Building the Physical World out of Powerful Properties

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Alexander Bird, *Nature's Metaphysics: Laws and Properties*, Oxford University Press: Oxford 2007, 256 pages.

When I was first introduced to the debate about the nature of physical laws, I remember wondering how the natural laws could be based in something external to the properties whose behavior they were meant to govern. Surely it is something about salt *itself* (or, rather, about the nature of both salt and water, and the interaction of those natures) that makes it a law that salt dissolves in water. At that time, however, the leading theories of natural laws denied this. On the *Nomic Necessitation* view (sometimes also called the Dretske-Tooley-Armstrong view), it is a law that salt dissolves in water because the properties of *saltiness*, *wateriness*, and *being a solution* are in a higher order relation of "necessitation" – a relation that could have failed to hold since it is not tied to the *nature* of the properties it relates. And on the most prominent version of *Humean* views of natural laws, David Lewis's, it is a law that salt dissolves in water simply because the universal generalisation "all salt dissolves in water" follows from the best systematization of true particular facts. Again, it is nothing directly about *salt* or *water* that makes it the case that they will form a solution.

So I was excited when I first heard about Dispositional Essentialism about laws of nature, many years ago.[1] On this type of view, the laws are grounded at least partly in the dispositional essences of properties. Instead of being somehow imposed from the outside on otherwise independent properties, or merely being some set of regularities of behavior of those properties (no matter how carefully selected), natural laws come from the *essential natures* of those properties themselves. In *Nature's Metaphysics,* Alexander Bird[2] presents a sustained argument for a strong version of Dispositional Essentialism, which holds that *all* fundamental natural properties have completely dispositional essences (which he calls *Dispositional Monism* to differentiate himself from Dispositional Es-

1 It was, in fact, at a talk critiquing Alexander Bird's "Necessarily, Salt dissolves in Water," *Analysis* (2001), 61/272: 267-274.

2 A. Bird, *Nature's Metaphysics: Laws and Properties*, Oxford University Press: Oxford 2007.

sentialists who hold that some fundamental properties are non-dispositional in nature, such as Brian Ellis), and provides a detailed exploration of what is involved in grounding natural laws in such properties. *Nature's Metaphysics* will be of interest not only to those who work on the metaphysics of natural laws and on dispositional ontologies, but also those interested in the nature of fundamental properties.

In what follows I will give a rough sketch of some of the main arguments in the book. I will focus in particular on issues arising from the interaction between different dispositional properties and the consequences this has for grounding the laws in relationships between these properties. I will also argue for a different understanding of the dispositional nature of fundamental properties – and how they interact – from the one Bird offers. I do not, however, take this to be a significant challenge to Bird's view, since I think the amendments I suggest are quite germane to the metaphysical spirit of *Nature's Metaphysics.*

I will begin by looking at Bird's treatment of arguments against Dispositional Monism. There are several substantial hurdles that face anyone who would claim that all fundamental properties are essentially dispositional. Chapters 5, 6 and 7 of *Nature's Metaphysics* are devoted to dealing with arguments against worlds that are wholly dispositional in nature. Firstly, since dispositional properties may be instantiated without ever manifesting, you might worry that they are too modal to be part of the *actual* world, or what actuality they have is too thin to constitute the actual world. In chapter 5 Bird argues that these sorts of objections either beg the question against the existence of essentially dispositional properties or else allow that entirely non-dispositional ontologies would be subject to the same sort of objection (this last point also picks up on arguments he gives in chapter 4 that non-dispositional properties seem to be too thin to constitute reality). Since dispositional properties need not *actually* manifest to be instantiated, one may be tempted towards thinking that part of the identity conditions of such a disposition must be its relationship to the non-actual state of its manifesting. But while a particular instance of a dispositional property may never *actually* manifest, it need not be thought of as a pointing towards mere possibilities – the conditions that fix its identity may instead involve a relation between *actual* property types or universals.[3] And, although

3 If one is worried that property types that do not have any instantiated tokens are not around to be so related, one could go for a Platonic view of universals. An Aristotelian universalist will have to find a much more complicated relationship to ground the identity of dispositions, or else give some reasons for rejecting the assumption that the identity of dispositions is fixed by relations between properties.

