

Real Modalities

21. That nothing happens by chance, but all things occur from necessity and that all future things that will be will be of necessity, and those that will not be it is impossible for them to be; and that upon considering all causes [it will be seen that] nothing happens contingently. [This is an] error.

34. That the first cause could not make several worlds. [An error.]

147. That the absolutely impossible cannot be done by God or another agent.—
An error, if impossible is understood according to nature.

(From the Condemnations of 1277; Grant 1974, 48–9.)

Modal Modesty

We inhabit a universe pregnant with possibility. I can say with confidence that the gutters on my house might overflow during the next thunderstorm, but they could not be dislodged from the eaves by less than gale force winds. If the houseplants are not watered, they would certainly die, and, were they to die, their leaves would turn brown and fall off.

Often in speaking thus, we mean only to be placing bets on how things are likely to turn out. Sometimes, however, we take ourselves to be saying something about what really *is* possible (even if not actual), what is not possible, what is necessary, what *would* or *would not* happen were certain conditions to obtain, we take ourselves to be saying something about how matters stand *modally*. When this is our aim, what features of the universe are responsible for the truth or falsity of what we say?

I shall offer reasons for thinking that an ontology of interrelated dispositionalities provides the resources requisite for an accounting of real modalities, truthmakers for certain modal truths. Consideration of these reasons

will, in addition, disclose surprising connections between dispositionality, on the one hand, and, on the other hand, causation and causal laws as these are commonly understood.

My approach to these topics assumes ‘modal fallibilism’, assumes we could be wrong in our modal beliefs. Fallibilism stands in contrast to the idea that we are in a position to discern possibilities from the armchair. We philosophers have lost sight of fallibilism, largely, no doubt, owing to the near universal acceptance of the apparatus of ‘possible worlds’ in discussions touching on modality.¹ It is easy to concoct alternative universes, universes that differ from the universe we inhabit in any respect you please. But what gives us the right to assume that any of these alternatives *are* genuinely possible?

Fallibilism treats modal truths as mind-independent, presuming that they reflect ways the universe could be, not merely our capacity to invent alternative universes. The question then is, what are the ways in question, what are the truthmakers for modal truths?

Progress on this topic will be hampered so long as we insist on framing answers in terms of received conceptions of laws and causation. Achieving clarity here will reveal important connections among ontological categories widely regarded as independent. Although I do not anticipate agreement on all I have to say in what follows, I am hopeful that revisiting the historical roots of some of the doctrines we nowadays take for granted might lead to a heightened appreciation of the substantive nature of those doctrines, hence the extent to which each stands in need of a substantive defense.

1. An important source for conceptions of possible worlds is the medieval thesis that an omniscient God could create any logically possible universe (see e.g. Grant 1974, 45–50). What is possible is what is logically possible, and what is logically possible is ascertainable a priori. Presently I shall suggest that there are good reasons to suppose that familiar conceptions of causal laws are traceable to the same source.

Laws²

Everyone—*almost* everyone—agrees that laws of nature are central to the scientific enterprise. But what exactly *are* laws? The thought that objects are governed by laws did not fall from the sky. A glance at the history of science reveals that talk of laws of nature stems from medieval considerations of God's omnipotence and the divine will, considerations that were aggressively promoted by the Church as replacements for an Aristotelian picture of nature as self-governing. On the Aristotelian model, things behave as they do, not because they are governed by laws, but because they are as they are.

The alternative is to suppose that how things behave is not up to the things but depends on something outside the things, on God's will, for instance, a will constrained only by principles of logic and God's benevolent nature. With the encouragement of the Church, a conception of a contingent universe, one universe among endless possible—because logically possible—universes, a universe administered by a divine lawmaker, became the default.

Two components of this conception stand out.

First, laws, God's decrees, are *external* to what they govern. It is no part of the nature of objects subject to the laws that objects with those natures behave as they do. Laws are independent of the character of objects they govern. God creates the objects and, in a distinct exercise of will, enacts the laws. Think of laws as expressions of God's nature, freely chosen principles on which God imposes His will on material bodies.

Second, God, being omnipotent, could have willed that the laws be otherwise. The laws are, in this regard, contingent. God's power includes the power to create

2. As historically informed readers will quickly discover, my discussion of laws omits many important qualifications. My aim is not historical, however, but philosophical. For historical discussion see Grant 1974, 1981, Ruby 1986, Des Chene 1996, and Milton 1998. See van Frassen 1989, 1–14, and Roberts 2008, chap. 1, for contemporary discussion.

alternative universes, universes altogether different from the actual universe in every logically possible way.

