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## Contingency and the order of nature

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### ABSTRACT

Many profess faith in the universal rule of deterministic law. I urge remaining agnostic, putting into nature only what we need to account for what we know to be the case: order where, and to the extent that, we see it. Powers and mechanisms can do that job. Embracing contingency and deriving order from powers and mechanisms reduces three kinds of problems: ontological, theological, and epistemological. Ontologically, there is no puzzle about why models from various branches of natural and social science, daily life, and engineering serve us in good stead if all that's happening is physics laws playing themselves out. Also, when universal laws are replaced with a power/mechanism ontology, nothing is set irredeemably by the Big Bang or at some hyper-surface in space-time. What happens can depend on how we arrange things to exploit the powers of their parts. That may be put to significant theological advantage. The epistemological problem comes from philosopher of physics, Erhard Scheibe. Given what we take physics to teach about the universality of interaction, there is just one very large object – the entire universe – to be governed by laws of nature. How then do we ever learn those laws?

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### 1. Setting things up

This article sets out a defense of radical contingency in nature, radical contingency despite the pockets of rough order we observe in our daily lives and of precise order we report in our modern sciences. But, are contingency and order not in opposition? Yes, I think they are... if the view of nature and science that has dominated since the Scientific Revolution is correct, that order arises from the rule of universal laws, laws that hold everywhere and everywhen and that dictate all aspects of what happens. But they are not in conflict if the source of order in nature is not laws but powers and mechanisms.

I have been arguing for the importance of powers (which I have called *capacities*) and mechanisms (which I have called *nomological machines*) for a long time and I have my own slant on just how to describe them. But these are both central topics in philosophy now, powers primarily for the metaphysicians, and mechanisms in the philosophy of science, and there are a variety of different accounts

available. No matter. Almost any of the variations can be adapted to the image of nature where laws play a minimal role, powers rule, physics is incomplete, the future is open, and what occurs in nature can be a matter of mere hap.

I have argued against universal laws as the correct way to reconstruct our impressive body of knowledge in modern science and in favor of powers instead in a number of different ways. The basic attitude behind all the arguments is a metaphysical modesty: postulate what is needed and don't make grand gestures beyond this. Powers make sense of the practices of much modern science and of its impressive empirical successes. They allow us to account for any order that we have actually observed or established, without signing up to the faith that all is ordered everywhere and that physics is Queen of all of Nature. Finally, powers allow for a this-worldly metaphysics in which nature, once created, moves forward of its own accord; what happens next is governed from within nature and not by some mysterious laws that dwell outside and operate by some extra-natural force.

In this paper I shall argue that embracing contingency and deriving order from powers and mechanisms resolves three distinct kinds of problems in one fell swoop: ontological,

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theological, and epistemological. The theological question draws upon the work Peter Harrison, whose historical research into the origin of the idea of laws of nature provides the starting point for it (1995, 2008, 2013). The ontological problem is one adumbrated before and the dimensions of it will be familiar to many. But the epistemological problem is, I believe, relatively unfamiliar. I take it from the recently deceased German philosopher of physics and friend, Erhard Scheibe (2001). I begin by outlining the view about powers, mechanisms, and contingency that I maintain will solve the three problems I will describe.

### 1.1. Powers and mechanisms

So, what is a power? I don't think the lens of modern science is strong enough to show an answer, which I take it is why contemporary metaphysics has taken up that job. Happily for present purposes it is enough just to note a handful of features that I argue we had best ascribe to powers and their mode of operation if we are to account for at least a large swathe of the practices and impressive empirical successes of our modern sciences.

1. Powers are identified by a canonical operation. For example gravity is the power in a mass  $M$  to attract objects of mass  $m$  a distance  $r$  away with a force  $GmM/r^2$ .

2. Our modern sciences have empirically established a very great number of powers. Some are the result of stable arrangements of components with other powers, for instance, the power of objects identifiable as toasters to brown bread depends on the arrangement and familiar powers of its parts. But we cannot assume that all powers “reduce” to arrangements of some basic set. Each science produces knowledge of myriads of special powers that relate in complicated ways to other powers. And where reductions are possible, the lessons of the “mechanists” in contemporary philosophy of causation (like Abrahamsen and Bechtel [2005] or Machamer, Darden, and Craver [2000]) must be heeded: arrangements matter, not just the powers of the parts.

