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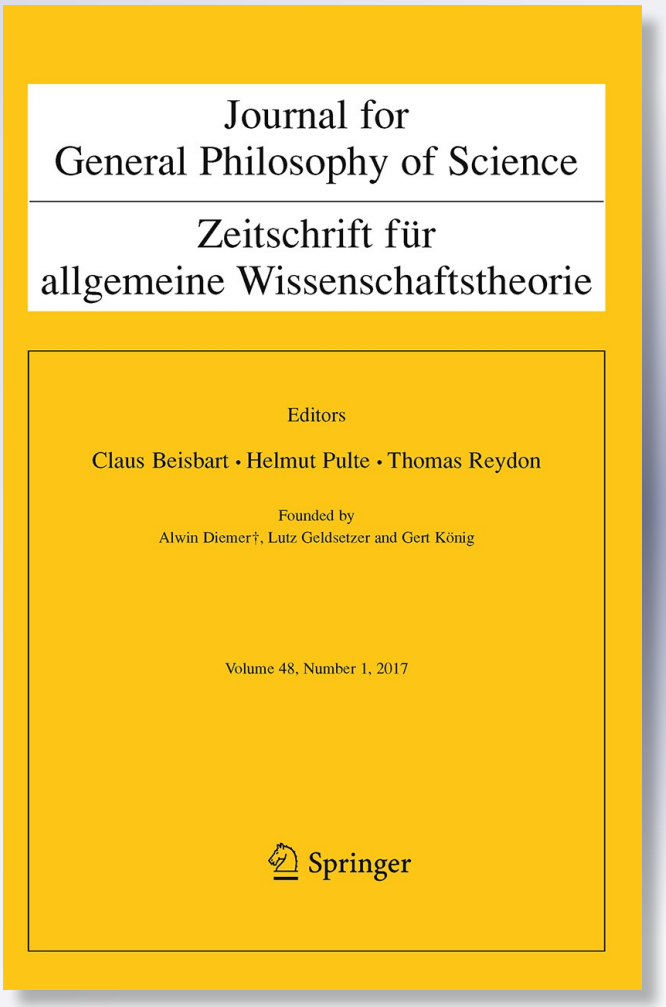

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ARTICLE

The Naturalizing Error

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Abstract We describe an error type that we call *the naturalizing error*: an appeal to nature as a self-justified description dictating or limiting our choices in moral, economic, political, and other social contexts. Normative cultural perspectives may be subtly and subconsciously inscribed into purportedly objective descriptions of nature, often with the apparent warrant and authority of science, yet not be fully warranted by a systematic or complete consideration of the evidence. Cognitive processes may contribute further to a failure to notice the lapses in scientific reasoning and justificatory warrant. By articulating this error type at a general level, we hope to raise awareness of this pervasive error type and to facilitate critiques of claims that appeal to what is "natural" as inevitable or unchangeable.

Keywords Error types · Naturalizing error · Naturalistic fallacy · Public understanding of science · Social construction of science

1 Introduction

"That's the way nature is." "You can't argue with nature." "It's only natural." Such appeals are common in everyday discourse, from gossip and social commentary to political grandstanding and academic arguments. They are presented, for example, to justify the virtues of a "Paleolithic" diet, the "natural" appropriateness of nuclear families, the evolutionary "inevitability" of male infidelity in relationships, and the "inherent" unhealthiness and dangers of genetically modified crops (Allchin 2014; Buss 2007; Carlson 2015; Zuk 2013). We wish to highlight and articulate how such arguments often exhibit a significant source of error, what we identify here as a general and widespread error type.

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Ultimately, we hope awareness of the error type may help foster more effective appraisal of scientific claims in cultural contexts and more responsible discourse where social issues are informed by science.

Our central theme intersects with but goes beyond widely familiar conceptions of the naturalistic fallacy, the "social construction" of science, and feminist, Marxist and other critiques in the cultural studies of science. Our domain of concern is how claims about nature, apparently endorsed by science, are interpreted and assessed in non-scientific discourse. In such cases, nature may become an implicit or explicit benchmark for justifying or sanctioning behaviors.

Many such appeals aim specifically to interpret or extract values from nature, a misstep in ethical reasoning widely known as the naturalistic fallacy. Our focus, however, is on a parallel set of cases where *the purported scientific claims themselves are false or misleading*. We share the concerns of many sociologists of science and others who have already shown that scientific claims may be strongly shaped by personal ideology, biographical contingency, and cultural context. Scientists may project their particular, contingent views onto natural phenomena and thereby inscribe them into the concepts that purport to describe nature in wholly objective terms. That is, the cultural or personal perspectives may be unwittingly *naturalized*. Although subsequent appeals to "nature" in such cases seem to draw on an epistemically reliable source of information, they are critically susceptible to error. Moreover, the error typically goes unnoticed, due to incomplete (and systematically selective) information. A social decision that on the surface seems informed and justified by "nature" as an independent benchmark may thus instead merely (re)express the original, limited cultural perspectives. The justification is circular and thus epistemically vulnerable. Any subsequent conclusion may thus be critically ill informed. This specific pattern of interpretations is what we newly identify here as *the naturalizing error*.

