

THIS MOMENT AND THE NEXT MOMENT

(Draft)

ABSTRACT. This paper outlines a version of instantaneous presentism and defends it from two prominent objections. The first one can be found more or less explicitly in Le Poidevin 2007 and has to do with the difficulty of accounting, from the point of view of instantaneous presentism, for the existence of events that take time, e.g. a rabbit's running, and of our representation of them in *this* moment, as we enjoy a specious present in which the movement of objects appears as a continuous flow and not as a sequence of discrete steps. The second objection is explicitly formulated in Craig 2000 in support of a different form of presentism. It has to do with the problem of accounting for the passage of time from the perspective of instantaneous presentism, in the light of a Zenonian argument based on viewing time as a continuum that can be subdivided ad infinitum. In order to tackle the first objection, the paper presents an account of events and the specious present compatible with instantaneous presentism. As regards the second objection, two options are considered: (i) take time to be discrete, or (ii) accept the idea that, if an item x ontologically depends on another item y , then there is a third item z such that x depends on z and z depends on y . We are left with a dilemma regarding which is the best choice, for both of them have costs. But other theories of time, even of the currently fashionable B-theoretical variety face the same dilemma.

1. Introduction

Very roughly speaking, presentism is an A-theory of time (a theory that acknowledges A-determinations or properties such as present, past and future), according to which only the present is objectively real. Moreover, instantaneous presentism, as Craig 2000 calls it, is that version of presentism based on the idea that times, the moments at which things happen, are point-like, durationless instants. Instantaneous presentism is to be contrasted on the one hand with B-theories of time, according to which only B-relations such as earlier or later can be used to characterize time; and, on the other hand, with other A-theories of time that deny that things happen (only) at durationless instants. Here I want to outline a version of instantaneous presentism and defend it from two objections. The first one can be found more or less explicitly in Le Poidevin 2007 and has to do with the difficulty of accounting, from the point of view of instantaneous presentism, for the existence of events that take time, e.g. a rabbit's running, and of our representation of them in *this* moment, as we enjoy a specious present in which the movement of objects appears as a continuous flow and not as a sequence of discrete steps. The second objection is explicitly formulated in Craig 2000 in support of a different form of presentism and has to do with the problem of accounting for the passage of time from the perspective of instantaneous presentism, in the light of a Zenonian argument based on viewing time as a continuum that can be subdivided ad infinitum.

I do not mean to imply that these are the only objections that instantaneous presentism must face. In particular, there are many well-known objections that this view inherits from the simple fact that it is a form of presentism. But more or less satisfactory shields against them can already be found.

For example, both Craig 2001 and Bourne 2006 try and defend presentism from the allegation that it is at odds with relativity theory. In contrast, the two objections that will occupy us here have not been to my knowledge effectively tackled and yet, I think, are most pressing. Without defusing them, it is hard to concentrate on the merits that, as I see it, can be ascribed to instantaneous presentism, more specifically on the advantages that it has over other forms of A-theory and over B-theories of time (one advantage of instantaneous presentism over non-instantaneous presentism will somehow emerge below).

Before going ahead, it might be worth saying for those whose anti-presentist prejudices are very much entrenched that at least some of the issues that will be raised below are of general interest, since, as we shall see, they somehow surface even in a B-theoretical perspective.

2. Some basic points

We can view time as a sequence or succession of items, the time series, ordered by the asymmetric B-relation *earlier*, which we'll symbolize with "<" (the converse of this relation, *later*, can then be symbolized with ">"). The items in the time series, times or moments, are such that states of affairs (facts) and events, e.g., a cat's being on a mat or the running of a rabbit *occur (take place) at* them. For convenience, states of affairs and events of this kind can be cumulatively called *ordinary occurrences*. In a derivative sense, we can say that the objects involved in an ordinary occurrence that occurs at a certain time, e.g., the cat and the mat of our first example, also occur at that time. (Many philosophers hold the view that times are not really primitive entities for they can be somehow explained away, e.g., in terms of occurrences, or of propositions; but this need not concern us here.)

