies is not conventional in a similar sense as the choice between signifiers such as “snow”, “Schnee”, and “neige” is conventional as it will often turn out that one ontology is much more fruitful than others in achieving our epistemic aims. Furthermore, the fruitfulness of an ontology cannot be determined a priori but only on the basis of an open-ended empirical inquiry. While epistemological accounts of natural kinds introduce non-conventional elements, they are still often compatible with my claim that truth values of scientific statements depend on ontological choices. Indeed, if we would find that one ontology is epistemologically superior across all contexts of application, we may conclude that scientific practice does not involve ontological choices in a substantial sense. However, examples such as different accounts of species illustrate that scientists with different explanatory interests often find different ontologies epistemically fruitful and therefore opt for different ontologies.

While purely epistemological accounts of natural kinds may be compatible with my discussion of ontological choices, many philosophers have argued that any convincing account of natural kinds will require at least some metaphysical depth. Some kinds are epistemically more fruitful than others *because* they have certain features. Many current accounts of natural kinds with metaphysical ambitions rely on claims about property clustering—whether characterized as “stable property clusters” in general (Slater 2015), causally unified property clusters (Khalidi 2013; cf. Craver 2009), or more specifically homeostatic property clusters (Wilson et al. 2007).

However, even these more ambitious notions of natural kinds are arguably compatible with my discussion of ontological choice. Again, consider my example of orchid species (a) and two different ontologies A and B that imply different truth values of (a). While it may be that only A or B provides an account of orchids that satisfies characterizations of natural kinds as property clusters, it may also happen that both ontologies pick out stable albeit somewhat different property clusters. Indeed, decades of debates about different species ontologies have taught us that the latter result is actually more realistic. The plurality of different species concepts is so persistent precisely because there are different ways of picking out stable and causally unified property clusters. For example, recall Kitcher’s case of a shift towards the ecological species concept in the case of research on interactions between asexual organisms in a coral reef. Both a focus on reproductive patterns and on ecological niches will lead to the discovery of (partly overlapping) property clusters but the relevance of discovered clusters depends on explanatory goals. A metaphysical specification of natural kinds in terms of property clusters therefore does not stand in the way of pluralist account of different ontological choices.

To sum up, my claim that the truth values of scientific statements depend on ontological choices does not presuppose a general conventionalism about scientific ontologies but is compatible with a variety of epistemological and metaphysical characterizations of natural kinds. Of course, this does not mean that my proposal of ontological choices is compatible with *every possible* account of natural kinds. Most obviously, one could endorse a strong metaphysical realism that insists on exactly one correct scientific ontology and one correct way of carving nature at its joints. While such a monism retains a certain popularity in some areas of analytic



metaphysics (e.g. Sider 2011), it is usually limited to the “fundamental sciences” and not extended to the idea of one fundamental biological or psychological ontology. The assumption that scientific practice in the life sciences comes with ontological choices therefore only requires the (at the most) mildly controversial assumption that we should not expect one biological or psychological ontology to be preferable across all explanatory contexts.

#### 4 Non-epistemic Values in Ontological Choices

I have argued that the truth values of many scientific statements depend on ontological choices and that ontological choices depend on explanatory interests of scientists. There is a tension between these claims and any variant of VFI that is motivated by the allegedly clear distinction between fact questions and value questions. Consider questions such as “How many species of orchids became extinct in Indonesia during the twentieth century?” or “What is the capacity of the human short-term memory?”. While these questions are clearly fact questions in the sense of Weber, the value-dependency of ontological choices suggests that they cannot be understood as completely independent of value questions.

Proponents of VFI may attempt to solve this tension by emphasizing the distinction between epistemic and non-epistemic values. Proponents of VFI are happy to accept epistemic values in theory choices (e.g. McMullin 1982) and can also accept epistemic values in ontological choices as long as social and other non-epistemic values remain excluded. A look at my examples (a)–(c) can further strengthen the intuition that we can and should avoid non-epistemic values in ontological choices. My examples of species and short-term memory suggest that epistemic values such as explanatory power are crucial in ontological choices. A plurality of equally legitimate ontologies has to be understood as consequence of explanatory power being dependent on explanatory interests: While the biological species concept has proven to be extraordinarily helpful in some explanatory contexts (e.g. the Malaria case), it evidently lacks explanatory power in other contexts (e.g. asexual organisms). The same point can be made with respect to memory research. Whether an internalist or externalist account of cognition has more explanatory power crucially depends on explanatory interests. All of this seems not to be a problem for proponents of VFI who are happy to admit that epistemic values such as explanatory power are crucial for the evaluation of scientific theories. As long as ontological choices are made solely on the background of these epistemic values, my discussion of ontological choices does not seem to pose a threat to VFI.

There are at least three problems with this defense of VFI. As I mentioned in the introduction, some philosophers reject VFI by arguing that we cannot neatly separate epistemic and non-epistemic values. While this objection may undermine the idea of value-free ontological choices, it would also make my argument dependent on a more general objection against VFI. I will therefore presuppose the distinction between epistemic and non-epistemic values for the sake of argument. But even if we grant proponents of VFI epistemic values, there remain two



problems with the exclusion of non-epistemic values in ontological choices. First, I will argue that explanatory interests are often shaped by non-epistemic factors and cannot be reduced to epistemic values. Second, ontological choices are often not only dependent on explanatory interests but also directly on non-epistemic factors.

