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EVOLVED POWERS, ARTEFACT POWERS, AND
DISPOSITIONAL EXPLANATIONS

Alexander Bird (2018) puts forward a modest version of anti-Humeanism about the non-fundamental, by providing an argument for the existence of a certain select class of non-fundamental but sparse dispositions: those that have an evolutionary function. I argue that his argument over-generates, so much so that the sparse-abundant distinction, and with it the tenet of his anti-Humean view, becomes obsolete. I suggest an alternative way of understanding anti-Humeanism in the non-fundamental realm, one which is not concerned with the existence of sparse properties but with explanatory relations.

I

Introduction. According to the thesis of Humean Supervenience, the world is ‘a vast mosaic of local matters of particular fact, just one little thing and then another’ (Lewis 1986b, p. ix). Hume’s ‘loose and separate’ world has gone metaphysical: things just happen, but nothing that happens is truly connected to anything else; anything can co-occur with anything. Humeanism was orthodoxy for several decades in analytic metaphysics, but more recently there has been a change of climate. Alexander Bird (2007) has been a leading voice in that change, arguing that the fundamental properties are not ‘qualities’ but essentially dispositional, and proposing a view of our world as essentially connected: which properties are instantiated at which points has implications for the instantiation of properties at other points; the laws of nature are embedded in the properties themselves, and through them in the propertied particulars.

Bird, in many ways, is a modest anti-Humean. He seems to accept a principle of parsimony for powers: do not accept more powers than is necessary! In other words, unless we have good reasons to believe that a property is essentially dispositional, we ought to refrain from

claiming that it is. Other anti-Humeans have been less modest. Powers, that is, essentially dispositional properties, on some views, are everywhere; they can be called upon to explain such different phenomena as laws, causation (Mumford and Anjum 2011), modality (Vetter 2015), agency and intentionality (Groff 2013, Ellis 2013). Bird (2018) admonishes anti-Humeans to be more modest, thus continuing the thread of Bird 2016. But in Bird 2018, he has something positive to offer: there *are* reasons for believing in powers beyond the fundamental realm. They do not quite provide the plenitude of powers that some less modest anti-Humeans have appealed to, but they are an important start.

Powers, according to Bird, are sparse, essentially dispositional properties. I will look at the relevant conception of sparseness in §II. An essentially dispositional property, for Bird, is one that is characterized, in every possible world, by a particular conditional. I disagree with Bird about the characterization of dispositions (see Vetter 2012, 2014), but I will not belabour this point here. Instead, I want to argue (in §III) that Bird's argument, modest as it is intended to be, supports a rather immodest version of anti-Humeanism: if Bird is right that there are some non-fundamental powers (namely, the evolved powers), then it turns out there are many, many more. §IV suggests that the argument gives us reason to construe anti-Humeanism in a different way, focusing not on the existence of properties (and in particular, of powers) but on explanatory relations.

II

Sparse Properties. There are different ways of thinking about the natural or 'sparse' properties. Before I take a closer look at Bird's argument, let me note three decision points and which decision I take Bird to have made on each.

First, as is well known, we can think of naturalness as absolute or comparative. Absolute naturalness provides a partition of (putative) properties into two (hopefully clear-cut) classes: the natural and the non-natural, or the sparse and the abundant ones. Comparative naturalness provides an ordering on properties according to the relation of *being more natural than*. We can define either one of those in terms of the other. David Lewis, for instance, took there to be an

elite class of fundamental, ‘perfectly natural’ properties, and defined the comparative ordering in terms of a property’s distance from them (measured by the length of its definition in terms of perfectly natural properties; see Lewis 1986a, p. 61). Alternatively, we can take the comparative notion to be primary and define an absolute notion in terms of it, much as fundamentality is now often defined in terms of grounding: roughly, a perfectly natural property is one such that no property is more natural than it (see Taylor 1993). The perfectly natural properties on this view are the fundamental properties.

Bird’s argument clearly uses the absolute notion of naturalness or sparseness. His concern, after all, is with which properties we are to admit into our ontology, that is, with existence: existence does not come in degrees. Note, however, that the absolute notions I have just mentioned—of perfectly natural or fundamental properties—are unsuited for his purposes: Bird is, after all, concerned with *non-fundamental* sparse properties, so he will hardly want to use a conception of sparse properties that rules out the non-fundamental from the start.

This brings me to my *second* decision point, which I take from Schaffer (2004). Schaffer distinguishes between the ‘scientific conception’ of sparse properties, on which we draw sparse properties from all levels of nature (and thus from total science), and the ‘fundamental conception’, on which we draw sparse properties only from the fundamental level (and thus, presumably, from a select part of physics). Given Bird’s concern with *non-fundamental* sparse properties, it is clear that he here¹ adopts the scientific conception (which, incidentally, is also the position of Schaffer 2004).