Traditionally, these two options regarding time are in play:

CT. *Continuity of Time*. Time is continuous and thus in particular it is dense, i.e., if t_1 and t_2 are two moments such that $t_1 < t_2$, then there is another moment t such that $t_1 < t < t_2$. In other words, the time series is a succession of items without consecutiveness: for no element in the series there is a next element.

DT. *Discreteness of Time*. Time is discrete, i.e., for any moment t_1 there is a next element t_2 , i.e. an element t_2 such that $t_1 < t_2$ and there is no t such that $t_1 < t < t_2$. In other words, the time series is a succession of consecutive items.

For the time being, we simply record them, without trying to choose one of these contrasting options.

According to a B-theory of time, times and the items occurring at them are not objectively characterized by A-properties. In contrast, an A-theory of time admits that such properties objectively apply to times and the items occurring at them. In particular, in an A-theoretic perspective, there is only one present moment (although which moment is the present moment keeps changing) and the past and future moments are, respectively, all the times earlier and later than the present moment (we leave aside here the issue of whether in an A-theory the B-relations can be understood in terms of A-properties). Presentism is an A-theory according to which the only ordinary occurrences that really exist are the present ones, those that occur at the present time. In other words, according to presentism, there are

no ordinary occurrences if not those that take place at the present moment and thus we can define the present moment as the one at which all ordinary occurrences occur, if there any. (we can drop the clause "if there any", if we admit that some ordinary occurrences must always exist, perhaps because there are some necessary ones, e.g., that the universe is self-identical). Relatedly, presentism holds that the only objects involved in ordinary occurrences that really exist, cats, mats, etc., are the present ones, those occurring at the present time. In sum, for presentism, if there are ordinary occurrences that take place at a time t , then no other time t' is such that there are ordinary occurrences that take place at t' . And thus the present moment is the one *at* which ordinary occurrences (if there are any) occur.

Instantaneous presentism is a variety of presentism, according to which times, the items in the time series at which occurrences take place, are *instants*, i.e., point-like or durationless moments that involve neither an earlier "part" (a sub-moment classifiable as past in an A-theoretic perspective) nor a later "part" (a sub-moment classifiable as future in an A-theoretic perspective).

In an A-theoretic perspective, time passes, i.e. there is becoming or passage of time in the following sense: the present moment is such that ordinary occurrences *will* occur at later moments and that ordinary occurrences occurred at earlier moments. In other words, it occurs at the present moment that the future moments *will be* present moments and the past moments *were* present moments. Still in other words, if t is the present moment, then it occurs at t that: there are t_1 and t_2 such that $t_1 < t < t_2$ and $PAST(t_1 \text{ is present})$ and $FUTURE(t_2 \text{ is present})$.¹

2. This moment

The first objection against instantaneous presentism that I want to consider is based on the intuition that some occurrences are events, i.e., occurrences that (in contrast with states of affairs as here understood) in some sense "occupy" an extended time and thus seem to occur at times characterizable as intervals, involving an earlier and a later part, rather than at instants. This seems testified by the fact that we perceive events, that our experienced or specious present involves an earlier and a later part. On the basis of this, Le Poidevin argues against presentism in general and promotes a B-theory of time. As we shall now see, in effect, considerations based on the existence of events and our perceptions of them are problematic for presentism in general, but, in the first place, they are more specifically a hurdle for instantaneous presentism.

Consider for example the event of a body, say a billiard ball, moving from a place to another, an event characterizable as follows (I use asterisks to refer to occurrences and sometimes also to refer to properties or relations):

- (1) *x moves from p_1 at time t_1 to p_2 at time t_2 .*.

It seems plausible to say that this event somehow involves the two states of affairs

¹ The tense modalities FUTURE and PAST are supposed to be primitive (perhaps we can select only one of them as primitive). Note that it is not ordinary occurrences that become past, but times. The ordinary occurrences just are at the present moment or otherwise cease to exist (they do not become past, although we may want to say that propositions describing them become "past").

(1a) *x is in p1 at p1*

and

(1b) *x is in p2 at t2*.

