Causality as a Partitioning Principle for Upper Ontologies

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Abstract

In his "Bridging mainstream and formal ontology", Augusto (2021) gives an excellent analysis of Dietrich von Freiberg's idea of using causality as a partitioning principle for upper ontologies. For this Dietrich's notion of extrinsic principles is crucial. The question whether causation can and indeed should be used as a partitioning principle for ontologies is discussed using mathematics and physics as examples.

Key words: Upper ontology; Causation; Dietrich von Freiberg; Partitioning principles

Classical philosophical scholarship is the use of texts from the entire range of our philosophical tradition as a source to fertilize contemporary thinking. Examples of this are getting rarer in Western philosophy as analytic philosophy and the idiosyncratic style of its main publishing organs have led many authors to neglect the history of philosophy before Wittgenstein. This leads to an underutilization of the Western philosophical tradition, which is regrettable because many of the philosophical problems we are facing today have been thought through during the history of our culture, albeit under different contexts. But the continuity of our culture nevertheless enables us to use them productively.

Augusto's piece (Augusto, 2021) is an example of this type of classical scholarship. His aim is to use the ontological work of Dietrich von Freiberg, a disciple of Albertus Magnus, to show "how a particular medieval text can be (made) relevant to contemporary ontology, namely to the effort of constructing, or–perhaps more adequately put–engineering, upper ontologies" (*op. cit.*, p. 2).

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What makes Dietrich interesting from today's perspective is that in his work *Tractatus de origine rerum praedicamentalium* (*Treatise on the Origin of the Categories*) (Dietrich von Freiberg, sd/1983) he investigated on what today we can call and upper ontology based on causation as a partitioning principle. As Augusto points out, causation could be used also to partition modern upper ontologies. Indeed, some domain ontologies have attempted to model causality, for example Rovetto & Mizoguchi (2015), who developed a model of disease causation with causation-related entities (such as "Causal Structure" or "Causally-linked occurrent") in combination with binary causation-predicates ranging over entities such as "Process" or "State", a design that makes their ontology unattractive because different approaches to modelling causality compete within it.

But causality is generally not treated at the top level of upper ontologies such as BFO (Arp et al., 2015) or DOLCE (Borgo & Masolo, 2009). Augusto sees this as a deficit and sets out to show how Dietrich von Freiberg used causality as a partitioning principle in his ontological work. Augusto provides the first (thus far missing and of high utility to the reader not fluent in Latin) translation into English of the first part of Dietrich's treatise and extracts an interpretation of Dietrich's thinking formulated as an upper ontology represented in a cognitively compelling, modern taxonomic form (which of course was not used in the 13th century when Dietrich wrote).

The core of Augusto's analysis shows a partitioning of entities using three types of causation:

1. *extrinsic causes* (efficient and final causes in Aristotle, on whom Dietrich, like all later medieval scholars, heavily bases his thinking; Augusto calls them OUT-causes);

2. *intrinsic causes* (material and formal causes in Aristotle, IN-causes for Augusto), and

3. *extrinsic principles* (OUTIN-causes for Augusto).

The last item on this list is an invention of Dietrich. Augusto describes it as a third way of causation, "in which [A] something's principle (so, an IN-cause) is a cause (so, extrinsic to the entity that is thus originated, or an OUT-cause) with respect to some other thing, but thanks to which [B] this other thing subsists formally." Extrinsic principles, which Augusto calls OUTIN-causes, are for Dietrich "the principles of cognition in the human mind. So, Dietrich is laying out the path to elaborate on his view that the human mind can also be a causal origin for an entity" (Augusto, 2021, p. 17, fn. 27). The OUTIN-causes "are the human mind's principles for the cognition of reality, and they are causal with respect to its objects in the sense that the objects are only insofar as they are known"' (*ibid.*, p. 28). Thus, OUTIN-causation is not a relation between or within entities as they are in nature (external reality), but rather something that is performed by the human mind.

