

Given the range of studies described in this volume, the intrinsic interest of many of their findings, and the inclusion of both advocates and critics of this approach to philosophical inquiry, I recommend *Experimental Philosophy*, the book, to philosophers interested in the evidential status of intuition in philosophical inquiry (as well as to anyone – especially potential jurors – interested in learning more about the contingencies that can affect one’s untutored intuitive judgements about a range of important things). As for Experimental Philosophy, the discipline, I’d say the jury is still out!⁸

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Reference

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8 I’m grateful to Kadri Vihvelin, Terrance Tomkow, and Eric Schwitzgebel for comments and discussion of these issues.

Nature’s Metaphysics

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This book advocates dispositional essentialism, the view that natural properties have dispositional essences.¹ So, for example, the essence of the property of being negatively charged is to be disposed to attract positively charged objects. From this fact it follows that it is a law that all negatively charged objects will attract positively charged objects; and indeed that this law is metaphysically necessary. Since the identity of the property of being negatively charged is determined by its being related in a certain way to the property of being positively charged, in any world in which these properties exist they must be related so that all negatively charged objects attract positively charged objects.

Bird opposes his dispositional essentialism to the view that properties are categorical in nature, with their identities grounded in quiddities that are not exhausted by their relations to other properties. The main exponents of this view are D.M. Armstrong and David Lewis. They take the laws of nature to be contingent though they entertain very different views about their nature: Armstrong is a necessitarian about laws, taking them to be relations of nomic necessitation between universals, while Lewis is a Humean about laws who takes them to be a special kind of regularity.

1 *Nature’s Metaphysics: Laws and Properties*, by Alexander Bird (Clarendon Press, 2007. xiv+231 pp. £30 cloth, £18.99 paper).

The book is a sustained defence of the dispositional essentialist conception of properties and laws against the competing conceptions espoused by Armstrong and Lewis. One rough way to characterize the difference between these conceptions is to say that the categoricist sees properties as passive and inert with the laws of nature being fixed independently of the nature of properties whereas, in contrast, the dispositional essentialist sees properties as active potencies from which the laws of nature automatically spring. A slightly more tendentious way to express the difference is to say, as Bird does, that the categoricist views embrace the Humean doctrine that there are no necessary connexions in nature, while the dispositional essentialist view, on the other hand, repudiates this doctrine. This is tendentious because Armstrong takes laws to involve a relation of nomic necessitation, but in Bird's view this falls short of being fully anti-Humean because these relations of nomic necessitation are merely contingent.

The dispositional essentialism defended in this book is not unique or original to it. Similar views about properties and/or laws of nature have been advocated by Brian Ellis, Stephen Mumford, Sydney Shoemaker and Chris Swyer. Moreover, the anti-Humean metaphysics Bird embraces has clear affinities with that developed by Harré and Madden and by George Molnar. Nonetheless, this book represents the most sustained and the most powerful elaboration and defence of dispositional essentialism to date. The book is notable for its ambitious scope, its clarity, and its careful argumentation. It is a fine addition to the metaphysical literature about properties and laws of nature. It is already beginning to assume the status of a canonical text on the subject.

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The book falls into three rough parts. The first part consisting of Chapters 2–4 articulates the dispositional essentialist position, partly by way of critical comparisons with the opposing categoricist views of Armstrong and Lewis. In Chapter 2, Bird argues for a metaphysical conception of properties as natural or sparse properties and opposes this to less full blooded conceptions of them as concepts or as the ontological shadows of predicates. Because he argues that the natural properties are causal powers or potencies, as he calls them, Bird attempts a characterization of the concept of a disposition or causal power, arguing that the concept cannot be analysed in terms of counterfactuals. In Chapter 3, he sets out his view that natural properties have dispositional essences; and motivates the thesis that natural properties, so construed, generate metaphysically necessary laws of nature.