Accordingly, it seems also plausible to say that the event occurs at a time interval T that goes from t1 to t2 rather than at a single instant (at most, one could add, the two states of affairs (1a) and (1a) occur at single instants, namely at t1 and t2, respectively). An observer that observes this event has an impression of movement, say as of a moving ball, in its specious present, which we should also take presumably as occurring at the interval T, rather than at a single instant.

Now, to the extent that we take this at face value, we clearly have a problem for instantaneous presentism. But we also have a difficulty for presentism in general. Consider a presentist who accepts that times may be extended intervals and that there can be a present event that occurs at such an extended interval, an interval which is then, as a whole, to be regarded as present. This presentist thus accepts that T is present and that (1) occurs at T. Now, as we put the matter, the interval T comprises, so to speak, two states of affairs, one of which, (1a), occurs before the other, (1b). Hence, (1a) should be regarded as past. On the other hand, (1a) should be regarded as present, since it is comprised in the interval T at which, we may say, the event (1), as a whole, is NOW occurring.

Whatever the presentist chooses there are problems. To the extent that our presentist denies that there are past states of affairs, he may want to accept the second horn of the dilemma and declare (1a) present. But then, if (1a) is present, what shall we make of the fact that it occurs before (1b)? Shall we say that (1b) is so to speak "more present"? Suppose the presentist chooses the first horn and declares (1a) past. But then, she should also say that (1a) is non-existent. How about event (1) then? Is it partly existing and partly non-existing (at T), as is made up, so to speak, of a non-existent past part and a present part? Or consider the state of affairs consisting of an atom a that decays precisely at t1. If the present coincides with T, is the atom partly existing and partly non-existing now (i.e. at T)?

More generally, as Augustine teaches us, since some events seem to take longer than others, if we take this road there seems to be no limit as to the length of the intervals of times that could be regarded as present. Perhaps we can even look at the whole history of the universe as if it were a gigantic event that takes place at the interval which is the whole time series, an event somehow reflected in God's specious present. But then, it would seem, the whole time series is in some way present and such are the occurrences that constitute the world history. All this is hardly compatible with presentism. Perhaps a presentist can find a way out without being an instantaneous presentist, but it seems to me that an instantaneous presentist can avoid all these troubles at the outset, if she can understand events and the specious present in a way compatible with her assumption that the present is a point-like instant and not an interval.

I think she can. Let us see how by focusing on event (1). What the instantaneous presentist can say is that the movement of the billiard ball x consists in the fact that at instant t1 it had the property *is in p1* and another property, to be considered in a moment, that has to do with its position at the successive instant t2. Moreover, at time t2 it has, *in addition* to the property *is in p2*, the "time-indexed" property *was in p1 at time t1*. The idea is that, although only the present time is replete with objects and states of affairs, in such present time there may occur objects with properties indexed to

past times, i.e. states of affairs consisting of objects' having such time-indexed properties. Furthermore, there may also occur at the present time other time-indexed properties having to do with the future of the object in question. To clarify this, let us go back to our event (1). We said that at time t_1 x had the property **is in p_1 ** and another property having to do with its position at the successive instant t_2 . What is this property? We can understand it in two ways, depending on whether or not we take it as fully determined at t_1 that x would have then been in p_2 at time t_2 . If it was fully determined, then x had at time t_1 the indexed property **will be in p_2 at time t_2 ** (and, correspondingly, it has at t_2 the property **was at t_1 such that it would have been at p_2 at t_1 **). On the other hand, if we do not take it to be fully determined at t_1 that x would have been in p_2 at time t_2 , the indexed property concerning its future that x had at t_1 was a mere propensity, a property such as ** x is potentially at place p_2 at time t_2 ** (and, correspondingly, x has at t_2 the property **was potentially in p_2 at time t_2 **). We can conceive of the property ** x is potentially at place p_2 at time t_2 ** as a property that x has insofar as, roughly speaking, it had stored (say, by having been pushed) some energy leading in a certain direction. Having this property does not necessarily result in being at p_2 at time t_2 , for, e.g., there can be an intervening obstacle.² In sum, according to this perspective, an event is an occurrence involving these time-indexed property and it occurs at a certain instant. It can be said to occur at an interval, say the one from t_1 to t_2 , only in a derivative sense based on the fact that it involves time-indexed properties such that t_1 and t_2 are the indexes.

