Scientific Models Are Not Fictions

Erik Curiel[†]

5. Mar 2023

ABSTRACT

Scientific models are not best understood as fictions. If one wants to use such an idiom, it is perhaps better to think of them as metaphors.

1. Scientific models are not falsehoods purporting to be true (Godfrey-Smith 2007; Frigg 2010). They make no claim to verity, only to propriety and adequacy. They are cognitive constructs we know how to reason about and with in a way that conduces to learning about the world, often about matters we do not know about or do not well understand, not necessarily by virtue of their (even limited or merely approximative) verisimilitude. The contrary seems to me to be the essence of a fiction: we know how to approach it and how to understand it by comparing it to and explicating it in terms of things we do already know to be true, and (in the best of cases) it teaches us what we would not otherwise on our own have realized about things we know to be true. That is not the role scientific models play in our cognitive life. They act in the opposite sense. They allow us (in the best of cases) to approach and to understand things we do not already know to be true.

2. If one follows Frigg and Nguyen (2021), and takes the view that the account of models as fictions is best understood as an account of the ontology of models, rather than their function, then the account is worse than wrong—it is useless. To try to tell me what a model is, and then to say that one has not also told me what a model does and how it does it, is to have told me nothing about the scientific character of models. One has told me only that the fundamental `hulē` of models is the medieval idea of Aristotle's Prime Matter, that a model is a pure potentiality. But all the action is in the model's `morphē`—how it is instantiated *so as to* potentiate our reasoning.

   If the account is to be worth consideration at all, it must be construed, at least in part, as a description of the epistemological role of models and of their epistemic status.

[†]**Author's address**: Munich Center for Mathematical Philosophy, Ludwig-Maximilians-Universität; Black Hole Initiative, Harvard University; **email**: erik@strangebeautiful.com

3. Consider the statement that "in NY 14.72 people live in the average household" (Peirce 1878a, p. 144): I should say this is an *idealization*; this is not a fiction, for we do not *pretend* that there is such a thing as a 100th of a person (at least in the relevant sense, not as in, *e.g.*, chopping a human up into 100 bits); we rather use what corresponds to a relation among known facts about the distribution of the population for use in further reasoning; it is not "known to be false, strictly speaking", nor "what we know to correspond to no fact", for the average is indeed a fact in every sense of the word.

4. Fictions are governed, if at all, by conventions grounded only in subjective human experience; scientific propositions in general and models in particular are governed by fitness to the purpose of understanding the physical world, and thus by how the world pushes back against inappropriate, inaccurate or otherwise unfruitful attempts to scientifically comprehend it.

5. Fictions are cognitively and representationally open-ended: our ability to "interpret" them is bounded only by our imagination. (*Cf.* the profusion of literary criticism on "Hamlet".) That is not true of scientific models.

   Someone may retort, of course interpretation of scientific models is open-ended, just look at philosophy of physics on quantum mechanics or even on Newtonian gravitational theory.

   That is to miss the point: (1) QM and NGT are not models; and (2) (I want to say) the struggle there is to find a good interpretation, or at least to rule out the more wrong ones. Again, it is well to get straight on what "interpretation" of a model may mean, and then it will become clear that, in the relevant senses, interpretation of models is not open-ended. Curiel (2009) provides a useful starting place for classifying, and thereby in part comprehending, the kinds of interpretation at issue.

6. Literary criticism may also aim to find good interpretations, or at least to rule out the worse ones, but here it is the fiction itself that pushes back; it is, again, rather the world that pushes back against attempts to interpret a scientific model. The model itself does not push back, except in so far as it may be self-contradictory in a deleterious sense, or poorly defined, or computationally intractable, or conceptually muddled, or something along those lines—but nothing along those lines has to do with the more important way in which the world pushes back.

7. A fiction can never be shown to be inappropriate or inadequate by facts in the world (although such facts may justly lead one to judge it "unrealistic" or "shallow"). There are experiments in fiction, and they can fail in many ways, but one of those ways is not by failing to uncover something about the world.

8. If one wants to speak in such an idiom at all—and I am not at all convinced it is fruitful to do so—it is more appropriate to think of models as metaphors.

9. Metaphors are *not* open-ended in the way fictions are, for a metaphor has a function (in the technical literary sense, of this individual particular metaphor, not of metaphor as a literary trope), and all pedestrian uses, and much more extrapolative essays and exploratory exegeses, must respect it.

10. Metaphors teach us about the world, not by getting something wrong, by describing something falsely, but by drawing our attention to unforeseen similarities, to unexpected harmonies, by reconciling the seemingly disparate—a formal symbolic system partaking of our concepts on the one hand and physical stuff on the other.

11. And that a meaningful, even deep, metaphor can be drawn between two such things is one of the most remarkable facts about human cognition I know of.

References

Curiel, Erik. 2009. "General Relativity Needs No Interpretation." *Philosophy of Science* 76 (1): 44–72. doi:10.1086/599277.

Frigg, Roman. 2010. "Models and Fiction." *Synthese* 172 (2): 251–268. doi:10.1007/s11229-009-9505-0.

Frigg, Roman, and James Nguyen. 2021. "Seven Myths about the Fiction View of Models:" chap. 6 in *Models and Idealizations in Science: Artifactual and Fictional Approaches,* edited by Alejandro Cassini and Juan Redmond, 133–157. Logic, Epistemology, and the Unity of Science 50. Cham: Springer. doi:10.1007/978-3-030-65802-1_6.

Godfrey-Smith, Peter. 2007. "The Strategy of Model-Based Science." *Biology & Philosophy* 21 (5): 725–740. doi:10.1007/s10539-006-9054-6.

Peirce, Charles Sanders. 1878a. "The Doctrine of Chances." Chap. 9 in *The Essential Peirce: Selected Philosophical Writings,* edited by N. Houser and C. Kloesel, vol. 1 (1867–1893), 142–154. Bloomington, IN: Indiana University Press. Originally published as Peirce (1878b).

———. 1878b. "The Doctrine of Chances." *Popular Science Monthly* 12 (March): 604–615.