Why It Matters that Idealizations Are False

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Abstract

Many of our best scientific explanations incorporate idealizations, that is, false assumptions. Philosophers of science disagree about whether and to what extent we must as a result give up on truth as a prerequisite for explanation and thus understanding. Here I propose reframing this. Factivism or veritism about explanation is not, I think, an obvious and preferable view to be given up only under duress. Rather, it is philosophically fruitful to emphasize how departures from the truth facilitate explanation (and understanding). I begin by motivating one version of the idea that idealizations positively contribute to understanding, and then I make the case that it is philosophically important to emphasize this contribution of idealizations. I conclude with a positive account of what theorists about science stand to gain by acknowledging, even emphasizing, how certain departures from the truth benefit our scientific explanations.

Keywords: idealization, veritism, factivism, scientific explanation, scientific understanding

1 Introduction

Many of our best scientific explanations incorporate idealizations, that is, false assumptions. Does the contribution idealizations make to scientific explanations interfere with the facticity or veracity of explanations and the understanding they produce? Some philosophers think so. On the face of it, explanations' reliance on false assumptions seems to require the acknowledgement of ways in which those explanations fall short of complete truth. Elgin (2004, 2017) argues that "felicitous falsehoods" are central to scientific understanding and thus motivate a rejection of veritism, or "truth-centered epistemology" (2004, 113). On Elgin's alternative nonfactive account of understanding, the posits that contribute to generating understanding need not all be true (nor believed to be true). Batterman (2009) argues that some idealizations are explanatorily ineliminable. Bokulich (2009, 2016) argues that scientific models constitute many scientific explanations and that those models' fictional elements are crucial to the explanation. de Regt (2009, 2017) focuses on the pragmatic aspects of understanding and how idealization can contribute to these. Potochnik (2015b, 2017) similarly emphasizes the centrality of idealizations to scientific explanations and also concludes that explanations and the understanding they produce may not be, strictly speaking, entirely true.

Others who also afford a central role for idealizations in explanation argue that idealizations do not interfere with explanations' facticity or veracity. Pincock (2021) endorses veritism, which he defines specifically as the view that "truth is a necessary condition on explanation," or that "each genuine explanation will consist of propositions that are true and appropriately related to the target of the explanation" (3). Pincock argues that idealizations contribute to explanation in other ways but are not included

among those true propositions. This is similar to the view of Lawler (2019), who argues that idealizations contribute to understanding by enabling it rather than constituting it. Mäki (2011) argues that idealizations contribute to the pursuit of truth and are perhaps even only apparently false. Strevens (2017) in turn argues that idealizations' contribution to explanations consists in showing which factors are not difference makers and which causes are truly difference-makers. Khalifa (2017) defends a somewhat weaker "quasi-factivism" about understanding, which he holds to be the view that understanding requires belief in an approximately true explanation and the role of idealization is simply to scaffold human cognition to achieve these approximately true explanations. Similarly, Sullivan and Khalifa (2019) argue that falsehoods' value to understanding is not epistemic but merely practical. According to these philosophers, truth or approximate truth is a requirement for explanation and understanding, and idealizations thus do not partly constitute explanations but in some other way support the generation of (true or approximately true) explanations.

This debate has progressed to a point where there is a range of nuanced, credible positions on both sides. People on each side—those who think idealized explanations challenge factivism or veritism and those who deny this—grant much of what those on the other side assert. On one hand, idealizations are widely agreed to be of value to the scientific project of explaining, to achieving understanding. On the other hand, there is agreement that there must be some veracity requirement—some requirement of truth, approximate truth, or accuracy—for legitimate understanding. The differences among philosophical positions lie in the details of how each of these ideas is developed and in what is emphasized: the explanatory value of departures from the truth or the residual veracity requirement.