A *third* question concerns the relation between sparseness and its main indicator, the role played by a property in true causal/scientific explanations. (Note that the notion of ‘explanation’ here is intended to be worldly, not epistemic. My question concerns the relation between sparseness and a property’s contribution to the causal order of our world; not between sparseness and our thought.) Is playing such a role constitutive of, or is it merely indicative of, a property’s being sparse? On one conception, call it the *explanatory conception* of sparseness, a property earns its status of being sparse by playing a causal-explanatory role; if it did not play such a role, it would not be a sparse property. On such a conception, the distinction between

¹ In contrast to Bird 2007, p. 14.

sparse and abundant properties would be just a distinction between different types of property, those that do and those that do not play a particular role in our world. Bird rejects such a conception, and adopts instead an *ontic conception* of sparseness, where the distinction between sparse and abundant properties is an ontological distinction, that is, one which concerns existence (2018, p. 248). One way of cashing out this ontological distinction is to say that only the sparse properties exist. Another way of cashing it out is to say that only the sparse properties are universals (a view adopted in Bird 2007, p. 12), or classes of perfectly resembling tropes, or some such, while abundant properties are at best sets of possible individuals. Whichever version we adopt, a property's being sparse will not consist in its playing an explanatory role in our world. A property's causal-explanatory role, on this second conception, is good evidence for its being sparse, because only the sparse properties are available to play an explanatory role in the first place. But a property's being sparse cannot depend on its playing such a role, as it would on the explanatory conception.²

The ontic conception will play an important part in my argument in what follows. I will generally gloss it as the view that sparseness is a matter of existence, but this need not be read as denying that there are abundant properties. Rather, whether *F*-ness is sparse is a matter of whether there exists a universal (or whatever else the relevant ontological category is) of being *F*.

Our question then becomes: are there any non-fundamental, sparse properties—in the absolute, scientific, and ontic sense of 'sparse'—that are essentially dispositional? In the next section (which takes up most of the paper), I will take a closer look at Bird's argument for an affirmative answer, and I will argue that the argument generalizes far beyond the cases that Bird cautiously considers. I will suggest that this result stems from a combination of precisely the views of sparse properties that I have outlined here, and in particular the combination of a scientific and ontic conception of sparseness.

² One might be tempted to say that on the ontic conception, playing an explanatory role is merely a sufficient condition for sparseness, while on the explanatory conception it is both sufficient and necessary. I will appeal, below, to the idea that an explanatory role is sufficient for sparseness, but we should not forget that there are other conditions in the literature. See Dorr and Hawthorne (2013) for an overview and extensive discussion.

III

3.1. *The argument.* A non-fundamental power is a property that is (i) non-fundamental, that is, supervenient on or grounded in something else; (ii) sparse; and (iii) essentially dispositional. Bird argues that these conditions are met by dispositions that are ‘evolved functional properties’, such as the capacity to see. Being biological, they are (i) non-fundamental. The central role that they play, as both explanans and explanandum in biology, is good evidence that they are (ii) sparse. Finally, since they are multiply realizable and play their explanatory role independently of their causal base, we have good reason to believe that the property in question really is the disposition and not its underlying causal base, so it is (iii) essentially dispositional.

Note that the argument is intended to apply only to a very select class of dispositional properties: those that are *functional* in the sense of being such that their bearers exist *because* they have, or their ancestors had, the disposition in question.³ The argument is not meant to apply to such ordinary dispositions as fragility, and Bird defends (ii) and (iii) precisely by pointing out the differences in the explanatory roles that these dispositions play. It is obvious that functional dispositions explain a great many facts of biology: sightedness, for instance, explains ‘how animals find food, seek and attract a mate, escape from a predator, and so on’ (2018, p. 256). But what is crucial to the argument is that functional dispositions play an explanatory role that is not played by their various categorical base properties: thus, for instance, we get a *unified* explanation for the instantiation of sightedness by different kinds of animals, via different kinds of causal basis, by referring to the fact that sightedness enables creatures to gain information through light, and the fact that these different animals all live in ecological niches where that is an advantage. With fragility, such explanations are not available: different kinds of objects are fragile simply because they instantiate one or another causal basis for fragility.⁴

³ This is a rough characterization only, but giving a full account of function would go beyond the scope of this paper. Beyond the rough characterization, Bird cites some proposals for defining biological function, but it seems to me that a general account of function should leave room for designed function in addition to evolved function—as Bird does (2018, p. 271), and as I will do below.

