Powers, Processes, and Time

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Abstract. In this paper I argue that even the most radical metaphysics of powers (such as that adopted by Mumford & Anjum, Cartwright, or Groff) are compatible with eternalism. I first offer a taxonomy of powers ontologies, and attempt to characterise the difference between moderate and radical powers ontologies – the latter are characterised by an emphasis on *production* and *dynamicity*. I consider an argument by C. Friebe to the effect that the productive character of powers is inconsistent with Eternalism and find it wanting. I then elucidate the notion of *dynamicity* that radical powers theorists employ by making apparent their link with an ontology of irreducible processes. Finally, I respond to an argument by Donatella Donati to the effect that eternalism entails a reductive account of change which is inconsistent with process ontologies, and show that the the two are compatible. I conclude that we have no reason to think that radical powers metaphysics (and, a fortiori, every powers ontology) are not compatible with eternalism.

A broadly Neo-Humean conception of the world, paradigmatically embodied by Lewis' claim that 'all there is to the world is a vast mosaic of local matters of particular fact, just one little thing and then another' (Lewis 1986: ix) has been, at least implicitly, the background world-view of most metaphysical theorising in the last decades of the twentieth century. Recently, however, this paradigm is being put 'under serious pressure within analytic metaphysics' (Groff & Greco, 2013: 1) by a rival, broadly Neo-Aristotelian picture of reality, spearheaded by the idea that there are real causal powers that establish necessary connections between existents.[i]

So far talk of powers has been mostly limited to the closely intertwined discussions about laws of nature, (natural) modality, and causation. However, if powers metaphysics and in general Neo-Aristotelianism are to become a serious competing research tradition and hope to replace the dominant paradigm, they better show that they can be fruitfully deployed in a variety of other debates in metaphysics, as well as other fields of philosophy (some examples can be seen in Groff & Greco 2013, Mumford & Anjum 2018). If powers metaphysics turned out to offer a better theory of, say, laws of nature, but prevented us to deal with[ii] problems about persistence, mereology, objective chance, emergence, time, free will and so on, its chances to replace Humeanism would look rather grim, since that framework has proved to be immensely fruitful and influential in all those fields.

I can see two strategies available to the Neo-Aristotelian: she can either show that some of the theories in these debates, although developed with a Humean background, are compatible with a powers metaphysics and can be adopted without many modifications, or she can completely reject the options on the market because they are irremediably tangled up with Humean presuppositions and develop a brand new theory about these phenomena. In this paper, I will tend toward the former, more conservative option: I aim to show that an ontology of powers is compatible with an eternalist view on the metaphysics of time.[iii]

The task is rather urgent: recently it has been argued that powers metaphysics is inconsistent with *any* of the major theories of time (Backmann 2018, Donati 2018). Evidently, this would be a major problem for Neo-Aristotelians. Even conceding the non-trivial assumption that eternalism, moving spotlight, growing block, and presentism do not exhaust the logical space for a metaphysics of time, it would put powers metaphysics at a considerable disadvantage – powers theorists would have to build such an alternative theory from scratch before being in the position to be an even remotely credible threat to Neo-Humeanism. In order to show that powers can adopt an eternalist view of time, we will have to shed some light on some key notions of Neo-Aristotelian metaphysics – in particular, the notions of *production, dynamicity*, and their link with processes.

Note that I will be solely concerned with the fact that powers are compatible with eternalism because I find the view independently plausible and appealing, as well as for the fact that it would considerably help the task of offering a satisfactory semantics for dispositions (Vetter 2015: 186-194). I do

not intend to suggest that powers are *only* compatible with eternalism. Unfortunately, a more comprehensive survey on the relationship between powers and others views of time would exceed the limits of a single paper, and will be left to future work.

The paper will be structured as follows: in section §1 I introduce eternalism and two varieties of powers metaphysics, which I dub 'moderate' and 'radical'. Radical powers metaphysics differ from their moderate counterparts by requiring powers to be also *causal, productive, dynamical,* and *tendential*. In section §2, I discuss and reject an argument by Friebe (2018) aiming to show that radical powers are incompatible with eternalism on grounds on *production*, and conclude that productivity is compatible with eternalism. In section §3., I consider two further objections against productive powers in the eternalist block. In §4, I cash out the notion of *dynamicity* by appealing to processes, and I sketch the features of processes which radical powers theorists are committed to. In section §5. I discuss and reject an argument proposed by Donati (2018) to the effect that eternalism involves an account of change which is incompatible to the ontology of processes presented in the previous section. I conclude that there is no reason (yet) to think that powers metaphysics cannot be embedded in an eternalist framework.

1. Eternalism & Two Brands of Powers

The goal of this paper is to show that powers are compatible with an eternalist metaphysics of time. Some stage-setting first: what are these two theories? My preferred characterisation of eternalism is as the conjunction of the following:

a. The domain of the most natural, unrestricted existential quantifier used to univocally express ontological commitment (Sider 2011, van Inwagen 2009) includes present, as well as past and future times and entities. Present, past, and future times and entities exist *simpliciter*.
b. There is no unique objectively privileged time or temporally located entity. A description of reality can be correct and complete without specifying what time is present.
c. Times and objects are ordered by relations *being before than/being after than/being simultaneous with* which are true *simpliciter* and therefore can be specified without mentioning what time is present.

d. Tense operators do not change the truth-value of any existential claim: Always, for every x, x Always exists. In other words, what exists *simpliciter* never changes (Correia and Rosenkrantz 2018).

Clause d. is more contentious than the others, and is far from being universally accepted: there are more standard characterisations of eternalism that do not make use of tense operators. I think that the view of eternalism resulting from the adoption of d. is overall preferable, but unfortunately offering a detailed defence of this theory would take us too far astray. In §3, I will present a more standard version of eternalism, which I will dub 'Tenseless Eternalism', and briefly examine whether there are reasons to think that Tenseless Eternalism is more problematic for powers ontologies than my preferred view, formulated using tense operators.

What about powers? Unfortunately, there is no single, widely shared metaphysical theory of powers, nor there is yet a universally accepted terminology, which makes it harder to compare different theories. Let's start with a terminological note: for the purposes of this paper, I will take 'power' to be synonymous with 'potentiality' (Vetter 2015), 'tendency' (Mumford and Anjum 2018), 'capacity' (Cartwright 1989), and even 'disposition'.[iv]

It is controversial whether powers exist only at the fundamental level or there are genuine non-fundamental powers – the referents of many of our everyday dispositional predicates such as 'fragility', 'irascibility' and the like. I will remain neutral on this point – it does not really affect the arguments in what follows. Throughout the paper, however, purely for matters of clarity of exposition, I will help myself to macroscopic, non-fundamental properties when providing examples of powers. Note that this controversy does not map onto the distinction between sparse and abundant conceptions of properties (Armstrong 1978). I will operate under the assumption that both parties have the right to adopt a sparse conception of powers, according to which not all predicates correspond to a property, and will assume that all predicates used henceforth do correspond to genuine, 'ontic' properties.

We can now start to formulate the minimal common ground that all powers metaphysics share. The core insight of powers metaphysics is that powerful properties "point beyond themselves". 'Powers... are properties *for* some behaviour, usually of their bearers. These properties have an object towards which they are oriented or directed. The objects of powers are usually called

"manifestations"' (Molnar 2003: 60). From this core insight we can extract the two minimal features of powers.