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there is such "pointing" towards possibly non-existent manifestation properties, Bird argues that this is no reason to think that dispositional properties have intentionality – even though there is something *like* the directedness of intentional states in dispositions, they are missing many other characteristics of intentional states, such as having their descriptions form intensional contexts.

In Chapter 6, Bird addresses versions of the "always packing" objections to worlds that are wholly dispositional. Since in such worlds both the stimulus and manifestation of a dispositional property would themselves be dispositional, it has seemed to some that such a world would be incoherent, or that nothing would ever happen in such a world, or that such a hypothesis is inconsistent with our epistemological access to the world, or that the identity of dispositional properties needs some anchoring in something *non*-dispositional. Bird takes the last of these to be the most worrisome form of the objection, but argues that the identity of dispositional properties could be uniquely fixed in a wholly dispositional world, if the structure of relations were to be sufficiently asymmetrical.

Chapter 7 focuses on the commonly held intuition that at least some of the properties that prominently feature in natural laws must be non-dispositional – in particular, spatial relations. While it is perhaps easy to see the dispositionality of properties such as charge, spatial properties and relations (such as shape or displacement) are often given as examples of paradigmatic *non*-dispositional properties. Bird argues that the concept of space as non-dispositional rests on the idea of space as a causally inert background for causal happenings. While this conception of space may be strongly engrained in our folkish intuitions, modern science gives us reason to doubt this – according to General Relativity, space-time is changed by the presence of mass, suggesting that it too is dispositional in nature.

While chapters 5-7 focus on concerns about worlds that are wholly dispositional, chapters 8 and 9 deal with issues arising from taking the natural laws to be dispositionally based. There are some consequences of the view that might violate one's intuitions about natural laws. The upshot of grounding laws in the essences of properties is that the laws of nature will be necessary, at least in the sense that if we have two worlds with the same universals instantiated, they have the same laws. Yet it seems that we can imagine such worlds having *different* laws. Bird deflates this intuition in two ways: first, anyone – dispositional essentialist or not – will have to accept that at least *some* laws are necessary. It may seem contingent, for example, that salt dissolves in water. Yet the very existence of salt requires Coulomb's law to hold in order for the sodium and chlorine ions to bond together in the right way. And Coulomb's

law is also responsible for the dissolving of salt in liquid H_2O. Thus, so long as salt and water exist, salt will dissolve in water. Second, the intuition that salt's solubility is contingent can be explained away in a Kripke-esque manner – what we are latching on to in our intuition is the possibility of some salt-like stuff failing to dissolve in some watery-ish stuff. Intuitions about modality should be taken with a grain of salt in a post-*Naming and Necessity* world. This Kripke-style redescription of imaginings isn't going to convince someone who isn't already tempted by Dispositional Monism. It does, however, provide a possible tool for Dispositional Monists to explain away their guilty imaginings of worlds that appear to have different laws from that of the actual world.[4]

Having cleared the way for the possibility of worlds that are wholly dispositional and for laws that are necessary, it is time to turn back to the details of how natural laws are grounded in properties that are essentially dispositional. In chapter 2, as well as giving an overview of the dispositions literature that would serve as an excellent introduction to dispositional properties, Bird argues that we can derive law-like generalisations from the existence of essentially dispositional properties.

Given that the fundamental properties are the properties that figure in the fundamental natural laws, the Dispositional Monist holds that the fundamental nomic relations will be between properties with dispositional essences. Take one of these properties, P. Since P is essentially dispositional, it is necessary that wherever P is instantiated, so are the dispositions that make up its essence. Now consider one of these, D(S,M) – the disposition to M in situation S. So we have:

$$P \rightarrow D(S,M)$$

We commonly characterise dispositions using counterfactuals – we might explain *solubility*, for instance, by saying that soluble things *would* dissolve if they *were* to be placed in water. While Bird does not generally accept the counterfactual analysis of dispositions, he *does* think it probably holds for the dispositional essences of fundamental properties – more about this in a minute – so the attribution to an object x of the *fundamental* disposition to M in situation S is necessarily equivalent to the counterfactual: x would M if it were in situation S. So we have:

4 Although for worries about this general argumentative strategy as applied to natural laws, see Alan Sidelle (2000) "On the Metaphysical Contingency of Laws of Nature," in Tamar Szabó Gendler and John Hawthorne (eds.) *Conceivability and Possibility*, 309-336.

