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TOWARDS A PHYSICAL THEORY OF THE NOW

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Abstract
In this essay I note that while physical theory has provided insights into time, it has provided few insights into what one might call the 'now'. I argue that by coupling little-known physical insights into time with certain results from Peter Slezak's rational reconstruction of Descartes's Cogito argument, a physical model of the now can, however, be seen to be possible.

1. *Introduction*

What, physically, is the now? Before the debate engendered by McTaggart's classic discussion of the 'A-series' and the 'B-series' canonical philosophers tended to ignore this question. The system of Kant, for example, exhibits an intricate dovetailing-together of all its components; but even though one of the fundamental components is time, no account is given of the now.[1] So far as physics is concerned, the situation is even worse: Einstein stands almost alone in even considering the question of the physics of the now.[2] Carnap,

[1] Two earlier philosophers who do develop a philosophy of the now are Aquinas and Schopenhauer. Aquinas says, for example:

> The now that stands still, is said to make eternity according to our apprehension. As the apprehension of time is caused in us by the fact that we apprehend the flow of the 'now', so the apprehension of eternity is caused in us by our apprehending the now standing still. (Aquinas, in Fathers of the Dominican Province (1947), 41)

Schopenhauer, on the other hand, stands out as one who sees problems in theorising the now — particularly objectivist views of it. I discuss Schopenhauer later in this essay.

[2] Of course, the now can appear in a scientific account as (for example) a convenient point of reference. Grünbaum (1971, 202), however, provides a convincing argument that such appearances always occur in a non-essential way.

in The Philosophy of Rudolf Carnap, recalls a conversation with him:

> Once Einstein said that the problem of the Now worried him seriously. He explained that the experience of the Now means something special for man, something essentially different from the past and the future, but that this important difference does not and cannot occur within physics. That this experience cannot be grasped by science seemed to him a matter of painful but inevitable resignation. I remarked that all that occurs objectively can be described in science: on the one hand the temporal sequence of events is described in physics; and, on the other hand, the peculiarities of man's experiences with respect to time, including his different attitude toward past, present, and future, can be described and (in principle) explained in psychology. But Einstein thought that these scientific descriptions cannot possibly satisfy our human needs; that there is something essential about the Now which is just outside of the realm of science. (Schilpp, 1963, 37–38)

Despite such pessimism, I shall shortly be discussing an attempt by physicist Fred Hoyle to provide exactly that which Einstein says is impossible. A complication with Hoyle's theory is that two separate issues — the nature of the now and the question of whether time flows — are conflated. Such conflation is only to be expected when one bears in mind that the goal of the theory is to explain as much as possible of the now. But even though the conflation makes exposition a little less direct than one might wish, it provides no great obstacle. Given this, my strategy will be to devote some space to the ideas of Hoyle. I shall then argue that the kind of problem Hoyle's theory exhibits can be solved by means of hypertime, a 'meta-time'[3] that serves to pick out or privilege points in time (to give them 'now' status). Because hypertime arises in the well known 'myth of passage' debate, I then examine this debate. I conclude that those who argue against the existence of hypertime are right, but maintain that there is another way a 'meta perspective' on time can arise.

2. *The Now According to Hoyle*

As developer of the Steady State cosmological model of the universe, Fred Hoyle needs no introduction. His theory of the now, however, seems hardly

[3] (Williams, 1951, 464) also uses this term, but in a loose sense on which he fails to elaborate.

to be known at all. Admittedly, this obscurity may be partly attributed to the brevity of his account of the theory; on the other hand, this very brevity throws the central ideas into sharp focus. Seen this way, it is perhaps best to present Hoyle's ideas in his own words. He begins by identifying two problems with regard to time: 1) the 'arrow of time', and 2) the present (that is, what I am calling the now). He says:

> Physics has made a good deal of progress in understanding [the first] problem. ... The same cannot be said for the second problem. What constitutes the present? Provided one considers oneself as something apart from the physical world, the answer does not seem difficult. The present can be thought of as the particular place in the map where you happen to be. It is your subjective presence at a particular spot that defines the present. But you cannot have your cake and eat it. You cannot consider your subjective presence as being outside the physical world and in the same breath consider yourself as a part of the map. (Hoyle and Hoyle 1963, Preface, 2)