What can we say from this perspective about the perception of movement, the presence, so to speak, of a moving object in the specious present? According to instantaneous presentism, a specious present occurs at an instant, but it may well involve the perception of an event to the extent that events are conceived of in the way we have seen. Consider (1) again. At t_2 an observer in the vicinity of p_1 may see the moving event (1) in the sense that she observes something like a state of affairs consisting of an object x with the following properties (assuming there is no determinism): **was in p_1 at time t_1 **, **was potentially in p_2 at time t_2 **, **is in p_2 ** and (let us suppose) **is potentially in p_3 at time t_3 ** (we neglect here for simplicity's sake the fact that in causal account of perception there is a time lag between an event and the perception of the event).

We can surmise that the impression of a movement in the specious present, i.e., the perception of events such as (1) (understood in the way I have suggested), is due to memory traces corresponding to properties indexed to past times and to expectations corresponding to properties indexed to future times. It is often said that the specious present involves continuity in the sense that a movement is perceived as continuous or gradually evolving and not, so to speak, as a sequence of broken still images (Vicario 2001, p. 337). From the present perspective, this perception of continuity is due to our capacity, based on these memory traces and expectations, of perceiving objects *qua* having time indexed properties such as the ones we have considered above. But we cannot go into these details here.

In sum, we could say that at the present time t_2 there is the *state of affairs*

(1b') ** x is in p_2 **.

But there is also the *event* (1), in that this event is understood as

² Properties of this kind are postulated by Lange 2005 in an effort to make sense of instantaneous velocity. For a criticism see Harrington 2008. Harrington admits he has no knock-down arguments against Lange's proposal, although he prefers another view.

(1') *x was in p1 at t1, was potentially in p2 at t2 and is in p2*.³

4. The next moment

Let us now move to the second objection against instantaneous presentism. Roughly speaking, it has to do with the problem of understanding how presentness can shift, so to speak, from this, point-like, moment to another, point-like, moment, given that no instant can play the role of next moment after this one. Given that there is no next instant it looks as if we are stuck forever in this instant. But how can it be? Here is how Craig (2000, p. 231) formulates the problem, with the goal of attacking instantaneous presentism:

"Zeno's paradoxes of motion and quantity seem to become inescapable. How can time progress instant by instant, since instants have no immediate successors? Like Achilles in the Dichotomy Paradox, the present instant would be frozen into immobility; it could not elapse to be succeeded by another, for before any new instant could be actualized an infinite number of prior instants would have to be actualized first."

Similarly, at p. 235 of his 2000 Craig says:

"... let us suppose ... that the basic parts of time are instants. In order for the present instant to elapse it must be succeeded by another. But there is no immediate successor to the present instant. Before the [a ?] succeeding instant can become present, an infinite number of succeeding instants, will have to become present first. The point is not the fallacious inference that it would therefore take an infinite amount of time for the succeeding instant to become actual. Rather the point is that no instant can succeed the present instant. For no instant can immediately succeed the present. The present would therefore exist as the *nunc stans* of the classical doctrine of eternity, not the *nunc movens* of A-theoretic time".

Although it is somehow intuitively clear what Craig is after, there is a key notion somehow left in the background. Without bringing it to the fore, we cannot, I think, fully understand and evaluate the argument. Before trying to uncover this key notion, let us note that Craig, following James and Whitehead, is here trying to take advantage of an argument which, although derived from Zeno's paradoxes about space and time, makes no reference to space. According to Owen 1957-58, Zeno wanted to show that both the hypotheses that time and space are continuous and that they are discrete lead to trouble. The paradox of the Stadium and the plurality paradoxes were designed for the former task and the more well-known puzzles, such as the arrow and race paradoxes were designed for the latter task. From this latter group of puzzles we can derive a "distilled Zenonian argument based on

³ How about the decayed atom a? If we assume something like a Plantinga-style individual essence, $e(a)$, corresponding to it (Plantinga 1974), we may say that at the present time t_2 there are states of affairs of the kind *t was such that the object with property $e(a)$ existed then*, where t is a time preceding the time t_1 of the decay. But we cannot explore the details of this way to go here.