Sociologists seem content merely to display this error as a political check or blemish on the authority of science. In appealing to methodological relativism, they typically dismiss or deny any epistemic problem—missing the important philosophical dimensions of the problem. Our approach, drawing in part on cognitive science, and partly aligned with some recent efforts in social epistemology, is to seek a practical, methodological solution. We analyze the error philosophically as a general error type, and seek ways to mitigate or remedy the error in practice.

First, we distinguish the naturalizing error in science from the distinct yet parallel naturalistic fallacy in ethics. Second, we underscore the significance of studies in the sociology of science on the "constructed" nature of all knowledge, while adopting a role for epistemic analysis (from a philosophical perspective) that acknowledges error types. Third, we illustrate our interpretation with several historical examples. Fourth, we consider the naturalizing error historically and detail the unconscious human cognitive patterns that lead to naturalizing and then later to interpreting nature as a self-justified model. Finally, we explore some practical epistemic strategies for addressing and potentially remedying the naturalizing error.

2 From the Naturalistic Fallacy to the Naturalizing Error

The naturalistic fallacy in various forms (including the appeal to nature) is by now a familiar problem. Norms or values may be confused with descriptions of nature. Yet the critical problem may typically lie elsewhere. In our view, the error frequently arises at a deeper level: in the initial claims about nature, when presented as supported by science.

We contend, centrally, that the source of flawed normative judgment is thus typically misidentified.

In the conventional view, the fallacy lies in moral reasoning, as values are inappropriately derived from or defined by reference to nature. In the cases that concern us, the error is instead *scientific*. The original interpretation of nature itself can be flawed by cryptically expressing or embodying particular perspectives or norms. Ideology may shape or frame the scope of scientific problems or the formation of concepts. Ideology may also lead to using evidence selectively or to discounting criticism or alternative interpretations. In some appeals to nature, the values are not fallaciously derived *from* nature; crucially, they may *already be embodied in* misleading claims *about* nature. "That's just the way nature *is*," some contend. "You cannot change how the world is." In such a case there is no apparent "argument" that imports values from nature or derives "ought" from "is." Rather, the normative work is buried or disguised in constructing a flawed characterization of nature, then taking it as scientifically demonstrated fact.

Considerable commentary has challenged conventional understanding of the fact-value distinction (e.g., Kohler 1966; Putnam 2002; Putnam 1998). While we acknowledge the problematic entanglement of facts and values, even in science, our focus lies elsewhere. Our concern is in the nature of epistemic justification and the cognitive blind spots that hide particular flaws or vulnerabilities in identifying, characterizing, and reasoning about the evidence.

Consider, for example, the classic case of Moore's (1903) critique of Herbert Spencer's social interpretations of evolution (the views often misleadingly labeled Social Darwinism). Moore contended that Spencer's great transgression lay in *ethical* reasoning, conflating values with facts. However, we contend that Spencer's key error was *epistemic*. Moore criticized Spencer as having mistaken the source of "good" in natural terms:

> The survival of the fittest does not mean, as one might suppose, the survival of what is fittest to fulfil a good purpose—best adapted to a good end: at the last, it means merely the survival of the fittest to survive; and the value of the scientific theory, and it is a theory of great value, just consists in shewing what are the causes which produce certain biological effects. Whether these effects are good or bad, it cannot pretend to judge. (Chap. 2, Section 30)

Moore placed the lapse in reasoning in moving from nature to ethics:

> He [Spencer] argues at length that certain kinds of conduct are more evolved, and then informs us that he has proved them to gain ethical sanction in proportion, without any warning that he has omitted the most essential step in such a proof. (Section 31)

By contrast, we contend, Spencer's rendering of nature was itself scientifically flawed: shaped by his social views of competition, progress, and racial hierarchy, and by the normative standards among the privileged British classes about pleasurable experience and mutual aid. His views of the relevant evidence were limited by ideological lenses. He transferred those cultural ideals into his descriptions of nature through concepts as "most evolved" or "highest," as well as through the features and species (namely humans) that he claimed exhibited those properties. His *scientific* concepts inherently albeit subconsciously expressed his ideological ideals and norms. They implied that nature itself exhibited a scale, which reflected Spencer's idealized view of social (and thus also organic) *progress*. Similarly, the term "natural selection" seems to imply a choice, with nature expressing an underlying intent and implicit value. For Spencer (and others), evolution entails progress,

not merely change. From Spencer's own perspective, then, and among those who followed him (and contrary to Moore's charge), one did not actively derive "values" from nature. One merely appealed to nature, which could apparently "speak for itself." The human ideal of progress had already been *naturalized* as an inherent feature of nature, which seemed to plainly exhibit progress independently of human interests or norms.

Spencer's error illustrates our distinction between the naturalistic fallacy (variously construed) and the naturalizing error. We focus, not on lapses in ethical reasoning, but on epistemic failures in appeals to scientific claims. Especially important are claims that ultimately contribute to social or personal decisions where the original error is relevant but rendered invisible.

