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Time and
the Continuum



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INTRODUZIONE

Time and the Continuum. An Introduction to the Problem(s)*

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*The idea of this issue stems from a summer-school and workshop on temporal continuity held in Imperia, Italy in September 2019, co-organized by the University of Siegen, the Society for the Philosophy of Time (<https://s-p-o-t.weebly.com/>) and the Theatre Lo Spazio Vuoto. We thank the Thyssen-Stiftung for having made the conference possible through their generous financial support. We also thank the Goethe-Institute Turin/Genua for their contribution to the summer-school. The essays from Florian Fischer, Francesco Orilia, Cord Friebe, and Claudio Tarditi in this issue are based on their talks at the conference. We thank all other speakers of the conference as well as all participants.

Philosophy in the 20th Century is usually characterized in terms of the linguistic turn, language being a central topic that cuts across very different philosophical schools (Continental vs Analytic, Phenomenology/Hermeneutic vs Structuralism and Post-Structuralism, etc.). Yet, looking at its major philosophical, scientific and literary works, we may as well speak of a *temporal turn* to describe the movement of thinking throughout the century. From Bergson's *Creative Evolution* to Heidegger's *Being and Time*, from Einstein's theories of relativity to Prior's temporal logic, from Proust to Borges, the engagement with time is ubiquitous from the beginning to the end of the Century, tracing an alternative line of thought that runs parallel to that of the engagement with language. And, in fact, this line becomes even more visible and important now, from the perspective of the 21st Century where the linguistic turn seems to have been put aside and the topic of time is even more on the rise. In the last years, publications on the topic have been literally exploding, not just in metaphysics and philosophy of science, but also in the philosophy of mind, the philosophy of action, in ethics, and aesthetics.

This raising interest in the topic of time may have one of its important roots in the pervasive feeling that contemporary life has a serious problem with time, having made this the scarcest of all resources. Already Heidegger complained against the fact that the rhythm of modern life is dictated by a permanent lack of time (Heidegger 1983, 115). Over the course of the last century and especially towards the end, through the digital revolution, this experience has been pushed to an extreme. Recurrent talk of acceleration, of temporal disintegration, and of dysynchronicity testify to the fact that something has changed drastically in our relationship to time, creating a sense of loss and impotence. ¹ Traditional ways of experiencing, thinking, and organizing time that held for centuries seem no longer available. The result is that we feel as much disconnected from the past as we do from the present and the future. We have been long shipwrecking in the raging river of modern times. Given

¹ Many different works have explored the way our experience of time has changed over the last century. Two recent examples are Rosa (2015) and Han (2017).

this permeating feeling that we have somehow lost time, it is not surprising that so many philosophical works engage with such topic. As if the loss could be somehow compensated by thinking and the raging river be brought to rest in the vast number of books and publications on the topic.

Metaphors besides, re-thinking time and our relation to it seem to have become a matter of both theoretical and practical necessity. And the relation between time and the continuum is particularly relevant here. Then, as philosopher Byung-Chul Han points out, contemporary life is characterized by an ineradicable discontinuity (Han 2017). The 20th century has experienced the radical break from the past as well as the decline of utopian visions of the future. This has left us with an isolated present with no great temporal breath. Moreover, such discontinuity does not only shape the experience of history, it is also entrenched in our everyday life. Due to the strict regimentation of work and leisure, we often seem to experience *our* time as a sequence of disconnected events, appointments and achievements. This leaves little space for temporal breath, thus for an experience of duration. It makes any form of dwelling, resting and lingering difficult. ² Precisely in the light of such developments, it appears particularly relevant to reflect upon the concept of *temporal continuity*. What does it mean for time to be continuous? Does the passage of time imply some sort of continuity that holds past, present and future together? Or, is time really just a sequence of disconnected events? In fact, developing the right concept of temporal continuity is a necessary condition for understanding any experience of duration and persistence, hence for thinking (and re-thinking) our relationship to time.

² Codermatz's contribution to this issue analyses how psychological disorders such as schizophrenia are intimately related to a discontinuous experience of time.

From a purely theoretical perspective, the concept of *temporal continuity* is problematic mainly for one reason. In contrast to space, time is intimately connected to change and appears therefore irreducibly dynamical. Temporal change seem to imply more than the simple distribution of difference in a pre-given space. It seems to imply a genuine coming-to-be and a genuine passing-by. This raises a fundamental question: How can time be conceived as being both something continuous, hence extensive, and passing?

The current issue of Philosophy Kitchen investigates the notion of **temporal continuity** by grappling with these questions from a genuine philosophical perspective. We do not think that such questions can be settled by mathematical theories of the continuum or by physical notions of time alone. They require philosophical reflection about the way we experience time and we think of ourselves in the world. Only by addressing these questions at this level can we make *sense* of our experience and thus rethink our relationship to time.

More specifically, the aim of the issue is to show the relevance of the topic of the temporal continuity for the contemporary philosophy of time in its different strands. Especially in the context of analytic philosophy of time, the orthodoxy is to presuppose a mathematical conception of the continuum that goes back to Georg Cantor. Whether such a conception is apt to capture the nature of time is hardly discussed. Thus, the issue wants to bring to attention some problems that such conception may lead to. It wants to discuss possible solutions as well as considering alternative conceptions of the continuum from the history of philosophy and mathematics which may be better apt to capture the dynamical nature of time.

In what follows I'll first sketch some important stages in the history of the concept of the continuum to show how the contemporary orthodoxy to think about continuity emerged. The second part discusses the continuum in relationship to time.

I'll point at some questions the Cantorean definition of continuity raises in connection to three different debates in the philosophy of time: the nature of temporal passage, the meaning of temporal existence, and the ontological status of processes. This will provide some background for the papers published in this issue, as well as giving a general motivation for why the question about temporal continuity is of crucial importance.

I. The Continuum: A Brief History of the Concept

The concept of the Continuum has a very long history, going back to Zeno's paradoxes, hence to the very origin of western philosophy. From then onward, the problems that Zeno's paradoxes raised have been discussed in very different forms by philosophy, mathematics, and the natural science. Whereas mathematicians focused on the continuum to develop a formal definition of the real numbers, scientists addressed Zeno's paradoxes in the context of a treatment of movement, time and space. Philosophers grappled with both approaches, trying to reflect on their ontological and metaphysical implications. This variety of different perspectives and questions makes it very difficult, in fact impossible, to trace a single history of the concept. We may rather speak of histories of the Continuum, some of which are interconnected, others which remain independent of one another.

In the light of such a plurality of histories, here I will concentrate on a few important moments that allow for telling one consistent narrative about the development of the concept, a narrative that is in no way exhausting or inescapable. This narrative will mainly concern the abstract concept of the Continuum, independently of whether the continuity of space, time, or change is at issue.

The first important stage in this history of the concept is Aristotle's engagement with Zeno's paradoxes of motion in the *Physics*. Zeno had tried to demonstrate the non-existence of motion by showing that it can be neither infinitely nor finitely divisible. ³ To avoid Zeno's conclusion, Aristotle developed a detailed analysis of the notion of continuity. Central to this analysis is a top-down approach according to which the continuum is an undivided whole given prior to its (possible) parts. For Aristotle, parts merely are the result of a process of dividing that can be repeated *ad infinitum* (*Phy.* 231b15). From this, Aristotle inferred that indivisible points are neither actual nor potential parts of the continuum. However often the continuum is divided, the process of division never leads to points. Since all potential parts of the continuum exist only as a result of a process of division, points cannot be parts of the continuum. Points exist only as potential boundaries of continuous parts. They do not have any independent existence. ⁴ When applied to time, Aristotle's understanding of the continuum has many consequences. Is time continuous, so it follows that no temporal instant has an immediate successor. For, instants only exist as boundaries of temporal intervals. Accordingly, time is understood as that which passes continuously between any two instants, not as a sequence of extensionless instants. ⁵

This conception of the continuum together with Aristotle's understanding of the infinite have set the framework for all later developments of the

³ Zeno's paradoxes have only survived in Aristotle's formulation in the *Physics*. See Aristotle *Phy.* 239b-240a. For a general discussion of the paradoxes, see the contributions in Salmon (1970).

⁴ A classical interpretation of Aristotle's account of continuity is Wieland (1962, 278-325). For a more recent analysis of this account in comparison with contemporary mathematics, see White (1994).

⁵ This particular understanding of continuity leads to a series of puzzles about the nature and the status of time, which Aristotle attempts to solve in Book 4 of the *Physics*. See Coope (2008) for a recent interpretation of Aristotle's solution sensitive to the issue of continuity.

concept. In the 14th Century, Aristotle's conception of the continuum became object of an intensive debate. William of Ockham proposed a view of the continuum that in some respects departed from the Aristotelian view and anticipated later mathematical developments. ⁶ Thomas Bradwardine argued at length for the Aristotelian thesis that continua could not be made out of indivisible parts (see Bell 2013). Furthermore, in the 15th Century, Nicholas of Cues developed an account of the actual infinite which became prominent in the later mathematical description of the continuum by Cantorean set theory (see Moore 1990, 55-56). With the rise of modern science and the invention of the differential calculus, discussions about the continuum took a new turn. Developed independently by Newton and Leibniz, the calculus allowed the calculation of instantaneous quantities such as velocity by making use of infinitesimals. These are infinitely small quantities and therefore presuppose a conception of the actual infinite. Moreover, they make possible a new understanding of the continuum where it is constituted of infinitely small indivisible sections. For this reason, their introduction was an important step towards the abandonment of the Aristotelian framework and became the subject of numerous controversies. ⁷ It was only with the birth of set-theory at the end of the 19th Century that these controversies were (partly) resolved, as a formal treatment of the actual infinite put forward by Cantor.

⁶ For a reconstruction of Ockham's view, see Roques (2017a). See also Roques (2017b) and Bell (2013, Sec. 3).

⁷ For a good discussion of the calculus in connection with both the infinite and the continuum, see Moore (1990, 57-74).

During the 18th, Immanuel Kant's understanding of the Continuum is still essentially Aristotelian. Like Aristotle Kant considered continuous magnitudes to have extended parts only, points being no parts of continua but only limits (Kant 1781/87, A169/B211). He did not break with such a definition, as later mathematician would do. Nonetheless, Kant still represents an important point within the history of the Continuum. For, Kant related the continuity of space and time to their being *intuitions* rather than concepts. According to the arguments of the Transcendental Aesthetics in the *Critique of Pure Reason*, the continuous nature of space and time is nothing that can be grasped on conceptual grounds alone. It requires an intuition, a singular immediate presentation of its object (Kant 1781/87, A32/B47). Thus, Kant established an important distinction between intuitional and formal/conceptual accounts of the Continuum, which would be later taken up by different philosophers and mathematicians in reacting to Cantor. ⁸

⁸ In the context of Kant's understanding of the Continuum it is important to mention the works of Gerold Prauss. Prauss argues that Kant's understanding of time presents elements of a radically new conception of continuity (Prauss 2001). Starting from Kant, Prauss works out such a conception, criticizing both Aristotle's and Cantor's definition. See Prauss (2017).

It is difficult to overestimate the importance of the works of Georg Cantor at the end of the 19th Century. At least from a mathematical perspective, these present the most important development in the history of the Continuum since Aristotle, set theory having become the foundation for doing and understanding modern mathematics and physics. However, not only because of this are such works philosophically relevant. They also have led to a radically new way of thinking about infinity and the Continuum.

In a nutshell, Cantor's account is based on the identification of the Continuum with the structure of the real numbers. According to this identification, the set of the real numbers is isomorphic to the set of potential points of dividing a line in space. Thus, the Continuum is no longer seen as an irreducible concept, but it is identified with a certain set of *points*. Cantor developed a definition of such a set through a

formal construction of the reals. ⁹ These constructions deliver a purely algebraic definition of a continuous line freed from any geometric intuition. This definition requires the concept of the actual infinite developed by Cantor's theory of transfinite numbers. Thanks to this, the continuum could be identified with an actual (uncountable) infinity of points satisfying certain properties (see Moore 1990, 110–122). This new approach to the continuum breaks radically from the Aristotelian understanding of both the continuum and the infinite, as well as from our everyday intuition. For this reason, it received numerous critiques from philosophers and mathematicians at the beginning of the 20th Century. The pragmatist philosopher and logician C.S. Peirce defended an Aristotelian approach of the Continuum against the set-theoretic one (Peirce 1992). Similarly, the mathematician L.E.J. Brouwer took the intuition of the temporal continuum as the basis for a constructivist account of real numbers (Brouwer 1975). Herman Weyl argued for the impossibility of any formal definition of the Continuum to match entirely with our intuitions (Weyl 1987).

⁹ Cantor constructed the reals by using fundamental sequences, whereas Dedekind developed a more intuitive construction based on so-called Dedekind's cuts. See Bell (2013).

Parallel to this controversy in the context of the foundation of mathematics, the beginning of the 20th Century saw the rise of phenomenology. Edmund Husserl engaged directly with the Cantorean set-theoretic account of the Continuum. His phenomenological approach led him to emphasize the priority of an intuitive account of the Continuum over any formal, mathematical treatment of it. ¹⁰ Thus, Husserl followed Kant in emphasizing a dichotomy between intuitional and conceptual accounts of the continuum. Moreover, Husserl argued for the phenomenological fundamentality of time, thus ascribing a central role to temporal continuity in the constitution of intentionality. Another important thinker of the beginning of the 20th Century is Henri Bergson. Bergson did not only insist on the profound differences between our intuition of the continuum and any conceptual description of it but also emphasized the dynamic nature of time. On this basis, he rejected any attempt to model the continuity of time with a spatial line. Independently of whether such a line is given through geometrical intuition or described conceptually, it is static. It is therefore not suitable for understanding the continuity of time. By the notion of a qualitative multiplicity, Bergson tried to develop an alternative conception of the Continuum to reconcile the dynamical nature of time with its continuity. ¹¹ Given that the distinction between temporal and spatial continuity is a recurring topic in this issue, this makes Bergson particularly relevant. ¹²

¹⁰ For a discussion of Husserl's engagement with Cantor and of his understanding of the Continuum, see Tarditi's contribution to this volume.

¹¹ As above suggested, such a distinction can be already found in Kant. Even Aristotle in some passages of the *Physics* seems to suggest that there may be crucial differences between temporal and spatial continuity, see the Interview with Tom Crowther in this volume. For a comparison between Bergson and Aristotle's conception of time, see de Lándazuri's contribution to this issue.

¹² In this context it is also important to mention the works of William James and Alfred North Whitehead. James' conception of the stream of consciousness ascribed a central role to temporal continuity. See James (1981, 148) where James introduced the concept. See also James

Despite these controversies, during the 20th Century Cantor's account of the Continuum became the standard framework to think about continuity. This holds not just for the continuity of space, which was the focus of Cantor's works, but also for the continuity of time and change. Motivated by a general skepticism towards intuition, the rise of formal methods in mathematics, philosophy and physics certainly contributed to the establishment of such a framework. Cantor's definition of the Continuum delivered a solution to Zeno's paradoxes that was formally correct and therefore, as many philosophers argued, satisfactory.

II. The Continuum and the Contemporary Philosophy of Time

At this stage we can now turn to the specific question of temporal continuity. How should the continuity of time be understood? As I have suggested above, the orthodoxy in the contemporary philosophy of time is to take Cantor's definition for granted. ¹³ Even if Cantor's original intent was to develop an algebraic equivalent of the spatial continuum, his identification of the continuum with the set of the real numbers can be and has been applied to time. To do this, it is necessary to map the real numbers with instants of time. The total order on \mathbb{R} given by " $<$ " corresponds to the order of temporal instants according to the relation of "before-than". ¹⁴ Density here means that each interval of time can be further partitioned into smaller intervals. Lastly completeness means that each instant of time represents the common boundary of past and future. In this section I want to show that such an assumption is problematic and therefore requires further discussion. To do so, I will focus on three debates in analytic philosophy related to time. The claim is going to be that the Cantorean definition of the Continuum raises a series of questions, at least for those views which emphasize the dynamic nature of time.

The first important debate in the contemporary philosophy of time concerns the question about the fundamentality of temporal becoming and goes back to McTaggart's distinction between two series of time (see McTaggart 1909). The A-series determined by past, present and future, the B-series determined by the binary relations after-than, before-than and simultaneous-with. Based on this distinction, the A-Theory argues that the A-series marks fundamental aspects of reality. *Tensed* temporal determinations such as "present", "past" and "future" relate to aspects of the world which are fundamental and thus irreducible. This implies a commitment to the reality of temporal becoming. Time passes in a way which differs radically from the distribution of difference in space. It implies things becoming present. ¹⁵ In contrast to the A-Theory, the B-Theory rejects the fundamentality of the A-Series. According to the B-Theory. The tensed determinations are considered as merely indexical linguistic devices through which we relate to a tenseless world. They do not pick out real properties of things but rather reflect our subjective perspective on the world.

The second debate is intimately related to the first one, it concerns the notion of temporal existence. How precisely such debate should be understood is a matter of numerous controversies. ¹⁶ As a first approximation, it can be understood as addressing the following question: What kind of things exists? Do past and future things exist? Eternalism is the view according to which to exist in time is to be located at

(1930, 181-3) where James explicitly engages with Cantor's conception of the continuum. On the other hand, Whitehead denied the continuity of becoming on the basis of Zeno's paradoxes. He famously argued that «There is a becoming of continuity, but no continuity of becoming». (Whitehead 1978, 35).

¹³The application of Cantor's definition of the continuum to time goes back to Russell (1914) and has been developed systematically in Grünbaum (1973).

¹⁴One does not need to apply this to a universal order. The model can also be applied within the context of the Theory of Relativity. In this case, it suffices to identify a local ordering of events along a world-line. See for instance Grünbaum (1973), 326-8).

¹⁵The standard formulation of the eternalist (new) B-Theory of Time goes back to Mellor (1998). For a defence of the Moving Spotlight Theory (MST) see Deasy (2015) as well as Marques' contribution to this volume; for the Growing Block Theory (GBT), see Correia & Rosenkranz (2018); at last, for presentism see, e.g. Friebe (2012). For an overall view of the debate see Fischer (2013).

¹⁶In the last few years, some authors call for a reformulation of the controversy in terms of the distinction between *permanentism* and *temporaysm*. (Williamson, 2013; Deasy, 2017; Correia/ Rosenkranz 2018). Here I will stick to the traditional formulation.

some instant of the entire spatio-temporal block. Thus, according to eternalists past and future things exist as much as present things do. On the other hand, presentism emphasizes the relation between *existence* and *presentness*. Thus, presentists hold that only present objects exist. Insofar as “present” is a tensed expression, presentism presupposes the A-Theory of time. While the A-Theory assumes that the present is a fundamental aspect of reality, presentism specifies such fundamentality in ontological terms. The fundamentality of the present is the fundamentality of existence. Further views in the debate are the growing block theory, according to which the present and the past equally exist and the moving spotlight theory, which combines eternalism with an A-Theory of time.

In the light of these two debates, Cantor’s definition of the Continuum raises a series of questions. First, it is not clear how this understanding of the Continuum could be compatible with presentism. ¹⁷ Insofar as it presupposes an actual infinite of distinct temporal points, the Cantor’s Continuum seems to imply a commitment to eternalism. ¹⁸ Moreover, the model only describes the continuity of *temporal order*. It leaves out any sense in which temporal becoming as the motion/direction of the present may be continuous. Hence, the challenge of reconciling this model with the dynamical nature of time seems to hold for any A-Theory. ¹⁹ Different alternatives are open. One may argue that dynamic theories of time such as Presentism should develop a different understanding of temporal continuity, thus the importance of looking at the history of philosophy and mathematics for alternative conceptions of the Continuum. Another possibility here would be to reject temporal continuity *in toto* by claiming that time is not continuous. Some recent developments in physics seem to point in this direction. ²⁰ This nonetheless raises a series of further questions concerning the extension of the present and its elapse. ²¹ Moreover, it is not clear how the physical discreteness of time should be addressed philosophically. Even if physical time consists of indivisible temporal intervals, dynamic theories could still be arguing that time passes within such intervals. The third important debate does not concern time as such but a specific class of temporal entities, namely processes. A lot of work has been recently devoted to the logic of aspects and to the difference between the progressive and the perfective.

Consider for instance the sentence in the progressive: “Marcel is writing his last book”. Such sentence describes an occurrence as it is unfolding. In contrast, the sentence in the corresponding perfective form “Marcel has written his last book” describes an action in the past that has come to an end. It is possible for the sentence in the progressive to be true without the sentence in the perfective ever being true. Marcel may be writing his last book without ever the complete event of Marcel’s writing of his last book been instantiated. Marcel’s writing of his last book could be

The claims concerning temporal continuity apply to permanentism and temporaryism as well.

¹⁷ Bourne (2009) is an example of a presentist who presupposes Cantor’s definition of the Continuum (see for instance p. 55).

¹⁸ In fact, it presupposes an uncountable infinity of points corresponding to the cardinality of the real numbers. That the infinity is uncountable is however not relevant here. The central problem is that continuity is understood as a property of a set that has more than *one* point.

¹⁹ Both Friebe and Yechimovitz argue in this volume that the Growing Block Theory of Time has a problem with temporal continuity. In contrast, Orilia presents a version of presentism called *substantialist presentism* that is compatible with Cantor’s definition of continuity.

²⁰ Rovelli argues for the discreteness of time on the basis of recent developments in Quantum Mechanics, see Rovelli (2018).

²¹ For a discussion of such questions and problems see Craig (2000, 227-248).

interrupted, for instance by his sudden death.

Reflection on similar examples has led some philosophers to draw an important distinction between events and processes. ²² In contrast to spatio-temporally bounded events, processes are understood as incomplete, extending temporal entities. They are the ontological correspondent to the linguistic progressive aspect. This in turn means that processes are essentially continuous. Their unfolding is continuous in the sense of being always further extendable and at any point divisible. However, it is hard to see how the Cantorean conception of the Continuum could help understand this kind of continuity. Such an understanding presupposes then an actually infinite set of points, thus it describes a structure that is devoid of any incompleteness. ²³ Hence, a different understanding of temporal continuity may here help to shed light on the nature of processes. All these considerations lead to the fundamental question of the volume: How can time be conceived simultaneously as something continuous, hence extensive, and passing? They suggest that this question cannot be settled by appealing to Cantor's formal definition of the Continuum alone. Be it in the context of the debate about temporal passage, about temporal existence or about the ontological status of change, views which hold onto some robust sense of becoming seem all to be requiring a more dynamic account of the continuity of time that is not delivered by Cantor's.

²² For a systematic study of the logic of aspects see Galton (1984). Thompson (2008) has emphasized the importance of such distinction for action theory. O'Schaugnessy (2000) and Soteriou (2018) do the same for the philosophy of mind. They argue that experience is a process, by necessity. There are different ways in which the ontological status processes can be understood, see Stout (2016) and Crowther (2018) for two opposing views.

²³ In discussions about *processes* and the progressive, Aristotle's definition of the continuum has been recently rediscovered. See for instance Rödl (2005, 166-172) and Arsenijevic (2007). A further, here related issue concerns the problem of the first moment of change. This problem arises when one considers the beginning of change and is therefore intimately related with the continuity of time and change. See Strobach (1998) for a systematic history of such problem as well as Fischer's contribution to this volume, where dispositions and processes are introduced to solve the problem.

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Aristotle and Bergson on Time

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Both in *Being and Time* and *Basic Problems of Phenomenology* Heidegger criticized Bergson's views on time by affirming that he misunderstood Aristotle's traditional exposition from *Physics* IV. In this paper I will examine Bergson's distinction between *durée* and the time of physics to show its relationship with Aristotle's exposition. I will defend Bergson's view on time by showing that it does not criticise Aristotle's, as Heidegger says, but rather develops a different approach that goes beyond the Aristotelian paradigm. For this purpose, I will briefly analyze Aristotle's texts of the *Physics* and Bergson's views on time in his *Essay on the Immediate Data of Consciousness (Essai)*, *Creative Evolution (EC)* and *Duration and Simultaneity (DS)*. ¹ It will be also helpful to make some remarks on the recently published courses he gave in the *Collège de France*.

¹ For the works of Bergson, I use my own translation and I will reference the works in French.

Both in *Being and Time* and *Basic Problems of Phenomenology* Heidegger criticized Bergson's views on time by affirming that he misunderstood Aristotle's traditional exposition in *Physics* IV. He accuses Bergson of criticizing Aristotle's vision of the time when in fact his philosophy of *durée* is dependent on it. Bergson, according to Heidegger, would not have overcome the philosophy of presence proper to Aristotelian metaphysics. This dependence of Bergson on Aristotle's philosophy of presence (according to Heidegger 1927a, 433) rests on the fact that Bergson's *durée* flows in the constant present, whereas Heidegger had treated temporality as the basic condition of human existence: «Whereas *durée* is primarily present the eternal present of the now and of the living act *Zeitlichkeit* is primarily future. Whereas Bergson's duration is first of all creation on life, Heidegger's temporality is naked existence toward death» (Seypell 1956, 506). Now, does Bergson really criticize the Aristotelian conception of time, as Heidegger supposes? Did Bergson treat time in an Aristotelian fashion without having understood it properly? In any case, if he has done so, it has not been in an explicit way, since clear criticisms of Aristotle's philosophy of time can hardly be found in his writings. In fact, in his best-known works about time (*Essai, Matière et mémoire, Duration et simultanéité*) references to Aristotle are scarce, if not non-existent. In Bergson's work, the discussion with Aristotle is absent, which is surprising considering the subject of his doctoral thesis: the doctrine of place in Aristotle (*Aristoteles de loco senserit*). We only find open criticism of Aristotle in *Creative Evolution*, but in this case, Bergson wants to correct the role of stable forms (*εἶδος*) in nature, the heritage of Plato's philosophy, and not the conception of time.

Heidegger points out in *Grundprobleme der Phänomenologie*: i) that Bergson's doctrine arises from an Aristotelian confrontation of time; ii) that Bergson's interpretation of time in the common sense (*vulgäre Zeitverständnis*) is based on not having understood the Aristotelian understanding of time («beruht auf einem Missverständnis des Aristotelischen Zeitverständnisses» Heidegger 1927b, 328). I will try to show: i) that Bergson's philosophy of time arises from a confrontation with the modern view of time, especially with Kant's (time as a homogeneous scheme); ii) that Bergson's interpretation of the vulgar understanding of time precisely allows him to inaugurate a metaphysics of flow as continuous creation, not a metaphysics of presence. As Massey has shown, «is explicit aim is to demonstrate that all counting presupposes spatial representation and that the measurement of time treats it as a homogeneous medium like space. In this regard, Bergson is more directly concerned with Kant's treatment of time and space than Aristotle's» (Massey 2005, 65). Heidegger, in similar fashion to Bergson, accepts that life cannot be understood from traditional concepts. However, he thinks that life itself has been shaped into concepts, such as culture, and therefore it must be understood in its cultural forms. In this sense, Heidegger reproaches Bergson for trying to offer a new conception of time that is ultimately dependent on Aristotle. In *Being and Time* Heidegger addresses the problem of being as presence and the Aristotelian understanding of time. The problem for Heidegger with the Aristotelian conception of time is that the "now", the present instant, has all the protagonism, due to the metaphysics of the being as presence. Bergson would be dependent on that conception of time that highlights the present instant (Heidegger 1927a, 17-18), only that he would have transferred the problem of time to the conscience flow. Bergson would have understood time from ontological categories, and would not have realized that temporality is the horizon of comprehension of *Dasein*.²

The main problem of Heidegger's views is that Bergson did not criticize Aristotle's philosophy of time

² For H. Massey, Bergson's dependence on Aristotle is not at all clear, at least in the philosophy of the *durée*, for although he made

in his writings. However, it could be said that even if Bergson did not openly criticize Aristotle, there is an implicit criticism in his approach, since Aristotle understands time as «number of motion in respect of “before” and “after”» (*Phy.* 219b1), a thesis that Bergson would have fought against since it would imply a spatialization of time. To the extent that time is a number, as Aristotle says, it implies counting, measuring, and it would only be possible to count the movement if the time line has been previously spatialized and the “nows” have been enumerated. This would obviously mean a freezing of time and, therefore, time as a number would be the time of physics, different from real time, which flows. Aristotle, having treated time as a “measure of motion” would have considered it in a spatial way, and its treatment would not be valid for a real philosophy of time.

However, is this really so? Does Aristotle understand time in a spatial way? The important word in this problem is ἀριθμός, which is translated as “number”, but in a broad sense means “measure”. «It is necessary to take the act of counting as consisting in noting and reproducing the structure of certain assemblies of units: a pair, a triad, a quarteron, a quintet, etc. The ἀριθμός is fundamentally a structure, an assembly» (Brague 1982, 137).

One can only measure movement according to its structure from past to future, according to before and after, and with reference to other simultaneous movements. If this is so, time is only possible and only exists to the extent that there is a soul that measures, since the only thing that exists is the now that changes, that flows, and time is the measure that the soul makes of movement. Only the soul appreciates the before and after, and the simultaneity of something with other movements.

Is this the time of physics? Yes, and as we measure motion, we spatialize time. This is Aristotle’s thesis, which Bergson shares completely: the time of physics is a measure of motion, and it implies a freezing of time to measure it according to the before and after compared to the “now”. However, does the time of physics exhaust the Aristotelian philosophy of time? In one sense it does, but in another it does not, for Aristotle points to an essential element of time which is not physical; the measuring soul. In this respect, as will be seen later, Aristotle does not seem to think that time is a structure of the soul or an *a priori* form of sensibility, but, as Wieland points out (1970, 316), a necessary condition for there to be time; without the soul there is no point in talking about time. That is why the analysis of time in Book IV of *Physics* does not point to an “original time” of the soul, but simply analyzes what time is as it manifests itself in the structures of our ordinary understanding of time.

Therefore, for Aristotle, ultimately, time does not exist. What exists for Aristotle are the substances that change, that exist now, in action, and that have potential aspects that allow change. Time is only a measure of the movement that takes place insofar as there is a soul that measures. In the following pages I will analyze briefly Aristotle’s philosophy of time in order to compare it later with Bergson’s.

II. Analysis of Time in *Physics* IV

In the second part of book IV of the *Physics* Aristotle offers us his famous analysis of time. His position in this respect is that this is not something in itself, but “the number of movement according to the before and after” (*Phy.* 219b1). Time is number not in the abstract sense (which we use in counting), but in the sense of movement that

his thesis on the place in Aristotle, he did not discuss it with him in the *Essai*. Massey suggests that Bergson’s view of time depends mainly on his criticism of Kant, and not so much on the Aristotelian view, as Heidegger supposes (Massey 2005, 50 nnd 90). G. Fasolo, on the other hand, has tried to show the speculative connection between Bergson and Aristotle, underlining also their differences (Fasolo 2006).

is counted (Ross 1936, 64). However, before giving the definition of time, Aristotle deals with the “now”, since time seems to have to do with the “now” and its relation to the “before” and “after”. We say that time passes because the “now” is different from what it was a while ago; before, it was in one way, after it is in another. The “now” only exists in a present way, so it cannot be said that time is a mere sum of “nows” (*Phy.* 218a19), since the now is changing, and time has to do with the perception of that change in the “now”, which even though it changes remains in a certain sense as “now”.

«In so far then as the “now” is a boundary (πέρας), it is not time, but an attribute of it; in so far as it numbers, it is number (ἀριθμός, 220a21–22)». In which sense it is number? In the sense that there is time when the now is both one and two, both unity of the before and after and inner dimension, tension of the before and after (Brague 1982, 142). Time is the experience of a peculiar structure of the movement according to before and after. Time is ἀριθμός because is unity of two elements: before and after.

The now is not a part of time, but a limit, because time is continuous, while the now is like a point that changes and remains the same as a point. That is why Aristotle thinks that time can be compared to a line, because a line might be divided into other smaller lines, but not into points (*Phy.* 220a18–20). This simile is very important in understanding Aristotle’s purpose in book IV, to investigate the conditions of possibility of time in its ordinary manifestations. If time is something continuous, and we normally imagine it as a line, then it cannot be a mere sum of “nows”. However, the “now” is very important for the existence of time, because it enables us to measure movement according to the before and after, so Aristotle states:

The ‘now’ is the link of time (συνέχεια χρόνου), as has been mentioned (for it connects past and future time), and it is a limit of time (for it is the beginning of the one and the end of the other). However, this is not as obvious as it is with the point, which is fixed. It divides potentially (διαίρει δὲ δυνάμει), and in so far as it is dividing the ‘now’ is always different, but in so far as it connects it is always the same, as it is with mathematical lines (*Phy.* 222a10–15).

If we say that time is continuous, and not a mere sum of “nows”, it is precisely because the now is something that changes although it remains the same; something that flows and links the past and the future. There is only time to the extent that there is perception of the now. Therefore, the foundation of time seems to be in the perception of the instant that changes. The instant as a subject remains identical, it continues to be instant, even though things change. The instant taken as “essence” is continually changing, there is never an instant equal to another. This is precisely the difficulty in defining the now, in which time is not composed of “nows” as parts: «For we may lay it down that one “now” (τὰ νῦν) cannot be next to another, any more than a point to a point (στιγμὴ στιγμῆς)» (*Phy.* 218a18–19). Aristotle warns of the difficulty of dealing with the now because precisely to speak of the “now” one must imagine that it is a point in an imaginary time line, but that is not the now, since it is not a fixed point: «When we think of the extremes as different from the middle and the soul pronounces that the ‘nows’ are two, one before and one after, it is then that we say that there is time, and this that we say is time» (*Phy.* 219a28–30). Aristotle is aware that the measurement of time implies a different type of measurement from that of space. It is not the number as a point, but as a line delineated by points that allow the measurement of time. «He holds that duration is in its own nature a perfect continuum admitting of no parts; parts of it and nows within it, which hitherto had

only a potential existence, are brought to actual existence by a mind which distinguishes periods and nows within it» (Ross 1936, 68). Precisely because time is a continuum, the now has a role in unifying time that the point does not have in unifying the line: «When two line segments are joined at a point, each segment itself exists as a unity whether or not we mark points on it. Time is not, in this way, prior to the now. The unity of time depends in part on our counting nows» (Coope 2005, 131).

The next step in the analysis of time is its relationship to movement. If there were no change, there would be no time either (*Phy.* 218b22), so time is dependent on movement. Now, why can we measure motion? Because every movement is accompanied by a magnitude (μέγεθος, *Phy.* 219a11), and it seems that time is that which is limited by the now (τὸ γὰρ ὀριζόμενον τῷ νῦν χρόνος εἶναι δοκεῖ καὶ ὑποκείσθω, *Phy.* 219a30). The soul perceives time as it measures movement according to different “nows”, and in that sense time is limited by the “now”. In this way we can see how Aristotle tries to separate time from the realm of reality. Time, thinks Aristotle, is a construction of the soul from the perception of change, which is the real, according to the “now” that has changed. So that «time is not movement, but only movement in so far as it admits of enumeration» (ἀριθμός, *Phy.* 219b3).

In *Grundprobleme der Phänomenologie* Heidegger analyzes Aristotle’s treatment of time in *Physics* IV, trying to show that for Aristotle what is essential to the measurement of time is not spatialization, but making-present. On Heidegger’s account, measured time is not a spatialization of pure duration, but a temporalization dominated by making-present (Massey 2005, 122). Heidegger points out that in order to be able to measure movement (that is time) it is necessary to be a change (ἔκ τινος εἶς τι), and for this appreciation the spatial character of the experience does not matter:

In the case of the determination of ἔκ τινος εἶς τι we should get rid ourselves completely of the spatial representation (*räumlichen Vorstellung*), something that Aristotle did, too. A completely formal sense of stretching out (*Erstreckung*) is intended in «from something to something». It is important to see this, because it was with reference to this determination that the Aristotelian concept of time was misunderstood (*mißverstanden wurde*) in the modern period, especially by Bergson; from the outset he took this dimensional character of time in the sense of spatial extension in its reference to motion.

(Heidegger 1927b: 343-344) ³

³ I use A. Hofstadter translation (1988).

Now, one thing is that in order to understand time we have to ignore the space in which the movement takes place, and another thing is that in order to count time the mind does not “spatialize” it, placing one moment next to another in succession. These are two different levels and, in fact, Bergson will underline the second level as the key to avoiding many errors in philosophy. One thing is the space in which the movement takes place (which must be ignored), and another is the succession in which the mind places the events according to the before and after.

A different question is whether Aristotle spatializes time (in a Bergsonian way) in his doctrine. In a certain sense he does (by stressing the character of time as measure), and in a certain sense he does not (by linking time as a measure with movement as change): ὁ χρόνος ἀκολουθεῖ τῇ κινήσει (*Phy.* 219b23). Heidegger understands this ἀκολουθεῖ in an existential way regarding motion thought along with time, rather than regarding time as being derived from motion (Massey 2005, 163).

III. Time and the Soul

According to Aristotle, time as such does not exist, there is only movement and the soul that measures it. Now, what exactly is the relationship between the soul and time that Aristotle marks? Could there be time without a soul? Aristotle makes it clear that this is not possible, but then, is time a form of the soul, as an *a priori* scheme of sensibility? Does Aristotle point to an idealistic theory of time (Hamelin 1931, 42)? And, if this is not so, perhaps he does not give a glimpse of an “original time”, proper to the soul, prior to movement, and with which the soul measures movement? This last hypothesis would seem to put Aristotle precisely in relation with Bergson, since apart from the time of the physics we could speak of an internal time, proper to the soul or the conscience. However, it should be considered that if Aristotle had pointed to an “original time” or “soul time”, this would not be what Bergson calls the real *durée*. It is not because the *durée* is not the “original time” as Heidegger thinks, it is not only a “time of consciousness”, nor even a “time of the human being”, but is the very time of things that flow, and that encompasses both human life and the life of the universe.

However, firstly it is necessary to examine Aristotle’s position regarding the soul and time: «But if nothing but soul, or in soul reason (ψυχῆς νοῦς), is qualified to count, it is impossible for there to be time unless there is soul» (*Phy.* 223a25-27). There is time in as much as the soul can number. Aristotle says little more about how the soul may be able to number with respect to “before” and “after”. It should be admitted that the soul “remains” in respect to change in a certain sense and can number it, because without something that does not change in respect to change, there could be no perception of change. It cannot be attributed to Aristotle that time is a “scheme” of sensibility or that there is an “original time” of consciousness. In any case it can be admitted that the human soul has the capacity to look (θεωρεῖν) beyond change and live life beyond the immediate present, thanks to memory and fantasy. Even though animals have these faculties, they are not capable of measuring time because they do not consider the now as “now”. In this sense, Wieland’s position (1970, 316) seems to be correct: time for Aristotle does not occur through the soul (*durch der Seele*) or in the soul (*in der Seele*), but rather depends on the activity of the soul (*nicht ohne der Tätigkeit der Seele*). Wieland considers that in the analysis of time Aristotle makes a consideration of the predicative structures already present in ordinary language about time and its properties. In this sense, the presupposition of the soul is not a fact of daily experience, but, is the result of a reflection on the conditions of possibility of such an experience (Conill 1981, 257). Time as measure or number depends on the act of the soul that measures (Festugière 1971, 206).

Aristotle does not therefore present an idealistic philosophy of time, but simply makes time dependent on two poles: the soul that measures and the movement that is measured. Aristotle thus puts an objective and a real criterion on the perception of time (Dubois 1961, 299-300), which is the very movement of things. Roark has recently defended an hylomorphic understanding of Aristotle’s doctrine on time, in which motion is the matter of time, and perception its form (Roark 2011): the only problem of this interpretation is that it could lead to an idealistic view of time (time as the form of perception). Ross seems to propose a realistic thesis on time as a real element of change (movement):

Time is not the *ratio cognoscendi* of change. It is rather the *ratio essendi*. A thing can only be in one place, or in one state, at once; it is the existence of time that makes it possible for a thing to be at different places or in different states; and thus change, or rather (since change

already involves time as an element) the existence of the same thing in different places or states, becomes the *ratio cognoscendi* of time. (Ross 1936, 65)

According to Ross, it seems that one thing is “real time” and another thing “know time”. If this is so, Aristotle would have seen the duration of things in a way very close to Bergson’s approach. However, there is a lack of textual evidence for this interpretation. I will compare both views after examining Bergson’s treatment of time.

IV. Bergson on Aristotle

Did Bergson criticize Aristotle’s analysis of time? We would strive in vain to find a critique of the approach of *Physics* IV in the works of the French philosopher. Either Bergson finds no reason to criticize it, or he is more interested in focusing his criticism on contemporary approaches (Kant, psychological positivism, etc.). It is clear that Bergson could not ignore Aristotle, as his doctoral dissertation was about the question of place in the *Physics*. Therefore, if Bergson does not confront Aristotle, it is because deep down he either accepts his approaches or finds no reason to criticize them. As I will demonstrate, an examination of Bergson’s approach allows us to understand to what extent Aristotle was the philosopher who best described how the idea of time originates, that is, the time of physics, the time we use in our daily lives, as a measure of movement. Aristotle himself is clear in his treatise when he states that time has magnitude because movement is susceptible to measurement (*Phy.* 219a11). Without movement there would be no time, and it is the soul that makes that measurement. Because time is a measure we necessarily spatialize it and draw it as a line (*Phy.* 220a17). In summary, Bergson could accept without reservation Aristotle’s treatment of time, the time of physics is the measure of movement; that time is not real, the only real thing is the very movement of things. Now, Bergson intends to introduce a time even “more real” than that of physics, to go into the very heart of reality, of movement; real duration as a march in continuous creation (*DS*: 53).

However, one remaining question of time in Aristotle could still be analyzed through Bergson’s lens, did Aristotle spatialize time? Here the answer is less clear. On the one hand it seems he did, because by considering time as a measure of movement, Aristotle emphasizes the fact of measuring time, and that measurement is only possible insofar as the movement has magnitude. On the other hand, it seems he did not spatialize it because Aristotle himself is aware that time cannot be taken as a sum of instants; the now cannot be understood as a point in a line, since it is something continuous that flows. Now, when we measure time, we have to take the now as a limit in a segment of time: this is necessarily an exercise of intelligence in which we “spatialize” time and turn it into a line. That is why, in the end, Aristotle spatializes time, although he is aware that this is a different measuring exercise from the real “now”, which is something continuous that flows, is in constant flux.