A. Powers are *directed* properties: their identity is determined by what they are for.[v] Powers are not quiddities (Black 2000, Mumford 2004, Bird 2007) and have their modal profile *essentially* (Bird 2016). From this it follows that their modal profile is necessary: 'the very same power could not have a different dispositional character or causal role: that character or role is fixed across possible worlds' (Bird 2016).[vi]
B. Powers are modal *properties*. Genuine dispositional predicates refer to *ontic* properties – entities in one's domain. They cannot be reduced to simple conditionals or counterfactuals that hold in virtue of something that is not, itself, a power.[vii]

These are the theses that any theory that aims to qualify as a powers metaphysics must accept. We can sum the up in the following Minimal Criterion for Powers:

MCP: Powers are ontic properties whose necessary modal profile holds in virtue of their nature.

Insofar as powers and manifestations are distinct entities, any theory that subscribes to **MCP** clearly violates some core tenets of the Humean world-view, positing necessary connections between them. However, some powers theorists – first and foremost, Stephen Mumford and Rani Anjum (2011; 2018) – maintain that there is *more* to powers than what is captured by **MCP**, and that a metaphysics of powers should represent a more radical departure from the Humean picture. Consequently, they wish to add a number of further clauses to the minimal criterion. The most important additions are the following:

C. Powers are productive: they bring about their manifestation by *producing it*. 'Powers, we maintain, are productive of their manifestations... [denying this] would do more harm to the metaphysics of dis-

positions than good...Powers would have lost their potency and thus would no longer be any use in explaining how one thing brought about another' (Mumford & Anjum 2011: 8).

D. Powers are *dynamic* and active. A world of powers is not a passive mechanism that receives its activity from an external source, but is itself the source of change (Mumford & Anjum 2011; 2018, Groff 2013).

E. Powers confer a tendential, *sui generis* kind of modality, stronger than mere metaphysical or natural possibility and always and necessarily short of natural and metaphysical necessity (Mumford & Anjum 2011; 2018).[viii]

Not all these theses are equally radical and need not be accepted or rejected as a package. In particular, it seems that one could adopt C. and D. without thereby being committed to E. (e.g. Groff 2013; ms. Anjum and Mumford 2018). Call the proponents of a powers metaphysics that only accepts **MCP** 'moderate powers theorists' and those that embrace some or all of C.-E. 'radical powers theorists'. In what follows, I will focus on radical powers theories incorporating at least C. and D. for two reasons: they are by and large stronger than moderate theories, so proving that they are compatible with eternalism *a fortiori* shows that moderate theories are; secondly, because the main arguments to the effect that eternalism is not well suited to accommodate powers rely on these stronger theses. This does not mean that I will offer any argument to the effect that the radical view is to be preferred to the moderate one: I simply aim to show that they are *both* compatible with eternalism. Now that we have a clearer picture of the views under scrutiny, we can turn to the arguments to the effect that they are not compatible.

2. Argument from Productivity

The first objection to the compatibility of powers ontologies and eternalism concerns the role of the notion of *productivity*. Radical powers theorists insist that powers *bring about* their manifestations: they *produce* them, and it is in virtue of this fact that powers have explanatory value when it comes to the evolution and behaviour of natural systems. Friebe (2018)[ix] thinks that this creates a problem for the pairing with eternalism. His argument, in short, is that if powers are to be productive of their manifestations, then manifestations ontologically depend upon their powers; in particular, the fact that the

manifestations obtain at some time *t* depends on the fact that its power exists at some time *t'*. However, Friebe argues that such ontological dependence is incompatible with Eternalism, for given eternalism, *x* exists *simpliciter* and it is in virtue of its existence *simpliciter* that it exists at *t*, and thus Eternalism is incompatible with the dependence required by productive powers.

The argument can be spelled out more precisely as follows, where *m* is the manifestation-token; POT[*m*](*x*) is the power of *x* for *m*;[x] *t, t'* are variables ranging over times,[xi] and $\mathcal{T}p$ is '*p* is true *simpliciter*'.

1. Powers are productive. If POT[*m*](x) produces *m,* then *m* ontologically depends upon POT[*m*](*x*).
2. Productivity entails ontological dependence. If *m* ontologically depend upon POT[*m*](*x*), then *m* exists at *t* in virtue of POT[*m*](*x*) existing at *t'*.
3. Eternalism: Truth *simpliciter* is static. Always, $\forall p$ Always ($\mathcal{T}p \rightarrow$ Always $\mathcal{T}p$).[xii]
4. Permanentism. What exists *simpliciter* is static. Always, $\forall x$ Always E!*x*.
5. What always exists simpliciter, exists at a time. Always, $\mathcal{T}$E!$x \rightarrow$ at *t*, E!*x*.
6. Existence simpliciter *grounds* existence at a time. If Always $\mathcal{T}$E!*x*, then at *t*, E!*x* in virtue of Always, $\mathcal{T}$E!*x*.
7. Incompatibility of grounding. If at *t*, E!*x* in virtue of Always, $\mathcal{T}$E!*x*, then $\neg\exists y$ (at *t*, E!*x* in virtue of *y*).
8. Therefore, Eternalism entails that manifestations do not ontologically depend upon powers, so there cannot be productive powers in an eternalism framework.

The argument seems valid. Let's examine the premisses.

Friebe does not offer a precise characterisation of what notion of ontological dependence he is working with in 1. and 2. Backmann (2018) reads him as using rigid existential dependence, which he takes to be unfit for the job because the notion is available to the Humean, too; he therefore proposes to formulate the argument in terms of *generic existential dependence* (Lowe 2006) plus temporal order: '*a*

produced *b*, iff *b* generically existentially depends on *a*, and *a* existed before *b* existed' (Backmann 2018: 14). This proposal won't do: if rigid existential dependence is unfit because too lightweight and weak for the job, so will be the generic existential dependence, which is even weaker.

There is no need to think that the notion of ontological dependence appearing in premisses 1. and 2. must be reduced to existential/modal terms, however. We can allow the 'ontological dependence' involved in production to be a primitive (Barnes 2012; 2018) hyperintensional diachronic dependence relation that we have a relative good grip upon and which is not available to the Humean, and leave it to radical powers theorists to elucidate the notion further.

It could be objected that dependence relations are usually thought to be *synchronic*, so there might be some skepticism to the effect that there could be anything such as the kind of ontological dependence involved in production, and therefore whether production is a consistent notion to begin with.[xiii] Unfortunately, addressing this point with the required level of detail would take us too far afield; I will offer only three brief observations. First, although it is common to think that ontological dependence relations are synchronic, it is not uncontroversial. Bennett (2017: 95-99) contends that causation is a kind of building relation, and that it makes sense to have building relations that 'can hold over an interval' (Bennett 2017: 95) — and, moreover, that many other building relations are 'diachronically tainted'. Insofar as the ontological dependence involved in production can be assimilated to such building relations, Bennett's arguments would open the possibility of a cross-temporal dependence.

Secondly, although Friebe assumes that the token-manifestation occurs at a distinct, and presumably later time than the power which brings it about, not all radical powers theorists would agree: Mumford and Anjum (2011) for instance argue that the action of powers involved in causation is simultaneous.[xiv] Therefore, it is open to the radical power theorist to assume that premiss 2., if *m* ontologically depend upon POT[*m*](*x*), then *m* exists at *t* in virtue of POT[*m*](*x*) existing at *t'*, holds, but that *t=t'* and thus productive dependence is synchronic. Note that the fact that *m* and POT[*m*](*x*) occur at different times plays no role in Friebe's argument: it relies, rather, on the fact that *x* exists at *t* is due to the fact that *x* exists *simpliciter* and on the fact that something brought it about.