CT", as we may call it, in which there is no essential reference to space. As Findlay 1941 puts it (p. 156), "when 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". He then goes to state the argument as follows (p. 157):

"... the problem assumes its most vexing form if we allow that ordinary happenings have ultimate parts that take no time. For of such parts it seems most natural to say 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."

Findlay refers to Whitehead, who in fact clearly acknowledges, as we shall see, that a distilled Zenonian argument based on CT can be constructed. Before Whitehead, as noted by Craig, this was also seen by James. In *Some problems of philosophy* (1911, p. 181), he offers this version of a distilled Zenonian argument based on CT (a version cited by Craig 2000, p. 231):⁴

"It seems to me however that Mr. Russell's statements dodge the real difficulty, which concerns the 'growing' variety of infinity exclusively, and not the 'standing' variety, which is all that he envisages when he assumes the race already to have been run and thinks that the only problem that remains is that of numerically equating the paths. The real difficulty may almost be called physical, for it attends the process of *formation* of the paths. Moreover, two paths are not needed — that of either runner alone, or even the lapse of empty time, involves the difficulty, which is that of touching a goal when an interval needing to be traversed first keeps permanently reproducing itself and getting in your way. Of course the same quantum can be produced in various manners. This page which I am now painfully writing, letter after letter, will be printed at a single stroke. God, as the orthodox believe, created the space continuum, with its infinite parts already standing in it, by an instantaneous *fiat*. Past time now stands in infinite perspective, and may conceivably have been created so, as Kant imagined, for our retrospection only, and all at once. 'Omega' was created by a single decree, a single act of definition in Prof. Cantor's mind. But whoso actually *traverses* a continuum, can do so by no process continuous in the mathematical sense."

But even in this version of the argument the key notion we are after is not explicitly made out. As I see it, this key notion emerges in Whitehead's version of a distilled Zenonian argument based on CT (1929, p. 94). A version also cited by Craig (2001, p. 232). here it is:

"The [distilled Zenonian] argument [based on CT], so far as it is valid, elicits a contradiction from the two premises: that in becoming something (*res vera*) becomes and (ii) that every act of becoming is divisible into earlier and later sections which are themselves acts of becoming. Consider, for example, an act of becoming during one second. The act is divisible into two acts, one during the earlier half of the second, the other during the later half of the second. Thus that which becomes during the whole second presupposes that which becomes during the first half-second. Analogously, that which becomes

⁴ The reference in this quotation to Russell's approach to Zeno's race paradox need not concern us here.

during the first half-second presupposes that which becomes during the first quarter-second, and so on indefinitely. Thus if we consider the process of becoming up to the beginning of the second in question, and ask what then becomes, no answer can be given. For, whatever creature we indicate presupposes an earlier creature which became after the beginning of the second and antecedently to the indicated creature. Therefore there is nothing which becomes, so as to effect a transition into the second in question."

Set aside that not everything might appear crystal-clear here, perhaps because of the difficulty in penetrating Whitehead's philosophical style and terminology. What I want to focus on is that the key notion we are after is, I think, somehow evoked, or perhaps even explicitly referred to, when Whitehead uses the word "presupposes". It is the relation of ontological dependence or, conversely, ontological priority. Although this notion is complicated and many varieties of it should perhaps be distinguished (see Lowe 1998, 2008, Correia 2005, Cameron 2008, Orilia 2009, Paseau forthcoming), for present purposes we should simply record that an entity *x* *ontologically depends* on an entity *y* (and, conversely, *y* is *ontologically prior* to *x*) only if *x* cannot exist unless *y* also exists. I think that ontological dependence is relevant for us here, because an ideal reconstruction of a distilled Zenonian argument based on CT takes for granted something like the following thesis:

DPP. *Dependence of what is chronologically Posterior on what is chronologically Prior.* The chronologically posterior depends ontologically on what is chronologically prior and, conversely, the chronologically prior is ontologically prior with respect to what is chronologically posterior.

