Dated Truths Without Dated Powers

Giacomo Giannini & Donatella Donati

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ORIGINAL RESEARCH

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Giacomo Giannini[1] · Donatella Donati[2]

Abstract

Dispositionalism is the theory of modality according to which all (metaphysical and natural) modal truths are made true by some actual irreducibly dispositional property. The relationship between Dispositionalism and time is yet to be satisfactorily explored. In this paper we contribute to this task by examining how Dispositionalism deals with 'dated truths': propositions involving a specific time, e.g. "It might rain at 12.30". We examine two possible accounts: the first, 'Dated Manifestations Strategy', is the idea that powers are very fine-grained, and tend towards temporally very specific manifestations. We argue that such strategy should not be adopted, for it leads to unnecessary violations of ontological parsimony; it is unable to accommodate an ontology of platonic universals; and it is incapable of offering a principled explanation of the forward-looking nature of powers. We offer an alternative account, the "Duration Strategy", which relies on an independently determined arrow of time and the existence of some "duration facts" that specify how long a power takes to bring about its manifestation. We argue that the Duration Strategy is to be preferred. We then flesh out the account by exploring the connection between powers, duration facts, and processes.

✉ Giacomo Giannini
   giacomo.giannini2@gmail.com; giacomo.giannini@hhu.de

   Donatella Donati
   donatella.donati@univaq.it

1   Heinrich Heine University Düsseldorf, Düsseldorf, Germany

2   Department of Philosophy, Università degli Studi dell'Aquila, L'Aquila, Italy

1 Introduction

According to powers ontologies, at least some of the properties that populate the actual world are irreducibly dispositional.[1] This means that the world has a modal component at the fundamental level[2]: the actual dispositional properties of an entity fully and ultimately determine how that entity *could* be.

Powers are modal properties in two senses. Firstly, powers are modal properties in the sense that they are modally robust: it is metaphysically impossible for fragility to be directed to something other than shattering (Bird, 2016). This is because the identity of a power is fixed by what it is for.[3] Secondly, powers are modal properties because they have (nontrivial) modal consequences—they are the source of some modal facts, they can act as truthmakers for certain modal claims (Jacobs 2010; Vetter, 2015). The fact that the sugar cube is soluble, together with the fact that solubility is directed at dissolving, fully grounds the fact that the sugar cube could be dissolved. Or, to use our preferred formulation, the modal claim 'possibly, the sugar cube dissolves' is made true by the sugar cube's solubility.[4]

This second aspect of powers makes them attractive candidates for the role of building blocks of a systematic metaphysics, for it opens the prospect of grounding various modal phenomena, such as laws of nature, causation, counterfactuals, etc. upon powers (Vetter, 2020). Among these projects, the most ambitious is Dispositionalism. This is the theory according to which *all* metaphysical modal claims can be made true by actually existing powers: powers are the sole source of metaphysical modality. Henceforth, all references to modal notions and modal operators are to be read as referring to metaphysical modality—where this is commonly taken to be the maximal or broadest alethic modality (Rosen, 2006; Williamson, 2016; see Clarke-Doane, 2019 for some doubts about this characterisation) The view can be spelled out as follows:

DPoss: 'possibly *p*' is true iff and because there is some power whose manifestation, if it obtained, would make '*p*' true.

DNec: 'necessarily *p*' is true iff and because there is no power whose manifestation, if it obtained, would make 'not-*p*' true.

We think that Dispositionalism is a promising theory of modality and powers are a promising building block for a systematic metaphysics. However, powers theorists still have a long way to go. One of the *desiderata* that Dispositionalism needs to

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[1] In what follows, we will talk of dispositional properties, powers, and potentialities interchangeably.

[2] Or, if we don't want to exclude the possibility of infinite descent, that "for every disposition that is explained at all, every full explanation of that disposition has an extension which involves dispositions" (Vetter 2020: 2068).

[3] At least partially. It is controversial whether there's more to the identity of a power than its manifestation, like its stimulus condition or its degree. See Bird 2007; Vetter 2015; Yates 2018.

[4] It is controversial whether truthmaking just is grounding or it is a distinct dependence relation (see Correia & Schnieder 2012; Griffith 2014; Asay 2018; Audi 2020) and hence it is not immediately clear whether our preferred formulation is just a notational variant or is rather a substantively different way of cashing out Dispositionalism. For the purposes of this paper, nothing hangs on this choice: all the arguments can be reformulated in terms of facts and grounding without problems.

meet to qualify as a viable theory of modality is what Vetter (2015) calls the Extensional Correctness constraint. This is the task of showing how Dispositionalism can account for certain widely believed classes of modal truths.

We doubt there is a direct, a priori way to show that a theory meets Extensional Correctness — one has to check piecemeal whether a theory meets it. We will contribute to this task by offering an account of how Dispositionalism can handle a class of modal claims that has been largely overlooked in the literature, namely modal claims that refer to a specific time. We call these "dated truths". Examples of this sort of claims include:

1. Possibly, it rains on 01/05/2023 at 4.30
2. It is possible that the mug breaks at 11, but it's impossible that it breaks at 10.30
3. Necessarily, there will be a sea battle on 01/05/2023

This kind of modal truths plays a very important role in our lives, both practically and theoretically: it makes a big difference as to whether I'll catch the 4.40 train whether I can make it to the station by 4.39 or whether I can only get there at 4.41.

They also play an important role in scientific theorising: for example, many scientific concepts (e.g. half-lives of isotopes),[5] claims, and predictions do not just state that some state of affairs can or cannot obtain simpliciter, but whether it can obtain at a particular time. Indeed, many scientific predictions need to be temporally accurate if they are to be testable at all (e.g. the particle will be detected exactly at time *t*). The fact that it is possible that our current ecosystem could collapse in a million years leaves us quite indifferent; but if it were possible that the same happens in 2025, our reaction should be considerably different.