V. Time in Bergson

Time certainly occupies a major place in Bergson’s philosophy; however, while Bergson does not have a specific writing on time, this theme appears again and again in his various writings. Therefore, when analyzing time in Bergson, it is important not to lose sight of the intention with which it appears in a work that deals with other topics. For example, the purpose in the *Essai* is to show how philosophers and psychologists have thought about the data of consciousness in a spatial way, eliminating the

continuous flow of the life of consciousness. Now, from this it would be inappropriate to think that Bergson understands time only as the flow of consciousness or an “inner time” to the subject. Moreover, the main objective of the *Essai* is to show the limits of the spatialization of psychological phenomena and to safeguard human freedom against determinism (*Essai*, VII-VIII), however, the question of time remains quite open. It is true that already in the *Essai* Bergson places the pure duration in front of the operation of the mind that places the images in space, but Bergson does not attempt to develop a philosophy of time in all its amplitude. In this sense, it is possible to consider Bergsonism as a philosophy that starts with psychology but continues with cosmology and ends with theology (Gouhier 1948, 161). Rather, what Bergson tries to do is to show the limitation of spatializing the living time of consciousness: «Can time be adequately represented by space? To this we must answer: yes, if we are talking about passed time; no, if we are talking about the time that flows» (*Essai*, 166).⁴

The key to the entire doctrine of time in the *Essai* is that time can only be understood in terms of space insofar as time has already passed and we need to measure it. The time that passes, the time that is lived in the now is something different that is not possible to spatialize. To talk about that living time, Bergson uses the word *durée*:

What is time inside us? A qualitative multiplicity, without resemblance to the number; an organic development that is not, however, an increasing quantity [...]. What is there of duration outside of us? Only the present, or, if one prefers, simultaneity. Without doubt external things change, but their moments follow one another only for a consciousness that remembers them. (*Essai*, 170)⁵

However, in the *Essai* duration is very much related to the flow of consciousness, to the extent that it seems that time would be that same flow. In this way, there is no “data” of consciousness as such, but a flow, a duration, which when it comes back on itself, “spatializes” time. In this work there is no treatment of the *durée* with metaphysical value, since the point of view of study is psychological.

In *Matter and Memory*, Bergson does not deal directly with the subject of time and duration, he only mentions the duration of consciousness as opposed to the time of physics. The objective of this treatise, as the author indicates at the beginning, is the relationship of the body with the spirit, and that is why the question of time occupies a secondary place. It is undoubtedly in *Creative Evolution* and in *Duration and Simultaneity* that Bergson develops his philosophy of time in a genuine way, giving metaphysical value to the internal time of things, as we will see later on.

VI. Abstract and Real Time

Through the different writings of *La pensée et le mouvant* we find the idea that the problem of time lies in the confusion of taking the abstract time of physics, the time that we elaborate as a measure of movement, as if it were real time. In this sense, when Aristotle states that time is a measure of motion, and that it does not exist in

⁴ «Le temps peut-il se représenter adéquatement par de l'espace? A quoi nos répondons: oui, s'il s'agit du temps écoulé; non, si vous parlez du temps qui s'écoule». I use my own translation for the texts of Bergson.

⁵ «Qu'est-ce que la durée au-dedans de nous? Une multiplicité qualitative, sans ressemblance avec le nombre; un développement organique qui n'est pourtant pas une quantité croissante [...]. Qu'existe-t-il, de la durée, en dehors de nous? Le présent seulement, ou, si l'on aime mieux, la simultanéité. Sans doute les choses extérieures changent, mais leurs moments ne se succèdent que pour une conscience qui se les remémore».

itself (since what exists is the motion that is measured), he does not present a thesis that Bergson rejects, but rather the reverse. The time of which Aristotle speaks is not something that exists, it is only a construction of the mind, a useful abstraction:

What exactly is the present? If it is a question of the present instant, I mean a mathematical instant which is to time what the mathematical point is to the line, it is clear that such an instant is a pure abstraction, a view of the mind; it can not have real existence. ...] Our consciousness tells us that, when we speak of our present, it is at a certain interval of time that we think. How long? Impossible to fix exactly; it is something quite floating. (2013, 168-169) ⁶

⁶ «Qu'est-ce au juste que le présent ? S'il s'agit de l'instant actuel, – je veux dire d'un instant mathématique qui serait au temps ce que le point mathématique est à la ligne, – il est clair qu'un pareil instant est une pure abstraction, une vue de l'esprit ; il ne saurait avoir d'existence réelle. [...] Notre conscience nous dit que, lorsque nous parlons de notre présent, c'est à un certain intervalle de durée que nos pensons. Quelle durée ? Impossible de fixer exactement ; c'est quelque chose assez flottant»

To take the present as a mathematical instant is a pure abstraction, something that Aristotle had already warned of when he rejected the possibility of speaking of the “now” as a point in a line (*Phy.* 218a18). In any case, Aristotle thought that if we take the now as a measure, we must have it as the limit of a segment, so that the “before” and “after” are the terms of a time line. However, also in this case Bergson could say that it is an abstraction that has spatialized time turning it into a line: “The line we are measuring is motionless, time is mobility. The line is made at all, time is what is being made, and even what makes everything being made. The measurement of time is never about duration as duration” (2013, 3). ⁷

⁷ «La ligne qu'on mesure est immobile, le temps est mobilité. La ligne est du tout fait, le temps est ce qui se fait, et même ce qui fait que tout se fait. Jamais la mesure du temps ne porte sur la durée en tant que durée»

Bergson thinks that real time has to do with the intrinsic character of the movement as “becoming”. We could only say that there is no time if everything was already done and nothing changed if the universe were a whole composed of always the same movements, as Aristotle thought. However, the universe, the world, life, is always different. This is why we must admit that there is a real duration that operates in things. In other words, the “before” and “after” are not mere mental constructions, but rather operate in reality.

VII. Reality of Duration

The real duration of things is not for Bergson a metaphysical hypothesis, but something found purely and simply in immediate experience. The foundation of Bergson's philosophy on time must be sought in our own experience, without abstractions such as “data”, “sensitive impression”, etc., which are constructions of the intelligence. In this way: “Real duration is proved; we see that time is passing, and on the other hand we cannot measure it without converting into space and assuming that everything we know has passed” (*DS*, 62). ⁸ Real duration is not deduced from the experience of time, it is not an “original time” of consciousness. Bergson never makes a “transcendental deduction” of the original time, nor does he demonstrate the existence of the durée through argument, because it is the experience itself that directly shows the real duration, without the need for deductions. This time, on the other hand, is not only a psychic time, but real, ontological time:

⁸ «La durée réelle est éprouvée; nous constatons que le temps se déroule, et d'autre part nous ne pouvons pas le mesurer sans convertir en espace et supposer déroulé tout ce que nous connaissons»

If time has a positive reality, if the delay of duration over instantaneity represents a certain hesitation or indeterminacy inherent to a certain part of things that holds everything else suspended, and if there is creative evolution, I understand very well that the already developed part of time appears as a juxtaposition in space and no longer as a pure succession. (*DS*, 63) ⁹

Time is real as duration because things are not made, but are being made, incorporating reality into novelties. That is why reality is creative evolution. Philosophers have treated time as a homogeneous whole, as if things were there and time “passed” over them. However, Bergson’s point is that time as duration operates in the very flow of things. Time is that constantly new flow. What is experienced now is always new with respect to the past. Bergson says: «All our belief in objects, all our operations on the systems that science isolates, are in fact base on the idea that time does not bite on them» (*EC*, 8) and he also states: «The universe lasts. The more we go deeper into the nature of time, the more we understand that duration means inventions, the creation of forms, the continuous elaboration of the absolutely new» (*EC*, 11). ^{10 11}

At this point it becomes clear that Bergson makes a distinction between time as a construction in a scientific (that of physics) or vulgar sense (the time we use in our daily lives to solve practical problems), and time as the actual duration of things. In this sense, for Bergson, the Aristotelian analysis would not be incorrect; indeed, it would have seemed perfect in explaining how we construct time from the measure of movement. However, this analysis would have been insufficient, since it would not have taken into account that duration operates on things themselves. Aristotle thought that the universe moved in homogeneous cosmic cycles. Time does not change things, but things change in an unchanging time. Bergson tries to show how time has its foundation in the very movement of things which is based on a real duration, which makes things always different.

VIII. Duration, “Originary” Time and Time of Physics

Now it is possible to establish three types of time in Bergson’s philosophy. On the one hand, the real time of things, what Bergson calls *durée* and which is presented as a flow in constant novelty. On the other hand, the direct experience of this *durée* which is captured by intuition, and which is the original experience of time in consciousness. Finally, time as a conceptual construction from the original experience of time, which leads to the spatialised time of physics.

This distinction between *durée*, experience of *durée* and time in physics is fundamental both to understand why Bergson does not psychologize time (since it has a real foundation, the flow of reality itself), and to understand Bergson’s critique of Einstein’s theory of relativity, at least with regard to some of its philosophical implications (Bergson reproaches Einstein for having turned time into a dimension, conceptualizing time in a new way).

It is in our experience of the continuous duration of things that we

⁹ «Si le temps a une réalité positive, si le retard de la durée sur l’instantanéité représente une certaine hésitation ou indétermination inhérente à une certaine partie des choses qui tient suspendue à elle tout le reste, enfin s’il y a évolution créatrice, je comprends très bien que la partie déjà déroulée du temps apparaisse comme juxtaposition dans l’espace et non plus comme succession pure»

¹⁰ «Tout notre croyance aux objets, toutes nos opérations sur les systèmes que la science isole, reposent en effet sur l’idée que le temps ne mord pas sur eux»

¹¹ «L’univers dure. Plus nous approfondirons la nature du temps, plus nous comprendrons que durée signifie inventions, création de formes, élaboration continue de l’absolument nouveau»

encounter real time, multiplicity without divisibility and succession without separation. As Čapek (1971, 118–125) stated in contrast to the criticisms of Ushenko (1929, 120–121) and Lovejoy (1913, 328–329), the indivisible continuity of duration does not imply the absence of distinctions between the phases of duration. Bergson stresses that in real duration the separation of different qualities is not possible, but those different qualities do exist (Mourellos 1964, 88). The fact that they cannot be separated (because making such a separation is a conceptual operation) is not the same as saying that there are no distinct qualities.

IX. Simultaneity and Duration of the Universe

An important question when talking about the *durée* is in what sense various durations coexist in the universe and whether it is possible to speak of a single duration, common to all the other durations. The course that Bergson gave at the *Collège de France* in the 1901–1902 academic year, centred on the idea of time, and there are some enlightening expositions of what he thinks about the *durée*:

Duration is presented to us naturally, immediately as a moving continuity of qualities that extend each other. We said that there is not one duration, but rather durations, more or less tense, which represent, corresponding to all conceivable degrees of tension, from the complete relaxation, which would be the lowest degree of materiality, to the highest tension, to the duration contracted in itself, in its entirety, it would be eternity. (Lesson 16th May 1902) ¹²

¹² «La durée nous est présentée naturellement, immédiatement comme une continuité mobile de qualités qui se prolongent les unes les autres. Nous disions qu'il n'y a pas une durée, mais des durées, plus au moins tendues, qui représentent, qui correspondent à tous les degrés concevables de tension, depuis le relâchement complet, qui serait le plus bas degré de la matérialité, jusqu'à la tension la plus haute, jusqu'à la durée contractée en elle-même, tout entière, ce serait l'éternité»

Bergson already treats the *durée* here as a metaphysical, ontological flow, so that there are no “beings”, but “durations”, and here the duration appears as a unitary flow that can have more or less “tension”. The materiality of things is nothing but a relaxed duration, without any tension, in which something remains unchanged, whereas eternity would be the total duration, the perfect flow. Now, Bergson speaks here of the different duration of each thing, so that there is not one duration, but multiple ones. This idea is corrected (or at least nuanced) in *DS* by stating a single duration of the universe (*DS*, 44). The confrontation with Einstein’s theory of relativity leads Bergson to think that a single duration of the universe is necessary as a reference for all other durations in order to admit simultaneity. As Deleuze points out (1968, 87), if there is multiplicity in time it is necessarily by reference to a unit, since the multiple is only possible by reference to the one.

X. Duration and Originary Time

In his analysis of time in Bergson and Heidegger, Tugendhat states that for both thinkers there is a subjective time that is more original than natural time in its structure (Tugendhat 1992, 573–584). Certainly, it seems that Bergson treats *durée* as the time of consciousness and, in this sense, as either an original time or deeper and more real than “ordinary” time or the time of physics. However, is the *durée* only the time of consciousness? No, it is rather the time of life and, as such, it is not strictly subjective, but “internal” to things. It is not subjective because one can have an objective experience of that time or internal duration of things. The evident proof is that duration

operates in a real way: things flow irreversibly, and time operates in the same flow. Bergson says in *DS*:

The thing and the state are but instants artificially taken on the transition; and this transition, only naturally experienced, is the duration itself. It is memory, but not personal memory external to what it retains, distinct from a past which it would ensure the preservation of; it is a memory internal to the change itself, a memory which prolongs the before in the after and prevents them from being pure instants appearing and disappearing in a present which is constantly being reborn. (*DS*, 41) **13**

13 «La chose et l'état ne sont que des instantanés artificiellement pris sur la transition; et cette transition, seul naturellement expérimentée, est la durée même. Elle est mémoire, mais non pas mémoire personnelle extérieure à ce qu'elle retient, distincte d'un passé dont elle assurerait la conservation; c'est une mémoire intérieure au changement lui-même, mémoire qui prolongue l'avant dans l'après et les empêche d'être de purs instantanés apparaissant et disparaissant dans un présent qui renaîtrait sans cesse»

Memory, the original duration, is not a «time of consciousness», as Tugendhat and possibly Heidegger suppose, but the very time of flowing reality. Tugendhat in his analysis seems not to have understood Bergson's position well, since he takes the *durée* as the “original consciousness of time”; that is, according to Tugendhat, Bergson would have distinguished the homogeneous, spatialized time, which is a mental construction, and a previous original time of consciousness. The problem with this interpretation is that this original time for Bergson goes beyond consciousness, it is the duration of life itself. Only from this perspective can we understand Bergson's commitment to the creative evolution in order to explain how time operates in the flow of life.

XI. Conclusions

Bergson knew Aristotle's philosophy of time well, and not only did he write his doctoral thesis on its place in Book IV of *Physics*, but also in his courses at the *Collège de France* from 1902-1903 he exposed Aristotle's philosophy of time in contrast to Plato and Plotinus (Bergson 2016, 151-167). Curiously, we do not find there a criticism of the idea of time in Aristotle, but rather a defence against the Kantian interpretation, in a realistic sense. Bergson says that Aristotle does not believe that there would be no time if there were no human soul, since the soul of heaven that contains everything and possesses a regular movement would be the measure of all movements:

This sentence: suppress the soul, there is no more time, this sentence will simply mean that if there is movement of the sky, the sky enveloping all things and the sky moving with a regular movement, if there is sky, as it is not possible to do otherwise than to exist with it the soul enveloped by it, time will be born from an action and a reaction, from the movement on the soul and from the soul on the movement. Time will therefore be an absolutely necessary thing. (Bergson 2016, 162) **14**

14 «Cette phrase: supprimez l'âme, il n'y a plus de temps, cette phrase signifiera simplement ceci que si on se donne le mouvement du ciel, le ciel enveloppant toutes choses et le ciel se mouvant d'un mouvement régulier, si on se donne le ciel, comme on ne peut pas faire autrement que de se donner avec lui l'âme enveloppé par lui, le temps naîtra d'une action et d'une réaction, du mouvement sur l'âme et de l'âme sur le mouvement. Le temps sera donc une chose absolument nécessaire»

However, Bergson thinks that Aristotle is obscure on this point and does not finish explaining what it means that heaven has a soul. Now, to think that the universe has a “soul” might lead one to think that time is something internal to things themselves. This is a question that neither Aristotle in the *Physics* nor Bergson in his exposition of Aristotle addresses. Now, if Aristotle had assumed that time has its foundation in the soul and

that the universe has a numerical soul, we would be facing a thesis close to the real duration of the universe in the Bergsonian sense. However, this hypothesis is only a remote connection, although Aristotle points in some instances to an objective duration of the universe:

If, then, what is first is the measure (πρῶτον μέτρον) of everything homogeneous with it, regular circular motion is above all else the measure, because the number of this is the best known. Now neither alteration nor increase nor coming into being can be regular, but locomotion can be. This also is why time is thought to be the movement of the sphere, because the other movements are measured by this, and time by this movement (*Phy.* 223b17-24).

Aristotle thinks that there is a stable movement or rhythm that serves as a measure for time. «The only kind of movement which naturally maintains a uniform pace is movement in a circle; and the rotation of the heavenly sphere therefore furnishes the best unit for measuring the movement of everything else» (Ross 1936, 66). Now, if this is so, did Aristotle not point to the idea that beyond time as an act of measurement there is a rhythm to the motion of the universe, and that therefore, it would be a “real duration” of the motion? It seems so, and it is what Ross points out when he stresses that time is the *ratio essendi* of change (Ross 1936, 65). But it should be noted that time is then a certain circle (κύκλος τις, 233b29), and here lies the main difference with Bergson’s approach. Real duration thinks Bergson, is above all novelty, is continuous creation, and never mere repetition.

Going back to the analysis of time, Bergson’s turning point with respect to Aristotle would be that for Aristotle time would not exist without the numerical capacity of the soul, because there will be only movement, which is the “substratum” of time. In this way, time adds nothing to movement, there could be movement without time. For Bergson, however, movement implies internal time, duration. Something changes in the time arrow that transforms reality in an irreversible mode: there could be movement without time built by the soul, but there cannot be movement without internal duration, without irreversible flow towards something new and different.

For Bergson, time is not only a measure of the movement, but something else, because “before” and “after” are not simple moments; they point to the fluctuating arrow of the very movement of things. Time is thus the ontological property of being, which is movement, change. Time operates in the very heart of things in such a way that, contrary to what Newton and Kant had understood, it is not homogeneous, but always different; reality does not “pass” through time, but reality exists in a flow from past to future, is always new.

In this sense, Bergson could admit Aristotle’s analysis of time as valid as long as it is taken into account that it is “measured” time, “already past” time, since time of real duration cannot be measured:

The time that lasts is not measurable. The measure which is not purely conventional implies in effect division and superposition. However, successive durations cannot be superimposed to check whether they are equal or unequal. (*DS*, 47) ¹⁵

Bergson had already observed this in the *Essai*. To be able to measure something, it is necessary to group things into homogeneous units, identical from a certain point of view (*Essai*, 57). However, it is impossible to have two homogeneous durations, since the duration is

¹⁵ «Le temps qui dure n'est pas mesurable. The measure which is not purely conventional implies in effect division and superposition. Or on ne saurait superposer des durées successives pour vérifier si elles sont égales ou inégales»

always different. From this point of view, when Aristotle says that time is the measure of the movement according to the before and the after, what he has done is to homogenize the instants of time as segments that delineate a line. It is only possible to count according to before and after if I convert time lived to a succession of homogeneous instants.

One could still ask whether Bergson, although he did not openly criticize Aristotle's conception of time, would have misunderstood it by criticizing a conception of time that would be basically dependent on that of Aristotle. Would Bergson have misunderstood the Aristotelian conception of time and, if he had understood it correctly, would not have developed the philosophy of *durée*?

I think that Bergson would not need to criticize Aristotle too much on this point, although Aristotle could have deepened in the foundation of time: change (ἀκολουθεῖ τῇ κινήσει, *Phy.* 219b23). It is the primary duration of things and our experience of it that is the foundation of time. Actually Aristotle is very close to understanding time as a continuum. Bergson's understanding of *durée* is close to Aristotle's philosophy of the "now". The "now" (τὸ νῦν) is always new, different, and at the same time continuous. It is the very flow of movement (τὸ δὲ νῦν διὰ τὸ κινεῖσθαι τὸ φερόμενον αἰεὶ ἕτερον, *Phy.* 220a14), as Heidegger point out: «The now is consequently not a part of time but is always time itself» (*Das Jetzt ist daher kein Teil der Zeit, sondern ist immer die Zeit selbst*, Heidegger 1927b, 354). In the experience of the "now" is revealed the inner duration of things. Lévinas was certainly right when he denounced the summary execution of Bergson in *Being and Time* (Sinclair 2019, §11) because, in fact, it is through a peculiar reading of Aristotle that he can say that Bergson fail to overcome the Aristotelian paradigm (Massey 2005, 122).

For Bergson, time as a measurement is the objective measure of the movement, the constructed time that exists only for the soul it measures. Real time, however, is the flow of the universe, the continuous γήνησις of the cosmos. Bergson does not criticize the Aristotelian analysis of time, but rather accepts it as a valid analysis for the time of science, even for time as a measure of movement in our daily lives. Now, the appreciation that time is based on movement, as Aristotle had said, leads Bergson to situate time in the very heart of the flow of things. Thus, what Bergson could criticize Aristotle is his failure to realize that reality in motion is not a universe without history or duration. Aristotle thought that substances were there and moved in an unchanging universe, without internal time. Bergson's intuition is that time operates in nature creating novelty. The universe lasts, Bergson thinks in *EC* and *DS*, and involves the continuous creation of novelty. In this sense, the universe and things that change can be understood as an open potentiality, constant genesis (Mourellos 1964, 93), what Bergson calls "virtuality", as something that is not current but has a reality (Deleuze 1968, 99); power in the Aristotelian sense, but open to new actualizations.

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Reassessing Husserl's Account of the Time-continuum after the Debate on Presentism and Eternalism

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The recent philosophical debate about the nature of time is peculiarly focused on the divide between presentism and eternalism. As a matter of fact, after Einstein's General Relativity theory most theoretical physicists opted for eternalism, also known as "block-universe theory". This view finds support in Minkowski's famous paper *Space and Time* (1908). Even if theoretical physicists commonly accept nowadays the concept of spacetime as a mathematical tool, the situation is much more complex for what concerns the consensus about its very nature. For instance, for Rovelli's Quantum Gravity (QG) theory our perception of space and time as *continua* reveals itself as an illusion, that is, a blurry sight of elementary processes. My aim in this paper is to demonstrate that *a)* the opposition between eternalism/spacetime theory and QG theory is rooted in their underestimation of subjective experience; *b)* such a divide could be fruitfully overcome by transcendental phenomenology, based on the idea that the very experience of time is intuitively given as a continuum; *c)* the formalization of spacetime is possible only under this basic subjective experience.

ETERNALISM
CONTINUUM

SPACETIME

QUANTUM GRAVITY
PHENOMENOLOGY

I. Introduction

The recent philosophical debate about the nature of time is peculiarly focused on the divide between presentism and eternalism. Although there exist many variations of these theories, it could be basically argued that, according to presentism only the present is real, whereas for eternalism there are such things as merely past and future entities (Sider 1999, 325–326). As a matter of fact, after Einstein's General Relativity theory most theoretical physicists opted for eternalism, also known as “block-universe theory”. This view finds support in Minkowski's famous paper *Space and Time* (1908), where he provided empirical evidence of the reality of spacetime, consistently with Einstein's theory of special and general relativity. As is well known, Minkowski opens his paper as follows: «The views on space and time which I wish to lay before you have sprung from the soil of experimental physics. Therein lies their strength. Their tendency is radical. Henceforth space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality» (Petkov 2010, xv). Against Einstein, who initially disagreed with the concept of spacetime (but accepted it in 1915), Minkowski claimed that the idea of manifolds is essential for general relativity. Indeed, «we would then have in the world no longer *the* space, but an infinite number of spaces, analogously as there are in three-dimensional space an infinite number of planes. Three-dimensional geometry becomes a chapter in four-dimensional physics» (Petkov 2010, xxi). This means that, according to Minkowski, inertial observers in relative motion may occupy different spaces, as entailed by special relativity, only in a *real* four-dimensional world. Conversely, in his eyes, special relativity does not work in a three-dimensional world, simply because this latter would imply *one* absolute space for all inertial observers. As a result, Minkowski's idea of the four-dimensional spacetime not only excludes any variety of time-flow, but directly leads to a radical eternalism.

Nevertheless, even if theoretical physicists commonly accept nowadays the concept of spacetime as a mathematical tool, the situation is much more complex for what concerns the consensus about its very nature. ¹ Indeed, as emphasized by Petkov, the present situation is characterized by a «proliferation of views [...] which reject the reality of spacetime either explicitly or implicitly by defending concepts (e.g. becoming and flow of time) which are incompatible with the spacetime view of the world» (2019, 1). Among them, it is worth considering Rovelli's claim that both presentism and eternalism are “naïve options” (2019, 1325–1335) to be overcome in favor of a third way, namely a “local” account of time. In synthesis, Rovelli maintains that, following general relativity and QG (quantistic gravitation), time depends on the gravitational field: in other words, once assumed the quantum framework of the gravitational field, the quantum events are no longer ordered by a unique time. Rather than entailing that there is no change or becoming in the universe, QG demonstrates that the elementary processes cannot be ordered in a common succession of instants. Accordingly, time (as a succession of instants) does not exist; rather, time locally emerges from the relations among quantum events. There is neither a space that contains the world nor a time along which the events happen. Instead, there are elementary processes in which *quanta* of space and matter continuously interact. As a result, for Rovelli our perception of space and time as *continua* reveals itself as an illusion, that is, a blurry sight of elementary processes (2019, 1326).

¹ Actually, this debate dates back to 1908, when Sommerfeld remarks in his notes on Minkowski's article: «What will be the epistemological attitude towards Minkowski's conception of the time-space problem is another question, but, as it seems to me, a question which does not essentially touch his physics».

Following Petkov's criticism, Rovelli's argument comes at a high price. First, rejecting both presentism and eternalism keeps unaddressed the question of the dimensionality of the world (at a macroscopic scale). Indeed, if presentist account of the world is three-dimensional and evolving in time and eternalism (also called "block universe") accounts for a four-dimensional world with time as fourth dimension, claiming (as Rovelli does) «neither presentism nor eternalism» should entail that the world is neither three-dimensional nor four-dimensional. This means that, in Rovelli's eyes, dimensionality is not a fundamental feature of the world, as commonly accepted in physics. Secondly, Petkov assesses Rovelli's account of eternalism as a complete misrepresentation. Indeed, rather than claiming «that past and future events are "real now" as present events» (2019, 1329), the spacetime theory is based on the thesis that no event is to be privileged as "now", insofar as in spacetime the notion of «real now» is meaningless. In other words, Minkowski introduced a static view of time for which spacetime is an unchanging, once-and-for-all picture of the world encompassing past, present, and future.

Accordingly, from the eternalist perspective, there is no privilege of the "now" and, thus, it is totally illegitimate to talk about past and future events simply because they are equally real. It is worth emphasizing that, what is really at stake in Rovelli's attempt to overcome eternalism and Petkov's defense of Minkowski's spacetime is a precise description of what time really is, namely an ontology of time. In other terms, both spacetime and QG theory elude any inspection of how the experience of time (as becoming and flow) interacts with the physical (real) features of time. If, on the one hand, Minkowski admits that the reality of spacetime is a counterintuitive picture of the world, albeit supported by a number of experimental evidences, on the other hand, Rovelli argues that, all things considered, time's continuity is a persisting illusion. In other terms, they both underestimate the fact that *time is always experienced as a continuum*. Indeed, as stressed above, the conflict between spacetime theory and our common experience of time extensively characterizes the history of both contemporary theoretical physics and philosophy of time.

With this regard, such a conflict is probably at the root of the very diffused interpretation of spacetime uniquely as a mathematical tool. However, some eminent physicists felt the need to reconcile spacetime with the subjective experience of time. Among others, H. Weyl emphasized that «the objective world merely exists, it does not happen; as a whole it has no history. Only before the eye of the consciousness climbing up in the world line of my body, a section of this world "comes to life" and moves past it as a spatial image engaged in temporal transformation» (Weyl 2009, 135). In this short passage, there clearly emerges how, according to Weyl, the reality of spacetime and the subjective experience of the time's flow are to be understood on two different levels. Indeed, if from an ontological point of view the world does not happen, in the subject's eyes reality ceaselessly transforms itself throughout an infinite process. Thus, Weyl seems to suggest that the problem of time cannot be merely addressed from the ontological standpoint, but also requires an in-depth inspection of the subject's experience of temporal becoming. In other words, both theoretical physicists and philosophers of time should deal not only with the description of the ontological features of spacetime, but also with the transcendental inspection of the experience of the continuum as an absolute given for any subject.

Under these premises, my aim in this paper is to demonstrate that *a)* the opposition between eternalism/spacetime theory and QG theory is rooted in their underestimation of subjective experience; *b)* such a divide could be fruitfully overcome by transcendental phenomenology, based on the idea that the very experience

of time is intuitively given as a continuum; c) the formalization of spacetime is possible only under this basic subjective experience.

II. Ontology and Epistemology of Time

As is well known, Weyl's early account of time-continuum (developed in his major works *The Continuum*, 1987, and *Space Time Matter* 1922, both published in 1918) is deeply influenced both by neokantianism ² and Husserl's transcendental phenomenology. ³ Such an influence is to be essentially recognized in Weyl's claim that coordinate system is «the unavoidable residuum of the ego's annihilation» (1987, § 5.3.4), a clear reprise of Husserl's account of transcendental ego as the residuum of phenomenological reduction in *Ideen I* (1976, § 49). Nevertheless, although Weyl always refers to *Ideen I*, his account of the continuum is deeply indebted to Husserl's lectures on time-consciousness and the *Dingvorlesungen* (1997) on the constitution of space, some of which he probably attended when Husserl substituted for Hilbert (who was Weyl's teacher of mathematics at that time) during the years 1905-'08. In Weyl's view, our intuition about the continuum originates from common or stable elements, namely invariants emerging from a plurality of acts of experience: for instance, the perception of time, of movement, of a line extended, and so forth. For what concerns time, Weyl considers Husserl's (and Bergson's) phenomenal time as a conscious experience coexisting with memory of the instant just gone. Consistently with Husserl's perspective, Weyl describes the intuition of time as a flow of ongoing transformations. This means that time is a duration without points: time consists in interconnected parts that are superimposed on each other. With this respect, Weyl's phenomenological heritage is patent:

² See Bernard & Lobo (2019).

³ For more biographical and theoretical details, see Feist (2004).

The view of a flow consisting of points and, therefore, dissolving into points turns out to be false. Precisely what eludes us is the nature of the continuity, the flowing from point to point; in other words, the secret of how the continually enduring present can continually slip away into the receding past. (1987, 91-92). In other terms, Weyl shares with Husserl a radical opposition between, on the one hand, time and space as pre-phenomenal experiences and, on the other hand, time and space as *construed* mathematical entities. This means that, whereas the construed entities resulting from mathematical formalization are made out of ultimate elements (the points), the pre-phenomenal life-experiences time in particular cannot be further reduced. More closely, Weyl accepts Cantor and *Dedekind's* axiom about the one-to-one correspondence between the real line and the pre-phenomenal space, but judges unsatisfactory the extension of such a correspondence to time. Also considering spatial movement, the situation is not significantly different. Indeed, «in movement, the continuum of points on a trajectory recovers in a continuous monotone fashion the continuum of instants» (Weyl 1987, § 8). But following Weyl's argument, this is just superposition: the temporal continuum does not have points, the instants are merely transitions, the present is only possible because of the simultaneous perception of the past and of the future. Accordingly, Weyl maintains:

I think that everything we are demanding here is obvious nonsense: to these questions, the intuition of time provides no answer - just as a man makes no reply to questions which clearly are addressed to him by mistake and, therefore, when addressed to him, are unintelligible. So the theoretical clarification of the essence of time's continuous flow is not forthcoming. The

category of the natural numbers can supply the foundation of a mathematical discipline. But perhaps the continuum cannot [...]. (1987, 90).

From this there follows that 1) an individual point in time is non-independent, i.e., is pure nothingness when taken by itself, and exists only as a “point of transition” (which, of course, can in no way be understood mathematically); 2) it is due to the essence of time (and not to contingent imperfections in our medium) that a fixed time-point cannot be exhibited in any way, that always only an approximate, never an exact determination is possible (Weyl, 1987, 92). Points do not belong to our intuition of the continuum, neither temporal nor spatial. ⁴

As a result, «the point without dimensions is a derived conceptual construction, a necessary consequence of a line as a one-dimensional law. It is a posterior reconstruction [...] which puts together the points to reconstruct the line» (Longo 1999, 404). In the light of this inspection, it could be argued that Weyl's phenomenological inspiration leads him to account for the transcendental features of time experience as fundamental issues for any theory of time. Accordingly, although the evidence-based concept of spacetime provides with a useful mathematical tool for sketching an ontology of time, it cannot explain the subjective experience of time at all. Thus, from Weyl's perspective a complete theory of time is supposed to think *together* the ontology of time and the epistemology of time experience. In other words, there is no ontology of spacetime beyond an epistemological enquiry on time experience.

⁴ A precise proof of the fact that a curve is a law, not a set of points, is provided by Wittgenstein (1964).

Nevertheless, Weyl's phenomenological posture is not so radical as it seems at first glance. Indeed, his thought leads to a precise distinction between objective spacetime and subjective time experience, rather than an in-depth assessment of their actual interaction. As suggested by R. A. Feist (2004, 138), Weyl's declaration of phenomenological membership should not prevent from considering two points of substantial divergence. *a*) Firstly, Weyl's claim in *The Continuum* that the sequence of natural number is given in an immediate intuition of iteration is clearly in contradiction with Husserl's view that there cannot be any direct access to formal categories (included the sequence of natural numbers), uniquely graspable by categorial acts. *b*) The second point of divergence concerns Weyl's choice for predicativism. Following Weyl's argumentation in chapter 6 of *The Continuum* (probably influenced by Poincaré and Russell), the constitution of all higher level objectivities depends on the immediate intuition of natural numbers. Thus, whereas the latter exist independently, all other objectivities are constituted in conformity to logical constraints, that is, in Weyl's view, predicative constructions based upon the domain of natural numbers. By contrast, in Husserl's thought such logical restrictions are totally excluded, insofar as he was firmly convinced that mathematics is a variety of knowledge of reality and, at the same time, a formal theory of possible regions of being. In other terms, Husserl was not committed to any kind of restriction of mathematics with the purpose of fitting it into strictly intuitive (or predicative) limits. Rather, he was strongly involved in a research of formal systems, as testified by the *Mannigfaltigkeitslehre* developed through the *Logical Investigation* as a part of his formal ontology. This means that Husserl's phenomenology does not exclude any formal (non-intuitive) mathematics, as well as formal and axiomatic theories of analysis capable of providing a ground for regional ontologies.

These two arguments lead Weyl to the thesis that a phenomenological foundation of the mathematical continuum based upon the analogy between the

immediate intuition of time and the intuition of the natural numbers succession is in principle excluded. Once demonstrated that the intuitive and the mathematical continuum do not coincide, Weyl suggests that its mathematical construction must necessarily overcome the level of phenomenological description.⁵ This is the basic reason why Weyl progressively shift from phenomenology to predicativism. With this regard, in a lecture delivered in Princeton in 1927, with the title *Time Relations in the Cosmos, Proper Time, Lived Time, and Metaphysical Time*, Weyl concludes:

⁵ As stated by Da Silva (1997, 289): «Despite its debt to certain phenomenological ideas, the system of *The Continuum* cannot be seen as a prototype of how the whole of mathematics should be developed from the phenomenological perspective».

The immediately experienced is subjective and absolute. On the other hand, the objective world is necessarily relative and may be represented by something definite, numbers or other symbols, only after a coordinate system has been arbitrarily imposed on the world. This pair of opposites, subjective-absolute and objective-relative, seems to me one of the most fundamental epistemological insights one can gather from science. (Weyl 2009, 31)

III. Time, Reality, and the Transcendental

With and beyond Weyl, is it possible to conceive of spacetime and time experience *together*? More precisely, once grasped the double nature of time, how to sketch a description of the bond of ontology and epistemology of time? In other words, how to take into account both the physical evidence of spacetime and the experience of the flowing time *as two absolute evidences*? My core argument is that this attempt should be made through an in-depth reassessment of Husserl's transcendental phenomenology.

Within the limit of this work, I cannot provide a complete discussion of the huge quantity of passages from the published texts and manuscripts where Husserl deals with the issue of the continuum. I will limit to the most insightful. Although the continuum, namely the phenomenological condition of both the flux of the lived-experiences and the flowing of the intuitive data, is a real *leitmotiv* of the phenomenological method as a whole, it plays a peculiar role in the early Husserl, notably in his lectures of 1891 on *Philosophy of Arithmetic* (2003), those of 1905–1908 *On the Phenomenology of the Consciousness of Internal Time* (1991), and those of 1907 on *Things and Space* (1997). As emphasized by Tieszen (1996, 304), «Husserl thinks that arithmetical knowledge is originally built up in founding acts from basic, everyday intuitions in a way that reflects our a priori cognitive involvement». ⁶ Within this framework, it is worth noting how Husserl takes into serious consideration both the intuitive and formal structure of the continuum since his first great work. For instance, let us consider the following passage from the section about the *Origin of the Concept of Manifold* in *Philosophy of Arithmetics*:

⁶ See also Centrone (2010, 1) (footnote 2).

If we consider, for example, the cohesion of the points on a line, of the moments of a span of time, of the color nuances of a continuous color spectrum, of the tonal qualities in a “tone progression”, and so on, then we acquire the concept of combination-by-continuity, and, from this concept, the concept of the continuum. This latter concept is not contained as a particular, distinguishable, partial content in the image of every concretely given continuum. What we note in the concrete case is, on the one hand, the points or extended parts, and, on the

other hand, the peculiar combinations involved. These latter, then, are what is always identically present whenever we speak of continua, however different may be the absolute contents which they connect (places, times, colors, tones, etc.). Then in reflection upon this characteristic sort of combination of contents there arises the concept of *continuum*, as that of a *whole* the parts of which are united precisely in the manner of continuous combination. (2003, 20) ⁷

It is worth putting this passage in connection with Husserl's discourse on mathematical entities in § 60 of the *Sixth Logical Investigation* (2001c), where he distinguishes between sensuous abstraction and pure categorial abstraction. Whereas sensuous abstraction gives sensuous concept (for instance, "house, red") and mixed concepts, categorial abstraction gives categorial concepts (for instance, "relation, set, number"), called by Husserl "formal-ontological categories". If sensuous and mixed concepts are based upon sensuous intuitions, categorial concepts depend on categorial intuitions. Concerning the categorial intuition of a set, categorial abstraction refers to the collection's form, without any consideration of all material aspects of the set's members. Accordingly, provided that logico-mathematical intuition is a categorial intuition purified by categorial abstraction, pure logic and mathematics include no sensuous concepts. Once intuitively grasped a mathematical concept, one can grasp other mathematical objects in new categorial acts of higher level. Thus, mathematics results being based upon pure categorial abstraction, which excludes all the material contained in the categorial intuition.

From this standpoint, there emerges how the concept of the continuum originates in intuition of concrete data: more precisely, the intuition of continuity is the phenomenological condition for any mathematical formalization of the continuum. This does not entail that Husserl is not committed to the problem of a rigorous formalization of the continuum. With this respect, it must be noted a strong influence of Hilbert's view, following which «one begins by assuming the existence of all elements (that is one assumes at the beginning three different systems of things: points, lines and planes) and one puts these elements into certain relations to one-another by means of certain axioms, in particular the axioms of connection, order, congruence and continuity» (Hilbert 1900, 181). Nevertheless, Husserl is fully aware of the limits of any attempt of formalization of the continuity (the same limits Weyl will emphasize concerning Cantor-*Dedekind's* axiom):

We are able to bring *each single* group element to representation in its own right in temporal succession, even though not in one allinclusive act. But all of this is impossible in the cases to which we now turn. We speak of totalities, groups, and multiplicities also where the concept of their authentic formation, or of their symbolization through sequential exhaustion of the individuals involved, already contains a logical impossibility. We speak of *infinite groups*. The extensions of most general concepts are infinite. The group of the numbers in the symbolically expanded number series is infinite, as is the group of points in a line, and, in general, that at the limits of a continuum. The thought that some conceivable expansion of our knowledge capacity could enable us to have the actual representation or even the mere sequential exhaustion of such groups is unimaginable. Here even our power of idealization has a limit. (Husserl 2003, 231)

⁷ A very similar passage is to be found in the *Third Logical Investigation*: «Two contemporaneous sensuous *concreta* necessarily form an 'indifferentiated whole' if all the immediately constitutive 'moments' of the one pass unbrokenly over into corresponding constitutive 'moments' of the other. The case of exact likeness of any such corresponding moments shall count as a legitimate limiting case of continuity, i.e. as a continuous "passing over into self" » (Husserl, 2001b, 14).

One could spot the same tension between intuition and formalization of the continuum also in Husserl's lectures of 1907 on *Thing and Space* as well as in his courses on time-consciousness of 1905–19085. In both cases, I cannot provide even a synthetic overview of the enormous critical literature on these texts: thus I will only recall some quotations in order to show how the question of the continuum is at the very core of the general problem of the temporal and spatial perception. At the beginning of § 19 of *Thing and Space*, Husserl argues:

Here I have in mind the wonderful phenomenological forms of appearance which have the character of extensions of appearance: in them is constituted the spatial and temporal expanse that belongs to the essence of thingly objects; in them therefore lies the source of all spatial-temporal predicates. (1997, 51)

For what concerns the spatial continuity, Husserl distinguishes two main meanings: 1) The continuity that belongs to spatial extension as such and that comes to consciousness as an immanent moment when we allow unchange to pass over into change, for example in the continuous migration of a qualitative discontinuity over an expanse filled up unitarily in such and such a way. 2) The continuity of the filling determinations themselves, for example the flowing over from quality to quality, perhaps in the transition from red through purple to violet. But what is particularly relevant for us is that, in Husserl words, «continuity is extension, and qualitative continuity qualitative extension. *That essentially implies fragmentability and the ideal possibility of an abstract differentiation into phases.* [...]» (Husserl 1997, 59). This idea of the priority of intuitive continuum upon its mathematical construction is explicitly attested by the following passage:

Although in fact every body can be resolved into an infinite manifold of plane sections and can be considered a continuum of plane sections, yet the geometry of plane figures, which encompasses all these sectional figures, is still not the geometry of the spatial body. In proceeding beyond the plane, what is at issue is precisely the laws according to which the planes and the formations lying on them are continually modified. (1997, 173)

Much more complex appears to be the issue of temporal continuum precisely because of its irreversibility:

If time thus appears as an eternal stream which precipitates everything temporal into the abyss of the past, yet, on the other hand, time has validity as an eternal and fixed form, since every being maintains its position in time. Even a god cannot alter the temporal positions of events in the past. Here reside immense difficulties, which up to now have defied the acumen of the greatest. We will still devote efforts of our own to these difficulties. (1997, 55)

In order to make sense of these great difficulties, one has to address the question of the continuum within the framework of Husserl's lectures on time-consciousness from 1905–1908. Although the transcendental experience of time reveals some relevant differences with respect to the perception of space, it must be admitted that, in both the lectures on time-consciousness and spatial perception, there emerges the idea of a basic impossibility of reducing the intuitive continuum phases into a set of points. ⁸ From this perspective, in my interpretive hypothesis, Husserl's decision of keeping the notion of the “original impression”, ⁹

⁸ Indeed, Husserl argues that «What we call original consciousness, impression, or even perception, is an act that is shaded off continuously. Every concrete

although not conceivable as a punctual source of the temporal continuum, strictly depends on his attempt to clarify the conditions of the mathematical formalization of time. With this regard, Husserl argues:

It is inherent in the essence of every linear continuum that, starting from any point whatsoever, we can think of every other point as continuously produced from it; and every continuous production is a production by means of continuous iteration. [...] The primal impression is the absolute beginning of this production, the primal source, that from which everything else is continuously produced. *But it itself is not produced*: it does not arise as something produced but through *genesis spontanea*; it is primal generation, it does not spring from anything. It is primal creation. (1991, 106)

perception implies a whole continuum of such shadings. But reproduction, phantasy-consciousness, also requires precisely the same shadings, only reproducibly modified. It belongs to the essence of both of these experiences that they must be extended in such a way that a punctual phase can never exist by itself » (1991, 49).