I propose that this is a good opportunity to reframe the debate. So far, the debate has proceeded as if factivism or veritism is the default, obvious stance, to be given up only if idealizations are sufficient to force that move. I know of no positive arguments for why one *should* be a veritist, only arguments for how one is able to maintain veritism despite scientists' habit of introducing idealizations and arguments against the plausibility of rejecting veritism. I want to challenge this framing. Veritism about explanation is not, I think, an obvious and preferable view to be given up only under duress. The idea that scientific explanations and the understanding they produce regularly fall short of complete truth and accuracy is highly plausible, perhaps even obvious. Rather than focus on whether and how one is able to maintain veritism in the face of this, I propose that we should instead focus on developing the positive implications of this idea. It is philosophically fruitful to emphasize how departures from the truth facilitate explanation and the understanding they produce. In brief, it matters that idealizations are false. The onus should be on veritists to show why it is philosophically important to sideline the contributions idealizations make to scientific explanation and understanding.

I develop this line of argument in this article. I begin by arguing in section 2 that idealizations regularly contribute to scientific understanding, and thus scientific explanation, and that this contribution is due to their falsity. Misrepresentation can be and often is a crucial component of the scientific representations that we use to explain. This argument draws significantly from Elgin (2004, 2017); Bokulich (2009, 2011) and Potochnik (2015a, 2017). Then, in section 3, I motivate the importance of telling this story, that is, of emphasizing the contribution of idealizations qua falsehoods to explanation and understanding. In my view, focusing solely on ways in which our scientific explanations may qualify as true or approximately true leaves unexplained significant

aspects of scientific practices and enables us to continue to ignore overlooked features of science that (I will argue) are important. Finally, in section 4, I develop a positive account of what theorists about science stand to gain by acknowledging, even emphasizing, the role of false assumptions in supporting scientific understanding. I want to emphasize that my aim in this article is not to convince the reader that truth-centric accounts of the role of idealization in explanation and understanding are impossible to maintain. Rather, I want to show: (1) a strong case has been made that idealizations directly contribute to scientific understanding in virtue of their falsity, and (2) centering this rather than minimizing it gives rise to a philosophically productive take on the nature of scientific explanation and understanding.

2 How Misrepresentation Augments Understanding

My aim in this paper is to argue that it is important to acknowledge how idealizations' falsity contributes positively to securing scientific understanding and, thus, to successful scientific explanation—even if it may be possible to instead minimize their role in order to maintain veritism. The first step in such an argument is to motivate the idea that idealizations do in fact contribute to scientific understanding, and that they do so not in virtue of approximating the truth but in virtue of their falsity. In this section, I motivate a version of this idea based on discussions of idealization by Cartwright (1983); Elgin (2004, 2017); Bokulich (2009, 2011) and Potochnik (2017). This discussion is intended simply as a starting point for the argument developed in the subsequent two sections that it's philosophically productive to abandon veritism.

Let's start with a few preliminaries. First, I have been referring to both scientific

explanation and scientific understanding, but there are distinct literatures on these two topics. Moreover, there is also debate regarding to what degree explanation and understanding are bound up without each other, i.e., whether you can have understanding without explanation and vice versa. Despite all of this, I will presume a tight relationship between explanation and understanding in what follows. Philosophical discussions of scientific explanation from Hempel onward have presumed understanding follows from successful explanation. Whatever the precise relationship between and relative importance of a successful explanation and understanding, it seems producing the former is science's systematic means for generating the latter. Another reason I target both explanation and understanding is that philosophers have debated the contribution of idealization to both. Given this paper's focus, I cannot here provide an account of either explanation or understanding. I also have a principled reason to try to be generic in what I say about these topics: I aim for a general characterization of the importance of idealization, such that I hope what I say is relevant for philosophers holding a variety of different views about explanation, understanding, and the precise relation between them.

Here is a second preliminary. Sometimes the term "idealizations" is used to refer to representations that are inaccurate in some respects. But for this discussion, it's important to distinguish between idealizations, understood as assumptions made without regard for whether they are true and often with full knowledge they are false, from the representations (such as models) those idealizations facilitate. I will refer to the latter as "idealized representations." For example, the ideal gas law is an idealized representation, whereas the assumption that a gas is composed of non-interacting point particles is an idealization. My focus here is on the contribution that idealizations, the false assumptions themselves, make

to understanding.[1] Idealized representations can be approximately true, and attention is often paid to whether they are approximately true. But idealizations themselves by and large are not even approximately true, and by definition attention is not paid to whether they are. The ideal gas law well approximates the behavior of a variety of gases, but no real gas is actually composed of point particles experiencing no intermolecular forces. Focusing simply on the value of idealized representations in their entirety risks losing sight of the distinctive contributions made by false assumptions themselves.