The purpose of investigating how Dispositionalism handles dated modal claims does not stop at simply ensuring that the theory meets the Extensional Correctness desideratum. The treatment of dated claims is connected to a variety of important debates, e.g. the possibility of backward causation for powers, time travel (Giannini & Donati, 2022), the open future, and more generally, with the relationship between powers and the metaphysics of time, which regrettably remains largely unexplored.[6]

The paper is structured as follows. We start in §1 by clarifying what class of claims we are interested in examining—that is, what we mean by 'dated claims'. Then, we will present two strategies that dispositionalists can adopt to account for dated truths: we call them the "Dated Manifestation Strategy" and the "Duration Strategy", respectively, and argue in favour of the latter. We outline the Dated Manifestation Strategy in §2. Then, in §3, we argue that dispositionalists should not readily embrace dated manifestations, by presenting three problems for the view. In §4, we introduce our preferred dispositionalist account of dated truths, the Duration

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[5] Thanks to an anonymous reviewer for the example.

[6] There has been some discussion about the best temporal ontology for powers: see Donati 2018; Backmann 2018; Friebe 2018; Giannini 2021. We do not think that issues of temporal ontology are particularly salient for the purposes of our arguments. We will follow Giannini (2021) and adopt an eternalist temporal ontology for Dispositionalism.

Strategy, and show how it is not plagued by any of the problems we raised for its competitor. Sections 5 and 6 are dedicated to further fleshing out and justifying the Duration Strategy, by showing that all the ingredients needed for it are legitimate and unproblematic. In §5, we focus on the two less problematic elements of the duration strategy: generic (non-dated) powers and the arrow of time. In §6, we focus on the core ingredient of our proposal, namely duration facts, and show how they can fit within the broader framework of powers ontologies. We conclude in §8.

2 What is a dated truth?

Let us be a bit more precise about the class of statements we are examining. Adopting an operator approach to tense (Correia & Rosenkranz, 2018) we can introduce non-metric tense operators such as "at t, φ", "at 01/05/2023, φ". The function of these operators is to shift the context of evaluation for the embedded claim p: "at t, p" means that the tensed sentence p is to be evaluated against the circumstances that obtained at time t, just like a claim of possible worlds theory of the form "at w, q" specifies what are the circumstances against which the truth of q is to be assessed (namely, possible world w). Thus, the sentence.

4.   At 01/05/2023, it rains

expresses that the (tensed) sentence "it rains" is to be evaluated against the circumstances that obtain on 01/05/2023; that is to say, that 01/05/2023 is a wet day.

When considering sentences that include both a temporal and a modal operator, we can differentiate between sentences where the modal operator has a wide scope and embeds the temporal operator,[7] such as.

5.   Possibly, at t, it rains

And sentences where it is the temporal operator that has a wide scope and embeds the modal operator, like.

6.   At t, possibly, it rains

The difference is that sentences where the modal operator has a wider scope and a narrow temporal scope, like 5., express the possibility that the rain be *located* at t. That is to say, they express that it is possible that t in particular is a wet day. On the other hand, sentences where the temporal operator has the wide scope, such as 6., indicate that at a certain time the whole possibility obtains: they do not specify *when* it could rain; they just say that if we take time t as context of evaluation, "possibly, it

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[7] Many thanks to an anonymous reviewer for their suggestions on how best to formulate this.

rains" is true — t is a day where it is *possible* that, in general, it rains, but of course this is compatible with it raining the following week.[8]

Both classes of truths are interesting for dispositionalists. Sentences with a temporal wide scope like 6. will be especially important to those who think that the truth value of possibility claims can change over time—for instance, that it was once possible for me to be a child prodigy, but now it is no longer possible (see Vetter, 2015: 186–194). Sentences where the modal operator has a wide scope, like 5., on the other hand, allow us to specify the temporal location of the state of affairs under discussion. When we talk of dated sentences and dated truths, it is this latter class of sentences that we will have in mind: we are primarily interested in sentences that tell us if Sunday is a wet day, and not just if Sunday is a day where it's in general possible that it rains.

Of course, one can always further compound the operators, and form sentences like.

7. At t, possibly, at t^*, it rains.

These allow one to easily express the idea that some dated claim was once true, but it no longer is—e.g. that on 1 June 2017, it was possible for Jeremy Corbyn to be prime minister on 20 June 2017, but on 10 June 2017, after the election results, it was no longer possible that he is prime minister on 20 June.

In this paper, for reasons of simplicity, we will mostly focus on simple dated claims — so, claims like 5. which are not, themselves, compounded in a further temporal operator. However, we will occasionally discuss more complex claims such as 7., when needed (see for instance §2.3).

3 The Dated Manifestation Strategy

There is a very straightforward way in which Dispositionalism can account for dated truths: in the same way in which it accounts for any other truths. Consider a "generic" claim and some of its dated counterparts.

8. Possibly, the sugar dissolves in water.
9. Possibly, the sugar dissolves in water on Thursday 22/06/2023.
10. Possibly, the sugar dissolves in water on Thursday 22/06/2023 at 12.03.

Dated truths are just propositions that are more temporally fine-grained (with considerable variation as to how fine grained they can be). Dispositionalism has it that modal truths are ultimately fully grounded in powers. Therefore, all we need to

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[8] Correia & Rosenkranz (2018: 4, fn 2) note this ambiguity, stating that "[the tense operator] construal of 'On May 10th' is not the only possible one. We may instead regard 'On May 10th' as a syncategorematic part of the predication which latter is accordingly taken to attribute a *relation* between [φ] and May 10th.".

do, in order to account for dated truths like (8) or (9), is to get specific, and invoke correspondingly temporally fine-grained powers.