Let us first consider the question whether explanatory interests can be understood independently of non-epistemic values. A look at the vast and diverse literature on “the edges and boundaries of biological objects” (Haber and Odenbaugh 2009) raises doubts that the explanatory interests that shape biological ontologies can be understood as purely epistemic. In the case of some biological subdisciplines such as conservation biology, it appears almost trivial that non-epistemic concerns shape the explanatory interests of researchers. For example, the assumption of properties such as the diversity, integrity, sustainability, or health of ecosystems (Callicott et al. 1999; Wallace 2007) reflects explanatory interests of conservation biologists but these explanatory interests reflect non-epistemic concerns regarding ecosystems. Biologists in a society with different non-epistemic interests would have different explanatory interests and would therefore end up with different ontologies.

The situation appears less clear in the case of other biological issues such as different accounts of species. For example, the biological species concept is not attractive in research on asexual organisms but it is at least not immediately clear that an explanatory interest in asexual organisms should be understood as partly non-epistemic. One possible response is to accept that explanatory interests in biology are sometimes but not always shaped by non-epistemic factors. Therefore, some biological ontologies reflect only epistemic interests while others depend on non-epistemic factors.

However, one may also argue for the stronger claim that explanatory interests in biology are always shaped by non-epistemic factors even if they are often not as obvious as in the case of conservation biology. Explanatory interests have to be evaluated on the background of socially shaped assessments of scientific significance (Kitcher 2011). For example, different species concepts come with different explanatory strengths and weaknesses which need to be weighted by scientists (e.g. Stanford 1995). While it is clear that biological taxonomies should make significant distinctions, it is far from clear that there is a purely epistemic account of the significance of a distinction. Consider, for example, the case of Mayr’s biological species concept and its success in explaining the distribution of Malaria in Europe by distinguishing between two species in the *Anopheles* complex. While the example indicates an area where the biological species concept comes with explanatory resources that are superior to (some of) its rivals, the importance of this example also clearly depends on our non-epistemic interests. The ability to discern different species within the *Anopheles* complex is an impressive example for the explanatory benefits of the biological species concept *because* we care about human diseases and therefore also about the distribution of Malaria.

Of course, the roles of non-epistemic values vary with their importance for an ontological issue. In the case of species concepts, the relevance of non-epistemic values may often appear obscure as it is at least not obvious that the choice of one species concept over another has important social implications. The situation is different if we consider the case of race instead of species. The rejection of human

racess as legitimate biological entities is often associated with their limited explanatory usefulness (Maglo 2011; Hochman 2013; Mncube 2015). For example, Lewontin's (1972) classical argument that most genetic variation is found in and not between populations such as African or Asian was enormously influential in questioning the explanatory value of races and rejecting their taxonomic legitimacy.

While a primarily epistemic case against race may work in biological taxonomy, the situation is more complex in current debates about race in the biomedical sciences. Racial realists in the biomedical sciences typically grant epistemic limitations that have been stressed in the tradition of Lewontin but still insist on the significance of race in socially relevant biomedical applications. Risch et al. (2002, 1), for example, argue for an "epidemiologic perspective on the issue of human categorization in biomedical and genetic research that strongly supports the continued use of self-identified race". Even if we accept Lewontin's findings and the limited explanatory use of "race" in taxonomy, Risch et al. insist that racial distinctions capture relevant differences such as the prevalence of Mendelian diseases that are often "found only in specific races (for example, cystic fibrosis and hemochromatosis in Caucasians)" (2002, 9).

The issue of socially relevant explanations is not only prominent in defenses but also in challenges of current biological accounts of race. First, critics of biological accounts of race usually accept that races can be used as proxies for some biomedically relevant genes but insist that they are unnecessarily coarse-grained and unreliable proxies (e.g. Root 2003). Consider one of Risch et al.'s examples such as hemochromatosis. Mutations that are causally responsible for hemochromatosis are indeed more common in Caucasian populations such as Irish and Norwegian but the use of "Caucasian" as a proxy for determining risk groups would create a large and unnecessary amount of false positives (e.g. Italians or Italian-Americans). Maybe even more worrying is that the use of race as a proxy can lead to false negatives in cases such as sickle-cell anemia and children of Southern European ancestry (Kaufman and Cooper 2010).

Second, philosophers who understand races as social and not as biological kinds (e.g. Mills 1998; Haslanger 2012; Taylor 2013) could grant that biological accounts of race come with some relevant explanatory resources but insist that they are dwarfed by the explanatory resources of social accounts of race. Given that current biological realists accept that the social realities of race cannot be explained in terms of biological causes, a social constructionist can argue that it is more fruitful to think of races as social instead of biological groups.

