



# The Fundamentality of Fundamental Powers

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## Abstract

Dispositional essentialism is the view that all or many fundamental properties are essentially dispositional, or *powers*. The literature on the dispositional essence of powers is abundant. In contrast, the question of how to understand the fundamentality of fundamental powers has received scarce interest. Therefore, the fundamentality of powers stands in need of clarification. There are four main conceptions of the fundamental, namely as that which is (i) *metaphysically independent*; or (ii) *belonging to a minimally complete basis*; or (iii) *perfectly natural*; or (iv) *metaphysically primitive*. Here, I present and discuss each of these approaches from the viewpoint of dispositional essentialism. I show that (i) is incompatible with the metaphysics of powers and (ii)–(iv) have more drawbacks than merits. Therefore, my conclusion is that the dispositional essentialist should seek an alternative. Although I offer no positive account, I pave the way to more fruitful views by identifying the shortcoming of these unpromising options.

**Keywords** Dispositionalism · Powers · Essence · Fundamentality · Primitivism · Metaphysical dependence

## 1 Introduction

Dispositional essentialism is the view that many or all fundamental properties of our world are essentially dispositional (Bauer, 2013; Bird, 2007, 2012; Ellis, 2001; Ellis & Lierse, 1994; Marmodoro, 2020; Shoemaker, 1998; Swoyer, 1982; Yates, 2013). It lies in the nature of a dispositional property to bestow upon things that instantiate its distinctive dispositions and causal powers. For example, Bird says that “the real essence of some potency P includes a disposition to give some particular characteristic manifestation M in response to a characteristic stimulus S” (2007, p. 45). In a similar vein, Yates argues that “we must equate the dispositional essence of

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a property  $F$  with a set  $\varphi$  of dispositions such that for any property  $P$ , at any possible world,  $P$  bestows  $\varphi$  iff  $P=F$ " (2013, p 103.). Since dispositional properties empower their bearers in various ways, as it were, let us call them *powers*. Classic examples of powers are putative fundamental properties such as *charge*, *mass* and *spin*. On dispositional essentialism, instances of *charge* essentially bestow upon things that instantiate them certain dispositions. For example, by virtue of *having a certain charge*, an electron has the disposition to exert and experience a repulsive or attractive force on other charged particles.<sup>1</sup>

The advocates of dispositional essentialism argue that powers bring us an attractive package of benefits. For example, some defend the view that powers provide a ground for deriving laws of nature and modality (e.g., Bird, 2007; Vetter, 2015; Yates, 2013, 2015).<sup>2</sup> Here, I do not wish to assess the correctness of dispositional essentialism. Nor am I concerned with the question of how to spell out the dispositional nature of powers in precise terms. Much ink has been already spilt for (and against) the idea of fundamental properties with dispositional essences. However, very little has been said on how to understand the claim that powers are *fundamental*. This lacuna is quite surprising for a view which is, at its core, a fundamentality thesis. This paper aims to fill this gap.

Someone could demur that nothing relevant hangs on the fundamentality of fundamental powers. But this is a mistake; overlooking this question is problematic in more than way. There are various conceptions of the fundamental. Consequently, there are distinct ways to understand the thesis that powers are fundamental. I shall discuss four main conceptions of the fundamental, namely as that which is (i) *metaphysically independent*; or (ii) *belonging to a complete minimal basis*; or (iii) *perfectly natural*; or (iv) *metaphysically primitive*. I will show, under plausible assumptions, that dispositional essentialism is incompatible with (i), and (ii)–(iv) have more drawbacks than merits. Therefore, the dispositional essentialist should explore a different approach. In this paper, I do not aim to offer a positive theory of the fundamentality of fundamental powers. Instead, my goal is to pave the way to a more suitable framework by identifying the shortcomings of unpromising options (i)–(iv).

I shall proceed as follows. In the remainder of this section, I will lay out some preliminary assumptions and clarify the scope of this paper. In Section 2, I will discuss the fundamentality of powers *qua* metaphysical independence. In Section 3, I will do the same for the fundamental *qua* belonging to a complete minimal basis. In Section 4, I will discuss the fundamentality of powers in terms of perfect naturalness of these properties. In the same section, I shall distinguish between two flavours of perfect naturalness, which I shall call *Lewisian* and *Physical*, respectively. I will argue that the latter is a more promising option but nevertheless problematic. I will devote Section 5 to discuss the primitivist conception of the fundamental. In Section 6, I conclude by offering some comments on the shape that a better conception

<sup>1</sup> Some take powers to play certain nomic roles essentially. This claim can be understood in different ways. On a certain interpretation, it means that powers ground the derivation of laws of nature (Bird, 2007; Yates, 2013). Others take powers to have a nomic role in the sense of being definable in terms of suitable open sentences in the "Ramsified lawbook" of the world (e.g., Hawthorne 2001).

<sup>2</sup> For a discussion of this claim, see Barker, (2013), Vetter, (2012), Jaag, (2014) and Wang (2015).

of the fundamentality of powers should take in light of the discussion in the preceding sections.

A few preliminary remarks are needed. To begin with, let us distinguish between two senses of fundamentality: *absolute* and *relative*. An absolutely fundamental entity partakes in the very alphabet of being. The dispositional essentialist thesis is about the absolute fundamentality of powers. In the relative sense, fundamentality concerns the relations of “being more/less fundamental than” and “being equifundamental to”. Intuitively, for example, the particles that compose Hypatia are more fundamental than the philosopher. Again intuitively, an electron is equifundamental to another one. Unless specified otherwise, when I discuss the fundamentality of powers, I refer to the absolute sense of the notion.

The second remark is that, in discussing the conceptions (i)–(iv) of absolute fundamentality, I shall restrict my attention only to arguments and considerations that concern powers and dispositional essentialism directly. The question of how to characterize the fundamental has enjoyed a surge in popularity in contemporary metaphysics. Nowadays, the literature on this topic is vast and technical. Each of the conceptions that I will discuss has wider ramifications that extend well beyond the scope of this paper. My aim is not to adjudicate the best conception of fundamentality *tout court*. Rather, my aim is to show that standard conceptions of the fundamental do not fare well with dispositional essentialism. Methodologically speaking, we should not proceed by defending a theory of the fundamental over competing ones, and then attempt to match it with dispositional essentialism. Doing so would be putting the cart of fundamentality before the horse of powers. Instead, we should start with the thesis that fundamental properties are powers and then investigate which theory of the absolutely fundamental best captures it.

Third, I will remain flexible on the venerable question of whether powers are universals or tropes. Dispositional essentialism is available for both views. The following discussing can be easily amended for fitting either view.

Lastly, we should acknowledge an inevitable linguistic ambiguity. Talk of powers bestowing dispositions upon their bearers can misleadingly imply that the bestowal in question is some sort of *external relation* that a power bears to certain dispositions. But this understanding would mischaracterize the view. Powers have their dispositionality built-in. Talk of bestowal should be interpreted as a shorthand for saying that by virtue of a possessing a power, a thing has distinctive dispositions. To use the idiom of grounding, we could say that powers fully ground the dispositions of things that instantiate them.

Bearing these remarks in mind, let us move onto discussing whether the fundamentality of powers can be understood in terms of *metaphysical independence*.

## 2 Fundamental Powers *qua* Metaphysically Independent

A natural and popular way of thinking of the fundamental is *qua* metaphysical independence. On this view, an entity is absolutely fundamental just in case it does not metaphysically depend on anything else. This conception has an intuitive grip. It captures the idea that a fundamental entity is a basic building block

of reality by virtue of being metaphysically independent. As Bennett puts it, independence appears to be “the central aspect of our notion of fundamentality” (2017, p. 105).

Let us distinguish between two versions of metaphysical independence: *unrestricted* and *restricted*. Dispositional essentialism, I will contend, is incompatible with *unrestricted* metaphysical independence. By contrast, *restricted* metaphysical independence is indeed compatible but raises significant worries.

