



Dispositional realism without dispositional essences

Matthew Tugby¹

Received: 16 September 2020 / Accepted: 14 December 2021 / Published online: 13 May 2022
© The Author(s) 2022

Abstract

Dispositional realism, as we shall use the term, is a non-reductive, anti-Humean approach to dispositions which says that natural properties confer certain dispositions as a matter of metaphysical necessity. A strong form of dispositional realism is known as pan-dispositionalism, which is typically interpreted as the view that all natural properties are identical with, or essentially dependent on, dispositions. One of the most serious problems facing pan-dispositionalism is the conceivability objection, and the solution commonly offered by essentialists employs the so-called redescription strategy. In this paper I argue that this orthodox strategy fails in certain cases. This argument, in turn, shows that essentialist forms of dispositional realism are implausible. The discussion points us towards an improved version of dispositional realism. According to this new version, natural properties are not essentially dispositional but *necessarily ground* dispositions.

Keywords Dispositional realism · Pan-dispositionalism · Essentialism · Conceivability · Grounding.

1 Introduction: the aims of this paper

Roughly speaking, natural properties determine how things are, while the dispositions of things determine how those things could or would or must behave in certain circumstances.¹ According to dispositional realism, as we shall understand it, dispo-

¹ For the purposes of this paper we adopt a liberal conception of naturalness, so as to include everyday macroscopic properties as well as those posited in different branches of science. I shall not attempt to offer an analysis of the concept of naturalness here. However, we can understand natural properties by

✉ Matthew Tugby
matthew.tugby@durham.ac.uk

¹ Durham University, 50 Old Elvet, DH1 3HN Durham, UK

sitions are irreducible features of reality and are necessarily connected (in a way to be spelt out) to natural properties. Dispositional realism is thus an anti-Humean position that opposes the sorts of categoricalist views held by Lewis (2009) and Armstrong (1997). According to categoricalists, dispositions are reducible and contingent. On some categoricalist views, dispositions are simply reducible to the contingent Humean mosaic of non-dispositional (categorical) property instantiations, while on Armstrong's view dispositions are reducible to categorical properties plus the contingent nomic relations in which they stand.

A strong form of dispositional realism is known as pan-dispositionalism. Pan-dispositionalism is typically (though not always²) developed as an identity or essentialist thesis, and says that *all* natural properties are identical with, or essentially dependent on, some disposition or other.³ To use an example to which we will recur, an example of a natural property is the property of being spherical, and an example of a disposition associated with spherical objects is the disposition to roll down an inclined plane. According to pan-dispositionalists, if this property confers this disposition, then it does so essentially. It is perhaps not surprising that dispositional realism is often developed in this way, because since the work of Kripke (1980) many philosophers have been convinced that metaphysically necessary connections are rooted in the identities or essences of things. The aim of this paper, however, is to resist this trend.

In order to assess this strong form of dispositional realism, we focus on the *conceivability objection*, one of the most serious obstacles that dispositional realism must surmount. This objection has been discussed by, for example, Shoemaker (1998), Schaffer (2005), Bird (2007, Ch. 8), and Schroer (2018), and is explored in detail by Unger (2006) in his discussion of so-called spatial properties.⁴ The solution typically proposed by pan-dispositionalists in response to the conceivability objection employs a *redescription* strategy. After providing an in-depth exploration of the notion of conceivability, I argue that this redescription strategy fails in certain cases; and my argument, in turn, reveals that essentialist forms of dispositional realism are implausible. Yet the discussion also points the way towards an improved version of dispositional realism, according to which natural properties are not essentially dispositional or identical with dispositions, but rather *necessarily ground* dispositions. Various grounding-based theories of dispositions have been discussed in recent lit-

contrast with what Shoemaker calls 'mere Cambridge' properties, which are heavily relational and gerrymandered, such as Goodman's property of 'being grue' (Shoemaker 2003, p. 208).

² According to Bostock, pan-dispositionalism is the view that all natural properties are irreducible and he characterises it as the view that properties 'are themselves enough to ensure the truth of one or more counterfactuals about how an object bearing it would behave' (2008, pp. 141–42). This definition is neutral on whether properties are identical with, or essentially dependent on, dispositions, and the grounding-based version of dispositional realism that we explore later is compatible with Bostock's rendering of pan-dispositionalism. However, it is more common for philosophers to regard pan-dispositionalism as an essentialist thesis on which all properties are pure powers (see e.g. Molnar 2003, p. 153).

³ Not all pan-dispositionalists employ essentialist language. For example, Heil (2003), Mumford (2004) and Martin (2008) say instead that all properties are identical with dispositions.

⁴ The debate about whether, and in what sense, spatial properties are dispositional has cropped up in various guises over recent decades. See, for example, Mellor 1982, Prior 1982, Molnar 2003 Ch. 9 and 10, and Bird 2003.

erature (e.g. Coates 2021, Kimpton-Nye 2021, and Tugby 2021), which build on the work of Jacobs (2011), Audi (2012), and Tugby (2012)⁵. In the final part of the paper, I outline the main features of this new approach to dispositional realism and show how it offers a different response to the conceivability objections. This approach is in its infancy and as far as I know, no-one has yet explored in any detail its implications for the conceivability objection. By discussing this issue, this paper allows us to not only get clearer on the commitments of the grounding theory of dispositions, but also puts us in a better position to assess its viability.

The paper is structured as follows. In section two we discuss the conceivability objections facing pan-dispositionalism and the commonly employed redescription solution. In section three we explore the concept of conceivability in more detail, and section four contains a critical discussion of Unger's conceivability objection against pan-dispositionalism. In section five we develop a new and improved conceivability objection on Unger's behalf. In section six it is argued that the new conceivability objection poses a serious problem for pan-dispositionalism. In sections seven to nine, we discuss a grounding-based version of dispositional realism and explain why the conceivability objection does not pose a threat to it: it does not pose a threat because the grounding-based dispositional realists can accept the conceivability of the relevant scenarios while denying that conceivability is a good guide to metaphysical possibility. In section ten we briefly explore how the grounding theory of dispositions compares with rival theories of dispositions.

2 Conceivability objections and the kripkean redescription solution

In response to pan-dispositionalism, Unger has objected that we can 'clearly and fully' conceive of a 'spatial property' such as being spherical as failing to confer certain dispositions (2006, pp. 268–77). If one then takes conceivability to be a good guide to metaphysical possibility, it follows that the relation between sphericity and its associated dispositions is a contingent one. Hence, spatial properties like being spherical seem to pose a counterexample to pan-dispositionalism.

The obvious option for the pan-dispositionalists is to follow in the footsteps of Kripke. As students of Kripke are well aware, conceivability objections are a common form of resistance against theories which posit metaphysical necessities; Kripke (1980, pp. 129–35), for instance, considers a case in which someone objects that heat is not identical with molecular motion because we can clearly conceive of a situation in which there is heat but not molecular motion. In response, Kripke offers a general essentialist recipe for dealing with such objections, often called the 'redescription strategy' (see e.g. Shoemaker 1998, p. 62 and Lanao 2018, p. 2827). The idea behind the redescription strategy is to insist that, strictly speaking, the critics are not imagining what they think they are imagining; some kind of confusion or illusion is imported when the counterexamples are described (see also Bird 2007, Ch. 8). In the case of heat, for example, it is alleged that critics mistakenly assume that heat is just

⁵ Jacobs (2011) formulates the view mainly in terms of truthmaking, while I (2012) used both grounding and truthmaking language.

whatever causes heat sensations. The situation being imagined might well be *epistemically* indistinguishable from a case which really involves heat, but metaphysically speaking not really involve heat at all but only something that is superficially similar to it (i.e. in respect of causing certain sensations; Kripke 1980, pp. 131–32). Once we redescribe the situation in the correct way (metaphysically speaking), we see that the thought experiment is not a genuine counterexample to the identity claim.

An obvious route for the pan-dispositionalist, then, is to argue that the conceivability objection rests on a confusion or illusion. Although it might appear that we can imagine a spatial property like sphericity failing to confer, say, the power to roll down an incline, on closer inspection this is not the case. Once we redescribe the alleged scenario in the correct way, we find that it does not pose a counterexample to the pan-dispositionalist thesis.

In the following four sections I argue that although the redescription strategy has some plausibility in the cases that Kripke discusses, the strategy is not plausible as a general recipe for dealing with the conceivability objections facing pan-dispositionalism. Shoemaker 1998 contains an early dispositionalist defence of the Kripkean strategy; however, I shall focus mainly on arguments advanced by Heil (2010) and Mumford (2010), who I interpret as employing the redescription strategy in their responses to Unger (2006).⁶ For example, in response to the alleged sphere counterexample, Heil insists that he finds it difficult to conceive of a billiard ball which fails to roll down an inclined plane (in ideal conditions), the implication being that Unger is not genuinely conceiving the scenarios that he thinks he is conceiving: ‘We can easily imagine a ball closely resembling a billiard ball that does not roll ... It is however, rather more of a challenge to imagine a ball intrinsically indiscernible from this regulation billiard ball that does not roll’ (Heil 2010, p. 69).

