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Objects in Time

Studies of Persistence in B-time

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Objects in Time: Studies of Persistence in B-time
Tobias Hansson Wahlberg

For Lena, Idun and Hannes

Contents

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Writing a PhD thesis in philosophy is a rather lonely enterprise, despite seminars, meetings and teaching duties. However, I had the good luck to share

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Lund, October 2009

List of Papers

I. **"Endurance Per Se in B-time"**
Tobias Hansson Wahlberg
Originally published in *Metaphysica*, 2009, vol. 10, no. 2, pp. 175-183.

II. **"The Problem(s) of Change Revisited"**
Tobias Hansson
Originally published in *Dialectica*, 2007, vol. 61, no. 2, pp. 265-274.

III. **"The Tenseless Copula in Temporal Predication"**
Tobias Hansson Wahlberg
Forthcoming in *Erkenntnis*.

IV. **"4-D Objects and Disposition Ascriptions"**
Tobias Hansson Wahlberg
Originally published in *Philosophical Papers*, 2009, vol. 38, no. 1, pp. 35-72.

V. **"Can I be an Instantaneous Stage and yet Persist Through Time?"**
Tobias Hansson Wahlberg
Originally published in *Metaphysica*, 2008, vol. 9, no. 2, pp. 235-239.

VI. **"Can Persistence be a Matter of Convention?"**
Tobias Hansson Wahlberg
Submitted manuscript.

Eternity! thou pleasing, dreadful thought!
Joseph Addison

1. Introduction

1.1. The Commonsense Conceptions of Time and Persistence, and Two Technical Terms

In day-to-day life, we harbour certain loose and vague ideas about the nature of time and the persistence of physical, middle-sized objects, such as rocks, sticks and cars. We rarely make the ideas explicit, and may find it quite difficult to articulate them if asked to. However, I think many of us – at least in the West, and if we are familiar with some general philosophical terminology – would agree with the following two summary accounts of the nature of time and persistence. The first is an attempt to describe the commonsense conception of time.[1]

> The present moment is ontologically special: it is the only moment of time that exists.[2] Past and future moments do not exist. Past moments *have* existed, but they are no longer. Future moments *will* exist, but do not yet do so. (It is even tempting to think that it is indeterminate how the future will turn out to be.) Discourse involving expressions such as "have existed" and "will exist" reflects the fact that time *flows*.

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[1] The account is based partly on my own off-work intuitions, partly on what I have gathered from what friends, relatives and colleagues have said on the matter, and partly on what philosophers of time (such as Reichenbach, 1956, ch. 2.2; Prior, 1970; Horwich, 1987, ch. 1.2; etc.) and physicists (such as Penrose, 1990, p. 391; Davies, 1995, p. 76; Green, 2004, ch. 5; etc.) have written when they have tried to express the intuitive conception of time. The view conveyed can, I think, be traced back at least to St Augustine (*Confessions* XI) and in some parts even to Aristotle (*De Interpretatione* IX). To obtain a more scientifically based account of the modern intuitive conception, the description should be based on some empirical poll on the issue, and plausibly on several qualitative interviews. Being a philosopher, I will have to leave the proper sociological research here to the sociologists – as have the philosophers and physicists mentioned above.

[2] Speaking of moments, or times, existing – as opposed to objects, properties and events existing – does not commit one to *substantival* time, i.e. to the notion that times exist independently of their contents. Times can exist even if their existence derives from the existence of objects, properties, events and their interrelations. So-called *relationists*, who are anti-substantivalists, typically quantify existentially over times (see e.g. Quine, 1960, p. 174; for some discussion, see Mellor, 1998, p. 34).

Time flows in the sense that new times, new *nows* – i.e. universe-wide simultaneity planes – constantly come into existence as old ones disappear from reality. The flow is inherently directional: it "points", or "moves", towards the future, what is to come, and away from the past, what has been. Temporal succession, or temporal order, results from the directedness of the flow: events existing when certain other events no longer do so happen *after* the latter, which are events that happened *before* the first events. Moreover, the directedness of the flow explains why we have different attitudes towards the past and the future, although both "realms" are non-existent. We worry about, or look forward to, what is to come – about the not yet existent future – and feel nostalgia or regret about the past – what is now and for evermore gone. There are further asymmetries between the past and the future, even though both realms are non-existent. The future can be influenced but the past cannot: present events cause events to occur in the future, but they do not cause past events. If causation and/or the laws of nature are indeterministic – or if we have free will, as we take ourselves to have – then the future is *open*: contingent statements about the future lack truth value, and many nomologically possible futures, or ways the future might be, are consistent with the present state of the universe and the laws of nature. Irrespective of nomological indeterminism, however, the past is fixed and settled: contingent statements about the past are either true or false.

This description of time may be intuitive (at least, pre-reflectively), but it is doubtfully coherent as a whole. Moreover, a vital part of it, as we shall see in due course, invites serious objections, philosophical as well as scientific. The part in question is the one that says that only the present moment exists, but that there have been other times and that there will be other times. This part of the common sense view of time is usually called *presentism* by modern philosophers.[3]

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[3] Another name for the view is *dynamic presentism*. This name is sometimes used in order to distinguish the view from the position – to my knowledge, adopted by no one – that there have never been and will never be other times than the present one, a view called *solipsistic presentism* (for the distinct terminologies, see Dainton, 2001, pp. 79-92). For the purpose of brevity, I will stick to the shorter, more common name.

The next passage is an attempt to express our commonsense conception of persistence, a conception which, I think, has the view of time set out above as its backdrop.[4]

> New moments of time constantly succeed each other, but there is a certain stability in time's flow in that there are physical objects that continue to exist through the flux. The boulder on the beach is the same boulder as the one that lay there yesterday. The boulder has not, by the flow of time, been *replaced* by another one, a boulder exactly similar to the original. The boulder and other continuant, physical objects enjoy *identity* over time. Moreover, the way a physical object enjoys identity over time differs from the way it enjoys identity across space (at a time). A spatially extended object has identity across the space it extends over at a time in the sense that it is one and the same object that extends over the region of space: it is the very same extended object that is the owner of the distinct spatial parts located at distinct places of the spatial region. The identity over time of objects is not like this. It involves, not *extension*, but rather *continuation*: objects *last* in time, they *remain* in being during the flow. Objects even survive intrinsic change – i.e. change that happens to the object itself, not merely to its surroundings – at least, when it is gradual and within certain limits. At any rate, we find it highly useful to talk in such ways.[5] For example, the yellow leaf on the tree we say is the same leaf as the green one that was there this summer; the boat in the dock, repaired with new planks, we say

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[4] The source of the account is essentially the same kind of material as that described in note 1. The literature naturally displays variation. Here I would mention the works by philosophers such as Strawson (1959, ch. 1), Prior (1959), Merricks (1994), Hinchliff (1996), Zimmerman (1998) and Ingthorsson (2002, p. 26), which give expression to intuitive views (or our "descriptive metaphysics") about objects and their persistence which can to some extent be traced back to Aristotle's *Metaphysics*.

[5] It seems to me that common sense has a tendency to wobble between affirming and denying realism about persistence through intrinsic change – though it mostly affirms it, at least pre-reflectively. The philosophers mentioned in note 4 no doubt hold that our intuitions are *pro* realism here, but my experience is that non-experts (myself, before reading philosophy, included) sometimes deny or withdraw commitment to such realism – a scepticism that may be traced to Parmenides and Heraclitus (see Barnes, 1982). This hesitation about intrinsic-change realism within commonsense, and the possible cause of it, is an issue that will receive further attention as we proceed.

is the same boat as the one that took in water at sea a couple of weeks
ago.

This common sense view of objects' persistence is, I think, in agreement with the technical metaphysical position known as *endurantism* – a position which, in one version or another, is often taken as a philosophical specification or explication of the commonsense view.[6]

ccording to endurantism, physical objects are: (i) merely three-dimensional, so that they extend in, but only in, the three spatial dimensions;[7] and (ii) persist through time by being "wholly present" (unlike a "partly present" entity that extends beyond any specific time at which it exists) at distinct times as numerically the same entity. Here "numerically the same" is meant to convey the idea that we are dealing with *strict* identity over time, i.e. with one, and *only* one, object existing over time, not with two (or more) objects existing in succession. Moreover, numerical sameness, or identity over time, has generally been taken by endurantists to be compatible with objects (iii) changing intrinsically over time – i.e. the traditional view is that numerical identity over time does not require "qualitative identity" over time.[8]

1.2. A Major Complication and the Questions it Gives Rise to
– The Topic of the Thesis

Presentism and endurantism (especially in aspects (i) and (ii)) may be intuitive doctrines, and together they appear to describe a vital part of our fundamental

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[6] The philosophers mentioned in note 4 present and develop endurantism as a theory identical with, originating from, or specifying, the commonsense view of persistence.

[7] Whether there are three spatial dimensions or more is inessential to endurantism. The important point is that, according to endurantism, objects do not extend in time. String theory is said to postulate extra spatial dimensions (see e.g. Green, 2000, for a popular exposition), but as I understand the idea, macroscopic objects are not held to extend in these extra dimensions as they are too tightly curled up.

[8] There are endurantists who deny (iii), however: see the so-called mereological essentialists Chisholm (1976, ch. III) and van Cleve (1986) (and possibly also Hume, 1739-40/1978, book I, part IV, section VI). Strictly speaking, though, Chisholm and van Cleve deny that ordinary objects, such as mountains, tables and trees, exist: such entities are mere "fictions", logical constructions, *entia successiva* or *entia per alio*. Endurantism of the weaker (i)-(ii) variety is adopted for the truly existing things (i.e. 3-D mereological sums) that "stand in for" or "do duty for" *entia successiva*.

world-picture, or Weltanschauung. However, as mentioned above, there are scientific and philosophical reasons for thinking that presentism is a *false* doctrine. (These will be set out in Section 2.) A good case can be made for the view that a significantly different and revisionary view of time is correct, namely the so-called *B-theory of time*.[9]

According to the B-theory, the present moment is *not* ontologically special. Past and future times are just as real as the present, and together they and the present moment constitute an extended time-dimension: a fourth dimension along which all of the events of history are spread out, once and for all. The idea that time flows, in the mode of presentism, is thus rejected. Times and their contents do not come into being and disappear. There is merely a "static" arrow of time, meaning that the times and the contents of the fourth-dimension are interrelated and ordered by *earlier than/later than* relations. In the B-theory it is postulated that these relations hold among their relata without the relations being produced or grounded by some directed flow-process.

But if we reject presentism and adopt the B-theory, questions arise as to how we are to conceptualize the persistence of physical, middle-sized objects. *Prima facie* our commonsense views of persistence and time are allied. Does this mean that if we reject presentism in favour of the B-theory, we must give up the commonsense view of persistence (i.e. endurantism, in some version or other) to avoid self-contradiction or patent absurdity? Many philosophers, as we shall see, have indeed taken the B-theory to rule out endurantism (even of the weaker (i)-(ii) variety). B-theorists, on this view, need an alternative way of conceptualizing persistence. However, if we adopt a revisionary conceptualization of persistence, will *other* aspects of our commonsense conception of physical objects have to be revised? Will we have to start talking in significantly new ways? Or are questions about the way in which objects persist through time independent of the nature of temporal reality and dependent rather on human conventions?

In this thesis, these and related questions will be addressed. Very briefly, I will argue that we have as yet been supplied with no good argument for the widely held view that endurantism is to be rejected upon acceptance of the B-theory. We will have to rethink quite how endurance is *realized*, but such rethinking need not force us to give up the key commitments of commonsense – not even the notion that objects endure through intrinsic change (if that is indeed

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[9] The B-theory of time will be described in detail in Section 3. For a book-length defence of the B-theory, see Mellor (1998).

part of the commonsense conception). And yes, if we do adopt any of the major revisionary theories of persistence, we will probably have to start talking in significantly new ways. And no, questions about the way objects persist through time are not independent of the nature of temporal reality.

It should be added here that although the focus of this thesis is on the persistence of physical, middle-sized objects, like most philosophers of persistence I am inclined to think that the key points argued for below can be applied to the persistence of *persons*.[10] Occasionally the persistence of persons will be addressed explicitly (see Papers I, V and VI).

1.3. The Plan of the Thesis

The structure of the thesis is as follows. In Section 2, I present what I take to be the main problems facing presentism and therefore the commonsense conception of time. I begin by addressing the apparent incompatibility of the Special Theory of Relativity and presentism. I then discuss some more purely philosophical obstacles to retaining presentism, obstacles that remain even if STR is rejected. In Section 3, the B-theory of time, which escapes the difficulties levelled against presentism, is presented more fully. Section 4 is devoted to a survey of the principal competing accounts of the way persistence should be conceptualized assuming the B-theory, as well as of some of the main reasons that have been put forth for adopting them. I also indicate my own assessment of those reasons. Section 5 contains an exposition of my six papers; this summarizes their contents and makes it clear how the papers interrelate to form a fairly continuous narrative. Section 6 sums up the major conclusions of the thesis. The papers themselves can be found in the Appendix.

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[10] Some materialists will insist that persons *are* physical objects.

2. Some Problems for Presentism

I now discuss three major problems facing presentism. I begin with the difficulty of combining presentism with the Special Theory of Relativity; I then address two purely philosophical difficulties. The intention is not to establish conclusively that presentism is false. (The arguments do not strictly *prove* that,[11] although I think they render presentism highly problematic.) The purpose of the discussion is rather to give the reader a feeling for the main problems with presentism, and so to encourage curiosity about alternatives.

2.1. The Special Theory of Relativity and Presentism

In the Special Theory of Relativity (STR) the simultaneity of spatially separated events is a relative phenomenon.[12] "Observers" – i.e. persons or automatic devices "with a clock and a meter stick" (Benson, 1996, p. 812) – in distinct inertial reference frames, moving uniformly relative to each other, will not agree about which events occur simultaneously with which.[13] This spells a problem for presentism, because presentism ties up reality with what happens *now*.