Let us consider *unrestricted* metaphysical independence (UMI) first. Adapted to the category of powers, we can formulate it as follows:

UMI: a power  $P$  is absolutely fundamental if and only if for every metaphysical dependence relation  $D$ , there is no property  $Q$  such that  $P$  metaphysically depends <sub>$D$</sub>  on  $Q$ .

If the dispositional essentialist were to adopt UMI, a power would be fundamental just in case it is unrestrictedly metaphysically independent from any other properties.<sup>3</sup> The list of metaphysical dependencies that can replace  $D$  is open-ended. Some of them are *grounding*, *existential dependence*, *essential dependence*, *realization*, perhaps *supervenience* and many more. As it happens, there is a dispute on whether metaphysical dependencies are unified or not (cf. Wilson, 2014). There is also a debate on whether they form a class of relations by virtue of sharing some distinctive features (cf. Bennett, 2017). For the purposes of this paper, we can set these questions aside. Instead let us ask: can the dispositional essentialist endorse UMI for characterizing the fundamentality of powers? The answer is negative.

The incompatibility of UMI with the thesis that powers are fundamental has two sources. The first has to do with the canonical view that metaphysically independent entities are *modally free*, in a sense to be clarified. The second concerns a plausible link, which I formulate below, that ties essence and dependence. Let us consider them in turn.

The view that metaphysically independent entities are fundamental is standardly associated with the view that fundamental entities are modally free, or recombining. For example, Bennett says “that modal recombining is frequently taken as a mark of fundamentality: if nothing else modally constrains  $b$ , then  $b$  is fundamental” (2017, p. 50). Let us say that two entities  $x$  and  $y$  are modally recombining if and only if any way  $x$  can be and any way  $y$  can be is a way for them to jointly be (Schaffer, 2010a, p. 352; Wang, 2016; Bennett, 2017, p. 190). One way to tweak this principle for the category of properties is as follows: a set of properties  $\Gamma$  is modally recombining if and only if any patterns of instantiation of the properties in  $\Gamma$  is possible. On the view that modal recombination is a fundamentality-marker, if a property is fundamental, then it must be modally free. Consequently, a fundamental power should be modally

<sup>3</sup> Someone could maintain a stronger version of UMI, according to which an absolutely fundamental property must be metaphysically independent <sub>$D$</sub>  from *anything else*. But this reading is overly strong: for example, no property could be absolutely fundamental if properties depend on their bearers.

free.<sup>4</sup> Here is the problem: powers *are not* modally recombinable. Therefore, they cannot be fundamental.

To see why they are not modally recombinable, we need to consider that powers are essentially connected with the dispositions they confer upon their bearers. As is now standard, this claim implies that powers are necessarily connected with the dispositions they confer upon their bearers: if P is a power and D is one of its associated dispositions, then in every possible world where P exists, P confers D upon its bearers.

Now consider the possibility that a fundamental power bestows upon its bearers other powers. If this is a genuine possibility, then it is not the case that all fundamental powers are modally recombinable. As it happens, this seems to be the case. Suppose that *charge* and *mass* are fundamental powers.<sup>5</sup> The dispositional essentialist would maintain that *charge* essentially bestows upon its bearers the disposition to exert attractive or repulsive forces as specified by Coulomb's Law. In massive bodies, such forces produce accelerations that are specified by Newton's Second Law. Take two particles: one with certain quantities of *charge* and *mass*  $q_1$  and  $m_1$ , the other with *charge* and *mass*  $q_2$  and  $m_2$ . The two particles experience a force that is directly proportional to the product of  $q_1$  and  $q_2$  and inversely proportional to the square of their separation. Since the two particles are massive, they accelerate in a way that is directly proportional to the force they experience and inversely proportional to their masses  $m_1$  and  $m_2$ . It seems that the essence of *charge* involves, in a sense that could be sharpened, *mass*: it is part of the nature of *charge* to dispose charged objects to exert and experience a force which in *massive bodies* produces certain accelerations. If *charge* and *mass* are essentially related, they are not modally recombinable. *Charge* and *mass* would be tied together in every possible world. So, not every possible way in which *charge* and *mass* could be is available. We hit trouble: if fundamental entities must be modally recombinable, then *charge* and *mass* would not be fundamental. This upshot is problematic because it violates our initial supposition that *charge* and *mass* are fundamental powers.

Someone could quibble about the previous example.<sup>6</sup> For instance, one could object that the connection between *mass* and *charge* is weaker than the pictured one. However, dispositional essentialists do hold that fundamental powers constitute a *network* (Bird, 2007, p. 174) or a *causal structure* (Yates, 2018, p. 4526) in which there are necessary connections between them. We can run the previous argument by picking out two fundamental powers that stand in the same network. These powers would not be modally recombinable. If UMI is supposed to entail modal freedom, then it is not compatible with dispositional essentialism: fundamental powers do not enjoy unlimited modal recombination.

<sup>4</sup> For a more detailed discussion of the link between metaphysical independence and modal freedom, see Wang, (2016).

<sup>5</sup> Yates, (2013, pp. 105–111) discusses a sophisticated version of this example, emphasizing the difficulties in reducing the essence of powers to their modal profile.

<sup>6</sup> There might be other ways to reconcile dispositional essentialism with UMI. For example, someone could attempt to implement Wildman's (2018) approach to contingent fundamentalia into dispositional essentialism. I leave the task of assessing this option to another work.

Perhaps someone can resist this objection by denying that UMI entails modal recombination. But even if we concede this point, UMI would be still incompatible with dispositional essentialism.

There is, in fact, another source of incompatibility between UMI and dispositional essentialism. On a widely accepted principle that links essence and dependence, if  $y$  figures in the essence of  $x$ , then  $x$  depends on  $y$  (Fine, 1994).<sup>7</sup> Since our focus is on properties, we can think of the variables as ranging over properties. Let us also say that a property  $P$  figures in the essence of a property  $Q$  if and only if  $P$  is one of the constituents of the propositions that express or specify the essence of  $Q$ .<sup>8</sup> The essence of powers encompasses the various dispositions that they bestow upon their bearers. Think again of the essence of *charge* which, quite plausibly, includes the disposition to produce electromagnetic fields. A tension between UMI and dispositional essentialism arises: if the essence of powers involves other properties, and *if we adopt the essence–dependence link*, then powers are dependent on the properties that figure in their essence (see Jaag, 2014 for a more technical treatment of this issue). Therefore, powers are not fundamental in the sense of UMI.

One way to defuse the previous objection is to reject the essence–dependence link. While this strategy is viable, it forces us to abandon a widely accepted connection between essence and dependence. This move is costly. So, we should avoid it if possible.

A manoeuvre that could allow the dispositional essentialist to preserve the idea that the fundamentality of powers should be understood *qua* metaphysical independence is to deny that powers are fundamental in the sense of being *unrestrictedly independent*. Instead, on this approach, powers are fundamental in a restricted sense of independence—that is, with respect to some privileged metaphysical dependency. Accordingly, we could replace UMI with RMI:

RMI: a power  $P$  is absolutely fundamental if and only if for some specific metaphysical dependence relation  $B$ , there is no property  $Q$  such that  $P$  depends <sub>$B$</sub>  on  $Q$ .

Unlike UMI, RMI is compatible with dispositional essentialism. It is sufficient that the specific  $B$ -relation is not the same that connects a power and the properties that figure in its essence. Let us use *essence-dependence* as a placeholder for this relation. Insofar the  $B$ -relation is not essence-dependence, and if essence-dependence does not subsume under it, RMI is a possible way for elucidating the

<sup>7</sup> Here, I do not wish to assess the correctness of such a principle. However, it is worth noting that it might demand some tweaking due to the possibility of “essential generators”. These are entities whose essence is to ground (or serve as a dependence base for) other entities. If  $x$  is an essential generator of  $y$ , it seems that  $y$  figures in the essence of  $x$  and  $y$  depends on  $x$  rather than the other way round. I leave to the reader the task to imagine a suitable example of essential generators.

