

Formal Causation Regained

Abstract

Formal causation, one of Aristotle's 'four because's', is heavily under-researched and has fallen into disrepute. It is at play whenever a thing has a property because it is of a certain kind—or form, or essence. We argue that this pattern of explanation can be found both in everyday life and in science, and is in fact indispensable since all explanations will bottom out in this pattern. We also argue that Aristotle's formal cause can be understood in terms of identity dependence, and should thus be seen as a proper variety of causation.

I—Introduction

Formal causation, one of Aristotle's four causes, has long fallen into disrepute and, as a consequence, is currently heavily under-researched. There is no explicit discussion on it, though there is now a flourishing debate on the related topics of kinds, form, and essence. Formal Causation is at play whenever a thing has a certain property because it is of a certain kind; for instance:

- Whales have the disposition to breathe with lungs because they are mammals (or more precisely, because they are tetrapods, since birds, reptiles, and mature amphibians also breathe with lungs).
- A scalene has internal angles equal to 180° because it is a triangle.

We call these essential properties; in the Aristotle literature they are usually, and misleadingly, called *per se* accidents. Theoretical underpinnings of this type of explanation are found, e.g., in Jonathan Lowe's (2006) suggestion that kind membership comes along with dispositional exemplification of certain property universals (thereby comprising laws of nature); in Brian Ellis' (2001) scientific essentialism; and in David Oderberg's (2007) real essentialism.

In section II we make clear that our view of formal causation is not committed to, though consistent with, (1) a specific view on universals, (2) hylomorphism, (3) individual forms or haecceities, and (4) biological kinds, social entities, artefacts, etc. as real kinds. In section III we argue that formal causation is indispensable in explanation, and that it is a type of causation. In section IV we argue that essential properties depend for their formal identity upon a kind, along the lines of Tahko and Lowe's identity dependence. The final section presents an extensional procedure which identifies the formal cause of an essential property. This procedure is unable to handle exceptions, which are prevalent in fields outside of physics and mathematics. Therefore we bring in the idea, from Aristotle and default logic, that more specific kinds should override more generic kinds.

II—What formal causation is not committed to

In part, the misgivings against formal causation are due to the seemingly heavy ontological commitments that seem to come along with it. However, we defend a view of formal causation that is independent from four disputes.

First, formal causation is consistent with a wide array of views on universals: everyone from a Platonist (e.g., Tugby 2013), through an Aristotelian (e.g., Lowe 2006), a conceptualist (e.g., Wiggins 2001), or a nominalist that still allows for universals (e.g., Goodman 1977), or a nominalist that allows for something universal-like (e.g., Marmodoro 2017 argues that

substantial universals are special unifying powers, and Koslicki (ms.) argues that form is a kind of structure which is classified as a particular).

Second, our account does not presuppose hylomorphism (the doctrine that objects are a union of form and matter). Hylomorphism is not only controversial, but would also be inapplicable to abstract objects like geometrical figures, which are not composed of matter.

Third, our account is not committed to the existence of individual forms or haecceities, although it is consistent with their existence, and we will only be discussing general kinds.

Fourth, while formal causation is applicable to any field that has taxonomic hierarchies, it is also consistent with the rejection of biological kinds, social entities, artefacts, etc., and thus with limiting the fields that formal causation is applicable to.

III–Formal causation as explanation and as cause

It is probably less contentious that Aristotle's formal cause is a common way of explanation than that it should be thought of as a proper kind of causation. If the reader should be unconvinced by our argument for why formal causation is a proper kind of causation, then an alternative would be to understand formal causation as a purely non-causal explanation (Lange 2017). Either way, formal causation in mathematics will be non-causal.

In explanations, reference to kind membership indeed seems indispensable. We can explain why sugar is dissolved in water but not in oil by pointing out that water has a disposition that oil lacks. And we can in turn explain this dispositional property of water by reference to the structure of its molecular constituents, plus the dispositional properties of its subatomic particles. We can, however, not say anything by way of explanation regarding the dispositions of, say, electrons except pointing out that electrons have the disposition to be attracted by protons exactly because they are electrons: because they belong to this kind and not to another. Reference to kind membership is, thus, indispensable in explanation.

But how can it be a proper way of causation? Clearly, formal causation is not into the game when we talk about event causation – simply because kind membership is not an event. But once the causal relevance of properties, especially dispositions, is acknowledged, this objection falls. For after all, dispositions are similarly not events. Often, kind membership is correlated with typical properties, including dispositions. But what determines what? Does the kind determine the dispositions, or does the possession of these dispositions determine the kind?