⁴ Could the argument be generalized beyond strictly functional dispositions? I suspect that it could. While it is plausible that only functional dispositions afford unified answers to questions like the one we have considered, other dispositions can play all kinds of explanatory roles in a similarly unified way: water-solubility explains why we put different substances into tea and coffee, fragility explains why we handle objects with care, and so on. But

I take the argument to be convincing, and I accept its conclusion. What I want to point out is that it generalizes far beyond the cases that Bird discusses, and thus vindicates his opponent, the immodest anti-Humean, after all. I will proceed in three steps. First (§3.2), I will consider the case of biological functions and argue that Bird's argument gives us reason to accept not just the actual but any possibly functional dispositional property as a power. Second (§3.3), I will apply the same argument to the social realm and argue that it gives us reason to accept pretty much every disposition as a power. §3.4 will consider the assumptions that have led to this conclusion. The result is that, given Bird's rather modest argument, we are driven to accept a plenitude of powers after all.

3.2. *Evolution and Contingency.* Evolution is a highly contingent and variable process. Given what we know of it, it is plausible that many properties that could have been selected for ended up not being selected for; properties that have in fact been selected for might not have been, and may in fact have been around for a while before they were selected for; and properties that were selected for in one species may be mere by-products or vestigial features in another.

This is the basis for my argument in this section, which takes the following general form. Whether or not a disposition is functional, and hence whether it plays the right kind of explanatory role, is contingent and variable. But property existence, and thus sparseness, is generally assumed to be immutable and necessary. This is not a problem: after all, on the ontic conception of sparseness, playing an explanatory role can only be a sufficient, not a necessary, condition for a property's being sparse. But it does push us to accept a sufficient condition for sparseness that eliminates contingency and variability: any property that *possibly, at some time, in some species* plays the right kind of explanatory role (that is, is functional) must be counted as a sparse property.

Let us start with a case of variation across species: the ability to wiggle one's ears (by which I mean, to move one's ears at will). This ability is possessed by cats as well as by some humans; suppose that I am one of the latter. In cats, that ability plausibly serves an evolutionary function (it helps the cat locate its prey); in humans, it does

we need not go into this issue, for in this paper I will follow Bird in restricting myself to the kinds of explanations offered by functional dispositions.

not.⁵ Now, in virtue of its explanatory role with respect to cats, we must count the ability to wiggle one's ears as a sparse property. So, since the ability to wiggle one's ears is a sparse property, it will be sparse even where it does not play an explanatory role, for example, in me. If we give an inventory of my sparse properties, then my ability to wiggle my ears will have to be in it. (What if it weren't? Then cats would have a sparse property that I lack, even though we are alike in the relevant respect. Thus we would lose one of the main functions that sparse properties play: accounting for similarity between objects.)

Or take, next, an example of variation across time: the ability to fly. This ability, on our current understanding of evolution, must have developed *first* in order to *then* be selected for (Bird 2018, p. 268). So when an animal is first born with the ability to fly, that ability does not yet have a function, an explanatory role. It acquires that role only over time. But, again assuming the ontic conception of sparse properties, we hardly want to say that the property of being able to fly *became* sparse, that is, came into existence, only once the selectional process had reached a certain stage. It was there to be selected for from the start. (What if it wasn't? Then animals would acquire a new sparse, intrinsic property once the selection process had reached a certain stage, even though they would remain unchanged intrinsically. Thus we would lose one of the main functions that sparse properties play: accounting for the difference between an object's changing and its remaining unchanged.)

So far, we have looked only at variations within actuality. The upshot of the two cases is that a property can be sparse even where (as in the first example) and when (as in the second) it does not play an explanatory role, as long as it plays an explanatory role somewhere and at some time. But what about modality?

Consider again our two cases of variation in actuality. First, given the functional role that the ability to wiggle one's ears plays in cats, it is a sparse property even in me. But an inventory of my sparse (and intrinsic!) properties can hardly depend on the evolutionary

⁵ Other examples may include: the disposition for one's hair to bristle when fearful; the disposition to bare one's teeth when angry; the disposition to develop sickle-cell anemia, which may have an evolutionary function in regions where malaria is present, but exists also in other regions; and in general any vestigial traits that are dispositional.

history of cats. So we can conclude that if there had been no cats but I had still been able to wiggle my ears, that ability would still have been a sparse property. Second, given the functional role that the ability to fly has played later in evolutionary history, it was sparse even prior to playing that role. But an inventory of an animal's sparse (intrinsic!) properties can hardly depend on the future vagaries of evolution. So we can conclude that if the ability to fly had not been selected for but some animals had still been able to fly, the ability to fly would still have been a sparse property. Now go back in evolutionary history and consider every juncture where a property could have been, but was not in fact, selected for. With every such property, we are in exactly the situation that we have just imagined vis-à-vis the ability to wiggle one's ears and the ability to fly. Every such property must, therefore, by parity of reasoning, count as sparse. And so we reach the conclusion that any property which could have been, at some time, in some species, selected for is a sparse property, at least if it is instantiated.⁶

How far does this line of reasoning expand the sparse properties? That depends on the vagaries of evolutionary history, which I am in no position to spell out. So it is possible that my argument gives us only a few powers in addition to those that Bird has envisaged. But it gives us something else: a template for an argument I will use to expand the realm of sparse dispositions much further in the next section.

