A Symmetry in the Asymmetry: How explanatory asymmetries might shed light on explanations (in science and in society)

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Long abstract
(996 words)

In his paper 'Why Questions' (1966) Sylvain Bromberger offered a famous counterexample to undermine the claim that the deductive-nomological model provides sufficient conditions for successful scientific explanation. The counterexample concerns the so-called *explanatory asymmetries*. Explanatory asymmetries appear when we have pairs of deductively valid arguments which rely on the same law(s) but which differ radically in explanatory potential. The classical example is that of the flagpole and the shadow. If we consider a flagpole and its shadow, from informations about the height of the flagpole, the angle θ it makes with the sun plus the laws describing the rectilinear propagation of light, we can deduce the length of the shadow. This amounts to a reasonable scientific explanation of why the shadow has that particular length. Nevertheless, the deduction is perfectly legitimate, via the same laws and the same observation on the angle θ, the other way around. The latter case, however, is troublesome. The problem with this second derivation, in the context of explanation, is that it seems nonsense to say that the length of the shadow *explains* why the flagpole has that particular height.

In the tower and the shadow example we intuitively recognize that there is a direction which gets the explanation right. But how do we account for that intuition? A prima facie analysis reveals that we can pick out the (right) explanatory direction simply by focusing on the role of causal considerations in our explanation. The height of the flagpole causes the length of the shadow, while the converse is not true. This idea well fits well with a conception of

explanation according to which the nature of scientific explanation is essentially causal. However, it seems that the adoption of this 'causalist attitude' towards scientific explanation quickly leads to some problems. In his paper *Explanatory Unification and the Causal Structure of the World* (1989) Philip Kitcher observed that to take the concept of causality as the central concept for a theory of scientific explanation is not the most fruitfull approach. More precisely, he pointed out that in domains such as formal syntax or mathematics we have explanations which are not causal. Examples of non causal explanations provide, according to Kitcher, sufficient reasons to switch the focus from causal explanation to "theoretical" explanation, and consider the latter as primary to the former. The examples from mathematics reported by Kitcher include, among others, the proof of a property of finite groups by means of one specific axiomatization of the theory of finite groups. In that case, one particular axiomatization containing the existence of the inverse and idempotent elements is preferred by the mathematicians in order to explain why finite groups satisfy the division property. On the other hand, the reverse derivation, i.e. the derivation of the existence of an idempotent element and of inverses from the division property, is regarded as a less natural and non-explanatory derivation (although formally valid). Kitcher explicitly parallels this example with the case of explanatory asymmetries in empirical sciences.

By showing that explanatory asymmetries arise also in the domain of mathematics, Kitcher demonstrated that they are not exclusive to the causal debate on explanation. Furthermore, by suggesting that it is not causality the ingredient which permits to account for the directional features of asymmetric explanations, he provided a good reason to reject causality as the basic ingredient of a monistic approach to scientific explanation. Surprisingly enough, however, little (if not zero, at least to my knowledge) attention has been paid to this parallel. In this paper I suggest that Kitcher's parallel unveils a potential approach to the notion of scientific explanation (where the expression 'scientific explanation' indicates explanation in the empirical sciences *and* in mathematics). According to this new perspective, which is only sketched here, there are pragmatic constraints which operate in scientific explanation. These pragmatic constraints are specific abilities to reason (for instance, the ability to reason analogically, or the ability to reason causally) which are used in non-scientific explanations as well.

An ability to reason which operates in explanation is not a relative notion but it is constant for a group of persons, for instance a community sharing a system of beliefs, while it is psychological because it has to do with individual beliefs or attitudes of persons. Abilities to reason are used in scientific explanation and, in the specific context of the asymmetry problem, they contribute to the acceptance of one particular direction of the deduction as explanatory. A solution to the problem of explanatory asymmetries may require a different answer in empirical sciences and in mathematics, although in both the cases the answer can be given in terms of an ability to reason. Our ability to reason causally acts as a pragmatic constraint in the case of the flagpole and the shadow, thus permitting us to discriminate between the two putative explanations. In the case of explanatory asymmetry in mathematics another pragmatic constraint operates, under the form of an ability to reason, and it is used to pick out the explanatory direction. Such pragmatic ingredients, however, are also used in explanations which are given outside science. I consider here the example of the ability to reason analogically, i.e. the ability to reason and learn about a new situation -the target analog- by relating it to a more familiar situation -the source analog- that can be viewed as structurally parallel. This ability to reason is extensively used in scientific explanations as well as in our everyday-explanations. For instance, it is used in morality: why is it wrong to do something in situation B? Whether it is wrong to do something in a situation A, and situation B is analogous to A in all relevant features, then it is also wrong to perform that action in situation B. Such an explanation uses the the ability to reason analogically, however it is not scientific. The difference between an explanation in science and an explanation outside science resides in the way in which an ability to reason is used.