

# Metaphysics of laws and ontology of time\*

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Received: 07/10/2016

Final version: 17/11/2017

BIBLID 0495-4548(2018)33:1p.77-89

DOI: 10.1387/theoria.17178

**ABSTRACT:** At first glance, every metaphysics of laws (humeanism, primitivism, power metaphysics) can be combined with every ontology of time (eternalism, growing block, presentism). In contrast, this paper intends to show that humeanism requires eternalism and that Power metaphysics must presuppose an existentially dynamical view of temporal existence, i.e. the growing block view or presentism. The presented arguments turn out to be completely independent of whether the laws of nature are deterministic or probabilistic: the world is non-productive and static or productively dynamical, the future be 'open' or not.

**Keywords:** Humeanism; Dispositionalism; Eternalism; Presentism; Growing Block; Indeterminism.

**RESUMEN:** A primera vista, cualquier metafísica sobre las leyes (Humeanismo, primitivismo, metafísica de Poderes) puede ser combinada con cualquier ontología sobre el tiempo (eternalismo, bloque creciente, presentismo). Por el contrario, este artículo intenta mostrar que el Humeanismo requiere eternalismo, y que la metafísica de Poderes debe presuponer una visión existencialmente dinámica de la existencia temporal, i.e., la teoría del universo de bloque creciente o el presentismo. Los argumentos esgrimidos resultan ser completamente independientes de si las leyes de la naturaleza son probabilísticas o deterministas: el mundo es no-productivo y estático o productivamente dinámico, sea el futuro 'abierto' o no.

**Palabras clave:** Humeanismo; Disposicionalismo; Eternalismo; Presentismo; Bloque Creciente; Indeterminismo.

## 1. Introduction

The relationship between the metaphysics of laws of nature and the ontology of time is a rather under-explored topic.<sup>1</sup> As it seems to me, the views about laws are mostly considered

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\* I would like to thank two anonymous referees for this journal for very helpful, constructively critical comments. Also, many thanks go to the members of the Konstanz "real possibilities" group for their effort spent on previous versions of this paper.

<sup>1</sup> See, however, Backmann (2016) and Briggs and Forbes (2017) as evidence for increasing interest.



to be independent of the views about time,<sup>2</sup> i.e. every metaphysics of laws seems to be compatible with every ontology of time. Secondly, my impression is that according to many authors the crucial issue within the philosophy of time is whether the future is ‘open’ or not.<sup>3</sup> Since the laws of nature are deterministic or probabilistic independently of their metaphysical status, it again seems to be irrelevant what the underlying ontology of time is.

In contrast, it seems to me initially plausible that a *passive* understanding of laws requires *static* time, i.e. “eternalism”, whereas an *active* understanding of laws requires *dynamic* time, i.e. the “growing block view” or “presentism”, and that both implications are independent of the determinism/indeterminism distinction. The purpose of this paper is to provide convincing arguments in support of this plausibility. Laws of nature are passive just in case they merely supervene on a ‘given’ distribution of objects, events, or properties<sup>4</sup>; this view will be identified with “Humeanism”. They are active just in case they (partly) ‘generate’ such a distribution on the basis of initial conditions; this view will be identified with “Power metaphysics”. So, I will argue that Humeanism requires eternalism, and Power metaphysics requires non-eternalism, i.e. the growing block view or presentism.

My purpose is hence to show that the world is passive-static or active-dynamical, independently of the future being ‘open’. Before going on, there are apparently many terminological clarifications in order, in particular because I am arguing here across several debates (including those from the philosophy of spacetime). Concerning “Power metaphysics”, 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. In that case, the laws would indeed be passive, and active only the properties, but Power metaphysics would still require dynamic time. Then, I in fact exclude the (possible) variant according to which the relation between the disposition and its manifestation is merely a (*de re*) modal relation. In that case, one may have the vision that there are ‘already’ existing relations between which, e.g., a relation of necessity holds. This would indeed be compatible with eternalism, but would fall prey to Lewis’s complaint with Armstrong’s necessity relation: “metaphysical necessity” is merely a label when not combined with *productive* sense. “Power metaphysics” is hence restricted to the view that dispositional properties *productively* cause their manifestations, that the manifestations depend *existentially* on the dispositions. *This* view requires non-eternalism.