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$$P \rightarrow (S \mathrel{\square\!\!\rightarrow} M)$$

Thus whenever an object x has the property P, it will have D(S,M), and thereby it will be true that x would M if it were in S. From all of this we get the universal generalization that if anything has property P and is in S, then it is also M.

Yet we get more than just a true universal generalization – we also get a clear support of counterfactuals, which is one important feature that differentiates natural laws from merely accidentally true generalizations. Since dispositions have a close relationship with counterfactuals – and, for Bird, the fundamental properties have the *very* close relationship of guaranteeing the truth of appropriate counterfactuals – this counterfactual support falls naturally out of taking properties with dispositional essences to ground the laws. Laws are thus no longer mysterious relationships between universals (as they are, for example, for Armstrong), and they are grounded in the metaphysics of properties (contra Lewis).

As I mentioned, Bird's explanation of how the laws can be grounded in essentially dispositional properties relies on the counterfactual analysis of dispositions, even though Bird does not think that dispositional ascriptions really are equivalent to counterfactuals linking stimulus conditions and manifestations. In fact, Bird himself provided counterexamples to Lewis' counterfactual analysis of dispositions.[5] Although we commonly characterise dispositions using counterfactuals, it is generally accepted that dispositional ascriptions are not equivalent to such counterfactuals. Dispositions might not manifest themselves in their appropriate stimulus conditions because of interfering factors. These factors come in two types: *finks* and *antidotes:*[6]

In standard cases of finking, the fink interferes at some short interval of time after the stimulus begins, and removes the disposition before the stimulus-to-manifestation process can complete. A wire might be conductive, yet be attached to a device that renders is non-conductive should it ever have a potential difference applied across it. This kind of example falsifies the counterfactual analysis of dispositions, for it will not be true that the disposition's bearer *would* manifest the disposition *were* it to undergo the stimulus. The counterfactual analysis would also be falsified if the disposition had an *antidote* – something which would interfere with the causal chain from stimulus to manifestation, but without removing the disposition in question. Fragile

5 Bird (1998) "Dispositions and Antidotes," *The Philosophical Quarterly* 48/191: 227-234.

6 Antidotes are also sometimes called *masks,* following the terminology introduced in Johnston (1992) "How to Speak of the Colors," *Philosophical Studies*, 68/3: 221-63. The term "antidote" was introduced by Bird in his 1998 paper, "Dispositions and Antidotes", *op cit*.

vases may be wrapped in bubble-wrap, and such protection prevents breaking without stopping the vase from counting as fragile.

There can be no finks or antidotes at the fundamental level, Bird claims, which is why the derivations of law-like universal generalisations from dispositional properties can go through. The processes at the fundamental level are not extended through time, and so are not interruptible by finks. If the disposition were removed at the exact time of the stimulus, then we would not have a case of a disposition being finked – for the disposition wouldn't be there at the time of the stimulus.[7]

In the case of fundamental antidotes, Bird advocates for having the absence of the putative antidote as part of the stimulus conditions for the dispositions, with the consequence that, in the presence of a putative antidote, the fundamental disposition is in fact not in the right stimulus conditions at all. Bird argues that non-fundamental dispositions have too many possible antidotes to think that their absence is really part of the stimulus conditions. But since there will be relatively few antidotes at the fundamental level, including them in the stimulus conditions will not result in the disposition looking gerrymandered.

At the non-fundamental level, Bird claims, finks and antidotes are far from being a problem for his picture, as their existence opens up space for the dispositional essentialist to give an account of ceteris paribus laws.