Thirdly, accepting that production involves a cross-temporal ontological dependence and challenging the viability of such a notion, or denying the idea that production involves any ontological de-

pendence of this kind, undermines Friebe's argument against the compatibility of radical powers and eternalism, and so there would be no reason to doubt that the two theories are compatible. Therefore, for the sake of argument, I am happy to concede premisses 1. and 2. of Friebe's argument and concede that the ontological dependence involved in production, as formulated by Friebe, is in good order.

We can now return to the rest of the premisses in Friebe's argument. Premisses 3-5 should be uncontentious (given the somewhat heterodox characterisation of eternalism given above. I will discuss a more standard version of eternalism in §3). Premiss 3 is the statement of eternalism made in the tensed language. Premiss 4. trivially follows from it, and we can derive 5. if we accept these two (uncontroversial) rules of inference for the operators *simpliciter*, always, and at *t*.

A1: $\mathcal{T}\varphi \rightarrow \varphi$

A2: Always $\varphi \rightarrow$ At t, φ

So far in Friebe's argument, so good. The troubles start with premisses 6. and 7. For ease of exposition, dub the former **Ground** and the latter **Incompatible**. I think that **Ground** is at least controversial and in need of more justification, and **Incompatible** is false, and therefore Friebe's argument is not sound.

It is not obvious that the validly derived premiss 5. Always, $\mathcal{T}$E!$x \rightarrow$ at t, E!x entails that at t, E!x obtains *in virtue of* $\mathcal{T}$E!x. We arrived at 5. via purely (temporal) logical means: nothing has been said about explanatory or dependence relations captured by 'because' or 'in virtue of'. A position that denies this premiss is perfectly conceivable. Indeed, the eternalist might be tempted to assume these two further theses about tense logic:[xv]

A3: $\forall t$ (at t, φ) $\rightarrow$ Always φ

A4: Always $\varphi \rightarrow \mathcal{T}\varphi$

Given these two rules, the eternalist could conclude that something is true *simpliciter* iff it is true at all times. From this, she might be equally tempted to conclude that $\mathcal{T}\varphi$ obtains in virtue of the fact that φ at all times.[xvi] Were this the case, since 'in virtue of' is asymmetric, then it could not be the case that **Ground** holds. I do not intend to commit to any of these claims, I am saying that anybody who intends to adopt a radical powers metaphysics should. I simply want to point out that premiss 6. of Friebe's argument is at least controversial, and we need to be given good arguments before accepting it, thus undermining the strength of his argument.

However, Friebe has bigger fishes to fry than justifying **Ground** in order to guarantee the soundness of his argument: justifying **Incompatible**. I take that the rationale for adopting **Incompatible** is some worry about over-determination: if *m* existing at *t* is fully explained or grounded in the fact that always *m* exists *simpliciter*, then what role is left for *y*'s existing at *t'* to play? In other words, what kind of explanation, ground, or dependency would the productive power yield, given that the manifestation's existence at *t* is fully accounted for by Eternalism? However, it is doubtful that these overdetermination-like worries should raise with regard to the ontological dependence, metaphysical explanation, or grounding involved in cashing out what it means for powers to be productive. Since it is not uncontroversial whether the ontological dependency involved in spelling out Production is to be assimilated to one "big-G" grounding, or is rather a "small-g"[xvii] relation of its own right, let's consider both cases. Assume that there is but one relation underwriting metaphysical explanation, namely big-G grounding. In that case, **Incompatible** straightforwardly does not hold: [p ∨ q] because [p]. But [p ∨ q] also because [q]. Therefore **Incompatible** fails. Assume, on the contrary, that the ontological dependency involved in production is not grounding, but some other small-g relation, and hence the fact that **Incompatible** does not hold for the grounding doesn't mean that it must fail also for the this other kind of dependence.[xviii]

First, note that in general, the relations expressed by 'in virtue of' or 'because' do not validate **Incompatible**. Consider the following examples:

i) Exact Truthmaking. '∃xFx' is true because Fa. But '∃xFx' is also true because Fb.

ii) Property Realisation. Assume that a property (or state) P is multiply realisable, and is realised by both F and G. Then, there is P because G occurred, and yet there is P because F occurred. Note that there is no reason to think that multiple realisation cannot occur for token properties or states, too (e.g. see Horgan 1993). Note that P might be the manifestation of some power.

iii) Causal Explanation.[xix] The death of the prisoner is fully causally explained by John's shot to the heart. However, the death of the prisoner is also fully causally explained by Jill's shot to the head: they were both excellent marksmen in the firing squad. So, e because of c, but also e because of c*. Over-determination surely occurs (at least sometimes) in causation and causal explanations. The contentious point is whether *systematic overdetermination* is plausible, not whether it can obtain.[xx]

Matters become even more difficult for **Incompatible** if we take the dependence expressed by 'in virtue of' to be transitive: it becomes extremely easy to generate counterexamples. Consider:

iv) Constitution. Assuming that constitution is transitive and Constitution as Identity is not true, then it is possible that the *xx*s (fully) compose *y* does not entail that, for some *zz* ≠ *xx*, the *zz*s do (fully) compose *y*. Thus, *y* exists because the *xx*s exist and the *xx*s compose *y*, and yet also *y* exists because the *zz*s exist and the *zz*s compose y. Since the *xx*s are not identical to the *zz*s, **Incompatible** fails.

v) Set-formation. {{Socrates}} depends upon {Socrates}. {Socrates} depends upon Socrates. Therefore, {{Socrates}} depends upon Socrates. Since {Socrates} ≠ Socrates, **Incompatible** fails.

vi) Hybrid cases. {Socrates} exists because Socrates does. However, Socrates is also composed by a particular plurality of atoms, the *xx*. Arguably, Socrates exists because the *xx*s do (and because the *xx*s compose Socrates). Even philosophers who think that these are two distinct 'small-g' relations are often committed to the idea that these relations can dove-tail, and so that {Socrates} depends upon the *xx*s. Thus, {Socrates} depends upon Socrates. And yet, {Socrates} depends upon the *xx*s. Unless Constitution as Identity holds, Socrates ≠ the *xx*s, and thus **Incompatible** is violated. Similar cases can be easily drawn with most combinations of the relations mentioned above.

It will be objected that this only shows that **Incompatible** fails for a number of small-g relations, not that it fails for the ontological dependence relation that Friebe has in mind. However, it would seem that the principle fails also for paradigmatic cases of ontological dependence. Consider the case of Aristotelian Universals. According to the view, the universal Fness ontologically depends upon its instances: it cannot exist uninstantiated (at some point in time).[xxi] Thus, Fness exists because F*a*. But also, Fness exists because *b* instantiates it: Fness exists because F*b*. Therefore **Incompatible** fails. And this is a case of ontological dependence if anything is: it is one of the paradigmatic examples of the relation, even among those that do not take it to be reducible or related to grounding (Barnes 2018).

So, it would seem that there are clear cases where **Incompatible** fails for ontological dependence, as well as for a number of neighbouring building or small-g relations that are also expressed by 'because' and 'in virtue of'. And this, of course, assuming that there is not a single "big-G" relation that covers every case of dependence.[xxii] Therefore, it is far from clear that we ought accept **Incompatible** — or, at any rate, doing so would require considerable and controversial assumptions elsewhere, which neither the friend of radical powers nor the eternalist need accept. If this is the case, then they can reject premiss 7. of Friebe's argument. But it is hard to see how we can conclude for the incompatibility of productive radical powers and eternalism unless we endorse **Incompatible**. Why believe that *m*'s existing at *t* cannot hold in virtue of the fact that at *t',* POT[*m*](*x*) *and* that *m* exists *simpliciter*? If we grant this possibility, then the radical powers theorist ought not be fazed by Friebe's argument, and has no reason to think that Productivity is incompatible with Eternalism.