9 As is known, the most serious difficulty entailed by the concept of the original impression is the infinite regression from what is constituted to what is constituting.

Accordingly, the problem of the “original impression” contains and includes the ambivalence of the intuitive (pre-phenomenal) continuum and the mathematical continuum as a logical construction. As is well known, Husserl finds these different experiences of the continuum on two varieties of intentionality (but we know from a number of manuscripts that he was not really satisfied by this solution). Expressed in terms of the double continuum of “transverse” and “lengthwise” segments, the distinction between constituted transcendent object and constituting time-consciousness designates the transverse intentionality (phase-continuum), whereas the distinction between constituted time-consciousness (immanent unity of act and its content) and constituting absolute time-consciousness designates the “lengthwise” intentionality (stretch-continuum). Nevertheless, in a manuscript from 1908 or 1909, Husserl becomes definitively aware of the impossibility of conceiving of the phenomenological continuum of time as something objective:

Is it inherently absurd to regard the flow of time as an objective movement? Certainly! On the other hand, memory is surely something that itself has its now, and the same now as a tone, for example. No. There lurks the fundamental mistake. The flow of the modes of consciousness is not a process; the consciousness of the now is not itself now. [...] Memory is an expression that always and only refers to a constituted temporal object. Retention, on the other hand, is an expression used to designate the intentional relation (a fundamentally different relation) of phase of consciousness to phase of consciousness and in this case the phases of consciousness and continuities of consciousness must not be regarded as temporal objects themselves. These are extremely important matters, perhaps the most important in the whole of phenomenology. (1991, 345–346)

Husserl approaches anew these «extremely important matters» in the *Bernaer Manuskripte*, where the problem of the originary impression develops into the issue of individuation as a temporal process. From a genetic point of view, it is precisely in this process that the ego originates in its immanence. This means that individuation concerns not only the objects, but also the ego as such. In other words, the immanent “living-present” is the most originary type of individuation, composed of a multiplicity of sensible given unified in a continuous sequence. After a decisive discussion with R. Ingarden about the problem of the relation between the unity of sensible *data* and the flow of consciousness, Husserl recalls into question the scheme apprehension/content of apprehension introduced in his *Logical Investigations*, as testified by the

manuscripts n. 6 and 9. In these texts Husserl argues that the flux of absolute consciousness constitutes the *Erlebnisse* as temporal objects within immanent temporality. This implies that the constitution of the temporal objects is inseparable from the constitution of a temporal consciousness. In other words, the flux of absolute consciousness implies an essential correlation between immanent perception and perceived object. Accordingly, the immanent temporality, namely the noetic side of intentionality, derives from the temporal constitution of the flux of consciousness as a continuous and consistent flux. From this viewpoint, both objective and immanent temporality are based on the “originary process” (*Urprozess*) of individuation. Indeed, Husserl states in the text n. 9:

I mean that it is only by virtue of the coincidence (*Deckung*) which crosses retention and protention and continues from an originary presentation to a new one as a coincidence of this persisting sound (where the last originary presentation falls into retention), that we grasp the sound as a temporal object. If we abstractively isolate an originary presentation and its flow in the temporal flux, we obtain in each point a new nuclear given (*Kerndatum*) taken abstractively, not a temporal objective given (*zeitgegenständliches*). In other terms, we will obtain no representation (*Darstellung*) of something objective within the nuclear given. Accordingly, the persisting perception of a sound is not to be understood merely as the objective series of the originary presentations. This series is constituted [...], as well as the series of the originary flux; nevertheless its objectivation has a different sense [...]. (2001a, 171) ¹⁰

¹⁰Translation is mine. See also Schnell (2002).

In the light of this passage, it is clear that in these manuscripts Husserl is no longer committed to the idea of an originary presentation nestled in a double horizon of retentive and protentive phenomena. Thus, he changes his perspective and emphasizes the role played by both the protensions of the flux of retentive modifications and the influence of retentions in the determination of protentive contents. It follows that the originary process (*Urprozess* or *Urstrom*) reveals itself not as a mechanism of constant modification of the present in the just passed; rather, the temporal flux is deeply intertwined with passive syntheses, anticipations and more or less intense degrees of fulfillment (*Erffüllung*) and emptying (*Entffüllung*). With this respect, Husserl maintains: «Differently from the previous texts, what is at stake here is no longer the mere [...] retentive consciousness of the originary flux, but rather a self-consciousness of the originary flux originally anchored in the fluent present» (Husserl 2001, XIII). As a consequence, in the *Bernaer Manuskripte* Husserl testifies his awareness of the danger of infinite regression and describes the present itself as fluent continuity: «A fluent consciousness structured in this way is necessarily a consciousness of itself as fluent» (Husserl 2001a, 48).

Still, the problem is not completely solved as long as the *Urprozess* is understood as an independent level of intentional consciousness, responsible for both the constitution of the temporal (immanent) objects and the acts of apprehension. What remains definitely open is the question of the flux's nature: provided that the flux is placed at a transcendental level, why does it manifest itself *a posteriori*, as a condition of possibility of the constituted time? If the originary process needs to be grasped by the ego, without whom the function of constitution would not be possible, its independence is seriously compromised. This means that, although the nuclear model seems to be more fruitful than the model of apprehension (always subject to the danger of infinite regression), Husserl does not fully succeed in dealing with the difference between act-consciousness and consciousness of originary consciousness.

Some scholars ¹¹ conceive of the originary flux as the unique non-constituted element in Husserl's phenomenology. According to this view, the originary flux, understood as longitudinal intentionality, should be the origin of all temporal constitutions. Nevertheless, Husserl emphasizes how longitudinal intentionality is at the same time transversal intentionality, which is always in connection with the time of immanent objects. It follows that, in front of the problem of time, the notions of origin, process and constitution fall into a kind of short circuit. In order to summarize, what is at stake in Husserl's scrutiny of time-consciousness is the possibility of new originary presentations within the continuum of intentional givenness. More precisely, Husserl struggles to find an equilibrium between the continuous process of temporalization and the emergence of punctual new instants, that is, between the intuitive experience of continuity and the attempt to formalize it. Each protentional instant is never fully anticipated by the previous one: this means that the grasping of temporal flux does not consume the surprise of our consciousness in front of the presentation of each new instant. It is for this reason that Husserl describes consciousness as what emerges from the awakening of time itself (Husserl, 1966, 178).

¹¹ See for instance Sokolowski (1964).

IV. Conclusions

As already pointed out, the relevance of the phenomenological discourse about the time continuum has been largely neglected by mathematicians, theoretical physicists, and philosophers of time. Regardless of their reciprocal differences, all of them developed a number of ontologies of time (i.e. spacetime theory, QG, presentism, eternalism, etc.) without taking seriously into account the issue of the subjective-transcendental time experience, often dismissed as an illusion. Especially after the demonstration of the independence of the continuum hypothesis from the set theory's axioms, this issue is nowadays rather controversial. Its history ¹² has determined a global reconsideration of the notion of solution in set theory (and mathematics), because of its strong dependence on the issues of consistency and indeterminacy. With this regard, the continuum hypothesis involves a manifold of philosophical questions dealing with the question "what is a solution?" Has the continuum problem been resolved? If so, which solution has been found? Otherwise, which is its current status? Under Gödel's theorem of incompleteness, is it unavoidable a pluralistic view about the continuum?

¹² For a precise overview of this discussion, see Linnebo (2017), especially chapters 4, 8, and 12.

Gödel himself took part in this debate with an article (1947) in which he claimed that, once assumed the correctness of the set theory axioms, there follows that concepts and theorems describe a particular reality for which Cantor's conjecture is either true or false. Thus, the axioms' indeterminacy implies that they do not contain a complete description of that reality (Gödel 1947). Gödel's perspective can be included in the *platonian* approach to mathematics, namely the view for which mathematics has to deal with a realm of objects and concepts independent of our mind. From this perspective, the continuum hypothesis has a given value of truth, independently of our ability to discover it. By contrast, Cohen (1963) maintains that the demonstration of the continuum hypothesis' independence of Zermelo-Fraenkel's axioms (plus the axiom of choice) ¹³ is completely satisfying: rather than requiring the understanding of any mathematical reality (as argued by Gödel), the solution of the continuum problem depends on the results we

¹³ There exist two classic formulations of the continuum hypothesis: each infinite subset of the continuum (i) has the cardinality of

can reach within a certain axiomatic system. His *formalistic* solution is widely diffused among mathematicians.

Analogously, as I emphasized above, most physicists consider spacetime theory a fruitful mathematical tool, rather than an exhaustive explanation of the very nature of time. Those (like Weyl) who grasped the relevance of the subjective experience of time ended up admitting the immeasurableness of the intuition and formalization of the time continuum. What I attempted to demonstrate in this text is that Husserl's phenomenology is still in a position to provide a rigorous description of how the spacetime is given to a transcendental subject. More closely, rather than being a mere illusion, the intuitive experience of time continuum is an absolute given without which any mathematical formalization, therefore any physical theory, would be impossible. Much work is yet to be done in this direction. Nevertheless, Husserl's thought has still much to offer in order to shed light into the enigmatic entrenchment of our transcendental life with any scientific theory.

the natural (countable infinite) or real number set; (ii) has the smallest transfinite cardinality after the countable infinite. These two formulations are equivalent if one assumes the nine-item list of rules called Zermelo-Fraenkel set theory plus the axiom of choice (1904), affirming that, given any collection of non-empty sets, it is possible to make a selection of exactly one object from each set, even if the collection is infinite.

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Time, Mind and Aristotle. An Interview with Thomas Crowther

Tom Crowther is professor of philosophy at the University of Warwick. He mainly works on metaphysics, the philosophy of mind, epistemology and Aristotle, with a particular focus on the nature of time and the temporal structure of experience.

1. Can Our First-Person Experience Tell Us Anything About the Nature of Time?

In brief, I think our first-person experience can tell us something about the nature of time. But I think this for reasons that differ from those have often been offered for answering this question affirmatively.

Let me begin with a bit of background. The story of 20th century philosophy of time was a tale of two warring factions; with so-called “A-theorists” on the one side and “B-theorists” on the other. These unusual-sounding names derive from important ideas that were articulated in the work of the Cambridge philosopher John M. Ellis McTaggart. ¹ Crudely put, “A-theorists” believe that the distinction between past, present and future (the “A-series”) is a feature of temporal reality itself. There really is a time that is the present, and so there really is a past and a future. This is captured by the claim that “reality is tensed”. A-theorists also believe that there is a dynamic aspect to time; that time really passes. My typing this sentence is a present event but it will soon become part of my past. And my lunch will move from the future into the present, and then it will become past. ² B-theorists are philosophers who think that the distinction between past, present and future is not a feature of the temporal world itself. They think that this distinction is merely a matter of how we view things, rather than a matter of how things are out there independent of us. They think that temporal reality itself is a series of times and events the relations between which can be understood simply in terms of temporal notions such as “earlier than”, “later than” or “simultaneous with” (the B-series). Notice these relations are completely independent of notions of past, present or future. One can in principle know that 2030 is earlier than 2040 without knowing whether 2030

¹ Though the debate continues to be refocussed and refined, and the distinction itself continues to come under critical scrutiny, 21st century discussion in the philosophy of time is still shaped by this distinction. The key McTaggart texts are McTaggart (1908) and McTaggart (1927).

² For examples of the A-theory see Prior (1959), Zimmerman, (2008), Markosian (2004).

or 2040 is in the past, present or future. B-theorists also deny that time is dynamic, that time is something that really passes. This denial is often captured by the idea that B-theory is a block view of time. The times and events that constitute temporal reality are all in existence in the way that the different marked parts of a 12 inch wooden ruler are all in existence. ³ I incline towards taking various claims characteristically advanced by A-theorists – such as the claim that “reality is tensed”, and that “there is such a thing as temporal passage” – to be true. But I am sceptical about the way that experience has tended to enter into debates about the truth of claims of this kind.

At the very least, it is at least natural to reconstruct some of these arguments for the A-theory that have been offered in the literature in the following way: ⁴

1. When we reflect on first-person experience it seems to us that reality is tensed/there is such a thing as temporal passage.
2. The best explanation of its seeming to us that reality is tensed/there is such a thing as temporal passage is that reality is tensed/there is such a thing as temporal passage.
3. Therefore reality is tensed/there is such a thing as temporal passage. ⁵

Here, first-person experience is playing an epistemic role: it provides one with justification for various A-theoretic claims about the metaphysics of time. In the recent literature, most B-theorists have characteristically rejected (2), arguing that there are better explanations of the character of temporal experience consistent with taking reality to be tenseless or to involve no passage at all. ⁶ But it is an assumption common to A-theorists who argue in this way, and to many of the B-theorists who oppose it, that the very notions of “tensed reality” and “temporal passage” that figure in the formulation of this argument are sufficiently well-understood in the first place. I don’t think this is right. It is a familiar point that many of the traditional characterizations of temporal passage are either incoherent or remain uncashed metaphors. ⁷ But I think it is no less true that there is an insufficiently clear grasp of what it is for reality to be tensed. In particular, I think that the literature does not contain a satisfying discussion of the very idea of what it is for something to be *in the present*. I think that reflection on first-person experience can help us in trying to make some headway with these basic questions concerning the very content of such notions as “tensed reality” or “temporal passage”. This, in my view, is where experience – at least most fundamentally – comes into debates about the philosophy of time. It is a further story exactly what such reflection tells us about these notions. Telling this story is one of the themes of my research in this area.

³ For important examples of the B-theory in the earlier part of the 20th century see Smart (1949) and Williams (1951). More recent work includes Mellor (1998), Oaklander (1984), Le Poidevin (1991), and Dyke (2008).

⁴ This kind of argument is at least suggested in passages of Dainton (2011) for example.

⁵ Reconstructions of arguments for the A theory like this play an important role in the arguments in Paul (2010) and Dyke (2008).

⁶ This is the line taken by Paul (2010), Dyke (2008, ch.2), and other B-theorists such as Prosser (2016, ch.7).

⁷ Scorn for A-theorists’ attempts to articulate the relevant features of the manifest world is a theme of some of the classic mid-20th century work on the B-theory. See, for particularly good examples of this, Smart (1949) and Williams (1951).

Returning to the kind of argument we have just been considering, this leaves it open whether experience has any epistemic role to play in debates about time, once such questions about the content of the notions up for dispute have been clarified and made determinate. One thought here might be that once these questions have been settled, then we are still faced with the task of providing an argument for the claim that notions such as “the present” or “temporal passage” actually have application. And it may be that experience then has a role to play in providing a premise in those arguments, much as the argument in (1)–(3) above. ⁸ That may be so. But there are other possibilities. For one to even entertain the thought *that object is that colour* (a kind of thought that philosophers call a ‘perceptual-demonstrative’) it is necessary that there is in fact an object in front of one, that one perceives, that has some perceived colour. If someone is indeed entertaining a perceptual-demonstrative thought of some kind, then there is not a further step to be taken to establish that the concepts involved in the demonstrative have application in their environment, let alone a further step to which experience of a certain kind may be relevant in providing a premise. The very conditions required for someone to entertain such a perceptual-demonstrative thought are sufficient in themselves for the existence of the things which are the referents of the concepts that constitute the content of the thought.

⁸ For an example of this view of the role of experience in general metaphysics see Lowe (1998, ch.1).

Given what I have said here, it remains open that the situation is somewhat similar in the case of the temporal notions we have been discussing. That is, it is possible that the conditions required for one to have a grasp on the concepts of “the present” or of “temporal passage” – where those notions are clear and determinate enough to frame fruitful debates about the nature of time – are such that the obtaining of these conditions guarantees that these concepts have application. Were this the case, there would be no need for an independent argument for the existence of the present or of passage, an argument in which experience of a certain type functioned as an independent premise (as in the argument (1)–(3) above). ⁹ These are complex and delicate questions that go well beyond what I can go into here. Before moving on from this question, I ought to mention a familiar worry about taking first-person experience to tell us anything much about the nature of time. Briefly put, the thought is that contemporary physics simply tells us that reality is tenseless and there is no such thing as temporal passage.

⁹ I emphasize that the claim here is not that experience will thereby be irrelevant in constituting the relevant truth about how things are. For it will be open to argue that the occurrence of experience of a certain kind plays a constitutive role in a grasp of the relevant notion of the present or of the notion of passage (in a similar way that it is likely to be argued that the occurrence of experience of a certain kind plays a constitutive role in the capacity to entertain thoughts with perceptual demonstrative contents).

This raises many further questions that I cannot possibly do justice to here. Of course it triggers the worries about contentfulness that I have just talked about. But setting this aside for the moment, what I think, very crudely, is that the notion of time that physicists operate with – and that informs the work of many philosophers of time – is just a different notion of time from that which I am attempting to better understand in my research (and others like me are). I am primarily interested in providing an account of the nature of *manifest time*. Manifest time is *time as it is revealed to us in sense-perceptual experience of the world, and first-person*

reflection on that experience. It is not that I am not interested in that other notion of time, or that I take it to be irrelevant to metaphysics. I just suspect that there is much less substantive disagreement here than there might seem to be at first sight.

2. **Some Philosophers Have claimed that Our Experience of Time Eludes Our Attempt to Capture Its Nature Conceptually. Artistic Practices Seem Better Suited to Express this Elusive Nature Than Philosophical Reflection. What do You Think of this Claim?**

There are two different but related ideas here. Let me deal with them separately. I am inclined to think that there is something right about both of them, but with the caveat that each of these suggestions really raises many more questions than it answers.

The first claim is that our experience of time is nonconceptual. Let's try to unpack this a bit. Experiences are phenomenally conscious events or processes. Drawing on an idea from Thomas Nagel (1974) one can say that experiences are events or processes such that "there is something that it is like for the subject" to be undergoing them, in the way that there is nothing it is like for a rock to be rolling down a slope.

What it is for an experience to be *of time* is potentially quite controversial. But let me try to address this question in a way that does not commit us to too much on this front. Whichever side of these various debates about time or temporal experience one is on, it ought to be relatively uncontroversial that an experience as of some kind of change going on (e.g. a ball rolling along the lawn) or of stasis (e.g. an experience as of a cat just lying there motionless on the lawn) or of one occurrence succeeding another (e.g. an experience as of one footstep following another) count as *experiences of time* in some reasonably broad sense. I think every philosopher of time would be able to agree that we have experiences of time in such a broad sense.

Now to the substance of the first question. The claim that one's experience of time eludes our attempt to capture its nature conceptually might mean a number of things. ¹⁰ But the usual way in which this claim has been understood is as the claim that the subject can have an experience of time without the subject of the experience possessing the concepts that would be used to characterize the content of the experience. ¹¹ The "content" of the experience is how things seem to one in having the experience one does. In this case, the claim is that it would be possible for one to have experiences as of something changing, or as a cat in stasis on the lawn, or footstep following footstep, without having the concepts of "change", "stasis" or "x follows y". There are different notions of a concept obviously, and a lot depends on how this notion is understood. But let's assume – as it has been in debates of this kind – that having a concept, for example, the concept *blackbird*, consists in the ability to use the word "blackbird" correctly. Against this background, the idea that the experience of time is nonconceptual appears quite plausible. Those of us who have children will find it hard to resist the

¹⁰ For different sides of this debate see Evans (1982) and McDowell (1994). See Crowther (2006) for argument that there are ambiguities in how this claim might be understood, ambiguities that have an impact on how effective some of the important arguments in this area are.

¹¹ See, for example, Crane (1992).

thought that even before our offspring came to understand the use of the words “change”, “stasis” or “succession”, they enjoyed experiences in which things seemed to them some way, a way that is characterizable in terms of these very temporal concepts. That shows that the possession of these concepts is not necessary for perceivers to have these experiences. It seems to me that one could make the same point on the basis of reflection on the experience of non-linguistic animals of various kinds.

This claim has generated quite a bit of discussion in the literature over the last few decades. ¹² I do not present the ideas I have just discussed as conclusive. But at the very least, the claim seems plausible. Even if it is conceded that this claim is plausible, though, some caveats need to be made. First, note that this is just a negative claim. It does not tell us a great deal about our temporal experience, nor exactly how the relevant temporal features of experience are to be explained. It says only they are *not* concept-dependent in the relevant way. That leaves many different options open about what the positive story is.

¹² See for example, McDowell (1994, lecture III) for an influential response.

Second, it does not follow from this that there aren't *any* temporal experiences with conceptual content. Think of the differences in the kind of perceptual engagement involved in someone without any music-theoretic training or understanding of musical form listening to a piano sonata by Mozart, and the auditory experience of an expert on sonata form like Charles Rosen, who is listening to the same piece of music. I think that the rich perceptual experience that Rosen has in such circumstances is something that wouldn't be shared by one who knows nothing of music theory or sonata form. And I think that the kind of auditory experience that Rosen is having wouldn't have been available to him unless he had the conceptual capacities that are drawn on in his auditory experience of that piece of music.

The second part of this question involved the suggestion that artistic practice may express the nature of the experience of time better than philosophical reflection. This is a really interesting suggestion. A lot here, I think, depends on how exactly it's understood.

The notion of “expression” is most naturally used to indicate the idea of something which is *inner* and (in some sense) *private* to the subject, being made *outer* and (in some sense) public. So we take someone's crying to express their sadness, for example, or their furious shouting to express their rage. The fact that we talk about expression here seems to involve the idea that the subject does something with their body that serves as the public vehicle for something broadly *internal*, which is what's expressed. In these cases, it is emotions of different kinds which are expressed.

Given that philosophical reflection, understood as deliberation about philosophical questions, does not essentially appear to involve doing things with one's body, one might worry about the degree to which it is *expressive* of anything. This, of course, is not to say that such reflection doesn't *manifest* anything. As an exercise of creativity, intelligence or rationality, it clearly does manifest capacities that one possesses. But it is normal to distinguish expression from manifestation.

Against the background of this way of understanding the question, I think it's true that artistic practice does express the nature of temporal

experience better than philosophical reflection. But I think that this may be true in a sense that is not particularly interesting: philosophical reflection – as a mental rather than bodily action – doesn't really express anything.

A different way to take the suggestion is as the idea that artistic practices, like music, dance or drama, provide *particularly good examples* of the elusive temporal characteristics of experience. Specifically, they provide better examples than philosophical reflection does. I am inclined to agree. The temporal properties of such practices as music, dance and drama are so evident and important that it is hard to even begin to see how to make sense of them without thinking of their temporal properties.

But again, I want to hedge this agreement. Don't forget that philosophical reflection itself is something temporal, that is, it is something that goes on in time and over time. Philosophical reflection might involve, say, over the space of an hour, one trying to work out what Aristotle is saying about time in some passage of Book IV of the *Physics*, or involve trying to work out whether two sentences in the same paragraph of that work are consistent with one another. This is activity that goes on over time. One can narrate what went on over that time. One can say, *it took me an hour* to come to understand that the way I had read this paragraph previously was mistaken.

It is easy to forget that such reflection is temporal. There are many reasons for this. One obvious contributing factor is the sheer difficulty of the topic. If the temporal properties of experience are elusive, then even more so is arriving at an understanding of the temporal properties of such actions as thinking, reasoning and decision. I think there has been very little good work done on this. ¹³ Another is a tendency to run together philosophical reflection with the very idea of propositional contents and their relations. Consider the argument form below, in which 1 and 2 are the premises and 3 is the conclusion. It is true, I think that the propositional contents, and the relations between the contents communicated by this argument form:

1. p
2. If p then q
3. q

are atemporal and timeless. These atemporal and timeless properties are a bad fit for the temporal properties of experience. But 1-3 is not an instance of philosophical reflection. It is a written inscription that communicates relations of implication between abstract contents. Philosophical reflection, on the other hand, is something that agents do, that may involve judging that such propositional contents are true, or imply one another, or may involve deliberation about whether they are true or not. But such reflection is not to be identified with the contents themselves.

Even with that warning having been made, I still think it's hard to deny the suggestion when it is understood in this way. Artistic practices – in particular, music, dance, and drama – do provide *better* examples or models of the experience of the passage of time than does reflection. They and their temporal properties are publically observable and open to view.

¹³ Here I'd refer the interested reader to Part II of Matthew Soteriou's outstanding 2013 book *The Mind's Construction*, for the best thing written on these issues in the recent literature.

But this isn't true of philosophical reflection and mental activity in general. Indeed, nothing about the temporal properties of philosophical reflection seems obvious. (The idea that we are able to point our attention inside ourselves to see the drama of our thinking unfold before an internal eye seems wrong to me, as a claim about the character of my own mental life).

Though I'm aware I've pursued this topic for too long anyway, I'd like to make a final point, because there is another way that the question might be read, and indeed is perhaps more likely to be read. This raises an important issue about philosophical enquiry more generally. And here I want to dissent from the suggestion rather than agree with it.

A different way that one might understand this suggestion is that there is an intrinsic difficulty in thinking that philosophical reflection can properly illuminate certain areas, because philosophical reflection is linguistic and conceptual, and the relevant subject-matter is not. This is a general worry about philosophical theorizing that might apply much more widely than just to the case of temporal experience, but to other topics that seem to involve something *ineffable*, or *inarticulable*. According to this worry, "philosophical theory" is simply incapable of delivering the kind of illumination of these topics that philosophers might have hoped for, simply by virtue of this distinction between the linguistic medium and the non-linguistic subject matter. And it is this in-principle incapacity that provides for the possibility that illumination might be better provided by a form of engagement that took place in a different medium, say, dance or music or poetry.

I should start by saying that I certainly don't think that philosophical reflection has a monopoly on providing illumination and understanding. Of course the kinds of practices I have mentioned can do just that, in ways which are sometimes very subtle and difficult to discern, and at other times overwhelming and unmistakable. Many of us spend a great deal of our lives allowing art to transform us in all of these ways. But with that being said, I think it's important to resist the worry as I've just expressed it. The "medium" of philosophical theory and the philosophical use of language is not some insurmountable barrier when it comes to engaging with subjects like this. It's just the form within which philosophers work. Philosophical reflection in these areas can be done well, or it can be done badly. A good philosopher ought never try to pretend that the relevant problems and challenges arising from the nature of the subject matter don't exist. Doing this work well is hard. It requires creativity, and requires that philosophers find ways to draw on their own imaginative powers, and to draw on the imaginative powers of their readers. It requires exercising the capacity for insight and understanding, and putting this together with what might have to be a new way of conceptualizing the subject-matter; one that is capable of providing form for these exercises of insight and understanding. And all of this needs to be done in a way that makes one's intellectual engagement with the – purportedly *ineffable* and *inarticulable* – subject-matter publicly accessible, in a form that invites and makes possible constructive critical engagement from other enquirers.

One might think that questions concerning aesthetic experience and aesthetic engagement are one of these areas in which philosophical theory might be a barrier to successful illumination of a subject-matter that eludes the reach of language. For a model of what philosophy can

do here I'd encourage you to read some of Richard Wollheim's magnificent work on these topics. ¹⁴ If the subject matter in question is the muddy and nuanced character of our ethical responses and the fine structure of our ethical life, read anything on these subjects by David Wiggins or Bernard Williams, or read Sarah Broadie's extraordinary book *Ethics with Aristotle*. ¹⁵ It is interesting here to note that the challenges that the philosopher faces are in fact quite similar to the challenges faced by those working in literature and poetry. It would be very odd to harbour reservations about the capacity of the novel to illuminate character and emotional life because the fine details of character and emotional life are too delicate, intricate and subtle to be capturable or understandable through the crude tools of conceptual structure or linguistic expression. To this philosopher – and lover of literature – the work of Marcel Proust and Leo Tolstoy, amongst many others, would dispense with this line of thought pretty quickly.

¹⁴ See for example, Wollheim (1980) and Wollheim (1987).

¹⁵ See for example, Wiggins (1998), or the magnificent series of lectures in Wiggins (2006). Williams (1985) is one of the most important works in moral philosophy of the second half of the twentieth century. Williams (1981) and (1995) are collections of extraordinarily brilliant essays.

I don't think that any of this is accidental. I think that part of what will make for good philosophy in these areas is the ability of the philosopher to draw on imaginative capacities, skills of intelligent and creative insight and description, and focussed reflection on the world as it strikes them. These are just the capacities that are also required of good novelists. None of these skills comes (or stays) easy. These reflections prompt me to want to interrogate a bit further quite what the implied difference is between philosophical reflection and artistic practice, as we find it in the question. But this answer is already becoming Proustian and Tolstoyan enough in its length, so I had better leave things here.

3. **Do You Think Aristotle's Reflections on Continuity May Still Be Relevant Today, After Georg Cantor Succeeded in Providing a Mathematical Formalization of the Continuum?**

This is a very interesting question, and a question that is very difficult to give a satisfactory short answer to. There is so much that is controversial here. Hopefully some of my answers to other questions will help to fill out my thoughts about these issues a bit further. With the advent of set theory, in the work of Richard *Dedekind*, Karl Weierstrass and Georg Cantor, mathematicians came to possess a system of powerful new techniques for understanding and representing notions of continuity and infinity which went far beyond anything that was available to Aristotle and his contemporaries.

Part of the new conception of continuity that underlay Cantor's set-theoretic approach was the idea that it is possible to understand the notion of something continuous (or what Aristotle might have called "the infinite by division") in terms of a set of points. That is a straightforward rejection of ideas about the relations between points and lines that we find Aristotle articulating in Book VI of the *Physics*. There – amongst many other things – Aristotle offers an argument for the view that we cannot understand a finite magnitude as a construction from a set of extensionless points, no matter how many points we add together. If Cantor is right – and

the axioms of his set theory are generally accepted – then it might seem that this argument is a mistake.

I think that even if we accept that Cantor is right that we can represent continuity and ‘the infinite by division’ in a way that seems to be inconsistent with what Aristotle says in Book VI of the *Physics*, there remain a number of ways in which Aristotle’s discussions of continuity remain relevant for contemporary philosophy. I will mention just two, though I don’t think that these are exhaustive.

The first thing to say is that I think that Aristotle’s investigations of continuity in the *Physics* is quite circumscribed. My view is that even the most abstract and formal parts of the discussion of the notion of mathematical continuity in Book VI are not intended to be descriptions of the relations between magnitudes, quantities or objects, understood as abstract objects that have a determinate identity and reality completely independent of all connection to the natural world. They are discussions of formal and structural properties that are intended to be applicable to, or grounded in, the structural properties of the world that is the object of natural science, that is, that world as manifest to us in our ordinary experience of it. In general, the *Physics* is an attempt to identify the *principles of nature*, and so, an attempt to understand such notions as “time”, “change” and “place” which are basic in the world as we find it in our everyday experience. Here is a place in *Physics* III.5 where Aristotle is speaking to this point: «Now, the issue here might be a very general one, including the question of whether there is a place for infinity among mathematical entities and among things which are intelligible and which have no magnitude. However, we are conducting an investigation into perceptible things...» (*Ph.*

204a34–a36). ¹⁶ This may reflect nothing more nor less

¹⁶ In this passage I quote the translation by Waterfield (1996).

than a specific application of Aristotle’s general views about mathematics. A familiar narrative in histories of the development of mathematics is that Aristotle just straight out rejected Plato’s idea that mathematics had a distinctive subject matter; a set of Forms or abstract objects, their properties and relations, which were metaphysically distinct from the objects of the sensible world. According to this narrative, for Aristotle, mathematics can only be a high-level or general scope investigation of the formal or quantitative features of objects that can be encountered through the senses, whether we are talking about geometry or arithmetic. Unfortunately, from the few passages of the *Metaphysics* in which these questions come into focus, Aristotle’s views about mathematics – and in particular the ways in which his attitudes to mathematics differ from some of the different ideas about mathematics that we find in Plato – cannot be reconstructed in very much detail; or at least with very much confidence. ¹⁷ However, one doesn’t

¹⁷ For extremely helpful discussion of Aristotle’s philosophy of mathematics see Lear (1982) and Bostock (2009, ch.1).

need to be committed to claims about Aristotle’s views of mathematics in general to think that in the *Physics*, the discussions of mathematical notions of continuity

are intended to be discussions that capture facts about the notion of mathematical continuity that are applicable to the world of natural science as *it is manifest to us in sense-perception*. The lines quoted from III.5 above are evidence of that. And once one thinks about the notion of continuity in this way – as an attempt to spell out certain formal features of the

world as it manifests itself to us – I think that many of the claims Aristotle makes are intelligible, perceptive and defensible. The very notion of an extensionless point as being constitutively dependent on the notion of a limit of a line or of a part of a line, seems to make sense when we reflect on the way in which parts of the world are manifest to us in sense-perception. To the extent to which it makes sense to think of extensionless points as coming to awareness, they are manifest to us as the ends of lines or parts of lines. ¹⁸ And though this kind of approach to mathematical continuity – as a conception of the formal properties of the world as it is manifest to us – instantly generates a range of further questions, this approach seems no less relevant to me than the kind of project that P. F. Strawson, in the introduction to his 1959 work *Individuals* famously described as “descriptive metaphysics”, and contrasted with “revisionary metaphysics”. Strawson says: «Descriptive metaphysics is content to describe the actual structure of our thought about the world, revisionary metaphysics is concerned to provide a better structure» (1959, 9). Strawson describes Descartes, Leibniz and Berkeley as revisionary metaphysicians. Amongst late 20th century philosophers we could add David Lewis to this list.

¹⁸ And note further that where we understand these lines as themselves extensionless, in the sense that they lack breadth, these lines themselves manifest themselves to us as the surfaces of manifestly space-filling objects, their boundaries, or the boundaries of their parts.

Strawson offers Aristotle and Kant as examples of descriptive metaphysicians (1959, 9). That characterization, I think, is instructive. For it is suggestive about how we might expand the scope of what such a descriptive approach to metaphysics might involve. ¹⁹ It is obvious from their work that Aristotle and Kant were not merely interested in the structure of our *thought* about the world, or the *structure of the world as thought about*. For the *Physics* and the *Transcendental Aesthetic* are, quite explicitly, investigations of the *structure of the world as manifest to sense-perception and as manifest in temporal awareness*. Subject to this expanded conception of what descriptive metaphysics involves, what Aristotle appears to be doing in *Physics* VI is sketching out a branch of descriptive metaphysics; that branch which concerns notions of quantity, counting, measuring and ordering. He is not engaging in a discussion of the mathematics of continuity that is purely formal in the way that the set theory of Cantor, and his formalization of the notion of the continuum, is. Aristotle’s discussion of the nature of form, structure, magnitude, and continuity in the *Physics*, quite generally, is to be constrained by how these structures show up in the way that the natural world is manifest to us.

¹⁹ I do not imply that Strawson himself would have been happy with this catholicism about the notion of descriptive metaphysics.

It doesn’t follow from this that set theory shows that there is no place for such a project. Set theory and a descriptive metaphysics of manifest time are just different projects. The connection with the notion of descriptive metaphysics will no doubt strike some philosophers reading this as constituting even more of a reason to be suspicious about what Aristotle is up to in the *Physics*. I guess it’s obvious that I don’t share these suspicions. But I don’t have the time or space to say much more about these questions here.

There is a second sense, though, in which Aristotle’s discussions of continuity remain relevant even in the face of the idea that Cantor’s assumptions about how the continuum ought to be formalized are conceded.

This idea is related to some of the ideas I have just discussed. But it also involves scrutiny of the extent to which Aristotle does – or does not – offer us a unified treatment of continuity in the text of the *Physics*. And it focusses in particular on the interest of Aristotle’s claims about continuity, specifically, his views about temporal continuity.

The most focussed discussion of the notion of continuity in the *Physics* is in Book VI, the first chapter of which Aristotle devotes entirely to arguments for the existence of continuous quantities. ²⁰ This discussion concerns that notion of continuity which we might call “mathematical continuity” or the notion of “the infinitely divisible”. More formally, according to this view:

²⁰ For important discussions of continuity in the *Physics* see Bostock (1991) and White (1992).

(MC) x is a continuity iff x cannot be divided into indivisible parts/ x is divisible into infinitely divisible parts.

In Book VI of the *Physics*, Aristotle offers a battery of arguments for the truth of this claim about spatial and temporal magnitudes. But I think that there is another conception of continuity that is central to Aristotle’s discussion in the *Physics*. This is a conception of continuity that is particularly associated with time, and a form of temporal continuity. This idea is bound up with Aristotle’s idea that time is continuous or infinite in the sense that it just goes on and on.

At III.6, 206a23– 206b3, Aristotle says:

But the way in which the infinite manifests itself is different in the case of time and the human race from what it is in the case of the division of magnitudes. Generally speaking, the infinite exists by one thing being taken after another. What is taken is always finite on its own, but always succeeded by another part which is different from it. But whereas in the case of magnitudes each part persists, in the case of time and the human race the parts cease to be, but in such a way that the process does not fail. ²¹

²¹ Here I follow the translation of Waterfield (1986).

I think the idea that Aristotle is getting at here is that time is continuous because the “process” (the process in which the reality of time consists, presumably) “does not fail” that is, it does not come to an end. When one phase of process gives out, there is *always* another phase of process that follows it. So, we have this idea of a chain of occurrences, drinkings of coffee, walks to the shops, eating dinner, which is a continuous but never-ending narrative, a story which will include births, lives and deaths of different creatures of different species and which will take in the narratives of things both living and not living, which just goes on and on.

This notion of temporal continuity can be labeled “dynamic” in that it links the temporal continuity of something to the existence of an unceasing succession of process-phases.

(DC) x is a temporal continuity iff the existence of x involves process-phases always being succeeded by further process-phases in such a way that x does not come to an end.

In *Physics* Book III, it is this notion of dynamic temporal continuity, and the closely related notion of the “potentially infinite” that is on the surface of the text. ²² This is a notion of continuity that is quite distinct from that which I called “mathematical continuity”. Mathematical continuity is a property of a single magnitude and the relations between its parts. Dynamic continuity is not. Dynamic continuity has an important connection to the idea of process or occurrence. Mathematical continuity does not. Dynamic continuity is a property possessed by things with the logic of noncountable mass (things of which there can be more and more, for example *time*, *process*). Mathematical continuity, understood here as it is by Aristotle as the property of a single bounded magnitude, is not. One result of these observations is that at least without some quite substantial further argument, the concession of Cantor’s views about mathematical continuity, that is, about the possibilities of understanding finite magnitudes in terms of sets of indivisible parts – even if we were prepared to waive the kind of defence of these ideas offered above – would be of very little direct consequence for this idea that time is a dynamic temporal continuity. For set theory has, on the face of it, nothing to tell us about the dynamic continuity of time. This notion of dynamic continuity plays an important role in Aristotle’s discussion of time and his discussion of the sense in which time is infinite. And it is of considerable independent interest for contemporary debates in the philosophy of time.

²² For important work on the notion of the potential infinite see Hintikka (1966), Lear (1979) and for an excellent recent discussion see Coope (2012).

4. Are there Any Important Differences According to Aristotle Between the Continuity of Space and that of Time?

In short, yes there are. Let me say a little bit about some of these differences, and why these are interesting. If we focus our attention just on the notion of “mathematical continuity” that Aristotle discusses in Book VI, these differences won’t come into view. Aristotle thinks that both finite intervals of time and finite spatial magnitudes are mathematically continuous in the sense that I described earlier under (MC). That is, they are both infinitely divisible. But once we move away from this notion of continuity, differences emerge. In connection with the notion of time, I described a property that I described as “dynamic continuity” (DC) above). This was the idea that something is dynamically continuous if it consists of process-phase following process-phase, in such a way that the process never gives out. It is clear that this notion of dynamic continuity does not apply to spatial magnitudes. It is obviously not the case that spatial magnitudes consist of process-phase continuously following process-phase.

However, perhaps we might see this notion of dynamic continuity as just the specific application to time of a notion of continuity or infinity that does have application in the spatial domain. In the same way that the first notion of mathematical continuity was that of infinite divisibility, the idea that “we can always go smaller”, we might think that the notion of continuity of which dynamic continuity is a species is just that of *the infinite by addition*; that is, the idea that “we can always go bigger”. And then the thought might be that there is an analogue of this truth in the spatial case. Just as it is true that for every process-phase, when it gives out, there

is always another that follows it, it might be thought that for every determinate spatial magnitude that is traversed, once one reaches the far side, there is always another spatial magnitude ready to be traversed on the far side. For any spatial interval or magnitude, there is always more space on the other side of its boundary.

But Aristotle is very clear that he thinks that this claim about space, and indeed, material objects in space, is false. It is not true, according to him, that space is unlimited in this way. He thinks that the spatial universe is bounded and finite. And there cannot be an actually infinitely extended body. On the other side of that boundary of the spatial universe there is simply nothing; where “nothing” does not just mean “empty space”. These are views for which Aristotle offers an array of baroque arguments in *Physics*, III.5.

This claim is the source of a number of difficulties for Aristotle. Aristotle appears, for example, to accept Euclidean geometry. But Euclidean geometry does seem to require us to make sense of the idea of the of a straight line that can be extended indefinitely. If the universe is spatially limited, at the very least there seems to be a tension with the idea that one can construct a line like that. (I think that there are things to say here in Aristotle’s defence, but I won’t go into them now). I think that much of the resistance to Aristotle here is not so much that we each individually could give a proof of the infinity of space, or spell out the physics that shows that it is, but that his views about the nature of these limits and his views about actually infinite bodies, do not seem to be supported by particularly persuasive argument – they seem to emerge from some extremely elusive *a priori* arguments in *Physics* III.5 – and they are also embedded within a geocentric cosmology that we know to be false.

What’s really driving these claims about the finite nature of the spatial universe, and the impossibility of actually infinite objects? I think that this is a fascinating question. I suspect that here again we are seeing evidence of the fact that Aristotle is interested in manifest space, or space as it is presented to us in everyday sense-perceptual awareness. And while one might be impressed with the thought that at least as far as we move around on the earth, for every step across a distance we traverse, there is always another step we can take, so one also might have been impressed with the idea that whether one is in Macedonia, Athens, the islands of the Aegean or Chalcis, all of the action takes place “under one (visible) roof”; one vast cosmic container that seems to be the same container wherever one is.²³ What’s particularly interesting for me here, amongst other things, is that it reveals the extent to which the central role in Aristotle’s accounts of continuity and infinity appears to be being played by temporal notions rather than spatial ones. That strikes one even more clearly when one looks more closely at Aristotle’s views about what it is for space to be mathematically continuous; that is, for a spatial quantity to be an infinitely divisible magnitude. For, at least on the face of it – and here there is another area around which there is extensive disagreement between commentators – Aristotle’s explication of this notion in *Physics* III.6 itself appears to depend crucially on temporal notions. In particular, it seems to involve the

²³ Acknowledging that it is “the same container” wherever one is, is consistent with acknowledging that it does seem to move around in various predictable ways over time, and also seems to look slightly different to one depending on where one is spatially located.

idea that if one were to begin dividing up such a magnitude into smaller spatial parts, then for every spatial magnitude that might result from such a division, that process of division could always (in some way, in principle) be continued.