Not all law-like statements are universal generalisations – some admit of exceptions. So, if they are indeed instances of natural laws, not all laws are strict, but perhaps have ceteris paribus clauses attached. If we are to ground these laws in properties with dispositional essences, it will need to be the case that these dispositions do not always manifest in the appropriate stimulus conditions. Bird notes that when dispositions are finked or masked and so a failure of dispositional manifestation, explained by the dispositional interference, and claims that this is where we should look for the grounding of ceteris paribus laws.

7 Though we would still have something fink-like in that the counterfactual associated with having the disposition would be falsified in these conditions. My definition for finks in my 2010 paper, "Superficial Dispositionalism," *Australasian Journal of Philosophy*, 88/4: 635-653, allows that this is a case of finking:

A fink for a disposition D(S,M), where D(S,M) is had by an object x, is a property had by x that would prevent x from M-ing in S by removing the disposition D(S,M) should x undergo S.

In this case, then even if the processes at the fundamental level are not extended through time, there may still be finks for the fundamental dispositions. Such finks would operate *at the time of the stimulus,* removing the disposition immediately. We needn't think that they must operate faster than the disposition's manifestation itself.

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The thought that ceteris paribus laws are grounded in dispositions that sometimes occur with finks and antidotes gets rather quick treatment in *Nature's Metaphysics*, and deserves some more attention. Many ceteris paribus laws involve the absence of interfering factors that are *intrinsic* to the object to which the relevant disposition is attributed, and it is in fact quite controversial whether there can be intrinsic finks and antidotes.[8] Ceteris paribus laws in psychology and economics generally apply to the behavior of people under the assumption that they are rational. We know, of course, that people aren't always rational – which is why, of course, the laws are stated as ceteris paribus! However, the properties that prevent them from acting in a fully rational manner are, generally, *intrinsic*.

The existence of intrinsic finks and antidotes is denied by Bird in other work – although in unpublished work he has allowed for intrinsic finks and antidotes in restricted cases. Where it is not the function of the fink or antidote to interfere with the disposition that it prevents from manifesting, he thinks that dispositions may have intrinsic finks and antidotes. So, perhaps, if I fail to make a rational bet because I have religious beliefs about betting being sinful, I may have intrinsic antidote to the disposition to act rationally since it is not the function of the belief to stop me from acting *rationally*, and thus Bird could say that my disposition to act rationally in this instance has been interfered with, intrinsically. However, matters aren't quite so simple when it comes to attributing functions – one could also take the function of the belief to stop the disposition from manifesting *in this case.* Its function, after all, is to stop me from *betting*.

So it isn't clear whether Bird would really want to allow that these instances of putative ceteris paribus laws are grounded in dispositions in quite the way he suggests. However, we should note that an advantage of allowing that dispositions may be prevented from properly manifesting by other intrinsic properties of the object is that we can thereby tell a uniform story about natural laws, ceteris paribus or not.

Since finks and antidotes explain ceteris paribus laws, Bird goes on to consider whether there are finks or antidotes at the fundamental level – as, if there are, then perhaps even the fundamental laws are ceteris paribus. Bird argues firstly

8 For some recent arguments against their existence, see Choi (2005) "Do Categorical Ascriptions Entail Counterfactual Conditionals?" *The Philosophical Quarterly* 55/22: 495-503; Handfield (2008) "Unfinkable Dispositions," *Synthese* 160/2: 297-308, Handfield and Bird (2008) "Dispositions, Rules, and Finks," *Philosophical Studies* 140/2: 285-98; and arguments for their possibility: Ashwell (2010) "Superficial Dispositionalism," *Australasian Journal of Philosophy* 88/4: 635-53, Clarke (2008) "Intrinsic Finks," *The Philosophical Quarterly* 58/232: 512-18; Everett (2009) "Intrinsic Finks, Masks, and Mimics," *Erkenntnis* 71/2: 191-203.

that there could not be any fundamental finks, and then that there could not be any fundamental antidotes – although he is less committed to this last claim.

However, I will argue that we would be better off with a picture of the fundamental level that does allow for something like finks and antidotes at the fundamental level.