To be fair to Heil and Mumford, they are right in thinking that the conceivability counterexamples formulated by Unger are inconclusive. However, as we shall see, Unger could have played a stronger hand and employed a sphere thought experiment in which the redescription strategy cannot plausibly be employed. If I am right, then essentialist forms of pan-dispositionalism face a serious problem. However, all is not lost for the dispositional realists. According to the version of dispositional realism that I prefer, properties are not identical with or essentially dependent on dispositions, but rather they *ground* those dispositions. Crucially, the grounding theory of dispositions allows that we can fully conceive of properties failing to confer the relevant dispositions. Nonetheless, the grounding theorist can (and should) insist that conceivability is not a good guide to metaphysical possibility and thereby block the conceivability objection at its final stage.

⁶ See also Carruth (2016) who, in the context of defending physicalism, argues that if we accept the Martin-style powerful qualities theory of properties, then we can resist Chalmers’s claim that the co-variance of qualities and powers is conceivable.

3 Defining conceivability

Before proceeding, it is important to settle what it means to conceive something. Unger's criticisms of pan-dispositionalism often rely on the claim that this or that scenario is 'clearly and fully' conceivable (2006, p. 77), or conceivable 'fully and well' (2010, p. 485); more clarity might well be sought regarding what it means to conceive of something 'clearly and fully', however, if disputes about what is and is not conceivable are not to founder on equivocation. As Chalmers (2002), among others, has shown, a scenario can be conceivable in some senses but not in others. There is more than one dimension along which something can be more or less conceivable.

Although as far as I know Unger does not appeal to the distinctions framed by Chalmers (2002), much of what Unger says about conceivability can be interpreted using the distinctions Chalmers employs. What is clear is that Unger does not think the alleged sphere cases that he describes are conceivable only in the 'negative' or 'prima facie' sense; rather, he believes that the sphere scenarios are conceivable in a stronger sense. This is important, because if the scenarios were conceivable in only a weak sense, one would expect it to be easier for pan-dispositionalist opponents to deploy the redescription strategy.

Using Chalmers's terminology, Unger's claim appears to be that the relevant sphere scenarios are *positively* conceivable on sustained rational reflection—what Chalmers would call *secunda facie* positive conceivability (2002, Sects. 1 and 2). Unger's 2006 discussion of conceivability on pp. 179–80 supports this interpretation. In the first place, Unger is clear that a necessary condition for fully conceiving something is that there is an experiential aspect to our thinking. He writes: 'we most fully conceive a concrete object only when we engage in some thinking that's experiential thinking, whatever other aspect, or aspects, our thoughtful conceiving may also feature' (2006, p. 180). As Mumford points out, Unger's cases place a lot of weight on visualization (2010, p. 479), and this shows that 'full' conceivability in Unger's sense requires what Chalmers calls *positive* rather than negative conceivability. Negative conceivability requires only that a given scenario does not harbour a contradiction; this is largely an a priori matter and does not typically involve an experiential dimension. Positive conceivability, in contrast, involves what Chalmers calls *imagination*: 'To positively conceive of a situation is to imagine (in some sense) a specific configuration of objects and properties' (Chalmers 2002, p. 150). To succeed in imagining S, the scenario in question must be coherent and such that the object of one's imagination *verifies* S (2002, p. 150). In other words, the content of the imagined scenario has to be such that it provides good evidence that S is the case in that scenario.

As will prove important later, we should note that to say that S is verified in a mental image is not yet to say that S is *metaphysically possible*. As Chalmers points out (2002, p. 156), we should not define the positive conceivability of S in a way that trivialises the link between conceivability and possibility. Whatever our view about conceivability, the debate about whether conceivability entails possibility appears to be a substantive one. Fortunately, a mental image of S can positively verify the obtaining of S without entailing that S is metaphysically possible; as Chalmers emphasises, the notions of coherence and verification are epistemic rather than metaphysical.

Chalmers also adds that in most cases of positive conceivability, the imagination will be perceptual, or what Unger calls *experiential*: ‘A subject perceptually imagines that S when the subject has a perceptual mental image that represents S as being the case. This happens when the image is relevantly related to a perceptual experience that represents S as being the case’ (Chalmers 2002, p. 150).

We may conclude, therefore, that when Unger speaks of ‘full conceivability’ he must mean something like positive conceivability in Chalmers’s sense. This is not all that can be said of Unger’s notion of conceivability, however. In several places Unger acknowledges that ‘full’ conceivability involves an intellectual as well as an experiential dimension. For example, Unger asks hypothetically how we can be sure that a given mental image really does represent a sphere rather than something else (2006, p. 180). One possible answer here would be that we somehow fill in every last perceptual detail of the mental image, so that we have ‘an extraordinarily complete, or precise, mental image’ (2006, p. 181), but Unger argues that this is neither psychologically plausible nor necessary. Instead, our perceptual image is accompanied by an intellectual aspect, which helps us to determine what our mental images can (or cannot) reasonably be said to represent. Unger claims that the experiential and intellectual dimensions are mutually complementary (2006, p. 181).

Unger’s discussions of the role of the intellect in our acts of conceiving are sometimes sketchy (as he readily admits: 2006, p. 181). However, the idea seems to resemble Chalmers’s notions of *secunda facie* (or ideal) conceivability. Both of these notions contrast with *prima facie* conceivability, which requires only that something appears to be conceivable (in the relevant sense) upon first inspection. Scenario S is *secunda facie* conceivable in the relevant sense if the conceivability claim stands up to some intellectual rational scrutiny (see Chalmers 2010, pp. 143–44 for more on this distinction).

Given that Unger has something like positive conceivability in mind when employing his conceivability objection, and given the role that intellectual reflection is also supposed to play, I think we may interpret Unger as claiming that the sphere counterexamples are conceivable in at least the *secunda facie* positive sense.⁷ With this notion of conceivability in play, we shall see in the next section that it is debatable whether Unger’s sphere cases are indeed conceivable, and this opens the door to the redescription strategy employed by dispositionalists such as Heil and Mumford. However, in sections five and six we shall discuss an improved thought experiment in which it is arguably *secunda facie* positively conceivable that there is a sphere which lacks the power to roll. It is far from clear that the redescription strategy can be applied in this new case, which leaves pan-dispositionalists with a serious problem.

⁷ I set aside a further distinction that Chalmers (2002, Sect. 3) draws between primary (epistemic) and secondary conceivability. Whether a scenario is primarily or secondarily conceivable rests on the amount of empirical scientific information that the conceiver has about the scenario in question (see e.g. Vahid 2006, pp. 247–50). The reason I do not discuss this distinction is that it is unlikely that our assessments about the conceivability of the sphere cases we discuss are affected by a switch from primary to secondary conceivability. Since the sphericity of a billiard ball is a macro phenomenon, it is a property that one can know about without being acquainted with scientific theory. For example, it would be odd to suppose that there is a group of experts who are better at identifying ball-shaped objects than everyone else.

Before proceeding, though, it is important to note that the pan-dispositionalist redescription strategy can be expressed in more than one way depending on what one means by the term ‘conceivability’.⁸ Again, ‘conceivability’ is a slippery term and care is needed. For example, some pan-dispositionalists who employ the redescription strategy might be willing to accept that Unger is conceiving of a sphere *in some sense*, even if not in the stronger sense just discussed; that is to say, one might be willing to accept that Unger is conceiving of his sphere cases in the sense of *prima facie* conceivability. Alternatively, one might think that Unger is not conceiving of a sphere *at all*, on the basis that *prima facie* conceivability is not worthy of the name ‘conceivability’. I mention this issue so that the reader should not be confused by some of the dispositionalist literature to which I shall refer. For instance, when discussing worlds in which spatial properties and powers allegedly come apart, Mumford is happy to say ‘that there is some sense of “conceivable” in which these worlds are indeed conceivable’ (2007, p. 426). In contrast, Heil is less willing to make this concession, as far as I can tell (see Heil 2010, p. 69). In any case, what is important for current purposes is that Unger appears to take his sphere cases to be conceivable in a strong sense, along the lines of what Chalmers calls *secunda facie* positive conceivability. Let us now examine Unger’s thought experiment in more detail.

4 Unger’s conceivability objection to pan-dispositionalism: the sphere cases

To recap, Unger’s aim is (among other things) to undermine the claim that there is a necessary connection between a thing’s properties and its dispositions (or what Unger prefers to call ‘propensities’). His main argument, as we have seen, is that we can employ thought experiments in which it is positively conceivable that there is a spherical object which lacks the power to roll. The final important premise is that conceivability is a good guide to metaphysical possibility.

As we shall see below, there is a case to be made that the scenarios that Unger describes are conceivable only in the sense of *prima facie* positive conceivability. Although Mumford (2010) does not put his response to Unger in quite these terms, the response we shall consider is consistent with what Mumford says. The strategy would be to say that upon rational (*secunda facie*) reflection, what Unger is conceiving is not really a spherical object that lacks the power to roll—in other words, that upon close rational inspection, Unger’s imagined scenarios can be *re-described* in a way that is consistent with the pan-dispositionalist thesis.

Unger’s sphere thought experiments (presented in his 2006, Chap. 5, Sect. 16) all have a core feature in common, which is that some change occurs in a way that prevents a spherical object from rolling down an inclined plane. Because the spherical object cannot be made to roll in such cases, Unger infers that in these cases the sphere cannot be said to have the disposition to roll. This is the crucial inference, which critics like Mumford have rejected (2010). We shall examine Mumford’s criticisms in a moment.

⁸ Shoemaker makes a similar point: 1998, Sect. 2.