“Humeanism” is comparatively simple. The fundamental physical tokens such as mass and charge are considered to be *categorical*, i.e. independent of their actual causal role. The laws of nature supervene on the ‘totality’ of contingently distributed categorical entities (see Lewis 1986, ix). However, note that they are *actually* dispositional, in the neutral sense of the term that they actually play a causal role. The difference to Power metaphysics is that according to Humeanism mass and charge do not *essentially* play that actual causal role; they are not *essentially dispositional*. Thus, Humeanism allows for causal dependence rela-

<sup>2</sup> See, e.g., the seminal monograph by Bird (2007) in which he defends his view about laws in confrontation with many issues in metaphysics except those from the ontology of time.

<sup>3</sup> See, e.g., Müller (2006) and Hüttemann (2014).—The openness of the future will be identified with indeterminism; indeterminism may be lawful or not.

<sup>4</sup> Properties are intended to be tropes, i.e. particulars. If one holds that properties are universals, one should read “property-tokens” instead of “properties”.

tions between categorical properties, but excludes *productively* causal dependence relations. Likewise, eternalism allows for several dependence relations between ‘eternally’ existing relata (including alleged non-Humean, but non-productive modal relations), but what Humeanism and eternalism exclude is *existential* dependency between temporally separated entities. Further, I should stress that I will not defend the packages Humeanism/eternalism and Powers/non-eternalism as biconditionals. Eternalism, the growing block view, and presentism are perfectly compatible with the view that there are no laws at all. Also, “primitivism” of laws seems to be compatible with every ontology of time.<sup>5</sup>

Concerning “eternalism” (“block universe view”) et al., I will need an extra section to spell out the views in an adequate way. Roughly, of course, eternalism says that past, present, and future things exist on a par, while the growing block view affirms the existence only of past and present entities and presentism only of the present ones. However, no reasonable eternalist intends to say that, e.g., dinosaurs exist *now* so that there is undoubtedly a sense in which dinosaurs do *not* exist. The challenge is to combine the view that dinosaurs (and future things) do not exist now with the view that they ‘nevertheless’ exist *simpliciter*.<sup>6</sup> This challenge is satisfied by self-declared eternalists and by (eternalism-descriptions of) their opponents in different ways, as I see it. That matters for my present purpose. For, if one believes that Humeanism is compatible with non-eternalism, one apparently has a different understanding of eternalism in mind as in the case in which one believes that Power metaphysics is compatible with eternalism. So, both my opponents have different (non-)eternalist views: the first’s view of non-eternalism is —so to speak— not dynamical enough, the second’s view of eternalism is too dynamical. In contrast to both, I intend to show that the most challenging understanding of eternalism —which I will call “perspectival eternalism”<sup>7</sup>— is (still) incompatible with Power metaphysics, and that sharpened non-eternalism is in fact incompatible with Humeanism.

The paper is structured as follows: Section 2 is devoted to spelling out (non-)eternalism to the extent as needed. Subsequently, the metaphysics of laws enter: Section 3 argues in favor of Humeanism requiring (perspectival) eternalism, and Section 4 defends Power metaphysics implying (sharpened) non-eternalism. Humean contingency cannot stand within a (really) dynamical world, whereas dispositions cannot exercise their productive powers within (any sort of) the block universe. Both packages are independent of whether the world is (in)deterministic.

## 2. Spelling out (non-)eternalism

In this section, I will firstly spell out the most challenging understanding of eternalism. It includes a perspectival sense of existence, namely a temporally restricted way of being ac-

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<sup>5</sup> Maudlin (2007, chap. 2) defends the non-Humean view that laws are irreducible, i.e. given primitively. He also assumes the block universe but rightly does not claim that one is committed to eternalism by the assumption that laws are primitive.

<sup>6</sup> With respect to the past, the same holds for growing blockers.

<sup>7</sup> It is “most challenging” for non-eternalists, because it makes it most difficult to establish a contrast view to eternalism.

cording to which as of the time of dinosaurs no computer exists.<sup>8</sup> Thus, eternalism does neither imply that everything exists eternally in the sense of always nor that existentially nothing happens at all; instead, there is a sense in which from time to time different things exist. It is a sense of temporal variability, however, that must be compatible with the non-perspectival sense of existence according to which dinosaurs and computers exist on a par. Correspondingly, the mere focus on perspectival existence is not sufficient for the opponent views of growing block or presentism; non-eternalism has to be sharpened by rather modifying the non-perspectival sense of existence. In short, eternalism turns out to be more ‘dynamical’ than (perhaps) assumed, and non-eternalism must accordingly be even more dynamical, i.e. truly dynamical.