My third and final preliminary comment: idealizations make a wide variety of contributions to scientific investigations, many of which have been explored by philosophers of science. As Potochnik (2017) puts it, there are many reasons to idealize, and several of these reasons can apply simultaneously. Nonetheless, philosophers have often focused primarily on the role of idealizations in explanations. I think this is because this use seems particularly vexing. If idealizations positively contribute to explanations and the understanding they produce, then there may be permanent, epistemic value to certain falsehoods. At any rate, I want to acknowledge that the role of idealizations in augmenting understanding that I focus on here is not the only use of idealization in science nor may it be the most frequent or most important use.

So, moving on, why think idealizations contribute to scientific understanding? We can conclude this is so simply in virtue of the fact that many of our most heralded scientific explanations involve idealizations. What is more, these explanations are maintained with

[1]On the definition I have given, some idealizations may not be false; an assumption qualifies as an idealization in virtue of being made without regard for whether it is true. But I use the short-form characterization of idealizations as "false assumptions," as idealizations by and large are false and this potential falsity is key to their nature. Idealizations as I have defined them are different from simple abstraction. Abstraction is accomplished by simply leaving out details or omitting reference to something, whereas idealization involves a posit that is false (or at least made with indifference to its truth).

their idealizations in place, even when more accurate representations, i.e., those that replace one or more idealizations with accurate claims, are available. Such explanations include the ideal gas law as well as van der wals equation for gases, the Hardy-Weinberg law as well as optimality models for evolution, and so on. I won't spend long developing and defending this basic claim that idealizations contribute to scientific understanding, since I take it this much is agreed upon across the parties to this debate.

What is more at issue is the question of whether the contribution idealizations make to understanding is in virtue of their falsity. Philosophers who see idealization as compromising veritism think so, while philosophers who want to maintain veritism in the face of idealizations think not. On the face of it, even if idealizations—false posits—contribute to understanding, there's something puzzling about the idea that an idealization can support understanding *by* being false instead of *despite* being false. False posits clearly do not contribute to accurate representation, at least not in virtue of their inaccuracy. But, the success conditions for scientific explanation include more than just conditions governing their relationship to the world, such as accuracy. To succeed, explanations also must have the potential to generate understanding, and understanding is a cognitive state (as well as an epistemic success). Explanations must relate to the objects of understanding in the right way in order to succeed, but so too must they relate to the subjects of understanding in the right way in order to succeed. For some explanation Y to successfully explain an explanandum X, the relevant subject S must be able to understand that X because Y. This is not universally accepted; one who endorses a purely ontic conception of explanation may reject the idea that explanations are governed in part by success conditions bearing on their relation to the subjects of understanding. But, I do think this connection to the subjects of understanding—those seeking explanation—is widely

accepted, at least implicitly. After all, maintaining any representational requirements for scientific explanation entails that explanations are the sorts of things that are represented to an audience. If the success conditions for scientific explanation govern explanations' relationship to the subjects of understanding as well as their relationship to the objects of understanding, then improvements to an explanation can be made to either of these relationships. And it is the latter relationship, explanations' relationship to the subjects of understanding, to which idealizations can contribute in virtue of their falsity.

Securing the proper relationship with the subjects of understanding is a task to which idealizations might plausibly contribute in virtue of their falsity. Our world is complex, and any given target for explanation is influenced by myriad factors.[2] Idealizations—assumptions made without regard for whether they are true and often with full knowledge they are false—can be used as a way to ignore some of that complexity, to eliminate the practical and cognitive burden of getting those factors right. This is useful for lots of tasks in science, including the task of explaining. In this use, idealizations enable those seeking explanation to home in on how factors of interest bear on the phenomenon to be explained. They accomplish this by enabling the neglect of other factors that may be important to bringing about the phenomenon to be explained but that are, at least for the moment, incidental to the interests of the explanation-seekers. Put another way, idealizations enable explanations to zero in on patterns in our world that account for phenomena that we would otherwise find puzzling.