Before moving on to examine whether Dynamism is compatible with Eternalism, I will consider two further objections to the arguments presented above.[xxiii]

3. Two Objections and Replies

The first objection runs as follows: even if we grant that there radical powers theorists are entitled to use the a primitive cross-temporal ontological dependence relation to capture production, this very relation creates special problems for the *eternalist.* A non-eternalist can understand productive cross-temporal dependence in tensed terms, as '*m* will exist/occur in virtue of *y* existing/occurring (now)'. The eternalist, on the other hand, will naturally express the dependence in these terms:

Temporal Productive Dependence: at *t*, *x* exists in virtue of [the fact that] at *t'*, *y* exists.

It is customary, for the eternalist, to treat and model times as akin to possible worlds (Sider 2001). If this is the case, then a cross-temporal dependence relation should be in all respects similar to a cross-world dependence relation, such as:

Modal Productive Dependence: at *w*, *x* exists in virtue of [the fact that] at *u, y* exists.

But Modal Dependence looks suspicious — or so the objections goes. Could there be an existential dependence across worlds such as the one expressed by Modal Produtive Dependence?

The point would deserve an extended discussion that would, unfortunately, take us too far afield. As far as I can see, there are two broad strategies that can be adopted: i) show that the temporal case is acceptable even if the modal one is not, or ii) show that the modal case is not problematic, too. I will offer a brief argument for the latter.

Start by noting that Modal Productive Dependence is an instance of the more general:

MD: at *w*, A in virtue of [the fact that] at *u*, B.

MD is perfectly acceptable even for the genuine realist. For instance, if we substitute $\Diamond p$ to A and p to B, we obtain the canonical reduction of possibility to truth at some world: at *w*, $\Diamond p$ in virtue of the fact that at *u*, p (together with the fact that *u* is accessible from *w*). And, of course, p could be an existence claim: at *w*, $\Diamond \exists x$ (x = Sherlock) in virtue of the fact that at *u*, $\exists x$ (x = Sherlock), so that the second *relatum* is an existence claim similar to that of Modal Productive Dependence. But this, it might be objected, is not an *ontological* dependence yet: the first *relatum* is a possibility, and not an existence, claim. But now just consider the existence, at *w,* of the *fact* that Sherlock possibly exists. This fact depends upon

the fact that at *u*, Sherlock exists, plus the usual facts about accessibility relations. So, the following holds: at *w*, [possibly Sherlock exists] obtains (exists) in virtue of the fact that at *u*, Sherlock exists.

If for some reason we do not want to introduce facts, think of the property of possibly being a world-mate of Sherlock, or being such that possibly Sherlock exists. These properties exist at *w* in virtue of the fact that something else is going on at another possible world — e.g. that Sherlock exists at *u*. So, it would seem that cross-world existential dependence relations are perfectly acceptable, even by Lewisian lights. So, if cross-temporal dependence claims for the eternalist are in all respects like cross-world dependence claims, and the latter are sometimes admissible, so should be the former. The objection would deserve a more thorough treatment, but it seems that *prima facie* there is no reason to think that, even if the eternalist considers times in analogy with possible worlds, she should think that the cross-temporal ontological dependence relations involved in production are especially problematic.

The second objection concerns the way in which I have formulated Eternalism, and therefore Friebe's argument, using temporal logic. The objection, in a nutshell, is this: 'You have formulated Eternalism in non-standard terms — it is contentious whether this is a good way to express the position. Therefore, you have not yet shown that productive powers are compatible with eternalism: rather, you have shown that they are compatible with Correia and Rosenkranz's brand of Eternalism. But what about those who do not like the view? Furthermore, that is not the view that Friebe targeted in the first place!'

The point is fair. Ordinarily, eternalism is characterised as the view according to which the domain is static, there is no privileged present (which does not change), and tensed locutions have tenseless truth conditions — that is to say, the most fundamental and joint carving ideology does not include tense operators or tensed terms (see Sider, 2001: 14; Dyke 2003: 66). We can therefore characterise 'Tenseless Eternalism' by substituting the last clause:

d. Tense operators do not change the truth-value of any existential claim: Always, for every *x, x* Always exists. In other words, what exists *simpliciter* never changes

with the more standard:

d*. Tensed language does not reflect the way in which reality is; tensed language can be given tenseless truth conditions and is not joint-carving.

Friebe's argument against the compatibility of productive powers and Tenseless Eternalism, in its bare bones, runs as follows:

1. If Tenseless Eternalism is true, then there is no fundamental tensed phenomena.
2. If there is no fundamental tensed phenomena, there is no *genuine* ontological dependence.
3. If there is no genuine ontological dependence, then there are no productive powers.
4. Therefore, Tenseless Eternalism is not compatible with productive powers.

Premise 1. just is d*, and premise 3. just is Productivity. So, the crucial and contentious premise is 2. Friebe (2018: 86) justifies it as follows: 'Dispositions would be powerless if they existed merely perspectively at *t*… For, then, their manifestations would likewise exist merely perspectively at *t'*… and, hence, both the dispositions and their manifestations would be "given" anyway, i.e. they would equally exist *simpliciter'*. Perspectival existence is defined as follows: 'event *e* exists in a *perspectival* sense of existence, i.e. (tenselessly) as of given *p* iff it is located at *p* or at some *p'* within or on the (so-called) past light cone of *p*.' (Friebe 201: 80). So, the point here is that the eternalist can say that *m* does not exists as of t (before it is produced by the power) but exists as of t' (after it's been produced by the power), but *existence as of* merely concerns *location* and not genuine existence. This is in line with Sider's (2001: 59) view: "'Exists-at" is analogous to the spatial predicate "is located at", not the logician's "∃"'. For genuine existence, we need a change in the domain, of existence *simpliciter*. To reinforce this point, Friebe maintains that 'if *a* necessitates (or, is a tendency for) *b*, *b* cannot exist "anyway"… Rather, *b* only is located at its time *t* … when necessitated or successfully …brought about' (Friebe 2018: 87).

I can see two ways to spell out the justification for premise 2. more precisely. The first is that genuine ontological dependence requires a dynamical change of the domain — for *a* to genuinely produce *b* and therefore for *b* to genuinely ontologically depend upon *a*, there must be a time where *b* does

not exist *simpliciter* and a time where it does (this is what it takes for *a's* productive action to be productive: an expansion of the domain). This seems to be what Friebe has in mind when he writes that 'according to growing block and presentism, the present comes successively into existence *simpliciter*. (Only) this can be turned into a productive succession by dispositions' (2018: 88).

The other way to spell out the justification of premise 2. involves, once again, the overdetermination of explanation— that is, an invocation of **Incompatible**. The idea would be that *a* cannot be said to genuinely produce *b*, if *b* "already" exists *simpliciter*. Conversely, *b* cannot be said to genuinely depend for its existence upon *a*'s brining it about, if *b* exists *simpliciter* in virtue of its being "already" located at some region of spacetime: 'the dependence of the particular manifestation on the particular disposition allegedly is merely perspectival, whereas from God's eye — considered to be the truly eternalist 'perspective' — everything, every disposition together with every manifestation, exists *simpliciter*' (Friebe 2018: 87).

I think that both these justifications for premise 2. are unsatisfactory, and that therefore we have no reason to accept premise 2. I have already argued against **Incompatible** in the previous section: the fact that *b* exists (*simpliciter*) in virtue of its being located somewhere in spacetime does not mean that it is not the case that *b* exists (*simpliciter*) in virtue of its being produced by *a*: there is no reason to think that ontological dependence cannot be overdetermined.