Chapter 4 argues against categoricist conceptions of properties and associated theories of laws of nature. The main argument is based on some thought experiments. One thought experiment runs that if natural properties are quiddities that are not exhausted by their nomic roles, it should be possible for quiddities to swap their nomic roles in different possible worlds, even though, from a scientific point of view, there would be nothing to distinguish the possible worlds. Another thought experiment is that it should be possible for distinct quiddities to possess the same nomic role, even though we would never be able to distinguish them. I'm not sure that these sceptical arguments will move a staunch quidditist about properties, who might simply insist that the possibilities envisaged in Bird's thought experiments are genuine

metaphysical possibilities, however hidden from our limited epistemic perspective. The criticisms that Bird brings against Lewis's regularity theory of laws and Armstrong's nomic necessitation theory are familiar though nonetheless effective. He argues against the regularity theory that it implausibly makes laws supervene on matters of particular fact (the Humean supervenience thesis) and that it cannot account for the explanatory power of laws. He argues against Armstrong's theory that the nomic necessitation relation N cannot explain regularities without invoking potencies.

The second part of the book consisting of Chapters 5–8 responds to various objections that have been brought against dispositional essentialism. This is, in my view, the strongest part of the book, which contains many original, interesting observations and arguments. Dispositional essentialism has been criticized, for example, on the grounds that potencies concerning what might or would happen are suspect because they are too removed from actuality; on the grounds that potencies that are constituted by their essential relations to other properties are too much like the metaphysically mysterious notion of intentionality; on the grounds that fundamental potencies are defined by their relations to other such potencies and so are involved in a vicious circularity; on the grounds that fundamental structural properties such as temporal and spatial relations seem to be categorical rather than dispositional in nature; and finally, on the grounds that dispositional essentialism entails that laws of nature are metaphysically necessary, which goes against the widely held view that they are contingent. Bird answers these objections head-on and succeeds in showing that dispositional essentialism is much more credible than one might have initially thought. Especially impressive is his reply to the serious worry that inter-defined potencies generate a vicious circularity or regress. He takes the worry to concern whether the identity of properties can supervene just on the structure of a network of properties. He shows convincingly that if certain graph-theoretic structures are asymmetrical in the relevant respects, they can determine the identity of the properties in the structures.

The third and final part of the book consisting of Chapters 9 and 10 takes up some outstanding unresolved issues. One issue concerns the status of laws: Stephen Mumford has argued that once the dispositional essentialist view of properties is in place, there is no need to posit laws of nature as a separate metaphysical category. In Chapter 9, Bird responds by arguing that science does need the category of law, since it distinguishes in a principled way between laws and non-laws. Chapter 10 outlines some areas in which his dispositional essentialism stands in need of further work or refinement. One especially notable feature of Bird's dispositional essentialism is that it accords a minimal role to natural kinds, contrasting in this respect with the positions of Brian Ellis and Jonathan Lowe. Bird defends his view by saying that his primary task has been to explain the cement and motor of the universe (potencies and laws of nature) and that natural kinds should be explicable in terms of these more central features of ontology.

There is much in this rich and rewarding book to be discussed. In the remainder of this review, however, I wish to explore in depth the foundational claim of Bird's dispositional essentialism that natural properties are potencies – foundational because all of the distinctive theses of his position rest on this claim. What does this claim mean exactly? And how plausible is Bird's elaboration and defence of it?

Bird explains that natural properties have dispositional essences in the sense that causal roles are essential to natural properties in the same way as causal roles are essential to dispositions such as fragility and elasticity. Not all dispositions correspond to natural properties – the dispositions of fragility and elasticity probably do not. Nevertheless, we can come to understand how natural properties have their causal powers essentially by considering how dispositions have their causal powers essentially. Bird spends a good part of Chapter 2 elucidating the concept of a disposition though the elucidation mostly concentrates on arguing that the concept of a disposition cannot be analysed in terms of counterfactuals. The main obstacle to such an analysis is, in his view, the existence of antidotes. (He also mentions finks as counterexamples to counterfactual analyses: more on finks later.) An antidote to a disposition is something that interferes with the causal process that goes from the stimulus condition to the manifestation of the disposition. An example used by Bird gives the class of examples its name (27). Arsenic is poisonous, or has the causal power to kill when ingested, but ingesting its antidote, dimercaprol, can frustrate the manifestation of this disposition. An antidote need not always be a positive occurrence. For example, cows' milk has the causal power to nourish people, but those people who do not have the enzyme lactase are not nourished by cows' milk. In fact, drinking cows' milk causes diarrhoea in those who lack the enzyme. The point is a familiar one: the causal link between stimulus and response in a causal power or disposition is usually contingent on the presence or absence of many different factors.