This raises questions both interpretive and philosophical about what «in some way» or «in principle» could possibly mean as applied to the extendability of such a process of division. ²⁴ But whatever these further difficulties, it is very hard to come away from the discussions of continuity and infinity in Books III, IV and VI of the *Physics* without the sense that it is Aristotle's views about time, and the various respects in which time is continuous and infinite, that are the real intellectual driving-force behind the discussion.

²⁴ See Lear (1979) for fascinating discussion of this question.

5. How Do You Think We Should Understand the Connection Between Time and the Soul that Aristotle Draws at the End of the Fourth Book of *Physics*? Does It Imply Some Sort of Idealism?

The idea that there are connections between time, the soul, and the activities of the soul, is a thread that runs through Aristotle's discussion of time in the Book IV of the *Physics*. But there is a famous – or infamous – passage in which Aristotle discusses this question head-on. Here is the passage from Edward Hussey's translation in the 1983 Clarendon Aristotle Series edition of the *Physics* Book III and IV. I have omitted just a couple of sentences for ease of reading:

It is also worth investigating how time is related to the soul, and for what reason it is that time is thought to be in everything – on earth and in the sea and in the heavens... One might find it a difficult question, whether if there were no soul there would be time or not. For if it is impossible that there should be something to do the counting, it is also impossible that anything should be countable, so that it is clear that there would be no number either... But if there is nothing that has it in its nature to count except soul... then it is impossible that there should be time if there is no soul, except that there could be that X which time is, whatever X makes it what it is; as for example if it is possible for there to be change without soul. (*Ph.* 223a16–28)

Idealism about some subject-matter, say, ordinary commonsense objects like palm trees and peregrine falcons, is the view that such objects are in some way dependent on the mind or its activities (“activities” here is broad enough to include: experiences, beliefs, our capacities for describing the world in language, or broader cultural practices or institutions). Idealism is more plausible for some subjects than for others. For example, it would be odd to think of the property *now being seen by Tom*, as something independent of facts about Tom and his experiences. But when it comes to such things as ordinary objects – or time, for that matter – philosophers have generally wanted to avoid being idealists. At least, philosophers within the kind of philosophical tradition in which I was raised have generally wanted to avoid idealism about such things, and taken realism – the view that such things are in some robust and meaningful sense independent of us and our activities – to be the default position.

What motivates this idea that realism ought to be the default

position? Some delicate questions about the nature of the distinction between realism and idealism lurk in the background here. But in advance of taking a necessarily brief look at questions of those kinds, we might identify several motivations. One crude thought is that even if all sentient beings (on which the idealist may think the existence of the relevant objects putatively depends) were wiped out overnight, then there would remain a mind-independent world that contained objects and perfectly determinate facts about them. Or we want to be able to think that it might have been that no sentient beings who developed the representational capacities and culture that we have ever developed, though nevertheless the world independent of the mind did, and remained determinate in very many of the ways that it is so now, even given that we do exist. And with respect to such putative truths about objects like “that object is six feet wide” or even “that person is shameless” we want to think that the truth of such things is constitutively independent of any decisions that I may make about how those things may be, or any desires I may have about whether such things are true. The very idea of the world is the idea of that to which our representations must conform, and against which our desires or decisions, at least in the kinds of cases I have described, don’t get a say. ²⁵ Against this background, if someone says that your view commits you to a form of idealism about something, that is generally a bad thing, or a charge against you. It is a charge that you are generally under an obligation to show is misplaced.

The passage quoted above from the end of *Physics* IV has generated a great deal of discussion. One of the reasons for this is that the reader is likely to come away with the distinct impression that Aristotle is here saying that he is an idealist about time. Indeed, he seems to be offering an argument for that conclusion. An assumption of the passage appears to be that the notion of time is – or at least involves – the notion of what is countable. The next step appears to be that the only thing that has the ability to count is a soul. And then Aristotle seems to suggest that it follows from these ideas that were there no souls (with their abilities to count) then there could be no time.

Because many of us think that idealism about time is something to be avoided, and because all interpretation, even when the subject is not one of the greatest philosophers in history, is informed by some kind of Principle of Charity, there is a pressure on the part of the reader to find something here beyond the initial appearances. An additional motivation in this case is that the argument that I have just briefly reconstructed for the dependence of time on the soul looks pretty poor. ²⁶ Some philosophers have attempted to argue that the appearance that Aristotle is offering an argument for the idealism of time here is just that: an appearance, and nothing more. It is true that the text is not unproblematic. This is Aristotle writing after all. The argument consists largely of a series of conditionals about what would or might be the case, without a clear statement of the truth of the antecedent of these conditionals, and

²⁵ Of course, any fully satisfying specification of the way in which truths about the world are independent of our decisions and desires will need to be appropriately sensitive to the many ways in which our wills can manifest itself in changes in the facts, from my decisions about how to move my body or how to move parts of the world through moving my body.

²⁶ As I presented it, the argument seems to be invalid. As reconstructed, it says that O (time) has the property of being F (dependent on a soul) because a feature of a soul that counts O (the capacity to count) has the property of being F (dependent on a soul). But that doesn’t follow. O (time) and a feature of a soul that counts O (the capacity to count) are distinct things. The obvious invalidity of

a clear endorsement or assertion of the idealist conclusion. There are those also who believe that Aristotle intends the reader to see that the argument that he offers here is a bad one. Rather – so the thought goes – the reader is intended to think that just as there can be change independent of the soul – as ventured in the very final sentence of the quoted passage – so also can there be time without the soul. I don't have the time here to explain my reasons for thinking that this approach is mistaken. One very basic worry, though, is that Aristotle has gone to considerable pains earlier in Book IV to emphasize that while there is an important connection between time and change, they are not the same thing. Therefore it is unclear why he would expect or intend the attentive reader to generalize these claims about the mind-*independence* of change to a claim about the mind-*independence* of time.

the argument, as I see it, is a reason to suspect that whatever else may be going on in this passage, an argument of this degree of crudity cannot be the extent of it.

So I am not quite convinced that this is the best way with this passage. To engage a bit more fully with the question, let me try make a more positive suggestion. This will require me to say something a bit more general about “Aristotle’s idealism” in *Physics* Book IV, 10-14. Even if I don't have the time to apply this in detail to the passage, it will generate some ideas about what that treatment might look like.

Idealism itself is not so much a position or an idea as it is a family of positions or ideas. Idealism centrally involves some kind of *mind-dependence* claim. But there are different kinds of *mind-dependence* claims that can be made. Some of them are more nuanced and worthy of consideration than others, and idealist claims about some subject matter might be able to co-exist with at least some of the intuitions that motivate the assumption that we ought to be realists about that subject matter.

Here is an example from a different area. A suggestion that has been made in subtly different ways in the literature about value properties (for example, *goodness* of a certain kind) is that an object is good in the relevant sense in so far as it merits a positive evaluative judgement or positive evaluative response from an appraiser. Given this view, one understands what it is for an object to have the relevant property in a way that involves making essential reference to certain kinds of evaluative responses by subjects. So on this approach there is an element of “idealism” (or “subjectivism”) involved in the understanding of what it is for some property to be the very property it is.

But note that it doesn't follow from this that whether or not something is good or not is something that can be decided or stipulated by some individual evaluator, or that things don't have particular value properties independent of the contingent attitudes that a community of evaluators happens to have. For even if I judge that this object is good, it may nevertheless be the case that this object is not such as to merit such positive appraisal from an evaluator. This is to say that “mind-dependence” about understanding an object, property or phenomenon can come apart from “mind-dependence” about the existence of such a thing or the instantiation of such a property in the mind-independent world.

And this is relevant because, as I have alluded to above, one might think that what is really troubling about idealism, and what we really ought to care about resisting, is mind-dependence in this latter sense. We don't

want to think that the facts about ordinary commonsense objects and their properties are determined simply by our desires or decisions, or that there is no difference between an asteroid wiping out all sentient life, and wiping out everything there ever is or could be. But the moral of the kind of proposal just considered is that we can resist this kind of problematic idealism, even if our views about how to understand the relevant facts about those objects incorporate a form of idealism or subjectivism. I suspect that the kind of idealism about time that emerges in *Physics* IV.10-14 can be more helpfully understood in terms of the kind of idealism that I have just spent time describing. ²⁷ From this perspective, Aristotle would be advancing the claim that it is not possible to understand what time is without making reference to certain kinds of capacities of souls; specifically, the capacities for counting (including counting changes, and counting what he calls «the nows»).

²⁷ If I understand him right, this is the kind of suggestion that is made by Jonathan Lear in his fascinating discussion of *Physics* IV.10-14 in his book *Aristotle: the Desire to Understand*.

But that would be consistent with the idea that the existence of determinate countable changes of various kinds, and determinate facts about the «countable nows» is independent of the existence of particular souls who are doing any counting or measuring of changes or «nows». It should be noted that if one is attracted to this approach, then one important task is to give an account of the way that Aristotle couches his dependence claims in the paragraph with which I began my response to this question. For the critics may observe that contrary to the kind of story I have been trying to tell, Aristotle seems to make precisely the kind of dependence claims that I have said are the particularly problematic ones (e.g. «it is impossible that there should be time if there is no soul» (*Phy.* 223a26)). It is the existence of time that is said to be dependent on the soul, not *an understanding of what it is*, it might be objected. This is an interesting challenge, and it raises many further questions.

Let me end just by making a few observations. An obvious point to make in response is to note how natural it is to express even the claims about the mind-dependence of understanding in existential terms. If one is speaking loosely, it is fairly natural to describe even the more nuanced form of idealism discussed above in existential terms («If there were no practice of evaluative judgement there would be no goodness or badness») even though these existential constructions are elliptical for the richer intelligibility claim. It's also not irrelevant to this question, I think, to note that as Aristotle's philosophy matures, the very notion of "to be" (*na einai*) becomes crucially connected to the very idea of what can be made intelligible or understandable. Even if the *Physics* is a less mature work than the *Metaphysics* (where such a use of "to be" achieves its most articulate and developed form) what we may have here is an earlier example of a "to be" construction, in which the sense of it is not primarily "to exist", but to "be intelligible or understandable".

Suggestions for Further Reading

Aristotle, Continuity and the Infinite

I would suggest that the interested reader start with Aristotle himself. The following translation is very good, and an excellent place to begin:

Aristotle *Physics*. Transl. by Waterfield, R., with notes from Bostock, D. (1996). Oxford, Oxford University Press.

The following edition of the Clarendon Aristotle series focuses on Books III and IV. Edward Hussey's notes are excellent:

Aristotle *Physics Books III and IV*. Transl. with notes by Hussey, E. (1983). Clarendon Aristotle Series. Oxford, Clarendon Press.

If you want to investigate Aristotle's philosophy of time in more detail, two particularly important recent studies of Aristotle on time can be recommended:

Coope, U. (2005). *Time for Aristotle, Physics IV.10*. Oxford, Clarendon Press.

Roark, T. (2011). *Aristotle on Time: A Study of the Physics*. Cambridge, Cambridge University Press.

Here are three texts that include excellent discussion of issues relating to continuity and the infinite in ancient philosophy from the point of view of contemporary research on the philosophy of time.

Sorabji, R. (1983). *Time, Creation and the Continuum: Theories in Antiquity and the Early Middle Ages*. London, Duckworth Press.

This is a tour-de-force of a book, introducing ancient theories of time and the continuum and assessing their significance for contemporary research. It is relevant to many of the issues touched on in the discussion above.

Moore, A.W. (2019). *The Infinite*. 3rd ed. London, Routledge.

The first section of this book, which is now in its third edition, is an extremely helpful historical overview of the history of the notion of the infinite (to which notions of continuity are inextricably linked). Sections two and three contain excellent discussion of the infinite from one of the most interesting philosophers working today.

And finally:

White, M. J. (1992). *The Continuous and the Discrete: Ancient Physical Theories from a Contemporary Perspective*. Oxford: Clarendon Press.

White's text is difficult, but very rewarding.

If I had to recommend one book on Aristotle for those who are interested in the themes I have been discussing here, it would have to be:

Lear, J. (1988). *Aristotle: The Desire to Understand*. Cambridge, Cambridge University Press.

Jonathan Lear's book is a substantial work of philosophy in its own right, in addition to being an outstanding general overview of Aristotle's philosophy. It contains particularly stimulating discussions of *Physics* Book III and IV. My own views about Aristotle's discussion in *Physics*, Book IV (particularly about 'the now', which I have not said much about here) and my view that there are two different notions of continuity at work in the *Physics*—which I have said something about here—owe much to a few suggestive remarks of Lear's in this text.

Time and the Temporal

For very helpful basic introduction to contemporary philosophy of time, from a B-theoretic perspective, see:

Bardon, A. (2013). *A Brief History of the Philosophy of Time*. Oxford, Oxford University Press.

For those who want to go deeper into contemporary philosophy of time, I would suggest that one reads the papers collected in section C of:

Van Inwagen, P and Zimmerman, D. (2008) *Metaphysics: The Big Questions*. 2nd ed. Oxford, Blackwell.

Essential reading here must be the late Hugh Mellor's follow-up to his own 1981 book *Real Time*, a book that sparked so much interest in the philosophy of time in the late 20th century. This is:

Mellor, D.H. (1998). *Real Time II*. London, Routledge.

Even if one disagrees with Mellor, there is an extraordinary amount of interesting philosophy here.

There is a great deal of work in contemporary philosophy of mind that lies at the intersection of philosophy of perception and the metaphysics of time. For a very valuable collection of essays that includes introductions to research on the nature of temporal experience as well as substantial contributions to that research, see: Phillips, I. (ed.) (2017). *The Routledge Handbook of Philosophy of Temporal Experience*. London, Routledge.

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II. FILOSOFIA DEL TEMPO CONTEMPORANEA/ CONTEMPORARY PERSPECTIVES

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Nothing Comes Next

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There are many problems with temporal continuity, but there is a hard one for those philosophers who believe that the world is *existentially* dynamical. In particular, this holds for those who take seriously the requirement that in such a world must vary what exists unrestrictedly. As a paradigmatic case study, the paper discusses the Growing Block Theory (GBT) of time, as recently presented by Correia and Rosenkranz who consider temporal passage in the strong existential sense of the term. Then, it will be shown that their account fails to do justice to the continuity-requirement: nothing comes next. Without the time continuum, however, the *genuinely temporal* character of the dynamics gets lost: the objection of spatial analogue turns back. Finally, the paper suggests that Kantian consciousness-dependence is what one needs in order to get a genuinely temporal dynamics that really makes it distinguishable from mere variation across space.

I. Introduction

I will discuss a new formulation of the Growing Block Theory of time, recently presented in the monograph *Nothing to Come* by Fabrice Correia and Sven Rosenkranz (2018). Accordingly, the world is *existentially dynamical*: only the past and the present exist, but the future has to come. The advantage of Correia/Rosenkranz's approach, to be spelled out in Section 2, is that it really takes seriously the requirement that what exists unrestrictedly (*simpliciter*) must vary with time. It therefore should be viewed as the most promising account of existential dynamics.

However, in Section 3 I will argue that the block is not constantly increasing, that the account cannot adequately represent the *continuity* of time: nothing comes next. Moreover, without the time continuum, the *genuinely temporal* character of the dynamics gets lost: against this version, one can raise the objection of spatial analogue, i.e. nothing excludes that there is such a dynamics also, but then: mysteriously, across space. In particular, the *relativistic* version of Correia/Rosenkranz's growing block view turns out to be unsatisfactory, precisely because of the lack of time continuum.

In the final Section 4, I will suggest that Kant's theory of time being originally *pure intuition* may close the gap: objective time flow is existentially continuous in virtue of, i.e. ontologically dependent on, the continuity of subjective time. Kant presents a metaphor of time that is close to the growing block view: a line insofar one draws it. Then, Kant falls down the same objection as the current approach, unless he adds that the representation of time must be accompanied by the *I think*, by self-consciousness.

The paper has a wider underlying motivation than that of providing an argument against the growing block view. I believe that any metaphysics of time that considers temporal passage in the strong existential sense of the term must answer the challenge of doing justice to the continuity-requirement. Further, I also believe, in general, that Kantian consciousness-dependence is what one needs in order to get a genuinely temporal dynamics that really makes it distinguishable from mere variation across space. Thus, the case at hand should be taken as a paradigmatic case study. – Regarding the main topic of this *Special Issue*, i.e. “Time-Continuum”, the spirit of the paper can be characterized in this way: There are probably many problems with the continuity of time, but there is a hard one especially for those philosophers who believe that the world is existentially dynamical. In particular, this holds for those who take seriously the requirement that in such a world must vary what exists unrestrictedly, as Correia/Rosenkranz in fact do. Then, however, this challenge is not restricted to this particular version of the growing block view, but stands for all metaphysics being truly existentially dynamical.

II. The Growing Block Theory of Time

The *Growing Block Theory* (GBT) is intended to be the existentially dynamical ontology according to which the sum total of existence is always increasing. Always, new slices of existence appear without ever disappearing, and so the present is always new and the whole of the world is constantly growing. Intuitive as it seems, the GBT nonetheless faces various conceptual problems. The first set of problems concerns the idea of being “existentially dynamical”: it will be shown, in this section, that its main difficulty can be solved by a new formulation of the GBT. The second crucial problem surrounds the idea of time continuity, namely that the block is “constantly

growing”: as it turns out, in the following section, this difficulty remains unresolved even with the most promising account at hand.

To clarify the GBT, it is helpful to contrast it with the *Moving Spotlight Theory* (MST). ¹ For, as we will see, the MST does not have the difficulties under discussion. The contrast shows that not all notions of dynamism are subject to the first criticism. The argument only affects an *existentially* dynamical ontology, as GBT. Further, the second criticism does not affect the MST. Its notion of continuity is based on Cantor’s set-theoretical account of the continuum, whereas the intended GBT-continuity cannot (see the following section). Time-Continuum faces a particular problem within existentially dynamical ontologies. According to the MST, it varies temporally what is *objectively* present. Therefore, it can be considered as a *dynamical* ontology. However, this temporal variation occurs across the block universe, “given” as much as according to eternalism, the static ontology of time. The objective variation of what is present is not a variation of what exists; the MST-ontology is accordingly not existentially dynamical. By contrast, defenders of the GBT must argue that it varies temporally not only what is objectively present but also what exists. Then, the problem is that the notion of what exists is ambiguous: also eternalists surely believe that dinosaurs and computers are located at different times, and so they could accept, in some way or other, the GBT-idea that the world as of some time is larger than the world as of an earlier time. The question hence arises whether proponents of the GBT really can distinguish their view from reasonable eternalism.

One way of spelling out this difficulty requires the distinction of two different conceptions of existence, namely “existence *simpliciter*” and “existence@”. ² The first captures the non-perspectival sense of being in the domain of *unrestricted* quantification. Applied to spacetime physics, one can say that something exists *simpliciter* iff it is located somewhere in spacetime, at some spacetime point p or other. If spacetime as a whole is static (i.e. not growing), this expresses the idea of the block universe. The second sense of existence captures the merely *perspectival* sense of being located at a given time, applied to spacetime physics: of being realized with respect to a given, particular spacetime point p_0 . ³ Eternalism is, therefore, analogous to modal realism according to which something exists *simpliciter* iff it is located somewhere in the whole of possible worlds, i.e. iff it is located in some possible world or other, whereas something exists@ iff it is located within a given, particular possible world. Then, proponents of the GBT must argue that it varies temporally what exists *simpliciter*. For, a mere variation@ can and should be allowed by eternalists as well. However, the long-lasting most famous proponent of the GBT characterizes his own view in such a way that every eternalist could accept for her block universe view: «what exists as of one time, differs from what exists as of another» (Tooley 1997, 16; see the reply in Mellor 1998, 83). In such a way, there is no temporal variation of what exists *simpliciter* but only a variation@, i.e. a variation of what exists from one temporal perspective compared with what exists from another temporal perspective. This is compatible with the view that the block universe as a whole is static (i.e. eternalism), but that, restrictively

¹The MST combines the block universe view (eternalism) with the idea that an objective, irreducible property of presentness is moving across the block. In the last couple of years, this theory has found new friends; see Cameron (2015) and Deasy (2015). The standard reference for good-old eternalism is Mellor (1998).

²It is very close to similar distinctions in Sider (2001, 59) and Lewis (2004, 3-4); for more details see Friebe (2018, sec. 1).

³Depending on the specific spacetime structure, everything located on an absolute plane of simultaneity (containing p_0), or everything located outside the lightcone of p_0 , or only the event located at p_0 itself may be considered as existing in this perspectival sense.

speaking, what there is with respect to one spacetime point differs from what there is with respect to another. Thus, the challenge for proponents of the GBT is to spell out the (constant) growing in terms of existence *simpliciter*.⁴ Recently, Correia and Rosenkranz (CR 2018; CR 2019) have presented a significantly improved version of the GBT. According to them, Tooley et al. conflate two different commitments: a rather trivial one, shared by everyone, with a substantial one being characteristic for the GBT. Consider the following statement (example taken from CR 2019):

⁴ In the words of the grounding father of the GBT: «“the essence of a present event is, not that it precedes future events, but that there is quite literally nothing to which it has the relation of precedence» (Broad 1923, 66).

“Broccoli is presently to be found somewhere, but was nowhere to be found in 800 BC.”

This sentence is true. It is so in virtue of merely *empirical* reasons. Therefore, it should be accepted as true by every philosopher. Here, on the other hand, is the substantial commitment:

Broccoli is presently something, but was nothing in 800 BC.”

This sentence is true or false not only on empirical grounds but can be accepted as true only by non-eternalists (presentists included). In terms of the foregoing, the latter sentence expresses that with the appearance of Broccoli has changed what exists *simpliciter*.

Correia/Rosenkranz themselves go a different way of spelling out the difficulty at issue: they don’t accept the assumption that there are different senses of existence and instead hold that the alleged perspectival sense of existence is nothing over and above “location”. One should carefully distinguish, they argue, between “temporal existence” and “temporal location”, which leads to the counterintuitive way of talking that, e.g., Dinosaurs exist *now* but are located somewhere else, at some time in the past. Moreover, the whole account is idiosyncratically written in Timothy-Williamson-(2013) language, which makes the reconstruction not easier. Undoubtedly, however, the advantage of their approach is that now there is a GBT on the market according to which it really varies what exists *simpliciter*.

Formally, the growing block universe can fully be captured by the following two principles (with *E*: “exist”; *G*: “always in the future”; *T*: “time”; *At*: “shift”; *H*: “always in the past”):

(P1) $Ex \rightarrow GE_x$

(P2) $Tx \rightarrow At\ x, H-Ex$

To understand the formulas, one should notice that:

1. Every predication/quantification is *tensed*.
2. Principles allow prefixing by *any* combination of the universal quantifier and ‘Always’.
3. $Elm \rightarrow \mathcal{T}Elm$; with \mathcal{T} : ‘true *simpliciter*’.

Accordingly, the sentence “ Ex ” is shorthand for: Always, $\forall x$ Always, Elx , and so Elx should be read as: “Always everything always exists now”. This is Williamson’s

characterization of “permanentism”, i.e. eternalism. It is always true *simpliciter* that dodos exist now (‘although’ they are now located in the past).

Correspondingly, GBT’s first principle “(P1) $Elx \rightarrow GEIx$ ” should be read as: “Always everything will always in the future be something.” Nothing never ceases to exist. Further, GBT’s second principle “(P2) $Tx \rightarrow At x, H-Elx$ ” should be read as: “Always every time at itself was nothing before, i.e. is new.” At itself, every time is freshly added to the block. Consequently, for times (and residents in time), ⁵ Elm is true *simpliciter* although not always true. Therefore, what exists *simpliciter* varies temporally, along the idea of freshly added slices of existence that never cease to exist. To sum up, the dialectics is that there is a future for existentially dynamical ontologies. Not only varies what exists@ – in some perspectival sense from t to t' –, as it could be satisfied also by eternalism, but it varies what exists unrestrictedly. However, there is a second requirement to be satisfied: the variation must be *continuous*, otherwise it is not really temporal. The following is devoted to this second problem.

⁵ Throughout the paper, I assume that everything being said holds likewise for past, present, and future times and for past, present, and future residents (things, objects, events).

III. GBT’s Problem with the Continuity of Time

The GBT, as it stands, is intended to capture the idea that «the sum total of existence is *always* increasing» (Broad 1923, 66). ⁶ The block is conceived of as «*constantly* growing without ever eroding» (CR 2018, 44), so that time «*constantly* passes» (CR 2018, 66), in the existential sense of the term. Thus, the GBT not only is intended to be an existentially dynamical ontology of time but also to do justice to the continuity of time. ⁷ In this section, it will be shown that even the most promising account of the GBT cannot do this latter job. Further, it will be argued that, without an adequate representation of the continuity of time, the temporal character of the existential dynamics gets lost.

⁶ The italics in the quotations of this section are always mine.

⁷ A discrete sequence such as “2, 4, 6, 8, [...]” is (strictly) *monotonous* but not “*constantly growing*”, as it is assumed for the growing block universe.

To begin with, look carefully at Correia/Rosenkranz’s way of translating Broad’s slogan that the block is always increasing into their language: «always *there* is a new resident of time that was nothing before» (CR 2018, 36). On the grammatical surface, the expression «*is* [always] *increasing*» sounds dynamical, while «[always] *there is* [something new]» sounds static, but Correia/Rosenkranz apparently believe that also ontologically *increasing* is essentially *being new*; *always growing* is nothing other than *always being greater*. However, this is wrong. For, the continuity of growth is not guaranteed by always being greater.

The problem is that the last moment, the edge of being, will not have an *immediate* successor. Either there will be a gap between the newest moment and all the older ones, or together with the newest moment infinitely many other new moments (simultaneously?) appear. This criticism seems to be an old-fashioned, Aristotelian defence against Cantor’s account of the continuum, but in fact it is crucial for this (and, presumably, for all) existentially dynamical view(s) of time. By contrast (again), the MST does not have this problem.

For, the MST presupposes (in CR’s terms) “permanentism”, i.e. Elx . the *simpliciter*-existence of past, present, and future times (and residents in time). It, therefore, assumes the existence of Cantor’s continuum of (space-)time points. Then, the

MST is distinguished from eternalism by the additional claim that some time is objectively present. This property of presentness is assumed to move *constantly* across (space-)time, so that it could be the case that proponents of the MST also have the difficulty of doing justice to the continuity-requirement. That in fact they have not can be seen in the context in which Correia/Rosenkranz seek to avoid a *frozen* present for the MST – an ontologically distinguished moment of time that, unfortunately, is always the same. Formally:

$$\exists x(Tx \ \& \ x \text{ is present} \ \& \ H-(x \text{ is present}) \ \& \ G-(x \text{ is present}) \ \& \ \forall y(Ry \ \& \ y \text{ is present} \ \rightarrow \ y \ L \ x))$$

Interpretation: «It follows that always there is at most one time that is present. It likewise follows that a given time is only ever present once, and hence that always a distinct time is present» (CR 2018, 73).

Apparently, the given formula alone cannot exclude a somehow jumping present, i.e. a *non-continuous* motion of presentness. However, in the MST nothing differs substantially from Cantorian mathematics: taken the given formula together with a notion of precedence, some ϵ/δ -like definition will do the job of avoiding the jumping present. For every ϵ , there will be a δ such that [...], so that the present is moving continuously, in the ϵ/δ -sense of the term. This might work, thanks to the eternalist assumption that guarantees non-empty neighborhoods of every moment that is present.

Contrariwise, in the adequate GBT any neighborhood of the (new and) last moment of time is half-sided empty:



FIG 1 Screenshot of the growing block: Around the edge of being, the neighborhood is half-sided empty

As Correia/Rosenkranz frequently stress, it is really nothing to come. Everything in the past (within the block) exists, but nothing regarding the future. The term “existence” is unique, so that regarding the future nothing is *real* in some other sense of being. The sentence “*Elm*” is, if true, true *simpliciter* although not always true, which means that constants do not always refer, they do not necessarily have referents. Correia/Rosenkranz apply non-classical, ‘free’ logic in order to get the intended existential dynamics. All this is good, but the consequence is that the neighborhood of the present is half-sided empty.

No ϵ/δ -like definition can therefore be applied to get the continuity of growing, nothing comes next. In other words: the present is considered simply to be the new and last moment of existence, but it has no inherent motion, it is not directed towards the future. The lacking continuity apparently goes hand in hand with a lack of temporal directionality. *Prima facie*, the block represents a certain time direction by virtue of constantly becoming greater. However, this is illusionary. *Dynamics* rather comes from nowhere, the adding of fresh slices of existence apparently is *orthogonal* to the alleged direction of the growing. The block, in particular the edge being, is not acting while becoming greater, whereas “growing” suggests that the edge of being (or, the block) is doing something. In this way, the temporal character of the existential dynamics gets lost.

I will explain this further in the last section. Let me firstly add a different argument that shows that, even though Correia/Rosenkranz’s GBT-dynamics really is existential in the sense that it varies what exists *simpliciter*, there is no reason

to believe that this existential variation really is *temporal*. For, against the account one can raise the objection of *spatial analogue*, i.e. the argument – usually presented against eternalism – that everything said about time can also be said about space, which shows that the distinguishing character of time is missing.

Look again at the two principles of the GBT:

$$(P_1) Elx \rightarrow GEIx$$

$$(P_2) Tx \rightarrow At x, H-Elx$$

Now, one can construct a spatial analogue by substituting all the temporal notions with non-temporal ones. Here is it (with \blacktriangle and \blacktriangledown meaning ‘everywhere in the upper [lower] side’; and with s : “place”):

$$(P_1) Elx \rightarrow \blacktriangledown Elx$$

$$(P_2) Sx \rightarrow @x \blacktriangle -Elx$$

One gets an existential dynamics across space: everywhere everything everywhere in the spatial upper-side (of it) *continues* to exist; and for any spatial location s , at s , everywhere in the lower-side of s , s did not *yet* exist. *Simpliciter*-facts change across space. Counterintuitive as it may, nothing in the GBT-account at hand forbids that.

Moreover, Correia/Rosenkranz themselves construct a *relativistic GBT* in precisely this spatial-analogous way (see CR 2018, chap. 9). With regard to Special Relativity, they rightly hold that «we must make spacetime-points our basic points of evaluation», but wrongly conclude that

[we must] appeal to no objective structure of spacetime other than the fourfold division, determined by each such point, between that point itself, those points in the causal past of it, those in the causal future of it, and those in the elsewhere region of it. (CR 2018, 135)

Instead of appealing only to the lightcone-structure of relativistic spacetime, one would expect, from a non-eternalist perspective, that (the concepts of) timelike curves and proper times also are included into the objective structure: “proper-time” is usually considered to be the fundamental notion of time.

By contrast, Correia/Rosenkranz claim that «variation in what exists, if any, must accordingly be understood as variation across spacetime rather than time» (CR 2018, 136). In particular, this claim has to be understood as the rejection of the idea that there is variation along a timelike curve. For, this would be variation across (proper-)time rather than unqualified spacetime. In this way, so-called *spatiotemporaryism* ⁸ turns out to be an existentially dynamical ontology lacking the temporal character. In more detail, Correia/Rosenkranz distinguish – along the literature on the Putnam/Stein-controversy – between «pointy relativistic GBT» and «bow-tie relativistic GBT» (CR 2018, 150). Both versions have the two principles in common; with \blacktriangle and \blacktriangledown now meaning ‘everywhere in the upper [lower] lightcone’, and with s now meaning “spacetime point”. They disagree as to whether the elsewhere regions are populated or not, e.g., the pointy-version affirms: “at any given spacetime-point, the elsewhere region is unpopulated” (CR, 2018, 149).

⁸ “Temporaryism” is their term for “non-eternalism” (opposed to “permanentism”). “Spatiotemporaryism” is hence opposed to the (relativistic) block universe view, in their terms: “«the *spatiopermanentist* view according to which, everywhere in spacetime, what exists also exists everywhere else in spacetime» (CR 2018, 136).

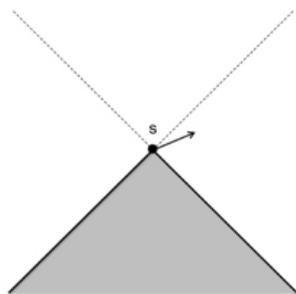


FIG 2 Pointy relativistic GBT:
Possibility of spacelike 'growing'

With regard to the pointy-version, the first principle “ $E!x \rightarrow \nabla E!x$ ” says that everywhere everywhere in the causal future (upper lightcone) still exists, and the second principle “ $Sx \rightarrow @x \blacktriangle -E!x$ ” says that for any spacetime-point s , at s , everywhere in the causal past of s , s did not yet exist. Therefore, Correia/Rosenkranz suggest:

Accordingly, at s , s is 'new' on any particle's trajectory passing through s , while it continues to exist on this trajectory even after the latter has passed through s . Let us call this kind of view *relativistic GBT*. (CR 2018 149)

Now, my objection goes as follows. The “particle's trajectory” – meant: a certain *timelike* curve through s – has been introduced arbitrarily. Nothing in the account forbids, i.e. there is no contradiction with the two principles, to assume a *spacelike* curve through s along which the block should *grow*. Then, *after* the curve has passed through s , s does not *continue* to exist, which after all does not contradict the first principle that only says that everywhere in the causal future s still exists. The point is that by saying that along a trajectory something “continues” to exist, “after” something has passed, one uses a temporal language stemming from the concept of proper-time (of that trajectory). This, however, is unjustified, given only the two principles.

The possibility of spacelike *growing* clearly shows the spatial analogue of the allegedly temporal passage, but one can avoid this with the bow-tie version according to which, at any spacetime-point, the elsewhere region is completely populated.

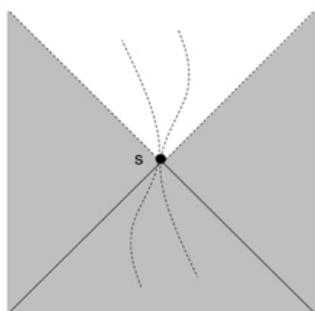


FIG 3 Bow-tie relativistic GBT:
Infinitely many timelike directions

With regard to this version, the block cannot grow in spacelike direction, because therein everything already exists. However, the two principles hold relative to “any” particle's trajectory (timelike curve). There are *infinitely many* such trajectories passing through s and, again, the question arises: what happens *next*, how does the block grow? Nothing comes next!

Here, the problem not only is that the neighborhood around s is partly empty but also that there are infinitely many directions in which the block could possibly grow. All timelike curves through s are ontologically on a par, no one is privileged, so that without further assumptions the proponents of the GBT cannot tell in which way fresh slices of existence should be added. There are many ways to do so. This shows that the (missing) continuity of time is closely connected with the (missing) direction of time.

Therefore, I conclude that, without an adequate representation of time continuity, time directionality gets lost and so the temporal character of the intended existential dynamics as well. Something has to be done to close the gap. In the final section, I will suggest that Kantian consciousness-dependence of objective time flow could help.

IV. Kant's Consciousness-dependence of Time

Usually, non-eternalists claim that temporal *experience* depends *explanatorily* on the objectively dynamical time. The assumption is that our experience and our perception are tensed (see, e.g., Soteriou 2013, chap. 4): one has the subjective impression of the passage of time. Given this, many philosophers believe that one can only understand this fact, i.e. one can only explain our experience/perception, if one grants that objective time, in some way or other, also has the characteristics of passage. ⁹ Given the foregoing, I take the opposite path: it is objective time that depends on time consciousness. However, this dependence is not (only) explanatory; I will not (only) argue that we can only understand that, e.g., Special Relativity is talking about objective time given our temporal experience/perception, our time consciousness. Rather, the dependence (also) is *ontological*, i.e. there only can be objective passage of time thanks to (in virtue of; grounded by) the consciousness of time. Apparently, the analytic metaphysics of time cannot do justice to the *continuity* of time, i.e. to its *genuine* dynamical character, even if one considers the most promising account of an existentially dynamical ontology. ¹⁰ Now, the idea is that consciousness provides the missing link, namely so that the *objective* continuity of time *ontologically* depends on time consciousness.

Such a consciousness-dependence is essentially Kantian. Firstly, Kant famously claimed that (subjective) time – time as pure intuition – is a condition of (the possibility of) the experience of objects or events in (objective) time. This makes objective time *explanatorily* dependent on subjective time: one can only arrive, *a posteriori*, at an understanding of objective temporal relations and temporal becoming because of subjective time, given *a priori*. Also famously, then, Kant provides a link between epistemology and ontology expressed by the slogan that the conditions (of the possibility) of experience also are conditions of the objects of experience (see, Kant 1781, A 111). This makes the temporal location of objects, temporal relations between objects, and the temporal becoming of (objective) events or processes *ontologically* dependent on the same conditions of their (possible) experience. Kant's critical metaphysics can be summarized by the idea that metaphysical statements – such as that “there is objective temporal becoming” or that “there is objective causality (necessary connection) between events” – are in fact justified (against Hume), but only if they can be linked with the conditions of experience (against ‘dogmatic’ metaphysicians such as Leibniz or Aristotle). ¹¹ Applied to the purposes of this paper, temporal continuity is, for Kant, “empirically real” – objective, in the sense needed – but “transcendentally ideal”, i.e. originally subjective. About temporal continuity, and closest to the GBT, consider the following quotation: ¹²

⁹ Of course, there are also many *eternalists* who disagree and argue that the perceived passage can be explained, ‘although’ the objective world is a (tenseless) block universe; see Deng (2017) and Sattig (2018).

¹⁰ To be fair, the MST seems to be safe at this point. As said, for dialectical reasons the MST appears in this paper as the contender that does not face the difficulties at issue.

¹¹ This characterization of Kant's metaphysical project can also be found, e.g., in Allais (2015).

¹² For a similar reading of this quote, see Prauss (2019).

[time] cannot be made representable to us except under the image of a line, insofar as we draw it (Kant 1787, B 156)

In philosophical reasoning, Kant says, one needs an “image” in order to make time representable to us. Philosophical reasoning is partly metaphorical, and, for an adequate philosophical understanding of time, one needs the spatial analogue of “a line”. Purely conceptual reasoning – as it were with Cantor’s set-theoretical account in mind – is apparently not sufficient. Time is so peculiar, because it is originally pure intuition, that one must use intuition also while reasoning about time.

Then, Kant argues, the (needed) spatial analogue of a line is misleading (or, at least, risky): indeed, it does the intended job only “insofar” as one draws the line. Otherwise, the dynamical aspect of time gets lost. Only the drawing of the line – not the line as such – can be an image that makes the passage of time representable to us. This remark should be taken as evidence for the fact that, for him, time order is dependent on time direction. For, a (spatial) line can represent the temporal *order* of earlier/later-than only dependent on the (temporal) *direction* of drawing it.

Thus, for Kant, time directionality is more fundamental than time order. Kant is a non-eternalist: eternalists, by contrast, have less problems with the spatial analogue since they claim that time order – the B-theoretical relation – is the fundamental feature of time. Again, the MST is the most illuminating contender, because it makes mostly plausible that non-eternalists must hold contrariwise that time direction is the fundamental feature of time. In MST, some Cantorian set of points, such as a timelike curve in spacetime, represents a merely antisymmetric, irreflexive, and transitive order that turns into a temporal B-series of earlier/later-than only dependent on the A-theoretic, directed motion of the objective presentness. The crucial problem with the GBT under discussion is that it has an order of precedence but not a notion of directionality. However, every version of non-eternalism should consider time direction as fundamental. ¹³ Now, let me focus on the impression that Kant’s claim is close to the GBT. Apparently, for Kant, while being drawn, the line is always increasing. However, if “drawing” is nothing other than “adding fresh slices”, the problem of the next moment is still to be solved. As it seems, also Kant faces the difficulty that the direction of increasing (along the board) differs from the direction of adding slices (crosswise/perpendicular to the board). What we make representable to us by drawing a line, is apparently not a line inherently extending but a line always being made greater by the stick in our hand. This directionality-problem directly leads to the continuity-problem: strictly speaking, again, the newest stuff on the board either creates a gap to the rest of the line, or cannot be pointlike, i.e. it adds at once a (small) line, not being progressively drawn. This would be the end of the story if one considers time as *originally objective*, in Kant’s terms: as “transcendentally real”.

¹³ See for a defense of this fundamentality claim, also with respect to General Relativity, Friebe (2016).

Taken in isolation, the given quote talks about “real time” in the sense of current analytic metaphysics. If so, Kant, as well, can be confronted with the problem that the intended existential dynamics of time cannot be continuous: nothing comes next. Given the context of Kant’s work, however, “time” does not mean (analytic) “real time”, i.e. transcendentally real time, but rather “objective time”, i.e. empirically real time. Then, this same time also is, for Kant, transcendentally ideal, i.e. *originally subjective*. ¹⁴ This is the source of a solution to the problem of the time continuum: the last moment, i.e. the edge of the line,

¹⁴ Note that Kant here is not talking about time as purely subjective (as pure intuition), but about objective time as originally

must be *accompanied* by consciousness. With regard to everything subjective, i.e. regarding every representation (intuitions; concepts) in us, Kant holds – again, famously – that:

The *I think* must be able to accompany all my representations. (Kant 1787, B 131)

Otherwise, the unity of the (transcendental) subject could not be established. Applied to the case at hand, this would mean that the *I think* must be able to accompany the representation of time, i.e. pure intuition. Self-consciousness, expressed by “I think, [...]”, establishes the unity of time. The unity of time is nothing other than the *continuity* of time, expressed by the drawing of the line, but not sufficiently so without being accompanied by the *I think*.

Transferred to the objectivized time – being no longer mere intuition but empirically real, i.e., so to speak, “actualized intuition” (=appearance): by consciously accompanying the last moment, the unity (=continuity) of the present could be established. There is no longer a discontinuous gap, since there really will be *no next* moment. The last moment, the edge of being, becomes its own, genuine direction of becoming. ¹⁵ There will be no next moment, because the alleged “next last moment” still is (and will be) the only last moment, in its activity of actualizing subjective time. This activity of actualizing subjective time essentially is time direction (not time order). It closes the gap of discontinuity, and so projects the direction of motion from the stick in our hand into the line that, by now, is inherently self-extending in the desired direction of the future. ¹⁶

¹⁵ But: what about the past moments? Is this still an articulation of the GBT or, instead, of presentism? – I would answer to these questions: it is neutral with regard to the GBT/presentism distinction, but it suggests that the past of the growing block is not simply an eternalist-like block. The GBT is not simply a combination of eternalism (regarding the past) and presentism (regarding the future), but its past still is dynamical in the sense that the whole block is extending.

