No Understanding without Explanation

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Understanding without explanation? Impossible, or so I will argue—in the case of science, at least. More particularly, I will defend in this paper a version of the following simple view concerning the connection between scientific explanation and understanding, which I call the *simple view*:

> Scientific understanding is that state produced, and only produced, by grasping a correct explanation. (Strevens 2008, 3)

The simple view, I will conclude, ought to be regarded as one part of a bigger picture. But the central idea, that scientific understanding is a matter of having the right epistemic relation to an explanation or explanations, will remain untouched.

1. Explanation Grasping a correct *explanation*. What is an explanation, such that it can be grasped?

It can be assumed, I think without any loss of generality, that an explanation is a set of propositions with a certain structure. Such a characterization is well suited, of course, to capture Hempel's deductive-nomological and inductive-statistical accounts of explanation (Hempel and Oppenheim 1948; Hempel 1965), along with other accounts according to which explanations have the form of arguments, whether the arguments are explanatory ends in themselves or whether they represent structural elements of reality, such

as subsumption under unifying patterns (Kitcher 1981) or causal processes (Strevens 2008).

But any almost view of explanation can be put in these terms. On Salmon's (1970) statistical relevance view, for example, an explanation is a table of statistical information, while on Woodward's (2003) manipulationist view, it may take the form of a causal graph. Both are perfectly representable, if not canonically, in sentential form.

To grasp an explanation, I therefore propose, is to grasp two kinds of things: first, that the states of affairs represented by the propositions in fact obtain, and second, that the propositions stand in the prescribed structure—for example, that they form a deductive argument for the explanandum (for Hempel) or that they stand in the right kinds of statistical relationship to the explanandum and to each other (for Salmon).[1] A sophistication will be added in section 3's discussion of idealizing explanation.

2. Grasping *Grasping* a correct explanation. What is it to grasp that a certain state of affairs obtains, or that a set of propositions stand in a certain relation to one another?

To grasp that a state of affairs obtains is to understand that it obtains; thus, grasping is a kind of understanding. There is no circularity here, however, because the kind of understanding that is constituted by grasping is not the kind of understanding that is supposed to be characterized by the simple view. Let me explain.

The cat is on the mat—so I will suppose. There are two ways you might be said to understand the situation. First, you might understand *that* the cat is on the mat, meaning that you are fully aware, you are entirely conscious, of the cat, the mat, and a certain spatial relation between them. (Whether such

1. When the structure represents an empirical matter of fact, such as the fact that the states of affairs represented by the propositions stand in the right kind of causal relationship to the explanandum and to each other (Strevens 2008), then this second grasping is of the same kind as the first grasping, namely, a recognition that some empirical fact obtains.

understanding requires that you *know* that the cat is on the mat is a further question that I will not answer here, but certainly, knowledge is typically a concomitant achievement.)

If you understand that the cat is on the mat, you might also understand *why* the cat is on the mat: perhaps the cat likes the mat, or perhaps it was drugged and left there to recover. This "understanding why" is quite separate from "understanding that": you might be exquisitely, incandescently aware of the cat's being on the mat without having the slightest clue how it got there.

My topic in this paper is understanding why. The simple view of understanding why is couched in terms of grasping propositions, which is a matter of understanding that. I have no account of understanding that (perhaps the deepest question in all of philosophy), but for my purposes here it is enough to say, I hope, that it is a entirely distinct from understanding why.[2]

Is grasping factive? Must the cat be on the mat, if you are to grasp that the cat is on the mat? Factivity seems to be implied by the "grasping that" locution; however, a friend of the simple view might, I suppose, find this implication unwelcome. Let me therefore briefly develop a non-factive notion to parallel "grasping that". Suppose that grasping has two components: a purely psychological (or "narrow") component, and the obtaining of the grasped state of affairs. What is wanted is the purely psychological state, the state that would persist in your mind if an evil demon, at the moment of your grasping that the cat is on the mat, destroyed the cat while maintaining in your mind the appearance of an enmatted cat. Give this state an unpleasant name: call it grasping*. Then the simple view might be reformulated as follows:

> Scientific understanding is that state produced, and only produced, by grasping* a correct explanation.

2. Kvanvig (2003) makes this distinction, or something like it; his term for "understanding why" is *objectual understanding*. Compare also Hempel's (1965, §4.1) discussion of various senses of the term *explanation*.

In my view, an explanation is correct only if its constitutive propositions are true, so this reformulation is a difference that makes no difference, but the notion of grasping* will find a philosophical use in what follows.

3. Correctness Grasping a *correct* explanation. Is correctness too high a standard?

Young earth creationists believe that the Grand Canyon was formed over a very short period (about a year) by a great flood. Suppose for the sake of the argument that their model for the canyon's formation is sufficiently science-y to count as an explanation (though not of course a correct one)—say, because it invokes law-governed causal processes. Assume further that the creationists fully grasp* all elements of their story (where grasping*, you will recall, is the non-factive analog of grasping). Do they understand the formation of the Grand Canyon? Surely not, because their explanation is incorrect. Thus, correctness of explanation is a necessary condition for scientific understanding.