Similarly, it is not the case that genuine ontological dependence requires fundamental tense, or an unrestricted domain that changes over time. There are perfectly good cases of genuine ontological dependence (let alone grounding or truthmaking) that occur between abstract entities: for instance, $\{\{\varnothing\}\}$ ontologically depends upon $\{\varnothing\}$. Since pure sets lie outside time and space, *a fortiori* it cannot be the case that temporal modifications of the domain or 'temporary non-existence *simpliciter*' are necessary conditions for there being ontological dependence: surely, dependency relation among abstract entities have nothing to do with tense, and pure set theory would remain unfazed by inhabiting a presentist or an eternalist world: it just does not concerns anything in space and time. But if this is the case, then it seems dubious that genuine ontological dependence requires a dynamical expansion of the domain: there is never a time when $\{\varnothing\}$ exists and $\{\{\varnothing\}\}$ does not, and yet the latter depends upon the former.

If premise 2. should not be accepted, then it is not the case that productive powers are incompatible with Tenseless Eternalism. Therefore, I conclude that, barring a more convincing justification for premise 2. or **Incompatible**, the productive aspect of radical powers do not raise particular problems with either Eternalism *à la* Correia and Rosenkranz (characterised with tense operators) or Tenseless Eternalism *à la* Dyke or Sider.

4. Dynamism and Processes

We can now focus on the other thesis that characterises radical powers theories, namely that powers-worlds are dynamic and active. It is not easy to formulate in precise terms what it does mean for the world to be active and dynamical: radical powers theorists often formulate the thesis in negative terms, conveying the idea that the picture of the world they have in mind is *unlike* the mechanistic world of Cartesian physics, where all motion and change in produced by forces external to the objects involved. For instance, Ruth Groff (ms.) states that 'to say that things in the world have causal powers ('thing' as a count noun) is to say that things engage in activity, are able to ***do***, and not just to be. Reality, we might say (from this perspective) is thus genuinely, irreducibly, non-metaphorically dynamic'.

In the present context, it might be tempting to interpret the thesis the that the world is non-metaphorically dynamic as entailing that what is the case *simpliciter* changes over time, along the lines of Correia & Rosenkranz (2018):

DYN: Sometimes, $\exists p$ Sometimes ($\mathcal{T}p$ & Sometimes, $\neg\mathcal{T}p$).

DYN is the negation of the static view that underwrites eternalism. Therefore, if we were to understand the radical powers theorist's commitment to a dynamic world to be a commitment to DYN, their ontology would be trivially incompatible with eternalism.

However, I do not think that, when radical powers theorists talk about a dynamic world, they have anything like DYN in mind: they are, rather, concerned with the role of objects in change: the key intuition is that objects are not, at least sometimes, merely lumps of matter being pushed around by something from without, but are rather the source of change, and are responsible for change: 'things

engage in activity, are able to ***do***, and not just to be' (Groff ms.; see Ellis's (2002) talk of 'anti-passivist ontologies). The kind of dynamism that radical powers theorists have in mind is not concerned with a a variations of what is true *simpliciter* over time, but rather with how objects are involved in change. I will therefore exclude that thesis D. entails DYN and therefore the trivially entails the incompatibility of radicals powers ontologies with eternalism.

How are we to understand dynamism, then? If dynamic powers are to be active sources of change, then they cannot be merely pushed around by their causes. The activation and action of a power cannot simply be the result of an external force or stimulus applied to it. This thought is captured by Martin's (2008: 48-51) mutual disposition partners model for powers interaction, according to which powers act by *coming together* as equals, which is widely accepted amongst radical powers theorists (see Mumford and Anjum 2011; 2016; 2018a, Groff 2013). Mumford and Anjum suggest that this coming together of mutual disposition partners should be thought in terms of a process: 'we see causation as an unfolding process whereby *a* turns into *b* (as in Martin 2008: ch. 5). The combined powers of the cause... become the effect... as part of what it is to be those powers' (Mumford and Anjum 2011: 119). So, I propose that the adoption of thesis D. concerning dynamism involves giving a central role to processes in accounts of change and causation.

Radical powers theorists are not wholly explicit on what they take processes to be. However, the key characteristic seems to be that processes are changing, dynamic entities at heart: they are temporally extended entities that are not composed out of static, changeless parts. They are active all the way down:

> Processes are seen as dynamic in the sense that change is undergone throughout the process, which means it is to be found in any part of it, and it thus cannot be broken down in a string of changeless parts' (Mumford & Anjum 2011: 116)

We can isolate the following three key features[xxiv] of process that powers invoke. Note that these features underdetermine the metaphysics of processes, and thus are compatible with both the most com-

mon theories of processes currently on the market, namely the 'stuff' view (Mourelatos 1978, Crowther 2011; 2018) and the 'occurrent continuant' view (Stout 2016, Steward 2015):[xxv]

I. Processes are irreducible to sequences of events.

II. Processes are essentially temporally extended (Mumford 2009: 229).

III. The part of a process is itself as active as the process itself (Mumford & Anjum 2011: 116).

This last point can be made more precise by saying that radical powers theorists subscribe to the idea that processes are homoeomerous, that is, like-parted. This means that the following principle holds of them:

HM: If it is true that a was φ-ing between t1 and t2 then a was φ-ing during any subinterval Δ between t1 and t2.

HM is quite commonly invoked in the process literature (Mourelatos 1978, Galton and Mizoguchi 2009, Hornsby 2012; 2015, Steward 2013, Stout 1998; 2016, Crowther 2018) and is meant to capture one fundamental difference between processes and events. The proper part of an event is not *the same event*: 'an event E is not made up of E-events: the capsizing of a boat is not made up of boat-capsizing' (Mourelatos 1978: 430). On the other hand, this is exactly what seems to go on in the case of processes: if there is an ongoing process of strolling from, say, midday till 2 pm, then there is *the same* strolling also between midday and 1 pm. This is made particularly apparent if we think, with Mourelatos (1978), that processes are the kind of thing that are picked out by the nominalisation of imperfective or progressive predications.[xxvi]

Note that this does not mean that processes have to be homoeomerous in the sense that every interval has to be indistinguishable from any other, and not composed of qualitatively different subprocesses (this would be what Crowther (2011) calls 'Homogeneity') – we don't have to think that processes could only be like the uniform motion of a body as described in Newtonian physics. Processes can be varied and have different stages – different things happen when I am digesting, say: mastication

is quite different from the action of hydrochloric acid and pepsin in the stomach. However, there is a sense in which the *same process* is developing in both occasions, and at each moment is true *simpliciter* that I am digesting, even if digestion is made of quite different sub-processes. This is particularly important for the powers theorist, if she wants to understand causal processes along the lines of Mumford and Anjum's "sweet solution" (2011:121).

Furthermore, note that **HM**, when paired with II. the assumption that processes are essentially temporally extended, entails I. that processes are irreducible to sequences of events. By itself this is consistent with there being a lower bound in the division of temporal regions and temporally extended objects – we can consistently accept both I. and **HM** and yet reject the idea that time is an 'atomless gunk' (Lewis 1991: 20); all we require is that the temporal atoms are not point-sized, but rather are extended simple regions: Braddon-Mitchell and Miller (2006) offer a spatial parallel. I take it that eternalism is perfectly neutral on the topology and structure of time: an eternalist should be allowed to think that time is either discrete, merely dense, continuous, or even gunky, and think that temporal atoms be either extended simple regions or point-sized. This latter option is unavailable to the radical powers theorist who takes processes to be fundamental. This loss of neutrality is not a great cost: it merely shows that eternalism is compatible with a number of different other metaphysical theories; but once you embrace one, some flexibility will be inevitably lost.