Here is an example illustrating the difficulty. Say that you are in an unpowered spaceship in outer space, and that I am approaching you at a constant velocity, with a magnitude of, say, half the speed of light. (See Figure 1, in which the scenario is depicted relative to your reference frame. Our "world-lines" depict us at different times. The figure is not to scale.)

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[11] Neither do I wish to devote disproportionately extensive space in this thesis to the discussion and evaluation of every possible presentistic counter-response. The primary topic of the thesis is not presentism versus the B-theory, but rather the conceptualization of persistence *if* the B-theory is adopted.

[12] For a book-length introduction to STR, see Taylor and Wheeler (1992).

[13] Here we will be neutral on the way observers persist through time.
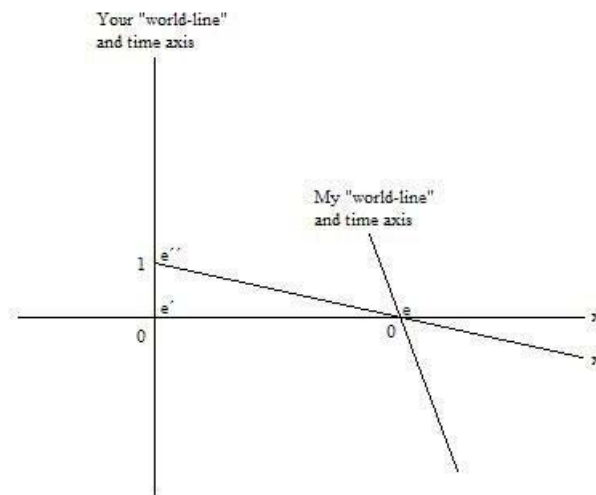
Figure 1.

In your reference frame, I turn on the headlights (event e) at the same time ($t_{you}=0$) as you sneeze (event e'). That is, according to you, the events e and e' happen simultaneously: at $t_{you}=0$, they both happen "now". (Of course, you do not know at $t_{you}=0$ that they happen simultaneously – you deduce that they happened simultaneously when the light beam emitted from e reaches you.) However, in my reference frame, e occurs simultaneously with your blowing your nose, an event (e'') which is in your *future* relative to $t_{you}=0$. Thus, given the presentist metaphysics, relative to you at $t_{you}=0$: e'' does not exist although I exist and e'' is existent for *me*.

Can temporal existence – and, consequently, the flow of time – be relative in this way? Kurt Gödel (1949/1990, p. 203, n. 5) famously held that the question is senseless in that "relative existence" is a vacuous notion (see also Penrose, 1990, p. 393, who seems to assume as much). Others have argued that the idea contradicts the principle that There Are No Privileged Observers (e.g. Putnam, 1967; see also Green, 2004, ch. II:5).[14] Yet others have rejected it because it entails intolerable

[14] This charge can reasonably be doubted though. On the world view at issue, existence is relative to states of motion of observers, but no observer is singled out as special or privileged, at

22

physical consequences (e.g. Davies, 1995, pp. 70-71): for example, they point out that, given the combination of STR and presentism, if, in the outer space scenario, I were to stop and then move away from you, then, in my reference frame, I will bring about the existence of events in your (according to you non-existent) past and future that would not exist in my reference frame were I to continue moving towards you with constant velocity; and surely we cannot bring things into existence (within a reference frame) simply by moving in this or that direction!

The moral, many philosophers and physicists think (as we have seen, for slightly different reasons), is that if we accept STR, we should abandon presentism and endorse the absolute, non-relative existence of all future, present and past events and things. The world of STR, they say, is a four-dimensional *space-time block*. The mathematical "space-time world" invented and described by Hermann Minkowski (1908/1952) is taken to be a realistic representation of the way our world in fact is (disregarding the effects of gravity and the expansion of the universe): all events occurring at some space-time point or region are just there, once and for all, and they are interrelated by frame-independent space-time distances. Albert Einstein apparently accepted a realistic space-time interpretation of STR (which he first put forth in his seminal 1905/1952 paper). Discussing STR, in his book *Relativity* (1961), he wrote: "It appears therefore more natural to think of physical reality as a four-dimensional existence, instead of, as hitherto, the *evolution* of a three-dimensional existence" (Einstein, 1961, p. 171). The four-dimensional space-time conception also turned out to be an integral component of his General Theory of Relativity, where gravitation is analyzed in terms of curvature of the space-time manifold (Hartle, 2003).

It is often said that presentism is conclusively rebutted by STR (e.g. Putnam 1967, p. 247). However, even if it is not (see e.g. Sklar, 1974, pp. 272-275), presentism with STR is *very* different from the presentism of common sense: relative existence and relative time flow are surely *not* part and parcel of our intuitive understanding of time.

Many presentists, wanting to hold on to the commonsense variety of presentism, therefore reject, or modify, STR by adding a privileged reference frame (e.g. Prior, 1996/1998; Craig, 2000b, ch. 5; Crisp, 2003; Bourne, 2006, ch. 6). Those who go into detail (e.g. Craig, 2000b, ch. 5) deny that light "really" travels at the same speed in all directions for all observers and maintain that there is an

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least not privileged *simpliciter*: you acknowledge that relative to *me* (at your $t_{you}=0$) events and things exist that do not exist relative to you at $t_{you}=0$.

absolute relation of simultaneity and a reference frame (the absolute space frame) which is absolutely at rest. Classical experiments such as the Michelson-Morley and the Kennedy-Thorndike experiments are accounted for, in the manner pioneered by Hendrik Lorentz (see his papers in Einstein et al., 1952), by invoking absolute clock retardation and the absolute shrinking of measuring rods: only clocks absolutely at rest measure the "true" lapse of time, and only measuring rods absolutely at rest measure "true" distances. Consequently, only observers absolutely at rest measure the "true" speed of light, which is "truly" constant in all directions only in the absolute rest frame. The speed of light *appears* to be constant in all directions in other frames, but this is because of absolute time dilation and absolute length contraction.

As pointed out by Lawrence Sklar, the major scientific challenge confronting neo-Lorentzians (as contrasted with the philosophical ones described below in Section 2.2) is to explain *why* physical processes slow down (absolutely) and material objects contract (absolutely) in the direction of motion when moving relative to the absolute rest frame. Without this explanation, the theory looks *ad hoc*. Lorentz himself failed to provide the necessary explanation in a satisfactory way, while the purely relative time dilations and length contractions of Einstein's STR follow from the postulates of the theory (Sklar, 1974, ch. IV, B).

2.2. Two Philosophical Problems with Presentism

Let us assume with the neo-Lorentzians that there is an absolute relation of simultaneity and an absolute rest frame, that physical processes slow down and contract when they move absolutely, and that gravitation can be accounted for in terms of forces rather than curved space-time. Difficulties with presentism remain, as we shall now see; and these difficulties are of a more philosophical character.

2.2.1. The Rate of Time's Flow

According to presentism time flows: only the present moment is real, but there *have been* other times and there *will be* other times. But if time really flows – if new times constantly come into existence – it seems that the flow has to occur at a certain *rate*. That is, it appears legitimate to ask: How *fast* does time flow? (This question is due to Smart, 1949.)

But can this question be answered in a sensible way? Many presentists (e.g. Prior, 1962/2003; Markosian, 1993; Craig, 2000a, pp. 225-226) think it can. They answer that time flows at a rate of one second per second. That is, they hold that it takes time one second to flow through an interval of one second, i.e. to continuously yield and destroy all of the superdenumerable many instants (if time intervals, whatever they are on the presentistic metaphysics, are continuous) that together "make up" a second.[15] Now, to what frame does the first second referred to in "one second to flow through an interval of one second" belong? Here we have assumed absolute time, i.e. that there is a single "true" flow of time. We have eschewed the many frame-relative flows that result when presentism is combined with STR. It would appear, then, that the first second is either a second of the "true" time flowing in the absolute rest frame – just as the second of the seconds is – or a second belonging to a frame existing in some meta-time, i.e. a second of some higher-order "true" time ($time_2$) in which $time_1$ flows.

On the first of these options, the complaint levelled by Huw Price looks valid: "A rate of seconds per second is not a rate at all in physical terms. It is a dimensionless quantity, rather than a rate of any sort. (We might just as well say that the ratio of the circumference of a circle to its diameter flows at π seconds per second!)" (Price, 1996, p. 13)

On the second option – i.e. if that time flows at one $second_1$ per $second_2$ – Price's objection lapses. However, we are now saddled with meta-time, which seems ontologically extravagant. Surely it would be preferable, for Occamistic reasons, to avoid introducing a meta-level of time. In any case, in combination with meta-time, presentism ceases to be a common sense theory, and because of this one of its supposed advantages over the B-theory of time (Bigelow, 1996, pp. 35-36) is lost. Epistemological problems also arise. Given that $time_1$ flows in $time_2$, it would appear the rate of the flow of $time_1$ could vary, sometimes increasing (e.g. running at 1.3 $seconds_1$ per $second_2$) and sometimes decreasing (to 0.8 $seconds_1$ per $second_2$) relative to $time_2$. There would be no way of us knowing, since we are (primarily) immersed in $time_1$. (Of course, we cannot even discern which frame is the absolute rest frame, and thus whose clocks at rest follow the absolute flow of time, due to the absolute Lorentz-contractions.)

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[15] James (1911/1996, pp. 170-183), Whitehead (1929/1978, pp. 68-69) and Whitrow (1980, p. 200) argue that there are Zenonian reasons for thinking that time cannot flow in a continuous manner. Instead they argue that time advances in discrete steps. But the "rate question" would seem to apply nevertheless.

Furthermore, if time$_2$ flows, there is the threat that *its* flow has to be regarded as occurring in, and that *its* rate must be regarded as defined by, the flow of some yet higher-order time (time$_3$), and so on. (If time$_2$ is not regarded as flowing, why not adopt this view already of time$_1$?) And if that is indeed the case, presentism looks even more ontologically artificial and even more counterintuitive. Not many, I suppose, conceive of presentism on analogy with an infinite set of Russian nesting dolls.

Worse still, the infinite regress here seems logically vicious, because, without end, the need to ground the flow is passed on to the next level of the infinite hierarchy: at no level is the flow grounded so that the flow of the lower level becomes secured.[16]

The upshot seems to be a dilemma: either time has to be held to not flow at any genuine *rate* at all, in which case it can be questioned whether time *flows*; or time has to be said to flow in a meta-time (perhaps with varying rates), which would render presentism ontologically extravagant and a departure from common sense. Worse still, the second horn of this dilemma may involve a vicious infinite regress of higher-order times, which would nullify the explanatory value of introducing a meta-time.

2.2.2. Present Truthmakers for Propositions about the Past (and the Future)?

Assume that only the present moment exists. What makes it the case now – what makes it *true* now – that there have been other times and that there will be other times? What are the present *truthmakers* for such claims? I here assume that "there have been other times" and "there will be future times" express non-tautological propositions, and that true non-tautological propositions (at least, positive ones like the one expressed by "There are monkeys", if not negative ones like that expressed by "There are no unicorns") require truthmakers in order to be true.

If no such truthmakers can be credibly described by presentists, presentism threatens to collapse into the solipsistic variety mentioned in Section 1, note 3. (Or if there are no truthmakers for propositions about future times – or, alternatively, past times – half a collapse threatens: it is a fact that time has flowed until now but it is not a fact that there *will* be other times; alternatively, it is a fact that time will

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[16] For a discussion of the distinction between vicious and virtuous infinite regresses, see Maurin (2007).

go on flowing but it is not a fact that there *have* been other times. The first kind of half collapse would, I suppose, be more acceptable than the second.)

Supposing that there are present truthmakers for the alleged general facts that there have been past times and will be future ones, we will also want to know what the truthmakers for more content-specific general truths, such as "There have been dinosaurs", and singular truths, such as "David Hume had two arms", are.

Some presentists (e.g. Bigelow, 1996; Crisp, 2007) adopt a doctrine called "Lucretianism" (after the Epicurean Lucretius) in order to meet these kinds of difficulty. John Bigelow explains the doctrine as follows:

> … time itself, as well as past and future things, has to be constructed as nothing more than *properties* or accidents of *present* things. […] One of the things that exists is the whole world, the totality of things that exist. The world can have properties and accidents, just as its parts may have. It is a present property of the world, that it is a world in which *Helen was abducted* and *the Trojans were conquered*. […] The past no longer exists; yet there is a sense in which the past can never be lost: the world will always be one with the property of having once been thus and so. Likewise the future does not exist yet; yet there is a sense in which the future will be what it will be: the world has always been one with the property of being a world which is going to be thus and so. (Bigelow, 1996, pp. 46-47; my italics)

The postulation of properties such as *will be succeeded by other times*, *previously contained dinosaurs*, *being such that David Hume had two arms*, and so forth, is dubious, however. What *exactly* are they? Can they be reduced to better understood ones? If not, the mere postulation of such properties to prevent presentism from becoming solipsistic looks suspiciously *ad hoc*.

So what are they? It would appear that they cannot be reduced to ordinary physical properties like the property of having this mass or that shape. One reason for this is that, *prima facie*, the physical world could, logically speaking, have sprung into being as it is at present without having a past, i.e. without it being true that there have been dinosaurs, even though there are fossils seemingly "of"

dinosaurs (cf. Russell, 1921/1995, pp. 159-160).[17] Truthmakers are ordinarily understood to *necessitate* the truth of the propositions they make true (Armstrong, 2004, pp. 5-7). But since the world, taken only with its ordinary physical properties, does not appear to necessitate truths about the past, it seems that the world, thus conceived, is not suited as a truthmaker for propositions about the past. (Nor, presumably, for similar reasons, is it suitable as a truthmaker for propositions about the future.)

But if Lucretian properties are not reducible to ordinary physical properties, what are they? Bigelow does not explain. Thomas Crisp (2007), however, sees the need to give a positive characterization of such properties – past- and present-tensed properties, as he calls them (p. 93) – in order for Lucretianism to be tenable.