And yet . . . consider three reasons for thinking that a more nuanced attitude to explanatory correctness is required.

First, some might say that understanding is a narrow psychological state, not dependent for its existence on the way things are outside the skull. This is a proposal to change the subject, not an argument against the simple view. The simple view gives an account of the sort of understanding why that the young earth creationists lack. You might also give an account of the "sense of understanding" that they indubitably feel. It might go as follows: to have a sense of understanding why a phenomenon occurs is to grasp* a potential (but not necessarily correct) explanation of that phenomenon. Then again, perhaps the sense of understanding is just the firing of U-fibers (Trout 2007). It is, in any case, not my topic here.

Second, many explanatory models in science contain idealizations; interpreted literally, these models are false. Yet scientists gain understanding by

grasping idealized models. A reason to abandon the simple view of understanding's requirement of explanatory correctness?

No; at most a reason to use the term *correct* rather than, say, *true*—as the simple view does already. Why? Some apparent falsehoods do not stand in the way of explanation, but others—as the young creationist case shows—most certainly do. The former class of models are "correct" in a sense that the latter class are not. Their correctness cannot, of course, consist in their literal truth. But if idealizing explanation is governed by any standard at all, there is a translation manual that, for any idealized model and context of (re)production, picks out a set of propositions that state the facts about the world that must obtain if the model is to be explanatory, and in virtue of which the model is explanatory, if they do obtain. Call these putative facts the *explanatory content* of the model.

In the simplest kind of idealized model, "All *F*s are *G*" might translate to, thus have the explanatory content, "Almost all *F*s are *G*". Or it might have the explanatory content "In conditions *C*, all *F*s are *G*", where the conditions *C* are determined by the context of production—the intentions of the explainer, for example. Strevens (2008, chap. 8) gives a more general account of the translation manual.

An idealizing explanation is correct if the propositions expressing its explanatory content (as opposed to its literal content) are true. To say that understanding requires "grasping a correct explanation", then, is to say that it requires grasping that the propositions expressing a relevant model's explanatory content are true, or in other words, understanding that the states of affairs represented by those propositions obtain.

The third reason to think that the correctness of an explanation is (at least sometimes) too high a standard for understanding is that we talk about understanding false theories: high school graduates are expected to understand Newtonian physics; historians of chemistry are supposed to understand phlogiston theory; and many cosmologists feel that they understand the

inflation model of the early universe in a sense that is independent of whether it ultimately turns out to be correct.

This represents, I suggest, a third sense of "understanding" that might be called *understanding with*. Like understanding why, and unlike understanding that, understanding with involves mastering a scientific explanation: to understand a theory in this new sense is to be able to use that theory to explain a range of phenomena. Understanding with therefore comes in degrees: the wider the range of phenomena you can explain (considered as a proportion of the total explicable range), the better you understand the explaining theory. When you can explain every phenomenon that the theory is in principle capable of explaining, you understand the theory completely, in the "understanding with" sense.

Understanding with does not require that the explanations in question be correct, but it does require that they be internally correct. What does this mean? When he presented the deductive-nomological account of event explanation, Hempel distinguished logical and empirical requirements for an explanation's being correct. His logical requirement was that the explanation should constitute a law-involving deductive argument for the explanandum's occurrence, and his empirical requirement was that the premises of the argument should be true. You might generalize as follows: every account of explanation imposes internal and external conditions for explanatory correctness. The external condition consists in some match between the explanatory model and the external world; in the terms developed earlier in this section, the empirical condition requires that the propositions expressing the model's explanatory content hold true. The internal condition holds or fails to hold independently of the way things are in the outside world. On a causal account of explanation, for example, the internal condition might stipulate that an explanation represent a potential causal history for the explanandum; the empirical condition would then stipulate that this must be the explanandum's actual causal history.

Satisfaction of the internal condition, but not the external condition, is necessary for "understanding with". To have this sort of understanding of Newtonian physics is to be able to construct an array of Newtonian explanations that are good in the sense that they would be correct if only Newtonian physics were true.

It is clear, I hope, that understanding why and understanding with in science represent distinct epistemic achievements, both of which involve scientific explanation and both of which may be characterized using the English word "understand". It would be correct to say that historians of science understand the phlogiston theory well, but wrong to say that the phlogiston theorists understood combustion well. Both claims turn on the "correctness" in some sense of phlogiston theory's explanation of combustion; however, the former requires only that the explanation satisfy the internal standards for correctness, while the latter requires that it satisfy also the external standards. Thus the former claim is true while the latter is false.