The immediate relevance of antidotes is that their existence refutes a simple counterfactual analysis along the lines:

- (1) x has the disposition D to give response R to stimulus S if and only if, if x were subject to stimulus S , it would give response R .

For example, the arsenic is still poisonous, or is disposed to kill a person if ingested; and yet it is not true of a person who has ingested its antidote that if he were to ingest arsenic, he would die. Similarly, cows' milk is disposed to nourish a person when ingested; and yet it is false of a person who lacks the enzyme lactase that if he were to ingest cows' milk, he would be nourished. Bird considers a number of ways of revising this simple counterfactual analysis but concludes that they are all unsuccessful. His official line is that the concept of a disposition is conceptually primitive and is not to be reduced to or analysed in terms of any other concept.

It is puzzling, then, to find in Chapter 3 that Bird makes a crucial appeal to a 'necessary equivalence' between dispositions and counterfactual locutions to demonstrate that, on the dispositional essentialist view, laws of nature are metaphysically necessary (43). Bird develops his argument in two steps. The first step starts from the simplifying assumption that antidotes and finks to dispositions do not exist and uses the left-to-right entailment of the simple counterfactual analysis to establish that if anything were to have the disposition D and were subject to the stimulus S , it would give response R . From this he establishes that an exceptionless law relating D and S to R must obtain. The second step takes account of the existence of antidotes and finks but uses the following entailment between dispositional and counterfactual locutions:

- (2) *x* has disposition *D* to give *R* to stimulus *S* only if, if *x* were subjected to *S* and *finks and antidotes to the disposition are absent*, *x* would manifest *R*. (60, italics in the original)

From this Bird establishes that a *ceteris paribus* law relating *D* and *S* to *R* must obtain.

I do not question his argument here. Rather I am puzzled by his appeal to the necessary equivalences or entailments between dispositional and counterfactual locutions when so much of the previous chapter has been devoted to showing that dispositional or causal powers concepts cannot be understood in terms of counterfactual concepts. Perhaps one way to explain his argumentative move here is to see him as claiming that while there are close conceptual links between dispositional and counterfactual concepts, there are no conceptual reductions to be had. In particular, the entailment in (2) is not part of a conceptual reduction because the concepts of an antidote and a fink appearing on the right-hand side involve a hidden dispositional component. On this interpretation, the entailment can act as an illuminating conceptual constraint on the concept of a disposition without being part of a reductive elimination of the concept. It's not clear from the text whether this is the right interpretation of Bird's intentions. In any case, an argument is needed to justify the assumption that the concepts of an antidote and a fink are ineliminably dispositional in character.

Setting aside this issue of interpretation, how is the concept of a disposition or causal power to be understood? Is what Bird says on this score plausible? One issue that is of immediate significance here concerns *the bearers* of causal powers. Bird takes properties to be the ultimate bearers of the causal powers. In this respect, however, Bird diverges from commonsense and science, which attribute dispositions to objects, or to systems that are structured complexes of objects. This practice is supported by our tendencies to engage in essentialist reasoning about dispositions and causal powers. (The pervasive influence of essentialist reasoning is attested to by more than two decades of research in cognitive psychology.) Thus we are inclined to think that the causal powers that an object enjoys belong to it in virtue of the kind of object it is. The vase is fragile because it is a certain kind of object with a set of essential properties, typically microstructural in character. Arsenic is poisonous to humans because arsenic and humans belong to kinds with essential properties, which are hidden from view but essentially open to empirical investigation. These properties determine that the ingestion of arsenic by humans results in death. The intuition that causal dispositions hold in virtue of membership of kinds seems to lie behind the ways which we specify and classify causal powers. For example, we attribute to cows' milk the causal power of being nourishing-to-(normal)-humans but not the causal power of being nourishing-to-humans-who-do-not-have-lactase. The difference in the causal powers, we are inclined to think, resides in the difference in the essential properties implicitly understood to define the two groups of humans.