This is what enables scientists to use game theory to explain phenomena ranging from biological symbiosis to international cooperation among governments, to use Mendelian

[2]I primarily have in mind causal factors and a broadly causal account of explanation, but perhaps other forms of determination are also among these influences.

genetics to explain the persistence of sickle-cell anemia, to use the Lotka-Volterra equations to explain spikes and drops in animal populations, the moon's revolution and Newtonian mechanics to explain the tides, and the ideal gas law to explain the pressure of gases in rigid containers and the volume of gases in balloons. All of these explanations employ idealizations: false assumptions to simplify heredity, community dynamics, the laws of physics, and more. The simplified treatments these idealizations facilitate enable the grasp of illuminating patterns (Elgin, 2004)—patterns of counterfactual dependence (Bokulich, 2011), of manipulability relations (Potochnik, 2017). Grasping such a pattern shows how the occurrence of the phenomenon to be explained depended on the factors of interest, how change in those factors would have altered the occurrence. Grasping such a pattern reveals how the phenomenon to be explained was to be expected given how things like that tend to go. These accomplishments have variously been associated with successful explanation; see (Hempel, 1965; Woodward, 2003; Strevens, 2008).

Because of the complexity of our world, depicting such a pattern often requires papering over complicating details that would otherwise obliterate the pattern (Elgin, 2004; Bokulich, 2011; Potochnik, 2015a). It's deeply illuminating to grasp how cooperation can maximize benefit to participants in an exchange and the wide range of conditions over which this can occur, from governments to bacteria (Axelrod, 1984). That broad pattern is no longer represented if a model of symbiosis incorporates information about the genetic causes of some cooperative trait in place of the idealization that traits propagate to the degree of their success. Rather, it has been traded for something more nuanced and much less broadly applicable. The latter model is less idealized and thus more accurate of the specific scenario at hand, and in some research contexts this responds to the explanation-seekers' cognitive needs. But in research contexts when the benefit-maximizing role of

cooperation is enlightening, this additional accuracy inhibits understanding. Idealization enables the representation of broad patterns that would otherwise be obscured. The same goes for medium-range patterns and narrow patterns: the key to understanding is not to maximize the generality of the pattern grasped, but to accomplish the right fit with what puzzles those seeking explanation, what fits their cognitive needs (Potochnik, 2015a).

If idealizations are integral to representing enlightening patterns, then the falsity of idealizations can directly contribute to scientific understanding. By artificially simplifying the target phenomena, idealizations positively contribute to representing one enlightening pattern.[3] I resist the interpretation of this as mere stage-setting—facilitation or enabling—because I think this role is naturally construed as representational. Idealizations in this use do not just avoid representing complicating detail but affirmatively represent aspects of the world as being other than they are. Game theory explanations for the emergence of cooperation cannot simply avoid saying anything about mode of inheritance; rather they falsely assume that strategies propagate to the degree of their success. This has content. This indicates something about the relationship the phenomenon bears to the enlightening pattern, namely, that its actual system of inheritance does not interfere with it embodying the pattern of cooperation's benefit. We can expect this pattern to occur (at some level of fidelity) in phenomena that can be represented in this way.[4] This idealization therefore misrepresents the phenomenon in an informative way—it represents it as simpler than it in

[3]If patterns are real, it could be said that idealizations actually are true of the patterns they help represent (Potochnik, 2020). As such, they also could be taken to disclose something true about the phenomena in question. But it does not follow from this that idealizations simply are true claims about the phenomena. Gases in our world are never ideal, even if their behavior often approximates that of ideal gases.

[4]It follows from this that there are success conditions to be met by idealizations that play this role in explanation. I don't have the space to go into this feature of the view here, but see (Elgin, 2017) and (Potochnik, 2017) for two approaches to theorizing those conditions.

fact is, thereby communicating that it is within the scope of the pattern that occurs in the ideal of strategies propagating to the degree of their success.[5] This plays out in the same way for idealizations supporting explaining the behavior of real gases with the ideal gas law, sickle-cell anemia with Mendelian genetics, and other explanations that incorporate idealizations.