V. Conclusion

Even the most promising account of an *existentially* dynamical ontology cannot explain how time *constantly* passes. Without the time continuum, however, the *genuine* temporal dynamics gets lost; the existential dynamics falls down the spatial-analogue objection. Kantian consciousness-dependence closes the gap by making objective time flow ontologically dependent on a subjective condition of experience: time as pure intuition (and imagination).

¹⁶ Probably at this point, Kant needs the capacity of imagination: what appears is present (as actualized intuition) and, grounded on the actuality of such appearance, the imagination makes the future possible; see also Rosefeldt (2019) for the claim that Kant additionally needs the imagination of time.

Although the paper focused on a specific variant of the GBT, the arguments given are perhaps sufficiently flexible as to also justify a more general suggestion: if one is after an ontology of temporal passage in the existentially dynamical sense of the term, the continuity/directionality of time provides the most serious challenge. The requirement can (only?) be satisfied by grounding objective time in subjective time, given a priori.

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The Growing Block and the Problem of the Continuum*

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The orthodox approach to time states it to be a continuum. In this paper I aim to show that the growing block model poses a unique problem to the continuity of time, on account of it being a hybrid A-B-theory. Tension lies in the fact that a continuous B-theoretical block is built through the A-theoretical becoming of instantaneous slices of present. First, I show that a continuous growing block necessitates a present with zero temporal duration; second, I show that such notion of present rules out some widely accepted B-theoretical solutions to the problem of the continuum, while its commitment to the B-theory rules out some of the A-theoretical ones. Finally, I will discuss possible consequences.

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BECOMING

CONTINUUM

TEMPORAL DIRECTION

TEMPORAL EXTENSION

GROWING BLOCK

I. Introduction

The standard conception is that time and space are continuous. Since time is commonly considered structurally similar to a one-dimensional space, the time continuum is often portrayed as the Euclidian straight geometrical line. Just as the straight line is made up of extensionless points, the time continuum is taken to be constructed of point-like durationless instants. The continuum is gap free: it persists without any breaks or interruption; it is dense: between each two point there is always another point; and it is infinitely and indefinitely divisible: any division of the continuum will always result in parts that can in turn be further divided, without ever resulting in indivisibles (Bell 2019, viii). These properties of the continuum on the one hand, and its being constituted by points on the other, raise challenges that were the subject of a long lasting philosophical and mathematical inquiry. The tension increases when it comes to time.

A geometrical line is not a full description of the ordinary (common-sense) notion of time, since it lacks two important unique features. The first is that time does not only have an order, it also has a preferred direction: it runs from earlier to later. The temporal series that runs from earlier to later is known as the B-series, and the relations between its terms will be referred to as B-relations. The second feature of time is that it appears to involve some sort of flow or change. It seems as if every instant in time changes from being future, to being present, to being further and further in the past. The series whose terms are past, present, and future is called the A-series (McTaggart 1908).

B-theories of time embrace the B-series and reject the objectivity of the A-series. They entail a space-like time and a metaphysical picture of the universe as a static four-dimensional spacetime block. Such views are compatible with the currently accepted Cantorian account of continuity. A-theories argue that the A-series is objective and things in time do change in respect to its terms. A-theories entail a dynamic metaphysical view and are therefore more inclined to embrace different accounts of continuity. Finally, the growing block view is a hybrid of the two. It is committed both to the view of the universe as a four-dimensional spacetime block that is eternally fixed in B-relations, and to the claim that there are objectively distinct A-categories, in respect to which time changes.

According to the growing block theory, the change of time itself cannot be put in the same terms as change in things in respect to time. An illustration of the latter is the change Tom Smith undergoes as he grows taller than his father John. There is a time t in which the son is shorter than his father and a time t' in which he is taller than his father. The change of things in time is relative to time. The change of a moment in time is different, and can be compared to the change Tom Smith undergoes as a new child is born into the family. If Tom is John's youngest son, he will remain so until the birth of a new sibling. Afterwards, Tom will no longer be John's youngest son. A change has occurred, yet Tom himself did not undergo any intrinsic change. What changed is the fact that a new entity came into being, thus forming new relations with the pre-existing members of the family. Such is the change of time. Three-dimensional slices of reality keep coming into existence, joining the world history one by one, thus forming a four-dimensional growing block. The future does not exist. The present is the most recent slice that came into being, and once another slice is added, it becomes the new present and the precedent slice becomes past. This process is called becoming (Broad 1923, 65-68).

The growing block's dual nature makes the puzzle of the continuum

seemingly impossible to resolve, as the block grows through the becoming of three-dimensional slices with zero temporal extension. Or if we think of time as a straight line, time in the growing block universe literally is formed through the accumulation of point-like instants. In the following section I show that the present slice cannot have any non-zero temporal extension, and that the block can only grow through the becoming of one such durationless slice at a time. In the third section I lay out some of the problems the point-like present brings about and their accepted solution. I then show why they do not apply to the growing block. In the final section I discuss possible consequences and conclusions.

II. The Growing Block and the Problem of the Extended Present

When holding to a continuous growing block view, a point-like present is inevitable. The only intelligible option for the growing block theorist is to admit that the temporal dimension of the block is constructed through the addition of present slices under two restrictions: (a) the present cannot have any non-zero temporal extension; and (b) the growth of the block can only occur through the becoming of *one* such instantaneous slice of reality at a time. These restrictions are a direct consequence of two pillar notions of the growing block theory. The first is the very definition of the A-categories in the model, which entails that the present moment cannot have any non-zero duration; the second pertains to the forming of the B-relations through the process of becoming, which cannot possibly allow for any duration of time greater than zero to become all at once.

II.1. The Problem of the Defining Features of the Present

The A-theoretical commitments of the growing block entail an objective present moment that is distinct from the two other temporal categories, the past and future. This distinction is derived from what Miller calls «the growing block ontological thesis»; namely, that the past and the present exist, while the future is a non-existence (Miller 2013, 348). The present moment is topologically distinct from the rest of the block by virtue of being the only slice of existence that has no successor: «the essence of a present event is not that it precedes future events, but that there is quite literally nothing to which it has the relation of precedence» (Broad 1923, 66). But this is not the full picture; the growing block's A-theoretical commitments also include what Miller calls «the dynamic thesis», according to which the answer to the question about which moment is the present is ever-changing (Miller 2013, 348). This change is possible due to the process of becoming; namely, the coming into existence of one temporal slice at a time. As a new slice comes into existence on the edge of reality, the slice that was once present becomes the past and goes deeper into the past as more slices accumulate one by one in a gradual process. The process of becoming entails not only the ordering relation of earlier and later than, or *succession* – it also entails enumeration, or *consecutiveness*, meaning the instantiation of the temporal particulars one by one and therefore one before the others (Craig 2000, 234-235). Hence the very definition of the present in the growing block consists of two distinct features: one, it has no successors; and two, it is not just the *last* temporal slice in the ordered, directed block, but is also the *latest* addition to reality. But these two defining features of the present cannot be consistent with the notion of extended present.

Let us assume a continuous growing block in which the present has duration greater than zero. Each new slice would then have some temporal extension,

even if very small. For convenience, consider such an extended temporal slice as a temporal interval on the growing block. Any such temporal interval of the growing block would then have to be indefinitely divisible into smaller temporal intervals that in turn are also indefinitely divisible. Since those sub-intervals are all parts of the latest addition to reality, each of them would also be considered a present slice. As a result we will end up with an entity that is contradictory by its very definition: a “present” slice that has one or more successors. And since one of the properties of a continuous interval is being indefinitely divisible, any such “present” slice could always have infinitely many successors, and no amount of division will ever lead to a single present slice that has no successors.

A possible objection might be that while this line of argument might enforce restriction (a), it does not necessarily imply that restriction (b) has to hold as well. Indeed, the objectors could say that it is easy to see why the *present* has to be point-like, but then ask: must the block grow through the becoming of one duration-less slice *at a time*? In line with this objection, some might try to reconcile the conflict between the extension of the temporal slices and the defining features of the growing block’s present by appealing to what Forbes calls «past genesis» (Forbes 2015, 191). In the context of the growing block, past genesis refers to things in time coming into existence directly as past, without having been present first. If the present is the edge of reality and the past is merely anything that precedes the present – the supporters of past genesis might say – there is no reason why the block should not grow in extended temporal intervals made mostly of past with one unique present end-point; namely, the boundary between this new temporal interval and nothingness. Thus, the proponents of past genesis attempt to hold on to the defining features of the present, while avoiding the problems of the point-like present and the continuum (to be discussed in section III). It might seem tempting to turn to past genesis as a reply to the objections the problems of the continuum may give raise to, but there are good reasons not to. For one, it strengthens another objection to the growing block known as the epistemic problem.

The epistemic problem, also known as «the present problem» (Bourne 2002) or «the now-now problem» (Braddon-Mitchell 2004) might be summarised as follows: we believe that our time is the present, but granted a growing block metaphysic, we are much likelier to be in the past. If we embrace (a) but not (b), not only do we have no way of knowing whether our time is the true present, but the hope that we ever *were* truly in the present is faint. Past genesis also weakens the dead past growing block: a variety of the growing block that was conceived in response to the now-now problem. (Forrest 2004, Forbes 2016) According to dead past growing blockers, we can know with certainty that we are in the present moment, since only this very instant can sustain activity or processes and consciousness. The misfortune of the past that was born dead is more than just grim; past genesis disqualifies the dead past growing block’s line of defence against the epistemic objection, as well as against the problem of past truth-makers, in particular the resolution to the problem suggested by Forbes (2016), that relies on the fact that things in the past used to be present.

Setting aside the epistemic objection and the dead past solution, there is a straightforward, conclusive way to prove past genesis to be impossible in a growing block universe, as past genesis ignores the second feature of the growing block’s present; it is not only the *last* moment, but also the *latest*. This will become clearer in the following discussion of the way the block’s B-relations are formed.

II.2. The Problem of Consecutiveness in Becoming and the Forming of B-Relations

As proponents of the A-theory observed, the process of becoming involves not only succession, i.e., the B-relations of earlier than and later than, but also enumeration, or consecutiveness, meaning the instantiation of the temporal particulars one by one and therefore one before the other (Craig 2000, 234-235). In the growing block view, the notions of temporal succession and consecutiveness are intimately connected. The succession of temporal slices depends on the consecutiveness of their becoming, which makes it impossible for a single temporal slice to have internal succession. Like the B-theories, the growing block is committed to the thesis that everything that exists in time does so in eternally fixed B-relations. Different B-theorists may employ different strategies to account for the order and direction of the time series. Some will take them to be primitive; others, as the result of asymmetries in the contents of time or in our consciousness, rather than features of time itself. But the growing block also adheres to the commitment that the temporal order and direction of the block are not arbitrary or illusory; rather they are objective features of time itself. It is widely held that in contrast with a static B-theory, objective temporal becoming has the ability to account for temporal direction (Craig 2000, 256-258), and the growing block makes use of this notion of becoming for this very purpose.

In other words, very much like in McTaggart's original argument, in the growing block model, the B-series stems from the A-series. When a new slice of reality is added through becoming, new relations between this slice and the sum total of reality come into existence that did not and could not have existed before, since before it came into being that slice was nothing at all (Broad 1923, 66). That includes the relations of temporal succession. To put it more simply, the fact that slice S at time t is later than slice S' at time t' is the direct consequence of S' coming into existence *after* S already existed.

It now becomes clear that the growing block does not allow for the present to have any non-zero duration. The B-relations of earlier than and later than in the growing block are formed through becoming. As a temporal slice comes into existence through the process of becoming, it concurrently becomes the immediate successor of the slice that was formerly the edge of being. Thus, any amount of existence that joins the universe through a single act of becoming can only be simultaneous in respect to the temporal dimension, which means all of the content of such a slice necessarily occupies a single temporal location in the B-series. Obviously, for anything in the spatiotemporal block to have duration – whether we refer to it as an event, a temporal slice or an interval of time is immaterial – it would have had to be spread across several B-locations, and there would have had to be a distinction between its earlier and later parts. But as previously shown, anything that comes into being together is B-simultaneous, and therefore cannot be divided into distinguishable, successive parts. The contents of each new slice are always simultaneous and therefore it takes more than one slice to form a temporal segment whose duration is greater than zero; whenever there is more than one slice, it means their becoming occurred consecutively, or else they would have been one and the same slice and therefore have a single B-location and zero duration. Thus, there can only be one new durationless slice at a time, and only one such slice can be the latest addition to reality. The derivation of succession from consecutiveness renders both the extended present and past genesis as impossible for the growing block.

III. The Point-Like Present and the Continuum

In this section I will explore two ways in which the point-like present may pose a challenge to the time continuum in the growing block model; the first is the problem famously known as Zeno's paradox of plurality: how can durationless slices add up and form temporal duration (zero times infinity still equals zero); and the second is that one of the properties of the continuum is density, yet it is unclear whether a growing block metaphysics allows for the time series to be dense.

III.1. The Problem with Point-Like Presents Forming Duration

The fact that the growing block builds through the accumulation of durationless slices poses a twofold problem. On the one hand there is the problem of addition; clearly the block itself has temporal duration, but it consists of individual slices that have zero duration, and even infinitely many such slices could never amount to any duration greater than zero. On the other hand there is the problem of temporal locations; the present slice lies at the very edge of the block, and when a new slice is added through becoming, it must also come to be exactly on the very edge of the block, or else the block could not be gap-free. In that case, how can B-locations be distinguished one from the other? Let the edge of reality be in time t_n . As long as the slices are actualized on that very location, there can be no further locations; in order for the location t_{n+1} to come into existence, a temporal interval from t_n to t_{n+1} will have to become all at once, which I showed to be impossible on the growing block. This applies equally to any number between n and $n+1$, no matter how small. Given that the present is point-like, the temporal location of each and every new slice would be the same as of its predecessor, and consequently, as of the entire block.

The solutions I am about to discuss in this section have one thing in common: they discredit the underlying assumption that the length of an interval on a line is generated by adding up the lengths of its smallest continuants. Looking back to the growing block account previously given, it becomes evident why proponents of the model might want to hold on to such an assumption.

The first solution is to view the line as prior to the points. This approach was first introduced in Aristotle's discussion of Zeno's paradoxes and later embraced by Brentano, Peirce and others. (Bell 2019, 157, 163). Continuous magnitudes are potentially divisible to infinity in the sense that they may be divided anywhere, though they cannot be divided everywhere at the same time. Aristotle's argument is as follows: first, since points have no parts, they cannot form a continuum, and second, the continuum is prior to its parts and points exist not in actuality, but as limits of lines (*Phy.* 231a21-b10). The continuum has the potential to be infinitely divided, not into points, but into segments that can also be infinitely divided, and so on, and so on. The points are the boundaries of the segments that are the parts of the continuum, but any such parts only come into being as the wholes are divided.

But this cannot be said of the growing block, seeing that addition in fact occurs in the process of becoming. Given a growing block metaphysics, *there has to be* such a thing as an actual instantaneous slice of time, and as I showed the block cannot exist prior to these slices and can only grow through the becoming of such slices. We cannot say that the time continuum is prior to these temporal slices, because nothing would have existed in time if it were not for the constant accumulation of these slices. Thus, if we are committed to the growing block view we must admit them to be *actual entities*, the components of the block and not just the potential

boundaries of its potential parts. Moreover, the problem of locations still remains as they cannot exist prior to the becoming of their content.

Let us move on to an approach that might allow for the instantaneous slices constituting the block to be actual. Our best science takes the Cantorian approach to the continuum, which models the continuum after the real number line. Cantor was able to prove that any finite segment on the real number line – regardless of how short or long – contains the same number of points as any other segment on the real number line, and as the entire real number line. I will briefly present the Cantorian account, and then show how it resolves the paradox of plurality. Then I will show why the Cantorian solution cannot be applied to the growing block.

Cantor proved something that seems counter-intuitive: that there are different sizes of infinity. An infinite set can be either denumerable (countable) or non denumerable. An infinite set is denumerable if it can be ordered in such a way that each of its members has finitely many predecessors. An example of a denumerable set is the set of integers. All denumerable sets can be put in a one-to-one correspondence with the set of positive integers, which is neither gap free nor dense. Cantor was able to establish a one-to-one correspondence between the set of integers and the set of rational numbers, which is dense, but not gap free. So despite the fact that there are more rational numbers than integers on finite segments of the same length, both infinite sets have the same number of members. But as Cantor proved, the set of real numbers cannot be put in a one-to-one correspondence with the integers. Furthermore, any proper subset on the real number line can be put in a one-to-one correspondence to any other proper subset on the real number line, and to the real number line itself. Hence, any segment on a continuous line, no matter how long or short, contains the same number of points as the entire real number line (Dainton 2010, 277–280). Therefore, the extension of a continuous line does not depend on the points it consists of. In everyday life, we take the size of objects to be the sum of the size of their smaller parts. If a segment of the sidewalk consists of paving stones, we would be right to think of the segment's length as the sum of the lengths of those paving stones. But since any segment on a continuous line contains the same number of points regardless of its length, we would be wrong to treat it the same way we treat everyday objects.

But what other ways are there to determine the length of an interval if not by adding up its points? One way available in mathematics is called “measure theory”. According to measure theory, an interval must contain non-denumerably infinite amount of points for it to have length. The length is the distance between the interval's end points. Since length is not an intrinsic feature of a set of points, the points themselves do not matter. The addition of a single point to an interval has no effect whatsoever on its length. Instead, the line must be associated with a metric or distance function (see Dainton 2010, 281–283). But if we try to apply this answer to the growing block, we will run into a problem. The sum total of reality at any time t_n consists of slices $S_1+S_2+\dots+S_n$. Let us say the temporal duration of the universe as of time t_n is not the sum of the duration of the temporal slices forming it (which has to be zero). Reality then increases through the becoming of a new slice S_{n+1} at a the new time t_{n+1} , which are also durationless. So how can the duration of time as of t_{n+1} be greater than the duration of time as of t_n ? Even if we assume that as of t_n there already was a pre-existing four-dimensional block with temporal extension, we cannot say that the adding of S_{n+1} to the block makes it grow in respect to its temporal duration. And if we assume there is a starting point to reality such as the big bang, there will be no temporal duration at all. Another thing is that according

to measure theory, an interval must contain a non-denumerably infinite number of points in order for it to have measure, which leads us to the problem of density.

III.2. The Problem of Density and Becoming

Euclid defined the straight line as a length without breadth, and if the line is composed of points, we take that to mean that there are infinitely many points between every two points on the line. Namely, that instances in time form a dense series:

Between every two elements of a dense series there will be at least one and therefore an infinity of other elements; so that no element has a successor, and no element a predecessor (Huntington 2003, 34)

As this definition makes very clear, a consequence of density is that a member of a dense series cannot have an immediate successor or predecessor. This contradicts one of the key commitments of the growing block view. Once a temporal slice is added to the sum total of reality through becoming, it comes into relations with the rest of reality. These relations, once formed, are eternally fixed (Broad 1923, 69). So once a new slice becomes on the edge of reality, a relation of succession is formed between it and the previous slices. Thus, every point on the time series has one direct predecessor and every single *past* slice has one direct successor. Once a slice's immediate successor comes in to being, there is no way of coming up with infinitely many slices in between them as density requires. In other words: between two different elements of the growing block time series, there can only be a finite or zero number of elements.

Once again, it is the combination of the metaphysical commitments of the B-theory and those of the A-theory that keeps the growing block theorist from achieving resolution. The fact that the B-series of time is formed through consecutive A-theoretical becoming conflicts with the property of density. The B-theorist can still accept that the indefinite divisibility will never lead to indivisibles or that there are a non-denumerably infinite number of points composing the continuum. But this means giving up completely on any A-theoretical notions. Such a block can never be formed through becoming.

III.3. Pure A-Theoretical Solutions

As previously mentioned, the B-theories of time need not be threatened by the notion of the point-like instant, and more specifically the point-like present. B-theoretical time is space-like and so B-theorists are not committed either to the objectivity of the present moment or to its dynamicity. Thus, the B-theorists are free to embrace the Cantorian continuum or the notion that points are potential or ideal. So perhaps the answer to the growing block's problem can be found in the A-theoretical solutions to the problem of the continuum. The bind is that the doctrine of the instantaneous present is incompatible with becoming (Craig 2000, 236). A pure A-theory is open to endorsing different solutions. Thinkers like Bergson, Brouwer, Wyle, and others assert that the numbered, mathematical notion of the continuum is not how time is in itself. The true nature of time is given to us by our intuition. Those who hold these views are free to assert that all that exists is a completely unified and indivisible duration of time and accept a primitive pre-metrical notion of the present. Could the proponents of the growing block too?

A-theoretical becoming cannot endorse an instantaneous present without raising Zeno's paradoxes of plurality and motion. One possible solution is adhering to the view that there is no such thing as the present *simpliciter*. The answers to question such as "what is the present time?" or "how long is the present time?" vary depending on the context in which they are asked. "Present time" can mean the present second, the present hour or the present decade (Loizou 1986 in Craig 2000, 248). This allows for duration to be taken as prior to metrics.

The growing block may hold to a dynamic thesis regarding the present moment, but is also, in a way, committed to a static block; new things come to be constantly, but once something enters existence, it remains unchanged (Broad 1923, 66, 79–84). Broad declares that it is misleading to call becoming "a change" (Broad 1923, 68), which is one reason it cannot fit with the idea expressed as Bergson's *durée réelle*, or Prior's idea that there is no transition of instants from being future to being present to being past: the present time is all that exists and the change is in things, or as he puts it: «the basic reality is things acting» (Prior unpublished, in Craig 2000, 246). By accepting a primitive pre-metrical notion of the present, A-theoretic metaphysics can avoid Zeno's paradoxes (Craig 2000, 248). But the growing block cannot accept such notion. Perhaps the most evident incompatibility of the growing block with such conceptions of temporal continuity lies in the fact that the growing block is committed to the claim that there is a temporal dimension along which all of the events in time are ordered and in respect to which reality keeps expanding. Such ordered homogenous space-like time is in complete opposition to these notions of duration and continuity.

IV. Conclusion

I showed that in a continuous growing block universe, the present has no duration. This is a direct result of its being a hybrid A-B-theory. The fact that the growth of the block can only occur through temporal slices of zero extension conflicts with the thesis that time is a continuum. All the B-theoretical solutions for the problems of the continuum that I tested so far conflict with the A-theoretical elements of the growing block, and vice versa. But the growing block is still a very intuitively and metaphysically appealing theory, so it would be beneficial to find a way to settle the problems of continuity. One approach is to continue looking for other accounts of continuity. Another is to reconceive the growing block in such a way that can transcend the conflicting traits. Or it could be that the growing block spacetime is inherently discrete.

IV.1. Revising the Orthodox Continuum

The Cantorian view of the continuum is not without its weaknesses, which gave rise to (roughly) two groups of opposing views: the hyper-dense Peircean continuum and taking extension as fundamental. Perhaps one of them could be a better fit for the growing block.

The idea underlying the hyper-dense continuum is that the continuum cannot merely be a collection of infinitely many points. In order to genuinely form a continuum, these points must be welded together, which cannot be conceptualized using the analogy of the real number line, as the true continuum requires an even greater number of points: nothing less than the maximal possible number of points. When packed in this hyper-dense manner, the points lose their individual identity and become welded together into a unified continuum. (Bell 2019, 163; Dainton 2010, 306).

While this view was proven useful in solving some of the puzzles of the continuum (see Dainton 2010, 307-309), it is hard to see how hyper-density could be applied to the growing block view given the problem of regular density and becoming discussed in section III.2. Moreover, since the temporal slices come into existence one by one, it is hard to see how they can ever reach such maximal quantity.

Extension as fundamental is the notion that the most fundamental parts of the continuum have extension, no matter how small. True, the orthodox continuum also has the property of being infinitely and indefinitely divisible, but it is also conceived as having indivisible, extensionless parts – i.e. the points that constitute a straight line – and it is this that the difference between the views hinges on. To take extension as fundamental is to abandon the idea that the points are the most fundamental constituents of a line. Instead, the parts of a line are lines, which are made of smaller lines, and so on without ever reaching a bottom level (Dainton 2010, 309-310). Taking extension as fundamental can provide a solution to the paradox of plurality, but it is incompatible with the growing block because – as I showed in section II – there must be such a bottom level in the form of instantaneous slices from which the block is constructed.

IV.2. The Growing Block Revised

In “A Reply to My Critics”, Broad himself deals with the problem of the instantaneous present and suggests that time could have another dimension along which slices can be extended. Think of things in time as ordered along a T-axis, which stands for ordinary time. A temporal slice shall be represented as a point t on the T-axis. But if we add a Θ -axis, which stands for an additional temporal dimension, the temporal slice would be represented by a straight line of finite extension, parallel to the Θ -axis. (Broad 1959, 769-772)

Recall that the problem this paper is concerned with is that the growth of the block cannot occur through the becoming of durationless instants, yet at the same time it must thus occur. On the above suggestion, the temporal slice is T-instantaneous, but has Θ -duration, so one might say it succeeds in being both instantaneous and extended. However, I do not see any way how incorporating Θ -duration can help the growing block overcome the problems described in section III. More over, while there appears to be no inconsistency on this particular account, accepting a second temporal dimension still seems like a slippery slope leading to infinite regression or circularity.

There might still be a way to loosen the clutch of some of the commitments by adhering to a theory of growing events, rather than growing block. Perović proposes a theory of growing events that still holds to the same ontological and dynamic theses as the growing block. But the growing events theory departs from the growing block in that in the former, events are the most fundamental ontological constituents of reality (Perović 2019, 19). So the continuous four-dimensional block is but an abstraction from existing events, and so are the instantaneous slices:

[...] it is not such slices with their instantaneous properties that build up the GE [growing events] theorist's events; rather, events are metaphysically prior and instantaneous slices and their properties are abstractions from events. This is just another way of saying that events take some time to unfold and such temporal extendedness of an event is difficult (if not impossible) to recover from instantaneous temporal slices of objects and their properties. (Perović 2019, 20)

On this account the universe grows, but it is a growing event rather than a growing block, and it consists of accumulating events, rather than slices. It appears the growing event theorist might be able to adopt a different, more A-theoretical account of the continuum. Perhaps this is a sacrifice worth making in order to preserve the ontological and dynamic theses of the growing block, because it may very well be that they are the source of the theory's strong intuitive appeal, and the block and slices are not indispensable features, but – some might say – redundant and even disqualifying. On the other hand there is the worry that these two theories differ on such fundamental grounds, that the growing events theory is not a defence of the growing block, rather it replaces it. Perović also notes that in order to keep to the growing block theory's original commitment to the privileged present, a variant of the growing event needs to be constructed that identifies the present not with “ongoingness” but with the very edge of being (Perović 2019, 22) and the question remains: how can the growing event theorist have an “edge of existence” and still avoid the B-theoretical succession?

IV.3. Can the Growing Block be Discrete?

The properties of the discrete and the properties of the continuous are diametrically opposed. While the continuous temporal interval is indefinitely divisible, the division of any discrete duration of time ends in indivisible atomic quantities called chronons. Chronons are usually defined as a certain minimal physical quantity. Indeed, when considering a discrete account of the growing block, questions from the physical sciences arise. While some of our best science relies on the continuity of time, quantum mechanics might support a discrete spacetime, and there are still some very promising theories, such as quantum gravity, according to which time might be discrete (Dainton 2010, 300–301; Rovelli 2018, 54–56).

But it seems that the theories in question do not concur with a growing block metaphysic. They might entail a dynamic metaphysical picture, but one that could not be farther from the growing block. They do not incorporate the notion of objective present, or the commitment of the growing block to temporal order and direction. As Rovelli puts it: «Time has loosened into a network of relations that no longer holds together as a coherent canvas» (Rovelli 2018, 58). Reality possesses no fixed, objective temporal relations or direction, and «in the vast universe there is nothing that we can reasonably call “present”» (Rovelli 2018, 59).

On the other hand, the special theory of relativity (which supports a continuous spacetime) and the growing block are far from a perfect fit. The special theory of relativity poses a challenge to both the ontological and dynamical theses of the growing block, and certainly to the notion of the objective present. (Miller 2013, 352–353). So physics gives us evidence *contra* the growing block, be it continuous or discrete. Evidence in support of the growing block may turn up in the future (more likely in the form of philosophical arguments, rather than scientific observations). In the meantime, there is still value in investigating other consequences of a discrete growing block picture.

A clear advantage of taking space and time as discrete is that, on this view, they can have a metric and they can be seen as formed of their smallest constituents. So perhaps if the growing block is discrete, there need be no tension in the fact that its temporal duration is constructed through the becoming of temporal slices. If the slices could be temporally extended, rather than instantaneous, we will be able to overcome the problems of addition and locations mentioned in section III.1. But

before we can arrive at that conclusion, the arguments against the extended present from section II must be rejected for discrete time, or else we end up back in square one (or in the first singular instantaneous slice of existence, if you prefer) stepping right into Zeno's paradox of plurality. But maybe by accepting the doctrine that time is discrete, the growing block theorist can salvage the extended present. That way, the duration of the entire block could be additive.

Thinking back to the defining features of the growing block's present, as long as the present slice cannot be divided into further present slices, there will be no paradoxical entities such as "present" slices with successors, and the latest addition to reality could be an atomic slice. But what will be of our commitment to the B-series? Can such an account give rise to Zeno's paradoxes of motion? Not necessarily. The growth of the block is not a kind of motion and must not be mistaken for motion (Broad 1959, 766-767), so there is no need to explain how the block grows from t_n to t_{n+1} without ever traversing infinitely many locations in between. There is nothing paradoxical about temporal slices just coming into existence on the edge of the block, as it is not the traverse of the block's edge from one temporal location to the next. The slices just become and by the consecutiveness of that becoming they can only become on the very edge of reality. And the fact that every other type of change in the growing block is reducible to becoming (Broad 1923, 67) does not conflict with the fact that once they come into existence, the slices remain static. Any motion of objects across space in the growing block can be analysed in a completely B-theoretical way such as Russell's "at-at" theory.

I trust that this line of thought has the readers of this paper warming up to the idea of the discrete growing block. But some questions still remain. What is the duration of the slices and how is it determined? Will they still be uniform once given duration? Perhaps the answer is that the features of the present slice entail that the extension of a single slice can only be as great as the extension of the smallest possible lapse of time: the chronon. The only thing that can be uneven is the qualitative difference between two slices, namely differences across the dimensions of space; any duration greater than a chronon is spread between more than two different B-locations, and therefore – by the way B-locations are formed – consists of more than a single slice. But what keeps them from being shorter than a chronon? There are still voices in the discussion who doubt the whole notion of chronons, claiming it to be incoherent and irrelevant (see Craig 2000, 240-242). But it seems that if chronons do exist, their size will be uniform and determined. In the words of Lee Smolin:

According to loop quantum gravity, space is made of discrete atoms each of which carries a tiny unit of volume. In contrast to ordinary geometry, a given region cannot have a volume which is arbitrarily big or small – instead, the volume must be one of a finite set of numbers (Smolin 2000a, 106 in Dainton 2010, 300).

In conclusion, as a hybrid A-B-theory the growing block poses a unique problem to the continuity of time. The defining features of the growing block's present demand that becoming will occur through the accumulation of instantaneous temporal slices, which inevitably conflicts with the doctrine that time is continuous. The A-theoretical commitments of the block on the one hand, and its B-theoretical commitments on the other, rule out any possibility to resolve this tension. It seems that the answer might be that the growing block theory cannot hold on to all of it. Its defenders will have to give up either some of the theory's commitments, or the continuity of time. Of all the options I considered, the growing event theory and the discrete growing

block seem the most promising. The growing events theorists should be able to hold to the growing block's ontological and dynamical theses, but there are still open questions: if they succeed in disposing of the B-theoretical commitments entirely, would it still be a growing block? And could the theory still support an objective present? If the growing events theorists will be forced to keep to the B-commitments, will they still be able to adopt an A-theoretical account for continuity? The discrete growing block, on the other hand, is able to preserve all of the elements that seemed contradictory on a continuous growing block view.

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Presentism and the Micro-Structure of Time *

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The standard account of the micro-structure of time is based on Cantor's conception of continuity and thus views the time line as consisting of undenumerably many instants ordered by the B-theoretic *earlier than* relation. This may seem problematic for an A-theory of time such as presentism, according to which only what is present exists, for it seems to leave no room for the instants of a Cantorean time line. This paper defends a version of presentism that can accommodate the Cantorean conception and more generally any approach to the micro-structure of time based on durationless instants.

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I. Introduction

Presentism is an A-theory of time, according to which only present things exist. It is very much debated nowadays and has many supporters, although it is probably a minority view, since the B-theory of time, or B-eternalism, appears to enjoy a larger consensus. Indeed, much of the literature on presentism involves criticisms of it by B-theorists, or even by non-presentist A-theorists, such as A-eternalists or growing block theorists. As a matter of fact, despite its commonsensical appeal, there are many serious difficulties that presentism must confront. Most notoriously, the truth-maker problem and the problem of cross-temporal relations. However, I shall not deal with them here (for my take on them, see Orilia 2016).

I shall rather focus on a further problem for presentism, which, with reference to the Cantorean account of the continuity of time, has been raised as follows in the call for papers for this issue of *Philosophy kitchen* (consulted on April 6, 2020):

It is important to underline that the Cantorean account was originally construed to formalize certain properties of the continuum of space. This leaves open the question whether such an account can be applied to temporal case. Is the time-continuum to be thought as an actual (uncountable) infinity of instants? In the contemporary debates about time in analytic metaphysics, the Cantorean account of the continuum is often presupposed. This raises a series of questions. It is not clear how this understanding could be compatible with Presentism. Insofar as it presupposes an actual infinite of distinct temporal points, the Cantorean continuum seems to imply commitment to Eternalism. Moreover, the Cantorean model gives priority to the temporal order based on the relation “earlier than”. Hence, the challenge of integrating this model holds for any theory which considers temporal passage to be more fundamental than temporal relations (A-Theory). These problems raise a fundamental issue: that of reconciling the continuous nature of time with its dynamic. How can time be conceived simultaneously as something continuous, hence extensive, and passing?

I shall argue that presentism, or at least an appropriate version of presentism, *substantivalist presentism*, can successfully address these problems, and thus be considered compatible with Cantor’s account of the continuum, as applied to time. More generally, I shall argue that a presentism of this sort is compatible not only with the Cantorean conception, but with what I would like to call *instantism*. By this I mean a general standpoint regarding, in the terminology of Newton-Smith (1980, ch. 6), the *micro-structure of time*, which, like the Cantorean conception, admits durationless instants as fundamental. The opposite general standpoint, according to which durations, or intervals of time, are fundamental, may be called *durationism*, and can be traced back to Aristotle’s conception of the continuum (*Physics*, 6). This, I shall also argue, indeed constitutes a hurdle for presentism.

I shall proceed as follows. In §2 I shall briefly review the main different theoretical options regarding the nature of times, i.e., instants and intervals, and the micro-structure of time, how times are connected. In §3, I shall briefly review the main standpoints in temporal ontology and introduce substantival presentism. In §4, I shall explain why this view is well equipped to deal with the challenges posed by the above quotation. In §5, we shall see that, if we look at events from the point of view of instantism, substantival presentism can deal with them. However, if we look at them from the point of view of durationism, a presentist account is more problematic. This, in my view, suggests that presentism should favour instantism over durationism. I

shall conclude, in §6, with some ruminations on which version of onstantism may be better for the presentist.

II. Times and the Micro-structure of Time

Are there times? Although some philosophers endorse or at least take as a serious option eliminativism about times (Chisholm 1990; Hestevold 2008), this option is most problematic. It is hard to deny that we succeed in referring to something with dates, e.g., “April 11, 2020, 2.30 p.m. Greenwich time.” Dates are not empty terms like “the winged horse” or “the round square,” and what do we refer to with dates if not to times? Let us assume then that there are times and that they are the referents of dates. Times may be either intervals, e.g., the hour going from today’s noon sharp to today’s 1 p.m. sharp, or the instant of the beginning of this interval, today’s noon sharp. Such items are what we are discussing about in considering Instantism and Durationism, but before turning to that, let us briefly consider the options regarding the nature of times.

What are times? There is a primitivist option and various reductionist options, not all of which are equally open to the different ontological views to be reviewed below. The primitivist option is *substantivalism* (about time; there is an analogous doctrine about space (Dainton 2010, 2)), according to which times are *sui generis* entities (with instants or durations as more fundamental, depending on whether instantism or durationism is accepted), and the occurrence of events at them is a primitive and unanalyzable relation. As regards reductionism, let us first consider *relationism* (about time; there is an analogous doctrine about space (Dainton 2010, 2)), according to which times are reduced to events. A time is either a complete class of simultaneous events (Russell 1914; Whitehead 1929) or a complete mereological sum of simultaneous events (Pianesi & Varzi 1996), where completeness must be understood as no lack of any event simultaneous with some event comprised in the class or sum in question. Given this line, occurring at a time is being a member of a certain set, or being a part of a certain whole. An alternative reductionist option, proposed by Prior (Prior 1968, ch. 11), is to view times as *world propositions*, which represent in all details how the world may be at an instant; the world proposition true now is the present instant, while world propositions that were true count as past instants, and propositions that will be true count as future instants. In this account, to occur at a time is for a proposition to be entailed by a certain world proposition; for example, that the death of Caesar occurred at a certain time means that the world proposition that were true when Caesar died entails the proposition <Caesar dies>.

Let us go back to *instantism* and *durationism*. According to the former, durationless or point-like instants are fundamental and any duration (interval, extension, or stretch of time) is somehow made up of them. According to the latter, durations are fundamental, and any duration is infinitely divisible into smaller and smaller intervals, without ever reaching durationless instants, which exist, at best, as derivative entities; i.e., to use a now-fashionable terminology, time is *gunky*, and the intervals that compose it are *gunks*.

We can further distinguish three alternative roads within Instantism. *Instant-discretism* holds that time is discrete, i.e., it has the structure of the set of (negative and) positive integers. *Instant-densitism* holds that time is dense, i.e., it has the structure of the (negative and) positive rational numbers. *Instant-continuism* holds that time is continuous, i.e., it has the structure of the (negative and) positive real numbers (negative numbers enter the picture if time is taken to have no

beginning). In instant-discretism, any instant has an immediate successor. In contrast, in both instant-densitism and instant-continuism, no instant has an immediate successor, for in between any two instants there are infinitely many other instants; denumerably or undenumerably many, depending on the former or the latter option, respectively.

Instant-continuism amounts to the Cantorean conception of the micro-structure of time, mentioned in the quotation from the Call for papers in the introduction. This arguably constitutes the standard view nowadays (Dainton 2010, 301), capable of answering Zeno's paradoxes (Grünbaum 1968). However, durationism, or more generally the Aristotelian conception of the continuum, has had its own notable supporters, including Peirce and Whitehead, and recently has seen something like a revival (see Dainton 2010, § 17.7, for references).

III. Temporal Ontologies

We traditionally distinguish between A- and B-theories of time (see, e.g., Loux 2006 for a survey and references to supporters of such views). According to the former approach, there are in a most fundamental sense objectively exemplified properties such as pastness, presentness and futurity. Such properties are taken to account for time passage understood as the becoming present of some temporal items that were previously future, while some other temporal items that were previously present become past. These temporal items may be times, events, or even propositions, as we shall see. As so understood, pastness, presentness and futurity are called *A-properties*, and are taken to be more fundamental than *B-relations* such as being earlier or simultaneous. These are typically considered, to the extent that they are admitted, somehow reducible to A-properties. According to the latter approach, in contrast, B-relations are most fundamental and are objectively exemplified by times or events, which are past, present or future only in a subjective sense, dependent on their being ordered by B-relations. Thus, there is no time passage understood in terms of A-properties.

According to *A-eternalism*, what is often called the *spotlight view of time*, past, present and future are equally real, they all exist. Thus, pastness, presentness and futurity objectively accrue to both events and times. For example, there are the events of Socrates' drinking the hemlock, of my pressing the *K* key on my laptop and of (let us suppose) the first human landing on Mars. The first of them objectively exemplifies pastness, the second presentness and the third futurity. Furthermore, there are the times at which such events take place, which also exemplify pastness, presentness and futurity, respectively. Finally, even the objects involved in such events, Socrates, the cup with the hemlock, myself, my laptop, the human landing on Mars, all exemplify pastness, presentness or futurity. All the entities that exemplify such properties also exemplify B-relations at best in a derivative sense. For example, Socrates' drinking the hemlock is earlier than the human landing on Mars inasmuch as the former event is past and the latter is future.

According to another A-theoretical approach, *pastism*, or the *growing block theory*, only past and present exist, and the future is not real. Thus, going back to the previous examples, there exist Socrates' drinking the hemlock, my pressing the *K* key on my laptop, the objects involved in such events, and the times of such events, exemplifying pastness and presentness, as the case may be. Futurity may at most be attributed to propositions, to the extent that they will be true; for example, the future-tensed proposition <a human will land on Mars> is true, and accordingly

the corresponding present-tensed proposition “a human is landing on Mars” will be true, and can thus be said to exemplify futurity. Consequently, the former proposition could be said, in a sense, to be earlier than the latter (it may be worth noting that when the present-tensed proposition “a human is landing on Mars” will be true, it will no longer exemplify futurity, but rather presentness).

A further sort of A-theory is *presentism*, or, let me say, *standard presentism*, as I will distinguish in a while different types of Presentism. Standard Presentism holds that only what is present exist. Hence, still relying on the previous examples, only my pressing the *K* key on my laptop, the objects involved in it and the time of its occurrence exist, and they all enjoy presentness. Pastness and futurity may at most be attributed to propositions, to the extent that they were or will be true; for example, the past-tensed proposition <Socrates drank the hemlock> is true, and accordingly the corresponding past-tensed proposition < Socrates is drinking the hemlock > will be true, and can thus be said to exemplify pastness. Again, the former proposition could then be said, in a sense, to be earlier than the latter.

In the B-theoretical camp, we shall mention just *B-eternalism*, typically simply called *the B-theory* (though there are many variants, as we turn to fine-grained ontological details, which need not detain us here). According to this approach, past, present and future are also real, but in a different sense: events and times are objectively arranged in terms of being earlier or simultaneous, and, on the basis of this, they are past, present or future, but only in a subjective sense pretty much as things are spatially here, near or far in relation to a given subject. For example, Socrates’s drinking the hemlock is past in that it is earlier than my tokening this sentence, which is simultaneous with my pressing the *K* key on my laptop, and earlier than the first human landing on Mars; which makes the latter two events, present and future, respectively. In a similar way, the times at which such events occur and thus the objects involved in them are also past, present, or future.