In a contemporary case, some people promote a diet that they claim accords with human natural history. Before agriculture, according to this argument, hunter-gatherers evolved to eat certain types of food. Our digestive enzymes and physiology adapted to those food sources and we inherited those traits from Paleolithic ancestors. Eating excessive grains (with gluten) or dairy (with lactose) is purportedly unhealthy because it is "unnatural." We should eat the way we evolved to eat. The reasoning roughly parallels Spencer's in mandating a behavior based on our evolutionary history. One could easily criticize the so called Paleolithic diet as seeking normative guidance in the wrong place, using the wrong principles. We nevertheless acknowledge the presumptive plausibility of an argument about maintaining health (as an ultimate value) by aligning diet with physiology (as a proximal norm). There is nothing inherently wrong with such an argument. If, however, one approaches this case from the perspective of the naturalizing error, the appeal to "natural" conditions inclines one to probe (instead) the justification for the scientific claims. Indeed, this case exemplifies what evolutionary biologists call the "mismatch hypothesis," positing that the modern human lifestyle is wholly unlike the one lived by our ancestors for tens of thousands of years (Lieberman 2013). The target diet seems to reflect, rather, particular preferences (tastes for meat and fat), and the purported history seems enlisted for convenience to rationalize those dietary choices. Further exploration into the scientific research indicates that diet promoters have misconstrued or misrepresented ancestral diets, intentionally or incidentally, and that the core premise of evolutionary stasis since the Stone Age is unsupported both in principle and in fact (Carrera-Bastos et al. 2011; Rosenbloom 2014; Zuk 2013). The naturalizing error, rather than the naturalistic fallacy, provides a framework for effectively analyzing the normative claims of the Paleolithic diet.

3 From Social Construction to Cognitive Error-Type

Our central claim resonates with—and may indeed seem merely to echo—well-established (and for some, well-worn) conclusions in sociology of science and cultural studies of science. Informed readers may readily recognize the examples we discuss below, some now viewed as classic cases. Yes, all knowledge is socially constructed. But this awareness does not itself inform us if the knowledge is well constructed or not. Is it epistemically well-justified? Is the construction sound? Specifically, we diverge from sociologists of science whose methodological relativism seems to eclipse the relevance of philosophical perspectives or analysis. That is, *epistemically* one may still characterize certain psychosocial processes as potential *sources of error* or, alternatively, as factors guarding against such errors.

We thus situate the naturalizing error with other types of error (such as systematic bias in experimental instruments or data collection, or fallacies in reasoning, or conflicts of

interest in trustworthy communication) already well characterized by philosophers of science. The naturalizing error, in contrast to the error types just listed, emerges at the cognitive and social levels of science. We thus view naturalizing as an important general *error type* (Allchin 2001). Unlike many sociological critiques of science, we articulate ways to identify a particular instance of the naturalizing error and then to "correct" for it.[1] If science is methodologically flawed, we argue, one can analyze the process and prospectively learn how to remedy its epistemic weaknesses. First, however, one must recognize naturalizing as a distinct error type and characterize it fully.

The naturalizing error seems to stem from the well-known cognitive pattern typically called confirmation bias (Gilovich 1991; Kahneman 2011; Nickerson 1998; Sutherland 1992), also known variously as the availability error, the primacy effect, belief persistence, positivity bias, and the congruence heuristic. That is, prior experience can filter subsequent perception and judgment, often in simple yet profound ways. The mind tends to classify perceptions into existing mental categories. It highlights confirming examples and discounts counterexamples by "cherry-picking" of evidence. The very relevance or significance of evidence is evaluated relative to concepts already adopted. Evidence that confirms expectations tends to be readily accepted and premature conclusions readily made, as in the familiar "hasty generalization." This all occurs unintentionally and more importantly without conscious awareness. Indeed, one rarely notices that the mental evidence stockpiled to bolster one's position may be selective, insufficient, or incomplete. As a result of this widespread confirmation bias, much perceived justification is simply selective rationalization. Naturalizing errors develop in our blind spots.

In cases of naturalizing, pre-existing cultural or individual perspectives become a template or schema for interpreting or conceptually scaffolding natural phenomena. Features that fit familiar concepts through analogy, metaphor, or association are mapped mentally as examples or extensions of those antecedent concepts. We easily project beliefs onto nature. Accepted norms easily structure selective descriptions. The same cognitive tendency to interpret the unfamiliar in terms of the familiar is found in anthropomorphisms and in teleological views of nature, where human intent and purpose is projected onto natural processes (see also below). The same filtering also occurs when we assess the plausibility and cogency of new concepts introduced by others. Unfamiliar ideas that do not match existing conceptions receive scrutiny, while resonant ideas are accepted or endorsed more uncritically. Naturalized errors can easily propagate in a like-minded culture. Scientific communities are no exception.

Our chief concern, however, lies not within the discourse in the scientific community itself, but in the downstream use or interpretation of scientific claims in personal decision making, social policy, and other cultural contexts. When is trust versus active skepticism of scientific claims about nature warranted or appropriate? Our analysis indicates a need for heightened awareness and critical analysis whenever appeals to "nature" as a benchmark or standard of reference appear in an ideological or normative context. In such cases, criticism should be aimed not only at the justification of values or moral arguments but also at the rigor of the underlying science itself. The consumer of science who is aware of naturalizing as an error-type is well positioned to be especially critical of claims precisely where advocates would benefit from or be blind to this error. In such cases one may demand more rigor in standards of evidence and seek more complete or robust

[1] Ironically, perhaps, this approach respects Bloor (1991) principle of symmetry, by coupling a sociological understanding of false beliefs (error) with a corresponding sociological understanding of the complementary processes that yield correct claims. See especially Bloor's response to critics (1991, 175–179).

demonstration. Conventional norms for the burden of proof may shift substantially. Knowing that naturalizing can be a source of error is a powerful tool in critically analyzing scientific claims in extra-scientific contexts.