In discussing the nature of laws today, mention of God's decrees sounds, well, *medieval*. The interesting point is that, although a conception of laws as contingent and external to what was governed had its source in contentious theological considerations, the demise of those considerations did not result in the demise of the conception. Philosophers altogether lacking in theological inclinations are nowadays happy to embrace a picture of the world according to which objects are governed by external, contingent laws. But if laws are not expressions of God's will, if laws are not God's decrees, what *are* they? Minus God, what could it mean to say that particles, for instance, are 'governed by' or 'obey' laws? Philosophers serious about metaphysics, have sought to answer this question by offering an assortment of God replacements.

Hume, an honest, if occasionally devious, ontologist, recognized that subtracting God from the picture was not merely a matter of adjusting a detail, it was in effect to forsake the picture. The subtraction of God meant abandonment of the idea that laws *govern*. Laws, Hume contends, are nothing more than true generalizations. This *F*'s being a *G*, is an instance of a law, just in case all *F*'s are *G*'s.

Humeans of various stripes dominated the philosophical landscape of the 20th century. Many 20th century philosophers simply embraced Hume's picture, pretending it to be metaphysically innocent. Others, David Armstrong, for instance, endeavored to incorporate an element of necessity into the Humean picture and thereby to resuscitate the governing character of laws (see, e.g., Armstrong 1997). Laws, according to Armstrong, are higher-order universals of the form $N(F, G)$: the *F*'s necessitate the *G*'s. The obtaining of this law guarantees

the truth of the corresponding Humean universal generalization—all *F*'s are *G*'s—but not vice versa.³

This treatment of laws upholds two central components of the theological picture. First, Armstrong's laws are *external* to what they govern. There is nothing in the *F*'s and *G*'s themselves that requires the *F*'s to necessitate the *G*'s. Returning to a theological idiom, God's creation of the first-order universals, the *F*'s and the *G*'s, in no respect constrains God's choice of which higher-order, necessitating universals to create. Second, Armstrong's laws are *contingent*. Alternative universes include alternative distributions of higher-order universals.

Another approach to laws recently championed by Marc Lange, explicates laws in terms of subjunctive and counterfactual conditionals (Lang 2009). If you want to know what laws physicists, or chemists, or biologists accept, look at the subjunctive and counterfactual judgments they embrace and exhibit an unwillingness to revise.

Lange's approach might well serve as a guide to which laws are accepted, but it remains curiously detached from the question as to what the truthmakers might be for those subjunctive and counterfactual conditionals. Invoking contrary-to-the-fact facts here would be ontologically evasive and ultimately unsatisfying.

Return to the original theological picture. That picture was meant to replace a broadly Aristotelian conception of nature. On the Aristotelian conception things do what they do owing to their various natures. Such a conception distances God from natural occurrences and, worse, in the eyes of the Church, challenges God's omnipotence. If being an apple is a matter of being an object of a particular sort disposed to behave in particular ways in particular circumstances, God loses

3. One immediate difficulty for any Humean conception of laws, including Armstrong's, is that universal generalizations taken to be implied by laws are so rarely true. Nancy Cartwright has made much of the apparent fact that, taken as universal generalizations, even 'strict' laws of physics evidently 'lie' (Cartwright 1983, 1999).

control of apples once He creates them. In electing to create objects of particular sorts, God would thereby elect to create objects with particular sorts of power, particular sorts of disposition to do this or that with particular sorts of reciprocal partner.⁴ Any intervention in the natural order would require tampering with the nature of the objects—hence changing the very objects—affected. Left to itself, nature takes a definite course, unfolding with a kind of inevitability sharply at odds with the theological vision.

Removing powers from the objects and placing them in God, solves the problem. Objects do as they are told, and what they are told depends exclusively on God's will. God might will any object to do anything at all consistent with the dictates of logic. Objects are governed not by their own natures, but by external factors.

It is one thing, however, to strip the objects of their powers and cede the powers to God, another matter altogether subsequently to delete God from the picture. Doing so leaves the objects waiting for Godot.

Once you abandon the idea that power resides exclusively in God, an obvious move would seem to be to return powers to the objects. Objects behave as they do, not because they are at the mercy of God's will. Objects behave as they do because they are as they are. What I have been calling the 'behavior' of objects would be better thought of as mutual manifestings of reciprocal dispositions: dispositions possessed by the objects. The manifestings of dispositions are wholly 'deterministic'. Simple Humean generalizations fail owing to vast complexities that come into play whenever objects interact.

You might sum this up by describing a position according to which objects are governed by laws as one in which there is a distinction between what something

4. I use 'power' and 'disposition' interchangeably.

is (an apple, an electron, a black hole) and what it does or would do. The alternative is a conception according to which what something is determines—because it is inseparable from—what it does or would do.

Suppose this is on the right track. Suppose powers—dispositions—are housed in the objects, suppose properties of objects dispose those objects to behave in various ways with various reciprocal disposition partners. Does this mean that we have dispensed with laws?