⁶ There may be an even more straightforward route to my conclusion. It is generally assumed that the existence of properties, unlike that of concrete particulars, is a matter of necessity: if there exists a property of being *F*, then it is necessary that there exists a property of being *F*. But if that principle is itself necessarily true, then we can derive that the possible existence of a property entails its actual existence, given a standardly assumed *S*₅ modal logic (or even the weaker Brouwerian system with the axiom $p \rightarrow \Box \Diamond p$), as follows:

Let *p* stand for the proposition that a given property exists. Then $\Box(p \rightarrow \Box p)$ entails, by contraposition and axiom *K*, $\Box \Diamond \neg p \rightarrow \neg \Diamond p$. But given *S*₅ (or the Brouwerian system), we have $\neg p \rightarrow \Box \Diamond \neg p$, and so by the transitivity of \rightarrow , we get $\neg p \rightarrow \neg \Diamond p$, which contraposes to $\Diamond p \rightarrow p$.

I prefer the argument I have given in the text, although its result is a little more limited (it applies only to historical, not metaphysical possibility), for two reasons: first, it does not have to rely on potentially controversial metaphysical premisses such as the necessarily necessary existence of properties or *S*₅, but instead on the—I hope uncontroversial—principle that an inventory of an object's intrinsic sparse properties at a time cannot depend on facts about other objects or other times. Second, it is less plausibly applied to the parallel case I will consider in the next section.

3.3. *Artefacts and Social Science.* At the end of his paper, Bird notes that

a similar point will apply to properties of artefacts. Their existence will be a product of their dispositional features, not of the details of the various possible realizers. So are artefactual properties also powers? My argument would suggest that they are—assuming that they are ontic. Is that a problem? ... Perhaps the most problematic aspect would be the proliferation of such properties—there would seem to be a lot of them. Maybe that's a bullet that can be bitten without too much discomfort. (Bird 2018, p. 271)

In this section, I would like to explore this suggestion further. Roughly, 'to say that some *X* has a certain disposition as a function is to say that *X* is present *because* it has that disposition' (Bird 2018, p. 267). Now, computers have the disposition to perform certain complex operations when given the proper input, and certainly they are present because they have such a disposition.⁷ Likewise (*mutatis mutandis*) for cars and bikes and their disposition to transport people, dishwashers and toasters and their capacity to wash the dishes and toast bread, chairs and windows and their dispositions to support the weight of people sitting on them or to block wind and cold, clothes and their dispositions to keep the human body warm and shield it from sight, and musical instruments and their disposition to produce certain kinds of sounds. In all of these cases we are dealing with dispositions that are functional in the relevant sense: the instances of the disposition are present (in part) precisely because they have the disposition.

Are these properties—the disposition to perform such-and-such operations when given the proper input, the disposition to support the weight of an adult human, etc.—sparse, and essentially dispositional?

Well: do they play a role in scientific explanations? The answer is that some do and some don't. Where they do, the relevant sciences—those that relate to these dispositions as evolutionary biology relates to functional properties—are social sciences, including history. Social scientists may study why computers came to be disposed as they are in fact disposed; why houses are built with

⁷ I am not making any claims about the essence of computers (and other artefacts in what follows), but merely claiming that they were built with the purpose of fulfilling a certain function.

windows of such-and-such a kind; when, how, and why chairs came to be produced.⁸ Should the scientific conception of sparse properties, in taking into account total science, include the social sciences? I say it should. After all, societies are but part of nature herself; they are the way that some animals, most conspicuously (but not exclusively) ourselves, live. Even evolutionary biology can hardly do without appeal to social entities, be they communities or artefacts, such as tools. The social sciences, including history, offer genuine explanations on how such social entities develop and why.

There will still be a great deal of contingency: there may be a sociology or history of windows or computers but not of toasters because the former bear greater significance, as a causal factor or a symptom, for the development of the society in question, or because the scientific community simply happens to be more interested in one than the other. But these differences are hardly differences between the existence and non-existence of (sparse) properties. (Funding decisions affect what scientists work on; they cannot affect which properties there are!) Rather than looking to actual (social) science, we should consider whether certain properties of artefacts are of the kind to *afford* the characteristic kind of explanation that we have seen given for properties of organisms in evolutionary biology.