Arguments concerning the compatibility of radical dynamic powers with the metaphysics of times should therefore focus on whether the existence of processes of the kind described above is compatible with the features of the various theories, or that an account of change which makes use of such processes is. This is far from obvious; Backmann (2018) takes powers metaphysics' commitment to processes as the key element in his argument against the compatibility of powers presentism, for instance. However, it is eternalism that interests us here, and so the question is whether irreducible processes can be accommodated in an eternalist framework.

5. Argument from Change

Donatella Donati (2018) has recently offered an argument to the effect that radical powers metaphysics are incompatible with eternalism based on the fact that eternalism entails an account of change that is

incompatible with the one delivered by powers.[xxvii] Although she does not frame her argument specifically in terms of processes, her argument relies on the idea that the eternalist's account of change reduces it to a sequence of static events, and hence can easily be adapted to target the compatibility of processes and eternalism. What follows is an adaptation of Donati's (2018) argument.

The argument starts by noting that it is extremely common for eternalists to subscribe to Russell's account of change, according to which 'change is the difference, in respect of truth and falsehood, between a proposition concerning an entity and a time T and a proposition concerning the same entity and another time T*' (Russell 1903, sect. 442). As Sider (2001: 212) notes, 'for someone like Russell who accepts he B-theory of time (eternalism + the reducibility of tense), this is the natural account of change'. McTaggart (1927, chapter XXXIII, sections 315-6) as well as many after him (e.g. Mellor 1981, Simons 1987) famously argued that this is no account of change, because *there is no change at all*. This because, on the one hand it does not involve the modification of any fact – it is *always* true that the poker is hot on Monday and cold on Tuesday – and on the other hand it is too similar to spatial variation (Sider 2001: 212-6).

The most common answer to these objections on the part of the eternalist is just to double down on the Russellian analysis, and then accuse the critics of begging the question. This strategy is perfectly exemplified by Sider: 'the objections may simply be met head-on. Change *is* analogous to spatial variation. Change *does* occur in virtue of unchanging facts about temporal parts. There are no good arguments on the contrary' (Sider 2001: 214). As a result of this dialectical situation, we can take the eternalist to define change along the Russellian analysis:

RA: An object *a* changing from being *F* to being *G* $=_{df}$ There is a time *t* such that *a* is *F* at *t* and there is a time *t'* such that $t<t'$ and *a* is *G* at *t'*.

Donati argues that **RA** is not compatible with powers metaphysics – in our case, in virtue of the fact that it is not compatible with a process ontology. The problem is not that **RA** employs instantaneous moments – the eternalist's reductive theory of change, despite being normally formulated in terms of instants, need not be: we could be employing intervals, or treat *t* as an extended simple region of time.

The problem is, rather, that according to radical powers theories, it is *powers* that are responsible for change and they bring it about by being exercised, which results in a continuous process unfolding until it reaches its natural endpoint. Powers theorists such as Mumford and Anjum would say that for *a* to change from *F* to *G* means that *F* is a power that *a* has at some time *t* which, when exercised results in the unfolding of some process of *φ*-ing, whose natural endpoint is that *a* is *G* (at some later time *t'*). So change is to be explained in terms of the *process* that takes place as a result of the coming together of powers, first and foremost. Recall that radical power theorists are committed to the idea that processes cannot be reduced to sequences of static events or facts. But this is exactly *all there is to change*, according to **RA**. We can spell out the argument more precisely as follows:

1. Eternalism entails the Russellian reductive account of change, **RA**.
2. **RA**: An object *a* changing from being F to being G = <F*a* at t, G*a* at t'> such that t<t'.
3. If **RA** is true, change can be analysed as a sequence of events or states of affairs.
4. Radical powers metaphysics are committed to the idea that change occurs in virtue of the unfolding of a process.
5. Processes cannot be reduced to a sequence of events or ordered series of states of affairs.
6. Change can be analysed as a sequence of events (3) and cannot be analysed as a sequence of events (5). ↯

This argument only poses a challenge to radical powers theorists who accepts i) that powers are dynamic, and ii) that this dynamism is to be cashed out in terms of irreducible processes. Moderate power theorists can help themselves to **RA** without any problem and reject that processes are anything over and above a sequence of events or states of affairs (Williams 2019). However, my aim is to show that also radical powers metaphysics are compatible with Eternalism, so it will not do to abandon processes. Fortunately, I do not think that moderate is the only response to Donati's argument: there is a way to defuse the argument that is available also to radical powers theorists. Donati's argument stems only from the fact that **RA** is a *reductive account* of change. I will suggest that the radical powers theorist should try to resist premiss 1: eternalism does not entail a commitment to a Russellian reductive ac-

count of change. Although the two views are commonly associated, the reason for taking them as a package is merely dialectical.

Start by noting that **RA** is ambiguous between a *description* of the phenomenon and its *explanation*. We are *tempted* to think that the right-hand side of the principle is what explains the left-hand side – that the left-hand side reduces to it. But this would be a mistake. Eternalism entails **RA** only insofar as it is understood as a *materially adequate description* of the phenomenon of change: considering it a (reductive) explanation of change is a further, quite independent thesis.

The point that I would like to get across is that we should distinguish between a modest – that is, descriptive – reading of **RA**, and an ambitious, reductive one. Eternalism surely offers the resources to *describe* change in terms of a sequence of property-instantiation, e.g. as an ordered pair of states of affairs such as <F*a* at *t*, G*a* at *t'*>, but that does only commit the eternalism to maintain that a certain biconditional holds:

RA$_D$: An object *a* changing from being F to being G *iff* there is a time *t* such that *a* is F at *t* and there is a time *t'* such that *t*<*t'* and *a* is G at *t'*.

This only tell us how we can *represent* change from an eternalist perspective. And surely, such representation of change gets something right: even the most radical powers theorist would concede that the ordered pair <F*a* at *t*, G*a* at *t'*> captures *something* of change. What the radical powers theorist denies is that such picture *tells us the full story* about change: a fully satisfying description and explanation will have to involve powers, processes, and so on. But it doesn't mean that the minimal scheme offered by **RA$_D$** cannot be enriched or is incompatible with powers. What she must reject is this further thesis, which represents a *reductive explanation* of change and which we should sharply distinguish from **RA$_D$**

RA$_E$: An object *a* changing from being F to being G *iff and* (*fully*) *in virtue of* there is a time t such that *a* is F at *t* and there is a time *t'* such that *t* < *t'* and *a* is G at *t'*.

It is only this latter, stronger principle which is incompatible with powers accounts of change, because it asserts that there is *nothing more* to change than such variation of properties. But this is an extra step: nothing in the doctrine of eternalism by itself forces us to go down this path. Compare this with the situation in which the perdurantist is in:

> Lewis formulates perdurantism as the view that "something... persists by having different temporal parts, or stages, at different times." (1986: 202) Crucially, this formulation includes the 'by'-locution, which indicates an explanatory claim—to say that an object persists by having temporal parts is to say that facts about persistence are grounded in, or obtain in virtue of, facts about temporal parts. This conception of perdurantism goes beyond the ontological account since ontological claims are not, by themselves, explanatory... it is one thing to say that persisting objects have temporal parts whenever they exist; it is another thing to say that objects persist because they have temporal parts. One can accept the first claim while denying the second, so the explanatory idea goes beyond the ontological. (Wasserman 2016: 244-5).