My purpose in this paper is to say (1) that Humeanism requires eternalism and so that the apparent compatibility of Humeanism with the growing block view is rather the compatibility of Humeanism with perspectival eternalism, and (2) that Power metaphysics is incompatible even with the most challenging understanding of eternalism, but properties as being essentially dispositional require sharpened growing block view or presentism in order to exercise their powers. This implies that (local) indeterminism does not lead to growing block —i.e. “open-future Humeanism” (see Hüttemann 2014, with reference to Beebe and Mele 2002) does *not* equal “non-eternalist Humeanism” (see Backmann 2016)—, and that determinism as objective metaphysical necessity does not undermine the productively dynamical Power world. Again: (1) even perspectival eternalism assumes, for each physical token, an *existential independence* without which Humean contingency cannot stand, and (2) the existential dependence of physical tokens on being (formerly) present —as it is required by sharpened non-eternalism— is of a dynamical character without which dispositions cannot exercise their powers. In particular, existential dependence on being (formerly) present turns out to be *productively* dynamical when combined with Power metaphysics of laws. Further, this is independent of whether the laws are deterministic or probabilistic.

Crucially, perspectival eternalism has to be characterized by a *combination* of an unrestricted and a temporally restricted sense of existence. Applied to Minkowski’s block universe, one possibility is the following:<sup>9</sup>

(Tenseless) Existence [*simpliciter*]: event *e* exists in a *non-perspectival* sense of existence iff it is located somewhere in spacetime, i.e. at some spacetime point *p* or other.

(Tenseless) Existence [*as of p*]: event *e* exists in a *perspectival* sense of existence, i.e. (tenselessly) as of a given *p*, iff it is located at *p* or at some *p'* within or on the (so-called) past lightcone of *p*.

<sup>8</sup> My crucial distinction between “existence *simpliciter*” and “existence as of *t*” —to be introduced below— is very close to similar distinctions in Sider (2001, 59) and Lewis (2004, 3-4). However, there are many authors who apparently disagree: Tooley, a growing blocker, characterizes eternalism as the view that “all temporal states of affairs are actual as of all times” (Tooley 1997, 41; but see also the reply in Mellor 1998, 83); Savitt, a philosopher of spacetime physics, (mis-)characterizes a model analogous to the one presented below as a “synthesis” of eternalism and presentism rather than just (perspectival) eternalism (see Savitt 2006, sec. 2); Deasy, a moving-spotlight eternalist, says that eternalism is characterized by permanentism: “it is always the case that everything exists eternally” (Deasy 2015, 2074).

<sup>9</sup> In this way, I would interpret the Clifton and Hogarth (1995) approach of special relativistic spacetimes.

The non-perspectival sense of existence is intended to express the idea that eternalism is a *static* view of temporal existence. Note, however, that the perspectival sense of existence is not merely pragmatic nor epistemic. For, the temporal perspective is not a perspective that ‘one chooses’, but there rather are objective restrictions in the world. What exists as of  $p$  objectively differs from what exists as of  $p'$ . What makes this eternalistic is the fact that both restrictions are ontologically on a par, i.e. every entity, may it exist as of  $p$  or as of  $p'$  (or, both), exists *simpliciter*. Again, this does not mean that existing *simpliciter* is existing truly, while existing as-of- $p$  is somehow deficient: according to perspectival eternalism, there simply are two different ways in which an object, event, or property exists.

Note further that the perspectival sense of existence does not necessarily include the (so-called) past. Instead, one may argue, for whatever reason, that as of  $p$  there exists only the entity located at  $p$ . Alternatively, in Newtonian spacetime all events exist as of  $p$  that are absolutely simultaneous (or, earlier) than the given event located at  $p$ . In general relativity it may again be different. What matters is that such dispute only concerns the restrictive sense of existence. All these variants can be considered as variants that have in common the given non-perspectival sense of existence. Thus, they all are variants of eternalism. Eternalism turns out to be more challenging, since now the opponents can no longer focus on the perspectival sense of existence but must modify the non-perspectival one.

The *sharpened* non-eternalist views must hold that the *unrestricted* sense of existence is temporally variable; what exists *simpliciter* varies with time. In particular, according to presentism, there seems to be only one single temporal perspective, namely the present one. Reasonably, the so-called present perspective is not even a perspective at all; for, there cannot be, in principle, a different one. Accordingly, the presentist's *non-perspectival* sense of existence is tensed (see, analogously, Hestevold and Carter 2002):

(Tensed) Existence [*simpliciter*]: event  $e$  exists in a *non-perspectival* sense of existence iff it is present.