The expression "what is chronologically posterior" and "what is chronologically prior" are admittedly somewhat vague, but they can be "precisified" on the basis of different perspectives on time. If we look at the matter in an A-theoretical perspective and more specifically from the A-theoretical perspective of instantaneous presentism, which is our concern here, we can say that the fact that a certain time *t* has an A-property is ontologically prior to the fact that another time *t'* has another A-property, provided that *t* < *t'*. The A-properties in question here are properties such as being present as well as "metrical" A-properties such as being past or future with a certain degree (which we may call, respectively, *anterior* and *posterior* metrical A-properties). The idea here is that, if *t* is present, then, for any *t*₁ and *t*₂ such that *t*₁ < *t* and *t*₂ < *t*, both *t*₁ and *t*₂ have an anterior metrical properties. This is so with the understanding that, if *t*₁ < *t*₂ then the degree of pastness of *t*₁ is superior to the degree of pastness of *t*₂, and it is of course the other way around if *t*₂ < *t*₁. Similarly, if *t* is present, then, for any *t*₁ and *t*₂ such that *t*₁ > *t* and *t*₂ > *t*, both *t*₁ and *t*₂ have posterior metrical properties. In this case, however, we shall say that, if *t*₁ < *t*₂, then the degree of futurity of *t*₁ is inferior to the degree of futurity of *t*₂, and it is the other way around if *t*₂ < *t*₁. We should take for granted that the A-properties in question are exclusive: a time is supposed to have just one of them, although the passage of time, or becoming, makes it the case that each time, one after the other, comes to have any of these properties.

Let us say that A(*t*) is the fact consisting of time *t* having a certain A-property of the kind we have just discussed. Thus, e.g., A(*t*) could be the fact that *t* is present or that it is past with a certain degree. With this terminology at hand, and from the A-theoretic perspective that we are taking for granted at this juncture, DPP can be put as follows:

DPPA. *Dependence of the chronological Posterior on the chronological Prior from an A-theoretic perspective.* $t < t'$ if and only if $A(t')$ ontologically depends on $A(t)$.

Now, DPPA is in tension with CT. As I see it, the point is that, in worrying about Zeno's arguments against continuity, we seem to take as an implicit axiom about ontological dependence that there cannot be dependence without *direct* dependence, where an entity x *directly depends (ontologically)* on an entity y iff there is no z such that x ontologically depends on z and z ontologically depends on y . In other words, we seem to take for granted that

NDWDD. *No Dependence Without Direct Dependence.* if x ontologically depends on y , then there must be a finite dependence chain linking x to y , i.e., a finite sequence of entities $z_1, \dots, z_n$, such that x directly depends on z_1 , z_1 directly depends on z_2 , ..., z_n directly depends on y .

The assumption that time is continuous, CT, and DPPA lead us to a conflict with this axiom, since they force us to say that, if $A(t_2)$ depends on $A(t_1)$ (given that $t_1 < t_2$), then no finite dependence chain linking $A(t_2)$ to $A(t_1)$ can exist. If this chain existed, its nodes would obviously be entities of the type $A(t)$, where t is either t_1 , t_2 or a time intermediate between t_1 and t_2 . And whatever length we choose for the chain, we can derive a contradiction. Suppose, e.g., that the chain is of length zero, i.e. $A(t_2)$ (say, that t_2 has a very low degree of futurity, so that it is just about to be actualized) *directly* depends on $A(t_1)$ (say, that t_1 is present). This cannot be the case because, by CT, there is a time t_1' such that $t_1 < t_1'$ and $t_1' < t_2$. And thus, by DPPA, $A(t_2)$ depends on $A(t_1')$ and $A(t_1')$ depends on $A(t_1)$, in contrast with the hypothesis that $A(t_2)$ *directly* depends on $A(t_1)$. A similar reasoning applies if we hypothesize that the chain is of length 1, so that, for a time t_1' intermediate between t_1 and t_2 , $A(t_2)$ directly depends on $A(t_1')$ and $A(t_1')$ directly depends on $A(t_1)$. And so on.