In opposition to Lowe (2006), one must carefully distinguish essential properties from dispositions (Jansen 2007); while the first is primarily concerned with universals, the second is primarily concerned with particulars. Suppose that it is an essential property of birds to have two wings. Yet birds are only disposed to grow wings in the embryonic stage; any adult bird with one wing only does not have the disposition to have two wings. Thus, the possession of a disposition is on the level of particulars, while an essential property depends upon the kind (i.e., a universal) such that the kind explains and makes that object have the property.

The objection might be raised that mature birds have two wings because they have fully manifested their disposition to grow two wings in the embryonic stage. Here, the possession of one disposition can be explained, and is caused by, another disposition. However, formal causation is still indispensable as an explanation and cause of the disposition to grow two wings.

As mentioned above, Lowe (2006) also identifies this connection between kinds and essential properties—and thus has an account of what we call formal causation—with laws of nature. While we do not want to defend this identification in full (e.g., as Johansson 2006 remarks, not all laws of nature fits this schema), it is true that formal causation plays a role similar to that of laws of nature.

IV–Dependence

What type of dependence-relation is involved when an essential property depends upon a kind? Clearly, the dependence-relation involved is not modal-existential, but rather some type of essential dependence. *Prima facie*, Kit Fine’s constitutive essential dependence might be thought ideal; however, because formal causation primarily concerns the essential properties that are *not* constituents of a real definition, this is in fact inapplicable. Further, applying constitutive essential dependence to formal causation would make the kind depend upon the properties referred to in the real definition of the kind; while we are looking for a dependence relation going in the opposite direction.

More plausible is what Tahko and Lowe (2016) call identity dependence:

(ID) x depends for its identity upon $y =_{df}$ There is a two-place predicate “ F ” such that it is part of the essence of x that x is *related by F* to y .

An essence is here more or less the object’s identity, and provides criteria for its identity and persistence. For instance, there is a two-place predicate “is the singleton set of” such that it is part of the essence of {Socrates} that {Socrates} is the singleton set of Socrates.

Still, ID is not yet right for formal causation. For one, it would be better to speak of a dyadic relational property R instead of a predicate F , i.e., about the world and not about our words. Second, Tahko and Lowe also argue that ID implies existential dependence:

(ID-EX) “If x depends for its identity upon y , then, necessarily, x exists only if y exists.”

This is too strong for formal causation, as properties could be multiply instantiated across distinct branches of a taxonomic tree (although it would hold for what Aristotle calls *propria*). Third, we want to say that it is in the essence of the kind y that x depends for its formal identity upon y . And further, that it is in the essence of the kind that the essential property is a consequent of the kind.

For example, (x) the disposition to be attracted by protons depends for its formal identity upon (y) the kind electron because (y) electrons (R) essentially have (x) the disposition to be attracted by protons. And R also includes the more specific relation, viz. that it is a consequence of being an electron that the object has the disposition. Note that antiprotons are also said to have this disposition; ID-EX thus fails to hold for this example.

V–Identifying essential properties and allowing for exceptions

Often, formal causes are identified as the kind highest up in the taxonomic hierarchy which is such that all instances of the kind possess the property in question. While this is purely extensional, viz. one identifies the kind which has the same extension as the property, it must be supplemented with intensional and counterfactual reasoning both in order to avoid mere accidental generalizations and to allow for exceptions.

Exceptions are a complicating feature for a theory of kinds, and many authors claim real kinds are only found in exceptionless cases from physics and mathematics. We develop an account which has the advantage of facing this complication head on. As a result, a kind cannot necessitate that an instantiation of this kind possess the essential property, i.e., possess an instantiation of the property. Instead, the consequence relation involved must be non-monotonic. The basic idea is that more specific kinds should override more generic kinds; an idea to be found both in Aristotle’s *Posterior Analytics* II 18 and in modern default logic (Touretzky 1984, 1987). For instance, it is essential for birds to fly, and it is essential for ostriches not to fly, and ostrich is a bird (and thus will inherit all properties belonging to bird); this entails the contradiction that ostriches both have the disposition to fly and does not have the disposition to fly. Touretzky’s implicit rule allows for the exception through making the ostrich-kinds’s non-flying override the bird-kind’s flying. As a result, one is only allowed to

correctly infer that ostriches cannot fly. This framework could be extended to also account for individual exceptions, if one supports individual forms.

VI–Conclusion

Formal causation is not only a frequently used way of explanation, but is actually indispensable, and—in metaphysical perspective—can be seen as a variety of metaphysical dependence and thus as a real variety of causation.

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