To summarize the view I have briefly motivated here, idealizations contribute positively to scientific explanations and the understanding thereby produced. This contribution is in virtue of idealizations' falsity, for their falsity eliminates complicating details that, represented more accurately, would interfere with the depiction of the explanatory pattern. Idealizations' contribution does not simply consist in facilitating veridical representation but in *mis*representing the system in regards that yield insight into an enlightening pattern. By misrepresenting systems—representing them as if they are different in certain regards than they in fact are—idealizations depict the true nature of an enlightening pattern, including the range of conditions over which it obtains. The depiction of patterns focal to explanation seekers, to the subjects of understanding, generates explanations and yields understanding. These successes rely essentially on idealizations' misrepresentation of the world, misrepresentation that sacrifices accuracy of the phenomenon to be explained for a corresponding gain in clarity for the explainers. Because understanding constitutes an epistemic success, there is epistemic value to sacrificing some accuracy or truth—to affirmatively misrepresenting—when developing (at least this variety of) scientific explanation.

[5]This idea has some similarities to what Rice (2018) says about idealizations and universality classes.

3 Why Not Just Focus on Truth?

In broad strokes, the view outlined in the previous section is similar to other accounts of idealizations' contribution to explanation and understanding. Some of these accounts also emphasize the significance of the departure from truth or accuracy (Bokulich, 2009, 2011; Elgin, 2004, 2017; de Regt, 2017; Potochnik, 2017) while others aim to show how such an account can be reconciled with veritism or factivism about explanation (Mäki, 2011; Strevens, 2017; Khalifa, 2017; Sullivan and Khalifa, 2019; Lawler, 2019; Pincock, 2021). This latter group agrees that idealizations facilitate explanation and understanding but aim to account for that facilitation in a way that maintains a core requirement of truth. Their work includes criticisms of the plausibility of non-factivism (Khalifa, 2017; Sullivan and Khalifa, 2019), interpretations of what idealizations offer that sidestep their falsity (Mäki, 2011; Khalifa, 2017; Strevens, 2017), and attempts to relegate idealizations to the periphery of explanation (Lawler, 2019; Pincock, 2021). However, I have not seen a positive argument for why veritism is a better view, at least not that goes beyond criticizing the plausibility of non-factivism. It tends to be assumed that veritism is a default, obvious stance that should be maintained if available. Here I motivate the opposite view: Even if one can maintain some version of veritism about explanation, it is better to emphasize how the role of idealizations in securing scientific understanding involves compromises of accuracy or truth.

What I have said so far offers many opportunities for veritists to disagree. Any step of the account briefly described in the previous section of how misrepresentation itself contributes to our understanding could be wrong. But, even if that account is more or less on the right track or is granted for the sake of argument, veritists still have opportunities to

insist that the outcome of all of this is not compromises of truth but rather securing truths that would otherwise be inaccessible. In line with Khalifa's quasi-factivism, one might hold that, though idealizations are false, the idealized representations they facilitate must be at least approximately true of any phenomena they can explain. Or, like Lawler and Pincock, one may conceive of idealizations' role in achieving understanding in a way that makes it compatible with veritism by arguing it is non-representational and facilitative rather than constitutive. These are all veritist positions; they are ways of accommodating idealization while maintaining a truth requirement for explanation and understanding. Alternatively, one might acknowledge the falsity of idealizations taken to be claims about the phenomena to be understood, that is, the objects of understanding, but emphasize idealizations' truth when taken to be claims about the *patterns* these phenomena embody and use this as a way to rehabilitate veritism.

I hope section 2's discussion, by motivating the centrality of idealizations to the production of understanding, provides some fodder for arguments against the plausibility of sidelining the contribution of idealizations to understanding or of chalking up that contribution to idealizations' relationship, however circuitous or tenuous, to truth. But I cannot provide knockdown arguments against these ways to preserve veritism. Rather, I want to offer reasons for why we should not *try* to rehabilitate veritism but rather emphasize how our scientific explanations fall short of truth. In particular, I suggest that three features of scientific explanation remain mysterious if we do not posit the epistemic value of compromising accuracy or truth in service of securing understanding. These features can perhaps serve as the basis for an abductive inference against veritism.