And the answer appears to be that they do. A chair's disposition to support a sitting human explains why there are chairs; there are chairs, at least in part, because they have the disposition to support sitting adults. A computer's disposition to perform certain complex calculations explains why the computer has been built. An artwork has the disposition to evoke certain reactions (of admiration, of alienation, and so on, depending on the kind of artwork) in certain kinds of observers, and typically artworks are produced precisely for such reactions: the artwork exists because it has those dispositions.

Are those properties, which play roles in potentially social-scientific explanations, powers (sparse and essentially dispositional properties)? By analogy with Bird's reasoning about biology, it looks as though they are. The dispositions that we have considered each allow for a multitude of different causal bases. But as in the case of

⁸ There is, of course, computer science for computers, architecture for buildings, and various branches of engineering for other artefacts. But these are concerned, I take it, with how to produce the right kind of causal basis for certain dispositions, not with the kinds of explanations that interest us here.

sight, and unlike in the case of fragility, we can give a uniform explanation of why there are instances of these dispositions: there are clothes with the disposition to shield the human body from cold because humans have designed them for this specific purpose to survive in cold temperatures. There are artworks with the disposition to inspire awe in human observers because artists have created them with that specific purpose, for instance, in religious settings. And so forth. All of these explanations can abstract entirely from the particular causal basis of the disposition (clothes may be made of felt or synthetics, artworks may be painted, sculpted, or performed by an orchestra). In all of these cases, then, the appeal to the dispositional properties cannot be replaced by appeals to their realizers. If Bird's argument worked in the case of evolved powers, then, it works in the case of the artefactual powers.

So far, I have merely vindicated a suggestion made by Bird. He was certainly right that the suggestion leads to a significant proliferation of powers. But we can now combine the argument of this section with that of the previous one to proliferate them even further.

The production of artefacts is at least as contingent and variable as the processes of evolution. In artefacts, as in organisms, we have non-functional properties that might have become functional; we have functional properties that might easily not have been functional, and that were instantiated prior to being functional; and properties that are functional in some kinds of artefacts but not in others. We can thus apply the same kinds of argument to them that we did to evolved powers, and argue that any disposition which could have been, at some time, in some kind of object, sparse is actually sparse (at least whenever it is instantiated).

Take, for example, the disposition to evoke a feeling of admiration in ordinary human observers (of a certain cultural background). Some artworks are specifically produced to have that disposition; they exist because they have this disposition. Other artefacts were produced with different aims—say, to placate the gods—but share the same disposition. Even some natural phenomena—perhaps Kant's 'starry sky above us' is a case in point—share it. If the disposition is functional in the one case, it is a sparse property; hence it counts as a sparse property even of the second class of artefacts and of natural phenomena. (What if it didn't? Then one artwork would have a sparse property that the other lacks, even though they are alike in the relevant respect. Thus we would lose one of the main

functions that sparse properties play: accounting for similarity between objects.)

Or take the disposition to support a sitting adult human. This disposition was instantiated before the first chair was made: a rock of the right shape and size shares it, for instance. When humans first began to manufacture objects with the functional disposition to support a sitting adult human, the rock did not acquire any new sparse properties. So its disposition to support a sitting adult human must have been sparse all along. (What if it wasn't? Then the rock would acquire a new sparse property once humans started to manufacture objects to sit on, even though it remained unchanged. Thus we would lose one of the main functions that sparse properties play: accounting for the difference between an object's changing and its remaining unchanged.)

What about modality? Given the functional role that the disposition to support a sitting human plays in chairs, it is a sparse property even in a rock. But an inventory of the rock's sparse properties can hardly depend on the design history of chairs.⁹ Moreover, given the functional role that the disposition plays now, it must have been a sparse property of the rock's even before anyone invented a chair. But an inventory of the rock's sparse properties, back then, could not have depended on the future designs of human beings. So we can conclude that if nothing had ever been manufactured for its disposition to support a sitting human, the rock's disposition would still have been sparse, and likewise in other cases, such as the starry sky's disposition to evoke awe in human observers. Now go back in history and consider every juncture where artefacts could have been, but were not in fact, designed to have a particular property—where, in other words, a particular property could have become, but was not in fact, functional. With every such property, we are in exactly the same situation that we have imagined vis-à-vis the disposition to support a sitting human. Every such property must, therefore, by parity of reasoning count as sparse. And so again we reach the conclusion that each property that could have been, at some time and in some species, the object of intentional design is in fact a sparse property, at least if it is actually instantiated.

⁹ Unlike the evolutionary case in the previous section, this time it is less clear that the sparse property is an intrinsic one: depending on how we frame it, it may be extrinsic by virtue of depending on the shape and weight of typical human beings. But even so, it will not depend on whether or not anyone ever designed a chair.

The conclusion is the same as in the biological case, but this time it is easier to see how far its scope extends. Which dispositional properties could have been the object of intentional design? I say, any property that we have some chance of recognizing and producing with some degree of reliability.