The naturalizing error provides a framework, for example, to address contemporary claims of whether genetically modified crops (GMOs) are safe to eat. Critics contend they are "unnatural" and hence less nutritious and more likely to contain harmful chemicals. A social constructivist perspective fosters examination of the interests behind claims of safety defended by producers of GMO seeds and farmers of GMO crops. Initial skepticism may surely be warranted pragmatically by potential conflicts of interest. Yet a staunch social constructivist would typically dismiss claims of safety as unreliable or unresolvable on that basis alone. Our approach supports instead a close scientific consideration of what critics mean by "unnatural." Ultimately, these claims seem embedded in widespread but ill-informed views of genes as constitutive of "natural" identity as well as vague connotations of the word "modification." The image, sometimes stated explicitly, is that the GMO crop is "essentially not the same." Critics disregard scientific details and fail to acknowledge that the nutrient composition of GMO crops is unaffected. In the case of *Bt* corn, this GMO's "new" chemical is one that was already applied externally to deter insect pests. While allergens are a potential concern, as with all foods, these (rather modest) genetic modifications entail no new or hidden type of risk. Criticism of these aspects of GMO safety, notwithstanding potential environmental concerns, are scientifically unwarranted, as reported by the non-political National Research Council (Allchin 2014). The framework of the naturalizing error as an error type thus differs from social constructivist critiques and, in the case of GMO food safety, ultimately fosters a deeper, more informed analysis.

4 Historical Examples of the Naturalizing Error

We contend that the naturalizing error is and has long been widespread. It is largely invisible because it is hard to notice one's own cultural perspective as a perspective that may require justification. In order to demonstrate the ubiquity and significance of the naturalizing error, and to profile its cultural influence more clearly, we survey several cases from the history of science.

As a striking first example, consider the scientific name given to mammals as analyzed by Schiebinger (1993, 40–74). Linnaeus introduced the term *Mammalia* in 1758 in the 10th edition of his *Systema Naturae*. But unlike other names he used there, it is sexually charged, highlighting mammae as characteristic structures. Indeed, the choice seems idiosyncratic, but it embodied Linnaeus's cultural norms. Mammary glands and external mammae are hardly the only unique or even the most distinctive structure of this animal group. All mammals and only mammals have true hair (distinct from the analogous setae of tarantulas and other arthropods). Accordingly one might have named them, as others had done earlier, *Pilosa*, *Pillifera*, or *Trichozoa.* Mammals also give live birth, as expressed in another earlier name: *Vivipara.* In addition, mammals have two ventricles in the heart: hence *Tetracoilia*, a later suggestion. One might also have focused on the nourishment of offspring by milk, rather than a structure that typified only one sex (and then only at certain ages).

Linnaeus's choice of mammae for naming this group is telling. Not incidentally, he introduced the name during cultural debates about the value of wet-nursing and the domestic role of women. Only 6 years earlier Linnaeus had penned a short tract that was critical of the widespread custom of surrogate wet-nursing and advocated breast-feeding by birth mothers. One can thus see his taxonomic name embodying a view that a mother's

milk is "natural" to the organisms' identity. For Linnaeus, the biological name chosen for the group ultimately carried social or political meaning. Numerous contemporaries concurred about the "natural" status of maternal breast-feeding. Edward Long regarded it as "consonant to the laws of nature." Jean-Jacques Rousseau portrayed wet-nursing as a depravity which undermined the very moral order of society. Decades later, Charles Whitlaw also appealed to nature: "If we search nature throughout, we cannot find any equal of this."

Framing the role of women as breast-feeders simultaneously helped exclude them from public discourse. There, too, "nature" was offered as justification. Pierre-Gaspard Chaumeure voiced his concerns in debates on the role of women in politics in post-Revolutionary France:

> Since when is one permitted to abandon one's sex? Since when is it decent for women to forsake the pious cares of their households and the cribs of their children, coming instead to public places, to hear speeches in the galleries and senate? Is it to men that nature confided domestic cares? Has she given us breasts to feed our children? (Schiebinger 1993, 70)

As noted by historian Schiebinger, "Linnaeus's term Mammalia helped legitimate the restructuring of European society by emphasizing how natural it was for females—both human and non-human—to suckle and rear their own children" (74). The taxonomic term *Mammalia,* apparently innocuous, exemplifies the significance of the naturalizing error as scientific claims cascade into social contexts.

The term mammal might now be viewed as a vestige, with few normative overtones. Today, ample information allows one to promptly dismiss the claims made by Linnaeus and his contemporaries in the name of science. Our framing of such naturalizing as an error type, however, could well have facilitated a critique of these gendered claims in their original context. By noting appeals to "natural" behavior, one would implicitly raise the evidentiary standards needed to support them. Even in the prospective absence of adequate published evidence, one could underscore the deficit of scientific warrant and thereby refocus attention and discourse on the cultural and political dimensions of the debate. The original arguments are far less persuasive if one cannot appeal to nature as an "objective" arbiter.

