



## Re-orienting discussions of scientific explanation: A functional perspective



Andrea I. Woody

Department of Philosophy, University of Washington, Box 353350, Seattle, WA 98195, USA

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### ABSTRACT

Philosophy of science offers a rich lineage of analysis concerning the nature of scientific explanation, but the vast majority of this work, aiming to provide an analysis of the relation that binds a given *explanans* to its corresponding *explanandum*, presumes the proper analytic focus rests at the level of individual explanations. There are, however, other questions we could ask about explanation in science, such as: What role(s) does explanatory practice play in science? Shifting focus away from explanations, as achievements, toward explaining, as a coordinated activity of communities, *the functional perspective* aims to reveal how the practice of explanatory discourse functions within scientific communities given their more comprehensive aims and practices. In this paper, I outline the functional perspective, argue that taking the functional perspective can reveal important methodological roles for explanation in science, and consequently, that beginning here provides resources for developing more adequate responses to traditional concerns. In particular, through an examination of the ideal gas law, I emphasize the normative status of explanations within scientific communities and discuss how such status underwrites a compelling rationale for explanatory power as a theoretical virtue.

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### 1. Questions concerning explanation and a brief analysis of why the common starting point has run aground

Since the middle of the last century, the vast majority of philosophical literature on scientific explanation has addressed a single question and more importantly, interpreted that question in a particular way. Philosophers have asked, “What is the nature of scientific explanation?” and assumed that an appropriate response would provide an analysis of the relation that binds a given *explanans* to its corresponding *explanandum*. Such analyses presume the proper analytic focus rests at the level of individual explanations, and that these are to be analyzed predominantly in syntactic and semantic terms. Inferential, causal (including process-based, kairetic, counterfactual, and mechanistic variants), and erotetic accounts each provide a direct characterization of individual explanations (Hempel & Oppenheim, 1965; Hempel, 1965a; Salmon, 1984; Strevens, 2008; Woodward, 2003; Van Fraassen, 1980). The unification account concerns itself, somewhat

differently, with determining the overarching theoretical system that is most unifying and, as a consequence, confers explanatory status on the explanations provided by that structure (Friedman, 1974; Kitcher, 1989). Yet even Kitcher’s account places emphasis on the structure of individual explanations, through its characterization of argument patterns (Kitcher, 1989).<sup>1</sup>

There are other questions we could ask about explanation in science, questions that are equally important to consider though they have received much less philosophical attention. Consider, for instance, the following three questions (and presumably there are others):

1. What are the adequacy conditions for individual scientific explanations?
2. How should explanatory power be justified as a theoretical virtue, if indeed it should be?
3. What role(s) does explanation play in science?

<sup>1</sup> Even so, Kitcher’s account stands perhaps closest in spirit to my suggestion here.

E-mail address: [awoody@uw.edu](mailto:awoody@uw.edu).

These are distinct questions, and each is intuitively meaningful (though admittedly vague as stated). Even so, we could expect that any response to one might well place constraints on acceptable responses to the others. One persistent weakness of the explanation literature, to my mind, is how seldom the interconnected nature of these issues is acknowledged.

As noted earlier, most attention has been given to the first question, rendered in terms of the *explanans-explanandum* relation, with an implicit assumption that this is the primary focus of concern.<sup>2</sup> Meanwhile an assumption that explanatory power is indeed a theoretical virtue and a justified factor in theory choice is so pervasive that the second question may hardly seem to require explicit argument. Yet debates about the legitimacy of inference to the best explanation appear to be the only discourse that outlines more explicitly how the justification of explanatory power is supposed to run, and the results are highly contentious. The third question, in contrast, seems rarely articulated.

While Hempel's (1965a) reasons for grappling with the first question in the ways I have described are clear enough, it is less obvious why most others have followed the same path. Perhaps philosophers within this tradition have been grappling, in effect, with the nature of explanation *simpliciter*. Science provides the epistemic warrant for the information provided in an explanation, but the explanation itself is not so much a *scientific* explanation as it is *the* explanation. The focus, in other words, has been on what makes some scientific information *explanatory* rather than on what makes some explanations *scientific* or what characteristics might be distinctive of explanation in science.