When scientists invoke laws they often have in mind formulae, equations, principles. These are what Armstrong would call ‘law statements’, statements that, if true, are made true by laws themselves, non-linguistic denizens of the universe. However, even philosophers who profess agreement with Armstrong on this point, occasionally slip and speak of laws as being true or false (see, e. g., Bird 2007). Philosophers debate whether Newton’s laws are true, for instance, or approximately true, or flatly false. This makes it sound as though laws are what I have suggested they are, formulae, equations, principles.

But if laws are formulae, equations, principles, what makes laws true when they are true? Here is one possibility. Laws, some laws, ‘causal laws’, isolate the contribution powers or dispositions make to their possessors.⁵ Take Newton’s laws of motion. These might be thought to provide an accounting of the contribution mass makes to objects possessing mass. In that way, the laws tell us—indirectly—how objects would behave *qua* ‘massy’. To be sure, objects with mass possess, as well, various other dispositions. How an object behaves in any given situation will depend on its ensemble of dispositions and on dispositions belonging to whatever interacts with the object.

5. The idea that laws tell us how ‘idealized’ objects would behave in ‘idealized’ circumstances could be seen as a special case of this conception.

Causation⁶

Serious discussion of the ontology of powers and dispositionality has in recent years reentered the philosophical mainstream. Owing perhaps to the relative novelty of powers, philosophers have tended to flesh out conceptions of powers using resources afforded by prevailing models of causation and laws. The results have been uninspiring and ontologically tentative. We start with a worldview according to which objects are obedient subjects in a realm of laws. We then stir dispositions into the mix. But adding dispositions requires fundamental changes in the way we think about laws, about causation, and, in the end about modality. Returning powers to the objects brings with it a package of interrelated commitments that philosophers have tended to evaluate in isolation.

Take causation. On the received view, causation is an asymmetrical, nonreflexive, relation among events. Some event, one billiard ball's striking another, causes a distinct event, a second billiard ball's rolling, or its rolling in a particular way. The whole affair reeks of contingency. It is easy to imagine a universe in which the second billiard ball fails to roll, rolls in a different manner, or, as Hume helpfully suggests, leaps off the table.

Consider a different case. You stir a spoonful of sugar into a cup of hot tea and the sugar dissolves. Sticking with the received view, the tea, or the tea's enveloping the sugar, causes the sugar to dissolve. The tea is the agent, the sugar the patient. Perhaps the tea has an 'active power' to dissolve sugar, the sugar a 'passive power' to be dissolved by tea. At any rate, this is how it looks when you introduce powers into the received model of causation.

But look more closely at what happens when you stir sugar into a cup of tea. Chemical features of the sugar *interact with* chemical features of the tea

6. Material in this and the next three sections is based on Heil 2012, chap. 6.

(Ingthorsson 2002). This interaction is, or appears to be, continuous, not sequential; it is, or appears to be, symmetrical. Both the sugar and the tea work in concert to yield a certain result: the sugar's being dissolved in the tea.

One way to understand such cases would be to imagine that sugar and hot tea possess reciprocal powers or dispositions.⁷ The sugar's dissolving is a *mutual manifestation* of dispositions of the tea and sugar. The result is something—sweetened tea—with new powers, new dispositions capable of further mutual manifestations with further reciprocal disposition partners.

We are trained to think of causation sequentially: a cause occurs, followed by an effect. In the case under consideration, the effect—the sugar's being dissolved in the tea—is the outcome of a dispositional process that is itself continuous and symmetrical.

Take two playing cards and prop them against one another so they stand upright on the table. The cards—with the help of the table—are mutually supporting: they remain upright. The cards work in concert with the table, the gravitational field, and assorted disposition partners to produce this result. But their working together and the result are not sequential. The cards' remaining upright is a continuous mutual manifesting of reciprocal powers possessed by the cards and the table.

Examples of this kind do not fit comfortably with the received model, yet, arguably, they are by far the most common species of causal interaction. We all depend for our existence on stable structures that we inhabit, move about in and on, and deploy. We count on our environment's maintaining a high level of stability. Stability would be impossible without massive cooperation, the mutual manifesting of countless reciprocal dispositions to hold things together, to

7. See Martin 1993, 2008, and Martin's contribution to Crane 1996; Heil 2003, 2012.

preserve the status quo. Their holding together is an outcome, but one that temporally coincides with their manifesting themselves as they do. Causation in this case is a reciprocal, symmetrical, continuous affair.

What of familiar causal sequences commonly deployed to motivate the event-causation model? Return to the billiard balls. One billiard ball approaches another, stationary, billiard ball. The balls collide. The second billiard ball moves off in a particular way. This sequence can be described as one in which one event, the first billiard ball's striking the second, causes a distinct event, the second billiard ball's rolling across the table, but such a description is unobscure. When the first billiard ball makes contact with the second, *both* balls compress, then decompress. The trajectory of *both* balls is altered. This process is, or appears to be, continuous, symmetrical, reciprocal (Huemer and Kovitz 2003). Its outcome is a change in the velocity of *each* ball. This outcome resembles the outcome in the sugar and tea case. It results from a mutual manifesting of dispositions. In the playing card case, the outcome is simultaneous with the manifesting.