According to the sharpened dynamical growing block view, it does not only ‘vary’ what exists as of  $p$  (or,  $t$ ) but it really varies what exists *simpliciter*.<sup>10</sup>

Regarding the connection with Humeanism or Power metaphysics, the questions to be answered turn out to be the following:

1. Is it possible that the *simpliciter*-totality on which the Humean laws supervene is temporally variable (e.g., growing)?
2. Is it possible that the local properties out of which the Power laws “flow” (Bird 2007, 2) are those existing perspectively as of  $p$  (or,  $t$ )?

Before going on, a short remark on the challenge from relativity is in order here. The challenge says that relativity is incompatible with non-eternalism. If so, the lesson of the subsequent two sections is that Power metaphysics is ruled out by relativity.

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<sup>10</sup> Note that the alleged variety as of  $t$  does not mean that it changes what exists as of a given  $t$ , say:  $t_0$ , but only that what exist as of  $t$  is different from what exists as of another time  $t'$ ; and so with  $p$  and  $p'$  in spacetime.

However, some arguments in favor of relativity requiring eternalism in fact only strike against the growing block view but not against presentism. It is said, e.g., that the ‘moving’ edge of being constitutes a global time order within the increasing block, but (general) relativity includes models of the universe with closed timelike curves, i.e. without a globally consistent time order. Presentism, by contrast, is perfectly compatible with (or, even required by) the view that time is fundamentally temporal directionality *and* does not imply that the ‘moving’ Now automatically constitutes a globally consistent time order (see Friebe 2016). Further, Earman argues that the causal set approach to quantum gravity suggests that a growing block emerges by underlying productive causality (see Earman 2008, sec. 7). Here, the growing block is connected essentially with productive causation; so there is justified hope in the kindness of nature that the speculative piece of Section 4 can be naturalized.<sup>11</sup>

### 3. *Humeanism requires eternalism*

Consider, with these ontologies of time in mind, the metaphysics of laws. In this section, I will defend the claim that Humeanism requires eternalism, i.e. that the *simpliciter*-totality as the supervenience basis for laws (the Humean mosaic) must be the block universe. I offer two arguments. The first argument says that Humeanism cannot answer the *changing-laws* challenge that arises when one takes seriously the (sharpened) dynamical views of temporal existence. The second says that Humeanism implies contingency in a way that makes everything *existentially independent* of anything other, whereas in a dynamical world objects, events, or properties are existentially dependent on being (formerly) present.

To begin with, I will firstly debug the impression to the contrary that Humeanism is compatible at least with the growing block view. The impression has to do with confounding “open future Humeanism” with “non-eternalist Humeanism”:<sup>12</sup> In my view, open-future Humeanism is a debatable position, but non-eternalist Humeanism is not. It is important, for my purpose, to firstly clarify this issue because the (mis-)identification of open-future Humeanism with non-eternalist Humeanism is motivated by (partly right) observations on indeterminism. However, I want to argue that the determinism/indeterminism distinction doesn’t matter!

The reasoning (to be debugged) goes as follows: Following Lewis there is a certain sort of indeterminism compatible both with Humeanism and with his underlying eternalist assumption. Let’s call it “*global* indeterminism”. However, as Beebe and Mele (2002) have shown, there is a quite different sort of indeterminism compatible with Humeanism, call it “*local* indeterminism”. This sort of indeterminism seems to be non-Lewisian and so contradicts his eternalist assumption. Therefore, Humeanism is also compatible with non-eter-

<sup>11</sup> Note that such a naturalized metaphysics would reject the idea that non-eternalism can stand without causation/laws. In fact, Earman opens the door for the package production/growing block as a biconditional.

<sup>12</sup> Open-future Humeanism traces back to Beebe and Mele (2002); it has been criticized in Hüttemann (2014). As it seems to me, many authors identify this open-future Humeanism with non-eternalist (growing block) Humeanism, explicitly in Backmann (2016).

nalism. Against it, I will firstly argue that even this local indeterminism is compatible with (perspectival) eternalism (whereas, as will be argued subsequently, (sharpened) non-eternalism is in fact incompatible with Humeanism).