Take Bird's paradigm example of a dispositional property that is not a power: fragility. Suppose I won €50 million in a lottery. Being a metaphysician of dispositions, and somewhat partial to fragility, I decide to make sure that fragility is a sparse property. I use my money to collect and publicly display all the fragile objects that I can get hold of; I pay ridiculously high prices for them. Soon it will be the case that fragile objects are manufactured specifically for their fragility: they exist *because* they are fragile. Fragility will afford the kinds of explanations we have given in other cases, and lo and behold! it will qualify as a sparse property. Now, I do not play in the lottery, and I think there are much better causes on which to spend €50 million. Nevertheless, the fact that I *could* in principle do this shows that fragility must have been a sparse property all along, by the argument developed in this section.

3.4. *Diagnosis.* I have turned Bird's rather cautious argument for the existence of evolved powers into an argument that provides a plenitude of powers, from fragility to the disposition to evoke awe in human observers.

The source of this explosion of properties seems to me to lie with the conceptions of sparse properties that we have adopted. With Bird, we adopted the scientific conception, which draws sparse properties from all the levels of nature and all the sciences. The scientific conception was needed to make our question, 'Are there non-fundamental powers?', an open question in the first place. Further, we adopted what I have called the ontic conception, according to which sparseness is a matter of the existence of properties. This conception is clearly shared by Bird. It is also this conception that makes our question metaphysically interesting: we are looking for the properties that figure in our ontology, the properties that make up reality.

But as we have seen, the two conceptions, together with some natural assumptions on the metaphysics of properties, produce a *prima facie* tension.

The scientific conception has us accept, for the reasons given by Bird, functional properties of biology, sociology and psychology as sparse. But it seems clear that the status of *being a functional property of biology, sociology or psychology* is one that a property has or lacks contingently: it depends on the role that the property has played in the actual development of the world. It is also a status that a property may gain or lose: a property becomes functional once it starts playing a certain role.

The ontic conception makes sparseness a matter of existence, that is, of whether or not there exists something of the right ontological category (for instance, a universal). But unlike the existence of particulars, the existence of properties (of the right ontological category) is standardly assumed to be an eternal and necessary matter.¹⁰ I have relied on a weaker premiss: that the sparseness of a property does not vary across times or (historically) possible worlds where it is instantiated. If it did, then objects might acquire or lose sparse properties without undergoing any change in the relevant respect, and objects might fail to share sparse properties despite resembling each other in the relevant respects.¹¹

I have resolved this *prima facie* tension, in effect, by stressing that the scientific conception gives a sufficient, not a necessary, condition on sparseness. All the properties that are actually functional are sparse, but not all sparse properties are actually functional. Indeed, I have argued that every *potentially* functional property is sparse. (I have not argued the converse: that every sparse property is potentially functional.) This seems to me to go well with the ontic conception: sparse properties are those that are *suited* to play the role of being functional. However, being suited to play a role is very different from actually playing that role. My resolution of the *prima facie* tension has certainly exploded the class of sparse properties beyond recognition.

My argument, in fact, is not limited to dispositions or powers at all: it shows that if we combine the ontic and scientific conceptions (and hold on to certain assumptions about property existence), then the sparse properties will no longer be as elite a class as we may have

¹⁰ See footnote 6 above. Dorr and Hawthorne (2013) even count non-contingency among the features that figure in the 'job description' of sparse properties.

¹¹ This line of argument is convincing only given the ontic conception: an object might easily come to have a property that plays a certain explanatory role in the world without itself undergoing any change.

imagined. My argument did not rely on anything specific to dispositions—except, perhaps, that biological functions are often dispositions. But the considerations of §§3.2–3.3 could, on the face of it, just as well be applied to such seemingly categorical properties as being striped, being large or small, or having such-and-such shape or parts. The argument of §3.3 seems applicable even to such a suspect property as the property of being grue: we need only imagine a lottery-winning philosopher who wants to show once and for all that grueness is a respectable property, and proceeds as our disposition-loving metaphysician did in the earlier example.

The upshot of my argument, thus, is a Pyrrhic victory for the dispositionalist. Yes, many non-fundamental dispositions are sparse, and hence earn the rank of ‘powers’; but if sparseness is a distinction that is shared with the property of being grue, then it is not a distinction worth earning. In effect, we have abandoned the sparse/abundant distinction, and thus our result is one that even the Humean could accept: of course there are dispositions, and lots of them! It’s just that they are not fundamental, or perfectly natural, or ‘sparse’ in some more restrictive sense of the term (tied, presumably, to the fundamental conception of sparseness). My extension of Bird’s argument has shown it to succumb, ultimately, to the same flaw that he attributed to previous arguments for non-fundamental powers: the flaw of being acceptable for Humeans, and thus failing to establish a genuine alternative to a Humean metaphysics.