<sup>8</sup> Wang, (2019) submits a similar principle. Kindred formulations appear in Fine, (1994) and (1995). For a discussion on the implications of this principle with respect to fundamental entities, see Wang, (2019) and Wilson, (2020).

dispositional essentialist thesis. On this reading, a power is absolutely fundamental just in case is B-independent.

Lamentably, the adoption of RMI raises a few worries for the dispositional essentialist. Four are quite pressing.

The first worry is that strategy is incomplete. In the absence of a target B-relation, it is hard to assess whether this RMI is indeed a suitable competitor for elucidating the fundamentality of powers.

The second worry concerns the distinctness between essence-dependence and candidate B-relations. The success of RMI demands that essence-dependence does not subsume under a target B-relation. That is, we need to make sure that being metaphysically independent<sub>B</sub> and being essentially independent do not amount to the same form of independence, either explicitly or implicitly. The challenge is to show that this can be done, and this is not an easy feat. Several candidates B-relations seems to be tightly connected to essence-dependence in a way that licenses the thought that if something is metaphysically independent<sub>B</sub>, it is also essentially independent. But powers are not essentially independent. Therefore, *per modus tollens*, they are not metaphysically independent<sub>B</sub> either. Admittedly, the evaluation of this conditional requires a case-by-case analysis which we cannot pursue here. So, the worry remains. Two notable examples will suffice to convey the flavour of this objection. Take existential dependence. One might be tempted to say that a power is fundamental just in case it is existentially independent. But the temptation must be resisted. If a power is existentially independent, then it must also be essentially independent. But because of the essential dependence of powers on the dispositions they confer upon their bearers, powers are not existentially independent. Now think of grounding. Someone else might hold that a power is fundamental just in case it is ungrounded. But the fact that a power is essentially dependent on its dispositional character strongly suggests that the dispositional character grounds, at least partially, facts about the power: the former accounts (at least partially) for the nature of the latter.<sup>9</sup>

The third worry is related to the previous one. We have no reason to assume that there will be only *one* B-relation which is suitably distinct from essence-dependence. Thus, the challenge is to justify the choice of a specific B-relation over other possible ones. There are many dependence relations that one property can bear to another. It may well be that the metaphysics of powers imposes some constraints on the list of candidates B-relations that are eligible for RMI. Thus, the options might be fewer than one could fear. Yet, for now, the problem remains.

The fourth worry is that two dispositional essentialists could accept RMI and yet disagree about the relevant B-relation. It seems that RMI has the methodologically unattractive consequence of permitting a clash of interpretations. The dispositional essentialist would face the question of whether different B-relations pick out non-overlapping notions of absolute fundamentality. If they do, then RMI is problematic:

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<sup>9</sup> This objection is more forceful if adopts believe in an intimate connection between grounding and essential dependence. For a discussion on this topic, see Fine, 2015 and Schnieder, 2020.

two B-relations might convey divergent readings of the dispositional essentialist thesis. If they do not, then it is unclear why we should posit a genuine distinction between candidate B-relations. As it stands, RMI leaves unclear the dispositional essentialist thesis.

None of the above worries suffices to establish that RMI is hopeless. But they provide the dispositional essentialist reasons for seeking an alternative. I shall return to RMI in Section 6. For now, let us consider another conception of the fundamental.

### 3 Fundamental Powers *qua* Belonging to a Minimally Complete Basis

Let us now turn to another popular view, which takes the fundamental to be that which belongs to a *minimally complete basis*.<sup>10</sup> What underlies this conception is the idea that fundamental entities provide us with a “blueprint of reality” (Schaffer, 2010b, p. 39). We can regard a minimally complete basis as a set of entities that “figure in a minimal basis on which all else supervenes” (Lewis, 2009, p. 205). The entities in the basis suffice to account for or determine everything else that exists. In this sense, the basis is both complete and minimal because none of its proper subsets is complete. The minimality requirement is meant to ensure that only the fundamental entities belong to the basis. The set of all entities, fundamental and non-fundamental, is complete but intuitively not minimal. Before discussing whether this conception can elucidate the fundamentality of powers, let me put forward three remarks.

First, minimal completeness of a basis is a world-relative affair. Accordingly, a minimally complete basis of a possible world  $w$  is the set of entities  $\Sigma$  whose members account for everything else at  $w$ . It is possible that  $\Sigma$  is not a minimally complete basis of other possible worlds.

Second, we may wish to add a *uniqueness* requirement. A uniquely minimally complete basis is such that no distinct basis is complete. Note that uniqueness is not a mandatory feature. As it happens, it is an open question whether there could be distinct minimally complete sets for the same possible world.<sup>11</sup> For the sake of simplicity, I will discuss this conception under the assumption of the uniqueness constraint. But I shall not argue against the possibility of multiple minimally complete bases.

Lastly, we should note that there are different ways to specify the sense in which the elements of a complete minimal basis account for everything else. For example, Lewis, (2009) appeals to supervenience. Leuenberger, (2019) talks of grounding base, and Bennett, (2017, p. 109) discusses this conception by having in mind an array of building relations. Here, we do not need to establish which notion in the

<sup>10</sup> This conception has been invoked in many discussions of the absolutely fundamental. For example, it can be found in Lewis, (1986, 2009), Sider, (2011), Paul, (2012) Jenkins, (2013) Tahko, (2014) and Bennett, (2017).

<sup>11</sup> For example, Tahko, (2018b) drops the requirement of uniqueness and discusses the possibility of several ontologically minimal descriptions, which are akin to minimally complete bases.



metaphysical toolkit is the best one for constructing, as it were, the elements that are not in the complete minimal basis.

Now, we can formulate this conception of fundamentality for the category of powers as follows.

**CMB Membership:** a power  $P$  is absolutely fundamental in a possible world  $w$  if and only if  $P$  belongs to the unique minimally complete basis of  $w$ .<sup>12</sup>

Is CMB Membership a good interpretation of the fundamentality of fundamental powers? On closer inspection, it does not seem so. But let us consider the merits of CMB Membership first.

If the dispositional essentialist adopts CMB Membership, then a power is fundamental (in a possible world) just in case it belongs to the unique minimally complete basis (of that world). *Charge*, *mass* and *spin* would be fundamental powers in our world if and only if they belong to its unique minimally complete basis. A clear advantage of CMB Membership over UMI (Section 2) is its compatibility with dispositional essentialism. In fact, CMB Membership does not demand that fundamental properties are metaphysically independent. CMB Membership also escapes the worry of selecting a privileged relation of metaphysical dependence that RMI faces (Section 2).<sup>13</sup>

Despite its initial appeal, however, CMB Membership raises two significant concerns that undermine its adoption.<sup>14</sup> One is more general and targets the direction of the analysis of fundamentality in terms of membership to a minimally complete basis. The other is more specific and appeals to plausible considerations about the nature of powers. Let us discuss these in turn.

The first worry is that belonging to a minimally complete basis is explanatorily posterior to being fundamental. To illustrate this claim, let us modify Bennett's flat world example to the case of powers (2017, p. 123). Imagine a possible "flat" world  $f$  where only two powers,  $P$  and  $Q$ , exist. Suppose also that  $P$  and  $Q$  are B-independent and thus fundamental under RMI (Section 2; assume that B escapes by *fiat* the problems discussed with RMI). Now consider that the minimally complete basis of  $f$  comprises both  $P$  and  $Q$ . Here is the worry:  $P$  and  $Q$  belong to  $f$ 's minimally complete basis *because* they are B-independent, and not the other way round. If  $P$  and  $Q$  were B-dependent on something else, they would not belong to  $f$ 's minimally complete basis. This strongly suggests that membership to a minimally complete basis

<sup>12</sup> If the uniqueness requirement is dropped, then there are two ways of interpreting CMB Membership. On a stronger reading,  $P$  is fundamental in  $w$  just in case it belongs to every minimally complete basis of  $w$ . On a weaker reading, it is sufficient that  $P$  belongs to one minimally complete basis of  $w$ . Arguably, the weak sense is too weak. But I shall not discuss this claim further.