Global indeterminism states the following. The Humean mosaic consists in categorical properties distributed over the static *simpliciter*-whole of spacetime (eternalist assumption). Then, the Best System in accordance with this distribution can contain *probabilistic* laws. Indeterminism can be identified with these probabilistic laws. This indeterminism is ontological, rather than merely epistemical, although epistemic virtues (simplicity, strength, balance) are involved in the characterization of the Best System. For, in the world there really is, e.g., a 50/50-distribution of spin-up/spin-down outcomes when spin-measurements are made. It is global, rather than local, since the outcome of a spin-measurement *at p* is indetermined by the events located in (or, on) the past lightcone of *p* *only because* the outcome is different at some *other* point *p'* where the situation is completely similar. Locally, by contrast, there is only one real future, i.e. there is no branching of different possible futures there. As it seems, global indeterminism is compatible with eternalism precisely because in the local future lightcone of *p* the particular outcome of the measurement at *p* is 'already given'.

Local, but still Humean, indeterminism consists in the (apparent) *absence* of constraining laws as of a given time *t* or spacetime point *p*. Since the Humean supervenience basis of laws must be the totality, the whole of time or spacetime, the eternal *simpliciter*-laws hold timelessly, i.e. *not* already at a given time *t* (or, *p*). They do not hold always, not at every time, but only at the end of time (if there is any). Before the end of time, namely at *t* (or, *p*), hence as long as time progresses, the Humean mosaic is "incomplete". The reductive laws are fixed only when the world has come to an end; before that, the supervenience basis needs to be completed. Time progresses, and the whole of spacetime successively emerges until, at the very last moment, it will be complete. The eternal *simpliciter*-laws do not determine the course of events, but the events determine what at the end of the universe these laws will be. All this sounds 'dynamical', so that it, seemingly, cannot be said with the eternalist assumption.

With only global indeterminism, the underlying whole is simply 'given', the laws are 'eternally' fixed, period: nothing happens. With local indeterminism, in contrast, the local future is not 'already' given, apparently in conflict with the 'givenness' of all entities according to eternalism. So, global indeterminism requires eternalism, but local indeterminism requires non-eternalism. However, this reasoning is wrong: eternalism, so understood, is misleadingly characterized *only* by the 'perspective from nowhere'. By contrast, perspectival eternalism must be characterized both non-perspectivally (from God's eye) as well as by temporal restrictions, as of *t* (or, *p*). Open-future Humeanism (local indeterminism) can perfectly be based on perspectival eternalism and *must* be so: on the sharpened non-eternalist assumption, the Humean mosaic would *always* be complete; it is *not incomplete* presently or as of the edge of being. The *simpliciter*-totality on which the laws supervene varies with time, e.g., is growing according to the sharpened growing block view. From this it follows my first argument for Humeanism requiring eternalism.

First argument: non-eternalist Humeanism is at odds with the stability of laws. Usually, one assumes that the laws of nature are more or less stable, i.e. they generally do not change over time. Every metaphysics of laws has to provide an explanation for (or, at least,

to be in accordance with) the temporal stability of laws.<sup>13</sup> Taking seriously the difference between perspectival eternalism and the sharpened growing block view (or, sharpened presentism), it turns out that on the eternalist assumption one can properly respond to the changing-laws challenge but on the non-eternalist assumption one cannot. The crucial point is that a complete Humean mosaic contains all tokens that exist *simpliciter*, i.e. the supervenience basis for the laws includes the *simpliciter*-totality of all entities. With regard to (perspectival) eternalism, the totality is static, the unchanging whole of spacetime, and so the laws supervening on it are eternal at least in the sense of temporally stable. With regard to (sharpened) non-eternalism, however, the *simpliciter*-totality *changes*, and so, with Humean contingency, the supervening laws threaten to change, often and rapidly, as well.

Admittedly, open-future Humeanism is confronted with a similar challenge, but, on the perspectival eternalist assumption, there seems to be a consistent strategy to answer it.<sup>14</sup> Here is the (no-laws) challenge for open-future Humeanism: If it is true that there is not only the *simpliciter*-totality but also (infinitely many) objective temporal restrictions and if it is true that, as of *p* (or, *t*), the mosaic contains only those events that exist *as of that p*, then the local supervenience basis really is incomplete. So, apparently, no laws are given *then*, and the arising challenge is the threat that nature starts to behave very differently after *p*.

