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The diverse aims of science

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ABSTRACT

There is increasing attention to the centrality of idealization in science. One common view is that models and other idealized representations are important to science, but that they fall short in one or more ways. On this view, there must be an intermediary step between idealized representation and the traditional aims of science, including truth, explanation, and prediction. Here I develop an alternative interpretation of the relationship between idealized representation and the aims of science. I suggest that continuing, widespread idealization calls into question the idea that science aims for truth. If instead science aims to produce understanding, this would enable idealizations to directly contribute to science's epistemic success. I also use the fact of widespread idealization to motivate the idea that science's wide variety aims, epistemic and non-epistemic, are best served by different kinds of scientific products. Finally, I show how these diverse aims—most rather distant from truth—result in the expanded influence of social values on science.

The important role that models play in science has, in the past decades, been increasingly appreciated by philosophers. This attention to scientific modeling has, in turn, led to an emphasis on the centrality of idealizations. As Wimsatt (1987, 2007) says, "Any model implicitly or explicitly makes simplifications, ignores variables, and simplifies or ignores interactions among the variables in the models and among possibly relevant variables not included in the model (p.96)."[1] These are all idealizations. Most broadly, idealizations are features of representations that misconstrue the represented systems. Examples include the common assumption in physics of frictionless planes and the common assumption in economics that humans are perfectly rational agents. These assumptions are false of every real system: every plane has friction, and no human is perfectly rational. Assimilating several views about the nature of idealization, including Wimsatt's, Weisberg (2007, 2013) identifies three distinct purposes to which idealizations are put. These include Galilean idealizations, which are simplifications needed to secure computational tractability, to be eliminated if and when it proves possible; minimalist idealization, which is the elimination of all but the most significant causal influences on a phenomenon; and multiple-models idealization, which is the use of several distinct models that together shed light on a phenomenon. Rohwer and Rice (2013) argue that the roles of idealization are even more varied still.

One common view is that all of this idealization may be necessary, but it results in models that are lacking in various ways. Accordingly, the view goes, we must look for a subsequent step, a way to connect these idealized models to the successful pursuit of the aims of science, whether the specific aim is prediction, empirical confirmation, explanation, accurate representation, etc. The textbook version of this view would hold that science aims for truth, and so idealized models must be de-idealized in order to be useful. It seems that Odenbaugh and Alexandrova (2011) assume something like this view, for they argue that without the removal of all idealizations—complete de-idealization—we have "no ground, beyond that of our background knowledge that informed the model, for claiming that the model specifies a causal relation" (p.765). Odenbaugh and Alexandrova conclude that even the use of

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[1] Wimsatt (1987) is republished as Chapter 6 in Wimsatt (2007). Page numbers here refer to the latter publication.

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multiple models with different idealizations—i.e. robustness analysis—cannot yield the description of a causal mechanism. Thus, they claim, analysis based on multiple, idealized models does not allow for the confirmation of models, nor can it generate explanations.

Other versions of this view do not hold de-idealization to be necessary but still anticipate the need to bridge the gap between idealized models and the traditional aims of science. Wimsatt (2007), for instance, argues that idealized, "false" models can be used to produce "truer" theories without recourse to de-idealization. Similar to Odenbaugh and Alexandrova's concern with causal description and explanation, Rohwer and Rice (2013) argue that at least one purpose of idealizations, the investigation of general patterns across heterogenous systems, prevents the accurate description of causal factors and, thus, prevents the formulation of explanations (though they hold that resultant models may still be explanatory in some weaker sense). This style of view endorses the continuing practice of idealization, but also holds idealized models to be somewhat distant from the traditional aims of science. These authors accordingly explicitly or implicitly commit themselves to an intermediary step of some kind between idealized representation and achieving the aims of science. On this strategy, even though idealized models are of scientific value, they are not sufficient to provide adequate explanations, trustworthy predictions, causal representations, etc.—or at least not by themselves.