Another vivid example involves the popular dioramas in the African Hall at the American Museum of Natural History, as interpreted by Haraway (1989). Curator Carl Ackeley set out to recapture and represent a faithful view of nature when he arranged these exhibits, all of which include one adult male, one adult female, and two young. These arrangements did not accurately represent the social structure of most species on display. However, they perfectly modeled the idealized human nuclear family of that time. Indeed, the adult male is usually central and gazes out to the viewer as the dominant individual. All the specimens are unblemished, as though perfect skin were normal or typical. Ultimately, the exhibits embodied Ackeley's cultural norms of family structure, gender roles, and normality, but were presented as unmediated depictions of nature. They *naturalized* those societal norms. That is, by providing their viewers with models for what was "natural," the dioramas implicitly endorsed particular human conduct (Haraway 1989, 29–30, 38, 40–42). Decades later, after cultural norms had shifted, the implicit assumptions and the naturalizing error became more obvious. The Smithsonian's National Museum of Natural History, at least, felt obliged to revise its own, similar exhibits (Shanahan 1994).

The case of Ackeley's dioramas, made clear through a historical perspective, can be valuable for interpreting contemporary cases by illustrating how the naturalizing error can

occur even while individuals remain unaware of the unconscious role of their own cultural perspectives. For many people today, heterosexual relationships, families with children, and working males as heads-of-household are norms still established by the "objective" facts of nature.

A recent example is Allan Carlson's *The Natural Family Where It Belongs: New Agrarian Essays* (2014). At one level, Carlson presents a historical analysis of family organization in early agrarian society and its fate in subsequent socioeconomic transformations. But the appeal to families as "natural" may signal readers familiar with the Ackeley case to delve further into the possible normative foundation underlying Carlson's purported science. Indeed, one finds that Carlson's earlier works include an ideological "manifesto" on families (Carlson and Mero 2007) and explicit links between "natural" families, religious views, and political doctrines of liberty and democracy (Carlson and Mero 2008). Readers attuned to the naturalizing error are prepared to seek and secure more complete evidence about the science of family structures, revealing deficits in Carlson's work (for example, Canetto 1996; Smith 1993). The naturalizing error is an epistemic tool, opening historical insight into contemporary cases.

Consider next the role of competition in both nature and society, closely associated with the origin and support of theories of biological evolution, as widely noted by many historians (Browne 1995, 542–543; Ghiselin 1969, 48–49, 59–61; Young 1975). In this case we can effectively trace the direct association between cultural and scientific thinking. Victorian England exhibited widespread poverty and great wealth disparity as vividly portrayed by Charles Dickens. The social inequities were considered justified (by the franchised, at least) as a "natural" outcome of competition. Thomas Malthus had expressed that view in his 1801 *Essay on Population*. He portrayed food as inevitably limited and social competition as unavoidable. When Darwin read Malthus's essay in 1838, it helped crystallize his emerging thoughts on natural selection (Browne 1995; Desmond and Moore 1994). The same essay prompted Alfred Wallace to frame the same principle. Both Darwin and Wallace transferred Malthus's notion of a social "struggle for existence" into an organic context. Eliminative competition became naturalized. Spencer and others later used Darwin's and Wallace's notions to profile reductive competition in society as "natural."

The problematic circular reasoning was evident in Darwin's own time—at least to those with certain perspectives. Socialist thinker Friedrich Engels virtually defined the naturalizing error in an 1875 letter:

> The whole Darwinist teaching of the struggle for existence is simply a transference from society to living nature of Hobbes's doctrine of *bellum omnium contra omnes* and of the bourgeois-economic doctrine of competition together with Malthus's theory of population. When this conjurer's trick had been performed… the same theories are transferred back again from organic nature into history and it is now claimed that their validity as eternal *laws* of human society has been proved. The puerility of this procedure is so obvious that not a word need be said about it. (quoted in Lewontin et al. 1984, 309)

"Not a word" may have been needed for Engels' correspondent, but it was not obvious to those already embedded in a culture endorsing competition as an ideology, like the American industrialists who appealed to Darwinism as establishing an implicit natural standard to justify unregulated capitalism. The naturalizing error haunts cognitive blind spots.

Of course, "survival of the fittest" rhetoric continues to permeate culture today. Eliminative competition is a staple of American (and much Western) culture, from the Super Bowl to economic rhetoric, to televised singing and dancing competitions and other "reality" shows. The power of the naturalizing error may be reflected in the views of even those who accept Darwinism but reject competitive ideology. Darwin himself emphasized the role of cooperation as much as competition (Richards 2003; Sigmund and Hilbe 2011). Many people nonetheless believe that Darwinism necessarily entails social competition (Brem et al. 2003; Huxley 1894/1989). Other metaphors for natural selection are possible: for example, "amplification of the apt" (Allchin 2007a). The cultural context of the "naturalness" of competition remains invisible to a large sector of the populace in a culture dominated by capitalism, where the naturalizing error continues to exert an undue effect.

In a similar but more cursory way, one may view Robert Ardrey's "territorial imperative" of the mid-1960s as a glaring expression of Cold War politics embodied in the Berlin Wall, Iron Curtain, and tacit geopolitical spheres of influence. More recently, Matt Ridley's (1996, 227–246, 259–264; 2010), claims about the natural basis for "rational optimism" and the character of cooperation and competition in idealized societies, presumably based on primate and anthropological studies, exhibit a clear libertarian view. They seem to betray an unmistakable economic perspective which Ridley has defended elsewhere in his role as a businessman and banking executive. Awareness of the naturalizing error, again, may alert the citizen to be wary of claims about what is "natural," even if apparently supported by science. Accordingly, one should expect rigor and critical analysis in such arguments. Plausibility and a handful of confirmatory evidence alone should not suffice.