On Crisp's elucidation of the idea, a past-tensed property such as "*being an x such that dinosaurs roamed x* turns out to be something more like: *being an x such that the proposition that dinosaurs roam x is included in an earlier time*" (Crisp, 2007, p. 105). Likewise for singular propositions involving specific individuals like David Hume. Crisp explicitly denies existentialism, i.e. here, the position that propositions depend for their existence on the individuals they are about (pp. 100-101).

This position is meant to avoid the kind of difficulty with ordinary physical properties described above, because if the world presently has properties like *is such that the proposition that dinosaurs roam the world is included in an earlier time*, it is impossible for the world to be as it currently is but it not being true that there have been dinosaurs (p. 93).

Let me elaborate the theory a little more. This will enable me to point out what is wrong with it.

Crisp defines "*x is a time*" as a maximal and consistent class *C* of present-tensed propositions (pp. 99-100). Such abstract "times" – classes of propositions – form an abstract, *ersatz* time-series of times interrelated by a primitive *earlier than* relation. The abstract *earlier than* relation is taken to be analogous to the B-theoretical *earlier than* relation holding between real, concrete times (p. 102; see Section 3 of this thesis for the B-theory of time).

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[17] Bertrand Russell wrote: There is no logical impossibility in the hypothesis that the world sprang into being five minutes ago, exactly as it then was, with a population that 'remembered' a wholly unreal past. There is no logically necessary connection between events at different times; therefore nothing that is happening now or will happen in the future can disprove the hypothesis that the world began five minutes ago." (Russell, 1921/1995, pp. 159-160)

Now, all times are held to be "present$_1$, at no temporal distance from anything" (p. 103), even if it is the case that they are ordered by the abstract *earlier than* relation. However, although all abstract times are present$_1$, only one abstract time is present$_2$. A time is present$_2$ "iff it is the *true* time" (ibid.). Those times that are later than the present$_2$ time are future times, and those that are earlier than the present$_2$ time are past times (p. 105).

At this stage of theory development Crisp realizes that he ought to tell us which abstract times are included in the abstract time-series. Are *all* possible abstract times – including those incorporating propositions such as <Pigs fly> (using < and > to denote the proposition expressed by the sentence between < and >) – organized into a single time-series, or are there many time-series, each of which forms a distinct possible world-history?

Crisp answers: "I think the presentist should hold that there is one and only one ersatz [time]-series, all right, but that it does not include all the abstract times among its members. It counts among its members only some of the abstract times – those that did, do or will represent the world" (p. 104).

The general idea, then, is this. A proposition such as <There have been dinosaurs> is currently true because the world currently has the property *being such that the proposition that dinosaurs roam the world is included in an earlier time.* And the world has this property because there is a present$_1$ ersatz time that is earlier than the present$_2$ time which includes the proposition <Dinosaurs roam the Earth>.

This elucidation of Lucretian past-tensed and future-tensed properties is unsuccessful. Why think that there is an abstract *earlier than* relation ordering classes of propositions that are all present$_1$? This very relation looks as dubious as the kind of property it was introduced to analyze.[18]

But, more importantly, this account of presentistic truthmaking involving Lucretian past- and future-tensed properties appears to be circular. Remember Crisp's answer to the question about which times are included in the abstract time-series was: "those that did, do or will represent the world". But we want to know: What *makes it true* that a certain class of propositions C_n, which is said to have represented the world (or will represent the world) actually *has* represented the world (or actually *will* represent the world)? Unless it is currently *true* that

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[18] It is true that the "concrete" B-theoretical *earlier than* relation is also difficult to pin down, but at least that relation is supposed to relate real times, and suggestions can be made as to how that relation might be grounded in the physical world (see Section 3).

some such classes *will* represent the world and other classes *have* represented the world, there *is* no specific ersatz time-series to ground truths about the future and the past. Crisp's theory of truthmaking apparently makes tacit use of the very phenomenon it is meant to account for.

I conclude that, in the versions presented by Bigelow and Crisp, at any rate, Lucretianism does not provide us with a convincing story about why presentism stops from collapsing into solipsistic presentism.

Notice also that, as it is formulated above, Lucretianism is at odds with the commonsense view, or suspicion, formulated in Section 1, that most contingent propositions about the future lack truth value. The commonsense view seems to require that the truthmakers for truths about the future, if there are any, involve the present state of the universe *and the laws of nature*. If the laws are indeterministic, the intuition seems to be, there are no or very few contingent truths about the future – except perhaps for such general truths as that there will be future times and events.

The commonsense view is also in trouble, however. To begin with, as Theodore Sider (2001, ch. 2.3) points out, if the laws of nature and the present state of the universe are truthmakers for claims about the future, then by parity of reasoning they should be truthmakers for claims about the past – at least, pending support for the commonsense belief that truths about the future and the past are asymmetric. But if the laws are now assumed to be indeterministic, it seems that many propositions about the past will turn out to lack a truth value as well – for example, propositions concerning the whereabouts of present sub-atomic particles in the past.

The assumption of determinism also raises difficulties, in relation both to the past and to the future. One complication (also noticed by Sider, ibid.) is this: the present state of the universe – which we here take to be an instantaneous state – must contain, among other things, objects' instantaneous *velocities* if, together with the determinate laws of nature, it is to provide truthmakers. But according to Bertrand Russell's popular at-at theory of motion (Russell, 1903, p. 469), to have an instantaneous velocity at a certain time *t* is simply to be suitably located in space at distinct times in the temporal vicinity of *t*; it is not to have a property intrinsic to *t*. Since, on a presentist metaphysics, non-present times (and here I confine myself to "concrete", as opposed to "abstract", such times) cannot be invoked to provide truthmakers for claims about the past and future, presentists pursuing this path to truthmaking will need an alternative to the at-at theory of motion.

Another option would be to regard the present as temporally extended in such a way that objects have time to move within the present. However, this move

is surely not in the presentistic spirit: once change (extrinsic or intrinsic) is allowed to happen in extended time (many presentists think that change cannot happen in extended time), why not go all the way and endorse the full "block universe" conception of the B-theory of time?

A further difficulty with the law view, even assuming determinism, is as follows: the neo-Lorentzian presentism assumed in Section 2.2 seems to involve not only absolute but *substantival* time. (What else is the "true" time which clocks in the absolute rest frame measure and which the clocks in absolutely moving frames fail to measure? Could not this "true" time flow without anything physically happening? If not, what distinguishes the "true" time from the merely apparent or physical "times" of the absolutely moving frames?) In substantival time, it is possible for time to lapse, for new times to come into being, without anything physical happening. But if the laws of nature only govern physical circumstances and events, then, in regard to future flow and past flow, the present state of the universe plus the laws of nature cannot be truthmakers for truths about substantival lapse of time.

The law view also presupposes that, together with the present state of the universe, the *present* laws of nature suffice to determine, and act as truthmakers for propositions about, what has happened and will happen during the whole of history. But this excludes the possibility that the laws of nature change over time, unless of course any such change is entailed by the present laws and the present state of the universe. Do we really want a theory of truthmaking that rules out this *prima facie* possibility?

Finally, a defender of the deterministic law view will need to address an issue similar to the one faced by the Bigelowian Lucretian: Does the current state of the world plus the laws of nature – assuming now that all the velocities are given and that the present state of the world plus the deterministic laws of nature nomologically determine that the world has existed for twenty billion years and will exist for another 100 billion years – logically rule out the possibility that the world and the laws of nature came into being five minutes ago (or just *now*), or will cease to be one second from now?

All in all, I think it is reasonable to conclude that presentists have great difficulty saying why true propositions (propositions taken by presentists themselves to be true) about the past and/or the future are true. The problem evidently affects sentences which *prima facie* express propositions involving *cross-temporal* relations as well: for example, "The year 2000 is before the year 2009", "The draught caused the famine", "There are persisting objects", "There are enduring objects" and "The Eiffel Tower is 120 years old". Presentists, if they

cannot supply acceptable present truthmakers for the propositions expressed by sentences like these (as it seems they cannot[19]) appear to be doctrinally *hostile* to the idea that utterances about temporal relations, intervals, causation and – for our purposes the most important subject-matter – *persistence* are true. Thus, presentistic doctrine seems to make it hard to account for the (assumed) truth of the commonsense description (Section 1.1) of the way in which objects persist through time. On scrutiny, then, it appears that presentism and endurantism are not the happy bedfellows we tacitly take them to be in our day-to-day life.

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[19] It seems they cannot, even if the propositions expressed are analyzed in the mode of Thomas Crisp (2005). For example, Crisp says that the proposition expressed by "Today's flood bears the *is caused by* relation to yesterday's downpour" may be analyzed as follows: "['*Was-1-day-ago* (a downpour occurs at thus-and-such place)'] is a member of a set of truths which, given the laws of nature, are jointly sufficient for the truth of ['a flood occurs at thus-and-such place']" (Crisp, 2005, p. 14). One difficulty here is saying what the present truthmaker for the proposition expressed by "*Was-1-day-ago* (a downpour occurs at thus-and-such place)" is.

3. A Revisionary Theory of Time: the B-theory of Time

The B-theory of time successfully evades the difficulties faced by presentism. It denies that time flows and endorses the reality of all times and their contents, no matter whether the times are deemed past, present or future by commonsense. The considerations presented in Section 2 above therefore pose no threat to it.

Let us take a closer look at the way the B-theory succeeds in evading the difficulties. In the process of doing so we will obtain a more comprehensive and deeper understanding of the content of the B-theory, and of how it contrasts with presentism. At the end of this section I will address some worries that are often expressed in connection with the B-theory and argue that they are largely unfounded.

The B-theory does not presume the truth of STR, but it can easily accommodate it. One of the central notions of the B-theory is that of a *B-series*. This, according to the inventor of the term (McTaggart, 1908, p. 458), is a "series of positions which runs from earlier to later".[20] "Positions" are to be understood as denoting times, i.e. worldwide planes of simultaneity. The contents of the positions J. E. McTaggart called "events", but the events here include objects and just about anything that exists at a time. All the positions with their contents/events are treated as ontologically on a par: the times, with their

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[20] J. E. McTaggart held, though, that in fact there is no B-series. He even denied the existence of time altogether. According to him, behind the veil of temporal illusion there is just an undirected C-series (McTaggart, 1927, p. 30). Modern B-theorists (but also A-theorists, i.e. philosophers who hold that time flows) do, however, make use of McTaggart's terminology and concepts – see e.g. Mellor (1998, p. 10), Le Poidevin (2003, p. 140) and Oaklander (2003). Strictly speaking, for Hugh Mellor "B-series" refers to the sequence of the *contents* of the positions, not to the sequence of the *positions* with their contents. For the purpose of this section, I do not think we need to make such a distinction. As was said in Section 1, note 2, talk about positions (i.e. times) existing does not commit one to substantival time; Mellor agrees (ibid, p. 34).

contents, form a genuine *whole* – a genuine *series*, all of whose positions (parts) exist.

Now, in a Newtonian universe (or in a neo-Lorentzian one) there would be only *one* (one "true") B-series: the B-series that constitutes the total history of absolute time.[21] STR, however, denies the reality of absolute time and says that times are relative to states of motion of frames of reference. This means that, if it incorporates STR, the B-theory of time is committed to there being *several* B-series, one for every reference frame in relative motion. In terms of Minkowski's space-time world, the space-time world is composed of myriad B-series whose times intersect each other at different angles (see Figure 1, Section 2.1).[22]

Thus, on a B-theory married with STR, the event *e´´* described in Section 2.1 is not in an existential limbo state: *e´´* simply exists in space-time and is located within several B-series. The event *e´´* occurs at $t_{you} = 1$ (in your B-series) and at $t_{me} = 0$ (in my B-series). I can existentially quantify over *e´´* and other "future" and "past" events according to you at $t_{you} = 0$, *but so can you* at $t_{you} = 0$.[23] *e´´'s* existence does not become a relative matter. Nor is the existence of distinct B-series a relative matter. My B-series is as real "for you" as it is "for me", even if it is not *your* B-series.

The difficulty, addressed in Section 2.2.1 above, raised by the rate of time's flow is straightforwardly circumvented by the B-theory, because it denies that time flows. All times within the distinct B-series – or in the single B-series of absolute time, if we live in a Newtonian or Neo-Lorentzian world – and their contents are equally real. They just exist. They do not come into existence, or undergo what is often called "temporal Becoming"; nor do they then cease to exist, or undergo "temporal Annihilation". In the absence of flow, *earlier than* and *later than* relations relate times and their contents. These B-relations, as they are often called, are transitive, asymmetric and irreflexive – at least, they are asymmetric and irreflexive if time is *linear* and not cyclic. They provide the world with an "arrow of time", but it is an arrow which does not *fly* in some meta-

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[21] McTaggart spoke of *the* B-series, so apparently he had a Newtonian view in mind; his article was published only a few years after Einstein had published his 1905/1952 paper on special relativity.

[22] This is not to say that there are several time dimensions. The distinct B-series are all part of one and the same four-dimensional universe. Observers in relative motion merely "cut up" the four-dimensional universe in different ways and have time axes that are "tilted", or rotated, relative to one another.