Of course, a proponent of biological realism could react to the second argument by proposing a discipline-relative pluralism: "race" in the biomedical sciences refers to biological populations and "race" in the social sciences refers to social groups. Furthermore, a social constructionist could reject this proposal by pointing out that socially caused differences between racialized groups are of crucial importance not only in the social but also in the biomedical sciences. Lorusso and Bacchini (2015; cf. Kaplan 2010), for example, have argued that "race-based" studies in the context of complex diseases are justified only if "self-identified race" is used as a proxy for social realities and not for genetic differences.

The goal of my discussion is not to decide these complex issues but to point out that explanatory interests are entangled with social concerns in the case of race. Indeed, current controversies about the ontological status of race reflect questions about the explanatory relevance of racial distinctions. A discussion of these questions, however, does not provide a purely epistemic ground that would allow us to decide the ontological status of races independently of non-epistemic concerns. On the contrary, a substantial discussion of explanatory benefits and disadvantages of different accounts of race requires careful consideration of our non-epistemic aims. Recognizing this entanglement of epistemic and non-epistemic issues is of crucial importance for understanding the structure of current debates about racial ontologies. Risch et al. for example, combine their defense of a biological account of race with the appeal to an “objective scientific perspective” (2003, p. 1) that is supposed to validate their proposal and contrasts with the socially motivated claims of eliminativists. Framing the debate by opposing “objective scientific” and “socially motivated” perspectives reflects a fundamental misunderstanding of the debate as the usefulness of racial distinctions cannot be evaluated in isolation of our non-epistemic aims.

So far I have argued that an exclusion of non-epistemic values from ontological choices is not possible because explanatory interests of scientists are shaped by non-epistemic factors. However, there is a further problem: many ontological choices not only depend on explanatory interests but also directly on non-epistemic values. In order to illustrate this dependency on non-epistemic values, we do not even need to move to new examples but can stick with the cases of species and race. In fact, it is not difficult to find real-life examples of how choices between species ontologies become directly entangled with non-epistemic concerns. For example, consider phylogenetic accounts of species that follow cladistic approaches and often lead to the recognition of far more species than traditional accounts of species in terms of interbreeding or even morphology. The often staggering differences in the number of recognized species do not only lead to epistemic but also straightforward non-epistemic implications of ontological choices. For example, a conservation biologist who is concerned with the preservation of vulnerable species has to choose what counts as a species and the choice will affect conservation practices. Zachos et al. (2013, p. 1) provide illuminating examples of this as they argue that phylogenetic accounts can lead to an inflation of “new species [that] creates an unnecessary burden on the conservation of biodiversity.”

While the case of phylogenetic species concepts illustrates that overly fine-grained ontologies can be problematic for conservation biology, conservation concerns can also lead in the other direction as the case of the Alabama Sturgeon illustrates (Scharpf 2000; cf. Winther and Kaplan 2013, footnote 15). The Alabama sturgeon (*Scaphirhynchus suttkusi*) is a critically endangered fish that exists only in a small portion of the lower Alabama River. Recognizing the Alabama sturgeon as a distinct species would place it on the Endangered Species List and lead to conservation measures that were strongly opposed by an industrial interest group along the Alabama River. The consequence of this opposition was a long political, scientific, and legal struggle over the status of the Alabama sturgeon until a lawsuit in 2000 mandated protection of the fish.

The case of the Alabama sturgeon is a helpful reminder that biological taxa often become agents in complex networks that include diverse entities such as the US Fish and Wildlife Service, industrial lobby groups, legal documents and laws, environmental activists, conservation policies and budgets, and so on. The introduction or elimination of taxa as well reconsiderations of their boundaries can have considerable effects on these networks (cf. Mol 1999; Latour 1999). It is therefore a misunderstanding to think that the choice between different species ontologies will exclusively reflect explanatory issues.

While direct influences of non-epistemic values may be somewhat unexpected in the case of species, debates about the ontological status of race are more commonly interpreted as normative (e.g. Mallon 2006; Gannett 2010; Winther and Kaplan 2013; Ludwig 2015a). I have already argued that controversies about racial ontologies reflect non-epistemic concerns that shape explanatory interests regarding human diversity. However, there are also more direct influences as illustrated by debates about the effects of racial distinctions in public understanding of human diversity (e.g. Morning 2011; Donovan 2014; Phelan et al. 2013). The worry that biological accounts of race create a burden for science communication and science education can be motivated by the observation that they require constant distinctions between correlation and causation. On the one hand, membership to biologically defined races will be correlated with social differences in education, criminal justice system, health care, and so on. On the other hand, the biological properties will not be causally relevant and can therefore easily lead to a conflation of correlation and causation.

This worry about public misunderstanding of human diversity can be substantiated by recent research on the use of biology textbooks in high school education. Donovan (2014) compared the impact of using racialized and non-racialized textbooks on reasoning about human diversity. In his study, racialized textbooks introduced diseases such as sickle cell anemia or cystic fibrosis in racial terms (e.g. “particularly common among people of African descent”) while non-racialized textbooks referred more generally to geographic variability (e.g. “carriers of sickle cell anemia are more resistant to malaria, a common and serious disease in many parts of the world”) (Donovan 2014, p. 470). While the racialized passages did not make any assumptions about cognitive or behavioral differences, Donovan’s data suggests that “subtle references to race in the modern biology curriculum can lead students to agree more strongly that races differ in complex human traits (e.g. academic ability and artistic ability) because of genetics” (Donovan 2015, p. 1; cf. Condit et al. 2004; Phelan et al. 2013 for complementary studies on the effects of media reports).