By 'map' Hoyle means the four-dimensional space-time continuum that is the universe. Roughly speaking, the idea expressed above is that the present must be determined by something external to the four-dimensional space-time continuum. Though plausible, it is difficult to see a way of providing a wholly convincing justification for this idea. Such a justification, however, would clearly be welcome. Nevertheless I shall leave this on one side; for what perhaps most needs noting in the passage above is Hoyle's use of the word 'subjective': the use suggests that the now is intimately related to the human subject, rather than that it is something that exists independently of the human subject (which, it goes without saying, is how physicists view space and time). I shall in fact follow Grünbaum and endorse such an idea later in this essay; nevertheless, it is important to note that Hoyle himself does not defend this position. He goes on to say:

> ... the events that constitute the human are confined to a four-dimensional tube, a world tube, that threads its way over a finite portion of the map. ... The subjective present consists not of the complete collection of events but of a certain subset. (Hoyle and Hoyle 1963, Preface, 2)

Rejecting the idea that mysticism is needed to account for one's 'position in the map', Hoyle instead postulates a function, such that:

> ... the required subset [is] defined mathematically as the intersection of the world tube with a three-dimensional space-like surface. Thus a surface $f(x_1, x_2, x_3, x_4) = c$ for a particular value of c, and with $f/x_i(i = 1, 2, 3, 4)$ a time-like vector, serves to define a subset of points in the world tube. Changing c changes the subset. We could be said to live our lives through changes of c — i.e. by sweeping through a family of surfaces. (Hoyle and Hoyle 1963, Preface, 3)

Hoyle speculates that the f surfaces could be derived from known physical fields — for example, the electromagnetic field. On the one hand, this speculation seems reasonable; for it is clearly the business of physicists to try to relate unknown phenomena (in this case, the now) to known phenomena (in this case, those associated with the electromagnetic field). On the other hand, given Hoyle's earlier requirement that the mechanism responsible for the now be external to the space-time continuum, there appears to be, at best, a certain indirectness in seeking to make the electromagnetic field the source of this externality; for irrespective of what may eventually prove to be the case with electromagnetism at a foundations-of-physics level, it seems reasonable to say that for all practical purposes electromagnetic fields may be conceived to exist within the space-time continuum.

If the just-quoted passage were read in isolation, Hoyle could perhaps be interpreted as requiring the electromagnetic field to be external merely to a given individual's world-tube; but again, upholding this position would require the addressing of whether the now is at least to some extent subjective or psychological in nature, and Hoyle does not do this.

It is worth pointing out that Grünbaum sees problems with Hoyle's theory. In a discussion published in (Gold, 1967) Hoyle summarizes his position as follows:

> Suppose we define as the 'present' the intersection of a four-dimensional tube with a spacelike surface. Then a scalar function of position equals some specified constant, and the value of that constant determines the present. By changing that constant, we get a different set of intersections. So 'now' is the meaning attached to the constant. The flow of time is just the one-parameter family of surfaces. (Gold, 1967, 182)

Grünbaum responds this way:

> That is an order structure. You are saying that, in accordance with some arbitrary criterion, any particular section instead of another one is the 'now'. Of course in that sense the 'now' is the same as

> that used in a Minkowski diagram. This 'now' surely can be arbitrarily picked, whereas the 'nows' that you consider as 'nows' in your life are not arbitrarily picked, because you constitute a particular segment of the career of the universe. (Gold, 1967, 82)[4]

In view of the above, if externality to the space-time continuum is required, there clearly must be some means of providing it other than that considered by Hoyle. In the following section I shall examine one crucial way of providing it: 'hypertime', which plays a key role in the so-called 'myth of passage' debate.

3. *The Myth of Passage*

Over fifty years after McTaggart, Smart, in 'Time', takes issue with the idea of time as a kind of stream. More specifically, he disagrees with what, following (Williams, 1951), he calls the myth of passage.[5] He says:

> If time flows past us or if we advance through time, this would be a motion with respect to a hypertime. For motion in space is motion with respect to time, and motion of time or in time could hardly be a motion in time with respect to time. ... The idea of time as passing is connected with the idea of events changing from future to past.