<sup>13</sup> Of course, a relativized version of CMB Membership is available. For example, we could have a uniquely complete minimal basis for the set of entities that *ground* everything else in a certain world, and another that groups the set of entities that *compose* anything else in the same world. But these relativized versions are problematic. On the one hand, they weaken the idea of completeness; on the other, they face similar challenges to RMI.

<sup>14</sup> This conception of fundamentality raises more general worries. For an overview of some of these, see Bennett, (2017) and Tahko, (2018a). Here my focus is only on those problems that concern dispositional essentialism directly.

is, in some sense, derivative with respect to being fundamental. This makes the former unfit to analyse the latter.

The second worry concerns the metaphysical inseparability between the ontic dispositions that figure in the essence of a fundamental power and the power itself (for a discussion of a similar problem from an Aristotelian perspective, see Marmodoro, 2010, pp. 30–32). Under CMB Membership, these dispositions would be fundamental if they belonged to the minimally complete basis. The objection here is that not everything that figure in the essence of a power should be fundamental. The essence of a power may comprise other fundamental powers, but it may contain non-fundamental ontic properties as well. A good conception of the fundamentality of fundamental powers should permit this possibility.

Let me illustrate with an example. Suppose that the essence of a power includes various ontic dispositions that it bestows upon its bearers. Assume that some of them are non-fundamental. For instance, take *charge* and the disposition to produce an electromagnetic force in certain circumstances. The latter is plausibly non-fundamental for things that have it owe its possession to the fact that they instantiate determinates of *charge* (if the example is controversial, the reader is encouraged to pick a more suitable non-fundamental property). Since the dispositional essence of a power is, metaphysically speaking, inseparable from it, the ontic dispositions that figure in the essence of a power are inseparable from the power itself. One way to unpack this objection is to say that if an ontic disposition D figures in the dispositional essence of a power P, and if P belongs to a minimally complete basis, then so does D.<sup>15</sup> After all, a power without its dispositional essence is an incomplete entity at best (someone could deny that it is an entity *at all*). Grant for a moment that you are persuaded by this principle of inseparability. A pressing worry would arise: if the ontic dispositions that figure in the essence of a power belong to the same minimally complete basis, then CMB Membership renders them automatically fundamental. To use the previous example, both *charge* and the disposition to produce an electromagnetic force would be fundamental under CMB Membership. This result is problematic for it clashes with our stipulation that the disposition to produce an electromagnetic force *is not* fundamental.

The rejoinder could be that the ontic properties that appear in the essence of fundamental powers do not belong to the minimally complete basis. However, this response is problematic. The dispositions that powers bestow upon their bearers are constitutive of what powers *are* (e.g., Molnar, 2003, p. 60–61). A power stripped of its dispositionality is not a power. Note that this is not to say that we cannot *regard* or *conceive of* a power as undressed from its dispositional character (cf. Heil, 2003). For example, we can abstractly think of *charge* without attending the dispositions it bestows upon charged carriers. But this is nothing more than a mental operation of neglecting the dispositional character of *charge*. From an ontological viewpoint, *charge* does not exist independently from its dispositional essence.

Another rejoinder is that the properties that figure in the essence of a power are predicatory, non-ontic entities (e.g., Bird, 2016, pp. 362–363). For example,

<sup>15</sup> Although, of course, this is not to say that D is necessarily manifested for D's manifestation, like that of other typical dispositions, would occur only if certain circumstances are met.

one could maintain that when we say that a determinate of *charge* bestows upon a particle the disposition to produce an electromagnetic field when in motion, we are not ascribing to the particle another ontologically robust property. Rather, we are attributing a certain dispositional description, which reference (e.g., Bird, 2016) or truthmaker (e.g., Tugby, 2012) is the ontic determinate of *charge* in question. Such a parsimonious view would escape the problem of turning into fundamental the dispositions that figure in the essence of fundamental powers. Despite its initial plausibility, this strategy raises two difficulties that make it an unattractive option.

First, recall that a fundamental power may figure in the essence of other fundamental powers. Since they are fundamental, these powers should belong to a minimally complete basis. But if this is a genuine possibility, then not *all* properties that figure in the essence of a power are non-ontic. Thus, we need to find a principle for discerning between the ontic and non-ontic properties that figure in the essence of a power.

Second, we need to make sure that the principle—granted for a moment that we can find one—does not simply track the fundamental/non-fundamental distinction. We should not equate “being ontic” with “being fundamental”. This would make dispositional essentialism incompatible with views that adopt a *scientific conception* of sparse properties (Schaffer, 2004). On this view, ontic properties are still sparse. But there are more of them than just the fundamental ones. As it happens, this is the view that some dispositional essentialists endorse (e.g., Bird, 2007, 2016). The ontic/non-ontic criterion should leave this option on the table.

More generally, we should not rule out a priori the possibility that the essence of a power includes some ontic yet non-fundamental properties. We can imagine, for example, that the dispositional character of *charge* includes the non-fundamental ontic property Q, which may be a property that things have by virtue of being charged. If powers are inseparable from the ontic properties that figure in their dispositional character, both *charge* and Q belong to a complete minimal basis. Under CMB Membership, this is to say that both *charge* and Q are fundamental. This upshot violates the assumption that Q is *not* a fundamental property. To escape this worry, it seems that the dispositional essentialist should argue that only *some* ontic properties that appear in their dispositional essence can join powers in the minimally complete basis. However, this response raises two further concerns: one is that it is evidently ad hoc; the other is that *all* ontic properties, irrespective of whether they are powerful or not, that figure in the dispositional character of a power are constitutive of its essence. If we are persuaded by the inseparability between a power and the ontic properties that figure in its essential dispositional character, then *all* of them should belong to the same minimally complete basis if the power in question enjoys this privilege.

Overall, this approach is unpromising. If the dispositional essentialist aspires to preserve the possibility that some ontic properties that figure in the dispositional character of a power are not fundamental, then CMB Membership is not a good option.

#### 4 Fundamental Powers *qua* Perfectly Natural Properties

Another candidate view that might clarify the dispositional essentialist thesis defines the fundamental in terms of *perfect naturalness*. This view has been popularized by Lewis, who connects this notion with the concept of *sparseness* (1983, 1986, 2009). On Lewis's account, sparse properties are those that ground objective similarities among properties. As it happens, Lewis believes in a tight connection between perfect naturalness and belonging to a minimally complete basis. For example, he claims that perfectly natural properties are just enough to characterize "all things completely and without redundancy" (Lewis, 1986, p. 60). Two things are unclear about how Lewis regards the link between these views. One is whether perfectly natural properties form a minimally complete basis *because* they are perfectly natural or the opposite. The other is whether Lewis takes perfectly natural properties to be fundamental *because* they form a minimally complete set, or whether he takes perfectly natural properties to form a minimally complete basis *because* they are fundamental. Here I shall not attempt to adjudicate these exegetical matters for two reasons. First, my aim is not to shed light on what Lewis believed. Rather, my goal is to discuss a conception of the fundamental properties *qua* perfectly natural properties which has a Lewisian flavour but is not Lewis's very own. Second, there seems to be no contradiction in claiming that fundamental properties form a minimally complete basis while denying that these are perfectly natural. This strongly suggests that the two conceptions are amenable to separate treatment.

Perfectly natural properties are a privileged minority of sparse properties that Lewis regards as being fundamental:

[...] Fundamental properties are those that I have else called 'perfectly natural'. They are not at all disjunctive, or determinable, or negative. They render their instances perfectly similar in some respect. They are intrinsic; and all other intrinsic properties supervene on them. They are not conjunctive or structural. (2009, p. 204)<sup>16</sup>

We can formulate this conception of fundamentality as follows.