Concerns about public (mis)understanding of race in science communication and science education can provide another non-epistemic reason to reject biological accounts of race. In this case, the non-epistemic concern does not shape explanatory interests but rather directly affects an ontological choice. As a matter of empirical description, it should be uncontroversial that ontological choices often involve a complex mix of epistemic and non-epistemic considerations and can also be shaped by direct social concerns such as public (mis)understanding of scientific research. However, my discussion of ontological choices in the last sections suggests the

stronger claim that there is no good reason to exclude these non-epistemic concerns from debates about racial ontologies. Given the assumption that there is not one metaphysically correct way of distinguishing between human populations, we will have to choose between different ways of “carving up” human diversity. And given that this is a genuine choice, it is unclear why we should consider non-epistemic values secondary or even exclude them from decision-making processes. Epistemic values are often considered to be of prior relevance in theory choice because they are truth-indicating in the sense that they “promote the attainment of truth” (Steel 2010, p. 17). If there is not only one correct ontology, however, this line of argument clearly fails to prioritize epistemic values in ontological choices.

## 5 The Argument Against VFI

The considerations of the last sections suggest a quite simple argument against VFI:

*Premise 1)* The truth values of scientific statements depend on ontological choices. *Premise 2)* Ontological choices depend on non-epistemic values. *Conclusion 1)* The truth values of scientific statements depend on non-epistemic values. *Premise 3)* If the truth values of scientific statements depend on non-epistemic values, then we should reject VFI. *Conclusion 2)* We should reject VFI.

In Sects. 2 and 3, I have argued for the first premise of the argument. I have admitted that this premise presupposes the rejection of a strong metaphysical realism that implies a monist account of biological and psychological ontologies. A philosopher who is convinced that there is exactly one fundamental account of entities such as species, race, memory, intelligence, obesity, or depression will reject this premise and insist that scientific statements such as (a)–(g) have truth values that do not depend on ontological choices but rather on fundamental ontological facts. I have argued that even the endorsement of a substantial metaphysical account of natural kinds is compatible with a moderate pluralism that requires ontological choices in the life sciences. Proponents of VFI who do not want to presuppose such a monism have to reject either the second or the third premise. However, it seems that the second premise is well justified. First, ontological choices are shaped by explanatory interests that are often inextricably entangled with non-epistemic values. Second, the examples of species in conservation biology and of racial ontologies show that ontological choices are also often directly shaped by non-epistemic concerns.

However, one may still reject the relevance of all of this for debates about VFI by rejecting the third premise of the argument. Maybe truth values of scientific statements such as (a)–(g) depend on non-epistemic values but this value-dependency does not threaten a moderate version of VFI. Maybe we can somehow disentangle the value-laden component of ontological choice from the value-free component of empirical evidence and limit VFI to the latter.

I take this objection seriously and I will discuss it in the next section. However, first I want to point out the *prima facie* incompatibility of the claim that the truth values of scientific statements depend on non-epistemic values and most common formulations of VFI. Consider Weber’s strict distinction between fact questions

(what is the case in the world?) and value questions (what should be the case in the world?) that provide the basis of his account of value-free science. While it is certainly often helpful to distinguish between fact questions and value questions, the claim that both types of questions are entirely independent from each other is highly dubious in the case of my examples (a)–(g). Certainly, (a)–(g) are factual statements in Weber’s sense but given their dependency on value-laden ontological choices, they are clearly not completely independent from non-epistemic values.

Similar problems arise in the context of contemporary formulations of VFI that are not explicitly based on the distinction between fact questions and value questions but assume that the evaluation (e.g. Lacey 2010; Sober 2007) or justification (e.g. Betz 2013) of scientific theories or statements should not involve non-epistemic values. Again, the tension between my discussion and these suggestions seems almost trivial: If the truth values of statements such as (a)–(g) are dependent on ontological choices and if ontological choices are dependent on non-epistemic values, then it is not possible to evaluate or to justify (a)–(g) independently of non-epistemic values.

## 6 Avoiding Ontological Commitments?

The basic idea of my argument against VFI is that scientific statements presuppose ontological choices that are often shaped by non-epistemic values. One possible response to this challenge is to suggest that scientists can somehow avoid ontological commitments and restrict themselves to a discussion of empirical evidence that remains independent of any non-epistemic concerns. For example, consider the case of tigers in the San Diego Zoo. I have argued that there are two species of tigers according to the phylogenetic species concept but only one according to the biological species concept. One may argue that a scientist could limit herself to making this statement without having to endorse either of these accounts.