Unger's cases can be divided between two categories. The first kind of conceivable case is one in which a spherical object has the propensity to change its shape just as it is about to roll, so that the rolling is prevented. For example, Unger considers a case in which a small sphere is resting on a large cube that is subsequently tilted. Although we might expect the sphere to roll down the tilted cube's surface, Unger asks 'why didn't the Small Sphere turn into a Small Cube—and then *slide* down the tilted surface?' (2006, p. 269). Unger's point here is that we can easily (positively) conceive of changes taking place that would result in different behaviours. Hence, the fact that the sphere was spherical does not by itself determine that it will roll.⁹

The second kind of conceivable case that Unger appeals to is one in which the sphere has the disposition to retain its shape (contrary to the cases above) but has additional dispositions to move in unusual ways. For example, Unger considers a case in which the small sphere flies away like a rocket when the surface on which it is sat is tilted. This leads Unger to conclude that sphericity is not sufficient for the disposition to roll, because in order to have such a disposition, other dispositions—such as the disposition to fly away—must be absent; and since it is contingent whether these further dispositions are present, it is contingent whether a spherical object has the power to roll.

The key assumption behind Unger's arguments is that if the spheres in these thought experiments can never be made to roll, then they are not cases in which the disposition to roll is present. But is this assumption correct? To recall, if Unger's cases are to be *secunda facie* positively conceivable, then this assumption must remain reasonable upon rational reflection. Is this the case? A pan-dispositionalist is likely to reply that it is plausible on rational reflection to think that dispositions can exist even if, due to interfering factors, they never get to manifest. Indeed, realists about dispositions have often responded to reductive analyses of dispositions precisely on the basis that dispositions can be 'finked' or 'masked' (see e.g. Martin 1994 and Bird 1998). Mumford dismisses Unger's arguments on the basis of precisely this kind of reason. Considering Unger's examples of shape-changing spheres, Mumford writes: 'this is a bad argument. If the particular changes from being spherical to being flat, then naturally it no longer has the power to roll. But while ever it is spherical it will indeed have that aforementioned Propensity' (2007, p. 426). As a realist about dispositions, Mumford is prepared to insist that the sphere really does have the power to roll, even though we could never get the sphere to roll in the imagined scenario. The crucial point here is that it is reasonable to believe in dispositions that make merely a counterfactual difference. Although a piece of salt in the desert may never actually dissolve, we can still say that it has the disposition to dissolve because the following counterfactual is true: if the salt were to be submerged in (non-saturated) water in certain conditions, then it would dissolve.

At first glance, the Mumford-style response seems compelling: upon close rational scrutiny, we cannot really conceive of Unger's spheres as lacking the disposition to roll. I think, however, that matters are more complicated. It is true, following the work of dispositionalists like Martin (1994), that most philosophers are prepared to

⁹ Mumford also considers further examples along these lines, such as the case of a spherical soap bubble which sticks to an inclined plane rather than roll down it (2010, p. 481).

accept the existence of dispositions whose manifestations are always prevented by finks or masks. In finking cases, the properties of an object are altered when a certain disposition is triggered, such that the disposition is immediately lost. In contrast to finkish cases, masking cases are those in which the relevant disposition is retained once triggered but the disposition's manifestation is nonetheless trumped by the presence of an opposing disposition. In Bird's example (1998), we can say that a uranium pile in a nuclear reactor has the disposition to undergo a catastrophic chain reaction even though the presence of boron rods will (we hope!) act as an antidote to this disposition.

The problem is, though, that Unger's sphere cases differ in important respects from the typical examples of finks and masks. The crucial difference is that the common examples of finking and masking used by Martin and others are cases in which the finks and masks are *extrinsic* to the object with the disposition in question. In contrast, the sphere cases that Unger appeals to are all ones in which the finking and masking dispositions are *intrinsic* to the sphere. In the finking cases, the spherical object has an intrinsic disposition to change shape when the plane is inclined. In the masking case, the spherical object has a further disposition to fly off into space.

One might think that it does not make much difference whether the finking or masking factors are intrinsic or extrinsic. Given that extrinsic and intrinsic finks/masks play the same sorts of causal roles, one might naturally assume that there can be dispositions which can be finked or masked by further intrinsic dispositions of that same object. Mumford's reply to Unger seems to rely implicitly on this assumption. However, the problem is that many philosophers who accept the existence of extrinsically finkable or maskable powers have denied the existence of intrinsically finkable or maskable dispositions. In order to rebut Mumford's criticisms, Unger could simply side with the many philosophers who reject the possibility of intrinsically finkable and maskable dispositions.

Roughly speaking, the main argument against intrinsically finkable or maskable dispositions is that duplicates of the object with such alleged dispositions would not be able to manifest those dispositions in any possible scenario (or at least in any possible world with the same laws of nature as ours). But surely it is counterintuitive to believe in the existence of a disposition that would never manifest. If the relevant manifestation would never occur, surely that is evidence that the disposition in question is not present (see e.g. Choi 2005, pp. 499–500 and Bird and Handfield 2008, pp. 291–92 for details).

Now, there have been responses to these arguments (see e.g. Clarke 2008, Kittle 2015 and Tugby 2016), but I shall not attempt to settle the debate about intrinsically finkable and maskable dispositions here. My point is just that the debate between Mumford and Unger depends on the outcome of this debate, and therefore the plausibility of Mumford's response is debateable. However, in the next section we will see that there is another thought experiment which shows more clearly that we can positively conceive of a sphere which lacks the power to roll, in a way that more clearly withstands rational scrutiny.

5 The conceivability objection to pan-dispositionalism improved

What all of Unger's conceivability cases have in common is that some other disposition of a spherical object manifests in a way that interferes with its rolling down an inclined plane. Rather than cooking up an example in which some further disposition operates in a way that blocks the rolling, why not simply conceive instead of a case in which the plane is inclined but *nothing at all* happens to the sphere sitting on it? Such a scenario is less complicated than the ones Unger considers and it bypasses the debate about intrinsically finkable or maskable dispositions, since in such a case there are no other dispositions that interfere. Rather, it is simply a case in which the sphere is in ideal conditions for rolling but nonetheless it stays put.

Let us illustrate the case more clearly in order to assess whether it really is conceivable in a strong positive sense. As with Unger's cases, perceptual imagination plays an important role in the thought experiment: if the scenario described is positively conceivable, this is because we have a good grip on how the situation would appear to a human with functional perceptual apparatus. As we will see below (and as Unger would concede), there also has to be an important intellectual element when grasping the details of the case. But for starters, we can illustrate the basic picture as follows: in order to distinguish the new case from Unger's cases we need to imagine a spherical object which could not be said to instantiate any intrinsic finks or masks. That is, we require an example of a spherical object that we would ordinarily expect to roll on an inclined plane in ideal conditions. This means the imagined sphere cannot be like one of Unger's 'gelatinous' objects, for example. For the sake of the new example, then, let us conceive of a billiard ball, which is non-sticky, rigid, sufficiently heavy, etc. Since billiard balls are precisely designed to roll easily, this looks like a good example of a spherical object that does not conceal any intrinsic finks or masks against its rolling. The rest of the thought experiment, then, is relatively straightforward. We imagine that the billiard ball is in a room where it is placed on an inclined plane but simply fails to roll. Importantly, we must also stipulate that the conditions are ideal for rolling: the plane is not itself sticky, gravity is present, there are no external forces such as a gust of wind acting on the ball, and so on. Notice here that the thought experiment focuses only on what properties things have and how those things are behaving. We need not and should not stipulate facts about laws of nature, since doing so would beg the question against some dispositional essentialists, like Mumford (2004), who are eliminativists about laws.

In order for this modified thought experiment to show that properties and dispositions can conceivably come apart (in the appropriate sense), we must make some key assumptions and address some initial concerns. The first assumption is that if something were not to manifest a certain effect in response to triggering circumstances that are ideal for that effect, then that is good evidence that the thing would not have a disposition for that manifestation. Notice that this assumption is in the subjunctive mood, because I take it that when conceiving of the billiard ball, what we are doing is thinking about how things could be in a possible world. However, I take it that the sorts of evidence we have for ascribing dispositions (or not) in the actual world are the same as those that we would apply in counterfactual scenarios. This is precisely why Unger-type thought experiments are meant to enable us to draw various meta-

physical conclusions about our world.¹⁰ With these standards of evidence in place, we can still agree with Mumford that the constant *prevention* of a certain effect in a counterfactual scenario would not always be good evidence that the disposition for that effect is not there. This is precisely what Martin's cases of finks and masks are supposed to show. But that is just to say that in such cases the conditions would not be ideal for the relevant manifestation. In contrast, where the conditions for a manifestation were ideal, and preventative finks and antidotes were absent, then the failure of the manifestation would surely be good evidence that the relevant disposition is absent—especially in deterministic examples, such as the disposition to roll. If we were told that the constant lack of an effect in ideal circumstances were not good evidence for the lack of the relevant disposition, then I am no longer sure how the world could constrain our beliefs about the dispositions of things.

Second, we should immediately address the worry that we are not entitled to stipulate that the imagined scenario has the properties required for the triggering circumstances to be ideal, such as the presence of gravity and the absence of, say, a gust of wind. If, for example, we are imagining the presence of gravity simply by inserting a 'gravity' label into the imagined picture, this would make the conceivability task suspiciously easy. But if this simple labelling strategy is not allowed, on what basis can we say that gravity really is present in the scenario described?