Lewisian Naturalness: a property P is absolutely fundamental if and only if P is a Lewisian perfectly natural property.<sup>17</sup>

The adjective 'Lewisian' demands an important clarification. It is a mistake to analyse perfectly natural properties in terms of their possession of the features cited in the above passages. That is, if a property is a Lewisian perfectly natural property, then it is intrinsic (non-disjunctive, non-determinable, etc.). But the opposite is not true. On Lewis's view, some properties are intrinsic and yet fail to be perfectly natural (1983, pp. 356–357). We should keep this in mind in what follows.

<sup>16</sup> For an extensive discussion on the theoretical role of naturalness, see Dorr and Hawthorne (2013).

<sup>17</sup> Lewisian Naturalness can be modified for other categories of entities. Since dispositional essentialism is a thesis about the fundamental of properties, the proposed formulation is handy as is.

Now let us ask: Is Lewisian Naturalness a good candidate for making sense of the fundamentality of fundamental powers?

It is tempting to answer positively. Powers ontologies are indeed primarily concerned with joint-carving sparse properties. In fact, some dispositional essentialists advocate the notion of sparseness openly. For example, Bird, (2007) explicitly formulates dispositional essentialism as a thesis about fundamental sparse properties. In a similar fashion, Bauer, (2013, p. 1) says that “dispositional essentialism maintains that all sparse properties are essentially dispositional or powerful. Sparse properties are the natural properties, including at least the fundamental properties, as Lewis, (1986, pp. 59–61) conceives them”. If we endorse Lewisian Naturalness, the dispositional essentialist thesis would state that all or many perfectly natural properties are powers.

Lewisian Naturalness has some important advantages over the conceptions of fundamentality that we discussed in the previous sections. To start, let us note that a power can be perfectly natural and yet dependent on its dispositional character. Nothing in the formulation of Lewisian Naturalness prevents such a possibility. Therefore, Lewisian Naturalness is preferable to UMI (Section 2).<sup>18</sup> Since Lewisian Naturalness is not a characterization of the fundamental in terms of metaphysical independence, it escapes the problem with RMI (Section 2).

Lewisian Naturalness is also preferable to the definition of fundamental properties in terms of CMB Membership. It is not automatically the case that *all* properties that figure in the essence of powers are fundamental; only perfectly natural properties would be. Of course, Lewisian Naturalness does not force us to reject the claim that the set of fundamental properties forms a minimally complete basis. But we must preserve the ontological primacy of powers over the ontic properties that figure in their dispositional character. To achieve this goal, we could hold that the fact that properties are fundamental because they are perfectly natural is explanatorily prior to the fact that they form a minimally complete basis.<sup>19</sup>

Overall, it seems that Lewisian Naturalness is a favourable candidate for elucidating the fundamentality of fundamental powers. Unfortunately, on closer examination, trouble is in store. Lewisian Naturalness faces an objection that targets dispositional essentialism specifically.

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<sup>18</sup> Perfectly natural powers would be essentially related to other perfectly natural powers, namely those who figure in their dispositional character. Therefore, there would be necessary connections among fundamental properties. Coincidentally, Lewis is a categoricist. Thus, he defends the opposite view. However, it is important to stress that Lewisian Naturalness *on its own* is silent with respect to the nature of properties. It is therefore available to dispositional essentialists as well as categoricists.

<sup>19</sup> It is of course possible that *some* properties that figure in the dispositional character of perfectly natural powers are themselves perfectly natural. These may be powers or not. Good news for dispositional essentialism if they are. If they are not, then a *stronger version* of dispositional essentialism according to which *all* fundamental properties are powers is under threat (this seems to be the view held by Marmodoro, 2020. Note, however, that Marmodoro’s metaphysics of powers is substantially different from the one discussed here). If the dispositional character of a power contains a non-powerful perfectly natural property P, then both this power and P are fundamental. Fortunately, this possibility, which seems to be indeed a genuine one, does not affect the *weaker* but more plausible version of dispositional essentialism that all *or* many fundamental properties are powers. This is the version under scrutiny here (e.g., Bird, 2007; Bird, 2016; Ellis & Lierse, 1994; Yates, 2013).

This objection concerns the claim “perfectly natural properties are intrinsic *ex officio*, and can never differ between duplicates” (Lewis, 1986, p. 163). If the dispositional essentialist adopts Lewisian Naturalness, then fundamental powers are perfectly natural. And if fundamental powers are perfectly natural, then they are intrinsic. But one can make the case that fundamental powers are not intrinsic. Therefore, they are not perfectly natural. This result undermines the suitability of Lewisian Naturalness in elucidating the dispositional essentialist thesis: if fundamental powers are not perfectly natural, they would not be fundamental either.

Here is an example to illustrate. Take *mass*, a putative fundamental power. Bauer, (2011) argues convincingly that current physics implies that *mass* is extrinsically grounded in the Higgs field that permeates all space (given Einstein’s equivalence, the following considerations apply both to inertial and gravitational mass). Particles, except for photons, that are immersed in the Higgs field become massive by virtue of acquiring potential energy. Bauer makes the case that particles that exist in a possible world without the Higgs field would be *mass*-less. Therefore, one could say that *mass* is not an intrinsic property of particles.

Other putative fundamental powers such as *charge* and *spin* seem to be extrinsic under certain physical considerations. In contemporary physics, symmetry groups play a central role. These are set of specific transformations that form mathematical groups and permit the derivation of particles and their properties. As it happens, *spin* can be identified via symmetry-based considerations as an invariant parameter under specific transformations of the Poincaré Group (like *spin*, also *mass* can be identified as an invariant under the same group). Symmetry-based considerations allow us to identify *charge* as an invariant under the action of specific transformations associated with the U(1) group. As Livanios (2010) argues, the fact that putative fundamental powers are derivable from symmetry groups gives us reason to think that these powers are dependent on them for either their identity or existence. The physical connection between powers and symmetry groups suggests that the former are plausibly extrinsically grounded in the latter. In a possible world *w* where the Poincaré Group and the U(1) do not exist, it is dubious whether *mass*, *spin* and *charge* exist. And even if we concede that these properties exist in a physically attenuated world like *w*, certainly they do not have the same features of our worldly *mass*, *spin* and *charge*. For example, they lack the feature of being invariant under the action of specific transformations associated with a certain symmetry group. Surely, dispositional essentialism should meet the requirement of empirical adequacy. Thus, if physics supports the view that fundamental properties are extrinsic, then the dispositional essentialist should adopt a conception of fundamentality that accommodates the possibility of extrinsic fundamental powers. To be clear, I acknowledge that the above considerations rely on ontologically charged interpretations of physical theory. Moreover, such considerations do not rule out that *some* fundamental powers are intrinsic. Rather they are meant to show that the perfect naturalness of powers is in tension with current physical theory if these must be intrinsic.

One way to respond to the extrinsicity objection is to invoke, as Lewis did in a footnote (1983, fn. 16 in p. 356), a distinction between *purely extrinsic properties* and *impurely extrinsic* ones. A purely extrinsic property is one which is never shared among perfectly natural duplicates of things. Instead, impurely extrinsic properties

can be sometimes shared. One can argue that physical theory merely shows that putative fundamental powers are impurely extrinsic. Duplication of things in possible worlds where the Higgs fields and the relevant symmetry groups exist safeguards the sharing of *mass*, *charge* and *spin*. However, the response does not solve the problem. Impurely extrinsic properties are still extrinsic. Perhaps one could argue for an impure notion of perfect naturalness, one which countenances impurely extrinsic properties as perfectly natural. But such a deviation from the original notion seems to be illegitimate. Lewis takes perfectly natural properties to never differ between duplicates. Contrary to Lewis's claim, impurely perfectly natural properties violate this principle. Thus the appeal to impurely extrinsic properties does not work if we wish to preserve the Lewisian notion of perfect naturalness.