Essentialist thinking also explains another important feature of our thinking about dispositions. It is widely held that dispositions are an intrinsic matter. When some object or system possesses a disposition, it is in virtue of the intrinsic properties of the object or of the objects composing the system. Lewis expressed this idea in these terms: if two things (actual or merely possible) are exact

intrinsic duplicates (and if they are subject to the same laws of nature) then they are disposed alike. The attraction of this idea is explained by the essentialist view that a thing has its causal powers or dispositions in virtue of the kind of thing it is. To explain this idea we have to add the very plausible assumption that the essential properties that determine something's membership of a kind are its intrinsic properties. Essentialists tend to think that all essential properties are intrinsic properties but not the converse. For example, the essential properties of a vase might include its intrinsic microstructural properties but not all its intrinsic properties, such as its colour and shape, are essential to the kind that determines its response to being struck. So if we have two objects that share the same intrinsic properties (and are subject to the same laws of nature), then they will share the essential properties, belong to the same kinds and so have the same dispositions. Of course, from an essentialist point of view, it is the shared essentialist properties, and not the shared intrinsic properties, that are really crucial to the agreement on dispositional powers. Nonetheless, the intrinsicity intuition is respected.

Bird distances himself from the intrinsicity intuition (29–31). He cites some examples of Jennifer McKittrick, which purport to describe dispositions that are extrinsic in character. McKittrick cites the disposition of a key to open a door, which depends on the key matching the door's lock; the disposition of an object to weigh a certain amount on the earth, which depends on the earth's local gravitational field; and the vulnerability of a painting to attack by vandals, which depends on whether the painting is protected by plate glass. In all these cases, whether a thing has a causal power depends on whether something extrinsic to the thing exists. Nonetheless, the essentialist has, in my opinion, a ready answer to this kind of counterexample to the intrinsicity thesis. The essentialist can point out that ordinary discourse is somewhat loose in what it takes to be the bearer of the disposition. While it is convenient to isolate one object as the bearer of the disposition, it is rather a system consisting of several objects with their intrinsic properties that is the real bearer of the disposition. It is the system comprising the key-and-lock that has the power manifested in the key's unlocking the door. It is the system comprising the person and the earth with its local gravitational field that has the power to register a certain weight on a weighing machine. It is the painting with its protective glass that has the power of invulnerability. This answer is not implausible given that we have to take into account the causal properties of the whole system, rather than a single isolated constituent, in determining how a system's dispositions are manifested. If this is correct, McKittrick's examples pose no threat to the intrinsicity intuition since the causal power of the relevant systems clearly depends on the intrinsic properties of the constituents that make up the system. The key can open the lock in virtue of the intrinsic properties of both the key and the lock. The painting is invulnerable to attack because of the intrinsic properties of both the painting and the glass plate protecting it.

Besides providing an explanation of the intrinsicity thesis, the essentialist view that causal powers derive from membership in kinds also provides an explanation of the circumstances in which causal powers can be frustrated in their characteristic manifestations. If something has a causal power to give response *R* to stimulus *S* in virtue of the essential properties determining its membership in a kind, then if it fails to give this response when it undergoes the stimulus, it cannot be due to its essential properties: it must be due to its non-essential properties, among which are included its extrinsic properties. If something's essential properties are intrinsic to a thing, it

follows that its extrinsic properties are not among its essential properties. How to distinguish intrinsic from extrinsic properties is a notoriously thorny philosophical problem. But roughly speaking, an object's extrinsic properties imply the existence of something distinct from the object. With this understanding, we can see antidotes to causal powers as always involving a non-essential property of the system in question, typically an extrinsic property of the system. For example, ingesting dimercaprol is an antidote to the poison arsenic but plausibly this is an extrinsic property of the person who has taken the poison. A similar diagnosis seems to apply to other examples that Bird gives of antidotes (27–40). For instance, a sorcerer protects a fragile glass by administering shock waves that cancel out the waves it undergoes when it is struck. This is a case in which the glass is fragile but does not break when struck. But again it would appear that the sorcerer and his remedial action on the struck glass are extrinsic to it. Or take another example. A nuclear pile is disposed to melt down when it is above a critical mass. But the pile is attached to a fail-safe mechanism consisting of a boron rod that penetrates the nuclear pile and absorbs the radiation preventing the meltdown. The nuclear pile has the disposition to melt down but does not do so when the boron rods are inserted. Here again it seems that a plausible diagnosis is that the antidote to the disposition – the insertion of the boron rods – involves the presence of something extrinsic to the system that has the disposition.