The way in which powers can get suitably more specific is to pack more information in the *manifestation* of the power. According to the characterisation of Dispositionalism we have given above, a certain power P is the truthmaker of a claim 'possibly, *q*' iff the manifestation the power is directed at, M, would be the truthmaker of *q* if it obtained. So, if a power needs to make "possibly, the sugar cube dissolves in water on Thursday 22/06 at 12.03" true, it needs to have a manifestation that would make "the sugar dissolves in water on Thursday 22/06 at 12.03" true, were it to obtain. The obvious candidate is simply the property "dissolving on Thursday 22/06 at 12.03".[9] If we express "*x*'s potentiality to φ" as "POT[φ](*x*)", we can then offer the following truthmakers for the claims above:

M8) POT[dissolves in water](sugar).

M9) POT[dissolves in water on Thursday 22/06](sugar).

M10) POT[dissolves in water on Thursday 22/06 at 12.03](sugar).

In slogan form, the proposal can be summed up thus:

(DMS) Dated claims are made true by corresponding dated powers.

To clarify, what (DMS) is stating is that dated powers are the *ultimate* grounds for dated modal truths—that is to say, these dated powers are not in turn grounded in anything that is not a further dated power. So, we can accept that POT[dissolves in water on Thursday 22/06](sugar) is not a fundamental power, and is grounded in something else, e.g. facts about water molecules and their ionic bonds, etc. But, in keeping with DMS, the grounds of that dated potentiality will, in turn, be dated potentialities (for instance, dated potentialities of the molecules composing the sugar cube, and the particles composing those molecules and so on until we reach the fundamental level). In short: for every dated truth that is explained at all, every full explanation of that dated truth has an extension which involves dated powers (cf. Vetter, 2020: 2068).

We can get an even more fine-grained account if we recognise that also stimuli partially determine the identity of a power (Bird, 2007; see Vetter, 2015 for arguments against the view), for we could then distinguish between the following powers:

11. POT[is immersed in water on Wednesday 21/06, dissolves in water on Thursday 22/06](sugar).
12. POT[is immersed in water on Tuesday 20/06, dissolves in water on Thursday 22/06](sugar).

These extra fine-grained powers might come in handy when powers theorists need to account for 'doubly dated' counterfactuals of the form

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[9] Or the corresponding event (Taylor 2021) or state of affairs (Williams 2019).

13. Were the sugar to be dropped in water on Wednesday 21/06, it would dissolve on Thursday 22/06

But, for the purposes of the sort of dated claims we are currently interested in, all the relevant information is contained in the manifestation alone. Therefore, in what follows we will continue to speak only of 'dated manifestations' and not of 'dated stimuli & dated manifestations'.

Tempting as the Dated Manifestation strategy might seem, we don't think it is the right solution. There are three main reasons why we think it should be abandoned. We will dub them the Profligacy Worry, the Neutrality Worry, and the Explanatory Worry. Let's look at these in turn.

4 Three Worries for the Dated Manifestation Strategy

4.1 Profligacy Worry

There are a lot of dated truths out there. It is true that my sugar cube could dissolve at 10.03. It is also true that it could dissolve at 10.04, and at 10.05, etc. And this, of course, is still an incredibly coarse-grained way to illustrate the case. For each generic, undated sentences such as 'the sugar cube can dissolve' there must be as many correspondent dated claims as there are temporal points (which is quite a lot, especially if time is dense). If Dated Manifestation is the right account of dated truths, it follows that to each dated truth corresponds a specific dated manifestation and, of course, a corresponding power, for the identity of a power is at least partially determined by its manifestation.[10]

As a result, the Dated Manifestation Strategy incurs in heavy ontological costs — provided, of course, that we think that properties (or facts involving those properties) are to be counted in our inventory of what there is. Note that the Dated Manifestation Strategy might incur in these hefty ontological costs even if we think that only fundamental entities should not be multiplied without necessity (Cameron 2010; Schaffer 2015)—if there are dated truths about fundamental entities, powers theorists will have to posit fundamental dated powers to account for them.

4.2 The Neutrality Worry

The second worry is that the Dated Manifestation Strategy is inconsistent with some plausible views about the metaphysics of manifestations. In particular, it is

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[10] The multiplication of powers occurs even if we do not think that (unmanifested) manifestations need to be existents entities (Martin 2007; Molnar 2003). For, even if accept 'physical intentionality', it is still the case that there will be a power for each *specification* of the manifestation, even if the manifestation itself is not itself an entity.

inconsistent with the view that manifestations are Platonic universals. We characterise Platonic universals as follows:

(PU) A Platonic universal Q is an abstract entity, which exists necessarily and not in virtue of being instantiated.

Platonic Universals cannot be the manifestations of potentiality if Dated Manifestation is true. The gist of the argument is this: for Platonic universals to be dated entities (and therefore the appropriate manifestations of dated powers), they would have to refer to some (space)time point. That is to say, they would be properties such as "being broken at t_1", "being dissolved at t_2", etc. This means that their constitutive essence mentions points of (space)time: the property of being broken at 10.53 is the very entity that it is partially in virtue of the fact that it refers to 10.53 and not to another time. So, Platonic universals would not be modally and metaphysically independent of (space)time, and that conflicts with their characterisation as independent, abstract entities. There are two ways to make the argument more precise. The first relies on the assumption that spacetime is not a necessary existent, while Platonic universals are.

1. All manifestations of powers are Platonic universals (assumption)
2. Platonic universals are abstract necessary existents (PU).
3. There are dated truths (assumption)
4. Dated claims are made true by corresponding dated manifestations (DMS).
5. There are dated Platonic universals. (3,4).
6. Spacetime is a contingent existent (assumption)
7. It is possible that Platonic universals exist and spacetime does not (2, 6).
8. The reference to a specific point in time is part of the constitutive essence of the dated Platonic universal.
9. Necessarily, if x is part of y's essence, then x exists only if y exists.[11]
10. Therefore, it is metaphysically impossible that dated Platonic universals exist in a world without spacetime and it is metaphysically possible that they do (7, 9). ⨲

The second argument is very similar. Instead of relying on (6) the contingency of spacetime, however, it employs a stronger principle about essence than (9), defended among others by Fine (1995b) and Lowe (1998), namely:

Essence to Dependence: if x is part of y's essence, then y depends on x.