[4] In the discussion cited above, Hoyle earlier comments:

> I am not convinced against the flow of time. If we regard ourselves as four-dimensional structures, then our conscious awareness of the present must be regarded as a subset of events from our whole four-dimensional structure. Now the question is: What rule do we accept for determining that subset? As soon as we take a subset of events from a larger collection, we need some sort of rule to define these events. The rule would give us the meaning of 'now,' and out of this rule we would expect to understand what is meant by the flow of time. (Gold, 1967, 177)

In private correspondence, Grünbaum observed to me:

> Alas, Hoyle gives us no clue to the 'rule' he has in mind. And he gives no reason to reject the 'rule' I offered by reference to mind-dependent indexicality.

I thank Professor Grünbaum for offering his clarification here.

[5] In this essay, I concentrate on Smart's account of the myth of passage, because his encyclopedic approach means he is familiar with most of the arguments and counter-arguments.

> (Smart, 1972, 126)

Thus Smart's argument is that we cannot talk about the flow of time — a change of events — without invoking a hypertime. Actually, this idea has been current in various forms at least since Kant. In The Critique of Pure Reason, Kant observes:

> For change does not affect time itself, but only the phenomena in time. ... If we were to attribute succession to time itself, we should be obliged to cogitate another time, in which this succession would be possible. (A183, B226)

Nevertheless, Smart has done much to popularise the idea; and he devotes a great deal of his essay to maintaining that there is no need to posit events changing at all. This is because, he claims, what actually changes are continuants, such as objects or things.[6] The implication is that the life-history of an object is rather like the set of frames that make up a filmstrip.[7] I hasten to add that Smart would reject the idea that time can be modeled as a filmstrip. One reason is that continuants do 'not form a sequence since there are no instants that are next to one another' (Smart, 1972, 130).

It is important to point out that Grünbaum criticizes the views of theorists such as Smart on the basis that they have confused physical time, where the concepts 'earlier than' and 'later than' but not 'now', 'past', and 'future' — the characteristics of becoming — are relevant, with psychological time, where 'now', 'past', and 'future' are relevant.[8] (Grünbaum thus can be seen to uphold the reality of both the A-series and the B-series: the A-series holds sway in the mind and the B-series holds sway in physical reality.) I think

[6] Prior, in 'Time After Time', misses Smart's point here. Prior, in arguing that we can talk about events changing without having to invoke a hypertime, considers only events of the kind that can be represented as of zero temporal length and receding into the past — and Smart would not deny that these kinds of event can change.

[7] Indeed, Williams, when criticising the notion of passage, invokes the image of the filmstrip. He says:

> More explicitly we may speak ... as if the time sequence were a moving-picture film, unwinding from the dark reel of the future, projected briefly on the screen of the present, and rewound into the dark can of the past. (Williams, 1951, 461)

[8] Russell, in 'On the Experience of Time', similarly points to two kinds of time when he distinguishes 'time-relations of subject and object [and] ... time-relations among objects' (Russell, 1915, 212).

Grünbaum's criticisms — as articulated in, for example, 'The Meaning of Time' — are persuasive. On the other hand, according to Grünbaum 'the transiency of the now or of the flow of time is a qualitative concept without any metrical ingredients' (Grünbaum, 1963, 329); and he cites this alleged lack of metricality as a reason for dispensing with hypertime. But claiming that the flow of time lacks any metrical ingredients is debatable: in a popular sense, at least, it is not incoherent to say such things as 'A day on vacation seems to pass twice as quickly as a day when one is at home, and that, in turn, seems to pass twice as quickly as a day spent engaged in an unpleasant occupation'. Admittedly, these estimates of temporal passage are imprecise — but perhaps psychological tests could sharpen them.