Dispositions

Several points here are worth emphasizing. First, manifestings are most often mutual manifestings of *many* reciprocal disposition partners. We are inclined to omit mention of most of these in our descriptions, relegating them to the status of 'background' conditions. This practice is unobjectionable in cases in which our interest lies in singling out particular aspects of an occurrence in assessing responsibility for particular outcomes (a spark, not the presence of oxygen, caused the fire), or in determining what you would need to add on a particular occasion to achieve a particular outcome (a charged battery, not a fully functioning drive train). But this way of talking cuts no ontological ice. Any

outcome, even the status quo, turns on the cooperation of multitudinous reciprocal dispositions.

Second, the status quo is not a matter of dispositions waiting docilely to be manifested. The status quo is itself an ongoing mutual manifesting of countless dispositions, indeed many of the same dispositions that manifest themselves in new ways with the advent of new reciprocal partners.

Third, to the extent that it might be correct to recast causal sequences as mutual manifestings of reciprocal dispositions, it is important to see that one and the same kind of disposition is capable of manifesting itself differently with different kinds of reciprocal partner. Failure to appreciate this point, has led to confusion in recent discussions of dispositions.

A ball's sphericity disposes the ball to roll. But it is also, in virtue of being spherical, that the ball is disposed to make a concave, circular impression in the carpet, and disposed to reflect light so as to look spherical. Rylean talk of single- and multi-track dispositions is confused from the outset. Dispositions, quite generally, are 'multi-track', if this means that they would manifest themselves differently with different kinds of reciprocal partner. If you start with the thought that diversity we find in the universe stems from varying combinations of a comparatively small number of different kinds of fundamental entity, then you will want dispositions to be capable of diverse manifestations with diverse kinds of reciprocal partner.

Philosophers who have been attracted to an ontology of dispositions, sometimes characterize dispositions as features of objects that manifest themselves in a particular way given a particular kind of 'trigger' or 'stimulus'. Alexander Bird (2007), for instance, takes a disposition, *D*, to be characterizable by reference to a manifestation, *M*, resulting from *D*'s being stimulated by *S*:

$$S \rightarrow D \rightarrow M$$

Note, first, how poorly this way of thinking about dispositions fits with the examples discussed earlier, with, for instance, sugar's dissolving in a cup of tea. You have sugar, tea, and the sugar's dissolving. Where do you locate *D*? In the sugar? In the tea? And where is *S*? Is *S* the sugar, the tea, or something else?

Second, observe that dispositionality is being characterized causally. But by now it should be clear that this puts the cart before the horse. Once dispositions are on the scene, you have the resources needed to make sense of causation. Reversing the order of explanation requires pairing dispositionality with conceptions of causation and laws that have a role only in a universe stripped of dispositionality.

Third, note that by individuating dispositions Bird's way, you are bound to over-count. Suppose one and the same disposition manifests itself one way with one kind of reciprocal partner and another way with a different kind of partner. This, I think, is the norm, although it altogether eludes the individuating scheme implicit in the idea that a disposition can be pinned down in the manner suggested by Bird.

So where are we? The reinstatement of powers in the objects mandates a rejiggering of the prevailing conception of causation, a conception that had been tailored to a picture of a universe comprising passive objects governed by laws. It remains to be seen how dispositionality could yield an account of modality, the topic featured in the title of this paper. One route from dispositionality to modality runs through causal indeterminacy.

Nondeterministic Causation

If you thought of causation as a relation among distinct events, and if you thought that there were more to causation than the correlation of types of event, you

would want an account of the causal nexus. What might it be for a cause to *bring about* its effect? One option would be to build *necessitation* into laws governing types of event. The *C*'s necessitate the *E*'s when there is a law to that effect. One selling point for such a view is that it makes it easy to understand cases of nondeterministic or probabilistic causation. You have probabilistic causation when the *C*'s (merely) make probable—or raise the probability of—occurrences of *E*'s. In fact, it might be thought that you could understand *all* causation probabilistically. Deterministic cases are just those in which the probability of a *C*'s causing an *E* is unity.

A conception of this kind is plausible, however, only so long as you think of laws as external to whatever they govern. The law manages somehow to ensure that *E*'s occur in tandem with *C*'s with a certain probability. Once you relinquish this picture, however, matters are less clear. Suppose sugar were disposed to dissolve in tea, but only with a certain probability. This is, in fact, most likely *true* given that numerous additional factors are required for a dissolving. Pretend that it is not so, however, pretend that cases in which sugar fails to dissolve are not due to the presence—or absence—of some further factor, some 'hidden variable'.