These reflections about the essentialist nature of dispositions or causal powers suggest that it is possible after all to frame some kind of explication of the concept of a disposition. I do not claim that the following is a reductive definition, merely that it captures important features of the concept and illuminates the concept by allowing us to see how it is connected to other less (in the context) problematic concepts:

- (3) A system x of kind K is disposed to give response R to stimulus S if and only if (i) it has the properties essential to the kind K ; and (ii) if x were to retain these properties while subject to stimulus S , then these properties and S would cause the system, in the absence of its extrinsic properties, to give response R .

The account is meant to capture the idea that a system has its dispositions in virtue of its membership in a kind and the idea that the essential properties of the kind are the basic determinants of the process by which the disposition's stimulus produces its response. In the account, the bulk of the explanatory work is done by the reference to natural kinds and essential properties rather than by the use of the counterfactual concept. When dispositions have the features accorded them by this account, they are clearly useful things for us to posit for the purposes of discerning commonalities in diverse situations. For example, a system with a causal power has, on the account, an enduring potential to give a response to a stimulus while it possesses certain essential properties. The account implies that a system with a causal power will manifest its characteristic response to a stimulus so long as no object extrinsic to the system interferes with it. The account implies that causal powers are widely shared since it says that any object belonging to the same kind will possess the same causal powers.

Finally, the explication appears to handle the antidote counterexamples to the simple counterfactual analysis. As we saw above, a person who has been given arsenic is indeed disposed to die because he has the essential properties that will ensure death in the absence of an antidote extrinsic to the system. Again the vase is disposed to break when dropped because it has the intrinsic properties that will combine with

dropping to cause breaking in the absence of an extrinsic sorcerer. And so on for other counterexamples.

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The other type of counterexample to counterfactual analyses that Bird cites involves finks. A finkish disposition is one in which the stimulus causes the disposition to disappear before its manifestation occurs. (This characterization differs slightly from Bird's (25) because he tries to accommodate acausal dispositions in which the disposition disappears because of some factor that is independent of the stimulus. I believe that such examples do exist but they are not counterexamples to counterfactual analyses.) An example due to Charlie Martin goes like this: a live wire (that is, one that can conduct electricity) is connected to a device that makes the wire go dead whenever it is connected to a source of electricity. Lewis used a different example: a sorcerer who is intent on protecting a fragile glass casts a spell that changes the microstructure of the glass just after it is struck but before it has a chance to break. In these cases the stimulus causes the disposition, or at least its causal basis, to disappear with the result that its manifestation does not occur. Before the stimulus occurs, the objects have the dispositions but it's not true of them at that time that they would manifest their characteristic response if the stimulus were to occur. An antidote differs from a fink because the antidote is something occurring *independently of the stimulus* that frustrates the manifestation of the disposition.

A virtue of the explication tentatively proposed here is that it handles finks just as well as antidotes. The explication applies smoothly to the examples of finks above. Let us suppose, as seems reasonable, that the live wire has certain essential properties that allow it to conduct electricity – including the presence of a cloud of free electrons – and let us also suppose that the finking device is extrinsic to this system. Then we can see that if the wire were to retain these essential properties when connected to electricity, then these properties and its connection to the electricity would, in the absence of the finking device, cause the wire to conduct electricity. Similarly, suppose that the glass has certain microstructural features that are essential to its being a member of the relevant kind and that the sorcerer is extrinsic to this system. Then once more we see that the glass counts as fragile according to the explication above. For it is true of the glass before it is struck that it has essential microstructural features such that if it were to retain these properties while it was struck, these properties would combine with its being struck to cause the glass to break in the absence of the sorcerer. (Strictly speaking, these counterfactuals would be true even without the addition of the clause 'in the absence of the extrinsic fink'.)