First, there is the persistence of idealized explanations when more realistic alternatives are available. Ideal gas law explanations persist in a variety of scientific contexts

when more realistic treatments would be possible (Woody, 2013). Optimality and game theory explanations are regularly developed in evolutionary ecology even though modeling approaches that more accurately characterize the genetic transmission of traits are available (Potochnik, 2010). On the face of it, veritism renders this practice illegitimate. Even if veritism permits some deviation from truth, it seems this deviation at least should be minimized if the truth requirement has any teeth at all. In contrast, the view I sketched in section 2 can make sense of the persistence of more idealized explanations. The continued value of idealized explanations consists in their ability to represent a pattern that is enlightening to those seeking explanation. There are some explanatory jobs that the ideal gas law does best, in virtue of rather than in spite of its representation of gases as noninteracting point particles. Explaining these phenomena in other circumstances of explanation, when the subjects of explanation have different cognitive needs, or explaining other phenomena entirely may call for a more realistic approach. It may be that idealized explanations need to be approximately true. But the false assumptions themselves, and their maintenance when it would be possible to eliminate them in favor of more realistic assumptions, cannot be motivated by focusing on truth as an epistemic end.

Second, there can be and often are multiple scientific accounts of a single phenomenon. We see non-competing varieties of understanding, tailored to different research projects. One biologist seeks the game theoretic account of the cooperative outcome, while another seeks the population genetic account of how this came to be (Potochnik, 2010). For some projects, the ideal gas law suffices to account for the properties of a given gas, while for others, the van der Waals equation is apt. Such multiple accounts, different varieties of understanding, are to be expected if idealizations' contribution to explanation is to home in on one pattern among many that a phenomenon embodies, in a way that is indexed to

the specific cognitive needs of those seeking explanation. This also gives a ready account of the value of this feature of science. Focusing on only one variety of understanding makes the resulting account more broadly applicable, more exportable, than if researchers worked toward a more accurate, integrated account of one system in particular. The price for this broader applicability is artificial simplification via idealization. In contrast, this multiplicity of accounts is not readily explainable if the epistemic value of the elements of an explanation is always cashed out in terms of approximate truth of the object of understanding. Whenever simplification and exportability are purchased with idealizations, an aim of truth or approximate truth should motivate de-idealization, steps toward an integrated, realistic account. But integrated accounts are an exception that proves the rule of the proliferation of simplified, interest-relative accounts. The standard move in philosophy of science has been to attribute different explanatory strategies solely to differences in how the explanandum, the object of understanding, is characterized. But above I suggested and elsewhere [cit. omitted] I have argued that there is no grounds for expecting that the influence of scientists' interests is limited to merely how the explanandum is characterized. Here is another place where philosophers of science owe an argument for what has been taken to be an obvious truth.

Third, explanations bear the mark of the particular individuals who develop them—the subjects of understanding—in a way that goes beyond simply uncovering what is true about objects of understanding. Scientists' representational choices, including what to emphasize, what to take into account, and what to idealize, cannot influence what's true of the world. But these are inarguably decision points that bear on the nature of the explanations scientists generate. In this way, specifics of the research agenda that is pursued shape the resulting explanation. This is akin to the mundane point that science

seeks important truths, not just any truths. But the extent of the choice is much greater than simply choosing which phenomena to investigate. The choice of what to focus on, what variety of insight to seek, occurs even when the phenomenon of interest is settled on. In North America, Mountain Bluebirds are early settlers in areas after wildfire, and they are eventually displaced by the more aggressive Western Bluebirds. Is it important to understand how changing access to resources leads Western Bluebirds to colonize Mountain Bluebirds' territory? What leads some Western Bluebirds to be colonizers and others to stay put? What accounts for the relative aggressiveness of Western Bluebirds? Whether interbreeding influences each species when they are colocated? This list just scratches the surface of what could be explained about this phenomenon. Each specific research focus is linked to quite different representational choices, ranges of similar phenomena, bodies of background knowledge, and, yes, idealizations. To account for the features of scientific explanations, we must ask not just about the features of the phenomena scientists wish to explain, but also about the features of the scientists who wish to do the explaining. This sensitivity to the features of the subjects of understanding is hard to make sense of if we take the aim of explanation simply to be supplying generic truth or approximate truth about a phenomenon.