At a basic level, positing a hypertime immediately solves the problem of the now; for the answer to any question of the form 'Why does the now correspond to date and time x?' will be: 'The now is date and time x because hypertime is in state y'. But this is not a very satisfactory answer, because there then arises the question of why hypertime is in state y. A hyper-hypertime can be invoked to answer this question; but few philosophers find the infinite regress that this ushers in appealing. Smart puts the objection like this:

> ... just as we thought of the first time-dimension as a stream, so will we want to think of [hypertime] as a stream also; now the speed of flow of the second stream is a rate of change with respect to a third time-dimension, and so we can go on indefinitely postulating fresh streams without being any better satisfied. (Smart, 1956, 215)

(Williams, 1951, 463–464) foreshadows Smart's criticism when he implies that the myth of passage scenario leads to a divergent regress of meta-levels. One response is to question why the notion of a hierarchy of hypertimes should automatically be considered unworkable or undesirable. So far as physical theory is concerned, it may simply be of marginal relevance. The analogy suggests itself of the regress obtained by repeatedly deriving position with respect to time. The first derivative of position is velocity; the second derivative of position is acceleration — but while we can continue to derive position with respect to time, physical theory seldom calls for it. Perhaps, somehow, physical theory likewise seldom calls for the higher hypertimes.

On the other hand, any solution to the problem of the now that does not require a hierarchy of hypertimes will have to be considered more persuasive, if only by virtue of Occam's Razor. In the following, I shall attempt to sketch such a theory. It will be a theory primarily of the nature of the now, rather than of the flow of time (as I pointed out, Hoyle's theory conflates the

two); but when I have presented the theory I think it will be agreed that the theory is not inconsistent with the idea of temporal flow. The ideas derive from results achieved by Slezak in his 'Descartes's Diagonal Deduction';[9] so I shall turn now to a discussion of that essay.

4. *Slezak's 'Descartes's Diagonal Deduction'*

Slezak's argument pertains to the Cartesian Cogito — roughly speaking, the 'I' — but given the close relationship between the indexicals 'I', 'here', and 'now'[10] (about which I shall have more to say), my purpose in presenting the argument should be clear. Slezak begins by reviewing various accounts of Descartes's Cogito argument, and suggests that these accounts lack an essential ingredient: a plausible, textually faithful rational reconstruction of the argument. With a view to filling this lack, he observes that the representational character of ideas in Descartes makes them semantically analogous to pictures or sentences, the object of which is the physical world. Slezak's concern is to demonstrate that the reasoning employed by Descartes can be shown to be compatible with a physicalist account of the mind and, indeed, can be seen to follow from certain kinds of physical or information-processing arrangements — even though, he cautions, 'there are notoriously troublesome features of subjective, introspective experience which seem to be intractable to any physicalistic reduction' (Slezak, 1983, 15).

Slezak sets the stage by presenting pertinent observations by such thinkers as Wittgenstein and Gunderson. He quotes, for example, the following words of Gunderson:

> If a thoroughgoing physicalism... is true, why should it even seem so difficult for me to view my mind or self as an item wholly in the world? (Slezak, 1983, 17)

Slezak suggests that perplexity such as that cited by Gunderson is of a particular type — one concerning the place of the entity itself in relation to the rest of the world — and using an example of Gunderson's, he points to a parallel between the apparent irreducibility of the mind's relation to the rest

[9] The section below is based on my paper 'Cartesian Dualism, and the Universe as Turing Machine'.

[10] 'Here' and 'now' are, fairly obviously, personal counterparts of space and time. Likewise — if I may be forgiven for lapsing into Descartean metaphysics — the 'I', as mental substance, is the counterpart of physical substance. 'Space' and 'time' determine the location of a body; 'here' and 'now' determine the location of my mind.

of the world and the fact (for instance) that the one thing a periscope cannot locate is its own cross-hairs. Yet, as Slezak implies, the parallel is of limited application; for although the periscope cannot see its own cross-hairs, both periscope and cross-hairs are both expressible in physical terms — whereas, of course, the mind and the body seem irreducible to each other.

Slezak's next step is to adopt Gunderson's method of looking at the world W from the point of view of a person M. According to this method, M will have an 'internal model' W* of the world. Seen this way, it is logically impossible for M itself to appear "directly as a physical object in W* among the other physical objects represented in W*, since W* is itself part of M" (Slezak, 1983, 19). Slezak is quick to point out, however, that for many 'ordinary purposes' there is no contradiction in representing the self as a physical object. There are problems only when we try to push that representation too far.