The possibility of extrinsic fundamental powers suggests that Lewisian Naturalness cannot fit dispositional essentialism without some amendments. The characterization of perfectly natural properties could be modified to include possible extrinsic powers—granted that we acknowledge that the resulting notion is not Lewisian. Let us call this conception *Non-Lewisian Naturalness*. According to it, a power is fundamental if and only if it is a non-Lewisian perfectly natural property, where the latter can be intrinsic or extrinsic. Does this strategy solve the problem? Only partially.

Arguably, the dispositional essentialist should expand the scope of the notion of perfectly natural properties in a way that accommodates *every* feature that a fundamental power might have. We discussed the case of intrinsicity above. But we could imagine that some power is fundamental and yet has some other features that are inconsistent with both Lewisian and *non-Lewisian Naturalness*. For example, a dispositional essentialist could argue that fundamental powers are determinable (for a critical assessment of the possibility of fundamental determinables, see Wilson, 2012). In this case, we should replace *Non-Lewisian Naturalness* with *Non-Lewisian Naturalness\**, which permits us to hold that a perfectly natural property is determinable or determinate. But now suppose that some fundamental powers are disjunctive. Once again, we should revise *Non-Lewisian Naturalness\** in a way that admits also disjunctive fundamental powers. The same procedure should be invoked for other features that fundamental powers might possess. While nothing said here shows that fundamental powers are indeed determinables or disjunctive, these possibilities intuitively cast doubt on whether we are still defining the fundamentality of powers in terms of perfect naturalness. If we chip off features of perfectly natural properties, the worry is that the starting idea of naturalness gets lost along the way. Is there a preferable approach to adapt Lewisian Naturalness to fundamental powers? Luckily, the answer is positive.

A promising strategy is to argue that fundamental properties are only *some* natural properties, namely the ones posited only by fundamental physics. This interpretation is hinted at by Lewis himself. For example, he says that “physics has undertaken, whether or not ours is a world where the undertaking will succeed, is an inventory of the sparse properties of this-worldly things” (Lewis, 1986, p. 60). Accordingly, we can identify two conceptions of natural properties. For example, Schaffer, (2004) distinguishes between a *scientific* conception and a *fundamental* one. The former takes natural properties to be the one “invoked in the scientific understanding of the world” (Schaffer, 2004, pp. 92–93). The latter takes natural

properties to be “only those invoked by fundamental physics” (*ibid.*). To give two examples of *scientifically natural properties*, we can think of the property of *being leukopenic* and that of *being homodesmic* (these examples are from Bird, 2016, p. 355). Instead, *having a determinate mass*, *having a determinate charge* and *having a determinate spin* are examples of *fundamentally natural properties*. In a sense, the fundamentally natural properties are an elite (and proper) subset of the scientifically natural ones if the latter exist.

Acknowledging the distinction between two conceptions of natural properties is just the first step. The next one is to adopt a more liberal conception of fundamentally properties that does not impose any other constraints on the features of perfectly natural properties. To this end, one could hold that a necessary and sufficient condition for a property to be fundamentally natural property is to be posited by fundamental physics—without requiring the possession of any other specific features. Since the emerging conception of naturalness is different from the Lewisian one, let us call it *Physical Naturalness*.

**Physical Naturalness:** a power  $P$  is fundamental if and only if  $P$  is posited by fundamental physics.

As it happens, some dispositional essentialists have explicitly endorsed something in the vicinity of Physical Naturalness. For example, Yates takes dispositional essentialism to be a “claim about the properties of (ideal, completed, fundamental) science” (2013, p. 93). Elsewhere, in a similar fashion, he characterizes dispositional essentialism as the view that “at least some basic physical properties have at least partially causal or dispositional essences” (Yates, 2018, p. 4526), where a basic physical property is a “any simple, unrealized property that features in the laws of ideal completed physics” (*ibid.*).

To stress the difference between Physical Naturalness and the Lewisian conception, let us consider *mass*. Even if it were extrinsic, *mass* could be fundamental in the sense of Physical Naturalness. It suffices that *mass* is posited by fundamental physics. This conception does not require *mass* to be perfectly natural in the Lewisian sense. To generalize, Physical Naturalness can accommodate extrinsic fundamental powers.

The dispositional essentialist thesis reformulated in terms of Physical Naturalness would state that many or all properties posited by fundamental physics are powers. For analogous reasons that make Lewisian Naturalness a better option than the conceptions discussed previously, Physical Naturalness is preferable to UMI (Section 2), RMI (Section 2) and CMB Membership (Section 3). For reasons just highlighted, Physical Naturalness is also preferable to Lewisian Naturalness. It is tempting to believe that Physical Naturalness is the most promising conception of the absolute fundamentality of powers. However, attentive scrutiny reveals some complications that undermine the conjunction of Physical Naturalness and dispositional essentialism.

An initial worry is that Physical Naturalness runs into a Hempel-style’s dilemma that afflicts some theory-based conceptions of physicalism (Hempel, 1965; see also Crane & Mellor, 1990).



Here is one way to reconstruct the problem by adapting it to the case of properties. On the one hand, if we define physical properties by reference to *current* physics, then physicalism is false. On the other, if we define physical properties by reference to a *completed future* physics, then physicalism is trivial. The first horn makes physicalism false. We have reasons to believe that current physical properties will be supplanted by future ones. The second horn leaves us ignorant of what these physical properties are (worse yet, future physics might posit some mental properties). Both options cast doubts on defining the notion of a physical property via reference to physical theory.

Physical Naturalness suffers a somewhat akin problem. If we define fundamental powers in terms of those that are invoked by current physics, it is likely the case that these powers will not be fundamental in light of upcoming scientific developments. Instead, if we define fundamental powers in terms of those that will be included in a future completed physics, we cannot tell what they are.

The dispositional essentialist could respond that current physics gives us reasons to believe in fundamental powers, and this is sufficient for elucidating the fundamentality thesis of dispositional essentialism. Albeit plausible, this response is rather weak. A detractor of the view could argue that future physics will strip off the privilege of being fundamental from putative present-day physical powers. Any reasonable dispositional essentialist should grant that we cannot rule out this possibility. Likewise, we cannot be certain that a complete physics will contain any fundamental powers. On this strategy, dispositional essentialism is hostage to future physics.

Physical Naturalness prompts another objection that concerns a popular view about the structure of reality: *foundationalism*.<sup>20</sup> As I shall understand it, foundationalism is the view that reality has a fundamental level (for a critical discussion of this view, see Bliss, 2019).<sup>21</sup> If the dispositional essentialist accepts Physical Naturalness, and if Physical Naturalness refers to a complete physical theory, then this conception presupposes the truth of some form of foundationalism. This is so because if reality has no fundamental level, physics cannot be complete; for any putative fundamental physical level, there will be another, more fundamental one (Schrenk, 2009). Here is the problem for the dispositional essentialist: it is far obvious that physics supports foundationalism (e.g., Ladyman & Ross, 2007, pp. 66–130). Thus, the dispositional essentialist should not endorse a conception of fundamental powers that relies on its truth.

The dispositional essentialist, who is presumably tired of looking for alternatives, might rest content with Physical Naturalness. After all, this conception does better than UMI and RMI (Section 2) for it does not require that fundamental powers are metaphysically independent, absolutely or restrictedly. Like Lewisian Naturalness, Physical Naturalness escapes the worries that CMB Membership (Section 3) for it does not automatically render the ontic properties that figure in the dispositional

<sup>20</sup> One might quibble that this objection does not affect dispositional essentialism only. The complaint is legitimate. However, for reason that I will explain in the next section, it does undermine the package deal “dispositional essentialism + Physical Naturalness”.