[23] Assuming here that quantification over events is in general feasible; see Davidson (1967/2001) and Simons (2003).

universe. The arrow merely "points" in a certain temporal direction (towards "the future", i.e. towards what is later), somewhat analogously to the way in which a compass-needle points to a certain spatial direction (north) without moving in that direction (this analogy obviously has its limitations too). Whether this arrow – these asymmetric earlier-later relations – can be reduced to, or shown to supervene on, some other asymmetric physical features of the world is a topic much debated by B-theorists. Several bases of the temporal arrow have been proposed: entropic, cosmological and causal asymmetries, to name but just a few. In this thesis, I will not endorse any one of these views, though I confess I am attracted to the idea that the temporal arrow is grounded on causal asymmetries. All I will assume is that there *is* an arrow of time, and that the arrow is not conventionally *assigned* to the world by us. (By contrast, the directedness of the compass needle arguably *is* assigned by convention: we could just as well have said that the compass needle points south.)[24]

The difficulty that presentism faces with finding present truthmakers for claims about the past and future (Section 2.2.2) does not apply to the B-theory. Since all times and their contents are equally real on the B-theory, truthmakers for claims about the past and the future do not have to be confined to the present; they can be located in the existing future and in the existing past. (Or partly in the existing past and the existing future: the truthmakers may, I suppose, contain earlier-later relations leading up to the present moment.) The expressions "the past" and "the future" here must not be taken to indicate that B-series come equipped with objective or non-relative distinctions: the parts which are metaphysically past and the parts which are metaphysically future. The B-theory renounces metaphysical so-called A-properties, such as *being past*, *being present* and *being future*. Words such as "past", "present" and "future" should be understood as conveying only a *perspectival*, or *subjective*, viewpoint on the B-series in question. An utterance of "The year 2178 is in the future" or "The French Revolution occurred in the past" has to take place at a point *in* time, at a certain moment of the B-series. Relative to *that* time, which is just one of many co-existing times, the year 2178 is "in the future" and the French Revolution is "past"

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[24] For discussion of these issues, see e.g. Smart (1963, pp. 142-148), Grünbaum (1973, Part II), Lewis (1979), Horwich (1987), Davies (1995, ch. 5), Price (1996) and Mellor (1998, ch. 10-12). Notice that if time's arrow were merely assigned, "persistence" from time *t* to *t´* could just as well be described as "persistence" from *t´* to *t*. In my view, this would rule out genuine persistence. However, the notion of a conventional arrow of time is *prima facie* incoherent. Surely, there must *be* an arrow of time in order for it to be possible for us to *assign* an arrow to the world.

(provided of course that the utterance in question takes place *after* the French Revolution and *before* the year 2178). Thus, such an utterance conveys only a perspectival viewpoint on the B-series, much as an utterance of "The object *a* is to the left of object *b*" conveys a perspectival view on space: we do not have to think that an objective, non-relative metaphysical property of *leftness* inheres in *a* in order for *a* to be to the left of *b*.

This point applies to all utterances of tensed sentences, according to B-theorists.[25] For example, an utterance of "Plato wrote the Republic" is true if Plato (i.e. Plato himself, not a property or proposition representing him in the present) writes the Republic during a stretch of time that is earlier than the time of the utterance. Plato's writing of the Republic does not have to have the A-property *being past* in order for such an utterance to be true; it is enough that it is *earlier* than the time of the utterance. Here it is important to notice that the verbs "writes" and "is" occurring in the truth-condition are not to be taken to be in the present tense, falsely indicating that Plato writes at the moment of the utterance (i.e. simultaneously with it). In that case the truth condition would express an inconsistent idea. Despite appearances, they are to be read *tenselessly*, i.e. as verbs with no tense at all. Tenselessness should be familiar from mathematical sentences such as "Two is an even number". When uttering this sentence we are not saying that two is *now* an even number, even though *we* utter the sentence "now" (Smart, 1963, p. 133).[26]

Now that we have introduced the notion of tenselessness, it is time to specify the notion of existence that we so far have been employing quite freely. What exactly does it mean to affirm or deny "The only moment of time that exists is the present one"? What is it that presentism and the B-theory disagree about here? Do they really disagree, or is the dispute merely "verbal"? Contrary to what some sceptics have thought, the theories do disagree, provided that we are – in a preliminary and fairly common way of expressing the idea (e.g. Bourne, 2006, p. 10) – concerned with *tenseless existential quantification*. The familiar symbol for

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[25] For somewhat different accounts of this general idea, see Smart (1949, 1980), Quine (1960, pp.170-173 and 193-194), Goodman (1966, ch. XI), Needham (1975) and Mellor (1981, ch. 2; 1998, ch. 3).

[26] Strictly speaking, however, I think that tenselessness comes in different versions, and that the mode of tenselessness of the "is" in the mathematical sentence differs from the tenslessness of "writes" in the truth condition for "Plato wrote the Republic" (but does not differ from the tenselessness of "is" in "is true" and "is earlier than" in the truth condition). For such distinctions, see Section 5 and Paper III, "The Tenseless Copula in Temporal Predication".

existential quantification, "∃", should be read tenselessly, not in the present tense. If "∃" is construed in the present tense, the claim that "The only moment of time that exists is the present one" turns out to be a tautological truth – something that both presentists and B-theorists agree it is not.

However, unlike its non-formal counterpart "exists", "∃" is not a verb but a quantifier in a regimented "logical grammar". Given this, and given that tenselessness comes in somewhat different varieties (as we shall see[27]), it is better, I think, to follow Ned Markosian (2004, p. 47) and put the idea we need to get a grip on here in this way: "∃" is to be read *unrestrictedly*, i.e. not as purporting to range, for example, only over entities that are simultaneous with the act of existential quantification.

When "∃" is interpreted as unrestricted, the difference between presentism and the B-theory emerges clearly. For example, presentists think that the proposition expressed by "$(\exists t)(t \neq t_\mathrm{p})$" (where "$t$" is a variable ranging over times and "t_p" denotes the present time) is false, while B-theorists think it is true. Similarly, B-theorists think that the proposition expressed by "$(\exists x)(x = \text{Plato})$" is true, while presentists think it is false. (Presentists will, however, want to say that the proposition expressed by "$(\exists x)(x = \text{Plato})$" *has been true*; they will want to represent this fact as "$\mathrm{P}(\exists x)(x = \text{Plato})$", where "P" says "it was the case that". We saw above, though, that presentists find it hard to account for the truth of a proposition about how things were in the past or will be in the future.)

It is important to realize here that (*pace* Smith, 1993, p. 192; Craig, 2000a, p. 210) the existential quantifier at issue is not to be read as expressing what the following disjunction expresses: "either $\mathrm{P}(\exists x)$ or $(\exists x)$ or $\mathrm{F}(\exists x)$", where each sub-∃ is read as being in the present tense/restricted to the moment of quantification, "P" means "it was the case that", and "F" means "it will be the case that". To begin with, although such a reading of the quantifier could be said to correspond to one mode of tenselessness that can be enjoyed by "exists", such a quantifier does not seem to be *unrestricted*, since apparently it does not range over timeless, abstract entities, such as numbers, if they exist in a Platonic realm. More importantly, on such a reading of the existential quantifier, B-theorists and presentists will not disagree about the truth value of a present utterance of "$(\exists x)(x = \text{Plato})$": both will hold the utterance to be true. Moreover, if B-theorists were to adopt the disjunctive reading, they could not endorse utterances of "$(\exists x)$

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[27] See especially Paper III, "The Tenseless Copula in Temporal Predication".

(*x* is a set whose members are a computer and a dinosaur)", which they would want to do (e.g. Sider, 2001, p. 16). Thus, the *unrestricted* quantifier is *not* to be conceived of as being "made up" of a disjunction of restricted quantifiers with tense-operators operating on them; rather it is plain and simple, irreducibly unrestricted.

All in all, I think both parties should stick to the plain, non-disjunctive, unrestricted quantifier. That, in any case, is the reading I adopt in this thesis.[28]

I should add in this connection that occasionally I will use the expression "*x* exists at *t*" to indicate that *x* is *located* at time *t* – i.e. to say that *x* is part of *t*'s content, as opposed to just being in the range of an unrestricted quantifier located at *t*. At any given point, the way I am using "exists" should be clear from the context.

According to the B-theory of time, then, the unrestricted existential quantifier ranges over "past" and "future" times, things and events, and over timeless objects, if there are any. Statements about the past and future are true (or false) "already" at the time when the statement is made. (B-theorists prefer to say that the statement is simply true or simply false.) Some have thought that such a view of time and truth entails *fatalism*.[29] I think this is wrong, however.

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[28] Those who suspect that presentists and B-theorists do not *really* disagree, and differ only "verbally", have been inclined to think that B-theorists understand the existential quantifier in the disjunctive way, while presentists understand it restrictedly (for discussion, see the papers in Zimmerman, 2004, part I, and Sider, 2006). As indicated above, I do not think they do talk past each other – at the very least, they need not do so. I suspect, however, that common sense is somewhat confused on the issue, wobbling between the feeling that presentism is a tautological truth and the feeling that it is a substantial truth. I will therefore put the idea expressed above in terms somewhat closer to ordinary language: presentists and B-theorists disagree (or should disagree) about what exists *simpliciter*: i.e. "exists" is neither to be taken to be in the present tense nor taken to be *reducibly* tenseless, i.e. as expressing what "has existed in the past, exists now, or will exist in the future" expresses. The totality of what exists *simpliciter* changes with the flow of time on the presentistic world view. This kind of change is denied by the B-theory.

[29] See e.g. Jan Lukasiewicz, following to some extent Aristotle (*De Interpretatione*, IX): "I can assume without contradiction that my presence in Warsaw at a certain moment of next year, e.g., at noon on 21 December, is at the present time determined neither positively nor negatively. Hence it is possible, but not necessary, that I shall be present in Warsaw at the given time. On this assumption the proposition 'I shall be in Warsaw at noon on 21 December of next year', can at the present time be neither true nor false. For if it were true now, my future presence in Warsaw would have to be necessary, which is contradictory to the assumption. If it were false now, on the other hand, my future presence in Warsaw would be impossible, which is also contradictory to the assumption. Therefore the proposition considered is at the moment *neither true nor false* and must possess a third value, different from '0' or falsity and '1' or truth." (Lukasiewicz, 1930/1970, p. 53)

It does not follow from the fact that I will buy milk tomorrow – that "I will buy milk tomorrow" is true – that, necessarily, I will buy milk tomorrow (more formally: $p \rightarrow \Box p$). At most it can be said that, necessarily, if I will buy milk tomorrow, I will buy milk tomorrow ($\Box (p \rightarrow p)$). The latter, though, is a trivial truth that has no bearing on fatalism, as has been noticed by several authors.[30]

The root of the problem here, I suspect, is that when we think about these matters we tend to get things back to front. We tend to think that the today's truth of my utterance, today, of "I will buy milk tomorrow" somehow compels me to buy milk tomorrow. But it is rather the other way around: it is because I happen to buy milk tomorrow[31] that the utterance is true. Truth supervenes on being, not being on truth.

Moreover, the fact that the past and the future are ontologically determinate on the B-theory of time does not entail that the theory is incompatible with nomological or causal indeterminism. The B-theory, as many have noticed, is neutral on this issue.[32] If we consider the world at some specific time t, the state of the universe at that time plus the laws of nature may not nomologically determine what is going to happen (e.g. whether a certain atom will decay) at some later time t'. Nevertheless, the content of that "future" time t' is what it is: either it contains a decayed atom or it does not.[33] Thus, the future may be *nomologically open* even if it is – let us say – *ontologically closed*. So the part of the commonsense conception of time which says that the future is open can be retained by the B-theorist, provided that the openness is nomological. The B-theory does not entail nomological/causal determinism.

In this connection I should mention, briefly, a different but related worry. This is the worry that there can be no causation at all – deterministic or indeterministic – in the world if all times are equally real, i.e. if the universe is a four-dimensional "block universe". The intuition – at least, when one first hears the idea – is that a block universe is a causally inert universe (this was my own reaction when I first heard about the B-theory).

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[30] See e.g. Haack (1978, p. 209) and Hughes and Cresswell (1996, p. 16).

[31] Perhaps even freely (see Oaklander, 1998); but the issue of free will is a difficult subject even disregarding the B-theory of time/presentism controversy.

[32] See e.g. Grünbaum (1973, pp. 319-324), Mellor (1998, pp. 128-129) and Bourne (2006, p. 83).

[33] At least if a measurement is made at the time; and plausibly, also, independently of such a measurement (think of Schrödinger's poor cat); otherwise there is a superposition of states at the time.

Obviously, I cannot address this concern at any length here. I merely want to point out that many of the traditional philosophical analyses of causation can be combined with B-theory. Think, for example, of the Humean view (Hume, 1739-40/1978, book I, part III, section XIV) that causation is constant conjunction: roughly, that if particulars *a* of kind A and *b* of kind B are spatiotemporally contiguous, *a* is before *b*, and all instances of A are followed by instances of B in a spatiotemporally contiguous manner, then *a* is a cause of *b*. (Note that this analysis is not available to anyone wanting to ground the arrow of time on causation, because with that grounding it would introduce circularity.) A counterfactual analysis of causation à la David Lewis (1973a) is also clearly compatible with B-time. Indeed Lewis *was* a B-theorist, and the possible worlds he invoked when evaluating counterfactuals like "If *a* had not happened, neither would *b*" are block universes (see Lewis, 1973b, ch. 4.1; 1979; 1986, *passim*). And I see no compelling reason to think that the more recent accounts of causation involving irreducible "powers", i.e. intrinsic causal abilities or dispositions (see Mumford, forthcoming, for an overview), are as such ruled out by the B-theory of time.[34] This much is true, however: within the B-theoretical framework, causation cannot be understood as involving the *bringing into being* of something which did not exist before (in the sense of coming to be within the scope of an unrestricted existential quantifier). If this *strong production* conception of causation captures the commonsense concept, which seems plausible given its presentistic leanings, then commonsense causation is incompatible with the B-theory of time (see my 2003; cf. Ingthorsson, 2000, p. 31, *passim*). But as I have just indicated, a number of alternative views of causation are compatible with B-time.

Another worry regarding the B-theory is that it is inconsistent with the possibility of change. I will address this "no-change" objection in the next section, taking it in one of its strongest forms – i.e. in relation to perduring objects. I will argue that it is unsuccessful.

Physicists and philosophers of time often ask: If time does not flow, why does it *seem* to us to do so – why is our experience one of time flowing? And it is widely felt that if B-theorists cannot explain this fundamental experience, the B-theory is doomed (e.g. Prior, 1996/1998, and Craig, 2000b, ch. 8).