In essence, then, as I see it, a distilled Zenonian argument based on CT is an argument showing that temporal continuity is in conflict with NDWDD, or alternatively, with DPP, i.e., from the A-theoretical perspective that we have just considered, with DPPA.

The instantaneous presentist has two ways to go. She either drops one among NDWDD or DPP or she drops CT in favor of DT. Both options have their difficulties, but such difficulties are not, as we shall see, a prerogative of instantaneous presentism and thus this doctrine does not seem to be, at least in this respect, in worse shape than other competitors on the market. Let us start with the second option.

4.1 Dropping DPP or NDWDD

It seems to me that DPP, i.e., DPPA, given the A-theoretic perspective, can hardly be dropped in an intelligible way. But I think that no real contradiction or absurdity follows if we drop NDWDD. Still, we must admit that it is well-entrenched and to abandon it may have its costs. In relation to this, it is then important to see that a distilled Zenonian argument based on CT, analogous to the one we have just seen, can be directed against rivals of our instantaneous presentism that are typically considered as

respectable approaches to time. In particular, contrary to what Craig assumes (2000, pp. 233 ff.),⁵ such an argument can be directed against a B-theory of time. Let us see how.

In constructing the argument, we cannot appeal to A-properties, but we can admit that at any time t , the world is a certain state. Let $t(w)$ be the state in which the world is at time t . With this terminology at hand, we can state this B-theoretical version of DPP:

DPPB. *Dependence of the chronological Posterior on the chronological Prior from an B-theoretic perspective.* $t < t'$ if and only if $t'(w)$ ontologically depends on $t(w)$.

It should be clear that, with DPPB in place, we can, *mutatis mutandis*, unfold the above argument again and show that CT is at odds with either NDWDD or DPPB, just as it is at odds with either NDWDD or DPPA. Now, it seems to me, DPPB is, from the B-theoretical perspective, just as plausible as DPPA is from the A-theoretical perspective. And thus, the B-theorist who wants to retain CT had better reject NDWDD just like the instantaneous presentist who wants to retain CT.

Let us now turn to the other option.

4.2 Dropping CT

There are some advantages if we drop CT in favor of DT. For one thing we can take at face value the fact that we normally use the expression "the next moment". For example, we say things such as "when John realized he had run out of water, he felt hopeless, but the next moment found him relieved as he spotted a fountain". If CT is true, it would seem that in all these uses of "the next moment" we refer to nothing, unless, e.g., the expression in question, not taken at face value, can be seen as referring to a certain time somehow selected by the context (Bonomi and Zucchi 2001). More importantly, we can take into account what some physicists tell us, namely that there seem to be empirical evidence from quantum mechanics that there are minimal discrete quantities of time, the so-called "chronons" (Smolin 2006).

If we take this line, there is the obvious difficulty that in describing the world and in doing physics, at least at the macroscopic level, we seem to need real numbers in a way that suggest that time is continuous. For example, if a physical square has a 1 meter long side, we must say that its diagonal is $\sqrt{2}$ m long. Consider then a body moving at the uniform speed of 1 meter per second. It will take, it seems we should say, $\sqrt{2}$ 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 1970a, p. 35).

This latter difficulty is perhaps not insurmountable, for the experts tell us that there are systems of discrete mathematics that could be used to do physics and that we could in principle view the use of reals as an approximation of what we should really do (Penrose 2004, ch. 16, Caratheodory 1963, Fano et al., forthcoming). But there is, I think, a most serious hurdle, namely the above-mentioned Zenonian paradox of the stadium, at least as it is understood by Russell 1929, as we shall now see.

⁵ Craig discusses Grünbaum's account of Zeno's paradoxes (see, e.g., Grünbaum 1968). This account, I think, can be taken to involve a rejection of NDWDD. Craig grants Grünbaum that his account works only because he is presupposing a B-theory of time, in which temporal passage is denied. Thus, Craig may be taken to say, implicitly, that NDWDD can be legitimately denied in a B-theory of time, but not so in an A-theory of time.