This brief survey should make it evident that, whereas both A- and B-eternalists could accept a reduction of times to events, this option is not open to Pastism and Presentism, for the former lack future events and thus cannot construct future times, and the latter also lack past events, and thus cannot construct past times as well. Thus, presentists, following the lead of Prior, have typically resorted to a reduction of times to world propositions. Once times are so viewed, even the presentist can say that there are past and future times. There is however a widespread opinion that times are somehow presupposed in this approach, so that it cannot be endorsed without circularity (see, e.g., Newton-Smith 1980, ch. 6, §6; Meyer, 2013, ch.9). Be this as it may, there are a number of other difficulties with this proposal or at least advantages for the substantivalist option. First, we may note a problem shared with the reduction of times to events, namely that the possibility of time passage without change can hardly be accounted for (Newton-Smith 1980, ch. 6, §6). If there were a period of time without change, i.e. a sequence of times with the very same events occurring at all the times in the sequence, only one world proposition could be true for the whole period, which would mean, given the identification of times with world propositions, that there would be a single instant, rather than, contrary to the supposition, a sequence of distinct times. Yet, a changeless period of time seems possible, and in certain peculiar imaginary circumstances even inferable (Shoemaker 1969). Second, it has been claimed that presentism is in trouble in accounting for the direction of time, because it cannot rely on the being earlier relation freely available to the B-theorist (Oaklander, 2002; 2003). Given substantivalism, however, times must be viewed as ordered by this relation, with presentness thus shifting from one time to

another in the order provided by the relation. Third, a reduction of times to propositions is hardly lined up with commonsense (Hinchcliff, 1996, 124), the preservation of which is typically taken to be a presentist asset.

In Orilia 2012, I have proposed that, in order to circumvent these difficulties, the presentist could subscribe to a substantialist approach to time and thus accept times as primitive irreducible entities. Moreover, I have also proposed therein that, in order to tackle many other well-known challenges that Presentism must confront, the presentist could also accept the “ex-concrete objects” endorsed in Williamson’s (2002, 2013) *permanentism*. According to it, as Williamson puts it (2013, 4), “always everything is always something;” thus, for example, Socrates still presently exists, though it is no longer a concrete object, as he used to be, and he is rather ex-concrete. Presentism with substantial times and ex-concrete objects, which I have called *moderate presentism*, is elaborated and defended in Orilia 2016. However, the reasons that motivate that endorsement of ex-concrete objects need not detain us here and we can concentrate for our purposes on *substantial presentism*, i.e., a presentism that simply incorporates substantial times and leaves it open whether or not there are ex-concrete objects.

According to substantial presentism, all times, understood as *sui generis* primitive entities, always exist, always permanently ordered by the being earlier relation, though only the present time is such that events occur at it. That is, we may say, only the present time is filled with events and thus with the objects involved in such events. The other times exist, but are, we may also say, *empty*. Such times are past or future, as the case may be, in that events occurred at them before the present time became present, or will occur at them when the present time will no longer be present. But they are not *merely* past or future, since they also exist at the present time just as much as the present time, though with no events occurring at them. For it is at the present time that there occur all the permanent facts of the sort *time t1 is earlier than time t2*. A comparison may be useful. The sun is a present entity that is involved in events that occur at the present time, but it is also a past and future entity in that there were events that occurred at earlier times and events that will occur at later times, involving the sun; so that the sun also existed at those earlier times, and will exist at those later times. In other words, the sun is a past and future entity, besides being a present entity, but it is not a *merely* past or future entity. Following McTaggart, we are used to think that *past*, *present* and *future* are incompatible determinations. This is fine if by *past* and *future* we mean *merely past* and *merely future*. However, of an entity that endures through time we can say that it existed, exists now, and will exist, and thus that it is past (existed at a past time), and it is future (will exist at a future time), while adding that it is not merely past or future, since it is also present (exists at the present time). This is what we think of the sun. The idea is to view the times that are earlier and later than the present time in the same fashion. It may be worth noting that the fact that all times exist at the present time is perfectly compatible with the present time’s being a durationless instant. For the existence of the times at the present time is simply due to the occurrence at the present time of all the facts of the sort *time t1 is earlier than time t2*. As constituents of such facts, which occur at the present time, all times occur at the present time, and this is perfectly compatible with the present time being an instant.

Of course, which time is the present time keeps changing, and here the dynamical A-theoretical aspect that we expect in any form of presentism enters the picture. Thus, one time after the other becomes present, thus ceasing to be empty and coming to host ordinary events and the objects involved in them, e.g., let us

suppose, John's kissing Mary, John and Mary, as well as the peculiar events, if we may call them so, which are the facts of the sort *time t_1 is earlier than time t_2* , and the times which are constituents of such facts. And correspondingly, one time after the other ceases to be present, thereby becoming empty. (Somewhat analogous views, although framed in terms of spacetime, rather than simply time, are defended by Zimmerman 2011 and Sullivan 2012).

IV. Instantism from the Perspective of Substantival Presentism

Let us now reconsider in detail the passage of the *Philosophy Kitchen* call for papers quoted in the introduction, with the goal of then evaluating it from the point of view of substantival Presentism. This passage raises the following difficulty for presentism: instant-continuism appears to presuppose eternalism, since it appears to presuppose that there are, tenselessly speaking, undenumerably many instants, only one of which, at most, can be present. Hence, instant-continuism appears to entail that there are some non-present entities, and thus it appears to be incompatible with presentism. Moreover, the passage raises a problem for A-theories in general, and thus implicitly a further difficulty for presentism: The undenumerable series of instants presupposed by instant-continuism is ordered by the B-theoretic being earlier relation, and thus this relation seems to be given ontological priority over A-properties. However, A-properties are taken to be fundamental in an A-theory, as they are taken to account for time passage, understood as losing futurity and acquiring presentness and then pastness.

It should be noted that these two issues could be raised in precisely the same manner from the point of view of instant-densitism and instant-discretism. All that really matters is the assumption of a series of instants arranged by the being earlier relation, independently of whether this series is continuous, in which case the instants are undenumerably many, or rather dense or discrete, in which case the instants are denumerably or countably many. Hence, the answers that substantival presentism can offer are equally valid, regardless of which version of instantism is assumed. Let us turn to such answers.

The first difficulty can be immediately disposed of in the light of the preceding section. Substantival presentism makes room for the series of instants presupposed by instantism. However, it takes all these instants to exist at the present instant, *qua* constituents of B-relational facts of the form *t is earlier than t'* , which are taken to occur at the present time. In so doing it remains a form of presentism.

As regards the second difficulty, the problem here is whether there is still room for time passage in terms of A-properties, once a most fundamental being earlier relation that arranges instants has been acknowledged. Now, given substantival presentism there clearly is such room. For this approach does not view the presentness of an instant subjectively in terms of simultaneity, as in the B-theory, but in terms of its objectively having events occurring at it. Since the instant that exemplifies such presentness keeps changing, and correspondingly futurity and pastness are lost and acquired by other instants, there is A-theoretical passage. The dynamic aspect of time is captured by the fact that instants, one after the other, as they become present, are filled with events, while all the other events are empty: only present events exist, thereby constituting total present reality, or the present total state of affairs, we may say. This is so, even though there is an irreducible being earlier B-relation permanently arranging the instants. Its presence in no way hinders the fundamentality of the A-properties in accounting for passage. It simply gives a direction to this

passage, in the sense that which instants become present, after the present instant ceases to be present, depends on which instants are earlier and which are later than the present instant. That is, if t_1 is present and t_0 and t_2 are, respectively, earlier and later than t_1 , it is t_2 that will become present, whereas t_0 will always remain past.

V. Dynamic Events

In Casati's and Varzi's (2015) terminology, events can be subdivided into *static* and *dynamic*. The former do not involve change and are perhaps more appropriately called states (of affairs). The latter in contrast typically involve change and are more usually called events. As an example of the former we could consider a snapshot of a ball sitting still at a certain specific place. By presupposing instantism we may say that this state occurs at a certain instant; the durationist may say something similar after reconstructing instants in terms of intervals. As an example of the latter, we could consider a ball rapidly moving from a place to another. Intuitively, this movement occupies an interval of time.

Dynamic events pose a problem for presentism. We observe them, they can occupy our specious present, and thus their existence can hardly be denied. And yet, once we admit this, it seems that we must also admit past events, in contrast with presentism. Suppose for example that August *now* sees a ball running from p_1 to p_4 in the interval from t_1 to t_4 . Thus August sees a certain dynamic event; call it *ED*. The perception is veridical, let us assume, and thus *ED* presently exists. However, *ED* is made up, one could say, of static events following one another, e.g., event e_1 consisting of the ball's being in p_1 , then event e_2 consisting of the ball's being in p_2 , then event e_3 consisting of the ball's being in p_3 and finally event e_4 consisting of the ball's being in p_4 . And thus we should admit that there are events, such as p_1 , p_2 , and p_3 , that are earlier than other events. By being earlier than other events, these events can hardly be considered present. They must be past, one could urge. Moreover, there is a conscious state of mind of August's, which lasts from t_1 to t_4 , his specious present, which, one could suspect, involves conscious states some of which are earlier than others and must then be past, e.g., the vision of e_2 and the vision of e_3 . Hence, there exist past events, both physical and mental, and presentism, one could then suspect, is false (Orilia 2012a).

What can the presentist reply? The problem is due to the fact that the dynamic event is taken to really occur at an extended interval of time, and once this is admitted it seems it can be subdivided into slices, some of which must be past. And if we accept durations as primitive and fundamental, it seems we are forced to view things precisely in this way. To be sure, a certain interval can be taken to be present. This is the choice proposed by Hestevold (2008), who calls such an extended present a "thick" present, and thus speaks of "Thick Presentism." The opposite choice is, in his terminology, "Thin Presentism", according to which the present is «thin», that is instantaneous or durationless. Hestevold argues that the duration of the thick present that presentists should allow for had better be that of "an 'extraordinarily brief' event; e.g. *a butterfly's flapping its wings exactly twice*" (Hestevold 2008, 334). For otherwise presentists would be committed to a host of past objects that they do not want to acknowledge. But even with such brief presents, there would be past objects that the presentist should not acknowledge, even simply the butterfly's first flapping of its wing within one thick present, when the second flapping is taking place. And moreover, what would precisely determine the length of the present? Why not that of a faster movement, occupying simply the time of the second flapping of wings, or that of a slightly faster movement, taking also the time of a third flapping? I think the

presentist is better off without having to answer these questions and without past events as subparts of events that occur at an interval. That is, the presentist had better take the present to be a durationless instant, at which events occur, and in fact I think presentists typically take the present in this way. And thus instantism rather than durationism seems to be a better choice for the presentist.

But then how should the presentist account for dynamic events? With the resources offered by substantival presentism, i.e., with instants as primitive entities and the appeal to tense granted by an A-theory, it can be done as follows. First of all, one could accept past-tensed and future-tensed properties of the sort *having been F at instant t* or *being potentially F at time t*. One could then reconstruct a dynamic event as an event that occurs at an instant, but involves the exemplification of such past-tensed properties. To illustrate, consider again the ball moving from p_1 to p_4 in the interval from t_1 to t_4 . At time t_3 there occurs a static event which is the ball's being at p_3 , but there also occur events involving past-tensed and future-tensed properties such as those consisting of the ball's exemplifying the following properties: having been in p_1 at t_1 , having been in p_2 at t_2 , being potentially in p_4 at t_4 . By virtue of this, we may say, there also occur at t_3 the dynamic event which is the ball's moving from p_1 to p_4 . There are dynamic events, in other words, insofar as there are objects having such past-tensed and future-tensed properties, in addition to present-tensed properties.

A natural further step is to associate this approach to a Husserlian retentive model of the specious present, which certainly is presentist-friendly, in contrast with other models of the specious present (see Dainton 2018). According to it, the specious present involves *retentions*, *impressions* and *protentions*. The idea here is that these three items represent exemplifications of past-tensed, present-tensed, and future-tensed properties, respectively. Thus, in perceiving the dynamic event consisting of the ball's moving, August has at t_3 an instantaneous conscious state with retentions, impressions and protentions within it, so that the perception of a succession is not a succession of perceptions but one perception with a “before” (retentions), a “now” (impressions) and an “after” (protentions) within it: retentions corresponding to the events consisting of the ball's having been in p_1 at t_1 and having been in p_2 at t_2 ; an impression corresponding to the event consisting of the ball's being in p_3 ; a protention corresponding to the event of the ball's potentially being in p_4 at t_4 (see Orilia 2012, for further details).

VI. Concluding Remarks

In sum, the presentist has no problems with instantism, at least after accepting the substantivalist option. By endorsing it, the presentist can also nicely account for dynamic events. And, on the other hand, dynamic events suggest that the presentist had better avoid durationism. But is instant-continuism really the best choice for the presentist (or more generally for whoever embraces instantism)?

The problem is that, despite our Cantorean wisdom, a continuous, or even simply dense, progression in time remains baffling for Zenonian reasons, with “a puzzling character ... [that] may be ineliminable” (Danto 2010, 284). The specifically temporal aspect of the perplexity is well explained by Findlay (1941, p. 156; insertions into brackets are mine):

[W]hen we strip Zeno's problem of its spatial and other wrappings, its significance becomes clearer. For it is not, essentially, a problem of space or quantity, but solely of time It is

therefore foolish to think that we can meet Zeno's puzzles by the modern theory of the continuum or by the facts of infinite convergent numerical series ... And the problem assumes its most vexing form if we allow that ordinary happenings have ultimate parts that take no time [in my terminology, static events occupying durationless instants]. For of such parts it seems most natural to say [given Instant-Densitism or –Continuism] that none can be next to any other, and once this is said it is hard to understand how any ultimate part can ever pass away or be replaced by any other. For before such part can be replaced by any other similar part, it must have first been replaced by an infinity of other similar parts. Our admission seems to leave us with a world immobilized and paralyzed, in which every object and process, like the arrow of Zeno, stands still in the instant, for the simple reason that it has no way of passing on to other instants.

Thus, perhaps, one may be tempted to say that one should favour instant-discretism, which grants that any instant has a next instant. After all, it is more digestible for common sense, which the presentist is supposed to honour. On the other hand, the math used in modern physics seems to presuppose continuity. To see it, it is sufficient to notice this: if a physical square has a 1 meter long side, we must say that its diagonal is $\sqrt{2}$ meter long. Consider then a body moving at the uniform speed of 1 meter per second. It will take, it seems we should say, seconds to move along the diagonal. The example suggests that we need reals to measure time, which in turn suggests that time is continuous (Salmon 1970, 35). And fortunately, after setting aside Findlay's perplexity, Zeno's arguments against continuity (the *Achilles*, *Dichotomy*, and *Plurality* paradoxes) can be answered by the Cantorean conception of continuity (See Grünbaum 1968, Salmon 1970). Finally, Zeno does not only have arguments against continuity. Its *Stadium* paradox can be viewed as a nasty argument against discreteness (Salmon 1970).

There are possible replies to these arguments in favour of continuity, though. Modern physics could be done with discrete math after all: the experts tell us that there are systems of discrete mathematics that could be employed, and that we could in principle view the use of reals as an approximation of what we should really do (Caratheodory 1963; Penrose 2004, ch. 16). And the Stadium can somehow be digested by the Instant-Discretist (Dainton, 2010, 296). Finally, one could add, Quantum Mechanics may be taken to suggest discrete time (Dainton, 2010, 299). In conclusion, ... I don't really know.

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What is Moving Right Now?

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Elton Marques works mainly on the metaphysics of time. He has received a Ph.D. from the University of Lisbon with a thesis on the relationship between determinism and eternalism. Elton is also a member of the international research group LanCog, in which he holds a fellowship as part of the project "The Online Companion to Problems in Analytic Philosophy".

This paper suggests an answer to a rarely approached question on the model known as the Moving Spotlight Theory (MST). Its advantage lies in that it adds to the debate a clear view of the kind of nature that might correspond to the 'moving spotlight' responsible for the passage of time. More specifically, our theory indicates clearly what kind of thing about which the model's spotlight can tell us. The paper's main goal is not the defense of the moving spotlight as a theory itself, but an approach for understanding the metaphor at the core of this theory. To achieve our purpose, we bring to the main thesis and promote the union of two components: a) the present is the awareness of our mental states and b) the flow of our awareness or our mental states should correspond to the passage of time and to the spotlight itself. We hope to indicate what is required to correspond to the "spotlight" in an illuminating way and address anticipated difficulties.

ETERNALISM

MENTAL AWARENESS

PERMANENTISM

MOVING SPOTLIGHT,

CONSCIOUSNESS

I. A Moving Spotlight

Before facing the challenges that we impose on this article, it is first necessary to explain the theory with which we struggle: the “Moving Spotlight Theory” (henceforth MST). MST emerged following a metaphor coined by C. D. Broad (1923):

We are naturally tempted to regard the history of the world as existing eternally in a certain order of events. Along this, and in a fixed direction, we imagine the characteristic of presentness as moving, somewhat like the spot of light from a policeman’s bull’s-eye traversing the fronts of the houses in a street. What is illuminated is the present, what has been illuminated is the past, and what has not yet been illuminated is the future (59).

According with the metaphor, a spotlight illuminating the present moves in uninterrupted fashion, travelling across space-time. Its theoretical advantage lies in that it can make the passage of time compatible with an eternalist ontology, which is typically tenseless. In this section, we present that model by discussing relevant aspects of its definition. **1** One way of presenting the model is by discussing it in relation to the theses it accommodates. Such theses correspond to the desire for a tenseless ontology, but also make it compatible with the McTaggartian A- theory of time. Those theses are, respectively, eternalism (or permanentism), and the thesis that time passes, usually referred to as the A-series. Permanentism **2** is, according to Deasy, the thesis that: «it is always the case that everything exists eternally» (Deasy 2015, 2074). **3** Eternalism is the thesis in which there exist non-present objects, facts, times, relations and events. According to eternalists, the difference between future or past things and present things is not that the former does not exist. This thesis contrasts with presentism, which makes the opposite claims. In Sider’s classic formulation, «a presentist thinks that everything is present; more generally, that, necessarily, it is always true that everything is (then) present» (1999, 326). According to the same author, «eternalism states that “there are such things as merely past and future entities”» (1999, 326). **4** Permanentism and eternalism are most commonly associated with B-theories of time. Their proponents usually deny that anything is an absolute and non-relative present, while presentism **5** and transientism **6** are doctrines typically associated with A-theories. The so-called “A-series theory” of time has different definitions in the literature. Deasy (2015), for example, defines it as a theory in which an instance of time is an absolute and non-relative present. **7**

In the McTaggartian approach, A-series refers to a description of time as events ordered according to the property of being future, present or past. This characterisation contrasts with B-series theories of time, in which points in time are ordered relatively as “being anterior, posterior, or simultaneously” to or with each

1 The use of ‘model’ to refer to theories like MST is not uncommon; however, we should clarify how we use that word here. We use ‘model’ to indicate theories that provide a picture of the world, or an image that clarifies an aspect of what we are inquiring in our investigation.

2 Williamson (2013, 4) coined the term ‘permanentism’ to describe this thesis.

3 Formally:
 $A \forall x A \exists y y = x$ (cf. Deasy 2015).

4 There are many different formulations of this thesis in the literature. Trenton Merricks, for instance, uses a different strategy, in terms of the existence of ‘times’ (2006:103). To a *slightly opinionated introduction* of different formulations, see Fischer (2016).

5 In a more rigorous manner, presentism is true if and only if the more unrestricted domain of our quantifiers consists only of present objects and events.

6 Transientism is the thesis according to which there are things that start to exist and things that cease to exist (cf. Deasy 2015). Formally: $S(\exists x P \neg \exists y y = x) \ \& \ S(\exists x F \neg \exists y y = x)$.

7 Its looks like a non-standard definition, indeed.

other. Before moving on to characterise the MST model, we would like to discuss the theses of permanentism and eternalism, since these are relevant parts of different definitions in the extant literature. While Deasy (2015), for instance, proposes MST as a model that binds the A-series to permanentism, other authors, like Sider (2001) and Cameron Ross (2015), focus the theory on eternalism only. **8** What is the relationship between permanentism and eternalism? We ought to consider their relationship as follows: all permanentists are eternalists, but only some eternalists are permanentists. **9** Can there be non-eternalist permanentism and non-permanentist eternalism? We may experience great difficulty in professing a presentist permanentism, at least in a way that makes it sound appealing. We think it does not fit well with our intuition of a temporal life that includes, for instance, different parts, i.e., days, ages, objects that change, etc. **10** Non-permanentist eternalism seems, however, more appealing for the simple reason that there is nothing inconsistent in the idea of an eternalist world that was, nonetheless, created by God. The opposite would be to impose a limit on creation: as long as there is a creative act at the origin of the world, the latter could not be, for instance, an eternalist one. However, that is a theological cost that no one should impose on any doctrine, at least not without a better reason than merely that of associating doctrines that are differently defined. Because of this, it is difficult to make permanentism and God's creation compatible; non-permanentist eternalism has a lower theological price, and we do have a reason to think that eternalism shall not be considered as a theory committed with permanentism. Naturally, any model that is permanentist and compatible with the A-series can be characterised as corresponding to MST, independent of whether it is eternalist or not.

Here, then, is how one could characterise MST, considering the additional clause that permanentism and eternalism may both be part of the definition: MST is true if, and only if, permanentism or eternalism is true, and some instant of time is a non-relative, absolute present. **11** This definition **12** bears the novelty of introducing a disjunction between permanentism and eternalism, which can only mean that both theses are individually sufficient for any MST model. The sense of this addition lies in considering the thesis that some variants of eternalism are not permanentist and can even themselves be part of an MST model. The disjunction “eternalism or permanentism” might not offer an advantage over Deasy's formulation. However, it captures aspects of the model that we think we should have in mind: a) the definition in terms of “eternalism” is not

8 Williamson (2002, 2013) has proposed a version of MST, or a model closely related to Broad's theory. The main question of this paper might not apply to models like Williamson's MST. That is the case because the model inspired by Williamson's theory of modality accepts that all fundamental facts are temporal, which leads to the view that temporal operators are fundamental as well. So, it might not call for an explanation of 'temporal facts'. Adepts of classical MST could resist explaining 'presentness', as we try to do in this paper. Here, we intend to present a version of MST that resembles the model coined by Skow (2015), which was inspired by Fine's fragmentalism.

9 Correa and Rosenkranz also seem to consider eternalism under the permanentism (2018:16), and Deasy (2019) suggests that presentism is a transientist ontology. Our thesis extends the same consideration to theories that oppose presentism and transientism, i.e., permanentism and eternalism. The reason would be straightforward, indeed: if everything that exists is eternal, so the past (or what we call 'past') has always exist eternally, because we have the experience of it many times, and the future (or what we call a 'future'), since we have the experience of things changing many times, which has always existed as well.

10 Despite our claims, Julian Barbour (1999) has been identified as a possible defender of static presentism, or if you like, a defender of what we might call 'Parmenidic presentism'. Perhaps this could be counted as a version of presentist permanentism.

11 This is a version of Deasy's (2015) definition, which includes eternalism. Indeed, we think eternalism plus A-series would be sufficient for MST, and eternalism and permanentism could be separate.

12 For a more content-focused characterization, take for instance a description by Fischer: «according to the moving spotlight theory, the present is like a spotlight (hence the name) which “sheds its light” on the present point in time. It moves (yes!) alongside the timeline, thus always rendering a different time present» (2016, 7).

less common, b) eternalism is sufficient for MST as a primitive thesis, and c) it seems untrue that all eternalist model is a permanentist one. With this picture in mind, after considering all we have, we can now ask properly: what is the spotlight that “shed its light” if anything? What could its nature be? How can we explain it as a metaphor? The typical motivation for a proponent of MST is to make compatible opposite theses: 1) time passes, having an objective absolute present and 2) the correct ontology is not presentist, i.e., it is that which includes in the most unrestricted domain of our quantifiers present as well as past and future entities. Considering all this, the reasons to be an eternalist are also reasons to prefer MST over other A-series pictures of the world: for example, arguments taking the relativity of simultaneity seriously (Rietdijk 1966; Putnam 1967; Penrose 1989; Petkov 2006); arguments in terms of “truthmakers” and the “grounding” version of this challenge (Rea 2006); considerations in favour of Minkowskian space-time; and the difficulties of causal relations between presents and non-present facts. The reasons for accepting MST, besides the classical block universe, are related to two strong intuitions: time passes, and there is something special about the present. Anyone who wishes to deny presentism while asserting the passage of time will find in that model an obvious source of interest. Given the high number of eternalists who are embarrassed by the difficulties involved in the idea that time passes and has a direction, we should wonder why that model is not more appealing. ¹³ In this paper, we hope to help to make sense of the metaphor that this theory embraces. We think that at least some adepts of MST will find it appealing to have something to indicate as a ground for understanding Broad’s original metaphor.

¹³ Deasy (2015) considers the unpopularity of that model a result of the unappealing way in which it has been defined, as, for instance, in Sider (2001).

II. A Metaphor to Be Understood and Exemplified

Why do we need to make sense of the metaphor in the first place? There are several characterisations of MST without any explanatory account of it: why not just accept the official formulations? In *Relativity and the Moving Spotlight*, for instance, Skow (2009) is quite explicit about metaphors in the context of MST: they may be helpful for illustrative purposes only. The whole point of metaphors is that they are easily understood. If being understood includes being identifiable, the metaphor of the spotlight does not seem sufficiently explanatory. As it happens, this might be the reason why Broad sought to reject it (or at least part of the reason). We suppose Broad did not imagine what could truly be elucidated by the passage of the spotlight if we do not know what the spotlight is. ¹⁴ It seems clear that the spotlight, to the extent in which it illuminates events in the world, must itself be an event in this world (Broad 1923, 60). If we say what is normally said, i.e., that the metaphor is too basic to explain, then we are enwrapped in the following circularity: the spotlight indicates a mutable present which, in turn, is the spotlight. The metaphor remains hollow, imprecise and non-explanatory. Answering the question posed by the paper amounts to offering a thesis on what the mutable present is, a thesis still absent from the literature. One important point to mention is that to conceive an explanatory account of “what is moving right now” does not depend on offering good reasons to accept MST as a model. Of course, if MST is false and the

¹⁴ In this paper, we assume that philosophers may be more sympathetic to the idea of taking the metaphor seriously and consider that it deserves a more explanatory account. We think that even classical spotlighters would enjoy the main question of this paper: does the moving spotlight correspond to something that we can explain or describe?

world is otherwise a block universe, our point would be empty, but it would not be invalid so much as it will shed light on the classical metaphor, which is our purpose here. Moreover, we assume that MST is an interesting account about time and that many defenses of this are sufficient to assume this model as a starting point. We assume as well that the question about what could refer to the classical metaphor in Broad's model is interesting in and of itself and that many philosophers might have the same interest in exploring possible answers to this quandary. ¹⁵ We are convinced that any attempted answer must indicate a real change. There is a clear sense in which things change, even in a standard block universe; ¹⁶ a qualitative change in time, i.e., in $t1$, x has the property p , but in $t2$, x does not have the same property. However, that sense raises questions about its legitimacy. Geach (1972) expressed it well when he wrote the following:

¹⁵To defenses of MST, see for instance Deasy (2015) and Ross Cameron (2015).

¹⁶The block universe refers to eternalist models compatible with B-series, in which events are organized according to relationships of simultaneity, succession and anteriority. In this model, time does not pass.

On this view, the variation of a poker's temperature with time would simply mean that there were different temperatures at different positions along the poker's time axis. But this [...] would no more be a change in temperature than a variation in temperature along a poker's length would be [...] We thus have a view that really abolishes change, by reducing change to a mere variation of attributes between different parts of a whole. (304-305)

Let us then undertake this methodological point: we want the spotlight to correspond to a change that is more than just a qualitative change in the sense of Geach's critique. That will be the beginning of our quest: How to find something changing that may correspond to the spotlight, in the world? Our mental states change. Could our mental states be responsible for the changes we indicate? Against that thesis, the proponent of a traditional block universe could claim that the changes in our mental states do not satisfy the above criterion, for all our mental states are somehow related with the non-present temporal parts of our non-present brains. The resulting change in our mental states would thus be that which we avert, by methodological principle, i.e., to present only different properties in different temporal parts. It seems to us that this hypothetical objector would be correct. The answer we are looking for, meanwhile, becomes closer. It is not our mental states that answer to the spotlight but our awareness of our mental states. What the proponent of the block universe says about our mental states is true: in a block universe, or any other eternalist model, our mental states must correspond to the states of affairs on which they depend, i.e., some future event must be connected with some corresponding mental state, of which the latter would, at least partly, be its cause. ¹⁷ However, the same does not apply in any way when it comes to our awareness of our mental states. We are aware of our present mental states, and the states of which we are aware, at least in the relevant sense to our purpose, are always present ones. Such a thesis resemble the one proposed by Braddon-Mitchell in 2004.

¹⁷ For instance, the act of breaking or smashing a window may be related to certain mental states of anger or frustration.

In the model known as the growing block model, it relates the present, to our conscious and dynamic mental states. Here, the same thesis can be defended against the arguments the author himself has made in his rejection of it. For now, we should simply clarify what is meant in that thesis. Let us bring to light a principle of which to make use, which we might call 'I now principle'. The "I now principle"

can be stated thus: *df.* we are always aware of our present mental states, and only of those. How can we defend the truth of that principle? We can answer this by elimination. The rival hypothesis would hold that we are aware of our future (or past) mental states. However, it is frankly absurd and would not be defended by any eternalist (or non-eternalist). **18** It is true that, in the future, when we will be aware of a corresponding mental state, we shall be living in the present and only in it. It is still true that, in the future, we will be aware of our mental states that, today, are in the future. **19**

18 Eternalists and non-eternalists would diverge on the existence of non-present mental states. An eternalist should say «yes», a presentist should not allow for any of them.

19 In fact, we believe that being able to accommodate conscious mental states far more intelligibly is an advantage of MST relative to the block universe. Our answer is simply to relate the property of being present with the property of being aware of something.

Thus, the present corresponds to the instant *t* in which we are aware of our mental states. We are aware of writing, and of the mental states that correspond to that action. We now feel a very slight pain in our throat; we are aware of it. The mental state of which we are aware is the pain, however mild, and it is present. Tomorrow we may feel great joy in walking through the streets of Paris, the city where we are. Now, certainly, if the eternalist picture of the world is the most accurate, the mental states relative to non-present events must correspond to the past or the future, themselves existing. Our thesis is committed to the existence of tenseless non-conscious mental states. On the tenseless existence of something, whether or not it is true, there is nothing to discuss, because it is an acknowledged part of any version of MST. However, the thesis that we can have non-conscious mental states draws little support, and we must say something about it. Can there truly be non-conscious mental states? This question is important because we should have a difference between present and non-present times. We shall consider, according to our model, just the present mental states as we are aware of them, and that is the difference upon which we wish to remark. Nevertheless, to be sure, many non-present mental states should be available to us, according to our model.

Searle, for instance, extends the scope of the mental to the non-conscious, including non-felt mental states, derived in the brain. His idea was to characterize mental states as states where consciousness might or might not reside. Mental states are the only candidates for consciousness (Searle 1997, 232). However, some mental states, such as unconscious states, will be purely neurophysiological phenomena, over which we have no control or emotion. These will be non-felt mental states. Supposedly, the future and past temporal parts of our brains have associated chemistry; they are functional brains, that had or did not have the device of consciousness. However, the only conscious mental states will be those about which we are in some way aware, now. We believe it is quite reasonable to restrict awareness of those mental states to the present. Our thesis attributes to those mental states the existence of the present, as well as temporality itself. **20**

20 Naturally, the thesis that we can have non-conscious mental states is not accepted by all, and it depends on how we define the mental, especially mental states. If we define mental states as subjective and private events, as does Ceel (1980), for example, we may reach a different conclusion.

The idea that our consciousness moves or flows while the universe is eternalistic is not new, and we question why we should associate it with the spotlight. The answer is straightforward: because it helps to make sense of the metaphor in MST. Indeed, the thesis that the “conscience flows” has everything we need: namely, it indicates a passage of time, in the correct direction, and a change in a more robust sense. It is also phenomenologically adequate, i.e., it helps us to make sense of the idea that we live temporal lives,

even in an eternalist world. So, for those interested in interpreting the MST metaphor as non-primitive, i.e., as something to explain, this is a promising idea.

All that conspires with a reasonable principle, the “I now principle”, and nurtures the thesis we wish to defend. The spotlight is an aspect of our mental life, related to our present mental states, which are present because we are aware of them. Ultimately, where time is concerned, MST meets idealism. ²¹ Naturally, that raises problems. And that is what we are going to tackle next.

²¹ Idealism on time, of which Kant (1781/87) is perhaps the most prominent defender, specifies time and temporal properties (to be past, present or future) as mind-dependent properties, i.e., dependent on a cognitive agent. The eternalist models, in general, are compatible with that thesis, while classic MST, even though it is eternalist, is not, *prima facie*. The present and the passage of time, in a classic MST, have no relation of dependence of our conscious minds. This paper aims to reestablish idealism within the MST model, even if we thereby end up with a non-classic model.

III. Problems with Our Solution

We aim to propose an answer, which accounts for the passage of time, to the question “what is the spotlight?” Surely, the association of the present with our conscious mental states, the only ones of which we are aware, does not gather consensus. Worse than that, it is polemic and objectionable for reasons we anticipate. Some of these are partly directed at similar models, such as MST-Time, a Skow’s model (2015) inspired by Kit Fine’s fragmentalism (2005). As a version of Skow’s model, it has many different present parts inside of a fragmentary world. Others, in turn, are directed at this paper’s original insight: the present and the experience of the present are the same. The objections that target our version or that apply to it will carry out their offensive on two fronts: they will either object to the idea of relating the present and consciousness, as we do; or they will object to the idea that our model can be classified as a version of Broad’s MST theory. Finally, we shall try to compare our thesis with hypothetical rival theses that offer potential answers to the same question: a) that the spotlight corresponds to a supertime identified with God’s conscious mental states and b) that the spotlight is related to the second law of thermodynamics, i.e., the present, and, consequently, the spotlight would somehow be related to the entropy of systems.

III.1. *Why Not Just Accept the Metaphor Without Further Explanation?*

We shall consider the simple idea that the spotlight is an ontological basic, as a divergent opinion that fits much more with classical adepts of MST. If the spotlight is somehow basic, it needs no further explanation at all. The passage of time would be a property more likely to have mass or size, i.e., a basic fact about the world. We think the very point of having a metaphor is to elucidate something. Of course, one could think about it as a basic fact, and it would remain an interesting proposal. However, if we share with Broad some of the negative considerations of his theory, perhaps we can elucidate it a bit more. In defense of our theory, we manage to avoid the circularity that we stated above: the spotlight indicates a mutable present which, in turn, is the spotlight. In our proposal, it might still be a basic ontological fact: what is basic now is the awareness of our mental states, without the above circularity.

III.2. *How Strange Would it Be as a MST Model?*

The next objection simply punctuates the impossibility of making our answer adequate as a version of MST. The MST has been defined as the union of theses like

eternalism with the McTaggartian A-series. The A-series, meanwhile, have been defined as theses that postulate one, and only one, absolute present. Without the uniqueness of the present, we do not envision a similar model. We defend the fact that our model is a version of MST for two reasons in particular: a) despite not contemplating a unique present it postulates an objective and absolute present time – in an important sense to the MST; b) a distinctive trait of all MST, the passage of time, is contemplated and exemplified in our model. Perhaps we should clarify in what sense there is and in what sense there is not an absolute present in our theory. It is because the theory lacks the uniqueness of the present, i.e., we could not have the same present always and also do not have an independent present, i.e., in this model, the ‘presentness’ is always relative to our awareness of our mental states. But of course, the present is absolute in another sense, since we can identify the present with something and agree about it, i.e., there is, in our model, just one present time for real, the one that correspond to our awareness on our mental states. We believe that this is the sense that matters to someone that wishes to adopt a version of MST, and we think that being aware of our mental states put us in a position to know what ‘the present’ is. This consideration follows from the identification of ‘being in the absolute present’ with ‘being aware of our mental states’.

Though it is quite possible to have different objective presents on different planes of simultaneity, especially for relativistic reasons, in practice, our subjective mental states include the perception of simultaneous events, with differences that the theory of relativity does not acknowledge as significant. The difference between two events, A and B, which are both simultaneous in our coordinate system and not simultaneous in the reader’s, is close to zero. This difference exists because the speed with which we move relative to others is irrelevant when considering the relativity of simultaneity, the contraction of space and dilation of time. The relativistic effects would become part of our life only if we could move at very high speeds, close to the speed of light. That contributes to our characterisation of the present as objective, despite not being absolute as we explained it, i.e., an ontological, unique, and independent phenomena. The passage of time occurs when one becomes conscious of the mental states related to chemical processes in the brain in a causally determined structure. That trace of the objective present belongs to a philosophical wager we take: an unique present is not required, but only makes room for the intuition that time passes. Furthermore, it is no longer agreed upon among authors that no MST model can contemplate more than one present, and, thus, more than one spotlight. For some developments on these models, we could draw on Skow (2015), in addition to Torrenço and Spolaore (2019). The latter authors consider a model they dub the double moving spotlight, which they defend persuasively against objections of inconsistency. It also seems that the correctness of those hypotheses reveals that we are correct in what we considering as requisites to conceive an MST model type.

One could also wonder whether or not the passage of time, as a mind-dependent phenomenon, would be an objective aspect of the world. We believe that the negative answer is false. The equivocation consists of identifying subjective aspects with illusions, i.e., that whatever is subjective must be non-objective, like a cognitive illusion. However, since our mental states, from which our consciousness somehow emerges, are aspects of our mental life, we can challenge the tacit identification between what is subjective and what is not objective. Everything that is part of the world is, whether or not it is a mental phenomenon, an objective aspect to which we can easily ascribe to the passage of time if we think of it as in the model we describe.

III.3. *The Presentness is Mind Depend?*

There is a possible objection to the idea that the present can be mental. In our model, the present is mental, but not only: the passage of time is a mind-dependent phenomenon too. However, if there are no minds, there are no temporal properties whatsoever. This objection merely presumes that it is unacceptable that temporality should be associated with a mental phenomenon. However, we should rather ask why this is unacceptable. We could simply reply: yes, time is ideal, as philosophers like Kant (1781/87) claim. If this is true, then so is the property of being present. With no minds to experience things presently, it does not make sense to attribute *presenthood* to any event or object. Of course, human minds are not the only thing required for there to be a present. Any minds capable of some awareness of their mental states, either human or non-human, alien or divine, count towards that purpose. Without any minds, there is no temporality. Time is ideal, as some authors (some of them eternalists) have already presumed (cf. Kant 1781/87; Gödel 1949, [22](#) Yourgrau 1991, etc.). Why would it be surprising that a model such as MST, which is eternalist, could be ideal when eternalists seem sympathetic to the idealism of time?

We should consider another hypothesis: perhaps the present is ideal – and it is a dependable aspect that depends on our minds and conscience – but the passage of time is an independent feature of the world. We argue that this seems possible, but that the result would be very different: the spotlight does not guarantee the passage of time anymore, because it is not a mind-depend phenomenon, at least in our model. However, we think that some points of tension might arise here: for example, the change of the present is purely mental, but the changes in time are not? That sounds less satisfactory. Additionally, we find it difficult to explain, within an eternalist ontology, the kind of change that could act as a passage of the time. Nevertheless, this is precisely the point of obtaining a clear notion on the spotlight metaphor: the ability to indicate something to explain of what consists the present and the passage of the time itself.

[22](#) According to Gödel (1949), McTaggart (1908) should be on this list as well.

III.4. *It Is a MST, Really? Two Objections by Wilson (2018)*

The version we present is related to that recently presented by Skow, called MST-Time (2015). MST-Time, in turn, has a manifest inspiration: Kit Fine's fragmentalism (2005). According to the author, that version of the model gives us not a unique present, but many objective presents: «(4) Each time is present relative to itself, and only to itself» (Skow 2015, 58). According to fragmentalism, the world is essentially divided, or, to put it another way, fragmented. The reality is constituted by different «fragments» not forming a complete and consistent «whole» (Fine 2005, 281). The maximal collections of tensed facts are fragments, and each fragment is internally coherent, but the whole of reality (all fragmented facts) is not: the legitimate perspectives on some phenomena correspond to their ultimate reality. The world is, after all, perspectival in that sense, without a division between the perspectival and the real. Our perspective on the property of being present indicates what the present is, and not a perspectival present. That is, in the end, the appropriation of Fine's thesis by Skow, which we also incorporate in answering our question. All we do is attribute to the spotlight the same character, indicating it as something undeniably fragmented: the aware or self-aware nature of our mental states. However, how plausible is Skow's version? We shall see whether or not some of the difficulties of MST-Time

apply to our effort to conceptualise MST as an idealist model.

The classic objection consists of denying a possible exemplification of Broad's model, which is present in Skow's thesis. That objection presents reasons to refuse attribution to Skow's model of the presence of elements, which differentiates it from a classic stationary block universe. Since the model initiated by Broad marks differences for any block universe, Skow's model would be wrongly categorised, i.e., it is, at best, a variant of the block universe, but not a new version of MST.

The answer to that objection is simple: despite our presentation of a version inspired by Fine and Skow, compatible with the theses of both, the difficulties of Skow's model are not repeated in our case. We can effectively provide a reason to differentiate our model from a classic block universe: our awareness of our mental states is not stationary, acting as a true moving spotlight. More specifically, our conscious mental states occur only in the present, but it is dynamic, and it moves over all physically caused mental states. It is not clear that, in classic eternalism, we must separate, somehow, present mental states from non-present ones. It is not clear that we can accommodate the dynamic of our consciousness to the classic model. Some authors have noted precisely that: no matter how much the world is declared tenseless, at least our mind must have a teased characteristic (cf. Geach 1972, 306 and McGilvray 1979, 275-99). The difference between a classic block universe and our model is, thus, quite simple. In the first place, in a block universe, time does not pass, and our experience of time passing is not appropriately explained. In the second place, in our model, time passes, the property of being present is subjective, but our experience that time passes corresponds to something identifiable and explainable. The second objection of the kind, applicable to Skow's model, but not to ours, says that there is no reason why the so-called 'arrow of time' must have the orientation it supposedly has. That objection is more encompassing. According to the objector, Skow provided no reason to locate the movement of the present as successive towards the future. It follows from this that Skow's model is unable to tell whether the world is time symmetrical or asymmetrical, whether we live in a world where time is circular, or whether the passage of time occurs in any other possible direction. Wilson calls this the «objection from mode of motion» (Wilson, 2018). According to the author, «MST-Time does not give us any clear sense in which the spotlight moves steadily forwards rather than moving backwards or moving in some other way» (2018, §4). Naturally, with MST being an asymmetrically conceived model, in which time runs from the past to the present and from the present to the future, that objection presents Skow with a delicate problem: it questions its adequate place and categorisation as a plausible version for MST. However, that problem does not apply to our version. Motivated by clarifying Broad's metaphor, we ended up answering Wilson's challenges and created a version of Skow's model that is immune to that criticism. The reason that our model preserves what is required is simple: our consciousness effectively preserves it and possesses the desired dynamic character or orientation. If we are correct, there is no static awareness of a mental state. To support this thesis, we shall observe how we are aware of a mental state and how our consciousness works. Our consciousness seems to flow in a time-oriented manner, and we are aware of different mental states one by one, in a dynamic movement. Using the terms with which we have been posing the question, our awareness of our mental states is dynamic, asymmetrical and has a direction that mirrors the direction we suppose time to have.