Next, Slezak seeks to rephrase Descartes's argument in Gunderson's terms. Descartes, of course, started by doubting the existence of the world; rephrased, this doubt can be expressed as the possibility that everything in W* fails to correspond to W. Slezak follows Descartes's own recommendation that 'thoughts must be arranged in an order like the natural order of the numbers' (Slezak, 1983, 24) to achieve an enumeration of propositions to which assent would be given. Such an enumeration might look like the following:[11]

(1) Grass is green
(2) Roses are red
(3) Snow is white
etc. (Slezak, 1983, 24)

Descartes's radical doubt — the denying of each proposition in the list in turn — could then be expressed as (x) I doubt (n), where n is the number of a proposition in the list. (Slezak's use of parentheses is unfortunate. Note that simple enumeration is intended, not universal quantification.) But what, it may be asked, corresponds to the stage in Descartes's argument where the latter considers doubting that he is in fact doubting? A little thought reveals

[11] Gandy (1980) suggests that iteration is (roughly speaking) that which makes a Turing machine a Turing machine: at the fundamental, 'hardware' level the Turing machine (for example) advances one discrete square, then another, then another, etc. Like Gunderson, then, Slezak, by enumerating a list of discrete and fundamental thoughts, implicitly assumes that the model is compatible with mechanism; in other words, he assumes that the human mind is a Turing machine. There have been a great many essays devoted to the question of whether the mind is a Turing machine; see, for example, Lucas (1961), Benacerraf (1967), Slezak (1982), Bowie (1982), Webb (1968), and my own essay 'Is the Human Mind a Turing Machine?'.

that the proposition expressing this must be of the form (x*) I doubt (x*). Slezak comments:

> Here we have (x*) expressing doubt about a particular proposition, namely, itself. That is, (x*) involves entertaining the possibility that (x*) is false. But if (x*) is false, this means that it is not the case that I doubt (x*). In other words, the attempt to doubt (x*) which involves entertaining the possibility of its falsity, leads directly to the conclusion that I do not doubt it. In this way (x*) seems to be a proposition which is immune from doubt. (Slezak, 1983, 24)

At this point, Slezak draws attention to the structural similarity of (x*) I doubt (x*) to the Liar paradox and the diagonal arguments of Russell and Gödel; and it is at this point that it is necessary to consider the criticism of Sorensen (1986).

5. *Was 'Was Descartes's Cogito a Diagonal Deduction?' a Diagonal Deduction?*

Sorensen, in 'Was Descartes's Cogito a Diagonal Deduction?', actually has two criticisms to make of Slezak. One of these, however, amounts to the claim that Slezak's reconstruction does not correspond in all its details to the ideas that Descartes expresses; and as I think this criticism is convincingly argued, I shall not consider it further in this essay.

The other criticism, however, I shall take issue with. As mentioned above, it concerns the relationship of Slezak's (x*) I doubt (x*) to the Liar Paradox. Sorensen certainly does not disagree that there is a resemblance to the Liar paradox: indeed, he argues that, analogously to the case with this paradox, (x*) I doubt (x*) would lead the Cogito into endless vacillation rather than to the indubitability of its own existence. He says:

> Although it is true that I cannot coherently doubt 'I doubt this sentence', it is also true that I cannot coherently believe it, or even suspend judgment about it (Sorensen, 1986, 350)

Here, however, Sorensen's reasoning is seriously and demonstrably awry. Specifically, if one were to apply the reasoning also to the Gödel formula's interpretation — that is, 'this formula is not provable', one would be compelled to say (given the fact that the formula is true and the fact that this truth is implied by the consistency of the formal system) that the formula simultaneously says "this formula is provable", and thus also vacillates. But

this is not the case. Sorensen forgets that these kinds of formula are never interpreted in isolation — this is a very common error in popular accounts of Gödel's argument — but always relative to a formal system; and just as 'not provable' (not 'provable') is the predicate of interest in the Gödel formula's formal system, so 'doubtable' (not 'believable') is the predicate of interest in Descartes's 'formal system'.

Of course, it may be argued that what Descartes produces — even in Slezak's version of it — is not a formal system. But it is, nevertheless, a structured, formal argument that proceeds according to definite rules — context plays the role of the axioms of the formal system — and it could easily be expressed purely logically and symbolically. Moreover, in a properly constructed system it would not matter that 'believable' has a different meaning from 'provable', for that difference could be designed to emerge only in the interpretation of the system. Indeed, it can be appreciated by simple inspection that 'x is believable' is of identical form to 'x is provable'.