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[34] However, in Paper IV, I argue that *perdurantism* is hostile to many *prima facie* powers. So if the B-theory entails perdurantism (I do not think it does), power-causation is in considerable trouble, given B-time.

The standard B-theoretical answers (e.g. Smart, 1963, p. 147; Grünbaum, 1973, p. 325; Mellor, 1998, pp. 66-69) involve the accumulation of memories and/or changes of A-beliefs, i.e. beliefs about what is happening now, has happened and will happen. I am not sure, however, that such explanations are adequate. This may not be a big issue, because I am not altogether convinced that the alleged explanandum here is really there to be explained. Personally, I do not find it self-evident that there is a clear and distinct *experience* of flow (at least, of the presentistic sort), as opposed to a firm and stubborn *belief* that time flows. True, I no longer experience past events (except as memories), but I have no positive experience of them having *disappeared* from reality. Nor do I have a positive experience of future times, things and events *not* existing. My belief that past events no longer exist and my belief that future events do not yet exist seem to be theoretical in status, not based on empirical or phenomenological data. I do seem to experience my memories as memories of events that have happened or are earlier than the events I now perceive by my senses, and that my intentions and expectations concern things that will happen or are later than the events I currently perceive; and thus I experience a certain *directionality* of time. But I am not fully convinced that this experience of directionality is also an experience of time *flowing*.

Finally, it is sometimes asked whether it is rational, as opposed to psychologically compulsory, or habitual, for a convinced B-theorist to have different attitudes to the past and the future. Anecdotes concerning Einstein suggest that he had doubts about the rationality of this kind of asymmetry, at least in some cases. The physicist Paul Davies describes Einstein as having tried to console a recent widow by saying "The distinction between past, present and future is only an illusion, even if a stubborn one" (Davies, 1995, pp. 70 and 76).[35] Perhaps it is to some extent rational for a convinced B-theorist to draw comfort from the idea that a recently deceased person "still" lives at earlier times, somewhat analogously to the pleasure the B-theorist may derive from contemplating positive events that "will" take place. In many cases, however, I suppose it is rational for a B-theorist to have different attitudes to what is later and what is earlier – e.g. to worry about the "future" but not about the "past". At any rate, this looks plausible if the B-theorist thinks that the arrow of causation is unidirectional and points to the future. If a person worries about the future, anticipating, anxiously, that certain unpleasant things might (epistemically) then

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[35] It matters not whether this anecdote is true; it illustrates a mind-set.

happen, the chances are that she will act so as to prevent the unpleasant things from happening. But since the past is causally beyond reach (as we here suppose the agent thinks), it is not rational for her to worry about it or try to influence it. If this is correct, then there can be other rational sources of the relevant attitudinal asymmetry to the past and the future than the one referred to in the commonsense description of time in Section 1.1.[36]

Before we move on to the next section I should mention that philosophers have developed theories of time other than presentism and the B-theory, the most famous being *growing blockism* and the *moving spotlight* theory of time. According to the first of these theories,[37] past and present times are real, but future times are not: the universe is constantly growing (temporally) as the result of the continuous creation of new times. According to the second theory,[38] past, present and future times are equally real, but, in contrast with the B-theory, moving spotlight theory says that every time has an objective A-property, instantiating either *being past*, *being present* or *being future*. The property of being present (in the "spotlight") is regarded as "moving" along the block in that the property is instantiated successively by distinct times. It is this kind of change that embodies "the flow of time" on this theory. Since the theory has it that there are objective A-properties, the world contains a B-series *and* an A-series, "the series of positions running from the far past through the near past to the present, and then from the present to the near future and the far future" (McTaggart, 1908, p. 458).[39] The positions of the A-series, whose contents change as the objective present flows on, are often called

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[36] It may be, however, that this issue hinges partly on the theory of personal persistence that is endorsed: Does the B-theorist think that she herself will exist in the future or does she think merely that a psychologically similar temporal counterpart of her will exist? Or, again, the issue may not hinge on such matters: see Parfit (1971) who famously argued that our *identity* through time, as opposed to psychological connectedness ("survival"), should not be of much concern to us: one should care in the same way about a "future self", i.e. a mere temporal counterpart, and *oneself*. The next question is why we should worry more about our future temporal counterparts (or ourselves in the future) than we do about our past temporal counterparts (or ourselves in the past). One reason, I suggest, is to be found in the direction of causation. For further literature on the issue of what attitudes we should have to the past and the future given B-time, see e.g. Parfit (1984, ch. 8), Oaklander and Smith (1994, part III), Mellor (1998, pp. 40-42) and Horwich (1987, pp. 196-198). My papers in this thesis, which are mostly concerned with the persistence of physical objects, do not address questions such as these.

[37] See Broad (1927, pp. 66-67) and Tooley (1997).

[38] Described but not endorsed by McTaggart (1908, 1927); see also Smith (1993).

[39] In fact, McTaggart argued that the A-series is more *fundamental* than the B-series; the B-series depends for its existence on the A-series (McTaggart, 1908, p. 463).

"A-times", while the positions of the B-series, whose contents are "permanent", often are called "B-times".[40] A-times (such as *two days ago*) are defined in terms of their permanent relation to the objective, moving present, while B-times (such as the *16th September 1932*) are defined in terms of their permanent relation so some physical event.

I see no compelling reason to addressing growing blockism and moving spotlight theory at length in this thesis. It is widely acknowledged that the theories face roughly the same problems as presentism does, although the truthmaker objection (at least, for the past) cannot be included in that generalization. Moreover, it has been argued that both theories fall prey to additional difficulties, such as McTaggart's Paradox (McTaggart, 1927, ch. XXXIII; Mellor, 1998, ch. 7) and the epistemological how-do-we-know-it-is-now-now objection (Braddon-Mitchell, 2004; Merricks, 2006). Again, neither theory seems to accord well with our commonsense conception of time. Of course, intuitions may be somewhat divided here, but I suppose most people would not think of Plato, for example, as an *existing* person, instantiating the A-property *being past*. (Speaking for myself, I certainly did not think in that way when I entered philosophy.) On the basis of these considerations I have decided not to examine growing blockism and moving spotlight theory in this thesis. In my view, presentism and the B-theory of time are the two really *interesting* options: the first enjoying support from our everyday ways of thinking about time, the second, it appears, relying more heavily on scientific and philosophical nourishment.

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[40] See e.g. Mellor (1998, ch. 1), although he does not endorse the reality of A-times, only the reality of A-*expressions*.

4. The B-theory and Persistence:
the Three Main Alternatives

Suppose we take the B-theory of time to be correct, even if it is somewhat counterintuitive at first blush; how, now, shall we understand the persistence of physical, middle sized objects? B-theorists have typically endorsed one of the three following theories of persistence: the endurance theory; the perdurance theory; and the stage theory.[41] These theories are not just metaphysical theories of persistence, I should say; they also contain significant semantic ideas about how language maps onto reality. In this section I will briefly describe these metaphysical-cum-semantic theories. I shall also rehearse some of the reasons philosophers have given for endorsing them, on the assumption of B-time (i.e. the kind of time postulated in the B-theory of time[42]), and summarize my own evaluations of those reasons. In Section 5, the reader will find a more substantial overview of my views on these matters, as expressed in the papers.

The *endurance theory*,[43] as we saw in Section 1, is the theory that objects are three-dimensional – i.e. extend or have proper parts only in the three spatial

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[41] The endurance/perdurance terminology was made famous by David Lewis (1986, p. 202), but it was invented by Mark Johnston in his PhD thesis (see Johnston, 1987, pp. 112-113). The theories denoted with the help of these expressions predate Johnston's terminology, however (for references, see below). The stage theory was developed later, in the 1990s and later (see Sider 1996, 2000 and 2001, and Hawley, 2001; see also van Inwagen 1990, pp. 246-247 who describes a theory similar to the stage theoretical one).

[42] "B-time" is a somewhat ambiguous expression. It can stand for a *specific date* (as described above, at the end of Section 3) or for a certain *kind of time*, viz. the kind of time described by the B-theory of time (a time which does not flow, is extended, and contains earlier-later relations). The intended meaning should be clear from context.

[43] Non-B-theoretical defenders of the endurance theory were mentioned in Section 1.1. An explicit B-theoretical defender of the endurance theory is Mellor (1981, ch. 7; 1998, ch. 8). Simons (1987, ch. 5), Johnston (1987), Lowe (1988), Haslanger (1989), van Inwagen (1990), and Wiggins (2001) also defend endurantism in what appears to be a B-theoretical framework (in the case of van Inwagen, endurantism for persons).

dimensions – and persist[44] through time by being wholly present at distinct times as numerically the same entity. It is part of the semantics of the theory, consequently, that ordinary proper names, such as "the Eiffel Tower", and ordinary kind/sortal predicates, such as "is a tennis ball", refer and apply to 3-D entities that are wholly present at distinct times, if they persist. Traditionally, endurantists – like proponents of the other two views – commit to the idea that objects survive intrinsic change, at least within certain limits. (For the purpose of future discussion, let us denote endurance through intrinsic change "wide endurance" and endurance not involving intrinsic change "narrow endurance".) How much intrinsic change a certain particular object tolerates depends on the *kind* of object it is: different kinds of objects are regarded as being governed by distinct persistence conditions. For example, a statue is said to not survive being squashed, while the lump of clay it is made of is held to survive the event; on the other hand, the statue is typically regarded as surviving being repaired by the insertion of new material, while the lump of clay is not. The issue whether the basic semantics of the endurance theory can be sustained if the traditional commitment to the idea that objects persist through intrinsic change – i.e. endure "widely" – is given up will be addressed later in this thesis (see Sections 5 and 6).

The *perdurance theory*[45] is the view that objects are four-dimensional – i.e. extend not only in spatial dimensions but in the temporal dimension too – and persist through time in virtue of being so extended in time, i.e. by having distinct proper temporal parts at distinct times. Persistence through time, then, is treated as being essentially no different from extension through space; the major difference being that the temporal parts of an object are interrelated by earlier-later and casual relations. Exactly what "unites" the temporal parts of an object into a perduring whole – i.e. into a 4-D "space-time worm" – is a somewhat

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[44] To be able to compare the different theories of persistence, we will, somewhat artificially, have to let "persist" have a constant and fairly weak meaning across the comparisons. The expression should be taken to mean merely that the objects in question, in one way or another, are located at different times; or, even more weakly, have at least temporal counterparts at distinct times. An endurantist, however, is likely to insist that in contexts where we are referring to objects, as opposed to processes, "persist" should be taken to entail that the objects in question are wholly present as numerically the same entity at distinct times. For more about how the respective theories interpret "persist", see Paper VI, "Can persistence be a Matter of Convention?".

[45] B-theoretical perdurantists include Russell (1948, pp. 308 and 475-477), Taylor (1955), Quine (1960, p. 171), Smart (1963, p. 133), Goodman (1966, pp. 127-130), Armstrong (1980), Hirsch (1982), Lewis (1986, pp. 202-204 and 210), Heller (1990, ch. 1) and Balashov (2000), among others. The question whether perdurantism is compatible with presentism is addressed below.

controversial issue. The traditional view, however, is that the temporal parts are united by unrestricted mereological composition, and that persisting objects are simply mereological sums or aggregates of their temporal parts.[46] Different 4-D sums are, naturally enough, regarded as having different properties, likewise with their parts, and the parts are moreover held to be interrelated differently, spatiotemporally, causally, and in terms of similarity. Because of such different features distinct sortal predicates are held to apply to them, and not just distinct proper names. Also, if a 4-D object satisfies a certain sortal predicate (e.g. "is a tennis ball"), the predicate is typically viewed as inapplicable to any of the proper parts of the object – the so-called maximality principle (Lewis, 1976/1983, p. 59). Due to maximality, the perdurantists get the intuitively right number when counting objects diachronically. (How many bananas were in the bowl today: one or infinitely many?) Finally, intrinsic change of an object is regarded as consisting in one temporal part of the object being *F* (where "*F*" is a predicate for an intrinsic property) and a non-overlapping later or earlier temporal part failing to be *F*.

The *stage theory*[47] retains the metaphysics of the perdurance theory but rejects its semantics. The world is regarded as consisting of the four-dimensional aggregates of the perdurance theory, but proper names and ordinary sortal predicates are held to refer to the fundamental temporal parts of the 4-D aggregates. Stage theorists take these fundamental temporal parts to be 3-D entities, i.e. entities with no temporal extension.[48] Since names and sortal

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[46] I address this issue at length in Paper IV, "4-D Objects and Disposition Ascriptions", and Paper VI, "Can Persistence be a Matter of Convention?". It would be interesting to explore the possibility of identifying objects with aggregates of successively existing, narrowly enduring, entities. To my knowledge, this possibility has yet to be addressed by philosophers. Some passages in David Lewis's work (e.g. 1983, pp. 76-77) may suggest such a reading of his version of the perdurance theory, but elsewhere it is clear that this is not what he had in mind (e.g. Lewis, 1986, pp. 202-204 and 210; 1988, pp. 69-70). Anyway, what features would objects have if they were identified with such aggregates? It seems to me that although objects could then be said, in a sense, to "perdure" (perhaps it would be better to say "pendure"), even if their proper "temporal parts" endure, they could not be regarded as *four*-dimensional entities, extending in time in the way they extend in space, for the kinds of reason discussed in Paper I, "Endurance Per Se in B-time". In this thesis I will ignore this hypothetical position: it is too underdeveloped. I therefore construe the perdurance theory as a position that presumes, as perdurance theorists in fact presume, a four-dimensional metaphysics.

[47] For B-theoretical stage theorists, see Hawley (2001) and Sider (2001). Varzi (2003) also defends the stage theory in what appears to be a B-theoretical context. The question whether the stage theory is compatible with presentism is addressed below.