III.5. *Where Is the Present and How to Know It?*

There is another objection, applicable not only to Skow's model but to the spotlight in general. It argues that the MST must be able to guarantee the indication of the present when there is no criterion for such. If we are not presentists and so accept the inclusion of non-present events and objects among our ontological commitments, we can never guarantee that we truly live in the present. Naturally, we live in the relative present. Relative to instant t in which we have our mental states, t is present. However, we know nothing of the absolute present. A relevant difference between the absolute and relative present must be produced, and the fact that we experience instant t as present does not confer upon us the discriminating power we seek.

A similar question was applied to the growing block model, the one that Broad renounced in 1923. Braddon-Mitchell (2004) tells us that there is no way, in that model, of distinguishing the absolute present from any other past time (a relative present). The author is correct, but that problem does not apply to our case. It is true because the present is the property that our consciousness attributes to the facts and events we experience. We know that we are living in the present because the present is, by definition, the time when we have conscious experiences of our mental states. According to our thesis, having conscious mental states is a legitimate condition for there to be a present. The result resembles Forrest's (2004) model for the Growing Block Theorists, sometimes called «the dead past view», according to which the past is dead aside from the fact that it exists. It is dead because no one lives in the past, since no one has a phenomenological life there. Of course, since our model is not a version of a Growing Block, we should have a very similar point about the future: the future is dead in the same sense, at least for now.

Note that if what constitutes the passage of time is the dynamic flow of our conscience, aware of our experiences only into the present, it is what constitutes the present as well. So, time would be an aspect of our mental life, and the flow of time could be explained with a phenomenological approach. We can use the awareness of our mental states, which is a dynamic process, to explain the use of the metaphor for a transient and constant spotlight that has a direction. Indeed, the spotlight does not just have a direction, but the direction is what we need to describe the MST! We have in this model a non-standard A-series theory but one that preserves what we need: the dynamic aspect of the flow of time, the special feature of the present, when we compare it with past or future, an eternalist ontology, an objective present, and, in some sense, an absolute one (in the sense that the present is identifiable, and we could even agree about where it is). This discussion brings us to a further objection put forward by Braddon-Mitchell.

III.6. *There are Zombies Everywhere?*

The author, Braddon-Mitchell, will have realised that the answer to our previous question rested on the temporal status of consciousness. He tells us, in an attempt to overcome the difficulties he raised:

Suppose that the hyperplane that is the objective present is the only one that contains consciousness. Some hold that consciousness is some by-product of the causal frisson that takes place on the borders of being and non-being. If this were the case it would restore our confidence that the current moment was the present, because it would become a priori in the manner of Descartes's cogito. In so far as we know we are conscious, we would know that

the current location in space-time was in the present, since as soon as that location in space-time was past, its occupants will be Zombies and thus we would have no awareness. (Braddon-Mitchell 2004, 202)

He considered so the costs of the thesis we enunciate to be too high. A version of his objection can be explained in the following terms. Assuming special relativity, we must equally relativise the answer to the question ‘what things, besides us, are in the present?’ Even assuming that we are in the objective present, we are still, according to special relativity, the occupier of several hyperplanes of simultaneity, each exhibiting different perspectives on the world. The things that now depend on perspectives are exhibited in different planes of simultaneity. This being so, even if we are in the present, we cannot guarantee that we have before us present objects. As if that was not strange enough, we cannot be sure that the people with whom we converse are not zombies, living in other times. That, if not absurd and unacceptable, has quite a high acceptance cost, thus making the theory unappealing. That is a sensible problem. None of us would accept the strange conclusion that seems to follow from that reasoning (as if our theories were not strange enough already). Neither can we avoid the questions concerning special relativity, since adapting to that theory, without artifice, is a reason that generally favours non-presentists. How could we deal with that? Our suggestion: we must guarantee that there is a certain coincidence between countless subjective presents, and so on, for all conscious people with whom we may interact. In other words, we must guarantee that our presents are sufficiently coincident, i.e., all must have conscious mental states only now at this moment at which we are writing. However, is that compatible with the relativity of simultaneity? By taking relativity as a horizon, we should note that persons are, in the relevant context of that theory, objects that have distended temporal parts, what is not promissory for us. How can we escape? In terms of simultaneity, Einstein’s thesis can only be accommodated with what was said above because people moving at a minimally necessary speed for the obtaining of observable relativistic effects is not something actual, or even expectable. Of course, if we are in motion relative to an observer or stationary relative to a train platform, for instance, there will be a minimal difference between what can be indicated in the present of both. However, it will be a near-zero difference, incapable of being measured by any normal, non-atomic watch.

Moreover, in the absence of anything further, surely the time interval encompassing our mental states, of which we are aware, and the reader’s, of which you are aware, do not differ significantly. We explain that for practical purposes, it is as if we were all in the same systems of coordinates, although we are all performing relative movements, ones toward the others. This reason is why, essentially, the relativistic effects had remained hidden until the beginning of the last century, when they were uncovered by Lorenz’s transformations and then explained officially by Einstein, as part of what occurs in the world. If there are, somewhere in the universe, minds travelling relatively close to what we consider to be the speed of light, the whole picture is changed, and then we shall have that undesired scenario, which puzzled us in a question inspired by Braddon-Mitchell. Nevertheless, we do not have, as far as we know, conflicts between present times, past and future, simply because relative simultaneity does not apply, in our common experience, to people and their conscious mental states.

What perhaps could be claimed is that instants of time and their intervals, in both systems of coordinates, will not be the same. However, they will be similar enough to both be called ‘the present’. It was Bertrand Russell (1915) who explained,

with his characteristic subtlety, that the present must have an extension that is, in fact, impossible to delimitate. Its extension is relative to the interval between the events we can perceive presently. For instance, if we snap our fingers, with 0.3 seconds of difference between the sound produced by the fingers of our right hand and the sound produced by the fingers of our left hand, we will surely have non-simultaneous events. However, both will be perceived by the conscious mind as present events. For that reason, unless the relativistic effects are quite evident, under characteristic circumstances familiar to the theory (a speed relatively close to the speed of light), there will be no conscious minds that coexist with zombies.

Our scope was, until now, only a way to run a scenario in which we share our lives with zombies. However, why do our future or past mental states not configure a zombie's life when there is no awareness involved? The answer is just that no zombies could have a mental life, as we do. To describe this by using the scenario of zombies is a strange way to understand it. Each temporal part of us has the experience of conscience, and the fact that it happens in a time-ordered flow does not transform us into zombies. To show the difference, we claim the following: no zombie had or will have an awareness of his mental state for each mental-event in his "life". However, that is our life, according to the theory we are describing. The other problem – how we know that an object is present – is solved in our proposal with the fragmentalism that is inherent to it, in union with our theory about what the present is. If fragmentalism is correct, then all objects are present in each of the simultaneity planes in which we happen to find ourselves, i.e., they are present only inside the fragment. That means that what is present depends only on what we are experiencing. It is true because our awareness of our mental states defines what is present or not. It will never be the case, as was described above, that we do not know what to say of an event whether or not it is present, for there are no non-present events of which we are aware. What makes an object present is that it is part of our present, or, better said, it is the coincidence with a conscious mental state what makes an object present. The fact that there is no significant and noticeable disagreement concerning the intervals of time we are exposed to indicates that the vast majority of objects we consider present now also belong to the reader's relative present. Again, this is what we mean when we say that our theory has an objective, though non-unique, present.

III.7. *But What About It Being Deterministic?*

Does the theory contain determinism? I believe that would be a valid criticism, but it is not a criticism exclusively directed at our model. According to many authors, any eternalist model faces challenges to accommodating free-will, whether they are determinist or fatalist (Rietdijk 1966; Putnam 1967; Penrose 1989; Shanks 1994; Maxwell 1993, Lockwood 2005). However, we believe our model faces an aggravating factor: in classic eternalism, we can say that our future choices are conscious, i.e., that they are conscious in the future. The composition of the theory would, therefore, have inherent in it the idea that we are entirely responsible for our past, present and future choices, all of which exist, according to a tenseless ontology. In our model, that possibility is discarded. Worse than that, even the choices of which we are now aware, in the present, must somehow be previous to our consciousness of them since they causally result from temporal parts of our brain that generate real mental states, which exist in the tenseless fashion. We become aware of them, in the very precise sense of the word, only when we experience them consciously. The problem seems unsolvable. How to proceed? We emphasise that determinism will only be a problem

for a non-determinist philosopher. That is, it would first be necessary to prove that determinism is unacceptable and only then reject the model for that reason. Relative to free-will, the compatibilist strategies are in order, if true. Since it is not our purpose here to defend any of them, it remains an indication that they might be a solution to conciliate our model with free-will.

III.8. *Is the Spotlight Something Else?*

We must compare our answer to two other possible answers. Could the spotlight correspond, somehow, to the entropy expressed in the second law of thermodynamics? Could we attribute to God's conscious mental states some priority, such that the absolute present, like a *supertime*, with which it could be identified? Concerning the first question, the answer is quite simple: the passage of time cannot be attributed to the second law of thermodynamics in any eternalist model. The reason for this is that thermodynamic states, which present a *ratio* in a clear sense, from order to disorder, are like any other state of affairs, in a block universe. There are temporal parts of systems with patterns of disorder in one direction, all of which are, however, existent. Thus, we cannot see how to discriminate the passage of time, which indicates an absolute or relative present, if we accommodate in that model the result of the second law of thermodynamics.

Concerning the idea that the present must be identified with the mental states of God, we have two things to say. The first is that, if such is the case, then our thesis maintains its explanatory power. The answer to the question 'what corresponds to the moving spotlight?' is 'the conscious mental states of God, which change'. The second thing we should say is that that which can only be said by someone who holds that God is a temporal being subject to change, at least in its mental states, i.e., beliefs, desires and joys. We suspect, however, that such a thesis will not be consensual among eternalist theorists who believe in God, but even if God could have changeable mental states, like ours, nothing prevents us from thinking of God's mental states as conscious now, in the same instant t in which we have consciousness. We believe that would be a natural response.

IV. Advantages

The advantages of the model are relative to its capacity to avoid the traditional problems with MST: namely, McTaggart's problem and the epistemic problem (Deasy 2015). Some authors have indeed provided good answers to those questions, but we easily avoid it, i.e., the same problems do not appear in our version of MST. If this is true, we do have this advantage. Since McTaggart's problem suggests a contradiction involving the notion of change in things, namely the notion of change in the properties of being present, past and future, our version is immune to it. A conscious mental state will never be an instance of the McTaggartian contradiction because it will never be present and past, past and future, future and present in the same instant. The epistemic argument, based on the impossibility of locating the present, also fails. All our conscious mental states are present, despite each person having their present. Naturally, as we have seen, the many subjective presents coincide, if not completely then at least sufficiently, which makes divergences in the size or duration of those same presents negligible. Many problems are thus avoided, such as Wilson's (2018) objections against adopting Skow's fragmentalism. Another advantage our model has is its explanatory power. Namely, our model answers a relatively ignored question: to what

does the moving spotlight effectively correspond? That is an important question, based on the need to give substance to a metaphor. Broad, who fathered the model, did not think of that metaphor as sufficiently explanatory. We hope to make clearer the borderline that separates the present from the non-present and to point out the possible changes in how it is drawn. With that, we hope to make MST more attractive, not only for eternalists, but for philosophers of time in general.

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Limit Deciding Dispositions. A Metaphysical Symmetry-Breaker for the Limit Decision Problem

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There are basically four options to which state the limiting instant in a change from one state to its opposite belongs – only the first, only the second, both or none. This situation is usually referred to as the *limit decision problem* since all of these options seem troublesome: The first two alleged solutions are asymmetric and thus need something to ground this asymmetry in (a symmetry-breaker); while the last two options leave the realm of classical logic. I argue that including the debate about dispositions enables new options for solutions to the temporal limit decision problem. Metaphysical considerations function as a symmetry-breaker and thus remove the need for a non-classical solution. Dispositions bring about the changes in the world, so they constitute the metaphysical background for the instant of change. In particular, I argue that according to the *triadic process account of dispositions*, the limiting instant belongs to the second interval and only the second interval.

I. Introduction

The so-called limit decision problem is a particularly tricky problem in theoretical philosophy. It has a long history ¹ and is still the subject of a lively debate. ² The temporal version of the limit decision problem is often referred to under the heading «the moment of change» and it circles around the question of how to describe the change from one state to its opposite. Take the well-discussed example of the change between rest and motion. ³ Clearly, there is a moment when the object in question, say a car, is still in rest, and clearly, there is a later moment where it is moving. The question is until when exactly the car is motionless and from exactly what time on it is in motion. Is there a first instant of motion? Is there a last instant of rest?

Under the assumption that time is continuous, we can think of the situation in terms of two adjoining intervals and the border between them. The question then becomes to which interval the border belongs. *Prima facie*, ⁴ there are four options: the moment of change belongs to the first interval and only the first interval; or it belongs to the second and only the second; or it belongs to both; or neither. It is called the limit decision *problem*, since all four options seem problematic. The last two options have the problem that they seem incompatible with classical logic, abandoning the *principle of bivalence*. Though the first two options are compatible with the classical logic, they are asymmetric, which raises the question of why the limiting instant should be assigned to the one interval *rather* than the other. At this point, it's not a question of logic anymore, i.e., logic cannot decide between the first two options.

The paper is structured as follows. In the second section, I introduce the limit decision problem for change. I focus on the systematic aspects of the exposition of the problem, rather than its history. The asymmetry of the possible solutions that are compatible with classical logic brings with it the need for something to decide one way or the other. I propose that dispositions can function as a *symmetry-breaker* for these cases. Therefore, I first introduce my favourite theory of dispositions, the triadic process account of dispositions, in section III, and then lay down the implications for the debate about the moment of change in the fourth section. In the final section, I take a step back and evaluate the argumentative setup of the paper.

II. The Moment of Change

To begin with, think of any temporal boundary that interests you. Before the boundary one state obtains and afterward another. Whether you fear or anticipate the new state or if you are emotionally indifferent, a theoretical question arises regarding the

¹ See Strobach (1998) for an overview of the history of the debate about the moment of change and the systematic answers to it. There, Strobach states that «[i]nterestingly, almost every systematically conceivable answer concerning the moment of change has been argued for in the past» (Strobach 1998, 1).

² See, for example, (Roques et al. (2018) for a recent collection of essays on the «The Instant of Change». The remarkable thing about this collection is that they include contributions from scholars of the medieval was well contemporary debate about limit decision problem.

³ Although quite prominent, this example is problematic because it involves the «question of how to define rest and motion» (Strobach 1998, 247). Motion has always been a prime example of change itself.

⁴ The options mentioned here do not exhaust the solution space. Besides the four options discussed, Strobach introduces the *either-way-option*: «In a certain respect, the old state still obtains at the limiting instant, in another respect it does not. Moreover, in a certain way the new state already obtains at the limiting instant, but in another way it does not» (Strobach 1998, 6). Also, sometimes a *mixed description* is suggested, as Strobach points out, i.e., that there are different sorts of changes that require different solutions to the limit decision problem. We will come back to this in section IV.

nature of the boundary: which state obtains at the boundary? Already at this level of abstraction, it is clear that there are, in principle, four answers. Since both the old and the new state can either obtain or not at the border, basic combinatorics yields the following four answers.

1. The old state and the old state only obtains at the border
2. The new state and the new state only obtains at the border
3. Both states obtain at the border
4. Neither state obtains at the border

This is the contentual way of framing the temporal limit decision problem. But one could also phrase it in terms of intervals. Take two adjoining intervals in the (one-dimensional) time continuum. Call the border between them the limiting instance. To which interval does the limiting instance belong? Once again, basically, there are four solutions.

- 1'. The limiting instance belongs to the first interval, and to the first interval only
- 2'. The limiting instance belongs to the second interval, and to the second interval only
- 3'. The limiting instance belongs to both intervals
- 4'. The limiting instance belongs to neither interval

With the common (Cantorian) distinction between open and closed intervals, we can depict the situation more formally. In general, a set of real numbers lying between two numbers is an interval. These two numbers are called the *extremities* of the interval. An interval is called «closed» if it includes its extremities and «open» if it excludes them. For example, the set of numbers $0 < x \leq 1$ is a left open and right closed interval, as it excludes 0 but includes 1. This is depicted as $(0,1]$ or $]0,1]$.

For our purpose, it only matters what is going on at $t1$. We can thus oppress the left border of the first interval and the right border of the second interval. You could set it to an arbitrary number properly smaller (or respectively properly higher) than $t1$, or you could just use $-\infty$ and $+\infty$, respectively. As we are focusing on $t1$, we can also drop the talk of left and right in the context of open and closed. Unless stated explicitly otherwise, «open» and «closed» means «open at $t1$ » and «closed at $t1$ », respectively.

Now, we can frame the four basic solutions in terms of open and closed intervals:

- | | | |
|-----|---|-----------------------|
| 1". | First interval open, second interval closed | $\dots t1), [t1\dots$ |
| 2". | First interval closed, second interval open | $\dots t1], (t1\dots$ |
| 3". | Both intervals closed | $\dots t1], [t1\dots$ |
| 4". | Both intervals open | $\dots t1), (t1\dots$ |

To see clearly why the limit decision is called «problematic», let's look at a simple example: a change from rest to motion. Say there is a time $t0$ ($t0 < t1$) at which we can safely ascribe rest, and then there is later time $t2$ ($t1 < t2$) at which we can safely ascribe motion. This is not about vagueness, so assume further that the object in question, say a car, exemplifies rest up until $t1$; and motion from $t1$ onward. So: REST ($t0, t1$) that is $\{x \in \mathbb{R} \mid t0 < x < t1\}$ and MOTION ($t1, t2$) that is $\{x \in \mathbb{R} \mid t1 < x < t2\}$.

Even with this all settled, it is still open what property we have to ascribe to $t1$, ⁵ i.e., the limit decision problem still arises. The motion-example helps us to see the logical consequences of the different possible answers very clearly, so let us list the four basic possibilities, one final time. With $R(\varphi)$: φ is at rest and $M(\varphi)$: φ is in motion, we can also formalize the four options:

1 ^{'''} . $t1$ is at rest and at rest only	$R(t1) \wedge \neg M(t1)$
2 ^{'''} . $t1$ is in motion and in motion only	$\neg R(t1) \wedge M(t1)$
3 ^{'''} . $t1$ is both at rest and in motion	$R(t1) \wedge M(t1)$
4 ^{'''} . $t1$ is neither at rest nor in motion	$\neg R(t1) \wedge \neg M(t1)$

The problem, now, is that all four solutions seem troublesome, while it seems like one of them has to be chosen. The last two solutions clash with classical logic, while the first two threaten to be arbitrary. Let me explicate.

You can easily see that the first two solutions are compatible with classical logic. The third and fourth solution, however, seem to reject principles at the heart of classical logic. ⁶ The third solution goes against the *law of non-contradiction*, which states that a proposition and its negation cannot be true together. The fourth solution goes against the *law of excluded middle*, which states that any proposition is either true or its negation is true. Of course, non-classical logics have been developed, and people have argued for the third and fourth solution. There is a general agreement, however, that the first two solutions would have to be preferred, because they do not *force* a deviation from classical logic.

⁵To be more precise, I would have to talk about the car here, since it is not the time itself that has the colour property. The talk about $t1$ having a colour property should, thus, be understood as a shorthand.

⁶ Some philosophers (e.g., Medlin 1963) question the third and fourth solution's incompatibility with classical logic. While I tend to agree, a discussion of this would go beyond the scope of this paper. I follow the standard way of depicting the debate: «The first two options seem arbitrary, the third goes against the law of non-contradiction, and the fourth against the law of excluded middle» (Roques et al. 2018).

But the first two solutions also have their problems. Attributing $t1$ to only one of the adjoining intervals brings with it the question of how to decide which of the two intervals this is going to be. There need to be some grounds for why the limiting instant should belong to this specific interval. Classical logic only gives us that the instant better be assigned to just one interval, not to *which* one. The first two solutions are, hence, asymmetric – this is why they are compatible with classical logic – but they should not be arbitrary (cf. Sorabji 1976, 69). It would be ad hoc to just randomly assign the limit to one of the intervals. The asymmetry needs to be grounded in something. I use the terminus technicus «symmetry-breaker» for this.

Summing up, the situation seems to be this: the first and second solution are compatible with classical logic; while the third and fourth are not. But the first and second solution are asymmetrical solutions, which brings with it the need for a symmetry-breaker. ⁷

Before we go on with my proposal for a symmetry-breaker – namely the underlying dispositions, which are involved in bringing about the change in question – some remarks are in order.

First, the epistemic and the ontological question regarding the moment of change need to be kept apart. The ontological question is which state or property obtains at the limiting instant or to which interval

⁷You should feel the same compulsion to explain why it is explicitly this interval as you feel in the case of Buridan's ass. It seems unintelligible that the donkey can choose a stack of hay if there are no grounds for preferring this particular stack over the other. This can be questioned in the case of Buridan's ass, and someone might think about also questioning it in the temporal limit decision case. Most of the people, however, agree that you

the border belongs. The epistemic question is, how do we get to know this. I am solely occupied with the ontological question in this paper. Because of that, there is no risk of confusion, and, thus, I can allow myself some formulations which might have epistemic connotations.

Second, I explicitly limit the discussion of this paper to *temporal* limit decision problems, aka the debate about the moment of change. Consequently, I abstain from any claim regarding the implications of my solutions towards other limit decision cases. ⁸

Third, the symmetry-breaker is not found in the mathematical description of the problem alone. ⁹ This is a common assumption, which I just want to make explicit. Note however, that the temporality of the intervals doesn't help *by itself*. Sure, time is asymmetric (future-directed, if you will), but how does this asymmetry translate to the limit decision problem?

Summing up, the task is to find an ontological symmetry-breaker to enable a classical solution to the temporal limit decision problem. This symmetry-breaker is not found in the (formal) description of the situation and, thus, we need external input. Obviously, we cannot just consider *anything* as external input; it needs to be relevant for the problem at hand. However, looking at the metaphysics of change is not arbitrary – after all, we are concerned with the «moment of change». There is a metaphysical debate on how change is brought about, and this is the debate about dispositions. I turn to this debate in the next chapter and give a brief account of and a short motivation for my favourite theory of dispositions.

III. Dispositions

In this section, I introduce the main aspects of the debate about dispositions required to introduce my solution to the problem of the instant of change. Standard examples of dispositions are fragility and solubility. These dispositions come with canonical manifestations: fragility can lead to breaking, and solubility can lead to dissolving. The question is, how do dispositions lead to their manifestations? Typically, glass doesn't break for no reason. Only if you strike it with a hammer or throw it to the ground, its fragility manifests. And a sugar cube needs to be put into tea or coffee to display its solubility. It seems like dispositions need a trigger or stimulus to manifest. ¹⁰

In a nutshell, the debate about dispositions circles around what I like to call the *prevented manifestation problem*, i.e., cases where the canonic manifestation is absent. There are tons of examples and counterexamples in the literature. ¹¹ Sometimes the problem cases are sorted whether the canonic manifestation is prevented by removing the disposition – these cases are called «finks»; or whether the canonic manifestation does not occur, although the trigger and the disposition are present – these cases are called «masks». There is

need grounds for picking one of the first two solutions rather than the other, and I will just assume this for the context of this paper.

⁸ For example, Brian Medlin considers a problem that occurs in the context of fracturing a martial body (Medlin 1983). Given that no matter can be created or destroyed, one of the surfaces after the fracture should be an open interval and the other a closed. But which is which? ⁹ An *external* solution, which surpasses the mathematical description of the temporal limit decision problem has the added advantage, that, if you disagree with the representation of time in terms of spatial intervals, as Henri Bergson (Bergson 1910, ch. 2) famously did, you could still agree to the TPD-solution regarding the moment of change.

¹⁰ It is controversial whether all dispositions need a trigger. Fundamental dispositions or radioactive decay may be good examples of trigger-free dispositions. I have introduced «trigger-talk», because the counterexamples discussed only arise for dispositions who need a trigger. Note, however, that the TPD does not exclude trigger-free dispositions.

¹¹ To get a glimpse of the various kinds of examples used in the debate about dispositions, take a look at the «case file» in Fischer (2018).

general agreement that masking cases are more problematic than finking cases. For example, if you take the corresponding antidote, you prevent death through a deadly poison. The antidote does neither take away the trigger, as the poison is still ingested (by a human), nor the dispositions, as the poison is still deadly, but it prevents the manifestation nevertheless. Masking cases pose a formidable challenge to any account of dispositions.

Upon the masking cases, there is a particularly nasty subclass: diachronic masking cases (cf. Schrenk 2010, 729). You might think that you could exclude the problem cases by making the trigger more explicit. So, instead of «ingestion» you could insist that «ingestion in the absence of the corresponding antidotes» is the appropriate trigger for the disposition of the deadly poison. The problem is that this does not exclude all prevention cases. Antidotes are often administered after (and, well, because of) the poison. Call cases where the preventer acts after the trigger «diachronic masking cases». As they cannot be fixed by tinkering with the trigger, these cases are the hardest problem cases for a theory of dispositions, for systematic reasons.

This tour de force brought us right to the heart of the contemporary dispositions debate. Of course, I cannot discuss the matter anywhere near exhaustion in this context. In the following, I present my theory of dispositions: the *triadic process account of dispositions* (TPD) and hope that my remarks about the diachronic masking cases at least motivate it. As this paper is concerned with the moment of change, I focus on the application of the TPD to this problem rather than defending it in detail. ¹²

The vital bit of the TPD for this paper is the process-understanding of disposition manifestations. ¹³ Upon reflection, you can see that the diachronic masking cases are so notorious because they include a time gap (Δt) between the stimulus and the canonical manifestation, and because of this temporal gap, «there is the in-principle possibility of an interference» (Schrenk, 2010, 729). Thus, the time span between the ingestion of the poison and the death is the core of the problem.

Note, that temporal action at a distance, even without the possibility of interference, would be ontologically bad. An account that claims that the trigger occurs at t_1 and then there is nothing for some time Δt followed yet again by a manifestation at t_2 , should be rejected in the first place. However, this is not what's going on in the poison case. With the ingestion, a process starts in your body. Sure, the specifics of the process depend on the specific poison and specific body, but in any case, it is not «nothing». A very clear indicator of this is that the poisoning can leave permanent damages to your body, even if the end result of the process (death) can be prevented.

So, in the case of the poisoning, there is a process that starts with the ingestion, and there is a possible end-result of this process. Not much hinges on this, but I'd like to reserve the word manifestation for the process. In this way, it can also be used in cases where there is no natural end-point to the process: for example, think of two particles in the void, thus charged that they repel each other.

According to the TPD, then, the manifestations of dispositions are to be understood as processes. This avoids the temporal-action-at-a-distance-criticism: there

¹² I have written a book-length introduction and defense of the TPD. The TPD consists of two parts, which can be understood as its synchronous and diachronic aspects. The synchronous aspect is that it supports a triadic ontology, with a third level in-between dispositions and the resulting behaviour, which I called *wirkungen*. The diachronic aspect is that *wirkungen*, as well as resulting behaviours, have to be understood as processes. See Fischer (2018, ch. 4).

¹³ There is some terminological dispute going on in the debate about dispositions. Some people use the term «manifestation» for what I have called resultant behaviour; others use the word for my *wirkungen*. But I don't want to let this succumb to a fight about words. As the triadic aspect of the ontology is not important in the context of this paper, I will use the word manifestation indiscriminately. For the official version, see Fischer (2018).

is no temporal gap between the process and the trigger. Only the (possible) end of the process is temporally separated from the trigger, not its beginning. The process understanding of manifestations also offers a solution to the diachronic masking cases. This solution is made possible by the same feature of the TPD that allows it to act as a symmetry-breaker regarding the moment of change. I will, hence, discuss it in more detail in the next section.

IV. Disposition and the Moment of Change

Let us take stock. In section II, we have said that the solutions 1 and 2 to the temporal limit decision problem are to be preferred, because they agree with classical logic. However, they are asymmetric solutions, and this asymmetry needs to be grounded in something. This something can come from outside the mathematics of the continuum, but should, of course, not be something random or ad hoc. But what would be more obvious than to look at the metaphysics of change in the context of the debate about the moment of change? In section III, we have seen that according to the TPD, the manifestations of dispositions are processes. But how does this help with the moment of change? To see how the TPD can act as a symmetry-breaker, we have to look at how the TPD deals with diachronic masking cases.

In a masking case, the manifestation can seemingly be prevented, although the trigger and the disposition are present. Diachronic masking cases are especially vicious as they allow for the prevention to happen after the trigger. Now, according to the TPD, the manifestation is not the end result but the process itself. We have already seen that therefore there is no temporal separation between the trigger and manifestation process. But the TPD also ensures that the process cannot be prevented. Let me explicate. The idea is that even when the end result is prevented, the process itself is not prevented. Remember that in the poison case, a lot of changes in the body of the victim happen, some of them irreversible, even if death is prevented.

The process-understanding of manifestations, according to the TPD, is closely connected to the progressive aspect. ¹⁴ Thus, a process is an *ongoing* entity, i.e., it need not be completed to have its full identity. From that it follows, that a process can be interrupted or even cancelled. Somebody can be walking to the university without ever reaching the university (maybe because she is struck by lightning, maybe something more mundane happens). The important thing is that there is an ongoing process that may or may not be completed; depending on the circumstances.

And in turn, this means that, actually, there is no diachronic masking problem. The manifestation process is there, even if it is interfered with or cancelled. Hence, the diachronic masking problem is a conceptual misunderstanding. It just arose, because people were focusing ¹⁵ on the end result rather than the process that leads to it. It didn't reach its canonical end result, but the disposition nevertheless was manifesting. Of course, the manifestation can still be prevented. If you take away the trigger or the disposition, no manifestation occurs. Yet, this is no wonder and not problematic. If I do not strike the glass (no trigger) or if I harden it to make it shatterproof (no disposition,

¹⁴ There are other understandings of processes, but I'm explicitly only considered with this one. When push comes to shove, I stick with «progressive» rather than with «process» to describe my account. It is because of this understanding that I don't think that processes are essentially temporally extended.

¹⁵ It would exceed the limitations of this paper, but there is a story in the background on how the focus of the debate about dispositions ended up being on the result rather than the process. Roughly this has to do with the humean ontology, which is implicitly or explicitly assumed in the debate. For more details, see Fischer (2018, ch. 4).

that is fragility), of course, the glass does not break. But if the disposition is kept, as soon as the trigger there, the manifestation process starts.

Thus, one could simply define the trigger as the beginning of the manifestation process. To be precise, with «the beginning» I do not mean its initial stage but *that* it begins. Hence, it is conceptually impossible that the manifestation (process) is prevented – and thus, the diachronic masking problem is a conceptual misunderstanding. All of this might be controversial. Yet all we need for the problem at hand is that the manifestation (process) begins when the disposition is triggered.

Let us take this to the limit. For the prevention of the manifestation to be conceptually impossible, the manifestation process needs to be present no matter how short a time elapsed. If we (in thought) push the interruption closer and closer to the trigger, we see that the manifestation process must start with a closed interval. There needs to be a first moment of the manifested, because otherwise a mask would still be (conceptually) possible. [16](#)

Now, it doesn't matter (here) whether you take this to be a viable solution to the diachronic masking problem or not. It should be clear, however, how this is supposed to help in the case of the temporal limit decision problem. But let's be explicit.

The two intervals in question need to have some qualitative difference, otherwise they would not be two. No limit, no limit decisions problem. But this qualitative difference, a dispositionalist would say, is due to (some kind of change): no change, no moment of change. So how would the situation be described in the terms of the metaphysics of change, according to the TPD? At $t1$ there is a change happening. A previously unmanifested disposition is manifesting. It might be for a short while only, but at $t1$ it is manifesting. Thus, the border belongs to the second interval and the second interval only.

Let us discuss this for a moment. First, note that the argument in favour of the second solution via this route consists of two steps. The first step would be the argument for the TPD itself – which we have omitted in this paper. The second step is the translation from the TPD to the temporal limit decision problem. Of course, this second step is open to criticism. I have claimed that the manifestation (process) of a disposition has to start with a closed interval because of the diachronic masking cases. One could accept this but reject that this favours the second solution to the temporal limit decision problem.

And in fact, I find it plausible that the TPD is, in principle, compatible with the third and fourth solution. The idea is that the manifestation and the change in property could come apart. Think about the change from rest to motion. The TPD only enforces that $t1$ is the first moment of the manifestation, not necessarily that it's the first moment of motion. Nothing in the TPD forbids that at $t1$ the object in question is neither at rest nor in motion, or that it is at rest and in motion at $t1$. For, if you have no problem with accepting truth value gaps or gluts, you could still hold the TPD. Still, it is much more natural to pair the TPD with the second solution. How to pair it with the first solution, I cannot see.

An additional way to challenge the second step would be the claim that the TPD is irrelevant for the limit decision problem. [17](#) The worry is that considering the manifestations of dispositions is changing the subject, especially as the

[16](#)The TPD surely is a minority position. Among other things, it features the claim that the manifestation of powers is synchronic with the trigger. This is very controversial (see e.g., Williams 2019; Maslen 2018 for objections to it), but that is precisely the point. Only because of those «strange» features, the TPD is able to have an impact on the debate about the debate about the limit decision problem. Not any theory of dispositions and processes would do.

[17](#) I would like to thank an anonymous referee for stressing this point.

(potential) end products of (manifestation) processes and the (manifestation) processes themselves have to be distinguished according to the TPD. To dissolve this worry, it is important that we need to be very careful, which dispositions and accordingly which manifestation processes we track. The limit decision problem only arises for *adjacent* states. Thus, whether the process is already in the state of its end result, say whether a breaking glass is already broken, is irrelevant for the question at hand. The limiting instance is between the unbroken and the breaking. The relevant questions are: is there a last moment of the unbroken, and is there a first moment of breaking? And to these questions, the TPD has a definite answer.

There is another potential point of critique for the second step of my argument. In my exposition of the temporal limit decision problem in section II, I have assumed that the four different formulations of the problem are equivalent. But they might not be. Paloma Pérez-Ilzarbe, for example, argues that the temporal question and the ontic question regarding the limit decision problem have to be kept strictly apart. «On the one hand, one can ask about the limit *of the time* that measures a state» and «[o]n the other hand, one can ask about the limit *of the state*» (Pérez-Ilzarbe 2012, 292).

A challenger to my argument could try to object that I only give a solution to one of the questions, either the temporal or the ontic, not the other. But if you grant the transmission from the metaphysics of disposition manifestations to the temporal limit decision problem in the first place, I can't see why there should be *prima facie* a stronger link for any of the two questions.

The combination of the two worries, the compatibility of the TPD with the non-classical solutions and the differentiation of the temporal and the ontic question, give rise to a fall-back option for my argument. The idea is the following. Accepting that the temporal and the ontic question are (partly) independent of each other, i.e., that the question to which interval the temporal instance belongs can have a different answer than the question which state obtains at the border, opens up the possibility of an interesting, complex answer to the limit decision problem. In particular, it allows to combine a symmetric solution regarding the properties involved with an asymmetric solution regarding the temporal instance. This, in turn, shows that accepting a truth value gap or a contradiction regarding the motion at t_1 , does not settle the temporal question. And then, the TPD still gives us good reasons for an asymmetrical solution to the temporal question, namely the second solution, that the temporal border belongs to the second interval and the second interval only.

Another issue worth discussing is the generality of the TPD solution. Does it hold that every temporal limit decision case has to be treated in the same way? I have based the asymmetry of the solution on the metaphysical asymmetry of disposition manifestation. I have argued that considering dispositions regarding the moment of change is not arbitrary, because dispositions are intimately involved in bringing about changes in the world. But do all changes involve dispositions? So even if one agrees that dispositions are involved in some changes and finds my examples convincing, one could still reject that (the same kind of) dispositions are involved in all changes.

At this point, there are two options: either being a pan dispositionalist or defending a mixed description. If you are a pan dispositionalist, you straight up reject the worry. Pan dispositionalists believe that *every* property is essentially dispositional. All changes in the world involve dispositions, and thus, the generality of the TPD is not limited. The other option is what Strobach calls a *mixed description*, namely that there are «different options for different cases» (Strobach 1998, 12). The TPD would then only be applied to disposition-involving cases. This, of course, does not rule out

that the other cases coincidentally also happen to support the second solution; but the generality of the TPD is restricted.

The last thing I want to discuss is the possible difference between the beginning and the end of a process. One could argue that there is a metaphysical difference between the beginning and the end of a process and that I have only spoken about the beginning. This is a different kind of attack to the generality of the TPD solution. It seems like you can accept everything I have argued for and still hold that the TPD only covers half of the cases. Reconsider the car, which is first in rest than in motion. Now also assume that it comes to rest again after a short period of motion. In this example, there are two interesting limits, the first between the initial rest and the motion; the second between the motion and the later rest. The objection would be that I have given only an account of the first instance.

First, I want to point out that this worry does not challenge the TPD solution itself but merely its generality. So, one option would be to just bite the bullet and accept that the TPD just gives us half of the picture. But maybe we can have more.

Why should we accept the asymmetry between beginnings and ends of processes in the first place? The moving car has the disposition to stop. You can stop it by jamming on the breaks, or it can be stopped in a more unpleasant way by guard rails. We have already given an account about the change from unmanifested to manifesting: the TPD says that there is a first moment of the manifestation process, and hence the second solution is to be also applied in this case. So, the «end» of the one process actually is the beginning of another process.

If this reply is sensible, one could try to draw implications regarding the fundamentality of different kinds of changes from it. Strobach distinguishes successes, or: s-changes and Cambridge-, or: C-changes (Strobach 1998, 2). According to Strobach, an s-change takes place between two positive states, e.g., between rest and motion; while C-changes consist in the beginning or ending of one positive state. Strobach, rightly, points out that «[e]very s-change consists of two C-changes: the ending of the old and the beginning of the new state».

This, in itself, does not imply anything about the fundamentality of the kinds of changes. But if I'm right that the end of a process has to be understood as the beginning of a new process, then the two C-changes involved are not on a par. And this, in turn, suggests that C-changes are ontologically more fundamental than s-changes. The picture is this: we have beginnings of processes (via dispositions manifesting), but each beginning is also the ending of an incompatible process. So, each beginning of motion is also the end of rest, and both together then is the s-change from motion to rest; while each beginning of rest is also the end of motion, and both together constitute the s-change from rest to motion.

This concludes my discussion of the TPD solution to the temporal limit decision problem. Its core – that disposition function as metaphysical symmetry-breaker that favour the second solution, namely that the limit always belongs to the new – is relatively independent of the more speculative considerations at the end of this section. However, I think it all amounts to a nice overall picture. Let us now take a step back and assess the argumentative setup of my account.

V. Conclusion

I have argued that the TPD allows for a solution to the temporal limit decision problem; but I did not argue for the TPD in this paper, so it might seem that the whole argument is only hypothetically valid. This however, is not the case. First, my goal was

more general than just the TPD. I wanted to show *that* the debate about dispositions is relevant to the debate about the temporal limit decision problem. Regarding this goal, the TPD only was an example with whose help I wanted to show how the debate about dispositions can influence the debate about the moment of change. If my argument was convincing, the claim that dispositions can be the symmetry-breaker is established. Furthermore, I don't know of any other attempt to take a specific theory of dispositions to have implications for the limit decision problem, let alone of any other account of dispositions that could potentially be used. It is the specific understanding of manifestations as processes of the TPD that enabled the transmission to the temporal limit decision problem – and this is unique, as far as I know. As long as there is no other contender, the TPD and with it the debate about dispositions speaks in favour of the second solution: the limiting instance belongs to the second and only the second interval.

But the whole argument can also be read the other way around: *that* it allows for a novel kind of solution to the temporal limit decision problem, speaks in favour of the TPD. It is quite a widespread view to think of philosophical theories in terms of costs and benefits. **18** Given stable costs, the more application cases a theory has, the more profitable it is. Thus, according to the motto «one person's modus ponens is another person's modus tollens» the solution to the temporal limit decision problem is an argument in favour of the TPD. **19**

Of course, I do not claim to have solved the limit decision problem once and for all. All I wanted to show was that dispositions allow for a new argument in favour of one of the classical solutions. I hope this will be seen as an advantage by the people who think that we should only accept gaps or gluts if there is no classical solution. My solution would need to be contrasted with the other available solutions in the next step. But this transcends this paper by far. In a nutshell, my goal in this paper was not to try and solve the limit decision problem but to enrich its solution space.

18 I don't think this is the right way to evaluate philosophical theories. I side with John Heil, who campaigns against the misuse of Occam's razor in philosophy (Heil, 2012, 97). Used too early in theorizing, Occam's razor can turn into a straitjacket and hinder the capturing of the complexity of the world. My ontological preference rather matches what James Ladyman and Don Ross have called *Rainforest Realism*. «Ours is thus a realism of lush and leafy spaces rather than deserts, with science regularly revealing new thickets of canopy. Anyone is welcome to go on sharing Quine's aesthetic appreciation of deserts, but we think the facts now suggest that we must reconcile ourselves to live in the rainforest» (Ladyman et al. 2007, 234).

19 So, for example, I cannot see how a (neo-)humean theory of change can be a symmetry-breaker for a temporal limit decision case.

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III. ESPLORAZIONI / FURTHER PERSPECTIVES

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**Rivivere l'incubo
di Zenone.**

Due evidenze cliniche

Rodrigo Codermatz

Rivivere l'incubo di Zenone. Due evidenze cliniche Rodrigo Codermatz

Rodrigo Codermatz, dopo essersi laureato in Filosofia all'Università di Trieste, per anni si è dedicato allo studio della psichiatria fenomenologica e della psicoanalisi. Attualmente partecipa al gruppo di Neuropsicoanalisi del Centro di Formazione e Ricerca in Psicoanalisi di Trieste a cui è associato.

Phenomenology has provided important investigative tools to psychopathology, psychiatry, neuropsychology and clinical psychology: one of these is undoubtedly the notion of lived temporality, duration, subjective episodic temporality that we find in many clinical models among such as Dalla Barba's Memory, Consciousness and Temporality Theory and Parnas's Ipseity-Disturbance Model. From the comparison of these models, we discover that both Dalla Barba's Temporal Consciousness and Parnas's Ipseity are lived temporality: a malfunction or weakening of this lived temporality would lead to confabulation (Dalla Barba) and to the manifestation of the first prodromal and early symptoms of a spectrum syndrome of schizophrenia (Parnas). In both disturbances time is blocked, encapsulated in the moment: in confabulation it becomes the serial cloning of a revitalized and relived engram; in schizophrenia a step that we cannot take in time, an eternal slow motion, Achilles or the arrow immobilized in their island of time. The lived temporality therefore leaves the purely speculative sphere and takes the form of a trans-diagnostic and differential diagnosis criterion in a dimensional approach that is by now guiding the latest clinical research. What role can the philosopher still have in this perspective?