One could instead take a very different approach to reconciling idealization with the aims of science. The observation of widespread idealization in science, and the distance between idealized models and traditional articulations of the aims of science, might be seen as grounds for concluding that those traditional articulations of the aims of science are incorrect. On this alternative approach, nothing has gone wrong with or is lacking from idealized models, and no intermediary step is needed for idealized models to achieve the aims of science. Those aims just stand in need of clarification. This is the tack I take in this paper. In §1 I develop a conception of science's epistemic aim to which idealized models can directly contribute. In particular, I suggest that science does not aim to provide truth, but instead to provide understanding. In §2 I outline a second consequence a positive conception of widespread idealization might be seen to have for the aims of science. Science's diverse aims, both epistemic and non-epistemic, often conflict and thus motivate different kinds of scientific products. Finally, in §3 I demonstrate that this alternative conception of science's epistemic aim and of the relationships among science's various aims creates new room for the influence of social values.

1. Understanding at the expense of truth

Wimsatt (2007) points out, regarding idealized models, that "unless they could help us do something in the task of investigating natural phenomena, there would be no reason for choosing model building over astrology or mystic revelation as a source of knowledge of the natural world" (p.101). This must be right. Idealized models, even though they are false in some regards, must get us somewhere that mystic revelation does not. At issue is what exactly idealized models are helping us accomplish, and in particular, the nature of their epistemic value. Here I will explore the idea that false models are not a means to truer theories, as Wimsatt believes, but instead themselves accomplish the end goals of science, including its epistemic success. I do not provide a conclusive argument in favor of understanding and against truth as science's epistemic aim. Instead, in what follows, I distinguish the aim of understanding from the aim of truth; motivate the former; and show how this enables widespread idealization to directly contribute to science's epistemic success. Because idealizations are patently untrue, their continued presence in models cannot be justified by their contribution to the truth of those models. Accordingly, if idealizations directly contribute to science's epistemic success, then this suggests the epistemic aim is something other than truth.

A first step toward a conception of the epistemic aim of science to which idealized models can directly contribute is provided by Elgin (2004). Elgin is also impressed by how many scientific laws, models, and theories diverge from the truth in various ways. Her aim is thus to show how these scientific products can be epistemically acceptable without being entirely true. She says,

> I take it that science provides an understanding of the natural order. By this I do not mean merely that an ideal science *would* provide such an understanding or that in the end of inquiry science *will* provide one, but that much actual science has done so and continues to do so (p.114, emphasis in original).

Elgin's strategy is to accept today's actual science as a successful venture, then look to see what this science accomplishes. What she finds is that science regularly produces understanding, even as it falls short of producing truths. Accordingly, rather than make excuses for the myriad ways in which our science fails to produce truth, Elgin redefines science's epistemic success to consist of understanding, not (necessarily) truth.

For this approach to have promise, it must be possible for the achievement of understanding to occur without the possession of complete truth, but understanding must still qualify as an epistemic success. A key feature of the concept of understanding enables it to play this role: it has a dual nature. Understanding is at once a cognitive state and an epistemic achievement. Because it is an epistemic achievement, understanding is not simply an "aha" moment. A felt sense of understanding is not sufficient for the possession of understanding; understanding requires successful mastery, in some sense, of the target of understanding. Both Grimm (2010, 2012) and Strevens (2013) describe this mastery as a form of grasping. As Grimm (2012) stresses, "grasping" is a success term. And so, "the mind of someone who understands mirrors or reflects reality" (Grimm, 2012, p.109). There is some debate over whether understanding is a species of knowledge (see, e.g., Grimm, 2006), but it is widely regarded as an epistemic success of some kind, and I take it to be as well. On the other hand, because understanding is also a cognitive state, its achievement partly depends on the psychological characteristics of those who seek to understand. This distinguishes understanding from truth, for whether a proposition is true in no way depends on the psychology of one who entertains or believes that proposition. Understanding's characteristics qua cognitive state accounts for how idealized representations can be well-positioned to provide understanding.

For Grimm (2012), you cannot have objective understanding without possessing truth (though in his view this is not understanding's full epistemic value). In contrast, Elgin (2004) suggests that understanding may be furthered by some departures from the truth. In her view, "felicitous falsehoods," or idealizations, can facilitate understanding insofar as they "impose an order on things, highlight certain aspects of the phenomena, reveal connections, patterns and discrepancies, and make possible insights that we could not otherwise obtain" (p.127). Elgin gives the example of drawing a smooth curve and treating the data's deviation from the curve as error or noise. This idea—that departures from truth can contribute to understanding by revealing patterns and enabling insights that would otherwise be inaccessible—is corroborated by research in psychology. Williams, Lombrozo, and