Now consider a case in which the sugar *does* dissolve. Remember: we are pretending that the circumstances are *exactly the same* in cases in which the sugar dissolves and those in which it doesn't. In what way is a dissolving a *manifestation* of dispositions of the tea and the sugar? The dissolving *occurs*, but in what way are dispositions of the tea and sugar *responsible* for its occurring? When the sugar dissolves, in what way do the pertinent dispositions *produce* or *bring about* the dissolving?

If you feel nothing here, if you are not gripped by the problem, what I have say will not much matter. But if, like me, you *are* moved by the problem, if you regard it as close to unintelligible that in one case *A* and *B* occur without an

occurrence of *C* and in another case *A* and *B* occur and are *responsible* for an occurrence of *C*, *A* and *B* *bring about C*, you will regard the production of *C* by *A* and *B* as deeply mysterious. *Laws* can be formulated in a probabilistic idiom, but the notion of probabilistic or nondeterministic causing or manifesting looks hopeless. There are probabilities of there *being* a particular kind of manifesting, perhaps, but not probabilistic manifestings.

The cognoscenti will scoff. Physics provides ample reason to think that the universe is not deterministic. This is not a matter of the occurrence of inconsequential micro-events that tend to ‘cancel out’ at the ‘macro level’. Nondeterministic micro-processes can have cosmic outcomes. This suggests that, whatever effete philosophical qualms I or anyone else might have, we are going to need a working conception of nondeterministic causation.

The question is not whether the universe is deterministic, however. It certainly seems not to be. The question is where precisely to *locate* nondeterministic occurrences. One possibility is that causality—the manifesting of dispositions with reciprocal dispositional partners—itself is or can be nondeterministic. But this is not the only possibility and, if my gut instincts are right, it is not a coherent possibility at all.

Begin with the idea that various occurrences are irreducibly nondeterministic: the decay of a radium atom, for instance. There is a certain probability that the atom will decay over a particular period of time. Probabilities are invoked in these cases, not owing to our ignorance of factors affecting the atom’s decay. There are no such factors, no ‘hidden variables’. A propensity for spontaneous decay is, rather, built into the nature of the atom. You could think of the atom’s decay as the manifesting of a disposition the manifestation of which requires no reciprocal partner. Alternatively, when the atom decays, nothing *causes* it to decay. The atom decays spontaneously.

Suppose the atom is harnessed to a device that would ignite an explosive charge were the atom to decay, and suppose the atom decays, thereby causing the device to ignite the charge. The mistake would be to think that the atom's decaying introduces an attenuated kind of causation, *probabilistic* or *nondeterministic causation*. Doing so would be to mislocate the nexus of indeterminacy. There is no saying *when* the atom will decay. The atom's decay, when it occurs, is spontaneous, uncaused. But when the atom *does* decay, its manifesting itself as it does in concert with the explosive device, the surrounding oxygen, the gravitational field, and perhaps much else, is wholly deterministic, deterministic through and through.

The important point here is that, if you introduce spontaneous elements into an otherwise deterministic system, you introduce proliferating contingencies. The atom decays on Tuesday, but it might not have. This truth is made true by the nature of the atom. The charge's being ignited on Tuesday is contingent, its contingency traceable to the atom's spontaneous decay.

Contingency aside, what of non-spontaneous, *deterministic* manifestings? As a preliminary, let me point out that, just as it would be a mistake to attempt to explicate dispositionality in terms of causal necessitation, so it would be a mistake to set out to explicate the determinism exhibited by the manifestings of dispositions modally, to explicate it by reference to necessitation. Do the dispositions involved in the dissolving of sugar in tea necessitate the dissolving? The dispositions could all be on hand, yet the dissolving fail to occur owing to the presence of some further disposition, one that 'blocks' or 'diverts' this manifestation. Does this mean that the presence of the pertinent dispositions

plus the *absence* of blocking dispositions necessitates the dissolving? Or perhaps the dispositions necessitate their manifestations *ceteris paribus*.⁸

The moral to draw from the difficulty of analyzing manifestings in modal terms is not that there is something fishy about dispositionality, or that dispositions manifest themselves as they do only *ceteris paribus*, but that it would be a mistake to set out to characterize dispositionality modally. Rather than explicating dispositionality by reference to necessitation, then, I would prefer to think that claims about possibility and necessity, modal claims, are made true by the dispositional structure of the universe (an exception being claims as to the modal status of the universe itself). Here is one way it might go.

Spontaneity aside, the manifesting of a disposition with its reciprocal partners is fully deterministic: if you have the right dispositions standing in the right relations, you have the manifestations. The universe unfolds continuously, gaplessly. The appearance of gaps and diversions results from the interrelatedness of dispositions. We expect sugar to dissolve in tea, but its doing so requires massive cooperation on the part of the surrounding atmosphere, the gravitational field, and the like. Manipulate these, mix in a new element, and you change the manifestation.