The naturalizing error extends equally to concepts of nature that are less overtly political, economic, or social. Nothing may seem more "natural," for example, than boy and girl, man and woman, male and female. But there are many exceptions and inconsistencies in the conventional biological accounts, as summarized by Allchin (2006). In the standard version, an individual's paired chromosomes (XX or XY) unequivocally determine its sex. Yet many fish (including wrasses, parrotfish and groupers) change sex over the course of their life cycles. In the cleaner wrasse, the largest female becomes a male when the previous male in the group dies. In clownfish, by contrast, males become females. Some gobies change sex multiple times. Sexed anatomies and physiologies can be fluid. In addition, many intersexes or sexual hybrids are possible. In species such as spotted hyenas, bush babies, Malaysian fruit bats, and kangaroo rats, the "exceptions" are frequent enough not to qualify as mere exceptions. Earthworms, snails, starfish, barnacles, sea anemones and many deep sea fish are hermaphrodites: simultaneously male *and* female (Roughgarden 2004). Plants, too. Male and female flowers often appear on the same plant or in the same flower. Even the notion of reproduction relying on one male and one female is not absolute. In two ant species of the genus *Pogonomyrmex* there are two distinct mating types. A queen that mates with her own type produces more queens; with the alternate type, workers. Continuity of the colony thus requires *both* matings. Parker (2004) argues this is a case of polysexes, with a total of *four* sexes. Sex conversions, intersexes, hermaphrodites, and mating types all disrupt the conventional cultural conceptions of male and female. One can imagine the irony of someone trying to dismiss these cases, found in nature, as "unnatural." The categories of male and female are not as discrete biologically as the human social conventions built on them seem to imply. Stereotyped gender roles and cultural standards about sexuality that depend on this dichotomy are thus fraught with problems. The effect of naturalizing conventional social categories must be made transparent before remedy is possible.

Our list of examples is intended merely to illustrate the nature and extent of the naturalizing error, not to exhaustively survey all instances of the problem. Other cases seem ripe for consideration, however, and we will note them briefly here. Another set of naturalized errors seem inherent in cases typically characterized as biological determinism, but which we prefer to label *biological essentialism*. That is, the core claims in these cases are not just that human social behaviors have biological or genetic roots (for example, critiques by Gould 1996; Lewontin et al. 1984; Moss 2002; Rose 2003). Rather, the biological bases are regarded as fixed by nature and cannot be changed. Among such cases, one might explore the familiar instances of sexual dimorphism and patriarchy (Mansfield 2006; critiques by Larsen 2003; Lewontin et al. 1984, 131–163; Samaras 2007); sexual anatomies and gender roles (Schiebinger 1989, 1993; Wijngaard 1997); brain size and intelligence (Fee 1979; Gould 1996); a purported "gay" gene; brain morphology and racial hierarchies (Barkan 1992; Gould 1996; Stepan 1982); and behavior "justified" by past evolutionary adaptations as depicted by "pop" evolutionary psychology (Buss 1995; Diamond 1992; Etcoff 1999; critiques by Bolhuis et al. 2011; Buller 2005; Laland and Brown 2002; and Richardson 2007). In all these cases, appeals to "human nature" or a biological "nature" are used to promote certain ideological aims, while at the same time discouraging any serious epistemic challenge to the science behind the underlying claims about nature.

As a final example, Steinle's (2008) analysis of the history of the concept of "laws" of nature certainly indicates that René Descartes drew on religious and cultural foundations in proposing that nature had an inherent and divine order structured in "lawlike" behavior. Cartwright (1999) for example, has presented an alternative view of a "dappled world" where regularity appears only periodically, in patches of order. The concept of universal and invariant "laws" that govern natural phenomena may thus also (provocatively) reflect a naturalized error (Allchin 2007b).

5 The Naturalizing Error in Historical and Cognitive Perspective

Why does the naturalizing error occur? What motivates it? Anyone can, of course, reason about normative benchmarks—whether gender roles, sexuality, family structure, competition, crop technology, human identity, or civil order, etc.—without reference to nature. Yet we seem prone to respect or yield to claims established through arguments appealing to nature. We more readily accept normative arguments that seem independent of human interests. "Nature" seems a disinterested, impartial arbiter. Thus, we tend to frame our personal beliefs as "natural" and universal. We project them onto nature and then interpret natural processes as embodying those beliefs independently of our own circumstances. This cognitive habit seems to have a long heritage.

Appeals to "nature" or "natural" features as justifications appear throughout the history of Western culture, at least. The Greek pre-Socratic philosophers wrote of natural law, natural rights, natural order, and natural theology. The notion of natural law was widely debated by the Stoics and later by the Romans (particularly Cicero). But Aquinas and other early Christian philosophers emphasized the "natural" aspect. Natural law flourished in Early Modern Europe, coincidentally paralleling the emergence of "laws" of nature (Daston and Stolleis 2008). By the Enlightenment, political philosophers accepted natural law as self-evident and it thence made its way into modern English and American jurisprudence. Self-evidence is also an essential element of natural rights (in contrast to divine rights). These rights emerged prominently with the signing of the Magna Carta in 1215 and also took root in Enlightenment philosophy. Thomas Jefferson, of course,

highlighted them in the American *Declaration of Independence*: invoking "certain inalienable rights," among them "life, liberty, and the pursuit of happiness." To these one may add declared rights of privacy, property, and reproduction without government interference. All have been rendered as "self-evident."