For veritist views of explanation, truth or approximate truth of the phenomenon to be explained is a requirement for explanation. I have described three features of explanations that I think are best accounted for by positing the positive explanatory value of departures from truth (and approximate truth). It may be possible to develop a factivism or veritism about explanation that accommodates these features. But the requirement of truth or approximate truth leaves these features unexplained, while positing the value of departures from truth accounts for them. Accordingly, failure to emphasize the contribution of

misrepresentation (as tends to happen with veritism) risks obscuring these important features of scientific explanation. So, why not give up veritism? To be clear, this is not to say we should give up on any success condition for the accuracy of our explanations. Such a condition is undoubtedly necessary. But what is the argument that simple truth or approximate truth of the target of explanation is the right success condition and the only success condition?

At the beginning of this section, I identified a second, very different strategy for the advocate of veritism. If one follows me this far, either out of agreement or for the sake of argument, one could still claim the veritist mantle by switching the truth attribution from the targets of explanation to the patterns I have said these targets embody. As Currie (2018) points out, "scientists say an awful lot that is true about patterns (even if... they do not say much strictly true of phenomena)." I wholly agree that idealized representations can be true of patterns phenomena embody even when they are not strictly true of phenomena. But I don't think this is reason to be a veritist about explanation. One immediate difficulty is that, when the objects of explanation are phenomena under investigation, veritism is a position about the truth of our explanations *of those phenomena*. Our explanations being true of patterns is incidental to that question. $PV = nRT$ is true of an ideal gas, and it is true of a pattern exhibited in a range of gases. But, this is not strictly true in any real gas the pattern is used to explain.[6]

Such an approach to veritism also has a cost similar to the more traditional paths to veritism I addressed above. Moving straight to how a claim of truth may be preserved

[6]Patterns can also serve as the objects of our explanations; one can ask why $PV = nRT$ (more or less) in a wide range of gases. But this, of course, must be explained by something other than that $PV = nRT$. My point here is simply the nonidentity between what is explained and of what the explanation can be said to be true.

in the face of idealization risks obscuring the extent of idealization and its epistemic value. This particular approach to veritism of emphasizing truth of patterns neglects the important disconnect between patterns and the phenomena that embody them. The relationship between phenomena and the patterns they embody is many-many. Any given phenomenon—any given target of explanation—embodies many patterns, and those seeking explanation influence which of these patterns is explanatorily relevant. And any given pattern is embodied in some range of phenomena. Information about that range is an important part of explanation, as this shapes our expectations and provides counterfactual information about how things might have gone otherwise (Woodward's (2003) "w-question:" what if things had been different). The many-many relationship between phenomena and the patterns they embody deserves more attention than it has received in science and philosophy of science. This disconnect between phenomena and patterns helps clarify the guiding role of the research agenda in singling out which patterns are explanatory, and it is also key to making sense of the pervasive role of idealizations in scientific explanations.

In this section, I have described three features of scientific explanation that go unaccounted for or are at least obscured by a commitment to the truth or approximate truth of any successful explanation. I have not argued that one cannot maintain veritism about scientific explanation. Rather, I have suggested that there is a philosophical cost to maintaining veritism and compensatory philosophical advantages to abandoning it. Given what we are familiar with in the everyday giving of reasons, positing the epistemic value of departures from truth may seem counterintuitive. But that in itself is not a reason to hold fast to veritism come what may. As with many aspects of everyday existence, what we have encountered in science can give us reason to revisit our assumptions, including

our assumption that approaching truth uniformly increases epistemic value. Explanations' departures from strict truth of what they explain has epistemic value. Abandoning veritism is a way to fully acknowledge this and its ramifications for our explanatory practices.

4 Upsides to Abandoning Veritism

That idealizations are frequent contributors to the understanding achieved through science is an important finding of contemporary philosophy of science, providing insight into the nature of our science and our world. The explanatory value of idealization deserves emphasis. It should not be brushed under the rug by focusing on how we might be able to accommodate idealization while still talking about only the aim of truth. Let me conclude, then, by answering the question behind the title of this article: why does it matter that idealizations are false? Why focus on this rather than zeroing in on ways in which idealizations and the representations they facilitate are related in one way or another to truth? This discussion follows closely on the heels of the previous section, where I characterized the features of scientific explanation that are obscured or go unaccounted for in veritist approaches. There I described what veritism about explanation misses. Here I develop a positive view of how the epistemic importance of departures from truth for explanation aligns with other plausible or widely shared philosophical views and the insights that can be gained by taking this to heart.