The best reply to this worry is to concede that merely 'labelling up' our imagined scenario in thought is not enough to secure positive conceivability. Even if some degree of intellectual stipulation is required for positive conceivability, there cannot be too much of it, since otherwise we would lose too many of the experiential elements that characterise positive conceivability. Hence, what is ultimately required for genuine (positive) conceivability is that we can imagine ourselves *verifying* the presence of the various features, such as the presence of gravity. Of course, it would be unrealistic to represent all of these verifying actions at once. But as long as a sequence of verifying actions is imaginable, we can insist that the relevant features of the scenario are not merely being stipulated in an ad hoc manner. Fortunately, it does not seem difficult to imagine the various verifying actions in the case at hand. For example, in order to be sure that what we are conceiving really is a billiard ball, we can imagine ourselves feeling its smoothness, weight, and rigidity as it is placed on the incline. In doing so we can also activate the intellectual components of conceivability and consider the geometrical information that would be gathered from such perceptions: namely, that we are in possession of an object such that every point of its surface is (roughly) equidistant from its centre. We can also imagine ourselves positively verifying the presence of gravity in the room by feeling its force on our body as the ball is placed on the incline. And for each possible fink or mask, it is not difficult to imagine ways of verifying their absence. For example, we can positively imagine ourselves feeling a lack of breeze, or feeling the non-stickiness of the incline. We can even check that a hologram machine or some other source of illusion is not in the vicinity. Although each of these verifying actions adds complexity to the imagined scenario, none of them are particularly difficult to imagine, and we can coherently put these elements in place while imagining that the ball simply remains static when

¹⁰ I am grateful to an anonymous referee for prompting me to think about this issue.

placed on the incline. Moreover, consideration of these imagined verifying actions, I submit, shows that the alleged conceivability of the scenario described can withstand rational scrutiny.

The final point to emphasise is that we are not begging the question by claiming that the scenario described is conceivable in the relevant sense. As we shall see, I ultimately agree with the pan-dispositionalists that the sphere scenario I am describing is not metaphysically possible. As explained in section three, to say that something really is positively conceivable is not yet to say that it is metaphysically possible. The overall aim of the paper, to recall, is to show that one need not deny the conceivability of, say, an unrollable billiard ball in order to be a dispositional realist. If one thinks that the redescription strategy is implausible in the new sphere case described (see next section), then the best thing for a dispositional realist to say is that such a case is positively conceivable but nonetheless metaphysically impossible. To support this conclusion, we must move away from pan-dispositionalist forms of dispositional realism, on which the necessary connection between properties and dispositions lies in dispositional essence or identity. If properties have a dispositional essence, or are identical with dispositions, then of course it should not be possible to coherently conceive of objects with certain properties lacking the relevant dispositions (see Caruth 2016 on this point). But as we saw in section one, there is more than one kind of dispositional realism. Our discussion of the conceivability objection points us in the direction of grounding-based dispositional realism. According to the grounding theory of dispositions, properties are not essentially connected to dispositions, and this is why we can positively conceive of objects with certain properties lacking the relevant dispositions. Nonetheless, properties necessarily ground dispositions. And the reason why positive conceivability is not a good guide to metaphysical possibility is that grounding relations are generally not epistemically transparent to us (see e.g. Schaffer 2017 and Sect. 9 below).

Before discussing the grounding theory of dispositions in more detail, we must first consider how pan-dispositionalists might try to respond to the new thought experiment described.

6 Essentialist responses to our revised conceivability objection

How, then, might the pan-dispositionalists try to apply the redescription strategy to the scenario described in the previous section? Assuming that the disposition to roll would not be present in the scenario described, the redescription strategy would require us to insist that what we are imagining in this scenario is *not really* a spherical billiard ball. To do this, the pan-dispositionalists must insist that some kind of illusion is taking place in the imagined scenario. For this move to be plausible, they must explain the source of this illusion. As we will see, I do not find this strategy to be plausible. My contention is that the typical moves made by Kripkeans who employ the redescription strategy cannot be applied in this case; this is because our sphere case is disanalogous in crucial ways to the sorts of cases that Kripke is concerned with in *Naming and Necessity*. So, although I am happy to concede that the redescription

tion strategy is plausible in some cases (particularly those involving natural kinds), the spherical billiard ball case is not one of them.

Earlier I argued that in the scenario described, the conditions surrounding the sphere really are ideal for rolling. The scenario can be constructed in such a way that we can imagine ourselves verifying that gravity is present, that the billiard ball on the incline is smooth and rigid, and so on. However, perhaps a pan-dispositionalist could concede all this and still insist that the scenario is not one that contains an unrollable spherical object. To do this, they could simply insist that the object in the thought experiment would not really be a spherical billiard ball. Although I have specified that the imagined object is a sphere, the pan-dispositionalists might try to redescribe the situation in a way that makes the appearances deceptive. The onus would then be on them to explain the source of this deception.

Those who pursue this strategy can hardly deny that, *prima facie*, what we have in this imagined scenario is a spherical ball. We have specified that the object appears spherical to someone who has fully functional visual capacities, and we can also specify that the lighting conditions are ideal. We have also ruled out any illusion-generating apparatus such as a hologram machine. How, then, can it be maintained that the appearances are illusory? It is here that I think the pan-dispositionalists encounter problems. What is important to note is that in the cases discussed by Kripke (1980), in which the redescription strategy is employed, Kripke is able to drive a wedge between the *superficial signs* of a property and the *underlying essential features* of that property. In these cases the redescription strategy gains its plausibility from the fact that the superficial macroscopic signs of a property could exist in the absence of that underlying property. The source of the relevant illusions is then explained in the following terms: the reason why we might think we are conceiving of (say) water that is not H₂O is that we are failing to distinguish the superficial, macroscopic signs of water (such as transparency and tastelessness) from the essential microscopic features of water, namely its underlying molecular structure. Kripkeans can then insist that such illusions occur precisely because substances other than water can display superficial signs of water.

In short, in order for the Kripkean redescription strategy to be applied with any plausibility, we need somehow to drive a wedge between the superficial and underlying essential features of sphericity. Can this be done in the sphere case? I am doubtful. The crucial problem is that the property of sphericity in our thought experiment is by its nature a macroscopic property. This makes it difficult to drive a wedge between the superficial marks of sphericity and some underlying essence of sphericity. If we want to know whether a medium-sized rigid object is spherical, then microscopic knowledge of the object is largely irrelevant.¹¹ This is why the sphere thought experiment is importantly different from those in which Kripke's redescription strategy is employed. The reason why someone might mistakenly think they can conceive of water that is not H₂O, or heat that is not kinetic energy, or gold

¹¹ Of course, if we were to claim that some object were a *perfect* sphere, then we would need microscopic knowledge of its surface at an infinitesimal scale. However, I am assuming throughout that a macroscopic object can count as spherical without being a perfect sphere. Indeed, it is highly unlikely that a perfect sphere would ever be instantiated in a physical world like ours.

that is not the element with atomic number 79, is that the conceiver is ignoring the ways in which things are categorised scientifically. The problem for the pan-dispositionalists is that it is difficult to see what it is that the observer of the spherical ball is ignoring. Assuming that the conceiver is of average intelligence, they will know that an everyday spherical object is nothing more (and nothing less) than a three-dimensional round object such that every point of its surface is (roughly) equidistant from its centre. Importantly, they will also know how rigid macroscopic spheres would look and feel in normal conditions, which makes them reliable identifiers of spheres. Because spherical billiard balls are macroscopic phenomena, it is difficult to think of a scientific development which could cast doubt on our ability to know a spherical ball when we see one. In contrast, the scientific developments on which Kripke's a posteriori essentialism rests, such as the discovery that water has the molecular structure of H_2O , are well established.

The problems facing pan-dispositionalism in this case can also be put in terms of the notion of evidence. Kripkean illusions typically occur when, by scientific standards, there is something wrong with the evidence that someone has for a given claim. The reason why Kripke's redescription strategy has some plausibility in the cases he discusses is that, again, the observable features of a substance at the macroscopic level do not provide *good evidence* for the kind of substance that it is, because we know that different substances can give rise to the same observable appearances. In contrast, the macroscopic appearance of a medium-sized sphere *is* surely good evidence for the fact that it really is a sphere (see Ingthorsson 2013, p. 68 who makes a similar point about spatial properties).

Let me now defend this line of argument against two further possible pan-dispositionalist responses. First, a referee has pointed out that when considering whether the imagined spherical object has the disposition to roll, certain underlying features of the object *are* relevant, just in the same way that the microstructural features of a substance are relevant for whether it is, say, water. This, it might be thought, gives us wiggle room to employ the Kripkean redescription strategy.¹² For example, suppose that the imagined spherical object had no mass. It is true that such an object would not roll, but this would not be because it lacks sphericity or the associated disposition to roll. Rather, the explanation for the failure to roll would be that gravitational pull has no effect on the (massless) object.

Now, to be clear, I do not deny that a spherical object's having mass is a necessary condition for its rolling. We can think of the object's mass as either part of the triggering conditions for the disposition to roll, or as something that partly constitutes the object's disposition to roll in conjunction with its sphericity.¹³ Either way, then, in order for the thought experiment to be successful, we need to stipulate that the object has mass (and other relevant features, such as a rigid microscopic structure) and maintain that the object still does not roll in the imagined scenario. Indeed, this is why in the previous section I was keen to stipulate that all the conditions concern-

¹² Again, I'm grateful to an anonymous referee for pressing this point.