My response goes as follows. Since, on the (perspectival) eternalist assumption, the mosaic as of *p* is a *restriction* of the mosaic *simpliciter*, there are indeed as-of-*p* laws holding at *p* which result by *p*-indexing the eternal laws (see, analogously, Backmann 2016).<sup>15</sup> The as-of-*p* laws, as *p*-restrictions of the *simpliciter*-law(s), must be compatible with them. If, e.g., there is no faster-than-light signal so far, there might be a reason *why* it is so: because the contrary would be inconsistent with the *simpliciter*-laws supervening on the whole from which 'as-of-*p*' is merely a restriction. In other words, the notion of Humean contingency comes in different strengths. In one sense, namely *simpliciter* (non-perspectival), the property distribution is contingent in the way that in another possible world the distribution is completely different including completely different laws supervening on it. In another sense, namely from a temporal restriction (perspectival), it is contingent how the world proceeds.

In the latter case, there also *is* a larger pattern (the totality) —given from nowhere— in virtue of which the perspectival contingency is *constrained*. Here is room for justified hope in the kindness of nature that it will not behave very differently after *p*. Although there still might be sophisticated arguments against open-future Humeanism, there is, after all, ap-

<sup>13</sup> Briggs and Forbes (2017) argue why changing laws really are disadvantageous, namely because then there are no non-trivial views about the future, and explanations about the past are unstable. It seems, however, that Briggs and Forbes take it for granted that Humeanism plus Growing Block implies changing laws. The purpose of this section is to defend this implication against impressions to the contrary, which can only be done by distinguishing perspectival eternalism and sharpened non-eternalism.

<sup>14</sup> This is to say that, if one distinguishes carefully open-future Humeanism from (alleged) non-eternalist Humeanism, one can defend Backmann's (2016) strategy against the worries raised by Hüttemann (2014).

<sup>15</sup> Example: take as *simpliciter*-law that spin measurement outcomes are 50/50, but as of *p* 70% show spin-up. Then, I would say that an as-of-*p* law says 70% spin-up, which is a consistent *p*-restriction of the *simpliciter*-law.



parently a consistent defense strategy. There is none, by contrast, on the (sharpened) non-eternalist assumption.

For, if “now” is not only an indexical indicating a temporal restriction, as it would be according to (perspectival) eternalism, but if “now” refers to the ontological (edge of) being, then, presently, the *simpliciter*-laws are fixed (and not only at the very end of the world). At the edge of being, the (alleged) supervenience basis is not incomplete—not to be completed at the very end of the world—but it is already always complete.<sup>16</sup> However, since it changes over time what exists *simpliciter* (the totality itself is growing according to the sharpened growing block view), the varying so-far laws no longer are restrictions of eternal *simpliciter*-laws. Thus, there is no longer a Humean way to eternal laws, so no longer a way to temporally stable laws.

The hope in the kindness of nature is, in non-eternalist Humeanism, no longer justified: the (essential) Humean contingency cannot be constrained, but there is only the strong sense of contingency available in non-eternalist Humeanism. The complete supervenience basis is continuously changing, and this change of the totality is, on the Humean assumption, entirely contingent and independent of the so-far laws. Hence, the reductive laws that continuously supervene on this changing mosaic likely will *always* be different. Therefore, non-eternalist Humeanism cannot explain (or, is even in conflict with) the temporal stability of laws.

Second argument in favor of Humeanism requiring eternalism: Humeanism is non-productive which requires an ontology of time according to which physical tokens are existentially independent. Even the most challenging understanding of eternalism assumes existential independence of every object, event, or property from anything other, whereas according to the sharpened dynamical views of temporal existence physical tokens existentially depend on being (formerly) present. Perspectival eternalism allows that as of the time of dinosaurs no computers exist; so it allows for succession and coming into being, in the perspectival sense. However, the perspectival sense only is a restriction of the non-perspectival sense of existence, i.e. being located somewhere in spacetime. From this it follows that the perspectival realization relation  $pRp'$ —read: whatever is located at  $p'$  is realized as of  $p$ —is *unconditioned* reflexive: “R is surely reflexive” (Saunders 2002, 283).

The perspectival sense of existence substantially concerns only physical tokens located *somewhere else*. All the mentioned variants of eternalism (see Section 2) differ in what is realized as of a given  $p$ —whether everything absolutely simultaneous with  $p$ , or everything in the past lightcone of  $p$ , or what not—, as long as one considers entities located at some other point  $p'$ . They all have *necessarily* in common that the entity located at the given  $p$  is realized as of that  $p$ . The eternalist assumption is precisely this: everything exists as of the  $p$  of its own location. Every non-eternalist ontology of time denies precisely this by claiming that something substantial must be added to ‘being located at  $p'$ ’ in order to be realized as of  $p$ : namely being (formerly) *presently* located at  $p$ .