The feature of the explication that is relevant to solving the problem of finks is the counterfactual's antecedent clause that stipulates that the object must retain its essential properties at the same time as it is subject to the stimulus. Of course, finks are defined by the condition that the stimulus condition causes the disposition, and presumably the essential properties on which it depends, to disappear. Nonetheless, there is no contradiction in saying both 'If *S* were to occur, a system's essential properties would disappear and such-and-such would not occur' and 'If *S* were to occur at the time as the system retained its essential properties, such-and-such would occur'. This feature of the explication is simply taken from the counterfactual analysis Lewis

formulated to deal with finks. Lewis's analysis, simplified in certain inessential respects, goes like this:

- (4) x is disposed to give response R to stimulus S if and only if, there is some intrinsic property B such that if x were to retain B while undergoing stimulus S , then S and x 's having B would jointly cause x to give response R .

Besides the omission of reference to kinds, Lewis's analysis differs from the proposed explication in that it anchors dispositions in *intrinsic* properties as opposed to *essential* properties. This may seem to be a negligible difference, given that essential properties are invariably intrinsic properties. However, not all intrinsic properties are essential properties and so there is the potential for the two accounts to diverge in their implications.

Indeed, they do diverge in their implications and this becomes important when we consider a certain kind of counterexample to Lewis's analysis first noticed by Stephan Leuenberger (in a private communication). Suppose that a very reliable and accurate thermometer has a low mercury column at a certain time. This is an intrinsic property of the thermometer. It's also true of the thermometer that if it were to retain this property at the same as being exposed to high temperature, the thermometer would give a misreading of the temperature. Yet it is implausible to say that the thermometer is disposed to give a misreading when it's exposed to a high temperature. Or consider another example. Suppose a person has a bacterial infection, which is plausibly an intrinsic property of the person. If the person were to retain the bacterial infection while taking a course of antibiotics, he would experience a high fever. But it seems wrong to say that the person is disposed to have a fever on taking a course of antibiotics.

By contrast, these counterexamples do not pose a problem for the proposed explication since the cited intrinsic properties are not essential properties whose retention is specified in the counterfactual construction of the explication. In both examples the proposed explication gives the right results. The thermometer has certain essential properties – and these do not include its having an initially low mercury column – such that if it were to retain these properties in a high temperature environment, it would give a correct reading. And the infected person has certain essential properties – and these do not include his bacterial infection – such that if he were to retain them while taking a course of antibiotic drugs, he would not experience a fever. This is exactly what we would expect if essentialism about dispositions is correct: if dispositions exist in virtue of the essential properties of a kind, then it is plausible to think that while the system retains its essential properties it would keep its dispositions.

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If these reflections have any force, then it would appear that Bird's view that the concept of a disposition or causal power is primitive, or at least cannot be explained in terms of other concepts, is not tenable. How these reflections bear on Bird's dispositional essentialism more generally is not entirely clear to me, since he proposes dispositional essentialism as a metaphysical doctrine about the nature of the world, not about the nature of our concepts. Nonetheless, the explication of a causal power proposed here, if read as carrying implications about ontological as well as conceptual

structure, does suggest that Bird has erred in making certain foundational choices in his metaphysics. First, the explication suggests that it is incorrect to construe natural properties as potencies or bare causal powers, since they are not the right kind of thing to have causal powers: objects or systems of objects, rather than properties, are the bearers of enduring causal powers. Secondly, the explication implies that causal powers supervene on facts about counterfactuals and causal relations. If anything like this is correct, then Bird's goal of defending a supervenience thesis in the converse direction, with counterfactual and causal relations supervening on potencies, is misguided. Thirdly, the explication is committed to an essentialist view of causal powers, anchoring them in natural kinds and essential properties. If this is correct, then Bird's choice of taking natural properties and potencies to be ontologically prior to natural kinds rather than the other-way-round is misguided. In this respect, I am inclined to side with essentialists like Ellis and Lowe. These brief reflections cannot by themselves bear much argumentative weight. But I hope they will contribute in a small way to what will, I'm sure, be a long ongoing debate. They are not meant to detract from the significant achievement that Bird's book represents. I recommend that all who want to engage with dispositional essentialism treat this as one of its indispensable texts.

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