¹³ This latter view would be more in line with Shoemaker's conception of properties like shape as being associated with conditional powers (2003).

ing the spherical object and its environment were ideal for rolling.¹⁴ Crucially, we saw that it is not difficult to imagine ourselves verifying the various features. In the current example, it is not difficult to imagine ourselves feeling that the ball has mass by picking it up. And it is not difficult to imagine ourselves feeling that the ball is rigid by squeezing it. The important point here is that where the mass and rigidity properties of medium-sized objects are concerned, tactile evidence is perfectly good evidence, as it is in the case of the sphericity.

At this point, it is difficult to see what other lines of response are available to the pan-dispositionalists. I have provided plenty of reasons for thinking that the scenario described really is conceivable in the relevant sense: I have explained why there is good evidence in the thought experiment for thinking that the static ball is spherical, for we can imagine ourselves verifying that it is such that every point of its surface is (roughly) equidistant from its centre. We can also imagine ourselves verifying that the static ball is massy, rigid, and non-sticky, and that the surrounding conditions are ideal for rolling. In order for the pan-dispositionalists to reject the conceivability claim, they must explain what it is that the conceiver has done wrong and why appearances are deceptive. I have tried to show that this is a formidable task, given that the standard Kripkean redescription strategies cannot be applied in this case. To repeat once more: The idea behind the redescription strategy is that superficial signs are not reliable indicators of the presence of the relevant property. My argument is that we simply cannot apply this strategy in the billiard ball case because the superficial (visual and tactile) signs of the relevant properties of the ball (like being spherical, having mass, being non-sticky etc.) *are* reliable indicators. For example, seeing that every point of an object's surface is (roughly) equidistant from its centre is generally good evidence that the object is spherical. I find this argument is compelling.

However, a further line of resistance to my argument is to point out that I probably have not ruled out *all* the possible ways in which the imagined visual and tactile appearances of the alleged sphere could be deceptive. Two points should be emphasised in response. Firstly, given the stipulations made earlier, any alleged source of illusion that is posited through a redescription strategy would have to be much more far-fetched than those posited in Kripke's work, which are based simply on ignorance of certain microscopic facts. For example, perhaps a pan-dispositionalist could maintain that after the imagined billiard ball were placed on the incline in the thought experiment, the ball would be switched for a hologram while the observer is not paying attention. But this is surely an ad hoc move. Moreover, if our evidence for things had to rule out such far-fetched sceptical scenarios, it is unlikely we would ever know anything. Secondly, and more importantly, it seems that we can rule out these far-fetched illusion scenarios within our thought experiment by adding more detail into the picture. For instance, in the scenario I have described, we can imagine checking constantly that the ball has not been switched. It is not even clear that this

¹⁴ In other words, it would be too simplistic to say that if the essence of sphericity does not rule out possibility *p*, then *p* is (positively) conceivable. I am attracted to the idea that the *totality* of essence-truths about properties constrains what is and is not conceivable, but our argument certainly does not assume that a single property can exert these constraints by itself. As should be clear, other properties such as the mass and rigidity of the ball, the non-stickiness of the slope, etc., play an important role in the thought experiment.

would be necessary to rule out switching. Given that we are assuming that positive conceivability involves intellectual and well as perceptual components, I see no obvious reason why we could not legitimately stipulate that the scenario we are imagining is one in which deceptive switchers are not in the vicinity.¹⁵

To be clear, though, none of this is a devastating result for dispositional realism: I *agree* with pan-dispositionalists that it is metaphysically impossible for the massy, rigid, spherical object described to fail to roll in the ideal circumstances that have been stipulated. My conclusion is just that the reason for this metaphysical impossibility does not lie in the fact that sphericity makes an *essential* contribution to the disposition to roll. The best dispositional realist response to our modified thought experiment, I argue, is simply to reject the link between conceivability and metaphysical possibility, rather than to deny the positive conceivability of the cases discussed. So, I ultimately disagree with Unger, who claims to have shown that the connection between properties and powers is contingent. In sum, the dialectical role of our new conceivability argument is to undermine essentialist pan-dispositionalism, rather than dispositional realism. Dispositional essentialists have to say that the relevant thought experiments are inconceivable, which is why they try to employ the Kripkean redescription strategy. That strategy breaks down in our new case, for reasons outlined above. However, this new conceivability argument does not undermine the grounding-based version of dispositional realism, which can accept the conceivability of the case discussed.

In the sections to follow, we shall explore more of the details of the grounding theory of dispositions and show how it allows dispositional realists to avoid the conceivability objection without having to employ a Kripkean redescription strategy. In the process, we shall say more about the link between conceivability and metaphysical possibility.

7 An outline of the grounding theory of dispositions

In a recent paper, Schroer (2018) also urges dispositional realists to accept that it is conceivable for properties to fail to confer the dispositions necessarily associated with them. Schroer and I agree on that general point. However, the sense in which we think such scenarios are conceivable is quite different. Drawing on Loar's work in the philosophy of mind (1990), Schroer proposes that we can imagine the relevant properties merely by 'tagging' them with thin type-demonstrative concepts such as *that property I was just thinking about*. So, for example, on Schroer's account we can think about the property of being salt and then imagine that 'An object possessing *that type of property I was just thinking about* fails to dissolve in water' (2018, p. 359). The reason why this kind of conceivability is not a good guide to metaphysical possibility is that 'the cognitive contents of these type-demonstrative concepts are not detailed enough to put the subject in a position to appreciate the metaphysi-

¹⁵ I leave this as a tentative suggestion because it is far from clear how much intellectual stipulation is allowed where positive (*secunda facie*) conceivability is concerned. I am inclined to think that a large amount of intellectual stipulation is tolerable but I do not have the space to explore the issue in detail here.

cal impossibility of various (imagined) scenarios' (2018, p. 360). This response to the conceivability objection is compatible with pan-dispositionalism because the type-demonstrative concepts can be applied even if the essences of the properties are dispositional. The type-demonstrative concepts ignore the content of the relevant property's essence, which is why they are thin concepts.

As should be clear from the previous section, I believe that the sense in which we can conceive of a spherical billiard ball lacking the power to roll is much richer than the type-demonstrative strategy allows.¹⁶ On my account, we can positively conceive of a spherical object by grasping its geometrical form, using a combination of perceptual and intellectual capacities. And so, due to the thought experiment described in the previous section, we must ultimately abandon pan-dispositionalism and develop an alternative dispositional realist response. Fortunately, a theory of dispositions has recently been developed that fits the bill.

A new anti-Humean theory of dispositions has emerged in recent literature on which natural properties fully ground powers (see e.g. Coates 2021, Kimpton-Nye 2021, and Tugby 2021).¹⁷ Grounding is a relation of metaphysical determination that explains why something is so. For instance, it is often said that parts ground the wholes that they form or that physical states ground mental states. It has been proposed that dispositions can be added to this list: natural properties fully ground dispositions. The theory is flexible on whether each disposition is fully grounded by a single natural property, or whether some dispositions are collectively (fully) grounded in multiple properties.¹⁸

It is widely accepted that grounding occurs with metaphysical necessity, in the sense that necessarily, a grounded entity exists if its (full) ground exists (e.g. Bliss and Trogdon 2014, Sect. 5). So, like pan-dispositionalism, the grounding theory of dispositions accepts that properties and dispositions cannot come apart in the way that categoricalists like Armstrong (1997) and Lewis (2009) claim.¹⁹ However, unlike pan-dispositionalists, grounding theorists do not think that dispositions are part of the essence or identity of properties. Indeed, it is generally implausible to

¹⁶ Although I will not develop this argument here, one reason why I am sceptical of Schroer's account of conceivability is that I think the essences of things ought to exert constraints on what we can and cannot conceive. The grounding theory developed here is consistent with this principle.

¹⁷ Again, this work builds on earlier papers by Jacobs (2011) and Tugby (2012). Different versions of the grounding theory of dispositions have also been discussed by Audi (2012, p. 117), Leuenberger (2014, Sect. 2.2), Smith (2016, pp. 250–51), Yates (2018, Sect. 4), Kimpton-Nye (2018, Ch. 3), Azzano (2019, p. 348), Contessa (2019, Sect. 6), Vetter (2021, Sect. 6.2), and Giannotti (2021).

¹⁸ See e.g. Tugby 2021, Sect. 3. The property of sphericity that we have discussed at length could be interpreted in either way by the grounding theorists. That is, some might argue that the disposition to roll is fully grounded by sphericity alone, or grounded collectively by the sphericity along with, say, the rigidity of the sphere. The arguments presented in the previous section are compatible with either interpretation. Regardless of whether sphericity makes a full or merely partial contribution to the disposition to roll, the point remains that it is implausible to think that this contribution is part of the essence of sphericity.

¹⁹ Interestingly, Leuenberger (2014, Sect. 2.2) has argued that if the relationship between categorical properties and dispositions were contingent, then we would have a reason to accept that grounding is contingent after all. I do not have the space to discuss Leuenberger's argument in the detail that it deserves, except to note that I draw a different conclusion from his discussion of categoricalism. Given the plausibility of the idea that full grounding is metaphysically necessary in the paradigm cases, I think that contingentist categoricalists should avoid formulating their theory in terms of full grounding.

think that a grounded entity is ever part of the essence of its ground. To use a well-known example, the fact that Socrates exists grounds the existence of the singleton {Socrates} but it is implausible to think that we need to mention this singleton when spelling out the essence of Socrates (see e.g. Fine 2015). This shows that grounding and essence are not the same thing, and also suggests that essence cannot be defined in purely modal terms (see Fine 1994 for discussion of the non-modal conception of essence; see also Jaag 2014 who discusses these points in a critical discussion of dispositional essentialism). Nonetheless, even if grounding entities are not essentially dependent on that which they ground, there is a remaining question about whether there are essential dependences in the opposite direction, such that grounded entities are essentially dependent on the entities which ground them. If, for example, dispositions were essentially dependent on the properties that ground them, this would still leave us with an essentialist element in the theory. It is to this issue that we now turn.