These three principles of causation lead to an (idealistic) partition of entities into natural and mental entities (*ibid.*, Fig. 9). The former are caused by extrinsic and intrinsic causes, for example qualities have an extrinsic, while quantities have an intrinsic causation. For Dietrich, the mental entities are caused by extrinsic principles (OUTIN-causes) and can be subdivided into first intentions (natural kinds) and second intentions (universals). Surprisingly, seven of Aristotle's accidentals (relation, place, time, ...) are classified under *first intentions*, which Augusto highlights by calling this partition an 'ontological "bomb"'. Augusto points out that further refinements to the upper ontology which he derives from Dietrich will be provided with the translation of the second part of the treatise; but the material available in this paper already gives us a very good insight into Dietrich's thinking.

One important question which this paper raises is whether we can really use this medieval ontology with causation as a partitioning principle for mathematics and domains strongly rooted in mathematics (such as physics), as Augusto suggests. To answer this question we would first have to address the following issues.

First of all: Is a partition according to causality necessary in order to distinguish mathematical ontology from ontologies created for other domains? Certainly, mathematics is distinguished from other sciences by the nature of the entities it deals with, which are strictly mental in the sense that (1) they have no instances in our natural environment, and (2) they are given to us only through the processes in the mind of the mathematician, (3) given to us *a priori* (they possess an intrinsic intelligibility) as opposed to entities of external reality (see Reinach, 1989, pp. 145f.). If this essential nature is seen to be grounded in a special type of causation (mental causation), then a causality-based partition for mathematical entities can be envisaged. This could indeed be developed from Dietrich's framework.

Second: Does causation play a role in mathematics? Traditionally, mathematical relations are seen to be grounded in essential structures (*Wesenszusammenhänge* in the terminology of Reinach, 1989), but have no causative character of their own. A mathematical proposition which is true given the axioms of a mathematical system of axioms is an *a priori* truth, but it seems to be neither caused by anything nor does it cause anything in the sense of intrinsic or extrinsic causation. But is this really so? Mathematical models are used to describe many causal relations of nature, namely when applied to physics or other sciences. But the causation-aspect of mathematical equations used in these sciences arises solely from the interactions of entities in the systems they describe, not from the mathematical models themselves. *In other words, mathematical models (such as equations) are causation-agnostic.* On the other hand, if the essential structures of mathematics are seen to be caused by biological structures of our brains, causation can indeed be regarded as the organizing principle of mathematics. But we do not know how this causation works at the level of specific mathematical structures such as a circle or a Riemannian manifold, and so the biological causation of mathematical entities could work only on the level of very general principles. Therefore, a mature upper ontology of mathematics, work on which is must less well-developed than in the case of the empirical-inductive and strongly descriptive sciences such as medicine and biology, would probably not be organised along causation principles.

Nevertheless, causation is of predominating importance in physics. Which brings us to the last question:

Third: When we model causation ontologically, for example, in an ontology of physics, do we have to use it as a partition principle *à la* Dietrich, or can we model causation types as types of relations? And if we decide to do the latter, do we maintain these relations as entities inside the ontology, or do we use the ontology to enable a controlled discourse about entities in domains where relations such as causation are expressed in the discourse? Upper ontologists have often decided not to model relations ontologically in order to avoid Bradley's regress (Perovic, 2017). In mathematics, however, most relations have to be modelled ontologically. For example, functions are mathematical relations, but also entities in their own right.

Following this line of thought, applications of ontologies both in philosophy–with the goal of clarifying philosophical arguments in the tradition of analytical philosophy and neo-positivism–and in software engineering–with the goal of machine-processable knowledge representation–can use ontologically well-defined entities to which relations such as causality are then applied. In computer science, this is usually done via the logical structure of the algorithms which are applied to digital instances of data-models of reality. It is crucial in this approach to be conscious of (and ideally make explicit) the nature of the causality that is being modelled.

These brief considerations show that Dietrich's idea of making causation a partitioning principle for ontologies as presented by Augusto encourages us to rethink how we structure ontologies. This example underlines the trivial (but in many circles now forgotten) insight that it is useful for contemporary philosophers to discover alternative views of the questions arising in their fields developed by philosophers working in periods of philosophical thinking before Wittgenstein. Augusto's paper nicely shows how fruitful such insights can be for today's philosophical questions.

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