One philosopher’s *modus ponens*, of course, is another’s *modus tollens*. You might take my argument to show that something was wrong with Bird’s argument to start with. Or you might reject the conception of sparse properties that I have relied on, a combination of the ontic and scientific conception; but to do so would be to reject Bird’s very question. Or you might reject one or the other side in my *prima facie* tension: the contingency of which properties are functional, either by evolution or by design; or the non-contingency of property existence. To do the former would be to adopt an extremely strong version of necessitism, quite unlike the form of necessitism that dispositional essentialists often embrace: it would claim the non-contingency, not of the basic parameters of our universe, but of the concrete unfolding of events in evolutionary and human history. To do the latter would be to develop a revisionary theory of properties, and to give up much of the work that sparse properties were introduced to perform. What are we to do?

I recommend accepting the argument, and accepting that there is no interesting and sharp distinction to be drawn among the non-fundamental properties, between ‘sparse’ and merely ‘abundant’. If we want a sharp distinction, we will need to go back to the fundamental conception and distinguish fundamental from derivative properties; or we could, at the other end of the spectrum, distinguish (existing) properties from non-(existing) properties, for example, properties such as fragility, greenness, charge and grueness, on the one hand, from paradoxical Russell-style ‘properties’, on the other. Between these two ends of the spectrum, I want to suggest, the search for a nice and clean cut-off, such as that between the sparse and the merely abundant, is moot. Rather, what we should be focusing on are the interesting *comparative* questions of which properties are more natural than which others, of what grounds or explains what. (In a sense, then, my suggestion is a version of Schaffer 2009’s liberal but hierarchic ontological picture.) In the next section, I will conclude by suggesting that it is precisely these questions that help us make sense of non-fundamental anti-Humeanism without focusing on the existence of powers.

IV

Explanatory Dispositionalism. Dispositional essentialism, as championed by Bird (2007), is a view about the nature of the fundamental properties: the view that they are essentially dispositional. But that is not all there is to dispositional essentialism. What has made the view so attractive to many of us is that it promises to reverse the *order of explanation*. I will now try to explain what this reversal amounts to.

Humeans and anti-Humeans can agree that there are true disposition ascriptions, or even that there are dispositional properties. But what is the truthmaker for the true disposition ascriptions, or what is the ground (the supervenience base, if you prefer that terminology) for the dispositional property? According to David Armstrong, the truthmaker of a true disposition ascription is a combination of two things: a categorical property of the relevant object and a law of nature linking that categorical property to other categorical properties, including its manifestation property. For David Lewis, the question is best framed as a question of supervenience. Dispositions

supervene on, or as many would now phrase it, depend on or are grounded in, categorical properties. The supervenience in question, however, can be at best nomic supervenience: in all possible worlds that share our laws of nature, objects with the given categorical property also have the disposition in question. In their different ways, then, both accounts rely on these two ingredients: a categorical property and a law of nature.

Dispositional essentialism takes a very different path, at least for the fundamental dispositions. On this view, the fundamental properties are essentially dispositional; and it is the (fundamental) dispositions themselves that explain the (fundamental) laws of nature. Dispositions have turned from a problematic *explanandum* into a respectable *explanans*. What is more, by making dispositions the explanans for laws, we have located the *source* of the law, and thus of the object's lawful behaviour, inside the object itself. On the Humean view, laws are, in some way or another, imposed on an object 'from the outside': they may be a matter of the best overall system of describing all of spacetime (Lewis), or of relations holding between universals (Armstrong). For dispositional essentialism, in contrast, each object has within itself the grounds of the laws to which it is subject—facts about how the object is (perhaps even: how it is intrinsically) explain its lawful behaviour.

This, at any rate, seemed to be the promise of dispositional essentialism: to reverse the explanatory order that was dictated by neo-Humeanism, and to thereby locate the source of laws and lawful behaviour—and then the sources of causation, modality, perhaps even agency!—within the properties and the propertied particulars themselves.

In his critique of non-fundamental dispositionalism, Bird has assumed that the tenet of a dispositionalist metaphysics, even at the non-fundamental level, must be the existence of (sparse) properties. Let us call a dispositionalist approach which takes this route *existential dispositionalism*. But if my argument in the previous sections has been correct, then that is not the right way to go. Rather, I want to suggest, the anti-Humean about the non-fundamental level should be concerned with an analogous reversal of explanatory order. Let us call a dispositionalist approach which takes this route *explanatory dispositionalism*. While these two approaches are compatible with each other, it is not obvious that explanatory dispositionalism must

go along with a concern about property existence. In what follows, I want to sketch how explanatory dispositionalism might be cashed out, though I can only provide some bare bones here. (Note that the explanation with which explanatory dispositionalism is concerned is meant to be metaphysical, not epistemic—you might call it grounding, dependence or supervenience. For present purposes, nothing depends on the exact way in which ‘explanation’ is spelled out here.)