Humeanism requires the eternalist existential independence because it says that nothing substantial will be added to ‘being located at  $p'$ ’ if one states that the physical token has

<sup>16</sup> As of a time  $t$  earlier than the edge of being the situation (in the growing block) is apparently analogous to eternalism.

been *produced* at *p*.<sup>17</sup> In a Humean world, the (deterministic or probabilistic) laws are not responsible for the distribution of the fundamental physical properties. Thus, they are not the *ground for the existence* of that development (which is even uncontroversial). Humean metaphysics assumes that either the existence of each object, event, or property is ungrounded or the ground for their existence is internal, i.e. it lies somehow within each entity considered for itself.

Take, e.g., charge and its alleged power to create an electromagnetic field. The Humeans agree with other views, in particular with Power metaphysics, about which physical tokens there are in the world. They disagree about the ontological status of these things, events, or properties. Humean contingency requires that the physical tokens *simply* succeed one another although some causal relations may supervene on them. The succession is simple exactly if the tokens are existentially independent from anything other; there are no existential dependence relations between distinct properties or events, nor do they depend existentially on laws or whatever else, e.g., not on a ‘moving’ present. *Being located at p* is the primitive concept, as well as according to eternalism, and nothing substantial would be added if one said that the entity *e* has been produced at *p*.<sup>18</sup>

The crucial point is that one must take seriously the difference between the ‘dynamical’ becoming, which *is* accepted by the reasonable eternalists via the perspectival sense of existence, and the dynamical becoming required by sharpened non-eternalism via the temporally variable *simpliciter*-existence. Humean contingency cannot stand in a dynamical world, because in such a world physical tokens are existentially dependent on the ‘moving’ present.

#### 4. Power metaphysics requires non-eternalism

Let me now turn to Power metaphysics. I will defend the claim that essential dispositionalism requires the sharpened non-eternalist views. The argument says that dispositions only can exercise their powers to bring about other (later) physical tokens if they are present, i.e., with the growing block view in mind, located on the edge of being. Dispositions would be powerless if they existed merely perspectively at *t* (or, *p*). For, then, their manifestations would likewise exist merely perspectively at *t'* (or, *p'*), and, hence, both the dispositions and their manifestations would be ‘given’ anyway, i.e. they would equally exist *simpliciter*. Contrariwise, *simpliciter*-existence must vary with time.<sup>19</sup>

<sup>17</sup> Nevertheless, Bourne (2006) apparently defends a Humean presentism. However, he does not explain how his abstract *ersatz* moments of time become concrete present moments. In this way, the sharpened dynamical nature of presentism is disguised.

<sup>18</sup> Semantically, the statements “*e* is located at *p*” and “*e* has been produced at *p*” have (according to Humeanism) the same truth-conditions, and so active production can be reduced ontologically on passive location.

<sup>19</sup> Here, an objection may be raised (see Backmann 2017) that, on the growing block view, properties lose their productive power when becoming past, which contradicts the idea that they are *essentially* dispositional. My possible response goes as follows: Probably, the growing blockers must modify their view. If it is true that what exists *simpliciter* varies temporally, then —on the growing view— both the present and the past (but not the future) successively come into existence. Thus, on the growing block view the past is not analogous to eternalism but has its own characteristic status which does not make the past properties powerless.

Still, there is the widespread intuition that Power metaphysics is compatible with the block universe view (see, e.g., Esfeld 2008, chap. 5). The idea firstly seems to be that the crucial difference between categoricism and dispositionalism is that the latter recognizes *metaphysically necessary* connections (or, *tendencies*) among distinct physical tokens, whereas the former denies them. These modal relations allegedly can hold between (or, even require) ‘already’ existing relata. So understood, Power metaphysics lacks productive sense and is, therefore, compatible with eternalism. Connected with this understanding is the requirement that one needs (a particular sort of) indeterminism to save oneself from the block universe view (see McCall 1976; and Müller 2006, 456). By contrast, I hold that indeterminism gets its (desired) productive sense from sharpened dynamical temporal existence, and not the other way around.

*De-re* modal relations of necessity or tendency, I suggest, are underestimated if one denies their productive sense. If a necessitates (or, is a tendency for) b, b cannot exist ‘anyway’, i.e. the realization relation cannot be unconditioned reflexive. Rather, b only is located at its time t (or, its spacetime location p) *when* necessitated or *successfully* be \*tended\*, i.e. in English: brought about. To mimic Lewis’s complaint with Armstrong’s necessity relation, I would say that “metaphysical necessity” and “tendency” are mere labels when not combined with productive sense.