The standard examples of properties that figure in laws, and ones which I have talked about here, will not, according to Bird, count as being fundamental properties – charge, mass, and space all turn out to be non-fundamental on his account. I think that the metaphysics in *Nature's Metaphysics* would be much more elegant if we can overcome Bird's reasons for taking properties like these to be non-fundamental. In the course of exploring alternative views of the fundamental properties I will argue that there are good reasons to reject Bird's claim that there are no finks or antidotes at the fundamental level.

So why aren't properties like charge fundamental? Bird draws a distinction between what he calls *pure* dispositions and *impure* dispositions. Pure dispositions can be characterized in terms of a single stimulus-manifestation pair. Charge, however, displays itself in different ways in different circumstances – there are many different pairs of possible stimuli and manifestation that appear to be characteristic of charged objects. It isn't just that like charges are disposed to move away from each other, and unlike charges attract, but also that the force with which they move apart or together varies with the distance between the charges and with the amount of charge each has. It is, therefore, an impure disposition. But "[f]undamental properties cannot be impure dispositions," Bird claims, "since such dispositions are really conjunctions of pure dispositions, in which case it would be the conjuncts that are closer to being fundamental" (22).

This leads to some problems. Firstly, there will be substantial regularities in nature that are not due to the dispositional nature of things. Let us call the pure dispositions that make up the property *charge* "chargelets". The chargelets hang together in a uniform way. We don't find that a force between two charges varies inversely proportional to the square of the separation of the charges at distances greater than 1km and less than 0.9km, but then between 0.9 and 1km charge behaves wildly differently.[9] In doing science we look for explanations why, when you play around with one variable (say, the distance between two charges), other things change too (like the force between the charges). If charge is really just a collection of disconnected chargelets, it isn't clear what

9 There are extra difficulties when we get to very small separations, but this does not, I think, go against the main point here, as it seems there is an explanation for this difference too.

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we're doing when we look at dependencies between different variables. If I vary the distance between the charges and see how the attraction changes, all I am doing is changing from testing one chargelet disposition to testing another, not testing a real dependency.

Now, it may be that this is a uniformity that can't be explained – it just *is*. However, this doesn't seem to be Bird's preferred answer, as he claims that "it is clear as regards the cases we are interested in, charge and knowing French, that the conjunctions are natural or non-accidental" (22). So perhaps we should look for an alternative view of fundamental dispositions. I will such two such alternatives. First, one might think that there is some disposition in addition to the chargelets that explains why they stick together. This, I will argue, should lead one to reject the idea that the chargelets are *more fundamental* than this additional disposition. Once we have disposed of the chargelet's fundamentality, I will move on to the second alternative view, where we can dispense with the chargelets altogether.

Now, starting along the path towards the first option, we must look for a disposition that could bind together all the little chargelets. It cannot be part of the essence of the chargelets themselves that they roam in neatly ordered packs, for if it were they would be *impure* dispositions. So the stickiness that binds together the chargelets must come from some other dispositional property or properties, which are presumably also pure dispositions (that chargelets come as a package deal seems to be a fundamental structure in nature). One option is to think that this stickiness comes from a number of other dispositional properties, to the effect that if you have chargelet A you also have chargelets B, C,… and if you have chargelet B you also have chargelets A, C,… and so on. However, this just shifts the problem. Now we need an explanation for why *these* dispositional properties tend to hang around together. So instead we'll explore the prospects for a single binding disposition.

This binding dispositional property must have no stimulus conditions[10] or a universally satisfied one, as the chargelets always stick together, and the manifestation will be the collective instantiation of all the chargelets. Despite the complicated manifestation condition, the binding disposition will still count as pure, as it associates no more than one stimulus condition (albeit either a null or universal one) with one manifestation (albeit a complex one). The instan-

10 BarbaraVetter has, in as-yet unpublished work, argued that dispositions without stimulus conditions are possible. I assume that such a disposition could be a pure disposition. Not all dispositions that Vetter argues are best understood as not having stimulus conditions will be pure in the sense Bird thinks the fundamental properties are, but I think this binding disposition would be.

tiation of the binding disposition then explains why the chargelets are always found together. However, now that we have something that explains why the chargelets are always found together, we should start to wonder whether they really are fundamental.