We want to underscore the problematic status of their warrant. When philosophers, especially in the Renaissance and Enlightenment, appealed to "natural X" or "natural Y," they did not intend to spur investigation into natural causes and natural events. Rather, they sought to press their case using "nature" as a rhetorical device. A "self-evident" claim based on "nature" neither demands nor deserves justification; it is a trump card meant to halt rather than foster debate. Ironically, this tendency to cut off inquiry fails to honor another great legacy of the Enlightenment: the tradition of rational criticism. Why were these concepts apparently exempt from the spirit of critical examination? In our analysis, appeals to nature as a form of justification reflect an effort (deeply rooted in psychology) to escape the very need for justification. One can eclipse potential disagreement by inscribing a claim in the inviolable fabric of the "designed" world. Instead of focusing one's attention on nature as the root cause and justification for behavior, the intent is instead to deflect or divert attention from nature, precluding empirical analysis of the "natural" foundation. Given that the starting premises are "self-evident," they are presumed to lie beyond scrutiny. Rather than basing views on a careful contemplation of nature, the effect is precisely the opposite, prompting conclusions where "nature" is taken for granted rather than carefully considered as a firm epistemic foundation.

The result, we argue, is an unsupported argument where attention is diverted not toward but away from naturalistic causes. Unfortunately, scientists and non-scientists alike may succumb to this misdirection, although the consequences are more problematic when scientists make the error type. Whereas the familiar naturalistic fallacy confuses descriptive and normative claims, deriving "ought" from "is," the naturalizing error does the reverse, deriving "is" from "ought" and thereby presenting descriptive premises founded upon norms.

Since the emergence of modern science in the late seventeenth century, the natural sciences have gained increasing authority in interpreting natural patterns, processes, and their causes. Questions of "human nature," in particular, have shifted into scientific discourse, especially with the emergence of psychology, sociology and evolutionary biology in the late nineteenth century. One generally expects such claims now to be accompanied by scientific evidence. Meanwhile, the prestige of science and its expertise has grown immensely. Science has thus simultaneously become a powerful ally in cultural arguments based on "natural" or essential dispositions. Yet while science has increased its power in characterizing nature over the past three centuries, the potential for the naturalizing error persists undiminished, as illustrated above. Moreover, the ability of the typical non-scientist to assess or critique claims by specialized scientific experts has gradually weakened. Naturalized errors in science are now, ironically, *more* obscured and *more* immune to exposure. Accordingly, in appropriate contexts, the scientific claims deserve especially rigorous epistemic scrutiny.

We suspect that prevalent teleological thinking patterns also contribute to naturalizing cultural norms. Humans seem to have a deeply seated tendency to seek purpose in nature. It appears in the explanatory structure of ancient myths as much as in modern beliefs about "Intelligent Design." Across many cultures, humans tend to believe that things happen in ways that are inevitable and that justify the final outcome. That is, humans generally interpret and explain natural phenomena in terms of an ultimate result rather than a proximal process. In Aristotelian terms, they seem to prefer explanations based on final

causes rather than material or efficient causes. Ironically, perhaps, this tendency may well be a fruitful cognitive heuristic that economizes on mental effort while yielding viable behavioral responses much of the time. We should be prepared to examine further teleological reasoning as a common, perhaps default cognitive pattern that contributes to the naturalizing error.

In addition, when humans appeal to natural explanations, they include more than just the evidence needed to justify an explanation. They seek not just order in nature, but an *ordained* order (Ayala 1970; Gonzalez Galli and Meinardi 2010; Kelemen and Rosset 2009). This widespread psychological disposition likely leads to the "intuitive theism" that develops in childhood (Dawkins 2006; Kelemen 2004). Controlled experiments in cognitive research supplement long-standing observations of teleological thinking in science, particularly in biological explanations (Dawkins 1995; Dennett 1995). Thus, referring to something as "natural" often embodies an implicit teleological belief. The ostensibly descriptive term (about causation in nature) is ultimately normative (about the intentional structure of the world). To the degree that these claims about human cognition prove reliable, they may certainly complicate effective strategies for reducing the frequency of or remedying the naturalizing error.

6 Mitigating the Naturalizing Error

One important reason for clarifying and profiling the naturalizing error as an error type is towards recognizing its impact and minimizing it through appropriate methodology. Analysis of the error's history and its cultural and cognitive contexts may, ideally, contribute to methods to prevent, mitigate, or remedy instances of it.

We should note that we hardly wish to exclude a role for science in normative reasoning. Science can inform personal and public decision-making by clarifying what we believe to be or not be the case, and what is or is not possible. Science can articulate the unforseen consequences of intended actions, so important to consequentialist thinking in ethics and to interpreting intentions fully. But the informed consumer of science must also be alert to when scientific claims may be considered untrustworthy and when (and how) they are susceptible to error.