A radical power theorist who subscribes to the view of processes sketched in the previous section should have no problem with the idea that we can speak of the parts of a process: surely it must be possible to distinguish between, for instance, an early stage and an advanced stage of a process, e.g. the rotting of an apple or the dissolving of the sugar. Even if we think of causation as an 'unfolding process whereby *a* turns into *b*', we must be able to say that at a certain time or interval the water was less sweet, and at a later time or interval it was sweeter as a result of the dissolving of a cube of sugar.
Therefore process theorists can describe a process in terms of a series of a succession of states of affairs. What they cannot say is that such succession of states of affairs tells *the whole story* about the process – that processes are *nothing over and above* such series, and thus cannot adopt a reductive explanation of change along the lines of $\mathbf{RA_E}$. But, according to the power theorist, we can enrich $\mathbf{RA_D}$ and formulate a more adequate account of change by adding elements from her metaphysics.

Here is a sketched proposal as how a radical powers theorists might improve on $\mathbf{RA_D}$. Mumford and Anjum argue that causation by powers is best represented not by neuron diagrams, but rather by vectors in quality spaces. The idea, in short, is that we take manifestations to be locations on a certain quality space – for ease of exposition, limit the example to one-dimensional quality spaces, *e.g.* hot and

cold. We then represent the current state of the object with regard to the quality space as a vertical line: this would be the current temperature of the object. We then represent its powers in action as vectors moving in a direction: the powers to heat as vectors pointing in one direction, and the powers to cool as vectors pointing in the opposite direction.

Importantly, Mumford and Anjum recognise that such a diagram only represents a *moment*:

> The vectors depicted within a quality space are meant to indicate how things dispose in that particular situation. The vectors represent only the operating dispositions but the model does not show, for instance, any actual change or movement within that quality space (Mumford and Anjum 2011: 26).

Assuming that the quality space is one-dimensional and the two poles are, respectively, F and G, that we represent directedness by introducing a primitive operator '⇀' such that 'P⇀F' is read as 'P tends to F', and finally that we can associate a real number to the intensity or degree of a power, we can represent a situation in a vector space where there are two powers disposing, respectively, toward F and G as follows: *n*P⇀F, *mP**⇀*G*. We can then represent a change in the vector space as an ordered pair of such situations – consistently with **RA$_D$**. For instance, we can represent an increase in the intensity of one of the powers and a decrease in the other as <(*n*P⇀F, *mP**⇀*G*), (*n*+1P⇀F, *m*-1*P**⇀*G*)>. This gives us the evolution of a situation with two conflicting powers where one power becomes stronger and the other weakens. To simplify, assume that there is just one power in action, increasing in intensity. We can then offer the following improved description of change:

RA$_D$+: An object *a* changing from being disposed toward *F* to being *more* disposed toward *F iff* <(*n*Pa⇀F) at t, (*n*+1Pa⇀F) at t'>

The radical power theorist will still think that this is not enough – that there is more to change that this. As suggested in §3, what we need is that the two elements of the ordered pair be connected by a primitive process. But we can simply *add* this requirement to our description. As a first stab, we just

need to add the clause that there is the relevant process between the two relevant instants that has all three the required features I-III. Informally, we can just say that some entity *a* undergoes change iff *a* is disposed thus-and-so at some time *t*, has some different disposition at some later time *t'*, and there is a irreducible, essentially extended, and homoeomerous process *φ* involving *a* which takes place between *t* and *t'*. More formally, we can depict what is going on as something like this:

RA$_D$++ An object *a* changing from being disposed toward F to being *more* disposed toward F *iff* <(*nPa*↝*F*) at t, (*n*+1*Pa*↝*F*) at *t'*> & there is (the right kind of) process *φ* such that there is *φ*-ing between *t* and *t'*, and *φ* is such that if it is true that a was φ-ing between t1 and t2 then a was φ-ing during any subinterval Δ between t1 and t2, *φ* is essentially extended, and *φ* is irreducible to sequences of events.

This description is an unlovely mouthful but seems, *prima facie*, to be quite close to what radical powers theorists think is going on in cases of causation (in this case, in case of an increase in intensity in the tendency to F). This representation of change is perfectly consistent with **RA$_D$**: it just contains *more elements* than those that would be available to *any* eternalist, for it requires the ontological toolkit which comes with radical powers. But this should come as no surprise: after all, eternalism is not a theory of properties, but merely of time. We should expect that a better description can be afforded by an integrated theory of time, powers, processes, etc. Assuming that something like **RA$_D$++** is a more adequate description of change for the radical power theorist, she can then offer an *account* of change in the following terms:

RA$_E$++ An object *a* changing from being disposed toward F to being *more* disposed toward F *iff and fully in virtue of* <(*nPa*↝*F*) at t, (*n*+1*Pa*↝*F*) at *t'*> & there is (the right kind of) process *φ* such that there is *φ*-ing between *t* and *t',* such that there is *φ*-ing between *t* and *t'*, and *φ* is such that if it is true that a was φ-ing between t1 and t2 then a was φ-ing during any subinterval Δ between t1 and t2, *φ* is essentially extended, and *φ* is irreducible to sequences of events.

Why do so many eternalists take the extra step from **RA$_D$** to **RA$_E$**? Recall the turn of phrase employed by Sider: 'for someone like Russell who accepts he B-theory of time (eternalism + the reducibility of tense), this is the natural account of change' (Sider 2001). There is no entailment between the two – strictly speaking, one is free to adopt the former without the latter. I can see two reasons to run them together, neither of which binding. The first, and weakest one, is purely dialectic: by doubling down on a reductive account of change, the eternalist can simply reject McTaggart's no-change objection by insisting that the A-theorist is begging the question against eternalism. From a purely dialectical point of view, I have nothing to object to the strategy. But, of course, we are not forced to go down this path. The eternalist could also show that she *can* give a richer account of change, one perhaps closer to the kind of story that the A-theorist feels entitled to hear, like **RA$_E$++**.

The most appealing aspect of **RA$_E$** is that it offers the resources to reply to the A-theorist without having to appeal to any other metaphysical theory: all the resources for responding to McTaggart are *already available* to the eternalist. But this is a positive aspect only if we are proceeding in our metaphysical investigation piecemeal, and we want each theory to be self-sufficient and amenable to be combined with every other theory in other areas of metaphysics. But this is not our current situation: we are starting by assuming a certain view of properties and causation. So there is no reason to appeal to the tools offered by eternalism alone to respond to the critiques of the A-theorist: we can invoke powers and processes, too! Assuming that the appeal to processes does manage to cash out the relevant notion of dynamism, I suspect that radical powers theorists could develop precisely the richer account of change that the A-theorist is seeking. The only reason to go for **RA$_E$** is dialectical: eternalists needed a way to dismantle McTaggart's objection. But such a consideration carries little weight in a different dialectical context, one in which a radical powers ontology is presupposed.

If we can reject premiss 1. of Donati's argument, we can easily escape the contradiction. If so, we have been offered no reason to think that eternalism is incompatible with radical powers metaphysics.

6. Conclusions

Proving conclusively that two metaphysical theories are compatible is a hard task – indeed, it might be not unlike an attempt to verify a theory, be it empirical or not. As in any other area of philosophy, new arguments can always crop up and undermine doctrines and connections thought to be on secure ground. Therefore, it would be rushed to conclude that it has been proved for good that radical powers metaphysics is compatible with eternalism. Ingenious Humeans will probably come up with further arguments, which will need to be rebutted in order to give Neo-Aristotelianism a chance. But, until then, I think that friends of powers should be warranted to hold the defeasible belief that powers *can* be embedded in an eternalist framework, and that powers theorists can take full benefit from the resources offered by such a theory of time for their own purposes (see Vetter 2015: 186-193).