We know the paradox of the stadium from Aristotle's *Physics* (VI, 9, 293b). Although, as Aristotle presents it, it may seem nothing more than a fallacious piece of reasoning that naively neglects the notion of relative speed (Salmon 1970a, p. 11), Russell 1929, following Gaye 1910, saw that this puzzle can be interpreted in an interesting way. Namely, as subtly directed against DT.⁶ Imagine the following situation. There is a series of consecutive places, individuated by their being occupied by three adjacent bodies, A1, A2, A3, of equal size. Call "point" the size in question. Thus we can say that each A occupies one point. Imagine further that two series of bodies of the same size (moving in opposite directions), B1, B2, B3 and C1, C2, C3, each occupying one point, are aligned at a certain instant t_n , respectively above and below the A's. We thus have the following situation N at the instant t_n :

Situation N, instant t_n

$$\begin{array}{ccccccc} \Leftarrow & & B1 & B2 & B3 & & \\ & & A1 & A2 & A3 & & \\ & & C1 & C2 & C3 & \Rightarrow & \end{array}$$

We can imagine that the B-bodies and the C-bodies travel in opposite directions at the absolutely minimum speed of one point per instant, while the A-bodies stand still. Hence, after one instant, B2 has gone from being above A2 to being above A1 and C2 from being below A2 to being below A3. We then have the following situation N+1, at instant t_{n+1} :

Situation N+1, instant t_{n+1}

$$\begin{array}{ccccccc} \Leftarrow & & B1 & B2 & B3 & & \\ & & A1 & A2 & A3 & & \\ & & C1 & C2 & C3 & \Rightarrow & \end{array}$$

Now, given DT, we have a problem. C1 is (from the reader's perspective) on the left with respect to B2 at instant t_n and on the right at instant t_{n+1} , and thus intuitively there should be an intermediate time at which C1 and B2 are aligned (each being in a smaller point, respectively above and below the point between A1 and A2):

Hypothetical situation S1', at hypothetical time $t1'$

$$\begin{array}{ccccccc} \Leftarrow & & B1 & B2 & B3 & & \\ & & A1 & A2 & A3 & & \\ & & C1 & C2 & C3 & \Rightarrow & \end{array}$$

⁶ Owen (1957-58 p. 149) interprets the puzzle more or less like Russell except that he concentrates on space and sees it as directed against the assumption that there are minimal units of space ("infinitesimal quantities"), i.e., what I have called "points".

But, given DT, t_n and t_{n+1} are consecutive and thus there cannot be this intermediate instant. As Russell puts it (Salmon, p. 53): "When then did B [B1] pass C' [B2]? It must have been somewhere between the two moments which we supposed consecutive, and therefore the two moments cannot really have been consecutive. It follows that there must be other moments between any two given moments and therefore there must be an infinite number of moments in any given interval of time".

I am not sure about what we should say in the face of this problem in order to drop CT in an intelligible way. Perhaps, the previous option is a better one. Be that as it may, if there are reasons to set the previous option aside so as to confront this option, these are not reasons that are peculiar to instantaneous presentism. As we have seen, even the B-theorist has to face these reasons. And once, in the light of them, we decide to adopt DT and come to terms with the stadium paradox, we are certainly not in a worse position, it seems to me, if we are instantaneous presentists rather than B-theorists.

Conclusion

We considered two objections against instantaneous presentism. In order to tackle the first one, an account of events and the specious present compatible with this doctrine was presented. As regards the second one we were left with a dilemma regarding which is the best choice among two possible avenues, as both of them have costs. We saw however that other theories of time, even of the now fashionable B-theoretical variety face the same dilemma. We might think then that we should endorse neither instantaneous presentism, nor a B-theory such as the one we considered. Perhaps, as Craig proposes, and as perhaps James and Whitehead also propose, we should adopt a different version of presentism. Unfortunately, as I hinted above, there are troubles even if we head in this direction, possibly more serious ones. But there is no time to see this in detail at this moment. We must wait for the next (available) moment.

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