Perhaps most importantly for the non-scientist, any appeal to what is "natural" or unchangeable in nature should be suspect and subjected to particular epistemic rigor. Often such arguments are presented as self-evident or self-justifying. Our examples, we hope, demonstrate how this ellipsis is unwarranted. Our cognitive analysis indicates that the demand for a full or complete justification can be easily overlooked by anyone who shares the claimant's ideological perspective.

An effective critique or analysis may be informed first by characterizing the cultural, ideological or political context in which the claim about "nature" is advanced, and precisely how any normative argument is presumably informed by the science. Conflicts of epistemic interest may be exposed, not as a final evaluation, but as a guide to further analysis. That is, the context of the argument may identify which scientific claims are most significant, where critical analysis or evidence is most needed, and where alternatives may have been overlooked or elided.

Second, plausible scenarios or explanations should not be allowed to substitute for analyses with substantive evidence. To challenge the cognitive dispositions that fuel the naturalizing error, one must measure the claims against appropriate material evidence. Thus, one of the chief weaknesses of current arguments in "pop" evolutionary psychology

is their reliance on "just so" stories, based on plausible assumptions not yet thoroughly investigated or tested.

Third, confirmatory evidence alone should not suffice. Evidence may easily be selected or "cherry-picked" to favor a particular claim. Completeness of evidence, especially in light of alternative hypotheses or perspectives, is equally important. Non-scientists may not be able to know or assess all the available evidence, but they may well note the absence of critical dialogue or sufficient depth of evidence on pivotal issues. Again, awareness of the naturalizing error helps underscore the need to raise the epistemic bar at specific times or for specific types of claims.

The prospective solutions to the naturalizing error (for citizens) thus resonate with several familiar strategies for evaluating arguments critically and for assessing evidence in science. However, attuned to potential for the naturalizing error, the non-scientist citizen may ideally be alert for the occasions when to activate and apply those strategies. In addition, cases of the naturalizing error tend to exhibit these characteristic weaknesses, and this can guide the would-be critic in focusing a critical analysis.

Addressing the basis for the naturalizing error among scientists (within a scientific community) may possibly be more challenging, especially when they seem to exhibit consensus. A community that shares the very cultural perspectives under question is, of course, generally ill-equipped to expose the situatedness of its own contingent norms or beliefs. Deep-seated cognitive tendencies tend to hide the very problem. As noted earlier, the naturalizing error inhabits our blind spots.

Because the naturalizing error is deeply embedded in the familiar, solving it typically requires drawing on the unfamiliar and thus going beyond how one individual thinks. Noticing the error typically involves a contrasting cultural perspective or ideology. One cannot expect self-regulation to be wholly effective. Resolving the naturalizing error may thus require, in part, a shift in epistemic methodology from the individual agent to the social, or discursive, level. The interaction of contrasting perspectives in an epistemic *community* has already been highlighted by several feminist philosophers of science and others who have helped develop an understanding of *social epistemology* (Longino 1990; Harding 1991; Solomon 2001) and we refer others to their work in thinking further about how to address the naturalizing error at this level. Their work suggests, however, that questions of gender must be addressed by both sexes. Questions of social status, by persons of all classes. Questions of property and power, by persons without economic or political privilege. For epistemic checks and balances to function, one must draw on contrasting sets of assumptions or perspectives, varying precisely in the dimension relevant to the normative claims at hand. At the very least, claims that have not been subjected to analysis and critique from such relevant alternative perspectives may be justifiably regarded as unresolved, uncertain or not adequately demonstrated, regardless of the "positive" evidence cited as support.

We hope that characterization of the naturalizing error contributes further to the process of critical analysis. First, awareness of the problem can promote recognizing it, or perceiving and articulating it more clearly when it arises. Second, it can guide criticism. The concept of an error type can thus be a form of currency in discussion about perceived errors. It can contribute to exposing the parochial limits of assumptions or to characterizing how evidence exhibits a qualitative form of sampling error. It will encourage incorporating criticisms from contrasting perspectives, which tend to raise the standards of trustworthy evidence. Our analysis *adds an additional burden of proof or level of argumentation when claims about nature are presented as "self-evident" and also relevant in normative*

contexts. Claims about human nature, for example, seem easy to make and support, but (if history is any guide) very difficult to secure through definitive evidence (Allchin 2012).

The ultimate significance of the naturalizing error, as we have noted, lies outside scientific discourse. The erroneous claims matter most "downstream" in normative arguments where the naturalized perspectives now masquerade as epistemically warranted claims about nature. Again, we wish to emphasize that appeals to nature in these cases are not based on *defining* normative ends in terms of natural properties (Moore's objection), nor on *deriving* values from nature as an implicit source of norms (Hume's is-ought fallacy). Rather, the appeals to nature as justification are typically presented as self-evident claims about nature. We have highlighted a specific set of occasions where such appeals are not epistemically warranted because the underlying science is missing or flawed. The scientific claims may well be systematically distorted by normative or ideological aims relevant to the arguments at hand. The justifications, assumed to be founded on unassailable evidence, can be empty and grossly misleading. However, awareness of the naturalizing error as an error type, commonly occurring whenever ideological, political or other normative arguments appeal to nature, can ideally aid in exposing and circumventing such epistemic errors in science.

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