Although manifestings involve continuous, simultaneous interactions of dispositions, they can be temporally extended. A dynamic process could unfold over time. Such a process might be relatively uninteresting, as for instance, the body of your automobile's retaining its strength and rigidity over the years, or a comet's orbiting the sun, or more exciting, as in the heating of a kettle of hot water, or the collapse of a star. You could think of processes as comprising

8. Some readers will recognize that the problem here parallels the problem associated with attempts to craft counterfactual analyses of dispositions.

sequences of manifestings, each member of the sequence being a manifesting of previous members.

Antidotes, Blockers, Finks, and Absences

Return to those cases in which a particular manifestation is 'blocked' or 'diverted'. On the view I am recommending, talk of 'blockers', 'antidotes', and 'finks' is perspectival. Such terms introduce what Descartes called 'extrinsic denominations'. Reflect again on attempts to distinguish causes from 'background conditions'. If a 'background condition' is required for a given occurrence, it is part of the cause of that occurrence. Conditions are relegated to the 'background' only because everyday talk about causation is bound up with talk of responsibility and with pragmatic constraints on explanation. We say that the lit match, not the oxygen, caused the fire, but this is only because the oxygen is presumed present anyway; it would be pedantic to include it in an explanation of the occurrence of a fire.

What occurs when a 'blocker' or 'antidote' is on the scene is not the prevention of a manifestation, but the occurrence of a *different* kind of manifestation. You swallow a poison pill and the poison, in concert with your digestive juices, issues in a particularly unwelcome kind of manifestation. If you take an antidote immediately after swallowing the pill, the antidote 'blocks' the operation of the poison. In this case, 'blocking' amounts to the facilitation of a different kind of manifestation. Details depend on how the antidote works. The antidote might alter the pill's chemistry so as to render it harmless in your system; or it might change your digestive tract so that the mutual manifestation of its features with features of the pill is physiologically benign. In both cases, the upshot is an ensemble of dispositions issuing in a particular kind of manifestation.

The same point applies to absences and privations. An absence of iron causes anemia. This does not mean that an absence, a privation, a nothing, exerts itself in a way that diminishes red cell counts. Rather, diminished red cell counts are what you get when you have a dispositional makeup that does not include iron. *That* makeup issues in the production of blood with fewer red cells by volume of blood than would a dispositional makeup that included iron.⁹

When you have the dispositions appropriately related, you have their manifestations. Particular manifestations can be blocked or prevented, or diverted, but that is just to say that they can be blocked or prevented or diverted from manifesting themselves in a particular way. In such cases, what occurs is not *no* manifestation but a different *kind* of manifestation.

Before saying what exactly any of this might have to do with modality, let me summarize.

Something's behavior is a matter of the mutual manifestation of dispositions possessed by the object and dispositions possessed by other somethings with which it interacts. Such manifestations are fully reciprocal, fully symmetrical. When one billiard ball strikes another, *both* balls are affected in a manner shaped by their various characteristics, characteristics of the surface on which they roll about, characteristics of the atmosphere, the gravitational field. These manifestings are straightforwardly deterministic: *inevitable*. If you have the dispositions suitably related, you have the manifestings. To the extent that some dispositions manifest themselves spontaneously, however, the causal system—the dispositional matrix—will be nondeterministic.

9. Lactase enzymes naturally 'block' manifestations of lactose in the digestive systems of mammals. The lactase enzyme breaks down lactose molecules so they can be absorbed into the bloodstream. The *absence* of lactase results in 'lactose intolerance', a condition in which the presence of lactose—most often in dairy products—in concert with digestive bacteria is manifested in fermentation and the production of gas.

Modal Truthmakers

We now have the makings of a picture of a nondeterministic universe in which every manifesting, every instance of causation, is perfectly deterministic. Start with a conception of the universe as a dispositional matrix, a vast network of interrelated manifestings of dispositions. This is a conception of a perfectly deterministic universe, an Aristotelian universe of the sort that the Church regarded as incompatible with an omnipotent creator. Now sprinkle in occasional spontaneous occurrences. Although these occurrences are uncaused, they can and do have perfectly deterministic repercussions. If you think of the universe as a closed system, spontaneous occurrences resemble interventions from the 'outside'. But, if you accept a nondeterministic universe, such occurrences are not *results* of anything, they are spontaneous manifestings, spontaneous uncaused causes.