3. Modern sciences have also empirically established a myriad of reliable indicators of powers: any system with a gravitational mass has the power of gravitational attraction; experts can tell a barley seed from rye and oat by its visible characteristics; I know the object in the box in the shop will brown bread because it is labelled “toaster.” (The metaphysical relation between the indicators and the powers is a matter of current controversy.)

4. What happens when a power operates in its canonical manner depends on the arrangement of circumstances: when the earth exerts its gravitational power on a compact unsupported object in a vacuum, the object falls at 32 ft/s/s; when—to use an example from Otto Neurath ([1933] 1987)—it exerts its gravitational attraction on a 1,000 mark note dropped on a windy day in Saint Stephen's square, the bill blows all over the place; when it exerts it on a glass sitting on a table, the glass sits still.

5. Some arrangements of circumstances fix what will result when the components exercise their powers in consort. Successful design will engineer these arrangements to produce the kinds of results we want. Some arrangements of the right sort to fix results occur naturally and these are the sources of predictability in nature. In other cases we have no guarantee that the results are fixed.

6. The impressive precise predictive success of modern physics as well as the phenomenal technological advances that physics

has aided can (as I shall describe in more detail in the last part of this article) be accounted for by “local mechanisms” without resort to universal laws that fix all of the effects in the domain of physics.

7. The possibilities for new reliably predictable behaviors by engineering new mechanisms are endless.

This last is what is so exhilarating about replacing the rule of universal law with a power/mechanism ontology, if correct. Nothing in our future is set irredeemably by what happened at the Big Bang or at some hyper-surface in space time. What happens can depend on how we arrange things to exploit the powers of their parts.

The place for radical contingency is found in point number five. It is here that others adopt a faith in determinism whereas I urge we remain agnostic, putting into nature only what we need in order to account for what we know to be the case. I say that *some* arrangements fix what happens. We have strong empirical evidence for this much at least. Moreover in different fields of knowledge we can say quite a lot about what the arrangements are like that provide fixed outcomes that we know, at least roughly, how to predict. But the empirical evidence stops far short of the stronger conclusion of determinism: that every arrangement has a fixed outcome. (Or, with quantum mechanics in view, a fixed outcome space with fixed probabilities across it.) Some things just happen. Powers operate in their usual way but circumstances are not right for a fixed outcome.

This is how nature appears to us much of the time, especially nature in the wild, outside of our technologies, our societies, and our laboratories, and it is how it continues in some cases to appear despite our best scientific efforts to uncover the hidden rules we take to be fixing its every outcome. What happens may be constrained in ways we have come to learn about—it is fairly certain that the thousand mark note in Saint Stephen's Square will not suddenly turn into a giraffe. But the evidence that secures that prediction does not go far enough to assure that just where the bill lands is fixed by law given the circumstances. You may if you wish have faith in determinism just as I have a strong esthetic preference for a dappled and open-ended world. But in either case it would be a mistake to maintain that the evidence selects one view over the other. At least the dappled, open-ended world where powers, not laws, operate, has this in its favor: It involves less metaphysical commitment and the metaphysics it does embrace is this-worldly, and, if I am right in my arguments here, it provides as side benefits help on pressing problems in theology, ontology, and the epistemology of science.

## 2. Some ontological advantages

The usual story has it not only that nature is ruled by universal laws, but that these laws govern only a special set of basic features. These features and laws are the special domain of physics. What then of all the other features we find in the world around us, from the central theoretical quantities studied in other disciplines to the everyday features by which we organize our lives?

Philosophers nowadays offer two accounts. One, which is very visible in the literature on mind–body relations, involves supervenience and multiple realizability. The microphysical state of the universe determines all the other features that hold in the sense that were the microphysical states different, these other features would have to differ as well. The reverse though is not the case. The same set of non-physics features can be realized by a variety of different physics states.

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