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[11] This is a fairly commonly accepted principle, but not universally: see in particular Fine (1995b) and Correia (2005: 52). However, if we accept the stronger Essence to Dependence principle discussed below, then we can derive premise (9) from the Dependence to Necessitation principle, $\forall x \forall y (x$ depends on $y \rightarrow (\exists z\ x=z \rightarrow \exists z\ z=y))$. Dependence to Necessitation has its critics, especially when concerning necessarily existent haecceitistic properties: see Fine (1995b) and Skiba (2022). Note, however, that in this case there are good reasons to think it holds. Skiba (2022: §5.4) argues that 'whether or not the dependence comes with necessitation hinges on the further question of whether or not the position occupied by the term b in the sentence A(b) is existence- demanding', that is to say, when the sentences in the scope of the essence operator are best treated as genuine predications (cf Williamson 2013: 156 ff). And this seems to be the case with regard to the essence of powers: it is very natural to read the 'is directed at M' embedded in the essence of a power as a genuine predication.

We can then run a similar argument to show that dated universals depend on spacetime points. We think that this would also unacceptable to the friend of Platonic universals. The usual characterisation of Platonic universals, expressed by (PU), states that they can exist uninstantiated, i.e. do not depend for their existence on there being an instantiation fact (Tugby, 2022). This, of course, is prima facie consistent with them being dependent upon something else—including, perhaps, spacetime points. However, we think that this would go against the spirit of the thesis, if not the letter of its standard contemporary formulation. The core intuition behind a Platonic conception of universals is that universals are what is real and fundamental, and as such are prior to particulars *tout court.* It's not only that they are independent of instantiation facts, but that they are independent of any particular whatsoever, be it contingent or necessary. A view according to which the haeccetistic Platonic universals of contingent particulars such as Socrates and Plato did not depend on their particular, but the universal of a necessarily existent particular did would be less uniform, and therefore less virtuous (Williamson, 2013), than one in which all haeccetistic universals are independent of their particulars. Universals could be dependent on other universals (as in the case of determinable/determinates), but not on particulars. And it's unlikely that a Platonist would think of spacetime points as universals (what could instantiate them?). Hence, we end up with the result that, given DMS, Platonic universals depend on some particular, and this should be unacceptable to the Platonist.

These are not knockdown arguments, and indeed the argument is the neutrality worry is the weakest among those we present against DMS. The friend of the Dated Manifestation Strategy could simply reject the principles about essence and dependence that we employed, or they can simply bite the bullet and claim that if DMS is inconsistent with Platonic universals, all the worse for Platonic universals.[12]

However, we think that the arguments above at least show that DMS is forced to make some potentially costly adjustments to their theory to deal with this worry— e.g. reject a strong candidate for the metaphysics of properties for powers[13] (Tugby, 2013, 2022) and thus renounce to neutrality with respect to that debate, or adopt somewhat controversial positions with regard to essence and dependence. We will argue that there is a more elegant solution—the Duration Strategy—which does not incur in these costs, and should therefore be preferred.

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[12] A reviewer has also helpfully suggested another solution, namely that we take the reference to spacetime points out of the manifestation, and that dated powers be characterised by the ordered pair of (dateless) manifestation, and a specific spacetime point or region: instead of having POT[M-at-t], we would have POT[<M, t>](x). Thus, manifestations would not be dated, and thus could be Platonic universals. However, *if* the spacetime point were to partially constitute the essence of the power, it would be inconsistent with *powers themselves* being Platonic universals. That is still a problematic result, but it is perhaps more promising, as it allows for more elbow room in escaping the neutrality worry (e.g. one might dispute that the date is not really essential to the power). It also bears some similarities to the solution we will present below in §6.

[13] Note however that the Dated Manifestation Strategy seems to fit very naturally with trope theory — especially if one spells out their identity conditions in terms of spatiotemporal location (Schaffer 2001).

4.3 Explanatory Worry

The final worry concerns the temporal direction of potentialities. Many friends of powers think that there is some general principle describing the temporal orientation of powers (Mumford & Anjum, 2011; Vetter, 2015). To keep things simple, let's assume for the time being that potentialities are forward-looking:

Forward Manifestations must obtain at a time after the activation of the potentiality.

Assuming that **Forward** is true and the Dated Manifestation Strategy is the correct account of dated truths, then it will be the case that *at t_1*, for some object *x*, and some action Φ, POT[Φ-at-t_2](*x*), POT[Φ-at-t_3], etc., while *at t_2*, *x* will have lost POT[Φ-at-t_2](*x*) and will have only retained POT[Φ-at-t_3](*x*), etc. Call this plurality of facts the "mosaic of dated potentialities".

This invites the question: what is the relationship between the mosaic of dated potentialities and **Forward**? One option is to say that the mosaic of dated potentialities is fundamental and grounds **Forward**, which is just a suitable generalisation of the particular distribution of dated powers. Of course, it is perfectly legitimate for a powers theorist to embrace a Best System account of laws, be they natural or metaphysical (Demarest, 2017; Kimpton-Nye, 2021, but see Friend 2023 for a critique). However, this comes with the cost of leaving a great number of unexplained, primitive facts about the appearance and disappearance of dated potentialities: there would be no further ground of justification to be given to the fact that *x* lost its potentiality to Φ-at-t_2 from t_2 onwards. The fact that the world is as regular as **Forward** describes it to be, would be nothing more than a gigantic, unexplained coincidence (Emery, 2019; Strawson, 1989). This mirrors a well-known bullet that Humeans have to bite (Hicks, 2021). Powers theorists are generally less inclined to find it acceptable to leave such global coincidences about the mosaic unexplained. Some of the attraction of powers metaphysics, we take it, lays precisely in the idea that only the *initial* distribution of powers is a primitive, brute fact (Vetter, 2015)—everything that comes afterwards, all the subsequent temporal slices of the mosaic, is explained by the action initial powers. But this would not work with regard to **Forward**. This option would be a somewhat awkward fit with powers metaphysics overall.