What, then, should be the claim of the explanatory dispositionalist? If I am right, it is not about existence, but about the order of explanation. A natural first thought would be this: an explanatory dispositionalist reverses the order of explanation between dispositional and categorical properties. Where the neo-Humean thought that a categorical property explained the disposition (ascription), the explanatory dispositionalist will claim that the disposition in fact explains the categorical property. It is easy to see that this would be a highly implausible view. A glass’s fragility does not explain its having the molecular structure that it has! Even a dispositionalist, explanatory or not, should concede that macro dispositions are partly explained by certain categorical properties.

But we have seen above that even the Humean accounts do not take a categorical property to be a complete explanation for a disposition. In Lewis’s and Armstrong’s account, another ingredient was needed: laws of nature. It is here that explanatory dispositionalism clearly diverges from the Humean view. For the explanatory dispositionalist, it is dispositions that explain laws, and not vice versa. How so?

Let me use a relatively simple example of a macro disposition, the water-solubility of salt. This disposition is no doubt explained by a categorical property of salt, its being a certain kind of ionic compound. But that categorical property is not quite enough for our explanation: why is it that the property of being such-and-such an ionic compound gives rise to the disposition to dissolve in water? The answer is, roughly, that salt is made up of ions, some of which are positively charged and some of which are negatively charged. When salt comes into contact with water, its positively charged ions attract the partially negative oxygen atoms that water contains, while its negatively charged ions attract the partially positive hydrogen atoms that water contains. This last fact about the interaction of a salt’s ions with those of water is the kind of fact that Humeans invoke in the form of a law of nature governing the categorical properties of salt

and water. But to the explanatory dispositionalist, they are facts about the dispositions of the ions that make up the molecular structure of salt and of water. And the explanatory dispositionalist, following the dispositional essentialist, insists that this is the source of salt's disposition to dissolve in water: the molecular structure of salt (a categorical property) along with the more natural, closer-to-fundamental dispositions of the elements of that structure. Nothing needs to be imposed on the object 'from the outside' in the way that Humean laws are. The object, this piece of salt, has everything that is required to explain its macro disposition, water-solubility.

What about the law, or lawful generalization, that salt dissolves in water? There are now two routes that explanation might take. One is to start with the dispositional essence of charge (or whatever more fundamental dispositions underlie it), which ground Coulomb's law, which in turn grounds the law about salt dissolving in water, which grounds the salt's disposition to dissolve in water. The other route is to start, again, with the dispositional essence of charge, which grounds the disposition of salt to dissolve in water, which then grounds the law about salt dissolving in water. It seems to me that by the lights of dispositional essentialism, the second route is much more natural, and the burden of proof is on anyone who wants to take the first. After all, everything that is required to ground the macro disposition is right there within the salt itself; there is simply no reason for a detour through the laws. Macro dispositions are explained by micro dispositions and the arrangement of their bearers; laws at any level are directly explained by the dispositions of the relevant level, and indirectly by the more fundamental dispositions of their parts.

Given dispositional essentialism as a thesis about the fundamental properties, it would seem that all it takes to explain macro dispositions is there within the disposition-bearing object itself: its categorical properties plus the dispositions of its parts. Where those parts are themselves complex, we may then go on to explain their dispositions in terms of the nature and arrangement of their parts; but the same reasoning will apply again. And thus we may, in principle, go on until we reach the fundamental level. Given dispositional essentialism, that level is itself dispositional; it's dispositions all the way down.

Thus explanatory dispositionalism reverses the order of explanation between laws and dispositions, beyond the fundamental level that was the concern of dispositional essentialism. It does so, not by according a special status—that of being sparse, and of being a

power—to this or that macro disposition, but rather by according special status to dispositionalism in general as being the explanatory factor, and not the problematic phenomenon to be explained away.¹² A similar strategy can be applied, I believe, to explanations of modality in terms of dispositions.

I have painted with a very broad brush in this section, and provided no more than the outlines of, and, with the easy case of water-solubility, a blueprint for explanatory dispositionalism. But given what I have argued in this paper, it seems to me that explanatory dispositionalism, rather than the existential dispositionalism targeted by Bird, is the direction that the dispositionalist ought to pursue when thinking about the non-fundamental level.^{13, 14}

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¹² This is one reason why my explanatory dispositionalism is not to be confused with the explanatory conception of sparseness, as introduced in §II. The other reason is that the kind of explanation I am after here is metaphysical, not causal.

¹³ It is, perhaps not coincidentally, the line that I have pursued, with respect to the relation between dispositions and modality, in Vetter (2015).

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