[48] Strictly speaking, it may not be necessary for stage theorists to hold that 3-D entities located at distinct times compose 4-D aggregates (Hawley, 2001, p. 52); the core ideas are that no 3-D

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predicates apply to 3-D entities, the stage-theoretical semantics is, in this respect, similar to the endurance semantics. There are differences though: one is that, given the 4-D metaphysics, a name such as "the Eiffel Tower" must be indexed to a certain instant if it is to acquire unique reference – otherwise it is not yet determined exactly what tower we are talking about, i.e. what stage of the relevant 4-D aggregate we are referring to. ("Stage" is the stage theorists' preferred term for temporal part.) Objects persist through time in virtue of having temporal counterparts at earlier/later times, not in virtue of being wholly, nor even partly, present as numerically the same entity at more than one time. An object's temporal counterparts – in practice, other stages/objects of the same kind within the very 4-D aggregate of which the object in question is a proper temporal part – "represent" the original object as being located at their times. If the temporal counterparts have distinct intrinsic properties, the object can truly be said to change intrinsically, by analogy with the way modal counterpart theory grounds the truth of "*a* could have been X" (see Lewis, 1968, 1971).

Before we look at the most prominent arguments for these theories of persistence (given B-time), let me point out that presentism renders all of the theories implausible (cf. Section 2.2.2). All of the theories appear to involve cross-temporal relations, but on a presentistic metaphysics it seems that there cannot *be* any such relations, since there are no non-present relata of the relations. How, then, can any of the theories be true? What are the truthmakers for such theories, or specific persistence statements, in the presentistic framework? As we saw in Section 2.2.2, the notion that we can ground truths that involve the way things were in the past or will be in the future in Lucretian properties, or laws of nature plus the present state of the universe, is highly problematic. So unless better accounts are forthcoming, it would appear that presentism comes with an unaccommodating stance on all three persistence theories.[49]

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entity is located at more than one instant and that names and sortal predicates apply to 3-D entities. However, both Hawley and Sider do in fact accept the existence of 4-D aggregates and develop stage theory on the assumption of the existence of such aggregates (see Sider, 2001, p. 191 ff.; Hawley, 2001, p. 68 ff.).

[49] Although there are presentists who defend endurantism (see Section 1.1, note 4, for some examples), I know of no self-professed presentist who defends perdurantism or the stage theory. Theodore Sider (2001, pp. 71 and 208), however, attempts to formulate perdurantism and stage theory in terms suitable to presentists (cf. Crisp's analysis of causal statements in note 19). I think Sider's suggestions fail because of the truthmaker problem discussed in Section 2.2.2. It seems he concedes this difficulty (p. 208). Trenton Merricks, a self-professed presentist, has produced a very short argument against the possibility of 4-D entities, or 4-D aggregates, in a presentistic

Now, what reasons have been put forth for adopting one theory or the other, given the framework of B-time?

I begin with endurantism. Some B-theorists have adopted traditional, wide endurantism on the more or less explicit grounds that it is intuitively appealing: that is, wide endurantism has been deemed very close to, if not identical with, the common sense view of persistence (e.g. Simons, 1987, pp. 123-127; Mellor, 1998, p. 86; Wiggins, 2001, p. 31, *passim*). The idea seems to be that if there are no very strong arguments against wide endurance in B-time, comparable in strength to those levelled against presentism, wide endurantism should be adopted, or retained, even if the revisionary B-theory of time is accepted. The combination is not to be rejected merely because it is initially counterintuitive. A moderate conservatism is at work here: we should revise our views about the world no more than necessary; wide endurantism is the default view, pending arguments showing that it is in great trouble or outright intolerable (given certain other ideas, such as the B-theory, which are held fixed).[50]

I have sympathy with this line of thought. My main reservation here is that I am not completely confident that *wide* endurantism explicates common sense. I do not deny that wide endurantism is in line with the above-mentioned philosophers' intuitions, but my experience is that when one discusses intrinsic change with non-philosophers one occasionally encounters the view that, although we talk as though it were so for pragmatic reasons, things cannot *really* change (cf. Section 1.1, note 5). Some people, at least, do not seem to be realists about endurance through intrinsic change. They readily accept narrow endurance, certainly, but they appear to regard wide endurance, on reflection, as quite unintuitive, contradictory even.[51] Thus, I am not completely convinced that wide endurantism is *the* common sense theory. (More about this later.)

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universe (1995, pp. 524-525). Here it is in an even more condensed form: an entity cannot have another entity as a part if that other entity does not exist; a 4-D entity would have to have parts that do not exist, given presentism, namely the non-present ones; so, assuming presentism, there cannot be any 4-D entities.

[50] One could, of course, take an established absurdity of wide endurantism within a certain context to flag the intolerability of the context rather than of wide endurantism. Several presentists seem to have argued thus in connection with combining wide endurantism with the B-theory. However, as just indicated (see also Section 2.2.2), the adoption of presentism to allow for objects enduring through intrinsic change does not seem wise.

[51] Such sceptical judgments are not, I think, generally based on an application of Leibniz's Law (the principle that says that if entities *a* and *b* are numerically identical, then everything that is true of *a* is true of *b*, and vice versa). Many people have never heard of the principle, and often they do not seem to be familiar with the idea expressed by it. It may be that Rychter (2009, p. 15)

A related argument for wide endurantism, and one sometimes pressed into service by endurantist B-theorists, is that traditional endurantism is needed in order for us to be able to distinguish between objects and events/processes, as we do in ordinary and scientific discourse (again, see Simons, 1987, pp. 123-127; Mellor, 1998, pp. 85-87; Wiggins, 2001, p. 31). Events and processes we usually take to have temporal parts. We say things such as "A football game consists of two halves, each of 45 minutes duration", "The evolution of man consists of several stages", and so on. Objects, on the other hand, are not normally taken to have temporal parts. We think of objects as *participating* in events and processes, but not as *being* events and processes (Strawson, 1959, p. 56-57). We treat them as belonging to distinct ontological categories. Endurantist B-theorists think that this useful commonsense and scientific distinction between processes and objects will be lost if traditional endurantism is given up.

Again, I have sympathy with this line of thought. If we adopt perdurantism, objects will turn out to be process-like indeed. According to that theory, objects persist through time in virtue of their possession of distinct temporal parts at distinct times. As Quine (who was a perdurantist) says: "Physical objects, conceived thus four-dimensionally in space-time, are not to be distinguished from events, or in the concrete sense of the term, processes" (Quine, 1960, p. 171). It may be, however, that the object/process distinction does not require wide endurantism – at least, if we are thinking about the general distinction. Think, for example, of an intrinsically unchanging, enduring object moving about in space. *Ex hypothesi* the object does not have any temporal parts, while arguably the temporally extended motion (the process) has (cf. Salmon, 1977). It may also be that the object/process distinction can be retained if stage theory is adopted. On that theory, a football game is a 4-D entity persisting through time by having distinct temporal parts at distinct times, while the players of the game are 3-D entities persisting by having temporal counterparts at distinct times; processes and objects turn out to have different properties. However, as I point out in Paper V ("Can I be an Instantaneous Stage and yet Persist Through Time?"), the stage-theoretic semantics is problematic.

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makes a correct diagnosis of the source of the occasional scepticism when he points out that such doubts may simply result from the confusion of numerical and qualitative identity. Another possibility is that the doubts are based on worries of the kind expressed at the end of Paper II, "The Problem(s) of Change Revisited".

Thirdly, some endurantist B-theorists have thought that a world that accommodates change must contain enduring objects with different properties at different times (e.g. Simons, 1987, p. 126; Mellor, 1998, pp. 89-90). Perduring entities, for example, are held not to change. They are as changeless over time as a poker with a hot end and a cold end at a certain time is changeless over space at the time in question.

I find the reasoning in this "no-change" objection unconvincing. We can agree that narrowly enduring objects and instantaneous stages do not change if, *pace* the stage theorist, "change" analytically requires the subject of the change to remain in being as numerically the same entity through the change. But *perduring* entities do remain in being as numerically the same entity through the variation of the properties primarily had by their temporal parts, since they are 4-D aggregates of such parts, extending over time as numerically the same entity by having distinct temporal parts at distinct times (cf. Lewis, 1976/1983, p. 57; 1986, p. 210).

Even if it is true that the supposed change is "derivative", and derives from the properties primarily had by the entity's temporal parts, why is it necessary to deny that variation in the properties of a perduring entity's parts counts as a change in the perduring entity? First, sometimes – and non-metaphorically, it seems to me – we apply the predicate "*x* changes" to objects if their proper *spatial* parts differ at a certain time. Consider, for example, "The road changes character beyond the hill: it becomes narrow and bumpy" (cf. Sider, 2001, p. 216; see Hales and Johnson, 2007, pp. 511-512, for further examples). Moreover, the parts of perduring objects are related by earlier-later and causal relations, and this makes the case very different from that of spatial variation at a time: the variation in the first case is inherently *directed*. Also, in ordinary and scientific discourse we do in fact speak of *processes* changing, even though they are said to have temporal parts. We say things such as "The game changed in the second half: the second half was more intense", and "After the inflationary phase, the expansion of the universe slowed down" (for further examples, see Hacker, 1982, p. 18). Changes in perduring entities may not be paradigmatic cases of change, but I think they deserve to be called changes nevertheless.

Fourthly, and finally, B-theorists rejecting modal counterpart theory have adopted traditional, wide endurantism so that certain modal statements about the possible life-spans of objects come out true (van Inwagen, 1990). It has been argued that perduring 4-D objects, understood as aggregates of temporal parts, cannot be ascribed modal properties such as *could have ceased to be already at t* unless modal counterpart theory is assumed, while widely enduring objects can, even assuming cross-world identities.

I think the complaint here, as directed against perdurantism, is valid, even if modal counterpart theory is adopted. I also think that the criticism can be extended to show that 4-D objects cannot, by and large, satisfy ordinary dispositional predicates, such as "*x* is elastic" or "*x* is water-soluble". I discuss this issue at length in Paper IV ("4-D Objects and Disposition Ascription"). However, if one is intent solely on ensuring that objects can have modal properties such as *could have ceased to be already at t*, then I think narrow endurantism, or stage theory (its problematic semantics aside), will suffice. In Section 5, I briefly address the question whether the difficulty regarding ordinary dispositional predicates applies to stage theory and narrow endurantism – it does not apply to wide endurantism, I argue in Paper IV.

Turn now to B-theoretical perdurantists: What are their main reasons for adopting perdurantism?

Some B-theoretical perdurantists (e.g. Smart, 1963, p. 133; Goodman, 1966, pp. 127-130; Quine, 1960, p. 171) seem to have based their view in part on the fact that, on the B-theory of time, time is *space-like*: time is viewed as being, in a sense, extended – all times are treated as equally real. This similarity between space and time, they seem to have thought (they do not really argue the matter, but rather state how things are), entails that things extend in time in the same way that they extend in space.

I think that the chief weakness with this line of thought is that although time is to some extent space-*like* on the B-theory of time, it is *not* a further spatial dimension on that theory. For example, the temporal dimension is held to differ from spatial ones in that it is *directed*, both temporally and causally (e.g. Mellor, 1998). And it may be another important difference between space and time that entities *extend* in space but *endure* through time. An argument for denying endurance in B-time is needed. We cannot merely rely on an intuition that if time is space-*like*, objects perdure. The analogy between space and B-time must be handled with care.

It may be, however, that the perdurantists of the past had in mind, in effect, arguments against endurance, and more specifically narrow endurance, in B-time of the kind offered by more modern philosophers. Carter and Hestevold (1994) argue that particular objects allegedly enduring in B-time cannot really be particulars but must be universals (which they take to be an intolerable absurdity), while Barker and Dowe (2003) argue that endurance in B-time entails straightforward contradictions. I do not think these arguments succeed, for the reasons explained in Paper I ("Endurance Per Se in B-time"). In any case, the

arguments do not, as such, favour the semantics of perdurance theory over the semantics of stage theory.

Another line of thought followed by perdurantist B-theorists has been that the combination of B-theory and wide endurantism fails to accommodate the fact that objects change *intrinsically*: the so-called "problem of temporary intrinsics".[52] This failure has been presented by some as the main reason for adopting perdurantism.[53] In the papers I spend quite a lot of time scrutinizing this issue (see Section 5, Paper II "The Problem(s) of Change Revisited", and Paper III "The Tenseless Copula in Temporal Predication"), so I will not go into details here. Suffice it to say that, in my view, the foes of wide endurance in B-time have not yet managed to recruit the problem of temporary intrinsics in a non-question-begging way. Also, even if some argument were successful here, all it would show is that objects cannot endure through intrinsic change in B-time: it would not establish that narrow endurance in B-time is to be rejected. Consequently, it would not establish that the world contains 4-D entities that extend through time in the same way that they extend in space, i.e. that every temporal part of such an entity (except the instantaneous ones) has proper temporal parts (Lewis, 1986, pp. 202 and 210). Some further, deeper, argument would be needed to establish this – an argument of a more fundamental sort, like the failing ones discussed above.[54] Nor would the argument as such establish that proper names and sortal predicates apply to the 4-D aggregates rather than to their instantaneous temporal parts.

Yet another prominent thought has been that if B-theorists adopt perdurantism, puzzles about entities that fully coincide at times are more easily resolved. Consider a statue which, at a certain time *t*, is composed of, or made of, a particular lump of clay that existed before the statue. At *t* the statue and the lump coincide fully: they interpenetrate each other, they share the same spatial region and the same micro-parts. And yet it would seem that they have to be distinct as they have distinct temporal properties (the clay predates the statue). But how can

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[52] It is remarkable that both endurantists and perdurantists charge each other with presenting theories that are incompatible with intrinsic change.

[53] David Lewis, for example, writes: "The principal and decisive objection against endurance, as an account of the persistence of ordinary things such as people and puddles, is the problem of temporary intrinsics" (Lewis, 1986, p. 203). He apparently takes perdurantism to be the only alternative to endurantism, and consequently adopts it.