8 Are grounded entities essentially dependent on their grounds?

Fine does indeed maintain that there is generally an essential connection in the other direction, such that grounded entities are essentially dependent on their grounds. For example, when discussing the Socrates example Fine claims that ‘it should somehow be part of the nature of singleton Socrates that its existence is to be determined in this way from the existence of Socrates’ (2015, p. 297). This form of ‘top-down’ essentialism about grounding has also been discussed by Dasgupta (2014) and Rosen (2010). If this form of top-down essentialism were to apply in the current case, it would mean that dispositions are essentially dependent on the properties that ground them. Of course, it would be implausible to think that the essence of a disposition is exhausted by the property (or properties) that ground it, because it is widely accepted that dispositions are metaphysically individuated by the manifestations that they are dispositions *for* (see e.g. Bird 2007, Ch. 6 and Lowe 2010).²⁰ Nonetheless, if dispositions were, in part, essentially dependent on the properties that ground them, this would leave us with an essentialism of sorts concerning the connection between dispositions and properties.

However, as I and others have argued elsewhere (see e.g. Bennett 2017, Ch. 7, Sect. 4, and Tugby forthcoming, Ch. 6, Sect. 7), this top-down essentialist view of grounding is problematic as a general thesis. Hence, in what follows I shall assume a view on which grounding is a more primitive affair. And importantly for current purposes, one of the implications of this view is that grounding is typically epistemically opaque. But first, let me say a little more about why I take top-down essentialism about grounding to be problematic.

One problem is that the Finean top-down essentialist claim would only be plausible in cases where the grounded entity is essentially constituted (at least in part) by that which grounds it. On this view, it seems that grounding entities would always be part of the *real definition* (i.e. real essence) of the grounded entity. In order for this

²⁰ For Bird (2007, Ch. 6), dispositions are also metaphysically individuated by the kind of stimulus that gives rise to the relevant manifestation.

top-down essentialist strategy to be applicable across the board, then, it would have to generally be the case that if ψ grounds ϕ , then ϕ is at least partly ontologically reducible to ψ . Let us call this principle the ‘Reduction–Grounding Link’. The problem is that this principle is implausibly strong, and it is also one that a grounding-based dispositional realist will be keen to reject.

Note, first, that the Reduction–Grounding Link is a manifestation of the more general thought that where there are metaphysically necessary connections, such connections must be explained in terms of the essential constitution of things. However, in recent grounding literature there are several grounding theories that are taken to be serious contenders but which provide counterexamples to the Reduction–Grounding Link. For this reason, it is difficult to see how top-down essentialist explanations can be delivered in such cases. Indeed, even Rosen himself acknowledges that there are plausible exceptions to grounding essentialism (2010, pp. 132–133). Consider, for example, a version of non-reductive physicalism on which physical states ground mental states (e.g. Schaffer 2017, 2021). Many physicalists deny that mental states are essentially connected to certain physical states, and for good reason: the real definitions of mental states seem to have nothing to do with their physical grounds. For example, the essences of thoughts arguably concern their intentional content rather than their physical grounds. Notice also that in our current context, in which we are trying to develop a grounding-based version of dispositional realism, it would be a bad result if we had to accept that dispositions were partly reducible to the grounding properties. This would shift the view more towards a version of categoricism, which as we saw earlier is typically regarded as a reductionist approach to dispositions (see e.g. Franklin 1986). Hence, the marriage of dispositional realism with a top-down essentialist view of grounding would surely be an unstable one.

I note that Dasgupta and other top-down grounding essentialists might deny that they are reductionists. ‘Reductionism’ is a slippery term, and as Dasgupta defines them, reductionists are those who think that grounding always has a physical ground (2014, p. 571). However, it is important to distinguish reductionism about *meta-grounding* (in Dasgupta’s sense) and reductionism about *grounded entities*. As explained above, reductionists in the current sense are those who accept that when one type of entity grounds another, the former partly essentially constitutes the latter. Dasgupta’s top-down ‘brute essentialism’ certainly seems to be reductionist in *that* sense.

The worry is, then, that the top-down essentialist account of grounding is only plausible if we rule out from the start the sorts of non-reductionist grounding theories described above. Fine (2012, p. 77) bites the bullet here, but tries to lessen the pain by suggesting that a version of, say, non-reductive physicalism remains available on which the physical *naturally* determines rather than *metaphysically* determines the mental. Nonetheless, the fact that a metaphysical grounding theory of the mental is precluded from the start is surely bad news. As we have already mentioned, many theorists take it that the connection between physical states or mental states (and in our case, properties and powers), is not merely that of natural determination but rather full-blown *metaphysical* determination. In short, metaphysicians with anti-Humean sympathies, in which group I include myself, have reason to be sceptical of top-down grounding essentialism.

My scepticism about the top-down essentialist approach to grounding does not rest only on the argument just outlined. Bennett and Audi discuss other reasons for scepticism (e.g. Bennett 2017: Sect. 7.4.4; Audi 2020): One of Bennett's arguments against the approach is that whatever metaphysically explains the fact that *a* metaphysically grounds *b* (or in her terminology what 'builds the building') must surely also explain *b*. But then the top-down theorist faces a problem, because 'the claim that *b* makes it the case that *a* builds *b* entails that *b* partly makes it the case that *b*' (Bennett 2017, p. 206). The irreflexivity of grounding explanations therefore appears to be violated.

In sum, there are good reasons for a grounding-based dispositional realist to resist the top-down essentialist theory of grounding. In the next section, we shall see what kind of grounding theory this leaves us with, and see why it allows the dispositional realist to deny that conceivability is a good guide to metaphysical possibility.

9 Grounding, conceivability and metaphysical possibility

As we have just seen, there are reasons for a grounding-based dispositional realist to deny that properties and dispositions are essentially connected, even though properties necessarily generate dispositions. Thus, grounding-based dispositional realists typically say that properties have a non-modal, *qualitative* essence (see Coates 2021, Kimpton-Nye 2021, and Tugby 2021, Sect. 3). Importantly, if properties like sphericity do not have a dispositional essence, then grounding theorists can agree with our assessment that we can genuinely conceive of situation in which the relevant properties are present but the dispositions in question are absent. We can coherently do this in certain cases because we can grasp the essence of a property independently of the dispositions that it partly or fully grounds. In the case of sphericity, for example, we can insist that the essence is geometrical rather than dispositional.

At the same time, the grounding-based dispositional realists will insist that the conceivability thought experiment does not show that a contingentist categorical theory of properties is correct, as Unger intended. The grounding theorists can still maintain that properties and dispositions are necessarily connected, by denying that positive conceivability is a good guide to metaphysical possibility. The reason why conceivability is not a good guide to possibility when it comes to grounding is that grounding relations are typically not epistemically transparent. For example, descriptions of grounds do not entail descriptions of the grounded (or vice versa).

On this point, I agree with Kimpton-Nye (2021) and also Schaffer (2017, 2021), who makes similar moves when developing grounding physicalism theory in the philosophy of mind. Cartesian dualists criticise physicalists on the basis that we can clearly conceive of physical brain states existing without mental states, which they take to be good evidence that physical brain states and mental states can exist without each other, contrary to the physicalist thesis. Schaffer argues, rightly in my view, that this is not a good argument against grounding physicalism. As we have already seen, a grounding theorist need not accept that mental states are part of the essence of physical states. Moreover, grounding is a theoretical *metaphysical* relation rather than a logical one, and therefore a grounding physicalist is not committed to the idea that descriptions of physical states entail descriptions of mental states. Thus,

it will hardly come as a surprise to a grounding theorist that we can coherently conceive of physical states existing without mental states. But it does not follow from this that there is not a metaphysically necessary connection between grounding states and the grounded states. At best, conceivability is only a guide to logical possibility; conceivability is not a good guide to metaphysical possibility because grounding relations are often opaque to us.

It is true that when the contemporary notion of grounding was first introduced, it was often assumed by prominent figures such as Kit Fine that grounding is epistemically transparent (see Trogdon 2013 for discussion). This is hardly surprising, given that many have taken there to be an essential connection (of one sort or another) between grounding entities and grounded entities. But as we have seen, the essentialist approach to grounding faces problems. Of course, we should still insist that grounding is explanatory, but we must be careful to distinguish explanation in the sense of metaphysical determination from explanation in the epistemically illuminating sense. While grounding always concerns the former kind of explanation, it does not always deliver on the latter (see Bennett 2017, p. 62).

Schaffer has also strengthened the case against grounding essentialism by showing that even the most common cases of grounding do not seem to be transparent on close inspection. To think of parts as being the grounds of wholes seems the most natural thing in the world, but even simple grounding claims involving mereology are far from transparent. As Schaffer points out, the thesis of nihilism, which denies that wholes exist at all, is a matter of substantive metaphysical dispute. And even if one denies nihilism, it is not transparent which parts should compose (i.e. ground) which wholes: 'Even given mereological universalism, the most that follows is that there is a fusion of the H, H, and O atoms. But for all classical mereology is concerned, that fusion could be a cabbage' (Schaffer 2017, p. 7). To use another example from Schaffer, it might seem obvious that the combination of two 5 kg masses necessarily generates a 10 kg mass, but this is only because we implicitly accept an underlying metaphysical principle, which is that mass is *additive* (2017, pp. 11–12).²¹ In general, grounds only metaphysically explain the grounded because such explanations are backed by these sorts of primitive metaphysical principles (see also Wilsch 2015).