Spontaneity breeds contingency. Any occurrence, any manifesting of dispositions, that has in its ancestry a spontaneous occurrence, is thereby contingent: *it* might not have occurred. Given massive interconnectivities, it is going to be difficult, perhaps impossible, to find *any* occurrence insulated from spontaneity, a manifestation that is flatly necessary. If the Big Bang was itself spontaneous, a live option, then the universe as a whole is contingent. The universe, this very universe, might not have existed.¹⁰

The universe would be contingent were the Big Bang spontaneous, but this is not something for which it would be appropriate to seek an explanation. The same holds for local contingencies. To the extent that these are traceable to

10. The assumption here is that distinct Big Bangs yield distinct universes. If time begins with the Big Bang, then you could think of the Big Bang occurring in proto-time, a temporal analogue of early medieval conceptions of the void taken to lie outside the finite created universe; see Grant 1981.

spontaneous occurrences, they resist the kind of explanation that would discharge shallower contingencies.

So much for contingencies, what of necessities? Necessities are reflected in the deterministic character of dispositionality. The character of the dispositional matrix enables us to predict, manipulate, and accommodate vagaries of the universe as we find it. In this context, it can be appropriate to describe some things as necessitating others.

Counterfactual and Subjunctive Conditionals, and Other Loose Ends

Counterfactual and subjunctive conditional judgments make up an important species of modal discourse. Were this radium atom to decay, the result would be a helium atom and an alpha particle. Were you to stir a spoonful of sugar into the tea, it would dissolve. Had you failed to remove the crumpets you had for breakfast from the oven, they would have burned. When a counterfactual or subjunctive conditional assertion is true, however, what *makes* it true? What might the truthmakers be for counterfactual and subjunctive conditional truths?

Discussions of such matters nowadays invariably invoke Lewis's alternative worlds. In the most similar or 'nearest' world in which the radium atom (or its counterpart) decays, it issues in an alpha particle and a helium atom. In the nearest world in which you (or a counterpart you) stir a spoonful of sugar into the tea, it dissolves. In the nearest world in which you (or your counterpart) neglect the crumpets in the oven, they burn.

This suggests that truthmakers for such claims are goings-on in alternative universes. The prospect seems odd on the face of it. Why should truthmakers for assertions concerning what transpires or could transpire in *this* universe reside in *other* universes?

Lewis's own view is that truthmakers for counterfactual and subjunctive conditionals *are* goings-on in our universe. These can serve as truthmakers by virtue of bearing the pertinent similarity relations to features of those other universes (see Lewis 1986, 22). This is a slight improvement, but it remains hard to see what a local something's similarity to something somewhere else could have to do with it's being true that the local something would dissolve, would issue in an alpha particle and a helium atom, would burn.¹¹

Some philosophers seem to doubt that counterfactual and subjunctive conditional truths require truthmakers. This is one way to interpret the suggestion that counterfactuals might be made true by rat-baggish contrary-to-the-fact-facts. I myself doubt that every truth requires a truthmaker, but it seems to me that counterfactual and subjunctive conditional truths can be seen to have perfectly upstanding truthmakers.

Return to the three examples mentioned earlier. A radium atom is disposed to decay spontaneously resolving itself into a helium atom and an alpha particle. Sugar and tea include reciprocal dispositions that manifest themselves in the sugar's dissolving. Heated ovens and crumpets are reciprocally disposed, over time, to issue in charred crumpets. These dispositional features of the universe are apt truthmakers for familiar counterfactual and subjunctive conditional truths.

Although I think this is exactly right, matters are more complicated than these brief remarks suggest. Counterfactual and subjunctive conditionals can have distinct kinds of deployment. The examples appealed to thus far might all be thought to subserve broadly action-guiding goals. We want to know what is likely

11. As Phil Dowe impressed upon me, Lewis is not in fact interested in the *nature* of causation, but only in advancing an account of our ordinary causal *concept*, which he thinks can be given a counterfactual analysis (see Lewis 2004). My aim, in contrast, is to show how causal claims and counterfactuals alike might be made true by the dispositional character of the universe.

to happen if we leave radium atoms to themselves, if we stir sugar into hot tea, if we leave crumpets unattended in the oven. In most cases, what actually happens is going to depend on endless factors concerning which the counterfactual or subjunctive conditionals are silent. Were you to hold a burning match to a piece of paper, the paper would catch fire—but not if the match's heat would set off the sprinkler system.

The situation is analogous to the scientific deployment of laws of nature. This is hardly surprising given the close association between laws and counterfactuals. I have suggested that you could see causal laws as teasing out contributions made by particular kinds of disposition. Electromagnetic laws, for instance, could be seen as providing an account of how electrically charged particles would behave *qua* charged. Laws can be both explanatory, providing an accounting of the dispositional nature of the universe, and action guiding. Successful interaction with the environment requires that we comprehend, if only in a rudimentary way, its dispositional character.