[54] In his (1988) Lewis tries to extend the objection to include external, relational change: continuous relative motion of two objects forces the objects to extend through time in the same way they extend through space. I think this argument is equally question-begging, however, for reasons the same as those discussed in Papers II and III.

two distinct objects fully coincide at a time? Perdurantists have a nice answer: the phenomenon is as unproblematic as two roads overlapping (coinciding fully) at a certain region of space: the statue and the clay simply share a proper temporal part located at *t*, just as two roads can share a proper spatial part (Lewis, 1976/1983; 1986, pp. 252-253; see also Sider, 2001, ch. 5.2 for a general discussion). Restricting our attention to *t*, the two objects can be said to fully coincide (*at that time*), but if we consider them as 4-D *wholes* it is clear that, as whole objects, they do *not* fully coincide. The lump has temporal parts located at times earlier than the times of the earliest temporal parts of the statue.[55] The traditional, wide endurantist, who will want to distinguish the lump and the statue, will not have such a straightforward answer, since she will regard both the clay and the statue as being wholly present at *t*, and hence as coinciding fully at *t* as whole objects. Wide endurantism therefore obliges its advocates to understand composition at times in other terms (it is unclear quite what terms, but see Lowe, 2002, p. 73, for an embryonic analysis), or simply to invoke a primitive composition relation (see Wiggins, 2001, p. 40, *passim*); the latter renders composition a fairly enigmatic phenomenon.

I agree that perdurantism has an advantage over endurantism here. Composition within the wide endurance metaphysics is a rather puzzling phenomenon. But the perdurance account is incomplete – at least, in respect of the linguistics of composition. Perdurantists should explain what makes it correct to say that the statue is made of the clay at the time in question rather than the other way around. There seems to be no asymmetry between the statue and the clay at *t* given that the two entities simply share a temporal part at *t*. Perhaps perdurantists will want to answer that it is correct to say that the lump of clay constitutes the statue at *t* simply because the lump pre-dates the statue. But this answer will not do as a general explanation. If the statue is repaired with new clay many of us will want to say that the statue is constituted by a new lump of clay, even though now the statue predates the relevant lump of clay.

Stage theorists point out another linguistic difficulty with the perdurance account of entities that coincide fully at a time. This difficulty constitutes the stage theorists' principal reason for replacing perdurance semantics with the stage-

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[55] Perdurantists tend to handle cases of full coincidence of *whole* 4-D objects by alluding to contingent identity (see Lewis, 1986, pp. 252-253). However, I think contingent identity is unacceptable even assuming modal counterpart theory: see Paper IV, "4-D Objects and Disposition Ascriptions".

theoretical one (see in particular Sider, 2001, ch. 5.8). (By and large, the stage theorists accept the metaphysical criticism of endurance in B-time levelled by perdurantists.) The problem is that perdurantists, like endurantists, are committed to saying that there are *two* objects present at the time of coincidence, viz. the statue and the lump of clay. The two objects may not be *wholly* present at the time in question, but nevertheless they are present (by being *partly* present). It is intuitively wrong, stage theorists suggest, to say that there are two objects present at the time in question (Sider, 2001, p. 189). Intuitively, *one* object is present.[56] Therefore we should take sortal predicates and names to apply to instantaneous temporal parts (stages) and not to 4-D aggregates of temporal parts. The expressions "the statue" and "the clay", when indexed to the time of coincidence, should be taken to apply to a *single* thing: an instantaneous stage. Composition at a time becomes *identity* – not overlap, nor primitive composition.

I have three comments on this stage-theoretical reasoning. First of all, is it *that* counterintuitive to say that there are two objects present when facing a statue made of a lump of clay? It is not obvious that this is to indulge in double-counting; it certainly is not if one assumes a wide endurance metaphysics. Secondly, I think stage theorists need to explain just as much as perdurantists do – and, equally, advocates of narrow endurance – what makes it correct to say that the statue is made of the clay rather than the other way around, given that the statute and they clay are identical. Thirdly, the stage-theoretical semantics presupposed here is problematic, as I argue in Paper V ("Can I be an instantaneous Stage and yet Persist Through Time?").

I have now sketched some of the main reasons that have been given, against a background of B-time, in support of three leading theories of persistence: endurance, perdurance and stage theory.[57] I have also indicated briefly how I

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[56] Lewis tries to accommodate this intuition by saying that in such cases we do not count by identity but by identity-at-a-time (Lewis, 1976/1983, p. 63).

[57] The reader familiar with the modern literature on persistence will have noticed that I have not mentioned that perdurantists (e.g. Lewis, 1976/1983) and stage theorists (e.g Sider, 2001, pp. 202-205) sometimes claim that they have the best solutions to the puzzles of fission and fusion, i.e. to cases in which one object apparently becomes two, or two objects apparently become one. I think the issues are too complex to be described here, and I do not have a firm, considered opinion on the matter (for an endurantist analysis of personal fission, see Merricks, 1997; Trenton Merricks, however, is a presentist). I have also left out the much-discussed homogeneous spinning disc thought experiment (Armstrong, 1980), which *prima facie* gives support for endurantism. Again, I think the issue is too complex to be described here, and I lack a considered view on the issue. One thing that surprises me about the discussion is that it ignores General Theory of Relativity, which seems unwise given that the thought experiment deals with accelerated motion.

would evaluate these reasons. It is time, then, to describe my papers and to say how they are related (Section 5), and to make clear the general conclusions that can be drawn from them (Section 6).

5. Summary of the Papers

In Paper I, "Endurance Per Se in B-time" (2009b), I address Carter and Hestevold's (1994) and Barker and Dowe's (2003, 2005) arguments for the conclusion that objects cannot endure in B-time even if they remain intrinsically unchanged.

Carter and Hestevold argue that if ordinary objects endure in B-time, they cannot be particulars but must be universals (because they will be multiply located in time) which they manifestly are not. Consequently, if the B-theory of time is true, endurance is to be rejected.

I argue that the argument fails because being multiply located in time, even in space, is not a *sufficient* condition of being a universal, as universals are traditionally understood.

Barker and Dowe describe two paradoxes, each of which they take to show that endurance in B-time is a straightforwardly contradictory phenomenon. The first paradox is supposed to establish that objects that endure in B-time are both 3-D and 4-D; the second is intended to establish that the proper temporal parts of the lives or histories of enduring objects both are and are not located within certain space-time regions.

The first paradox is no paradox, I argue, because it does not follow from the fact that an object endures in B-time that it is 4-D. The paradoxical result of the second paradox depends on the notion that enduring objects are *parts* of their lives. However, it is not evident that the relationship between an enduring object and its life is mereological. In particular, the argument that Barker and Dowe present for this conclusion fails.

In Paper II, "The Problem(s) of Change Revisited" (2007), I move on – only logically speaking, for this paper predates the first – to address "the problem of change" or "temporary intrinsics". I point out that in fact we are concerned with two arguments – no doubt closely related but nevertheless distinct – against the idea that objects endure through intrinsic change in B-time; hence the title of the paper. To keep the arguments apart, I dub one "the argument from Leibniz's Law" and the other "the argument from Instantiation of Incompatible Properties".

My main objection to the arguments is that both are question-begging. That is, both deploy premises that advocates of endurance through change in B-time ought to deny. Hence, the arguments fail to show that endurance through intrinsic change in B-time is impossible. However, at the end of the paper I express concern about the metaphysical nature of intrinsically changing, enduring objects. Do we have to postulate *haecceitas* (i.e. "thisnesses", see Adams, 1979) or even *thin particulars* (see Armstrong, 1997, pp. 123-124, for the notion) which inhere in enduring objects if endurance through intrinsic change is to make sense? If so, can endurantism (i.e. wide endurantism) then be said to accurately mirror the commonsense view of persistence? This is a worry which, I think, is not confined only to wide endurance in B-time, but applies to presentistic contexts as well – *if* presentism does not rule out persistence altogether, that is (see Sections 2.2.2 and 4).

Paper III, "The Tenseless Copula in Temporal Predication" (forthcoming), is in some ways logically prior to Paper II, although it was written after it. Discussing the semantics of tenseless discourse, it is an inquiry into the appropriate semantics for the tenseless copula "is" (or "*is*", as it is sometimes written). This copula makes frequent appearances in Paper II. The ordering of the papers I have settled on was chosen, however, because I think the point of the discussion in Paper III is more readily appreciated if one has read Paper II previously. "The Tenseless Copula in Temporal Predication" also clarifies, develops, and in minor respects revises, some of the ideas expressed in "The Problem(s) of Change Revisited".

For example, in Paper II, I took it for granted that the tenseless copula has a disjunctive character, and I said, rather quickly, that the copula should be read as "encompassing the tensed 'was, is or will be'" (p. 267). In Paper III, I argue that we should distinguish two tenseless copulas: one that has a disjunctive character (logically equivalent to "was, is or will be", which I no longer regard as tensed) and one saying that the subject plainly and unqualifiedly just is what the predicate expresses. (I also investigate a third possibility: a tenseless copula equivalent to the conjunction "was, is and will be". But I reject this copula as useless.)

The first copula can be companioned, and qualified, by an "at time *t*" clause, but the second cannot: it says that the subject is φ *simpliciter*. The second tenseless copula is apt for use in, for example, mathematical sentences, such as "The number two is an even number". It can also be used in sentences such as "Time *t* is before time *t′*", in sentences ascribing properties to temporal parts (at least instantaneous ones), and in sentences saying that an object has a relational property constituted by the fact that it bears a certain relation to a specific time.

The second copula is not suitable, however, for ascribing *temporary intrinsics* to objects enduring in B-time (nor, I should add, for ascribing temporary extrinsics to such entities). In such a case, I argue, B-theorists ought to use the first copula. When the first copula is used, no contradiction is entailed by the assertion that *a* is straight *and* bent, even if time clauses are left out. The predicates "is straight" and "is bent" are therefore not incompatible (as they are often alleged to be) if the copula is understood in this way – as it should be if we are concerned with an object enduring in B-time.

The perdurance theory is the focus of Paper IV, "4-D Objects and Disposition Ascriptions" (2009a). Here I ask whether dispositional statements, such as the statement that *a* is explosive at *t*, can be true if "*a*" denotes a perduring object. I argue that in most cases the answer is "no", whether or not the standard 4-D Formula for temporal predication is accepted. The standard 4-D Formula for temporal predication says that perduring object *x* is *φ* at *t* (derivatively) iff *x* has a temporal part at *t* which is *φ* – i.e. iff *x*-at-*t* is *φ*. If this formula is accepted, and "*φ*" stands for a dispositional predicate, modal difficulties similar to those described by van Inwagen (1990) arise in relation to the primary satisfaction of the dispositional predicate by the relevant temporal part (understood as instantaneous). On the other hand, if the formula is rejected, and dispositional predicates are held to apply "directly" to four-dimensional objects even though the predication is indexed to a certain time, the modal problem simply moves to the level of the whole perduring object. Unlike van Inwagen I argue that modal counterpart theory, with its *qua*-reasoning, offers no escape here. I go on to argue that endurantism does not face these or analogous difficulties with disposition ascriptions, since in its traditional, wide form, at any rate, it does not identify objects with mereological sums, as perdurantism does. The question of the metaphysical nature of enduring, changeable objects remains, however.

I end the paper by considering several possible perdurantist responses. One consists in simply biting the bullet and accepting that perduring entities rarely, if ever, satisfy dispositional predicates. A difficulty with this response is that some sortal predicates seem to analytically entail that entities of the kind in question have certain dispositions. For an entity to be a cracker, for example – to satisfy the sortal predicate "is a cracker" – it seems necessary that it be explosive. So if no entities are explosive, it seems that there are no crackers. Thus, biting the bullet appears to come at a high price: the elimination of many kinds of object. (An issue not discussed in detail in the paper is that the latter kind of difficulty affects those endurantists who deny wide endurantism as well: consider "*x* is a folding chair", for example. However, the difficulty is not as general for such endurantists as it is

for perdurantists, because it is only predicates entailing an ability to change intrinsically that are affected, for the reasons explained in the paper, n. 39, p. 65.)

Paper V, "Can I be an Instantaneous Stage and yet Persist Through Time?" (2008), is concerned with the stage theory. In the paper I address a *prima facie* logical problem with the view. Stage theorists explicitly say that (fundamental) stages are instantaneous, that objects are identical with stages (i.e. that a particular object is identical with a particular stage), and that objects persist through time. But how can a persisting object be identical with an instantaneous, non-persisting stage? Leibniz's Law – the principle that if *a* and *b* are identical, everything that is true of *a* is true of *b*, and vice versa – seems to rule that objects and stages must be non-identical.

The advocates of the theory do not address this argument from Leibniz's Law explicitly,[58] but important passages in their books suggest that they would reject the argument on the basis that "persist", strictly speaking, means different things when associated with different subject terms. When we say "stages do not persist" we claim that stages do not have any *stage*-counterparts located at times earlier or later than the instant at which they are themselves located; but when we say, for example, "books persist", we claim that books have *book*-counterparts at times... etc. However, in the paper I argue that Leibniz's Law can be reapplied to show that a stage that is identical with a book must have book-counterparts, and that it must be true of the stage *qua* stage (i.e. of the stage when it is referred to with an expression associated with the stage-concept) that the predicate "persists" applies to it with the same meaning, and is satisfied by it in the same way, as when it is applied to the book (*qua* book). But then "stages persist" comes out true, which stage theorists deny.

In order for the theory to be consistent, I argue, stage theorists must introduce an overabundance of persistence predicates expressing different persistence-concepts (one for every sortal-concept). Many of these predicates will be simultaneously satisfied by a particular object and the stage with which it is identical. But then stage theory can no longer be credibly regarded as a mapping of *ordinary language* on to a world of 4-D aggregates, as it is claimed to be (Sider, 2001, ch. 5.8, especially pp. 191-192; Hawley, 2001, ch. 2, especially p. 43).