There is certainly some truth to this objection. Scientists do not always have to choose sides in ontological conflicts and can often formulate their results in terms of conditionals that leave an ontological issue open. However, this suggestion will not work if it is supposed to exclude all ontological commitments and I will argue in this section that scientists often have to make ontological choices in order to conduct empirical research.

To illustrate why general avoidance of ontological commitments is not viable in scientific practice, let us consider one last case study. Research on domestic violence has considerably broadened its scope in the past 20 years through intersectional approaches that do not only consider gender but rather entangled social structures such as class, gender, race, and sexual orientation. This reorientation reflects the now widely shared assumption that earlier research on domestic violence was biased in not investigating a “universal family reality but the conditions of white middle-class heterosexual families” (Bograd 2005, p. 27).

As Kourany (2010) points out in *Philosophy of Science After Feminism*, intersectional studies on domestic violence provide rich examples for the

importance of values in scientific research. Kourany focuses on Carolyn West's research on the experiences of domestic violence of African American women in the United States. On the one hand, this project requires careful attention to structures that shape domestic violence in this specific context and have been ignored by accounts that focus on white middle-class households. On the other hand, West's project is also committed to analyzing unique social positions such as "African American couples who are young, undereducated, impoverished, unemployed, urban dwellers" (West 2004, 1487) without perpetuating the stereotype "that black Americans are biologically or culturally more prone to violence than other ethnic groups" (West 2004, p. 1489).

West's project provides an excellent case study for discussions of non-epistemic values in scientific practice. First, considering the experiences of African American women clearly shapes explanatory interests in the sense that it raises questions about social structures that were not considered in earlier research. Second, it also provides clear examples of direct influences of social considerations beyond explanatory interests such as the aim to avoid racial stereotypes. These considerations affect not only the collection of data but also answers to the question what counts as domestic violence in the first place. For example, Taft et al. (2009, p. 50) argue that the limited focus of earlier research has led to "conceptualizations [that] are predominantly grounded in the experience and worldview of Caucasian women."

Insofar as the boundaries of domestic violence are in question, there are many variables to consider. Some of them reflect general issues with boundaries of violence such as the questions whether violence should be considered illegitimate and/or physical by definition (Dempsey 2005). Other variables are more specific to the domestic context and have been questioned in the light of intersectional approaches. For example, accounts that presuppose gender asymmetry undermine research on domestic violence in same-sex couples. In the case of race, West (2008) stresses the need for an account that includes phenomena that have been masked by racial stereotyping as "normal" experiences of black women.

Returning to the question whether scientists can avoid ontological commitments, it is certainly plausible that researchers do not always have to be committed to exactly one account of domestic violence. In fact, a consideration of different accounts of domestic violence may be beneficial and could elucidate relevant patterns of how rates of domestic violence differ depending on the chosen account. However, even a consideration of different accounts of domestic violence will require the choice of a relevant subset. There are far too many variables that can also be weighed differently to consider all logically possible accounts of domestic violence. First, one may therefore argue that an avoidance of choices is not even logically possible. There are not only countless logically possible ways of defining "domestic violence" but every attempt to provide a complete list would arguably also lead to a regress problem. Definitions of "domestic violence" will refer to other entities such as intimate partners or physical abuse that can also be interpreted in different ways. And if we would also try to avoid one specific account of intimate partners or physical abuse, we would end up in a definitional regress by again having to refer to new entities.



Logical problems aside, it should be uncontroversial that avoiding specifications of “domestic violence” is not viable in scientific practice. What matters for researchers is not the logical space of all possible accounts of domestic violence but rather the choice of an (epistemically and socially) adequate account. For example, researchers who want to study the prevalence of domestic violence in a specific context will know what to look for only after having specified what counts as domestic violence. One of the charges against earlier accounts of domestic violence is precisely that they led to the collection of data that ignored the experiences of African American women and other marginalized groups. In contrast, a broader notion of domestic violence that reflects intersectional structures implies different criteria and therefore the need for different data. One can therefore not even design a meaningful study of domestic violence without making at least some choices regarding its boundaries.

The case of domestic violence provides a plausible illustration of the necessity of ontological choices in scientific practice and also connects the arguments of this article with research in feminist philosophy of science on diverse case studies from the social sciences such as divorce (Anderson 2004), employment rates (Anderson 1995), inflation (Dupré 2007), and rape (Dupré 2007). However, the same arguments can also be developed with examples from the natural instead of the social sciences. For example, attempts to avoid ontological choices in the case of species lead to analogous problems. First, one can reject the very idea of a list of all logically possible accounts of species. Second, avoiding any specifications of species would clearly not be viable in scientific practice as biologists need to specify criteria in order to know what data to collect. No matter whether we look at the natural or the social sciences, the general lesson of this section therefore remains the same: In order to get to the empirical issues, scientists need to specify the boundaries of entities and ontological choices are therefore ubiquitous in scientific practice.

## 7 Conclusion

In this article, I have argued that the truth values of scientific statements depend on ontological choices (Sects. 2, 3) and that ontological choices often depend on non-epistemic values (Sect. 4). Furthermore, I have argued that this value-dependency of scientific ontologies undermines VFI (Sect. 5) as it is neither desirable nor possible to avoid ontological commitments (Sect. 6).