<sup>21</sup> There are various ways to unpack foundationalism. Here this general formulation is sufficient. The rejection of foundationalism, namely the view that reality has no fundamental level is often called *infinetism*. I shall discuss how infinitism affects the dispositional essentialist thesis in the next section.

character of powers fundamental. Unlike Lewisian Naturalness, however, it has the advantage of permitting the possibility of extrinsic fundamental powers. Unfortunately, the dispositional essentialist who opts for Physical Naturalness cannot just ignore the Hempel-style's dilemma they face. And if the fundamentality of powers is to be understood with reference to a complete physical theory, this conception presumes problematically on the truth of foundationalism. Overall, it seems that even Physical Naturalness, which stands out among the conceptions of the discussed so far, encounters some significant challenges.

Let us ask this question *one more time*: is there any better conception of fundamentality for making sense of the dispositional essentialist thesis?

## 5 Fundamental Powers *qua* "All Powers God Had to Create"

The last conception of the fundamental I will discuss is the *primitivist* one. This section will argue that the primitivist framework does not fare any better than the views previously discussed. Like the other views, the primitivist conception can be motivated independently from dispositional essentialism (e.g., Wilson, 2014, 2016). Here I shall restrict my attention to considerations that are directly related to the fundamentality of powers.

On the primitivist conception, the fundamental does not stand in need of any relational metaphysical underpinning. As Wilson puts it, "[...] in any case, the fundamental should not be metaphysically characterized in negative terms or—indeed, in *any* other terms. The fundamental is, well, *fundamental*" (2014, p. 560). Rather "we should metaphysically characterize the fundamental in primitive, metaphysically neutral terms" (Wilson, 2016, p. 193). In the same spirit, Tahko says, about this view, that "fundamentality is itself primitive and not something that is fixed by the relevant chain of dependence" (2018b p. 238). Thus, the primitivist opposes any metaphysical definition of the fundamental, be it in positive or negative terms. Yet this approach does not preclude us from saying more about this notion. On the primitivist conception, the fundamental entities "play a role analogous to axioms in a theory—they are basic, they are 'all God had to create'" (Wilson, 2014, p. 560), and "it follows from what goings-on are fundamental at a world that these, individually or together, provide a ground for all goings-on at the world" (Wilson, 2016, p. 193).<sup>22</sup>

Someone might argue that this characterization is quite uninformative. The primitivist would reply that the claim that fundamental entities play a role analogous to axioms in a theory or are "all God had to create" captures an intuitive and commonly shared understanding of what it is to be absolutely fundamental.<sup>23</sup>

<sup>22</sup> When Wilson talks of ground here, she has in mind small-g grounding relations. Wilson argues against a unified, theoretically privileged notion of big-G grounding. See her 2014 and 2016 for a discussion against big-G Grounding.

<sup>23</sup> The theological metaphor enjoys some popularity in discussions of the fundamental. For example, it can be found in Kripke, (1980, p. 153), Schaffer, (2009, p. 351), Barnes, (2012, p. 876), Dasgupta, (2014, p. 14); Glazier, (2016, p. 35), Bliss, (2019, pp. 359–360).

If the dispositional essentialist were to adopt the primitivist conception, the fundamentality of powers cannot be reductively analysed in other terms. Powers are fundamental in the sense that they are properties that play a role analogous to axioms in a theory or are all the properties that God had to create in making our world.

Why should the dispositional essentialist be tempted to adopt the primitivist framework? An initial appeal of this conception is that it escapes *some* of the worries that the other views face. However, as I shall explain, the advantage is illusory; serious concerns persist.

Let us start with UMI and RMI (Section 2). Unlike UMI, the primitivist conception does not require the metaphysical independence of fundamental powers. It is fact compatible with the possibility that fundamental entities are mutually dependent or self-dependent (Wilson, 2014, p. 560). Likewise, the primitivist conception permits that an entity is fundamental and yet dependent on some other ones. Therefore, primitivism does not clash with dispositional essentialism: powers can be fundamental and yet dependent on the properties that figure in their dispositional character.

Unlike RMI, the primitivist approach does not face the challenge of finding and justifying a privileged form of metaphysical independence for characterizing the fundamental. The primitivist denies that the absolutely fundamental is defined in terms of *any* metaphysical independence. Therefore, the dispositional essentialist who embraces the primitivist conception would avoid this challenge as well.

Things get messy, however, when we turn to the problem that afflicts CMB Membership (Section 3). On CMB Membership, the inseparability of a power from its dispositional essence generates the worry that the ontic properties that figure in the latter are also fundamental. The primitivist framework incurs the same fate. The primitivist does not deny that the set of *fundamentalia* forms a minimally complete basis for describing everything else. For example, Wilson says explicitly that the fundamental entities form of “fundamental base” (2014, p. 560). What the primitivist denies is that properties are fundamental *because* they form a minimally complete basis. But it is unclear whether such a denial helps the primitivist. Suppose once again that you are persuaded by the metaphysical inseparability between a power and the ontic properties that figure in its essence. Now take the popular theological metaphor. If God can create the fundamental powers without their dispositional essence—thereby saving Himself some ontological work—then the problem evaporates. But if God must abide by the principle of metaphysical inseparability, as I am inclined to think, then the creation of powers also involves the creation of their dispositional essence. The ontic properties that figure in the dispositional essence of fundamental powers would be fundamental.

The primitivist could push back and argue that God needs not to accept the principle of inseparability. But now it seems that the conjunction of dispositional essentialism and the primitivist framework demands the commitment to a substantive view about the metaphysical omnipotence of God. And this is problematic: dispositional essentialism should not presume on the truth of any specific doctrine about God.

Fairly obviously, the primitivist could abandon the controversial theological metaphor and argue that it is possible for a power to be primitively fundamental without the ontic properties that figure in its dispositional entities being also fundamental. The rejoinder is that once we give up the inseparability between powers and

their dispositional essences, the former are stripped of their being. The dispositional essence of a power is constitutive of what it *is*. Without it, powers are too thin, metaphysically speaking, to do the required work in our theorizing. If this is correct, both powers and at least the ontic properties that figure in their essence must be taken as primitively fundamental. But this reiterates the problem that CMB Membership suffers.

Now let us consider the two flavours of fundamentality *qua* naturalness (Section 4): Lewisian and Physical. In contrast to Lewisian Naturalness, on the primitivist conception, powers do not need to be Lewisian perfectly natural properties to be fundamental. Thus, the primitivist can happily maintain that powers are fundamental and yet extrinsic. The same goes for other features that powers might have but perfectly natural properties could not. The primitivist conception is, therefore, preferable to Lewisian Naturalness.

The advantage, however, is lost when it comes to Physical Naturalness. The dispositional essentialist who adopts the primitivist approach avoids the Hempel-style's dilemma. The fundamentality of powers is not defined via reference to physical theory, whether contemporary or future. Consequently, the fundamentality of powers is set free from contingent developments of physics. Yet this seems to bring us a drawback: if powers are genuinely primitively fundamental, then there is nothing in virtue of which they are fundamental. But this leaves us in the dark about how to sort the properties we know to exist into those that are fundamental and those that are not. While they face the Hempel-style's dilemma, the advocate of Physical Naturalness gives us a criterion for distinguishing between fundamental and non-fundamental properties.

A related problem concerns foundationalism. Unlike Physical Naturalness, the primitivist framework does not assume the truth of foundationalism. But like Physical Naturalness, the primitivist framework does not handle the falsity of foundationalism well. If reality has no fundamental level, the chains of powers will descend infinitely without ever terminating. For every power P, there is another power Q such that P depends on Q. The problem is that no power is metaphysically fundamental in this sort of scenarios—primitively or otherwise. It seems that in such a scenario, either all powers are trivially fundamental or none of them is.<sup>24</sup>

Schaffer argues (2016, p. 158) that non-foundationalist scenarios are less problematic for someone who characterizes the fundamental relationally—namely, in terms of some relation of metaphysical dependence. This is because even if the chains of dependent powers do not terminate with absolutely fundamental powers, it could be possible to maintain that every power is *more fundamental than* the ones which depend on it. To use the previous example, Q would be more fundamental than P because P depends on Q. The primitivist who rejects a relational underpinning of the fundamental cannot adopt this strategy.<sup>25</sup>

<sup>24</sup> For a discussion of infinitism and its variants, see Bohn, (2018) and Morganti, (2018).