It would seem that a lesson to be learned here is that "persistence", as expressed in ordinary language, expresses absolute *numerical identity* over time,

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[58] Notice that this argument from Leibniz's Law is not question-begging, because stage theorists explicitly say that stages do *not* persist, while objects *do* persist.

not different kind-relative temporal counterpart relations in distinct contexts. (This is actually a rather weak conclusion, since it is compatible with perdurantism.) Moreover, in view of its messy character, the stage-theoretical semantics does not seem very inviting, even if one accepts the revisionary 4-D metaphysics. (Of course, here, four-dimensionalists must make a cost-benefit comparison of perdurance and stage-theoretical semantics: as we have seen, dispositional predicates seem to go overboard on the perdurance semantics. It is to be noticed, however, that if instantaneous stages are identified with the 3-D mereological sums of their spatial or qualitative parts, criticism like that found in "4-D Objects and Disposition Ascriptions" can be applied to the stage theory – at least, regarding predicates saying that the subject has a certain disposition to change intrinsically, or actually does change intrinsically. This complication is not addressed in the paper, because stage theorists do not explicitly claim that stages are identical with 3-D mereological sums. However, given their general distaste of coinciding entities, I think stage theorists ought to identify stages with such sums.)

The sixth and final paper, "Can Persistence be a Matter of Convention?" (submitted), is about the extent to which, and sense in which, the truth of an utterance of a sentence such as "The entity e located at time t is the same K as the entity $e´$ located at later time $t´$" can be a function of human conventions. It is sometimes suggested by philosophers that the truth of utterances like this is to some extent determined by arbitrary conventions. For example, Derek Parfit (1971) appears to hold that if "e" and "$e´$" refer to three-dimensional persons, then the truth value of the utterance depends partly on what persistence conditions – understood by him as *identity* conditions – we adopt for persons.[59] Others suggest that this is how we normally think about the truth value of utterances of persistence-sentences referring to physical objects. Trenton Merricks, for example, writes (in the material mode of speech): "We often assume that the identity over time of inanimate macrophysical objects can be somewhat conventional. For example, we might, for practical purposes, leave it up to the courts to 'decide' a

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[59] If we adopt very strict identity conditions for persons, requiring non-branching, maximal psychological connectedness, then, in all likelihood, the utterance of such a sentence will be false; if we adopt loose identity conditions, requiring only non-branching, psychological continuity, the utterance of such a sentence is more likely to be true. Strict identity conditions yield a world description similar to the stage-theoretical one in which the world is depicted as containing very short-lived persons with "future" and "past" "selves" located at other times; loose identity conditions yield a world description similar to the "wide" endurance-theoretical one in which the world is depicted as containing long-lived persons enduring through various psychological changes.

case of statue identity over time that – prior to any judicial decree – is in some sense borderline" (Merricks, 2001, p. 176).

Katherine Hawley objects, however:

> One idea is that questions of persistence in specific cases may be in some sense conventional. For example, it may simply be up to us to decide the persistence conditions for such objects as pieces of turf and guitars, and perhaps even for people. [...] To think that we can define, decide, or stipulate persistence conditions is to think that we can define, decide or stipulate whether or not a certain object which exists right now also existed yesterday. Taken literally, this view attributes to us mystical, magical powers to affect the past, to create and destroy things by the mere power of thought. (Hawley, 2001, p. 6)

Later, Hawley restricts her objection, suggesting that it applies only to the endurance theory, so that stage and perdurance theories escape it: "endurance theorists should not be conventionalists about persistence conditions, on pain of becoming idealists" (ibid., p. 151). Merricks apparently agrees that this kind of objection is fatal to the endurance theory (2001, pp. 176-179). Since he thinks that we occasionally do conventionally revise persistence conditions he takes the objection to be a good reason for abandoning the endurance theory. (But since he also rejects perdurantism and stage theory, he opts for the view that there simply are *no* middle-sized physical objects, besides persons: there are merely atoms arranged statue-wise, chair-wise, and so forth.)

In Paper VI, I try to make clear what is really going on in cases like those alluded to above. Is the conventionality at issue of a fairly trivial nature, or is it problematic and suspect, as Hawley and Merricks think? I urge that in discussing "conventional persistence" we must first distinguish clearly between conventions determining what linguistic expressions *mean* or stand for and conventions having to do with whether expressions governed by conventions of the first kind *apply* or not. Conventions of the first sort are metaphysically innocent; those of the second sort are not. The second sort do indeed invite the kinds of difficulty pointed out by Hawley; they also raise some further issues that I describe.

In the second half of the paper I try to show in detail that, just as the perdurance theory and stage theory can quite easily handle a typical case of "conventional persistence" without involving conventions of the second kind, so can the endurance theory. Thus, cases of alleged "conventional persistence" do *not*, I argue, refute the endurance theory (*pace* Hawley and Merricks).

The investigation does, however, reveal some of the strengths and weaknesses of the metaphysical-cum-semantic theories of persistence examined, the endurance theory included. For example, it shows that the endurance theory faces serious epistemological difficulties. These difficulties come in different versions depending on whether the persistence conditions we associate with a certain kind-concept are analytically or synthetically related to the concept. If the relation is analytic, there may very well not be any entities corresponding to the relevant kind-concepts, and it will be very difficult to know whether there are. If, on the other hand, the relation is synthetic, most of our persistence statements may be false, with little chance of us knowing this. In my opinion this is an issue that has not yet been properly addressed by philosophers of persistence.

6. Concluding Remarks

In the previous sections I have: described what I take to be the main problems facing presentism; explained how the B-theory of time avoids them; presented the main alternative metaphysical-cum-semantic theories of persistence and briefly evaluated the reasons usually given for accepting one or the other theory assuming B-time; and summarized the contents of my papers, which discuss the various theories of persistence within the framework of B-time. It is time to address the general questions raised in the Introduction (Section 1.2) in a more direct manner. I intend to answer them as succinctly as I think it is possible to do, by referring to what is argued in Sections 2-5 and the papers.

Does the rejection of presentism in favour of the B-theory of time oblige us to give up the commonsense view of persistence (i.e. endurantism, in some version or other) on pain of lapsing into self-contradictions or patent absurdities?

The message of Papers I-III is that, so far, it has *not* been shown that the combination of the common sense view of persistence and the B-theory of time results in contradictions or patent absurdities, even if the commonsense view is identified with wide endurantism. We do have to rethink how endurance is *realized* if we adopt the B-theory – objects do not *move* in (or with) time, but are rather *multiply located* in time. However, it has not been shown that such rethinking forces us to abandon the central notions here: viz. that objects are three-dimensional entities enjoying numerical identity over time (with different properties at different times). The situation actually seems to be the quite the opposite: upon scrutiny, it appears that endurantism (with or without intrinsic change) makes *better* sense given the B-theory than it does when presentism is

presumed (Sections 2.2.2 and 4). I therefore see no reason to withhold a negative answer to the question. Here I am opposing many philosophers.[60]

This is not to deny that endurantism has problems. In connection with wide endurantism, I have pointed out some metaphysical and epistemological difficulties (Papers II, IV and VI), and acknowledged that there are difficulties handling coinciding entities (Section 4). Narrow endurantism faces problems having to do with the genuine satisfaction of predicates such as "x has been folded", "x is foldable" and "x is a folding chair", and with the truth value of sentences such as "There are folding chairs". These problems deserve to be investigated further so that the coherence and plausibility of endurantism can be properly assessed. But the difficulties are *not* induced by the B-theory. Rather they are inherent in, or generated by, endurantism (wide or narrow) as such.

If we adopt a revisionary conceptualization of persistence, will other aspects of our commonsense conception of physical objects have to be revised? Will we have to start talking in significantly new ways?

Here I take "revisionary conceptualization of persistence" to entail the rejection of even narrow endurance, and consequently the adoption of traditional 4-D metaphysics, with its reliance on instantaneous temporal parts. The choice is then between perdurance or stage-theoretical semantics (pending the development of other alternatives). I have argued that if we adopt the perdurance semantics, we can rarely, if ever, regard objects as satisfying dispositional predicates (Paper IV). This will mean that, in all likelihood, we cannot be realists about many kinds of object, such as crackers and computers – i.e. we will probably have to regard sortal

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[60] I should add here, though, that STR might spell trouble for endurantism (narrow and wide) inasmuch as endurance involves being wholly present at distinct times – where times are understood as distinct simultaneity planes – and STR renders the simultaneity relation relative. Some have argued that STR does make trouble for endurantism (e.g. Balashov, 1999, 2000 and Hales and Johnson, 2003, 2007); others have denied this (e.g. Mellor, 1981, pp. 128-130; Simons, 1987, p. 127; Sider, 2001, ch. 4.4). This is an issue I have not addressed in this thesis. My main reason for this policy is that I do not think that the problem (*if* it is a problem) is primarily about uniting endurantism with the B-theory. Rather it is a problem about uniting endurantism with STR as such, i.e. with a relative simultaneity relation. But the question (or one of the questions) of this thesis is whether the *B-theory of time*, which can be combined with a Newtonian absolute relation of simultaneity, compels us to abandon our commonsense view of persistence – not whether STR does this. But I acknowledge that the issue ought to be addressed sooner or later if STR is invoked in support of the B-theory. I hope to be able to tackle questions about the compatibility of endurantism and STR in the future.

predicates such "is a cracker" as unsatisfied (ibid). Exactly how revisionary these consequences are depends on how heavily committed the commonsense view is (Section 1.1). If the commonsense view is identical with wide endurantism (Section 4), the adoption of the 4-D metaphysics plus the perdurance semantics will be revisionary indeed: either we have to drop many kinds of predicate, or we have to start to use them in new ways, indicating that we are indulging only in *as-if* talk.[61] If the commonsense view is merely committed to narrow endurance, the adoption of perdurance semantics will be less revisionary, because in this scenario we are already engaged in the as-if talk, at least when it comes to predicates that involve intrinsic change.

If we adopt the stage-theoretical semantics (neglecting the complications that arise if stages are identified with 3-D mereological sums), then we will have to introduce a plethora of persistence predicates, expressing different persistence concepts, several of which will be taken to be applicable to *single* objects (Paper V). This is revisionary since (1) we do not have these predicates, and, presumably, (2) "persistence" in ordinary discourse expresses numerical identity over time (ibid.).[62]

Are questions about the way in which objects persist over time independent of the nature of temporal reality and dependent rather on human conventions?

No, questions about the way objects persist through time are *not* independent of the nature of temporal reality. First of all, a presentistic universe seems in general persistence-hostile, while a B-theoretical universe appears in general persistence-friendly, no matter what kind of persistence is at issue (Sections 2.2.2 and 4). Secondly, the answer to the question whether temporal reality contains enduring entities, or whether the 4-D metaphysics is correct, cannot be a function of human

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[61] It might be doubted whether an as-if stance can be coherently adopted on *persons* – in particular, on oneself. Who here – what person – is doing the pretending?

[62] I suspect that (2) is the case even if "persistence" is used in a "narrow" endurantist as-if discourse: the "as-if" part – if it is tacitly there – qualifies utterances expressing *identity* through intrinsic change. However, this claim no doubt needs further argument. See Chisholm (1976, pp. 92-97) for the general idea that we sometimes make use of as-if identity, or "loose identity", in the sense of *feigning* identity, as opposed to expressing (in more modern terminology) *temporal counterpart* relations. I think, however, that it is unnecessary to accept his doctrine of *entia per alio* (ibid., pp. 97-104), which involves "fictive" subjects (at least ostensibly), to make sense of such as-if talk: the subjects of as-if talk may reasonably be thought of as real entities, at least in some contexts. I hope to be able to address this issue more fully in the future.

stipulation (in an interesting sense, at any rate): we cannot decide whether the relation of numerical identity holds between "two" three-dimensional entities located at distinct times (Paper VI). Decisions and conventions only enter at the level of what metaphysical theory to adopt and what language/semantics to implement.

Lastly, I would like to indicate how I think the philosophy of persistence in B-time can fruitfully proceed. Efforts should be redirected from the issue of the *compatibility* of endurantism and the B-theory towards the issue of the tenability of endurantism as such, even though the phenomenon is conceived of as occurring, or being realized, in B-time.[63] As I have argued in this thesis, B-time does not seem to be an obstacle to object-endurance. Rather, what needs to be explored is the tenability of, in the first case, wide endurantism, and, secondly (if wide endurantism proves untenable), narrow endurantism.

Questions such as the following need answers.[64] What is the metaphysical nature of a widely enduring object? What is such an object's relation to its temporary properties and concrete parts? How should constitution and mereology be understood given wide endurantism? What is the difference between "physical", or "brute", widely enduring objects (such as rocks, trees, and computers) and putatively "socially constructed" widely enduring "objects" (such as companies, states and governments)? What is the relation between an enduring object and the processes it participates in?[65] Can an acceptable semantics be developed for only narrowly enduring objects? Is narrow endurance plausible in relation to persons (cf. note 61)? Can objects be identified with aggregates of successively existing, narrowly enduring, entities (cf. Section 4, note 46)? Is endurance, wide or narrow, compatible with a relative simultaneity relation (cf. note 60)?

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[63] For the reasons alluded to in sections 2.2.2 and 4, and in view of the general difficulties described in Section 2, presentism does not seem to be a good framework for endurantism. But the combination of endurantism and presentism ought to be investigated further.

[64] I do not mean to suggest that such questions are not currently addressed by philosophers – they surely are. I intend only to indicate where I think the focus should be.

[65] Here the issue of the compatibility of endurantism and the B-theory may resurface *if* the relation turns out to be mereological, as Barker and Dowe (2003) would have it. However, see Hacker (1982, pp. 7 and 14) for principal reasons to think that the relation is *not* mereological.

If endurantism, even of the narrow sort, turns out in the end to be untenable, we shall have, apparently, to submit to the 4-D metaphysic; and then we shall have to struggle with the issues described in my papers IV and V.

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74

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Appendix: Papers I-VI