TEMPO VISSUTO

SCHIZOFRENIA

CONFABULAZIONE

TEMPORAL CONSCIOUSNESS

IPSEITY

Introduzione

La psichiatria e la neuropsicologia fenomenologiche contemporanee hanno fatto propria la riflessione sulla temporalità laddove la fenomenologia husserliana s'interseca col pensiero di Bergson (Minkowski), di Heidegger (Binswanger, Tellenbach), di Sartre, Polanyi e Merleau-Ponty. Il concetto di tempo vissuto è inteso come durata, come temporalità presente, tacita, prossimale, immediata, personale, vissuta in prima persona, immersione sintonica nel mondo come progettualità distesa sulle tre dimensioni temporali e intenzionante, volta a costituire preriflessivamente l'identità del soggetto e la trascendenza mondana. In questo senso è divenuto ormai il nucleo fondante di molte teorie e modelli di ricerca nel campo della neuropsicologia e della psichiatria, rivestendo un'importante funzione di diagnosi precoce e differenziale. Il concetto di tempo vissuto, per come lo abbiamo definito, imposta inoltre un costrutto per un fertile programma di ricerca interdisciplinare e un proficuo dialogo tra diversi ambiti quali la filosofia, la neuropsicologia, la psichiatria, la psicanalisi e le neuroscienze in generale.

Nel presente lavoro prenderò in esame due modelli, entrambi dichiarati debitori della tradizione fenomenologica: la Memory, Consciousness and Temporality Theory (MCTT) di Dalla Barba (2002) e i suoi studi sulla confabulazione in ambito neuropsicologico e l'Ipseity-Disturbance Model (IDM) di Parnas (2014) sui sintomi prodromici della schizofrenia in ambito psichiatrico. Comune a entrambi è, a mio parere, il concetto di vissuto in prima persona – il sentirsi situato come *Befindlichkeit*, qualità soggettiva dell'esperienza, i qualia di Chalmers che ci assicurano di essere effettivamente noi stessi presenti *hic et nunc* – dal quale vorrei iniziare questa mia riflessione: «ogni persona vive un tempo suo proprio, un tempo intraducibile, ognuno sente per sé, così come ognuno ha fame per sé, vive per sé, muore per sé. Nessuno può sostituirsi a questa nostra e sua esperienza» (Minkowski 1933, xi),

Sia la Temporal Consciousness della MCTT di Dalla Barba che l'Ipseity o Minimal Self nell'IDM di Parnas sono prospettiva in prima persona, presenzialità, temporalità personale, preriflessiva, tacita e prossimale immersione (carne husserliana) e protensione progettuale nel mondo distesa sulle tre dimensioni temporali, memoria episodica autobiografica e, in quanto tali, assolutamente inscrivibili nella nozione minkowskiana di tempo vissuto. Un malfunzionamento o un indebolimento di questa temporalità vissuta porterebbe, secondo gli autori, alla confabulazione nel primo caso (Dalla Barba) e al manifestarsi dei primi sintomi prodromici e precoci di una sindrome dello spettro della schizofrenia nel secondo caso (Parnas). Dal punto di vista fenomenologico, dicono entrambi gli autori, sia la confabulazione che la schizofrenia sono disturbi della temporalità vissuta: è Minkowski stesso ad affermare che la schizofrenia è durata intaccata, impossibilità di assimilare tutto ciò che è movimento e durata.

Avremo allora sia nella confabulazione che nella schizofrenia, l'incapsulamento nell'attimo: la clonazione seriale di un frammento del passato autobiografico ed episodico, un engramma rivitalizzato e rivissuto che ci cade addosso come una camicia di forza o un'armatura, compulsivi ritagli del passato nella confabulazione e un passo che non riusciamo a fare in tempo, un'eterna moviola, nella schizofrenia: un Achille o una freccia immobilizzati nella loro isola di tempo.

Che anche la domanda filosofica sul tempo non sia che un'eccessiva astrazione, una simil iper-riflessività, una speculazione destinata a rimuovere gli aspetti disperanti della temporalità nei vissuti tipici e quotidiani come in quelli atipici e patologici?

Che ruolo rimane allora alla filosofia a cospetto del tempo vissuto?

Non basta confidare in una precisa funzione o compito del filosofo nell'aiutare il professionista della salute mentale; bensì il professionista della salute mentale deve essere prima di tutto filosofo nell'assumere quella postura atta all'ascolto del paziente quale conditio sine qua non di ogni possibile "aiuto", nel percepire precocemente nel narrato e nel vissuto temporale del soggetto quel "vincolo creodico" che può preludere alla catastrofe. Una seria meditazione sulla temporalità deve ormai oltrepassare il dilettantismo filosofico, valersi dell'esperienza clinica per porsi al centro della ricerca (come lo dimostrano alcune teorie sulla disperazione) ¹ in un approccio dimensionale e trans-diagnostico dove il tempo vissuto venga a configurarsi come criterio diagnostico sovraordinato a più categorie nosologiche.

¹ Per esempio Abramson et al. (1989) e Panzarella et al. (2006).

I. Memory, Consciousness and Temporality Theory

La MCTT, definita dall'autore stesso neurofenomenologica perché combina la descrizione fenomenologica della confabulazione con i risultati di recenti studi neurologici e neurocognitivi (imaging), in linea con la tradizione fenomenologica continentale (Brentano, Sartre, Merleau-Ponty e Husserl), parte dal presupposto che la coscienza è intenzionalità, ossia noesi, atto noetico proiettato sugli oggetti, ed è sempre coscienza di qualcosa. Di conseguenza la coscienza "investe" i suoi oggetti secondo modalità diverse: per esempio io posso percepire questa penna sul tavolo di fronte a me, se chiudo gli occhi posso immaginarla, posso odiarla o amarla, posso distinguerla da una barca a vela, posso ricordarla, ricordare dove e quando l'ho comprata; tutte queste relazioni tra la coscienza e il suo oggetto sono originali e irriducibili perché diverse tra loro e non sono il risultato finale di un processo ontologico causale.

Il bicchiere sulla tavola, qui di fronte a me, apporta una modificazione nel mio cervello, nel mio sistema nervoso e cognitivo, modificazione che definisco traccia mnestica; ma qual è la natura temporale di questa traccia mnestica? Senz'altro il bicchiere-sulla-tavola non può che essere presente. Dalla Barba (2016) cita Merleau-Ponty:

Questo tavolo porta delle tracce della mia vita passata, vi ho inciso le mie iniziali, vi ho fatto delle macchie d'inchiostro. Ma, di per se stesse, queste tracce non rinviano al passato: sono presenti; e, se vi trovo dei segni di qualche evento "anteriore", li trovo perché, per altra via, ho il senso del passato, perché porto in me questo significato. Se il mio cervello conserva le tracce del processo corporeo che ha accompagnato una delle mie percezioni, e se l'impulso nervoso passa di nuovo attraverso questi percorsi già tracciati, la mia percezione riapparirà, io avrò una nuova percezione, forse pure affievolita e irreale; tuttavia, in nessun caso questa percezione, che è presente, potrà indicarmi un evento passato [...] una percezione conservata è una percezione, continua a esistere, è sempre al presente, non apre dietro a noi quella dimensione di fuga e di assenza che è il passato (1945, 529-530).

I segni che gli eventi hanno lasciato sugli oggetti acquisiscono il senso di passato solo in virtù di una coscienza che glielo attribuisce: le tracce sui cuscini del divano mi parlano di tutte le volte che io e i miei ospiti vi ci siamo seduti sopra ma non hanno mai smesso di essere presenti, sono io che gli conferisco il passato. Le incisioni e le macchie d'inchiostro sulla scrivania o i segni sui cuscini del divano non sono che la riattivazione delle modificazioni che gli eventi hanno causato a livello fisiologico, biochimico, neuroanatomico e funzionale e questa riattivazione non è che una nuova percezione, un rivivere paradossalmente l'evento contenuto nella traccia mnestica (Paradox of the Memory Trace).

Il tempo non può essere cercato nelle cose del mondo e neppure nel cervello, in quanto cosa tra le altre (tracce mnestiche), poiché il tempo, in se stesso, non esiste e le sue tre dimensioni non sono che strutture subordinate di una temporalità personale fermamente ancorata al presente, senza alcuna possibilità di viaggiare nel passato o nel futuro, senza alcun Mental Time Travelling, come non c'è priorità ontologica della memoria sull'anticipazione del futuro, sebbene queste strutture dipendano dallo stesso meccanismo neurale (lobo medio temporale.) Scrive Minkowski: «il tempo si presenta a noi come fenomeno primitivo, sempre presente, vivo [...] vicinissimo a noi» (1933, 19) e sembra descrivere il tacito (intraducibile) sé pre-riflessivo, il sé prossimale di Polanyi. E ancora: «Il fenomeno che introduce primitivamente il fattore direzione nel tempo non è la memoria, bensì lo slancio [...] non mi sembra che il passato ci sia dato in modo primitivo della memoria [...] l'avvenire vissuto ci è dato incontestabilmente in modo più primitivo del passato» (1933, 19). L'esperienza fenomenologica di un futuro personale verso cui protendere è, per l'appunto, lo slancio di cui ci parla Minkowski, mentre espressioni come “vivere nel passato” o “rivivere il passato” testimoniano che il passato appartiene di fatto al presente.

Gli oggetti del mondo, quindi, non sono mai presenti, passati o futuri ma ricevono una dimensione temporale solo in virtù della nostra presenza:

Risulta dunque chiaro che futuro e passato non esistono, e che impropriamente si dice: «Tre sono i tempi: il passato, il presente il futuro». Più esatto, sarebbe dire: «Tre sono i tempi: il presente del passato, il presente del presente, il presente del futuro». Queste ultime tre forme esistono nell'anima, né vedo possibilità altrove: il presente del passato è la memoria, il presente del presente è l'intuizione diretta, il presente del futuro è l'attesa. (Agostino, 325)

Gli eventi, di per sé, producono patterns di modificazione del cervello aspecifici e atemporali: aspecifici perché non contengono alcuna informazione che ci dice se sono rappresentazioni, ricordi, significati, procedure o altro; atemporali perché non contengono alcuna informazione concernente il tempo, né sono organizzati come una successione. Questi patterns, inoltre, possono essere più o meno stabili o vulnerabili a seconda dell'attenzione prestata nella codifica, dell'emotività associata all'evento, della profondità di codifica, se sono esperienze richiamate o ripetute più volte o associate ad altre ugualmente salienti.

È questa temporalità vissuta e personale - questa pura presenza *hic et nunc* della mia persona, quest' «unica posizione della lancetta e del pendolo» (Bergson 1889, 63) ma lungi dall'essere un homunculus “frontale” che setaccia e marca il tempo - a investire di unicità storica ed esistenziale la realtà e il mondo, ad aprire la dimensione *episodica e autobiografica* a immettere il tempo nel mondo, a collocare oggetti, eventi e informazioni nelle tre dimensioni della nostra temporalità soggettiva: Dalla Barba la definisce *Temporal Consciousness* (TC). Al di fuori di essa il mondo è il «nostro fantasma scolorito» (Bergson 1889, 134), è mera simultaneità; le cose esterne cambiano senza dubbio ma i loro momenti si succedono solo per una coscienza che li ricorda. Ben distinta dalla TC è, invece, la *Knowing Consciousness* (KC) un'altra modalità di coscienza che ci permette, al contrario della TC, di accedere a una temporalità impersonale, a una memoria semantica sia storica (sapere che Bush è stato presidente degli Stati Uniti) che autobiografica (conoscere la propria data di nascita, del matrimonio, sapere che quel cane è nostro), ad un futuro impersonale (conoscere la data delle prossime elezioni); ma la KC non concerne mai l'esperienza fenomenologica del tempo personale, del rivivere un ricordo o vivere un'attesa o del sentirsi situati e orientati nel presente riservata alla TC. La TC, nel suo essere tempo vissuto personale e attuale

(presente), cioè durata, non può essere confusa con la KC del tempo esterno, comune, della simultaneità e della molteplicità. Quando vedo la penna sul tavolo io la investo con entrambe le modalità di coscienza: la TC, interagendo con *patterns* meno stabili, le conferirà una sua unicità (U) inscritta in una temporalità personale (per esempio, quella specifica penna, che ho comprato la scorsa settimana in quel preciso negozio, e non altre penne) mentre la KC, interagendo con *patterns* più stabili, la riconoscerà come una penna tra le tante, nella sua molteplicità (M) trascendente ogni vissuto temporale: scriveva Minkowski (1933, 26): «Tutto ciò che è due in rapporto al tempo si succede. Inversamente, tutto ciò che dura passando si afferma come uno in relazione al tempo, allo stesso modo in cui tutto ciò che si succede si afferma come due o molti.»

La dissociazione delle due modalità di coscienza è ampiamente documentata: la TC e la memoria episodica vanno completamente perse nel danno bilaterale e completo dell'ippocampo ossia nell'amnesia ippocampale (Scoville & Milner 1957). I pazienti amnesici non hanno alcuna esperienza del loro tempo personale: gli oggetti possono sì essere riconosciuti come familiari ma non rientrano in un ricordo ben preciso, non vengono cioè investiti nella loro unicità ma processati dalla KC attraverso *patterns* più stabili e rimangono in una sfera, per così dire, impersonale. I pazienti, bloccati in un istantaneo presente, manifestano incapacità di orientarsi in un presente e di progettarsi in un futuro personali, perdita della memoria retrograda e anterograda e di ogni esperienza fenomenologica della temporalità soggettiva e personale in tutte e tre le sue dimensioni. Al contrario rimangono preservate la memoria implicita procedurale, la memoria semantica, il linguaggio, la conoscenza del tempo fisico e cronologico (Husserl 1893), la conoscenza semantica delle unità di tempo e delle loro relazioni, del tempo passato pubblico, autobiografico e della storia, nonché l'anticipazione di eventi pubblici, insomma, tutte le dimensioni concernenti la temporalità impersonale.

Le ricerche di Dalla Barba sulla confabulazione, e che qui ci interessano particolarmente, vanno in tal direzione. Dalla Barba e La Corte (2015) ipotizzano che l'ippocampo sia il correlato neurale della TC, avvalorandosi di recenti e numerosi studi di neuropsicologia e neuroimaging: l'ippocampo risulta essere una struttura centrale all'interno di una rete coinvolta nell'esistenza temporale dell'individuo. Definiscono quindi la confabulazione come produzione di false memorie, un tipo di distorsione della memoria che produce stati o azioni che sono non intenzionalmente incongrue con la storia, il background, la situazione presente e futura del soggetto. Nella confabulazione e nell'amnesia diencefalica, dove abbiamo un ippocampo almeno parzialmente preservato, la TC è presente ma malfunzionante in quanto riceve informazioni già distorte da altre parti del cervello: la TC non interagisce più con i *patterns* meno stabili perché questi sono aboliti o resi inaccessibili in modalità TC ma va a interagire con quelli più stabili, con il risultato che gli eventi ripetuti, le abitudini, la molteplicità, sono processati come evento unico, passato, presente o futuro (M è confuso con U). Si hanno allora le cosiddette *habits confabulation*, che sono di gran lunga le più frequenti e riflettono il richiamo di un passato episodico personale (ripetute esperienze personali passate, routine, abitudini o eventi frequenti) processato erroneamente come un unico e specifico evento in uno specifico contesto spazio-temporale. Quindi il contenuto di queste confabulazioni, formatosi dalla condensazione di eventi o comportamenti abitudinari e ripetuti, è verosimile, plausibile, indistinguibile dai veri ricordi persino dai familiari o da chi è in stretto rapporto col paziente e ne conosce la storia, il background, la sua situazione presente e futura. Così un paziente confabulante ospedalizzato, al quale venga chiesto cos'abbia fatto la sera prima, riporterà una

sua attività abitudinarie aggiungendo talvolta l'allocuzione "come al solito": un evento occorso in un unico e specifico contesto spazio-temporale (la sera prima) è rimpiazzato da un'abitudine, dalla routine, dal prodotto di una serie di ripetuti eventi passati che non hanno mai costituito una specifica singolarità spazio-temporale.

Un'altra caratteristica della confabulazione è il suo estendersi e coinvolgere tutta la temporalità soggettiva e personale del paziente, il suo passato, la sua memoria episodica, l'orientamento nel presente e il suo protendere al futuro: la tendenza dei confabulatori a con-fondere abitudini ed eventi ripetuti in un episodio unico non riguarda solo il passato ma anche il presente e il futuro. Spesso, infatti, confabulano sul loro presente dicendo, per esempio, che sono a scuola mentre invece si trovano all'ospedale, o sul loro futuro dicendo che domani dovranno recarsi al lavoro quando, invece, non lavorano più. ² Questa temporalità soggettiva e personale distorta e malfunzionante alla base della confabulazione può essere isolata e misurata empiricamente tramite la Batteria della confabulazione (Dalla Barba, 1993a).

² Questo è stato dimostrato nel *Recognition Memory Task* (Serra et al., 2004): ai pazienti venivano presentati degli *item*, alcuni una volta sola, altri quattro volte; i pazienti confabulanti affermavano di aver visto più volte *item* presentati una sola volta.

Le tecniche di neuroimaging evidenziano una long-axis specialisation che dall'ippocampo anteriore, dove vengono formate le rappresentazioni generali, proietta all'ippocampo posteriore dove avviene l'elaborazione dei separation/completion patterns e delle fine-grained local representation (funzione di pointer), cioè la ricerca e la selezione nella neocorteccia associativa di precise e specifiche informazioni episodiche, dei ricordi plausibili atti a riempire dei gap mnemonici (abductive inference). L'ippocampo posteriore e, in particolare, il CA3 (Corno di Ammone 3) giocherebbero quindi un ruolo fondamentale per la TC come modalità di coscienza conferente l'unicità episodica alla realtà. Prova a favore di questa ipotesi è che il CA3, comparato alla corteccia entorinale (EC), al subicolo, al CA1 e al CA2, è relativamente preservato nelle fasi d'esordio dell'AD dove di fatto abbiamo ancora le confabulazioni. Dunque, l'ippocampo e in particolare il CA3 sarebbero, per Dalla Barba, il correlato anatomico e neurale della TC e quindi della temporalità vissuta e personale. Lesioni a differenti aree del cervello porterebbero al malfunzionamento della TC per cui l'unicità di un vissuto personale verrebbe riprodotta serialmente e clonata in una molteplicità astorica e impersonale dalla KC come accade, per l'appunto, nelle cosiddette habit confabulations: c'è un'intrusione semantica nel tempo vissuto che genera il continuum, molteplicità, serie, successione e simultaneità.

La confabulazione non sarebbe quindi un semplice disordine della memoria ma il frutto di una distorsione della nostra temporalità vissuta personale e soggettiva, l'eterno ritorno seriale di un frammento del nostro passato sottoposto a continua clonazione. Questo clone temporale imprigiona e immobilizza il paziente, lo obbliga a recitare sempre la stessa parte, il suo passato: il fiume diviene risacca nella quale ci si bagna più volte.

II. Ipseity-Disturbance Model

Nell'IDM (Nelson et al., 2014) gli autori, anch'essi debitori alla tradizione fenomenologica, definiscono ipseità la sensazione di costituire un soggetto vitale, autocosciente e autoidentificantesi come polo di esperienza e come prospettiva in prima persona sul mondo, intenzionalità e costituzione trascendentale dell'oggetto: caratteristica fondamentale della coscienza è il suo essere diretta sempre verso un oggetto (la coscienza è sempre coscienza di qualcosa) e questa propensione all'oggetto è, per l'appunto,

l'intenzionalità. Riprendono anche la distinzione tra coscienza riflessiva tematica, focale ed esplicita (guardo la sedia alla mia destra) e una coscienza pre-riflessiva più basilare, **3** un tacito sentimento di *embeddedness in the world*, **4** di immersione nel mondo (Husserl parlava di Leib, carne come intersoggettività trascendentale a monte della costituzione dell'altro), definita operative intentionality che costituisce la nostra primaria presenza nel mondo che semplicemente accade, direbbe Henry (1963), cioè è data e potremmo pensare all'essere-nel-mondo (Dasein) come essere-gettati (Geworfenheit) heideggeriano. Senso del sé come unreflected self-presence ed *embeddedness in the world* sono inseparabili, soggetto e oggetto sono due momenti astratti di un'unica struttura che è il presente (Parnas & Handest 2003). Noi abbiamo coscienza di noi stessi grazie al nostro essere assorbiti nel mondo delle cose e ogni atto intenzionale è costituito da questi due aspetti interdipendenti, l'*embeddedness in the world* e la tacita pre-riflessiva autocoscienza come diretta, irriflessa, spontanea esperienza dei nostri pensieri, percezioni, sentimenti e sofferenze vissuti in prima persona: è questo essere vissuto in prima persona che rende un'esperienza soggettiva. Solo in un secondo momento, ciò che è stato esperito da una prospettiva personale ed è entrato nel campo di coscienza, **5** permette all'evento passato di diventare ricordo e contribuisce al senso di identità personale (Parnas, 2000). Parnas riprende il concetto strawsoniano di persona come riconoscibilità nel tempo attraverso i cambiamenti (identità diacronica e sincronica di Jaspers e Scharfetter). **6** Questo immediato e spontaneo senso di vitalità non va però letto in termini vitalistici: esso non è solo fonte di energia ma è il medium in cui l'esperienza è costituita e articolata. Nelson (et al., 2014) usa il termine Minimal self invece di ipseità e lo definisce come la qualità implicita della coscienza di darsi in prima persona, la coscienza implicita per cui tutta l'esperienza si articola nella prospettiva in prima persona, come la mia esperienza.

Nel concetto di *embeddedness* è insita, inoltre, l'esperienza stessa del nostro corpo che ha la peculiarità, a differenza di tutti gli altri corpi del mondo, di essere esperito simultaneamente come vissuto (Leib) o come semplice oggetto tra gli altri oggetti del mondo (Körper), di stare sospeso e oscillare tra queste due dimensioni. Queste due modalità intenzionali possono corrispondere alla distinzione focal v/o tacit tra immagine corporea e schema corporeo, dove la prima si riferisce alla rappresentazione obiettiva più o meno conscia del proprio corpo, la seconda a una consapevolezza implicita di fondo del nostro corpo che nella percezione entra in contatto e si incarna nel mondo, una consapevolezza cenestesica e propriocettiva sussidiaria che farebbe da medium all'ipseità nel suo incontrarsi e incarnarsi, a sua volta, nel medium del mondo degli oggetti. Parnas riprende evidentemente la fenomenologia di Merleau-Ponty quando parla di un senso di direzione familiare e abitudinaria: in quanto Leib, il mio corpo si incarna nel mondo, diviene abitudine primordiale, sapere abituale del mondo come schema corporeo preperceptivo: non sono io a toccare, dice Merleau-Ponty, ma il mio corpo, sotto di me c'è un altro soggetto, per il quale un mondo esiste. La percezione stessa «è accoppiamento del nostro corpo con le cose» (Merleau-Ponty 1945, 418): la piuma di un cappello può diventare una mano e la punta del bastone di un cieco un occhio. Il nostro corpo inerisce allo spazio e questa inerenza è l'*embeddedness* a cui si riferisce Parnas.

Per Parnas la schizofrenia, definita per l'appunto disturbo dell'esperienza del

3 Polanyi (1964) distingueva il polo distale (coscienza tematica) da quello prossimale (*tacit dimension*).

4 Cfr. anche Fuchs (2016).

5 Cfr. *arc of awareness* di Merleau-Ponty e Polanyi e il *cono attentivo* di Fuchs (2007).

6 Come la intendeva anche Ricœur nel suo arco ermeneutico (1991).

sé (Self-disorder) o dell'ipseità, va a colpire e alterare tutti questi aspetti dell'ipseità con un indebolimento della loro dimensione tacita (*diminished self-affection*), a cui subentra un intensificarsi di quella focale (*hyperreflexivity*): la dimensione tacita, che era stata data per scontata come medium dell'autocoscienza, ora diviene abitata, frequentata; ciò che normalmente è tacito diviene focale ed esplicito fino all'iper-riflessività, che si riferisce quindi a forme di esagerata autocoscienza e iperfocalizzazione attentiva. *Diminished self-affection* e iper-riflessività sono quindi strettamente correlate, complementari e compenetrantesi e il sintomo nasce dove l'indebolimento dell'una permette l'acutizzarsi dell'altra. Questo punto di vista permette, secondo Parnas, una rilettura critica e unitaria dei criteri diagnostici della schizofrenia (sintomi positivi, negativi e di disorganizzazione).

Un disturbo dell'ipseità colpisce quindi principalmente il senso di presenza e di identità con se stessi e il correlativo senso di co-presenzialità o simultaneità del mondo, il tempo vissuto: ne troviamo una esauriente descrizione fenomenologica nel secondo dominio dell'EASE-scale (*Examination of Anomalous Self-Experience*, Parnas et al., 2005). Innanzitutto nella *diminished self-affection* disturbi del senso di presenza appaiono molto precocemente come prodromi della schizofrenia e vengono descritti come una perdita di immersione nel mondo, un senso di imposto distacco dal mondo, un diminuito senso di presenza e di esistere, un evanescente senso del vissuto. Emergono profondi cambiamenti nella temporalità soggettiva (vissuta come lenta, discontinua, accelerata, rallentata, ferma), una diminuzione della chiarezza o trasparenza della coscienza, una certa opacità e un pervasivo senso di vuoto interno, di perdita del proprio nucleo interno, un senso di distanza dal mondo esterno (che sembra irreali, morto, meccanico) e una sensazione di vivere in ritardo o in una "campana di vetro", di percepire colori spenti e oggetti lontani. È persa la tacita e preriflessiva *myselfness* della propria esperienza, condizione e medium di una spontanea intenzionalità, e insorge una distanza fenomenologica per cui l'oggetto percepito appare in qualche modo filtrato, deprivato della sua presenza. Nel paziente subentra un senso di impossibilità a mantenere una presa sulla realtà, non si sente più affetto dal mondo, non è più stimolato, incitato, attratto, influenzato, immerso in esso: tutto è senza significato e il paziente lamenta di non sentirsi o di aver perso il contatto con se stesso, che qualcosa dentro di lui è cambiato, è diventato inumano.

In questo complesso panorama d'esordio predominano i sintomi negativi. La perdita dell'evidenza naturale come sindrome negativa è per Blankenburg (1971) il sintomo principale della schizofrenia nella sua forma più pura e riconoscibile: si tratta della perdita del senso comune dell'orientarsi nel mondo, di quel senso naturale di ovvietà e spontaneità, di quel tacito background che fa sì che la persona prenda per ovvi e scontati, per naturali ed evidenti, molti aspetti del mondo sociale e pratico con cui entra in contatto. Ritirando la sua presa e postura intenzionante ed esplorativa dal mondo, per cui questo non gli è più abituale e familiare, l'attenzione focale del paziente è diretta verso qualcosa che, in se stesso, nel suo corpo ma anche nel mondo, era finora vissuta o esperita tacitamente ma che ora richiede attenzione e concentrazione. Per esempio, la paziente di Blankenburg Anna Rau si sente "scucita", "disincarnata", tormentata da problemi e questioni che la gente di solito dà per scontate, le è impossibile "fermarsi dal pensare": esperisce quindi un'enorme distanza tra lei e le cose, che sono, a questo punto, solo dei pensati e insorgono l'iper-riflessività e la caratteristica perplessità schizofrenica (*Ratlösigkeit*) descritta da Störing (1939). L'iper-riflessività è la seconda modalità distorta della temporalità su cui verterà questa discussione.

La perdita della presa naturale spontanea sul mondo dissolve ogni possibile Gestalt e porta all'emergere e accentuarsi di singoli aspetti isolati, che diventano

intrusivi e si caricano di un significato esagerato, straordinario, emozionalmente invasivo e spesso autoriferito (apofania conradiana). In termini conradiani diremmo che l'oggetto mondano si è trasformato in una nube o inondazione (*Überflutung*) d'essenze, di proprietà d'essenze (*freigesetzt Worden*) e, in questa disarticolazione (*locke-rung*) della sua coerenza percettiva, dispiega la fisionomia come rapporto incrociato di *anastrophè* e apofania, ossia coscienza abnorme di significato. Mentre nell'esplosione fisionomica, nell'essere tenuto in ostaggio dal particolare, il paziente si sente alla mercé del mondo, segue la sua catastrofe e si sente "andare a pezzi", nella decostruzione della Gestalt, l'iper-riflessività non è più curiosità e perplessità ma diviene ruminazione pseudo-ossessiva, ansia, attacco di panico, stupor: l'esperienza introspettiva finisce con l'assumere caratteristiche quasi percettive (*Gedankenlautwerden*) sino a costituire un fenomeno che non viene più riconosciuto, trasformandosi in qualcosa di alieno, di completamente estraneo, una forza che sorveglia, controlla, o tiene in pugno (delirio di influenza), fino alla totale scomparsa di ogni distinzione e demarcazione tra sé e l'altro, alla con-fusione con l'altro (transitivismo di Bleuer come *fluid transition*). Questo processo di *backward migration* apre la strada all'emergere dei cosiddetti sintomi positivi, quali le allucinazioni e i deliri, che non nascono *ex novo* dal nulla ma ci son sempre stati e vengono riscoperti, per così dire, da questa dimensione di iper-riflessività (lo stesso accade anche per la disorganizzazione del pensiero, del linguaggio e dell'attenzione).

Si nota, infatti, un totale disancoramento, una fuga dal punto di vista prospettico e contestuale e la disinibizione di tutte le altre prospettive che convergono in un flusso, interferendo e compenetrandosi: una vera e propria cascata di iper-riflessività, una proliferazione di metaprospettive, da cui il paziente accede a un punto di vista esterno, più astratto e comprensivo, sovrastando questo flusso e cogliendo tutte le prospettive in una sola unica e grande giustapposizione. Ma ogni pensiero rimane indipendente e disconnesso, pulsa (*pulsating*) al suo posto e preme (*Gedankenjagen*), tanto che il paziente si sente sovrastato e incalzato dai pensieri, non riesce più a prendere l'iniziativa, a prestare attenzione, perde ogni capacità di controllo (*monitoring*) e di pianificazione (*planning*), diviene distraibile, il suo pensiero e il suo discorso si fanno confusi, incoerenti, tangenziali fino al deragliamento o al totale blocco del pensiero (*deficit delle facoltà esecutive della working memory*). Nel giustapporsi le prospettive si con-fondono e il loro contenuto diviene spesso neutrale tanto da gettare il paziente nella più completa perplessità e incapacità di decisione (*ambivalence*) fino alla paralisi dell'azione e al collasso di ogni *goal-directed behavior*. Il sé segue questa disintegrazione e deframmentazione iper-riflessiva sdoppiandosi (*Ich Spaltung*), dividendosi o compartimentalizzandosi (per esempio in un ego osservante e uno osservato che ingaggiano una irrisolta battaglia tra il bene e il male) e può subentrare una vera e propria confusione di identità.

L'iper-riflessività come *backward migration* blocca ogni protensione verso il futuro che rimane "bloccato, non avviabile" mentre il presente si trasforma in uno stereotipato ripetersi di un passato congelato, già descritto da Jaspers (1913) come una perdita di continuità nella temporalità dello schizofrenico e un continuo ripetersi di *deja vù*, di momenti passati nel presente. Stanghellini (et al., 2016) parla di frammentazione del tempo in atomici *now-moments* che si impongono e adombrano il soggetto, io aggiungerei di veri e propri conati di temporalità vissuta, di aborti temporali. L'aspetto protensivo della temporalità vissuta entra in scacco proprio come nella confabulazione di Dalla Barba, dove la TC malfunzionante ripropone pur sempre uno stesso fotogramma monolitico e seriale del passato personale: il fiume è diventato un blocco di ghiaccio ma è pur sempre lo stesso fiume.

Fuchs (2007) parla della protensione come di un cono di probabilità che origina dalla sintesi passiva della nostra temporalità vissuta (la *retentio* husserliana) e diviene aspettativa di come andranno le cose: 7 se io dico “ieri camminavo lungo il...” l’interlocutore si aspetta “ponte” piuttosto che “burro”. Questa tensione tra la prima parte della frase e la sua conclusione costituisce il senso di agency, la propria identità: è il tra di Kimura, quell’*aida* intersoggettiva come differenza derridiana, come ritardo temporale tra l’*onozukara* o secondo soggetto e il *mizukara* o primo soggetto. Il cono attualizza o inibisce probabilità (planning system e corteccia frontale), a seconda dello stato di vigilanza o nel caso di indebolimento della funzione protensiva, si può ritrarre e allargare (come nel sogno o in stati ipnotici indotti da droghe), interrompersi o frammentarsi come avviene nella schizofrenia. In questo caso, fallendo ogni processo inibitore, l’esterno diviene intrusivo e subentra il tentativo compensatorio da parte del soggetto di ricostruire una continuità interna attraverso l’iper-riflessività, quasi una rivalse cartesiana dell’anima sul corpo, o si rifugia in un’immobilità artificiale, minimizzando movimenti e percezioni, evitando ogni cambiamento (neophobia), ogni overstimulation e, al limite estremo, ritirandosi socialmente nel freezing of time, lo stupore catatonico, l’inversion of intentionality dei vissuti intrusivi.

7 Cfr. il *predictive coding* di Picard e Friston (2014).

Il tempo vissuto come TC o Ipseità – intesa come sensazione di costituire una prospettiva in prima persona, presenza pre-riflessa, contatto vitale con la realtà, sincronismo in quanto «facoltà di avanzare armoniosamente con il divenire ambiente, facendosi da lui penetrare e sentendosi uno con esso» (Minkowski, 1933, 280), come sensazione di costituire un soggetto vitale – perde slancio, si ritira: la concezione dinamica del tempo presupposto di entrambi i modelli esaminati, il presentismo di un tempo vissuto e personale, di una durata a cui è coesistente l’immersione nel mondo, un’incarnazione (Husserl) che riassorbe in sé le tre dimensioni temporali, si contrae, si frammenta, si atomizza e collassa in un continuum, indebitandosi con lo spazio.

Il momento compensativo della iper-riflessività (l’astrazione, la *Ratlösigkeit* di Störring, l’*apophänie* e la diffidenza conradiana, la perdita dell’evidenza naturale di Blankenburg) segna la rottura dell’organizzazione dinamica del tempo che diviene frammentato, compartimentizzato, parcellizzato, tomizzato per cui troviamo il collasso e l’indebolimento della funzione protensiva che si può ritrarre, allargare, interrompersi o frammentarsi, l’incapacità di procedere (perché di processo e non di evento si tratta) temporalmente, un’inerzia della temporalità vissuta che invece di protendersi al futuro si smembra autopticamente, si riavvolge su se stessa rileggendo le sue tracce in fotogrammi ricomposti in successione in una continuità senza durata: è il tempo incapace di avanzare, l’Achille o la freccia di Zenone che non appartengono più al tempo perché già risucchiati nel suo essere dissezionato, nel suo essere morto, nel suo non-essere, a prescindere dalla distanza, dalla meta, dallo spazio, come abbiamo visto non può esserci Mental Time Travelling. È questo tempo-fantasma che, come continuum, sommerge lo schizofrenico che si sente invaso da frammenti di passato e minacciato da frammenti di futuro (eventi catastrofici) e costringe il confabulatore nella camicia di forza della sua abitudine.

Volontari, attenti e precisi processi cognitivi di analisi in situazioni che di solito richiedono semplicemente comportamenti spontanei o automatici, una temporalità troppo lenta (slow down) o troppo veloce (speeding up), la sovrastima di intervalli temporali, un ritardo e un disturbo nei movimenti sequenziali delle dita, una ridotta abilità a riconoscere stimoli in intervalli di tempo minimali, disturbi negli span attentivi e nella working memory, delle funzioni esecutive (shifting, updating e

inhibition) localizzate nella corteccia prefrontale, sono sintomi che possono essere interpretati come gli equivalenti neuropsicologici della disintegrazione dell'unità temporale della coscienza (durata) nella schizofrenia, dell'iper-riflessività come backward migration, come stagnazione del tempo soggettivo contro il movimento nel mondo oggettivo.

Giersch (et al. 2016) sottolinea come nei pazienti schizofrenici sia compromessa la capacità di pianificare in anticipo una sequenza di azioni: nel Simon effect evidenzia la loro difficoltà a predire e seguire eventi in intervalli brevi di tempo, i pazienti rimangono come bloccati nel primo evento, incapaci di procedere al momento successivo; questi disturbi nel vissuto temporale sembrano essere anche alla base dei sintomi disorganizzativi. Per esempio nel “finger tapping” task il paziente SZ scompone l'azione in due momenti (abbassamento del dito fino al contatto con la superficie e attesa dell'informazione sensoria come input motorio per il risollevarlo del dito, momenti che nel soggetto tipico sono sintetizzati in una semplice e unica sequenza motoria) e dunque necessita di un tempo più lungo per eseguire l'azione che è programmata di passo in passo (analogamente si riscontra nei soggetti schizofrenici l'incapacità di tenere il tempo o di rilevare delle asincronie). Rifacendosi al modello di Frith (2005), gli autori sottolineano il ruolo importante di alcune reti neurali che coinvolgono il cervelletto (in particolare il peduncolo cerebellare medio), assieme ai già noti disturbi nella connettività neurale e nei sistemi dopaminergici, glutammatergici e del GABA, nel sequenziare l'azione: un ritardo della grandezza di millisecondi può impedire l'automatico integrarsi di momenti ed eventi discreti in un flusso vissuto come unico evento temporale (durata).

Un altro indirizzo di ricerca, rifacendosi al modello Bayesiano e al predictive coding di Friston (2008), evidenzia come i pazienti schizofrenici siano incapaci di avvalersi di stimoli-segnale nella predizione di uno stimolo-target, ossia falliscano il riconoscimento di una struttura sequenziale di cues nel prevenire eventi prevedibili. I pazienti schizofrenici, in poche parole, processerebbero allo stesso modo stimoli prevedibili e stimoli imprevedibili. Tecniche di fMRI e neuroimaging suggeriscono che questo sarebbe dovuto ad una maggiore attività delle connessioni neurali posteriori durante il compito di target detection, a un incremento della sensibilità delle cellule piramidali superficiali e degli interneuroni inibitori e a disfunzioni nella neuromodulazione dell'eccitabilità postsinaptica (dopamine-DR-1 e NMDA-R) in particolare nella lamina corticale sopragranulare. In questi pazienti resterebbe preservata la capacità di distinguere intervalli di tempo ma non quella di beneficiare di cues temporali e contingenti, del fluire del tempo, nell'adattarsi ai cambiamenti nei ritardi temporali. Nel caso citato da Martin (et al., 2018), i tempi di reazione del paziente AF non decessono affatto all'aumentare della probabilità del verificarsi dell'evento: è invalidata la sua capacità di formulare previsioni, la sua protensione intenzionante.

Conclusioni

Abbiamo cercato in queste pagine di delineare due quadri psicopatologici: nella confabulazione, la clonazione seriale di un frammento del passato autobiografico ed episodico, di un'azione abitudinaria del passato, non è altro che l'attivazione di un circuito neuronale ben definito, di un engramma rivitalizzato e rivissuto che ci cade addosso come una camicia di forza o un'armatura; abbiamo alluso metaforicamente ad una risacca che avanza e si ritrae, il fiume cerca di protrarsi (si confabula in tutte e tre le dimensioni temporali) ma continuamente ritorna sui suoi passi. Il tempo si disperde

nella autoptica dissezione in attimi, in singoli engrammi, prodotti serialmente da un sforzo confabulatorio che compulsivamente recupera ritagli del passato per colmare iati prodottisi nella temporalità vissuta. Parimenti, nella schizofrenia, imprigionati nel prima non riusciamo ad accedere al dopo: è un passo che non riusciamo a fare in tempo, non riusciamo a riappoggiare il piede a terra intenti e dispersi nel ripercorrere la moviola del nostro movimento. Nella confabulazione come nella schizofrenia il continuum filtra e dilaga nella durata; ma potremmo immaginare qualcosa di simile anche negli stati depressivi dove i *petites fautes* di Tellenbach costituiscono l'eterno ritorno di una coerenza di colpa nel rimuginare sul passato, o nella temporalità "circolare" della disperazione (Abramson et al. 1989 e Panzarella et al. 2006).

Ci chiedevamo in apertura se anche la domanda filosofica sul tempo non sia che un'eccessiva astrazione, una simil iper-riflessività e che non faccia il gioco del continuum col discredito della durata e della temporalità vissuta, che non debba, invece, essere declinata nel senso di un'indagine delle diverse modalità d'esistenza.

Le evidenze neuropsicologiche e psichiatriche a cui abbiamo accennato ci parlano di un tempo che si parcellizza e diviene paretico in funzione di determinati processi neurali alterati: ma non sono che dei casi limite di esperienze che, al di là di ogni disfunzione o atipicità, chiunque può esperire. Quanto lungo o interminabile può sembrare il tempo prima di un esame o fugace e irruente nel godere un attimo di estrema felicità? Ancora una volta dovremmo accontentarci di un'epoché del giudizio e di ogni ricerca del tempo poiché questo, nella sua vera natura, non può che essere percepito e declinato in diverse modalità (intensità?) di esistenza: il tempo è esistenza.

La temporalità apre quindi più che mai quell'approccio dimensionale e trans-diagnostico a cui tendono i più recenti indirizzi clinici e diviene criterio di diagnosi differenziale non solo per quanto riguarda gli ambiti qui considerati ma anche negli studi sulla depressione, sulla disperazione e il suicidio. Questo stesso mio contributo può essere considerato un tentativo di approccio trans-diagnostico dove la temporalità si costituisce a categoria sovraordinata ai due disturbi considerati.

Ma siamo partiti pur sempre dalla filosofia, dalla domanda filosofica sul tempo che ora deve diventare necessariamente ricerca clinica e psicoanalitica affrancandosi dal paradosso e divenendo postura del professionista che si pone in ascolto e "vibra" assieme al paziente.

La domanda sulla temporalità non può astrarre dal soggetto come testimonianza (per usare un termine jaspersiano) o vissuto o ancora come narrato, non può astrarre dall'esistenza ed erigersi a categoria logica, trascendentale, estetica: deve emanciparsi dai labirinti della speculazione filosofica e ricadere nella vera esistenza, anche e soprattutto quella del vissuto e della sofferenza psichica; il filosofo che un tempo meditava sul tempo oggi deve essere un clinico.

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*Ora il tempo è circolare e l'orizzonte si sposta più in là.
Butta in mare il cannocchiale, nella spirale niente
appare ciò che è in realtà.
—Marnero, Il porto delle illusioni*

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