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The notion of understanding with neutralizes an apparent counterexample to the simple view. According to the simple view, to understand something in the "why" sense is to grasp a correct explanation of that thing. It follows that whatever has no explanation, cannot be understood. Counterexample: As far as we know, general relativity is a fundamental theory (put aside its difficult relationship with quantum mechanics). As such, it has no scientific explanation; we can use relativity to explain many things, but we cannot explain relativity itself using further laws of nature, or else those laws, not relativity, would be what is fundamental. The simple view implies, then, that general relativity cannot be understood—an unreasonable conclusion.

The response to the objection is, of course, that the sense in which physicists understand general relativity is "understanding with". It is correct to say that many people understand relativity, but it is certainly not correct to say that many people understand why the theory of relativity is true. Further, if

we were ever to achieve such understanding, it could only be because relativity is not, after all, fundamental: to understand why relativity holds is to see it as a consequence of a more fundamental law.

4. Brief Objections and Replies

Objection: Understanding is a precondition for, not a product of, correct explanation.

Reply: True in many ways. "Understanding that" and "understanding with" are preconditions for every explanation. But understanding why a phenomenon obtains is not a precondition for constructing an explanation of that phenomenon; the two arrive as twins, like proof and knowledge in mathematics.

Objection: "Understanding why" comes in degrees; correctly explaining is an all or nothing matter.

Reply: First, distinctions can be made between correct explanations of the same phenomena, with some said to be better or deeper than others (Strevens 2008, chap. 4). Second, there are degrees of grasping itself: if you are not completely clear on how the correct explanation of a phenomenon goes, but you have a good grasp of most of the explanation's elements, then you understand it pretty well but not perfectly.

Objection: Understanding is active; it involves not only the comprehension of a theory but the ability to put the theory to use. So understanding cannot be a matter of merely grasping propositions.

Reply: The objection equivocates: insofar as understanding involves an ability to construct explanations, it is understanding with. Insofar as it is a matter of "merely" grasping propositions, it is understanding why.

Objection: Understanding is holistic; grasping propositions is atomistic.

Reply: Grasping the relation among propositions in virtue of which they constitute a standalone explanation with no missing or surplus parts is grasping a property of the whole that goes beyond the parts. On the simple view, understanding why is indeed holistic (and understanding with still more so).

Objection: What about the Verstehen tradition in the social sciences?

Reply: The subject of this paper is a kind of understanding that is found across the sciences, in physics and biology as well as in anthropology and sociology. The special role that understanding plays in the social sciences, if any, is a topic for another time.

5. Conclusion There are three senses in which it can be said that you understand a state of affairs: you might understand that it obtains, you might understand why it obtains, and if it is a theory or a theory part, you might understand how to use it to explain other states of affairs. These are understanding that, understanding why, and understanding with.

Writers on understanding have not always made these distinctions; de Regt and Dieks (2005), for example, might be interpreted as offering an account of understanding with, whereas Strevens's (2008) simple view—the view defended in this paper—was offered, though not explicitly, as an account of understanding why. For this reason, I have avoided direct comparisons between what may only appear to be contradictory theories of understanding.

This paper has, first, developed and defended the simple view of understanding why, on which to understand why a fact obtains is to grasp an internally and externally correct scientific explanation of the fact, and second, offered a complementary account of understanding with, on which to understand a theory is to have the ability to use the theory to construct internally correct scientific explanations of a range of phenomena.

Both accounts are limited to scientific understanding and scientific explanation, but they might easily be extended: to understand a moral rule might be to grasp a correct moral explanation of the rule (perhaps a derivation of

the rule from fundamental moral principles) or to have the ability to use the rule to explain moral facts (for example, why lying is usually wrong).

Finished so soon? My ideas about understanding are simple because understanding why and understanding with are derivative notions. The hard philosophical work lies in making sense of understanding that and of scientific explanation itself.

References

Hempel, C. G. (1965). Aspects of scientific explanation. In *Aspects of Scientific Explanation*, chap. 12, pp. 331–496. Free Press, New York.

Hempel, C. G. and P. Oppenheim. (1948). Studies in the logic of explanation. *Philosophy of Science* 15:135–175.

Kitcher, P. (1981). Explanatory unification. *Philosophy of Science* 48:507–531.

Kvanvig, J. L. (2003). *The Value of Knowledge and the Pursuit of Understanding*. Cambridge University Press, Cambridge.

de Regt, H. W. and D. Dieks. (2005). A contextual approach to scientific understanding. *Synthese* 144:137–170.

Salmon, W. C. (1970). Statistical explanation. In R. G. Colodny (ed.), *The Nature and Function of Scientific Theories*, pp. 173–231. University of Pittsburgh Press, Pittsburgh.

Strevens, M. (2008). *Depth: An Account of Scientific Explanation*. Harvard University Press, Cambridge, MA.

Trout, J. D. (2007). The psychology of scientific explanation. *Philosophy Compass* 2:564–591.

Woodward, J. (2003). *Making Things Happen: A Theory of Causal Explanation*. Oxford University Press, Oxford.