While I have formulated a general objection against VFI, the article also suggests a more positive picture of the roles of non-epistemic values. Focusing on these positive elements can be motivated by the case for “a new direction for science and values” (Hicks 2014) that moves beyond general controversies about VFI to more nuanced discussions of the appropriate roles of non-epistemic values (cf. Anderson 2004; Longino 2004 for related points). First, the ideal of a value-free science has become widely rejected by philosophers of science and one may worry that general objections against VFI are therefore only going to confirm what many philosophers already agree on. Second, a general rejection of VFI may be helpful in reminding us

of the “socially engaged” dimension of philosophy of science (Cartieri and Potochnik 2014) but it does not provide a positive characterization of the roles that non-epistemic values should play in scientific practice. Given that criticism of VFI should not lead to acceptance of every social value in every context of scientific practice (cf. Wilholt 2009; Kitcher 2011; Biddle and Leuschner 2015), it becomes of crucial importance to specify legitimate roles of non-epistemic values beyond the generic statement that they cannot be completely excluded.

Reflecting the need for a more nuanced picture, one can also read this article as an attempt to specify an area of scientific practice in which non-epistemic values play a productive and legitimate role in the formulation of scientific theories. Given that recent debates about science and values tend to focus on issues of uncertainty and induction (e.g. Winsberg 2012; Biddle 2013; Morrison 2014; Intemann 2015; Leuschner 2015 cf. Brown 2013), a discussion of ontological choices broadens the perspective of debates about social values in scientific practice. The case studies of this article illustrate positive roles of social values in scientific ontologies from species in conservation biology and race in biomedical research to intelligence in psychology and domestic violence in the social sciences. While these case studies lead to a positive perspective on the roles of non-epistemic values in scientific ontologies, they clearly do not provide a fully developed account. Such an account would not only require examples of non-epistemic values in scientific ontologies but also a discussion of how we should integrate them with epistemic considerations and the empirical evidence. Addressing the structure of such an integration requires that we move beyond general arguments about VFI and engage with ontological choices in their unique disciplinary, historical, and social settings.

**Open Access** This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

## References

- Anderson, E. (1995). Knowledge, human interests, and objectivity in feminist epistemology. *Philosophical Topics*, 23(2), 27–58.
- Anderson, E. (2004). Uses of value judgments in science: A general argument, with lessons from a case study of feminist research on divorce. *Hypatia*, 19(1), 1–24.
- Betz, G. (2013). In defence of the value free ideal. *European Journal for Philosophy of Science*, 3(2), 207–220.
- Biddle, J. (2013). State of the field: Transient underdetermination. *Studies in the History and Philosophy of Science Part A*, 44, 124–133.
- Biddle, J., & Leuschner, A. (2015). Climate Skepticism and the manufacture of doubt. *European Journal for Philosophy of Science*, 5(3), 261–278.
- Bograd, M. (2005). Strengthening domestic violence theories. In N. Sokoloff & C. Pratt (Eds.), *Domestic violence at the margins* (pp. 15–38). New Brunswick: Rutgers University Press.
- Brigandt, I. (2009). Natural kinds in evolution and systematics. *Acta Biotheoretica*, 57(1–2), 77–97.
- Brown, M. (2013). Values in science beyond underdetermination and inductive risk. *Philosophy of Science*, 80(5), 829–839.
- Büter, A. (2015). The irreducibility of value-freedom to theory assessment. *Studies in History and Philosophy of Science Part A*, 49, 18–26.