Alternatively, one might think that **Forward** *determines* the mosaic of dated potentialities: it is a sort of *governing* metaphysical law. This option is not much better, from the perspective of powers theorists, however. By maintaining that **Forward** determines the mosaic of dated potentialities, one raises the (metaphysical) analog of the governance and inference problems (Lewis, 1983; van Fraassen, 1989; Tugby 2016; Ioannidis et al., 2021), and therefore takes on the demand of a number of explanations: how are we to understand this relation of determination? How does **Forward** govern the mosaic of dated powers? Unlike the BSA-esque case above, non-Humeans generally think that these explanatory demands can be met and we can make sense of what it means for a law to govern (recent examples include Wilsch, 2021; Emery 2023). However, traditionally, friends of powers have been as suspicious of governing accounts of laws as they have been of full-blown Humeanism (Cartwright, 1999; Mumford, 2004). Indeed, one of the reasons why

non-Humeans might be attracted to powers metaphysics is that the theory allows for 'regularities [to] arise "from within" nature' (Hildebrand, 2020) and thus avoid the obligation to explain how it is that laws can govern.

Of course, this is not an argument against the view. It does nothing to establish that either these alternatives are not viable. However, it highlights that Dated Manifestation has a non-trivial explanatory burden to satisfy, and whose answers are somewhat in tension with the spirit of powers metaphysics. We will argue that there is an alternative account for dated truths which does not incur in comparable explanatory burdens, and that ceteris paribus it is preferable to adopt a theory with fewer explanatory burdens to discharge.

While none of these arguments, taken individually, represents a fatal blow to the Dated Manifestation Strategy, their cumulative weight is significant enough to encourage us to look for a better candidate.

5 The Duration Strategy

There is a better alternative account for dated truths, one that does not require dated manifestations. We call it the Duration Strategy. The proposal's central idea is that it takes some time for powers to bring about their effect (Mumford & Anjum, 2011: 122): there is a certain temporal gap between the activation of a power (or its stimulus) and its manifestation. If we couple this fact with an independent fact about how time passes, then we can establish what sort of dated truths a certain power can ground at the time of evaluation. That is to say, the gambit is to take the ground of the dated component of the dated claim out of the manifestation itself.

In order to make a dated claim true we will need three elements:

A. A power directed at some (suitably generic, non-dated) manifestation
B. The arrow of time
C. A duration fact: a fact that specifies how long it takes a certain power to bring about its manifestation since its activation

With these elements in place we can account for the truth of dated claims in a simple and straightforward manner. We want to establish whether M can obtain at t_n, (and so if 'possibly, at t_n, M is the case' is true). Say that there is a duration fact to the effect that P takes m time to bring about M and also that time is moving in a certain direction. Then, it will be possible that M obtains precisely at t_n if the relevant power, P, is instantiated exactly m time before t_n, i.e. at time $t^* = t_{n-m}$. If P is instantiated at a later time t^{**}, such that $t^{**} + m > t_n$, then it is not possible that M obtains at t_n. Thus, we get the truthmaker for a dated claim without saddling ourselves with a lot of hyper-specific manifestations, and related powers. If we add to the mix also the *date of activation* of the power, we can also ground the dated claim that *M will* obtain at time—provided, of course, that the power is not probabilistic and is not interfered with.

For example, 'the sugar can dissolve at 12.00' will be true iff the duration fact for the dissolution of the sugar is two minutes, and the sugar instantiates a generic power to dissolve at 11.58, and false if the sugar's solubility is only instantiated at 11.59 or later. If we add the fact that the sugar was actually immersed in water at 11.58, and so the power to dissolve was actually activated at that time, we can also conclude that the sugar *will* dissolve at 12.00 (assuming that the power is not probabilistic, and that no antidotes interfere) There is no need to attribute to the sugar cube all the ontologically costly time-specific powers (POT[dissolve-at-12.00], POT[dissolve-at-12.01], etc.).[14]

Here it is important to highlight a distinction drawn by Mumford and Anjum (2010: 109), namely between cases of *simultaneous* action of powers and *instantaneous* action of powers[15] (Mumford and Anjum provide a powers-based theory of causation, and so speak of causation in both cases). In their account, powers do not act alone, but only when they meet their 'mutual disposition partner' (Martin, 2007). When a power meets its disposition partner, it activates, that is, it commences a causal process which is, in some sense, the effect. Mumford and Anjum argue that such process begins as soon as the various disposition partners meet—there is no temporal gap between the encounter of a power with its partners and the commencement of its action, i.e. the unfolding of the process (more on this in §6). As soon as the sugar is immersed in water, it begins to dissolve. It is in this sense that they argue that the action of powers is simultaneous. However, they stress that the process that originates from the powers getting together might need time to unfold, and culminate in a particular state of affairs: it takes a while for the sugar to fully dissolve. This is why they deny that causation is *instantaneous*. Therefore, to be more precise, we should always talk about two duration facts: one concerning the temporal gap between the encounter of a power with its stimuli or disposition partners and the beginning of its action (call this the 'stimulus to action' gap), and one concerning the gap between the activation of the power and the obtaining of its manifestation proper (call this the 'action to manifestation' gap). The two duration facts are logically independent. Mumford and Anjum's view, for instance, is one where the stimulus to action gap is zero, but the action to manifestation gap is not. Our account would even allow for the bizarre case where both duration facts are zero, and thus action of powers is absolutely instantaneous, allowing for the metaphysical possibility of changing the present. However, for the sake of clarity, in what follows we will ignore this complication and only speak of a single duration fact.

We can sum up our proposal as follows:

(**DS**) Dated truths are made true by a combination of (dateless) powers, duration facts, and the arrow of time.