Another way of expressing these points is that the methodology of grounding is *abductive* rather than *deductive* (Schaffer 2021). Grounding relations or lack thereof are not revealed merely through thinking about concepts or essences or by contemplating thought experiments involving things like spherical objects and inclines. Thus, we should not expect that conceivability is a good guide to possibility in cases involving theoretical relations like grounding.

For the same reasons, grounding-based dispositional realists have the resources for giving a plausible response to the conceivability objection: the scenario described in the previous section is indeed positively conceivable even though it is metaphysically impossible, and this is precisely what we should expect, if metaphysical grounding is often epistemically opaque. This shows that the grounding theory of dispositions has an advantage over pan-dispositionalism. Is this advantage significant? One might doubt that it is, given that, first and foremost, the grounding theory of dispositions

²¹ More precisely, mass is additive on a Newtonian conception.

and pan-dispositionalism are both metaphysical theories about properties rather than theories about what is or is not conceivable.²² However, in the course of our discussion we have seen how one cannot judge conceivability objections independently of the metaphysics. For example, we saw how Mumford's dispositionalist response to Unger implicitly rests on the metaphysical possibility of intrinsically finkable (or maskable) dispositions. Many have cast doubt on the coherence of such dispositions, however, including those who are otherwise sympathetic towards dispositionalism (see e.g. Handfield and Bird 2008). This example shows why the arguments concerning conceivability are treated with utmost seriousness in the literature on the metaphysics of dispositions. It is a significant result, therefore, to see that there is another way of dealing with the conceivability objections for dispositional realists. Rather than arguing that the alleged counterexamples are not genuinely conceivable, we can instead question the assumed link between conceivability and metaphysical possibility. In this section, we have seen how a recent, grounding-based theory of dispositions can support this new strategy. Given that the grounding theory of dispositions is relatively unexplored, it is significant to see that it can support a new – and in my view, plausible – response to what has traditionally been one of greatest challenges facing anti-Humean theories of dispositions.

Although we have only focused on one type of property in this paper, namely spatial properties, I take it there are good reasons to accept this grounding theory across the board: all natural properties are qualitative and they necessarily ground powers. The alternative would be to accept a grounding theory of dispositions in some cases but a dispositional essentialist account of properties in others. This would leave us with a disunified and inelegant form of dispositional realism. Moreover, I direct the reader to Jaag 2014 and Tugby 2021 where other general reasons are discussed for accepting grounding-based dispositional realism across the board rather than dispositional essentialism.

Nonetheless, Ellis (2002) for one has advocated a mixed view, on which some properties are essentially dispositional while others are not. In particular, Ellis finds it plausible that the fundamental properties of physics, such as electric charge, are pure dispositions. Williams (2011) calls this 'the argument from science' for dispositionalism. So, one might wonder whether the grounding theory really is plausible in the case of the fundamental properties. And unfortunately, it is difficult to see how conceivability arguments can have much to contribute to this debate about fundamental scientific properties. Given that properties like negative charge are purely theoretical, it is difficult to see how we can engage in the sort of experiential thinking that Unger describes in his discussion of conceivability. It is not surprising, therefore, that Unger focuses on the sorts of macroscopic properties, like sphericity, that are direct objects of our experience.

Fortunately, though, there are other arguments which show that the grounding theory delivers a plausible account of fundamental properties like negative charge, some of which I have developed elsewhere. To give one example: The dispositional essentialist conception of fundamental properties faces problems when it comes to explaining the status of latent, unmanifested dispositions. If a fundamental property

²² I am grateful to an anonymous referee for raising this point.

like electric charge is nothing more than a bare disposition, how does it exist during periods when it is not manifesting (see Psillos 2006 and Tugby [forthcoming](#), Ch. 5)? Call this the ‘argument from latent dispositions’. The danger is that latent unmanifested dispositions become ghostly existents that amount to nothing more than mere possibilities. Mumford describes the puzzle as follows:

To be a disposition is just to be directed towards some possible manifestation. To be an ungrounded disposition is to be so directed and nothing else. In particular, it is for there to be no microstructural basis to this directedness (what Molnar calls, and accepts, the missing reduction base). But if such a property is unbased, what in the world is it that is directed towards some possible manifestation? Such a property looks like no property at all. It is nothing more than the possibility of some future property, when there is a manifestation. An ungrounded disposition has no Being between manifestations and such manifestations need never be actualized. (Mumford in Molnar 2003, p. 15)

I do not have the space here to discuss this problem in detail (see Tugby [forthcoming](#), Ch. 5 for further details). I shall merely observe that the grounding theory of dispositions offers a straightforward solution: unmanifested dispositions are grounded in qualitative properties which are fully occurrent and actual.

10 How does the grounding theory of dispositions differ from categoricism?

Let us finish by briefly considering a possible complaint that pan-dispositionalists might raise against the grounding theory of dispositions. A potential worry is that the grounding theory moves so far away from essentialist pan-dispositionalism that it is really just a version of categoricism by another name. Hence, solving the conceivability problem by accepting the grounding theory amounts to giving the game away. For a start, on the grounding theory, dispositions arguably become non-fundamental. Grounded entities are typically said to be less fundamental than their grounds, and when discussing the grounding theory of dispositions elsewhere (2021), I openly accepted that dispositions are taken to be less fundamental than qualitative properties. In contrast, essentialist pan-dispositionalism embraces the idea that dispositions are part of the fundamental fabric of reality. To make matters worse, if grounding connections are underwritten by primitive metaphysical principles in the way that Schaffer suggests, then it seems that dispositions are generated by metaphysical laws of sorts, in just the same way that natural laws generate dispositions on most categoricism theories.²³

In reply, I concede that essentialist forms of pan-dispositionalism are in some respects further away from categoricism than the grounding theory. For that reason, some philosophers have denied that the grounding theory is in the ‘dispositionalist’ camp (e.g. Vetter 2021, Sect. 6.2). However, I believe that the grounding theory

²³ Again, I am grateful to an anonymous referee for raising this point.

outlined disagrees with categoricism on a sufficient number of fundamental issues to be regarded as being a different view. Indeed, the grounding theory even satisfies some non-standard definitions of pan-dispositionalism that are to be found in the literature (e.g. Bostock 2008, pp. 141–42; see footnote two of this paper).

First, we have assumed that grounding occurs with metaphysical necessity, which means that properties confer the same dispositional profiles in all possible worlds. This leaves us with a version of necessitarianism about natural laws, which is clearly in opposition to most categoricists, such as Armstrong (1997) and Lewis (2009), who are contingentists about the laws of nature. One of the implications of this, as Smith notes (2016, p. 241), is that the grounding-based dispositional realists reject the sorts of free recombination principles that typically underwrite Humean approaches to modality.

Perhaps more importantly, and as we observed earlier, the approach to grounding that we have favoured allows that dispositions are not reducible (in either the conceptual or metaphysical sense) to the properties that ground them. This is partly because we have rejected the Finean essentialist view of grounding, on which grounded entities are essentially constituted by their grounds.²⁴ However, prominent categoricists such as Lewis and Armstrong are generally regarded as providing a reductionist story about dispositions (see e.g. Franklin's 1986 debate with Armstrong, which he presents as a disagreement about the reduction of dispositions). Moreover, if dispositions are not reducible to their grounds, then the necessary grounding connections between properties and dispositions are likely to violate most versions of Hume's Dictum, which rejects metaphysically necessary connections between distinct entities.²⁵ Overall, then, the grounding theory of dispositions firmly opposes the Humean approaches to metaphysics that typically underlie categoricist theories.²⁶ Even if the grounding theory is not a version of pan-dispositionalism (as standardly conceived), the grounding theory is still a version of dispositional realism as we have defined it.

It has not been my aim here to offer a detailed development of the grounding theory of dispositions or to consider other objections that the theory might face. Such work has been undertaken elsewhere and I direct the reader to it (e.g. Coates 2021, Kimpton-Nye 2021, Tugby 2021 and forthcoming).²⁷ My aim in this paper, rather, has been to offer new support to the grounding theory, which is in its infancy. What we have tried to establish is that considerations surrounding conceivability provide good reasons for favouring a grounding approach to dispositional realism. Given that the conceivability objection is arguably the categoricists' strongest weapon, the

²⁴ An argument from Audi (2012) leads to a similar conclusion. If properties ground powers, this precludes us from thinking that dispositions are identical with the properties that ground them. Given that identity is reflexive, such identity would violate the irreflexivity of grounding (see Audi 2012, p. 110).

²⁵ More precisely, they are typically violated providing that the grounding theorist accepts (as I do) that dispositions are multiply realizable. For a detailed discussion of this issue, see Tugby 2021, Sect. 5.

²⁶ I note that although Vetter denies that the grounding theory is a version of dispositionalism (2021, Sect. 6.2), she agrees that the grounding theory is a broadly anti-Humean view.

²⁷ For example, an important objection concerns how it is that qualitative properties are eligible to be grounding dispositions, given that they have a non-modal essence. See Tugby 2021, Sect. 3, and Tugby forthcoming, Ch. 6, for responses.

grounding theory of dispositions is a new and attractive prospect for those who think that properties necessitate dispositions.