- Callicott, J. B., Crowder, L. B., & Mumford, K. (1999). Current normative concepts in conservation. *Conservation Biology*, 13, 22–35.
- Cartieri, F., & Potochnik, A. (2014). Toward philosophy of science's social engagement. *Erkenntnis*, 79(5), 901–916.
- Clark, A., & Chalmers, D. (1998). The extended mind. *Analysis*, 58(1), 7–19.
- Condit, C., et al. (2004). Exploration of the impact of messages about genes and race on lay attitudes. *Clinical Genetics*, 66(5), 402–408.
- Cracraft, J. (1983). Species concepts and speciation analysis. *Current Ornithology*, 1, 159–187.
- Craver, C. F. (2009). Mechanisms and natural kinds. *Philosophical Psychology*, 22(5), 575–594.
- Danks, D. (2015). Goal-dependence in (Scientific) Ontology. *Synthese*, 1–16.
- Dempsey, M. (2005). What counts as domestic violence? *William and Mary Journal of Women and the Law*, 12, 301–333.
- Donovan, B. M. (2014). Playing with fire? The impact of the hidden curriculum in school genetics on essentialist conceptions of race. *Journal of Research in Science Teaching*, 51(4), 462–496.
- Donovan, B. M. (2015). Putting humanity back into the teaching of human biology. *Studies in History and Philosophy of Biological and Biomedical Sciences*, 52, 65–75.
- Douglas, H. (2009). *Science, policy, and the value-free ideal*. Pittsburgh: University of Pittsburgh Press.
- Dupré, J. (2007). Fact and value. In H. Kincaid, J. Dupré, & A. Wylie (Eds.), *Value-free science: Ideals and illusions?* (pp. 27–41). Oxford: Oxford University Press.
- Elliott, K. C., & McKaughan, D. J. (2014). Nonepistemic values and the multiple goals of science. *Philosophy of Science*, 81(1), 1–21.
- Gannett, L. (2010). Questions asked and unasked: how by worrying less about the 'really real' philosophers of science might better contribute to debates about genetics and race. *Synthese*, 177(3), 363–385.
- Gray, W. D., & Fu, W. T. (2004). Soft constraints in interactive behavior. *Cognitive Science*, 28, 359–382.
- Haber, H., & Odenbaugh, J. (2009). The edges and boundaries of biological objects. *Biological Theory*, 4(3), 219–222.
- Haslanger, S. (2012). *Resisting reality: Social construction and social critique*. Oxford: Oxford University Press.
- Hicks, D. J. (2014). A new direction for science and values. *Synthese*, 191(14), 3271–3295.
- Hochman, A. (2013). Against the new racial naturalism. *The Journal of Philosophy*, 110(6), 331–351.
- Hudson, R. (2015). Why we should not reject the value-free ideal in science. *Perspectives on Science* (online first).
- Intemann, K. (2001). Science and values: Are moral judgments always irrelevant to the justification of scientific claims? *Philosophy of Science*, 68(3), S506–S518.
- Intemann, K. (2015). Distinguishing between legitimate and illegitimate values in climate modeling. *European Journal for Philosophy of Science*, 5, 1–16.
- John, S. (2015). Inductive risk and the contexts of communication. *Synthese*, 192(1), 79–96.
- Kaplan, J. M. (2010). When socially determined categories make biological realities. *The Monist*, 93(2), 281–297.
- Kaufman, J. S., & Cooper, R. S. (2010). Use of racial and ethnic identity in medical evaluations and treatments. In I. Whitmarsh & D. S. Jones (Eds.), *What's the use of race* (pp. 187–206). Cambridge: MIT Press.
- Khalidi, M. A. (2013). *Natural categories and human kinds*. Cambridge: Cambridge University Press.
- Kitcher, P. (1984). Species. *Philosophy of Science*, 51, 308–333.
- Kitcher, P. (2011). *Science in a democratic society*. New York: Prometheus.
- Kourany, J. (2010). *Philosophy of science after feminism*. Oxford: Oxford University Press.
- Lacey, H. (2010). The constitutive values of science. *Principia: An International Journal of Epistemology*, 1(1), 3–40.
- LaPorte, J. (2009). *Natural kinds and conceptual change*. Cambridge: Cambridge University Press.
- Latour, B. (1999). *Politiques de la nature*. Paris: La Découverte.
- Leonelli, S. (2012). Classificatory theory in data-intensive science. *International Studies in the Philosophy of Science*, 26(1), 47–65.
- Leuschner, A. (2015). Uncertainties, plurality, and robustness in climate research and modeling: On the reliability of climate prognoses. *Journal for General Philosophy of Science*, 46(2), 367–381.
- Lewontin, R. (1972). The apportionment of human diversity. *Evolutionary Biology*, 6, 381–398.