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[14] The final picture might be slightly more complex once we factor in iterated potentialities (Borghini & Williams 2008; Vetter 2015), i.e. potentialities that could bring about that the salt instantiates solubility at the right time. This greatly increases the range of (future) dated truths that can be true at a given time, and therefore is important for the purposes of meeting the extensional adequacy condition. However, in what follows, we will leave iterated potentialities aside, to avoid excessively cumbersome formulations. Many thanks for an anonymous reviewer for highlighting this point.

[15] Thanks to a reviewer for flagging this point.

The Duration Strategy does not suffer from any of the problems that we raised for the Dated Manifestation. The proposal is ontologically more parsimonious, for we don't need to invoke countless very fine-grained manifestations, and hence introduce as many extremely fine-grained dated powers. All we need is the generic, non-dated manifestation (dissolving; shattering, etc.) and the correspondingly coarse-grained power (solubility; fragility). We have no reason, then, to multiply entities beyond necessity. Of course, we will have to posit a number of duration facts; thus, one might fear the Duration Strategy might incur in comparable ontological costs. This will largely depend on one's account of duration facts. We present our proposal in §6, where we argue that duration facts are ontological free lunches.

Secondly, the account we offer is perfectly compatible with the adoption of any metaphysics of properties, including Platonic Universals. The problem we encountered with Platonic Universals was that, since they are abstract entities, they cannot make reference to specific points of space–time, and were therefore unfit to be dated manifestations. But, according to the Duration strategy, manifestations need not be dated in order for their powers to act as truthmakers for dated sentences. Thus, there is nothing especially problematic under this regard for Platonic Universals—we can be neutral as to the metaphysics of manifestations.

Finally, the duration strategy has an easy time dealing with the explanatory burden of linking **Forward** with the mosaic of dated truths, and allows us to re-frame debates about the temporal orientation of powers in a simple and clear manner. **Forward** can be grounded on (i) the fact that powers take some time to bring about their manifestations and (ii) the (extrinsic) fact that the arrow of time moves in a certain direction. The principle does not need to determine or govern the mosaic of dated powers in order to explain the pattern of dated truths—indeed, there is no need for a mosaic of dated powers to begin with, since there are no dated powers! All there is, is the pattern of dated truths, which we can easily explain: 'the sugar cube can dissolve at 9' was true at 8 and false at 8.59 because, while the sugar cube has not lost or gained any powers, the direction of time and duration facts dictate that the manifestation can only be m instants in the future of the power's activation. If the duration fact for the solubility is longer than one minute, then of course at 8.59, the sugar won't be able to be dissolved by 9.

The Duration Strategy also allows us to reduce the debates about the temporal orientation of powers to other, better understood issues, i.e. to the direction of time's arrow. For instance, to reject **Forward** one would have to deny that powers take some time to bring about their manifestation (so that manifestations would be simultaneous to their activation date) or could contest the assumed direction of time's arrow: if the arrow of time was moving the other way or was not linear, then powers wouldn't all be forward facing. Disagreement about the forward-looking nature of powers just is a disagreement about the direction of time.

6 The Elements of the Duration Strategy

We've argued that the Duration Strategy fares better than the Dated Manifestation Strategy. But for **DS** to be a viable account, we need to make sure that all the elements required are kosher.

Condition (A), namely that a power be directed at some (suitably generic, non-dated) manifestation, is trivial. It is compatible with all metaphysics of properties, and all accounts of Dispositionalism that have thus far disregarded dated truths have been employing these more rough-grained powers.

Condition (B) is also relatively unproblematic. Powers theorists can adopt a variety of views about the direction of time: for instance, they can simply posit it as a primitive (Maudlin, 2007, Loew 2018), or reduce it to something more fundamental that does not involve dated powers, e.g. the increasing entropy's gradient (Dowe, 1992; Loewer, 2012). To see how powers theorists can adopt the latter strategy, consider that the reduction to entropy requires two elements: the fact that the entropy gradient of systems not in equilibrium tends to increase (in accordance to the second law of thermodynamics or the statistical mechanical laws that ground it) and the 'Past Hypothesis'—that is, the empirical hypothesis that the entropy gradient of the universe right after the big bang was incredibly low. Neither of these are problematic for the power theorist (Albert, 2015: 64). The Past Hypothesis is as acceptable to the power theorist as it is for the Humean; as for the dynamical laws, anti-Humeans can say that the fundamental dynamical laws are grounded in the dispositional properties of the micro-entities.[16]

Note that so far we have operated under the assumption that the fact that a power is instantiated is sufficient to ground the corresponding metaphysical modal truth—it does not require, for instance, also the existence of a stimulus. This relies on the tacit assumption that the existence of a power P at some time t fully grounds the possibility that P is activated at t. But we might want to resist this idea, and adopt a more demanding powers theory of modality, which also requires the existence of something else that makes it possible for a power to be activated (and therefore eventually bring about its manifestation): most commonly, the existence of some suitable stimulus, or even more demandingly, that it be possible for stimuli to interact with the power. In this case, the Duration Strategy would have to be suitably adjusted; we would also need to posit the existence of the stimulus at the right time, or that at that time it is possible for the stimulus to interact with the power, and add a further duration fact — namely, how long it takes for the stimulus to activate the power — covering the stimulus to action gap discussed in the previous section.

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[16] One might be worried that to make sense of the *increase* in entropy, one will need to invoke dated manifestation, thus creating a vicious regress or circularity. But this is not the case: the increase in entropy can be explained invoking the dynamical laws of statistical mechanics, which are time-reversal invariant. So, they can be grounded in powers that are not time-directed, and whose manifestations are not dated. Therefore, there is no risk of regress of circularity. Thanks to Matt Tugby for raising this point.

7 Getting Duration Facts From Powers

The crucial components of the duration strategy are duration facts. In order to properly assess the proposal, more details about them are needed. Unfortunately, a systematic exploration of the logical space for duration facts goes beyond the scope of this paper. In this section, we will limit ourselves to sketch one way to understand duration facts and their place in a powers ontology, as a way of illustration. We do not intend to suggest that this is the only possible or best account of duration facts. The main point we aim to establish in this paper is to argue for the Duration Strategy for dated truths; the particular account of duration facts we offer is meant as an example of how the duration strategy can be fleshed out (one which we find attractive for independent reasons), but the latter is quite independent of the particular account of duration facts we offer below.