When we think of what objects are fundamental, a natural thing to think is that things become closer to fundamental the more we break it up into smaller bits. The smaller parts are more fundamental than the larger whole, and the larger whole is made up of its parts, in the way that a child's building blocks might make up a castle. The fundamental stuff must be *simpler* than the resulting complex things that are built up out of it.

Now, this is a very natural way to think about fundamentality of *objects*,[11] but must we extend the same conception to the fundamentality of properties? It isn't clear that we can think about *parts* of properties in the same way that we think about parts of objects – or, even if we can, whether those "parts" will be "smaller" or more fundamental than the whole. Note that the binding disposition that sticks all of the chargelets together is *prior to* all the little chargelets – it makes it the case that they are instantiated *together*, and also, it seems, that they are instantiated *at all.* Although it is a more complicated disposition than each of the individual chargelets, it seems a better candidate for fundamentality.

If we move away from the idea that the fundamental properties must be the "smallest" properties (assuming we can even make sense of that), we lose the reasons we had to start thinking about chargelets at all. Perhaps the most fundamental properties aren't just single stimulus-manifestation dispositions, but something more variable and complex. I will now move on to a second possibility for the structure of dispositions at the fundamental level, which centrally involves the *interaction* of dispositions to get the variability found in properties like charge.

The kind of dispositional interference that is discussed in the disposition literature tends to focus on the *prevention* of a disposition's manifestation by either a fink or an antidote. Both finks and antidotes *stop* the characteristic stimulus of a disposition from issuing in its manifestation, either by removing the disposition in question or by preventing its manifestation without removing it. There is no room in this conception, however, for interference that involves an *alteration* in the disposition's display.

On the standard picture of dispositional interaction, I think, alteration of a disposition is generally understood as stemming from the multi-track nature

11 Although see Schaffer (2010) "Monism: The Priority of the Whole" *Philosophical Review* 119/1: 31-76 for arguments against this tendency to think that the smallest parts of objects are the most fundamental.

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of the disposition. If disposition D manifests differently in situation S and in situation S', then, it is assumed, disposition D must be *multi-track* in the sense that there is a different bit of the dispositional profile corresponding to the differing behavior in each situation. When we start to think of alteration in this multi-track way, it does seem like a conjunction of simple single-track dispositions – and, if we add that these are *parts* of the multi-track disposition, and parts are prior to the whole, then we must conclude that these single-track dispositions must be more fundamental than the multi-track disposition we started with.

When we think about full *prevention* of a disposition's manifestation, we don't tend to assume that there is a part of the dispositional profile corresponding to how the disposition will fail to manifest.[12] Prevention by an antidote, however, simply seems like the limiting case of alteration, so it is unclear why we should treat it differently. The fragile vase can be protected by bubble-wrap more or less effectively. The vase will break differently if wrapped in a little bubble-wrap, but not enough to completely prevent its fragility from manifesting. Continue wrapping it in more and more bubble-wrap, and at some point we get prevention.

Our interest at the moment are dispositions at the fundamental level, and it seems highly unlikely that fragility is one of these, so let us return to thinking about charge. On Bird's picture, we have an uncountably infinite number of chargelet dispositions that together compose the property *charge*. Each one corresponds to a different stimulus-manifestation pair, where the stimulus takes into account all the different possible combinations of other charges in the vicinity, and their displacement from the charge being considered. If we instead had a picture that allowed for alteration as an antidote-like interference, we could instead posit one single disposition for charge, where the different ways that it manifests depends on and is altered by the presence of other dispositions – for example, the space between the charges, and the other charges, and gravitational attraction.

Such a picture needs more exploration. There are still many details that need to be worked out – for example, in explaining such alteration we need to avoid having to privilege one stimulus-manifestation as the normal pair for the disposition, from which all others are *just* deviations. This will require us to move even further away from the stimulus-manifestation model that we have inherited from those who thought that dispositions were equivalent to counterfactuals. But this, I think, would not be a bad thing.

12 If we did, then Bird would have a far simpler argument as to why there are no finks or antidotes for the pure dispositions at the fundamental level.

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