- Longino, H. E. (1996). Cognitive and non-cognitive values in science. In J. Nelson (Ed.), *Feminism, science, and the philosophy of science* (pp. 39–58). Dordrecht: Springer.
- Longino, H. E. (2002). *The fate of knowledge*. Princeton: Princeton University Press.
- Longino, H. E. (2004). How values can be good for science. In P. Machamer & G. Wolters (Eds.), *Science, values, and objectivity* (pp. 127–142). Pittsburgh: University of Pittsburgh Press.
- Lorusso, L., & Bacchini, F. (2015). A reconsideration of the role of self-identified races in epidemiology and biomedical research. *Studies in History and Philosophy of Biological and Biomedical Sciences*, 52, 56–64.
- Ludwig, D. (2014a). Hysteria, race, and phlogiston. A model of ontological elimination in the human sciences. *Studies in History and Philosophy of Biological and Biomedical Sciences*, 45, 68–77.
- Ludwig, D. (2014b). Disagreement in scientific ontologies. *Journal for General Philosophy of Science*, 45(1), 119–131.
- Ludwig, D. (2015a). Against the new metaphysics of race. *Philosophy of Science*, 82(2), 244–265.
- Ludwig, D. (2015b). Indigenous and scientific kinds. *The British Journal for the Philosophy of Science* (ahead of print).
- Ludwig, D. (2015c). *A Pluralist theory of the mind*. Dordrecht: Springer.
- Ludwig, D. (2015d). Extended cognition and the explosion of knowledge. *Philosophical Psychology*, 28(3), 355–368.
- Machamer, P., & Douglas, H. (1999). Cognitive and social values. *Science and Education*, 8(1), 45–54.
- Macleod, M. (2010). The epistemology-only approach to natural kind. In F. Stadler (Ed.), *The present situation in the philosophy of science* (pp. 189–194). Dordrecht: Springer.
- Maglo, K. (2011). The case against biological realism about race. *Perspectives on Science*, 19(4), 361–390.
- Mallon, R. (2006). ‘Race’: Normative, not metaphysical or semantic. *Ethics*, 116, 525–551.
- Mayr, E. (1969). *Principles of systematic zoology*. New York: McGraw-Hill.
- McMullin, E. (1982). Values in Science. *PSA: Proceedings of the biennial meeting of the philosophy of science association*, pp. 3–28.
- Miller, G. (1956). The magical number seven, Plus or Minus Two. *Psychological Review*, 63(2), 81–97.
- Mills, C. (1998). *Blackness visible*. Ithaca: Cornell University Press.
- Mncube, Z. (2015). Are human races cladistic subspecies? *South African Journal of Philosophy*, 34(2), 163–174.
- Mol, A. (1999). Ontological politics. A word and some questions. *The Sociological Review*, 47(S1), 74–89.
- Morning, A. (2011). *The nature of race*. Berkeley: University of California Press.
- Morrison, M. (2014). Values and uncertainty in simulation models. *Erkenntnis*, 79(5), 939–959.
- Phelan, J. C., Link, B. G., & Feldman, N. M. (2013). The genomic revolution and beliefs about essential racial differences. *American Sociological Review*, 78(2), 167–191.
- Pöyhönen, S. (2014). Explanatory power of extended cognition. *Philosophical Psychology*, 27(5), 735–759.
- Putnam, H. (2002). *The collapse of the fact/value dichotomy: And other essays*. Cambridge: Harvard University Press.
- Risch, N., et al. (2002). Categorization of humans in biomedical research. *Genome Biology*, 3(7), 1–12.
- Rooney, P. (1992). On values in science. *PSA: Proceedings of the biennial meeting of the philosophy of science association*, pp. 13–22.
- Root, M. (2003). The use of race in medicine as a proxy for genetic differences. *Philosophy of Science*, 70(5), 1173–1183.
- Ruphy, S. (2006). Empiricism all the way down. *Perspectives on Science*, 14(2), 189–214.
- Ruphy, S. (2013). *Pluralisme scientifique, enjeux épistémiques et métaphysiques*. Paris: Hermann.
- Scharpf, C. (2000). Politics, science, and the fate of the Alabama sturgeon. *American Currents*, 26(3), 6–14.
- Schurz, Gerhard. (2013). *Philosophy of science: A unified approach*. New York: Routledge.
- Sider, T. (2011). *Writing the book of the world*. Oxford: Oxford University Press.
- Slater, M. (2015). Natural kindness. *The British Journal for the Philosophy of Science*, 66(2), 375–411.
- Sober, E. (2007). Evidence and value-freedom. In H. Kincaid, J. Dupré, & A. Wylie (Eds.), *Value-free science* (pp. 109–119). Oxford: Oxford University Press.
- Stanford, P. K. (1995). For pluralism and against realism about species. *Philosophy of Science*, 62(1), 70–91.

- Steel, D. (2010). Epistemic values and the argument from inductive risk. *Philosophy of Science*, 77(1), 14–34.
- Taft, C., et al. (2009). Intimate partner violence against African American women. *Aggression and Violent Behavior*, 14(1), 50–58.
- Taylor, P. C. (2013). *Race: A philosophical introduction*. Malden: Polity.
- Wallace, K. J. (2007). Classification of ecosystem services. *Biological Conservation*, 139(3), 235–246.
- Weber, M. (1917). Der Sinn der ‘Wertfreiheit’ der soziologischen und ökonomischen Wissenschaften. In M. Weber (Ed.), *Gesammelte Aufsätze Zur Wissenschaftslehre* 7 (pp. 489–540). Tübingen: Mohr.
- West, C. M. (2004). Black women and intimate partner violence. *Journal of Interpersonal Violence*, 19(12), 1487–1493.
- West, C. M. (2008). Mammy, Jezebel, Sapphire, and their homegirls. In J. Chrisler, C. Golden, & P. Rozee (Eds.), *Lectures on the psychology of women* (pp. 286–299). New York: McGraw Hill.
- Wilholt, T. (2009). Bias and values in scientific research. *Studies in History and Philosophy of Science Part A*, 40(1), 92–101.
- Wilson, R. A., Barker, M. J., & Brigandt, I. (2007). When traditional essentialism fails. *Philosophical Topics*, 35, 189–215.
- Winsberg, E. (2012). Values and uncertainties in the predictions of global climate models. *Kennedy Institute of Ethics Journal*, 22(2), 111–137.
- Winther, R. G., & Kaplan, J. M. (2013). Ontologies and politics of biogenomic ‘Race’. *Theoria*, 60(136), 54–80.
- Zachar, P. (2015). Grief, depression, and the DSM-5: a review and reflections upon the debate. *Revista Latinoamericana de Psicopatologia Fundamental*, 18(3), 540–550.
- Zachos, F., et al. (2013). Species inflation and taxonomic artefacts. *Mammalian Biology-Zeitschrift für Säugetierkunde*, 78(1), 1–6.