The central idea of the proposal is that duration facts are *indirectly tied to the essence of powers*. The intermediaries between powers and duration facts are *processes,* which are essentially tied with both powers and duration facts. Thus, our account consists of two steps: first, linking powers with processes; second, linking processes to duration facts. We call this the 'Process Proposal'.

The first step is to link powers and processes. The idea fits with a tradition in the powers literature according to which there is a close connection between powers and a process metaphysics (see Mumford 2009; Mumford & Anjum, 2011; Fischer, 2018; Meincke, 2020; Giannini, 2021). In particular, we propose that processes are the link between powers and their manifestations.[17]

Nancy Cartwright (1999; 2017; Cartwright & Pemberton, 2013) has forcefully argued for a distinction between the *obtaining* of a power and its *exercising*. The former term refers to what the power is ultimately for, the property, event, or state of affairs, that is the ultimate result of the action of a power: being broken, being dissolved, etc. For the sake of terminological clarity, we will reserve the term "manifestation(s)" to these entities. The exercising of a power, on the other hand, is the contribution the power makes to the end-result: the work it does to bring the manifestation about, which can occur even if, for some reason, ultimately the manifestation does not obtain. We find it natural to think of the exercising of a power as the *process* which culminates (if everything else works out fine) in the instantiation of that property, or the obtaining of that state of affairs that is the manifestation proper: the process of breaking which culminates in the shattered vase, the process

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[17] This is a substantial commitment: it might not fit with more lightweight theories of powers, such as Vetter's.

of dissolving which culminates in the solved sugar, etc.[18] As Vetter (2013) notes, the same manifestation can be brought about via different processes:

A fragile glass may manifest its fragility in breaking upon being hit with a spoon, being dropped onto the floor, being sung to by a soprano, or being subjected to pressure over a period of time. Fragile parchments break upon being merely touched, and a fragile old wooden chair may split when transferred into a different temperature (Vetter, 2013: 335).

This is a very heterogeneous list of physical processes, and we think that a theory of powers should be sensitive to their difference. Hence, we propose that the identity conditions of powers not only include their manifestations (or their manifestations plus stimuli, if we go for a Bird-style view), but also its exercising. That is to say, there is a specific telic process linking power with its manifestation that needs to be acknowledged. Crucially, the kind of process linking powers and their manifestations—the nature of the exercising of a power—is as much part of the essence of a power as its manifestation. What sort of process starts to unfold when a power is activated is constitutive of what it is to be that very power as much as what the powers is ultimately aiming to. That is to say, if powers P and P* both bring about the same manifestation, M, but do so through very different processes, then we should maintain that P and P* are distinct powers. The power to break (by being transferred into a different temperature) need not be the same as the power to break (by being sung at by a soprano).

So, we are suggesting that the essences of powers are more complex than what people usually think (see Giannini, 2021 and Fischer, 2018 for somewhat similar proposals): they do not only make reference to the manifestation, but also to the exercising. In short, we propose to replace this one-variable schema for identity conditions for powers.

(V1) P directed to M.

With a richer one, containing an additional variable:

(V2) P directed to M via Φing.[19]

Of course, this will mean that powers are a bit more fine-grained, and parchments and champagne glasses do not really share the same property, if they lead to breaking via different processes — one will be fragile$_1$ and the other will be fragile$_2$. We acknowledge that this seems to violate our intuitions: surely parchments and champagne glasses are both fragile, full stop. Here we have to bite the bullet, and simply

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[18] One might wonder whether this picture is still consistent with the view that the manifestations of powers are abstract Platonic universals. The solution is to think that powers are directed at Platonic universals, in the sense that the identity of the power is determined by the universal. However, what the causal process really brings about is the *instantiation* of the universal. Platonic universals and instantiations cannot be identical, because the former are abstract and the latter are concrete. Nevertheless, they must stand in a tight enough relationship, so that the universal is explanatorily relevant for the instantiation, and so one will be able to say that the power successfully manifested when it brought about the instantiation of the relevant universal. Crucially, any Platonist will have a story to tell here about the relation of universals with their instances, which they will be able to plug in also here (see for example Tugby 2022, ch. 7).

[19] In keeping with Vetter's formalisation that we have adopted so far, instead of saying POT[M](x), we ought to say POT[M]{Φing}(x).

accept that our intuitions are wrong. However we can soften the blown by appealing to pragmatic considerations: in most everyday contexts, we do not need to be very precise—so, we can concede that in such contexts, "fragile" refers to a plurality of properties, namely all those that have the right manifestation, and thus we ignore the differences in the processes that bring about the manifestation.[20]

The second step is to connect processes with duration facts. Again, the proposed connection is an essential one—therefore, the link is also necessary.[21] The move is to maintain that the time that it takes for a telic process to unfold and culminate in the obtaining of its end-state is part of the essence or nature of the process. That is to say, by specifying what process links P to M, we also specify how long it takes for it to unfold and bring about its telos. How long Φ-ing takes to unfold is part of one's understanding of what kind of process Φ-ing is. And this just is the required duration fact: the duration fact is an ontological free lunch, given the fact that it is essential to a process that it takes *n* time to unfold.

This second step might seem problematic.[22] Surely, in different circumstances where the same power is acting, the process will take more or less time, depending on the external environment: the very same solubility will sometimes result in a quick dissolution process, and some other time in a slower one, depending on temperature, pressure, etc. It would be unrealistic to think that there is a "one size fits all" duration fact linked to the process of dissolving. The duration of the process is determined also by the surrounding circumstances.