That Sorensen's approach invites the kind of Gödelian perspective I have just outlined is suggested by his alluding to one of three epistemic principles governing the thought of 'ideal thinkers', even if not real, physical human beings. Sorensen describes the principles as follows:

> First, there is a principle of self-awareness; one is aware of one's doxastic states. ... Second, there is the principle of deductive closure; if one believes that p, then one believes all of the consequences of p. Third, there is the principle of direct consistency; one cannot both believe a proposition and believe its negation. (Sorensen, 1986, 348)

But from the point of view I have just developed, the principle of deductive closure is uncomfortably close[12] to the requirement that all true propositions should be derivable from the axioms of a formal system — and, again, Gödel proved that this cannot be done.

[12] Here, 'uncomfortably close to' may or may not mean 'incompatible with', depending on the interpretation that one places on Sorensen's use of the word 'consequences'. Assuming that the mind of Sorensen's ideal thinker is a formal system, if 'consequences' means 'all truths that are derivable, not necessarily within the formal system', then Sorensen's stance will be incompatible with Gödel's, because the Gödel formula is a truth not derivable within the formal system. If, however, 'consequences' means 'truths derivable within the formal system', then Sorensen's stance will be compatible with Gödel's. I thank an anonymous referee of this journal for drawing my attention to this point.

6. *Towards a Physical Theory of the Now*

Summing up the argument of the previous section, one may say that Slezak's analysis manages to rephrase the Cartesian Dualist distinction between mental substance and physical substance as a distinction between two physical but structurally different perspectives, where the first bears to the second a relationship analogous to that holding between Gödel's undecidable formula and its formal system.[13] Given this, it is possible to sketch a way that a physical theory of the now could be created. That which would be required is at least the following:

(1) An argument that the irreducibility of the two perspectives just mentioned can also be construed as the relationship of externality (of one to the other) cited earlier as desirable in a theory of the now;
(2) An argument that the relationship between the 'I' and the 'now' is sufficiently close that the externality of the former with respect to the physical carries over to the latter with respect to time;
(3) An argument that can account for why this now 'flows'.

In the following, I shall offer a few comments on 2), some detailed, though to a degree tangential comments on 3), and nothing at all on 1). My not offering a comment on 1) should not be taken as implying that there are fundamental conceptual obstacles with regard to providing an account of how the irreducibility of the two perspectives can be construed as a relationship of externality, but rather that such a construal would be extremely complex in its minutiae.

So far as 3) is concerned, once a phenomenon (that is, the now) with the required externality to time were to be shown to be compatible with physical theory, presumably a mathematical account of its behaviour similar to that suggested by Hoyle, but deriving from the mathematics expressing the irreducibility of the two perspectives, could then be applied after all. The reader will remember that it was, in fact, only the perceived lack of externality in the application of Hoyle's functions that counted against his approach.

There is, however, at least one reason why an account of a changing now may turn out to be impossible. Graham Priest suggests in a number of

[13] I provide a different argument for this conclusion in my 'Entering the Chinese Room with Castañeda's Principle (P)'.

places[14] that a finitist account[15] of the universe would require that beyond a vast, unspecified number n — a number far beyond human experience — the universe is actually inconsistent. Also sprinkled throughout Priest's writings on the paraconsistent are tantalizing references to the problem of change. The following are two examples:

> The most natural candidates for the status of true inconsistent theory are certain theories of sethood and truth, which enshrine the paradoxes of self-reference. There are, however, other candidates. For example, theories of change. ... (Priest 2000, 228)

> This is still to neglect the much remarked connection between contradiction and change. For when dialecticians such as Hegel and Engels have emphasized the presence of contradictions in the natural world, they have done so in connection with change. For example, Engels is quite prepared to concede that a true description of the world, as it is at any one instant, a static account, may be consistent. However, once we correctly consider it as a dynamical system, in a state of flux, then a true description of what is going on must contain a contradiction. (Priest and Routley 1989, 522)

It is difficult to isolate the precise point that Priest or those sympathetic to the way his work develops might want to make with regard to change. Excessive speculation, of course, is not fashionable in much contemporary philosophy; so maybe Priest's reticence is merely a sign of prudence. But perhaps the guiding ideas are along the following lines. As logical systems are atemporal (although we can represent temporal relations logically), actually to view the changing world of experience as a logical system will lead to contradiction. Now assume for the sake of argument that the world of experience at any one instant is consistent. But reasoning in the spirit of Kant's[16] shows that beyond the world of experience no such consistency can obtain. Therefore,

[14] See, for example, Priest (1994) and Priest and Routley (1989).