Granting the importance of principled misrepresentation to scientific explanation shows how the epistemic successes of formulating genuine explanations, of coming to understand, are relational achievements. Science is not just about depicting truths, even important truths. Rather, it is an exercise in connecting human agents to the world in ways that

are cognitively and often practically useful. Sometimes depicting simple truths provides this connection. Other times, the connection bears more of a mark of the human-agent side of the connection. This can take any number of forms, but one important variety is when artificially simplifying our account of some phenomenon enables subjects to grasp an important feature of that phenomenon, to glean why it should be that way and what would have happened if things had been otherwise. Idealization, using simple assumptions to smooth out some of our world's complexity, is an essential step of many instances of coming to understand, at least in science.

This general role for idealization (one of several roles) accounts for why idealizations are present in so many scientific explanations, and it accounts for why such idealizations are voluntarily maintained when more realistic alternatives are available. This also accounts for the proliferation of different explanations in science, explanations that capture distinct features of the same or closely related target phenomena. There is also a closely related observation to make here about the world: our world is not one in which there is only one story to give about any given happening. Rather, it is richly complex, and there is room for multiple accounts of phenomena that are individually enlightening. I take it most of these claims are pretty uncontroversial among philosophers of science—or at least, similar claims have been made in many different philosophical debates about science. Rejecting veritism about explanation for something more nuanced that affords a distinctive, central role to idealization (as a departure from truth) fits neatly into such a picture.

Sometimes scientific realism is seen as a motivation for veritism about scientific explanations, but none of what I have said here requires abandoning scientific realism. Rather, the point I made above about scientific explanation as a relational achievement has an allied position regarding realism. Science generates knowledge in response to our

cognitive needs. That's uncontroversial, I think. And, it may be that responsiveness to our cognitive needs leads to the generation of scientific knowledge not of phenomena per se but of patterns they embody. It's often been said that science is after laws, regularities, repeat phenomena rather than one-off events. It's not a far stretch to suggest that scientists aim to understand phenomena, the events and occurrences of our world, by generating knowledge of the patterns these phenomena embody. This would eliminate veritism about explanations as a requirement for scientific realism. On this view, there is a deep relationship between scientific understanding and scientific knowledge, but it is not a relationship of identity.

This view also suggests the importance of epistemic subjects in shaping the content of scientific knowledge. Perhaps more than any other feature of science, idealizations make clear the range of ways in which the practitioners and audiences of science shape the nature of scientific findings. Idealizations enable researchers to focus myopically on exactly what they (or others) care about in a phenomenon, whether it's a given pattern, a different pattern embodied by the same phenomenon, a prediction of overall system behavior, or etc. Idealizations can tailor a representation to an audience, which is why their role in textbooks has long been appreciated. Idealizations enable the reapplication of approaches a researcher happens to be familiar with to disparate phenomena. In these ways and others, idealizations help tailor scientific knowledge to our cognitive needs. Among other things, which patterns scientists focus on, what they seek to understand, is influenced by who they are and who their audience is. This is one reason it matters for our scientists to have diverse identities and ranges of experiences and a reason it matters who is funding science—the public or, say, pharmaceutical companies.

We want something that usually does not technically exist: a simple answer to why.

So, we lie a little bit. We speak about the phenomena we seek to understand as if they correspond more fully than they do to patterns they embody. In doing so, we artificially simplify to gain clarity and control over our world. We represent the world multiply, so that we can represent it as simpler than it is. All of this is as it should be, given that our science is designed to respond to our epistemic needs. The mistake only arises if we refuse to acknowledge the epistemic importance of idealizations, of misrepresentations, and the resulting partiality of our understanding. It may be possible to maintain veritism about explanation or to rehabilitate a version of this commitment, such as Khalifa's quasi-factivism. But, I submit, this is not the default, obvious position to be maintained come what may. Departures from the truth are epistemically important, and it's philosophically fruitful to work out how this occurs and what it accomplishes.

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