Acknowledgements This paper is a descendent of papers presented in the departmental research seminars at Trinity College Dublin and University of Glasgow, as well as the New Foundations of Dispositionalism Conference at the University of Exeter. I thank the audiences and organisers of those events: James Miller, Nathan Wildman, Lorenzo Azzano and Andrea Raimondi. Special thanks are due to Sam Kimpton-Nye and Stephen Mumford, with whom I have discussed the themes of this paper over the years. I am also grateful to Ben Young for the excellent proofreading work. Finally, I thank the anonymous referees and the editors of this topical collection, Lorenzo Azzano and Andrea Raimondi, for their support and very helpful comments.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Armstrong, D. M. (1997). *A world of states of affairs*. Cambridge: Cambridge University Press
- Audi, P. (2012). A clarification and defense of the notion of grounding. In F. Correia, & B. Schnieder (Eds.), *Metaphysical Grounding: Understanding the Structure of Reality* (pp. 101–121). Cambridge: Cambridge University Press
- Audi, P. (2020). Bennett on building. *Inquiry*, 63, 677–692
- Azzano, L. (2019). The question of realism for powers. *Synthese*, 196, 329–354
- Bennett, K. (2017). *Making Things Up*. Oxford: Oxford University Press
- Bird, A. (1998). Dispositions and antidotes. *The Philosophical Quarterly*, 48, 227–234
- Bird, A. (2003). Structural properties. In H. Lillehammer, & G. Rodriguez-Pereyra (Eds.), *Real Metaphysics* (pp. 155–168). London: Routledge
- Bird, A. (2007). *Nature's Metaphysics: Laws and Properties*. Oxford: Oxford University Press
- Bliss, R., & Trogon, K. (2014). Metaphysical grounding. *Stanford Encyclopedia of Philosophy*. <https://plato.stanford.edu/entries/grounding/>
- Bostock, S. (2008). In defense of pan-dispositionalism. *Metaphysica*, 9, 139–157
- Carruth, A. (2016). Powerful qualities, zombies and inconceivability. *The Philosophical Quarterly*, 66, 25–46
- Chalmers, D. (2002). Does conceivability entail possibility?. In T. Gendler, & J. Hawthorne (Eds.), *Conceivability and Possibility* (pp. 145–200). Oxford: Oxford University Press
- Choi, S. (2005). Do categorical ascriptions entail counterfactual conditionals? *The Philosophical Quarterly*, 55, 495–503
- Clarke, R. (2008). Intrinsic finks. *The Philosophical Quarterly*, 58, 512–518
- Coates, A. (2021). Making sense of powerful qualities. *Synthese*, 198, 8347–63
- Contessa, G. (2019). Powerful qualities or pure powers? *Metaphysica*, 20, 5–33
- Dasgupta, S. (2014). The possibility of physicalism. *Journal of Philosophy*, 111, 557–592
- Ellis, B. (2002). *The Philosophy of Nature: A Guide to the New Essentialism*. Chesham: Acumen Press
- Fine, K. (1994). Essence and modality. In J. Tomberlin (Ed.), *Philosophical Perspectives 8: Logic and Language* (pp. 1–16). Atascadero, CA: Ridgeview
- Fine, K. (2012). Guide to ground. In F. Correia and B. Schnieder (Eds.), *Metaphysical Grounding Understanding the Structure of Reality* (pp. 37–80). Cambridge: Cambridge University Press

- Fine, K. (2015). Unified foundations for essence and ground. *Journal of the American Philosophical Association*, 1, 296–311
- Franklin, J. (1986). Are dispositions reducible to categorical properties? *The Philosophical Quarterly*, 36, 62–64
- Giannotti, J. (2021). The identity theory of powers revised. *Erkenntnis*, 86, 603–21
- Handfield, T., & Bird, A. (2008). Dispositions, rules, and finks. *Philosophical Studies*, 140, 285–298
- Heil, J. (2003). *From an Ontological Point of View*. Oxford: Oxford University Press
- Heil, J. (2010). Powerful qualities. In A. Marmodoro (Ed.), *The Metaphysics of Powers: Their Grounding and their Manifestations* (pp. 58–72). Abingdon: Routledge
- Jaag, S. (2014). Dispositional essentialism and the grounding of natural modality. *Philosophers' Imprint*, 14, 1–21
- Jacobs, J. (2011). Powerful qualities, not pure powers. *The Monist*, 94, 81–102
- Kimpton-Nye, S. (2018). Common ground for laws and metaphysical modality. PhD Thesis, King's College London
- Kimpton-Nye, S. (2021). Reconsidering the dispositional essentialist canon. *Philosophical Studies*, 178, 3421–41
- Kittle, S. (2015). Powers opposed and intrinsic finks. *The Philosophical Quarterly*, 62, 372–380
- Kripke, S. (1980). *Naming and Necessity*. Cambridge, MA: Harvard University Press
- Lanao, X. (2018). The space of possibilities of dispositional essentialism. *Philosophical Studies*, 175, 2813–2839
- Leuenberger, S. (2014). Grounding and necessity. *Inquiry*, 57, 151–174
- Lewis, D. (2009). Ramseyan humility. In D. Braddon-Mitchell, & R. Nola (Eds.), *Conceptual Analysis and Philosophical Naturalism* (pp. 203–222). Cambridge MA: MIT Press
- Loar, B. (1990). Phenomenal states. In J. Tomberlin (Ed.), *Philosophical Perspectives* (4 vol., pp. 81–108). Northridge: Ridgeview
- Lowe, E. J. (2010). On the individuation of powers. In A. Marmodoro (Ed.), *The Metaphysics of Powers: Their Grounding and their Manifestations* (pp. 8–26). Abingdon: Routledge
- Martin, C. B. (1994). Dispositions and conditionals. *The Philosophical Quarterly*, 44, 1–8
- Martin, C. B. (2008). *The Mind in Nature*. Oxford: Oxford University Press
- Mellor, D. H. (1982). Counting corners correctly. *Analysis*, 42, 96–97
- Molnar, G. (2003). S. Mumford (Ed.), *Powers: A Study in Metaphysics*. Oxford: Oxford University Press
- Mumford, S. (2004). *Laws in Nature*. London: Routledge
- Mumford, S. (2007). Review of Unger: All the power in the world. *Journal of Philosophy*, 104, 424–431
- Mumford, S. (2010). No power in Unger's world. *Philosophy and Phenomenological Research*, 80, 476–483
- Prior, E. (1982). The dispositional / categorical distinction. *Analysis*, 42, 93–96
- Psillos, S. (2006). What do powers do when they are not manifested? *Philosophy and Phenomenological Research*, 72, 137–156
- Rosen, G. (2010). Metaphysical dependence: grounding and reduction. In B. Hale and A. Hoffmann (Eds.), *Modality: Metaphysics, Logic, and Epistemology* (pp. 109–136). Oxford: Oxford University Press
- Schaffer, J. (2005). Quiddistic knowledge. *Philosophical Studies*, 123, 1–32
- Schaffer, J. (2017). The ground between the gaps. *Philosophers' Imprint*, 17, 1–26
- Schaffer, J. (2021). Ground functionalism. In U. Kriegel (Ed.), *Oxford Studies in Philosophy of Mind*, Volume 1
- Schroer, R. (2018). Conceivability arguments, properties, and powers: A new defense of dispositionalism. *Journal of the American Philosophical Association*, 4, 352–370
- Shoemaker, S. (1998). Causation and metaphysical necessity. *Pacific Philosophical Quarterly*, 79, 59–77
- Shoemaker, S. (2003). Causality and properties. In his *Identity, Cause, and Mind*, 2nd edition, (pp. 206–33). Cambridge: Cambridge University Press. (First published in 1980, P. van Inwagen (Ed.), *Time and Cause: Essays Presented to Richard Taylor* (pp. 109–35). Dordrecht: Reidel Publishing Company.)
- Smith, D. (2016). Quid quidditism est? *Erkenntnis*, 81, 237–257
- Trogon, K. (2013). Grounding: necessary or contingent? *Pacific Philosophical Quarterly*, 94, 465–485
- Tugby, M. (2012). Rescuing dispositionalism from the ultimate problem: Reply to Barker and Smart. *Analysis*, 72, 723–730
- Tugby, M. (2016). On the reality of intrinsically finkable dispositions. *Philosophia*, 44, 623–631
- Tugby, M. (2021). Grounding: theories of powers. *Synthese*, 198, 11187–216
- Tugby, M. (forthcoming). *Putting Properties First: A Platonic Metaphysics for Natural Modality*. Oxford: Oxford University Press

- Unger, P. (2006). *All the Power in the World*. Oxford: Oxford University Press
- Unger, P. (2010). Reply to Stephen Mumford. *Philosophy and Phenomenological Research*, 80, 484–490
- Vahid, H. (2006). Conceivability and possibility: Chalmers on modal epistemology. *Philosophical Explorations*, 9, 243–260
- Vetter, B. (2021). Explanatory dispositionalism: what anti-Humeans should say. *Synthese*, 199, 2051–75
- Williams, N. E. (2011). Dispositions and the argument from science. *Australasian Journal of Philosophy*, 89, 71–90
- Wilsch, T. (2015). The nomological account of ground. *Philosophical Studies*, 172, 3293–3312
- Yates, D. (2018). Inverse functionalism and the individuation of powers. *Synthese*, 195, 4525–4550

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.