<sup>25</sup> See Wilson, (2016) for a more extensive discussion on how the primitivist can address Schaffer's objection; here I shall restrict my attention to the case of dispositional essentialism.

But a strategy in the vicinity is available to the primitivist: primitivism about *absolute fundamentality* does not entail primitivism about *relative fundamentality*. That is, the dispositional essentialist who adopts the primitivist conception of absolute fundamentality can argue that the relations of *being more/less fundamental than* and *being equifundamental to* (being as fundamental as) are indeed analysable in terms of other metaphysical notions. In this sense, the primitivist about absolute fundamentality can be a deflationist about relative fundamentality relations. This is good news because primitivism about relative fundamentality would amount to the unappealing view that there is nothing in virtue of which certain powers are more fundamental than others. For example, the dispositional essentialist could invoke a specific metaphysical relation of dependence, D, under which the following principle is true. Let us use ‘power-dependence’ as a placeholder for the most suitable *asymmetric* metaphysical relation that can replace D.<sup>26</sup>

(Power-Dependence  $\rightarrow$  MFT): if a power P is dependent<sub>D</sub> on a power Q, then Q is more fundamental than P.

(Power-Dependence  $\rightarrow$  MFT) offers a sufficient condition for a power to be more fundamental than another. Thus, it allows us to retrieve the priority of some powers over others. This is all good and well. But it does not help to deal with *infinetist scenarios* where reality has no fundamental level.

To begin with, we need to fix the absolutely fundamental powers to get (Power-Dependence  $\rightarrow$  MFT) off the ground. And if foundationalism is false, there are no absolutely fundamental powers. Instead, if all powers are trivially fundamental, then (Power-Dependence  $\rightarrow$  MFT) should be rejected. Arguably, if two powers P and Q are fundamental, then neither P is more fundamental than Q nor is Q more fundamental than P.

The primitivist could respond, as Wilson, (2016, p. 197) does, that there are two ways to recover a proxy fundamental base, which would allow us to fix the direction of priority, in infinitist scenarios. One strategy, which draws on Montero, (2006), is by considering a convergent fundamental level where non-fundamental entities depend on others. Like an infinite sequence of decreasing number is being still “bounded below” by zero, there could be an infinite descent of entities that approaches a limit whereby the limit acts as the fundamental level even though it is never reached. The dispositional essentialist could opt for a similar strategy: namely, to take the limit as the fundamental level of powers. The second strategy is to consider a level fundamental “when the archaeology of further dependence relations ceases to be relevant to priority relations at or “above” that level” (Wilson, 2016, p. 197). The idea is that there might be a level of entities that can act as a fundamental base for what lies above after a certain

<sup>26</sup> It is important to note that power-dependence should not be confused with what I call essence-dependence in Section 2. The two notions are distinct: power-dependence concerns the dependence of powers on other powers, essence-dependence concerns the dependence of powers on the ontic properties that figure in their dispositional characters.

point in the infinite chain. To use Wilson's example, we can hold that the physical level might operate as a fundamental level for the purposes of understanding priority relations among broadly scientific phenomena even if the physical level is not absolutely fundamental for it depends on other ones (Wilson, 2016, p. 198). In a similar fashion, the dispositional essentialist could say that there is a point in the infinite chain of powers that can act as a fundamental level for the powers that stand above.

Both strategies are available to the dispositional essentialist.<sup>27</sup> But both are problematic. They give us a way to make (Power-Dependence  $\rightarrow$  MFT) workable. But they clash with the idea that the fundamentality of powers is primitive. The properties at the proxy fundamental level are not metaphysically primitively. They merely act as such by virtue of playing a certain theoretical role. But this contradicts the primitivist tenet that the fundamentality of powers ought to be a metaphysically primitive affair. This solution is, therefore, ideologically problematic. Overall, it emerges that the primitivist framework cannot claim any major advantages over Physical Naturalness. It appears that also this view is not a good option for elucidating the fundamentality of fundamental powers.

## 6 The Road Ahead

I argued that four standard conceptions of the absolutely fundamental—as that which is metaphysically independent, or belonging to a minimally complete basis, or perfectly natural, or metaphysically primitive—are either incompatible with dispositional essentialism or have more drawbacks than merits. My conclusion is that the dispositional essentialist should seek a different approach to elucidate the fundamentality of fundamental powers. The immediate question is: which conception of the fundamental should the dispositional essentialist adopt? I do not have a positive theory to offer. However, we can draw some lessons from the discussion carried over so far.

It seems that a suitable conception that can claim to elucidate the fundamentality of fundamental powers must possess, minimally, three features:

- 1) It should be compatible with the fact that powers are essentially dependent on the ontic properties that figure in their essence.
- 2) All else being equal, it should be theoretically conservative: it should not violate the metaphysical inseparability between a power and its dispositional essence.
- 3) It should handle the possible falsity of foundationalism better than both Physical Naturalness and the primitivist framework.

<sup>27</sup> In the literature, there are other strategies to retrieve the fundamentality of certain entities in infinite chains of dependence. For example, Raven, (2016) appeals to the notion of *ineliminability* to characterize the fundamental entities. But this seems to be a non-primitivist approach. Tahko, (2014) suggests that if some elements of the infinite chains of dependence repeat themselves, they might provide a minimal ontological description of this chain. Insofar this approach does not count as a definition of absolute fundamentality, it is available to the primitivist.

I wish to conclude with a tentative suggestion. Perhaps, the dispositional essentialist should begin with a definition of the absolute fundamentality of powers in relational terms. For example, one could attempt to develop the view that a power  $P$  is absolutely fundamental if and only if there is nothing more fundamental than  $P$ . Then, one might couple this principle with (Power-Dependence  $\rightarrow$  MFT) or something akin. On the resulting view,  $P$  is absolutely fundamental if there is no power  $Q$  such that  $P$  is power-dependent upon  $Q$ . Of course, the attentive reader will immediately recognize that this is nothing but a version of UMI. So, it faces the worries I discussed in Section 2 (here I shall not repeat them). But in light of the previous discussion, these worries now appear to be more tractable than those that the other views face. If this were correct, the next task for the dispositional essentialist would be to find out the most suitable metaphysical notion to replace power-dependence—making sure that it does not subsume under the essential dependence of a power upon the ontic properties that figure in its dispositional essence. For now, we should agree on one thing: it is not a legitimate elucidation to say that powers are fundamental in the sense of being power-independent *whatever this means*. The dispositional essentialist owes us a rigorous explanation of what this claim means. Until then, the dispositional essentialist thesis will remain unclear.

As it happens, there is no agreement about the sense in which powers, as well as non-fundamental properties (including non-fundamental powers if they exist), can depend on fundamental powers. For example, Molnar, (2003, pp. 143–147) holds that some powers may be derivative in the sense that they ontologically depend on fundamental ones. However, ontological dependence is not a univocal notion. Rather it is a banner under which a family of diverse relations of ontological non-self-sufficiency gather (e.g., Correia, 2008). Thus, the dispositional essentialist must specify which of these relations, if any, should replace power-dependence. And they should provide some arguments for thinking that it is the relation that supersedes power-dependence and not that which replaces essence-dependence that takes us from derivative properties to fundamental powers. I will take on these challenges in a future companion piece.

## Declarations

**Conflict of Interest** On behalf of all authors, the corresponding author declares no competing interests.

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