Imagine that you are a member of a group seated around a dinner table. Someone observes, 'Each of you *could* have been seated in the seat to your immediate left'. This seems correct. It seems contingent that you and your companions are sitting precisely where you are. But is that so? The truth of the original assertion depends on the world's being a particular complex way, one, namely, in which the circumstances responsible to your sitting where you happen to be sitting now are traceable to one or more instances of spontaneity. That would ensure contingency. But it is much more difficult to ascertain what could make it true that, had you not sat where you did, you would have elected to sit one seat to the left. If there is a truthmaker here, our epistemic access to it is going to be highly speculative.

It seems likely that we are bound to understand assertions such as ‘Each of you could have been seated in the seat to your immediate left’, not as straightforward expressions of truths about the universe, but on the model invoked earlier. Thus the assertion might be meant to express an observation about the dispositional character the circumstances, including the respective powers of you and your dinner companions. Regarded in that light, it could be seen as expressing a truth without any attendant commitment to contingency.

Concluding Remarks

In ontology one thing inevitably leads to another. It is a mistake of an especially pernicious sort to imagine that you can assemble a coherent metaphysical position as you might a radio or a desktop computer: by bolting together generic off-the-shelf components. Part of what I have sought to show is that, if you are attracted to an ontology of powers or dispositions, you are going to want to think very hard about how you might assess a host of related positions, including—even *especially*—widely accepted, ‘default’ positions.

It would be a mistake, for instance, to bolt the received conception of causality onto an ontology of dispositions, or to plug in a familiar conception of laws. These conceptions developed in large part as responses to the removal of dispositionality from the universe. Dispositions provide resources that make the conceptions superfluous. To graft laws or law-backed causation onto a universe of dispositions would be analogous to bolting a carburetor onto a modern fuel-injected automobile engine. The result would be something unlikely to run at all.

I do not expect you to agree with everything I have said here. My hope, rather, is that I will have at least convinced you to look more critically at what has become conventional philosophical wisdom. An old adage counsels us never to

look a gift horse in the mouth. But when philosophers come bearing gifts, you are well advised examine those gifts most diligently.

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References

- Armstrong, D. M. (1997) *A World of States of Affairs*. Cambridge: Cambridge University Press.
- Bacon, John, Keith Campbell, and Lloyd Reinhardt, eds. (1993) *Ontology, Causality, and Mind: Essays in Honour of D. M. Armstrong*. Cambridge: Cambridge University Press.
- Bird, A. (2007) *Nature's Metaphysics: Laws and Properties*. Oxford: Clarendon Press.
- Cartwright, N. (1983) *How the Laws of Physics Lie*. Oxford: Clarendon Press.
- Cartwright, N. (1999) *The Dappled World: A Study of the Boundaries of Science*. Cambridge: Cambridge University Press.
- Crane, T. (1996) *A Debate on Dispositions*. By D. M. Armstrong, C. B. Martin and U. T. Place. London: Routledge.
- Des Chene, D. (1996) *Physiologia: Natural Philosophy in Late Aristotelian and Cartesian Thought*. Ithaca, NY: Cornell University Press.
- Garber, D., and M. Ayres, eds. (1998) *The Cambridge History of Seventeenth-Century Philosophy*, vol. 1. Cambridge: Cambridge University Press.
- Grant, E., ed. (1974) *A Sourcebook in Medieval Science*. Cambridge, MA: Harvard University Press.
- Grant, E. (1981) *Much Ado About Nothing: Theories of Space and Vacuum from the Middle Ages to the Scientific Revolution*. Cambridge: Cambridge University Press.
- Heil, J. (2003) *From an Ontological Point of View*. Oxford: Clarendon Press.
- Heil, J. (2012) *The Universe as We Find It*. Oxford: Clarendon Press.

- Ingthorsson, R. D. (2002) 'Causal Production as Interaction'. *Metaphysica* 3: 87–119.
- Lange, M. (2009) *Laws and Lawmakers: Science, Metaphysics, and the Laws of Nature*. Oxford: Oxford University Press.
- Lewis, D. K. (1986) *On the Plurality of Worlds*. Oxford: Basil Blackwell.
- Lewis, D. K. (2004) 'Void and Object'. In J. Collins, N. Hall and L. Paul, eds. *Causation and Counterfactuals*. Cambridge: MIT Press: 277-90.
- Martin, C. B. (1993) 'Power for Realists'. In Bacon *et al* (1993): 175–86.
- Martin, C. B. (2008) *The Mind in Nature*. Oxford: Clarendon Press.
- Milton, J. R. (1998) 'Laws of Nature'. In Garber and Ayres 1998: 680–701.
- Roberts, J. T. (2008) *The Law-Governed Universe*. Oxford: Oxford University Press.
- Ruby, J. (1986) 'The Origins of Scientific "Law"'. *Journal of the History of Ideas* 47: 341–59.
- van Fraassen, B. C. (1989) *Laws and Symmetry*. Oxford: Clarendon Press.