Yet irrespective of the exact aim behind the general project, each traditional account (nomological, causal, unificationist, pragmatic) draws on core intuitions to offer its own characterization. The intuitions grounding each account are distinct, however, thereby exposing the most persistent problem in this lineage of philosophical analysis: the explanations that are generated and endorsed across modern scientific communities are diverse and pluralistic, rather than homogeneous, in kind. An account of the features of individual explanations that is both rich in detail and genuinely unified would seem to be out of reach. It simply would not fit the multiplicity of practices we observe. Analysis that begins with the first question, taken in isolation, can slide too easily into unwarranted essentialism about the nature of explanations across the sciences. Consequently such analyses must declare whole categories of explanations tendered by practitioners illegitimate or inadequate.

There are methodological problems as well. The participants in these philosophical debates have quarreled famously over a set of reputed, but still disputed, "counter-examples": the flagpole and the shadow, the ink spill on the carpet, leukemia and radiation exposure, and hexed salt (to name just a few). But the dispute cannot possibly be settled in this manner. The counterexamples themselves rely necessarily on the very intuitions that serve as foundation for the original disparity of viewpoints. The person challenged with a counterexample can always insist it is not a successful explanation; meanwhile, an individual upholding the counterexample's legitimacy has only further intuitions to ground her dissatisfaction. The likely outcome, of course, is a stalemate.

<sup>2</sup> For a different analysis that nevertheless seems consonant with the view presented here, see Love's (2012) discussion of formal and material methodologies within the philosophy of science. This framework provides a useful means of grappling with how the issues raised here with respect to explanation may have counterparts in other traditional philosophical subjects ranging from induction to the structure of theories or even discovery.

## 2. Changing the question: the functional perspective

I'd like to approach things somewhat differently, by beginning with the third question. What role or roles does explanation play in science? Turning our attention to the role(s) played by explanation in science compels, effectively, a functional analysis of exactly the sort delineated, for different purposes, by Hempel (1965b), himself drawing on the work of Merton (1957):

The kind of phenomenon that a functional analysis is invoked to explain is typically some recurrent activity or some pattern of behavior... And the principle objective of the analysis is to exhibit the contribution which the behavior pattern makes to the preservation or the development of the individual or the group in which it occurs. Thus, functional analysis seeks to understand a behavior pattern or a sociocultural institution by determining the role it plays in keeping the given system in proper working order... (Hempel, 1965b, 304–05).

This description suggests an important respect in which my third question, as originally expressed, harbors vagueness that should now be clarified. The notion of functional analysis borrowed from sociology applies to "recurrent activity" or "some pattern of behavior". Likewise, the question at hand concerns explanation as an activity, or custom, of scientific communities, rather than the propositional content produced as a result.<sup>3</sup> Explanation as activity involves a request for information and a response. It is a practice embedded in language and representation; it is discursive.<sup>4</sup> Thus, the question being considered can be stated more precisely as "What role does explanatory discourse, and explanatory activity more generally, play in the practice of science?" What I label *the functional perspective* aims to reveal how the practice of explanatory discourse functions within scientific communities given their more comprehensive sets of aims and practices. In comparison to traditional accounts of scientific explanation, there is a shift in focus away from explanations, as achievements, toward explaining, as a coordinated activity of communities.

On first consideration, it may seem there is nothing interesting for a functional analysis to reveal. It is commonly assumed that explanation is a central, indeed perhaps the paramount, *aim* of modern science:

It is the desire for explanations which are at once systematic and controllable by factual evidence that generates science; and it is the organization and classification of knowledge on the basis of explanatory principles that is the distinctive goal of the sciences (Nagel, 1961, 4).

According to this stance, explanatory desires are the starting point; we engage in science precisely because it helps us to understand the world around us. Notice that such a view treats explanations precisely as achievements, as the sorts of things for which one reasonably could aim. And even if we accept this view regarding the overarching aims of science (and we need not), the value of assuming a functional perspective does not evaporate, because acknowledging explanatory desires in no way determines what counts as explanatory for a scientific community.

<sup>3</sup> Kitcher also initially identifies explanation as an activity but then turns quickly to discussion of arguments, which he characterizes in terms of premises, conclusions, and the connection between them. He thereafter shifts focus to the following question: "What features should a scientific argument have if it is to serve as the basis for an act of explanation?" (Kitcher, 1981, 510). In this regard, he never grapples directly with the nature of the activity itself.

<sup>4</sup> This point is stressed in Van Fraassen's (1980) erotetic account of explanation, framed as it is in terms of the logic of questions.

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