Neo-Aristotelian metaphysics in general and powers ontologies in particular are still relatively underdeveloped and far from seriously threatening the Neo-Humean orthodoxy. Showing that they can avail themselves of a popular metaphysics of time will not, on is own, vindicate the paradigm and force Humeans to abandon their framework. But it is an important step nevertheless – at least, it shows that powers are not worse off when it comes to at least one theory of time: the crucial battle will have to be fought on other grounds.

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[i] See, *inter alios*, Bird (2007), Ellis (2001), Groff & Greco (2013), Jacobs (2017), Marmodoro (2010), Martin (2008), Molnar (2003), Mumford (2004), Mumford & Anjum (2011), Vetter (2015), Williams (2019).

[ii] By this I mean either offer a novel and more convincing account of these phenomena, or more modestly just adopt the existing theories.

[iii] I have reached the conclusion that powers ontology is compatible with Eternalism independently although contemporaneously with Andrea Roselli. Unfortunately, I came across his work too late in the publication process and could not take his arguments into consideration.

[iv] It would be best to distinguish between powers and dispositions, for a number of reasons: it seems that our usage of 'dispositions' only corresponds to powers with relatively high degree (Vetter 2015: §2-3), and that in general talk of dispositions is available to everyone, including the Humean (Azzano 2019). However, since Friebe (2018) speaks of powers and dispositions interchangeably, it would be artificial to distinguish between these terms while discussing his argument. Nothing of substance depends on this lack of terminological fineness of grain, for the purposes of this paper.

[v] This does not need to be in the future. E.g. Vetter (2015) admits certain powers whose manifestation lies in the past, and Mumford and Anjum (2011) only admit of powers whose manifestation is simultaneous with the exercise of the power.

[vi] Bird (2016) takes modal fixity to be the defining features of powers, but that is too weak. Also someone who accepts a governing conception of laws along the lines of the DTA account, but happens to think that the Necessitation second order relation (to give an example in terms of Armstrong 1997) is necessary as a brute fact will agree that properties have their nomic/modal profile modally fixed, but is not thereby a power theorist. See Azzano 2019 for an argument to the effect that realism about powers must be formulated in hyperintensional terms, such as essence or grounding.

[vii] There is a long literature of attempts to such reduction or analysis, and an equally long literature of arguments for their failures. For some relatively recent discussion see Wasserman & Manley (2011), Vetter (2015).

[viii] This amounts to saying that the following principle holds *essentially* of powers *qua* powers:
Independence: For every power X, for every manifestation Y, if X is directed to Y, it is possible that X obtains and Y does not obtain.

[ix] It is not wholly clear to me that Friebe intends his argument to show the incompatibility of *powers ontologies* and eternalism, for he states that he is concerned with *powers theories of laws* and not of properties: 'I should exclude the variant according to which the fundamental physical properties such as mass and charge —considered as *dispositions*— "generate" the regularities without any help of the laws which merely "flow" (Bird 2007, 2) from them'. I must confess that I have a hard time thinking of any example, within the powers literature, of somebody who takes the *laws themselves* to be powerful, as opposed to the *properties* themselves. The discussion among friends of powers is often whether we need laws at all (Mumford 2004, Bird 2007, Dumsday 2019). I will adapt Friebe's argument to be targeted at ontologies of *powerful properties*, rather than *powerful laws*.

[x] This is the symbolism of Vetter (2015). Note that, by Vetter's lights, POT[m](x) is not syntactically correct, since she takes POT to be a predicate modifier, and m is not a predicate. Strictly speaking, therefore, I should rather form a predicate along the lines 'being such that m obtains' using λ-calculus. However, since this would make the argument unnecessarily cumbersome, for the sake of readability I have preferred to simply use m as argument of POT.

[xi] In what follows I largely adopt Correia & Rosenkranz (2018) tense logic. However, unlike them I introduce a dedicated variable t for times. This is just for the sake of readability. We can easily specify the domain over which these variables range, {times} by using their primitive 'is a time' predicate, T, as follows: {times} = $\{x|Tx\}$.

[xii] This corresponds to the formulation of STA in Correia & Rosenkranz (2018).

[xiii] Thanks to an anonymous reviewer for this journal for suggesting potential difficulties in thinking that there could be cross-temporal relations of ontological dependence.

[xiv] This would not be in contrast with the 'no action at distance' principle, because in their view a power acts by unfolding in a process — all action is local. Thanks to an anonymous reviewer for raising this point.

[xv] Correia & Rosenkranz (2018: 10) do not incorporate these in their logic, but note that they do so because these are *metaphysically contentious,* and they aim to provide a theory-neutral logic. However, both should be quite attractive to the Eternalist, so there is no reason for her to endorse them as substantial theses.

[xvi] Perhaps this could be understood as a case of collective grounding not too dissimilar to those discussed by Dasgupta (2014) with regard to qualitativism and spacetime relationalism.

[xvii] Wilson (2014), Bennett (2017), Paolini-Paoletti (2019).

[xviii] Thanks to an anonymous reviewer for rising this point.

[xix] It might be objected that causation does not belong to the group. However, Bennett (2017) argues that causation is to be associated to other 'building relations' among which is most natural to look for the relation expressed by the 'because' in Friebe's argument. The main element in her argument is that many building relations bear a diachronic or 'causal taint' (Bennett 2017: §4). It is quite clear that the notion of ontological dependence under exam here is tainted in this way: it concerns entities that do not need to exist at the same time. Thus, it would be hard to treat causation (and causal explanation) and ontological dependence as utterly alien in this dialectical situation.

[xx] While most philosophers in the (mental) causation literature agree that *systematic causal overdetermination* is implausible, their reasons to do so differ (Kim 1998; Melnyk 2003; Yablo 2002), and it is neither obvious nor uncontroversial that they are right: see Sider (2003) or Lowe (2003).

[xxi] 'We certainly should not demand that every universal should be instantiated now...The principle of instantiation should be interpreted as ranging over all time' (Armstrong 2008: 65).

[xxii] See Berker (2018) for a recent argument in favour of grounding unity.

[xxiii] Thanks to an anonymous reviewer of this journal for raising both these objections

[xxiv] Note that I do not include any thesis concerning the *telic structure* of processes – i.e. whether they have their "goal" in themselves or not. This means that the distinction between process and event does not map the Aristotelian distinction between *kinesis* (movement) and *energeia* (activity) that readers of *Metaphysics* 9.6, *Nicomachean Ethics* 10.4 will be familiar with, nor the classic distinction between processes and achievements (Vendler 1957), understood as the difference between activities that can go on indefinitely and activities that have an (instantaneous) endpoint. Most processes that power theorists are interested in would be achievements, in Vendler's terms.

[xxv] The main difference between the two theories is that, according to the occurrent continuant views, there is such a thing as individual processes (e.g. *this* rotting as opposed to *that* rotting), whereas this is not the case when it comes to stuff views.

[xxvi] E.g. from 'Jones was pushing the cart for hours' we obtain 'There was pushing of the cart for hours by John'. I am not suggesting that we infer the existence of processes in virtue of the fact that certain languages, including English, have a progressive and imperfective verbal aspects. Radical powers theorists assume that there are mind and language independent processes; they do not *read off* their metaphysics from our language (Heil 2003). It is unclear to me what is the relationship between verbal aspect and A and B-theories of tense: it seems coherent to think that tense is not fundamental and yet aspect is, but I have no argument to support this.

[xxvii] A somewhat similar worry can be detected in Mumford (2009) and Mumford and Anjum (2011), but it is intermingled with worries about persistence and not spelled out in much detail, so I will stick to Donati's argument.