However, one even may argue that dispositions *are* productive without bringing the future into reality. Admittedly, a ‘present’ disposition *brings about* a later event but, the objection goes, if “now” is merely an indexical indicating a temporal restriction —as it is according to eternalism—, this holds for all dispositions, likewise for so-called past, present, and future ones. 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*. Against it, I argue that even the most challenging understanding of eternalism cannot do justice to the productive Power requirement that manifestations are existentially dependent on dispositions. Even if it is true that computers do not exist as of the time of dinosaurs, they do not existentially depend on something in their past. For, they still exist *simpliciter* which, in the eternalist understanding, implies that their existence does not depend on anything other. As being argued, the eternalist realization relation is “surely reflexive” (Saunders 2002, 283).

If the essential difference between categoricism and dispositionalism is that the latter requires *existential dependence* relations between different physical tokens, then the regularities in the world are not simply given but generated (see Esfeld 2008, chap. 5). A given object, event, or property has been produced. It existentially depends on something *external*, on other (earlier) dispositional properties, probably together with the active Power laws. Something *other* is the ground for the existence of the given token; it has had the power to produce the given particular.<sup>20</sup> Thus, according to Power metaphysics, something substantial has in fact to be added to ‘being located at p’: entity e has been produced at p. This ex-

<sup>20</sup> Note that the reasoning goes from some actual manifestation to the earlier disposition (and not the other way around): this avoids worries with antidote-cases. As Schrenk (2010) argues, dispositionalism is also confronted with antidote-cases and so ‘metaphysical necessity’ doesn’t help. However, the difference still is that the actual token *that has not been prevented by antidotes* has been produced at p, i.e. it is not merely located at p.

ternal ground of the existence of concrete particulars is incompatible (even) with the most challenging understanding of eternalism which requires, instead, that nothing substantial can be added to ‘being located at p’.

Power metaphysics needs the existential dependence on something external which is provided by the sharpened presentist’s or growing blocker’s idea that what exists at p depends on p being (formerly) present. This existentially dynamical presentness can become (and actually becomes) productive in virtue of dispositions and Power laws. According to perspectival eternalism (as well as according to Humeanism) physical tokens simply succeed one another, e.g., along a timelike curve in spacetime. According to growing block and presentism, the present (the edge of being) comes successively into existence *simpliciter*. (Only) this can be turned into a productive succession by dispositions and Power laws.

To sum up the connected argument from (non-)productiveness/existential (in)dependence: Eternalists and Humean metaphysicians agree that nothing substantial will be added if one states that the physical token is presently located at p or has been produced at p; both “being present” and “being produced”, over and above of being located, sound rather mysterious both for the eternalist’s and Humean habit. In contrast, both non-eternalists as well as Power metaphysicians agree that something substantial could and should be added to that ‘being located at p’. According to dynamical views of time, it makes an essential difference if something is (formerly) *presently* located at p or not. Likewise, according to the dispositionalists, it makes an essential, ontological difference if something has been *produced* at p or not. The connection is not casual: for, the Power metaphysicians must argue that “to be present” has productive sense. Thus, only in the (sharpened) dynamical world the dispositions can exercise their productive power.

Everything being said so far is independent of whether the Power laws are deterministic or probabilistic. Also, it is independent of whether the laws hold exceptionless or allow for (few and irregular) anomalies. In any case, Power laws have productive essence as long as *simpliciter*-existence is temporally variable.

## 5. Conclusion

To conclude, look at growing blocker’s view about the connection of the metaphysics of laws, eternalism and (in)determinism:

Regardless of whether one adopts a realist or a reductionist view of laws of nature, there is no reason why a static world cannot contain indeterministic laws. (Tooley 1997, 27)

This is troublesome. Though it may be true that eternalism is compatible with indeterminism regardless of whether one adopts primitivism of laws (the “realist” view from Maudlin) or Humeanism, the static world cannot contain indeterministic Power laws. Such a “realist” view of laws of nature is incompatible with a static world but requires the growing block view or presentism. However, this is so independently of whether those laws are probabilistic or deterministic. The productiveness of Power metaphysics does not stem from its laws, let alone from indeterministic laws, but from the dynamical existence of dispositions and their manifestations.

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