This is right. However, the problem only arises because so far we have operated in too simplified and idealised model. We have proceeded as if powers act alone, independently of each other, and the only thing that determines a duration fact is the essence of a particular power (via the process it is associated with). But this is clearly an incomplete picture: powers rarely if ever bring about anything working alone (for possible exceptions, see Molnar, 2003: 85). Normally, powers act in

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[20] Alternatively, we might hold that in such contexts the term refers to the big disjunctive property that includes all powers with the right manifestation. Either way, it is usually harmless to predicate the same, more coarse-grained property to different objects that actually instantiate different more fine-grained properties.

[21] The fact that the links between powers, processes, and duration facts is necessary is crucial: if it were contingent, it would make it considerably harder (if not altogether impossible) to carry out the dispositionalist project of grounding the truth of modal claims to powers.

[22] An anonymous reviewer helpfully pointed out a further issue: the Process Proposal might raise the Neutrality worry again. If powers essentially involve processes and are therefore dependent upon them, and processes essentially involve durations, then powers are mediately dependant upon temporal durations — which might be as problematic for the friend of Platonic universals as the involvement with spacetime points was for the Dated Manifestation Strategy. The Process Proposal might have slightly more elbow room to escape the worry than the Dated Manifestation Strategy: besides the strategies already discussed in §2.2, one might argue that there is a significant difference between mediate and immediate dependence, and that the former does not clash with the spirit of Platonism, or even deny that dependence is transitive and hence that Platonic powers would not depend upon durations whatsoever (cf Schaffer 2012 against the transitivity of grounding). Unfortunately, for reasons of space an in-depth discussion on how the Process Proposal can evade the Neutrality Worry will have to be left for future work focussed on exploring more thoroughly the logical space of Duration Strategies, and simply flag that this might be a cost of the process view sketched above.

concert with other powers—their mutual disposition partners (Martin, 2007; Williams, 2019). This is crucial because, apart from determining *when* a certain power becomes activated, mutual disposition partners plausibly influence *how long* the process that terminates in the manifestation takes to unfold: how long it takes for a sugar cube to dissolve in water varies on the basis of the level of saturation of the water, the liquid's temperature, whether I am stirring my tea, etc.

This complexity can be accommodated by invoking collective essences (Fine, 1994; 1995a, Zylstra, 2019). The notion of collective essence was originally developed to remedy to the following problem. It is a necessary that Socrates is distinct from Plato. According to essentialists, all necessities are grounded in essences (Fine, 1994). Thus, one should expect that it is essential to Socrates that he is distinct from Plato. But this seems wrong: intuitively, Plato should have nothing to do with the essence of Socrates. Whence the necessity of distinctness? The solution lays in recognising that, while it is not essential to Socrates that he is distinct from Plato (nor it is essential to Plato), it is essential to the *collective essence* of Socrates and Plato considered together. The idea is that the essence of particulars taken alone does not determine all the essential facts about them: some of these are determined by the collective essences of pluralities of which the individual is part of. In the case of mutual disposition partners, one might think that the duration facts are not determined by the essence of any single power alone—the essence of P alone does not determine for how long there will be Φ-ing before M obtains—but rather is determined by the collective essence of the power and all the relevant mutual disposition partners. Thus, the essence of the sugar's solubility alone does not determine how long the dissolving process will take to unfold. But the collective essence of the sugar's solubility, the atmospheric pressure, the room's temperature, etc. will together fix the duration fact of the dissolution. The possible variations in the temporal duration of a given process will be determined by the collective essence of all dispositional partners taken together — but these do not affect the individual essence of each of the participants. Thus, according to V2, the individual essence of P *will* include information about the kind of process that its exercising gives rise to, but *will not* include any information about *how long it takes for the process to unfold.* This further fact will be grounded in the *collective essence* of the whole plurality of mutual disposition partners that are acting in that particular circumstances. And this, finally, yields the duration facts: these stem from the collective essence of the process involved in bringing about the manifestation plus its manifestation partners. Duration facts, therefore, are grounded in the collective essences of the powers involved, and as such they do not represent further (serious) ontological costs.

Again, we want to stress that the Process Proposal is only one possible way to flash out the Duration Strategy, and one need not commit to the former to accept the latter. Indeed, there are some unsolved issues with the Process Proposal, including that it might fall prey to the Neutrality Worry (see fn 22).

8 Conclusions

Dated modal truths are an important group of modal claims, which plays a considerable practical and theoretical role in our lives. Any theory of modality worth its salt ought to account for them, and Dispositionalism is no exception. We have presented two proposals on how this might happen. The first is perhaps more straightforward, and invokes temporally fine-grained manifestations. We have argued, however, that it won't do—or, at least, that it encounters some serious difficulties that would need to be addressed before being accepted.

We have then argued that the Duration Strategy fares better. According to this view, dated truths are to be grounded somewhat extrinsically, by a combination of the time in which the power is instantiated, the direction of time, and some facts about how long the temporal gap between the power's activation and its manifestation is. We think that this framework offers all the resources for discussing the temporal direction of powers, and can therefore shed some lights on some puzzles concerning Dispositionalism, time, and the direction of causation.

Adopting the Duration Strategy leaves us with the task of figuring out what duration facts are, and how do they fit within the metaphysics of powers. We have offered a preliminary sketch of how we envision this relation, by claiming that powers are closely related to processes, and that processes can ground duration facts. However, more needs to be said, and it might well be that there is a better way of flashing out the Duration Strategy—one which is not threatened by the Neutrality Worry, for instance. And if our suggestion is on the right track, then it becomes of paramount importance for powers theorists to investigate the metaphysics of processes: many discussions concerning the fit between powers and temporal ontologies (Backmann, 2018; Donati, 2018; Friebe, 2018) for instance, would have to be best recast in terms of compatibility of processes and temporal ontologies. Much needs still to be said about the relation between powers and time. But the account of dated truths given by the Duration Strategy, and the constrains it imposes, hopefully take us a step in the right direction.

Declarations

Conflict of interest The authors declare that they have no potential conflicts of interest, and the research conducted involved no human and/or animal participants.

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