[15] Van Bendegem is one who has produced a great deal of persuasive work in favour of the finitist stance. See, for example, his 'Strict Finitism as a Viable Alternative in the Foundations of Mathematics'.

[16] I cite Kant because Priest, in 'The Limits of Thought – And Beyond', actually convincingly defends crucial Kantian insights. While he is quick to endorse modern consensus that 'the arguments used to establish the contradictions appear either question-begging or fallacious' (Priest 1991, 364), he observes that if Kant had used a genuine thought operation, he could have produced a genuine antinomy. Priest offers such a thought operation:

given that the world of experience is temporal, somehow inconsistency must be able to infect or influence the universe as a whole: kick-start its clock, so to speak, giving rise to temporality. In other words, inconsistency may be the source of the phenomenon of change (and thus temporal flow).

What are we to make of such ideas? A first response is to say that however speculative they are, we are at least provided with an insight into the otherwise completely obscure topic of change. Many would be inclined to say that change is foundational and, hence, cannot be analysed; but if the summary I have just provided has at least some merit, it may be the case that it is consistency/inconsistency, rather than change, that is the foundational notion. But this means that if change is fundamentally related to inconsistency (a beyond-n phenomenon), it may be impossible to provide a consistent physical/mathematical account of the changing now; for our mathematics is, by assumption, consistent only up to n.

Concerning 2), the following argument[17] is not decisive but strongly suggestive.[18] Consider again the filmstrip scenario (pace Smart.) If the now were not subject dependent, in the filmstrip of time there would have to be one, objective, constantly advancing now — a now independent of our minds. This now could be any point between the Big Bang and the far future. It hardly needs to be emphasised that it would be a statistical miracle for human consciousness to happen to coincide with that given privileged

> Consider the operation thought of (by which I mean the content, not the act). Now take an object, say Ayer's Rock, and apply the operation to it iteratively to generate the following sequence: Ayer's Rock, the thought of Ayer's Rock; the thought of (Ayer's Rock and the thought of Ayer's Rock); the thought of the three previous things. ... We know, as Kant did not, that this can be iterated into the transfinite in a natural way. Thus, having generated all the thoughts of finite order, we can apply the operator to give the thought of all thoughts of finite order, and so on. This is a subtlety, however. The important thing is that the operation is iterated as far as possible, however far that is. The result is, by definition, such that it can be no further applied. But now consider the limit, that is, the totality of all thoughts generated in this way. By definition, it is such that it is impossible to apply the operator to it (or the operator would not have been applied as far as possible); hence, there is no thought of it. Yet it clearly is possible to think of this totality — we have just done so. Contradiction: the totality is the limit of thought, but also transcendable. ... The fact that Kant may have been wrong about the details should not, therefore, be allowed to detract from his central profound insight: that antinomies may arise at the limit of a thought construction. (Priest 1991, 364–365)

[17] I present some details of this argument in my essay 'Time Travel and Self-Consistency: Implications for Determinism and the Human Condition'.

[18] Grünbaum (1971, 211) argues that the simple absence of the now from physical theory points to its mind-dependence.

location (or set of locations) of the now. Schopenhauer,[19] in the first volume of *The World as Will and Idea*, makes precisely this point:

> [A realist asks:] Why this now, his now, is just now and was not long ago? Since he asks such strange questions, he regards his existence and his time as independent of each other, and the former as projected into the latter. He assumes indeed two nows — one which belongs to the object, the other which belongs to the subject, and marvels at the happy accident of their coincidence. (Schopenhauer, in Haldane and Kemp (1964), 359)

7. *Conclusion*

The upshot of the last section would seem to be that, unless one believes in miracles, there is indeed a fundamental relationship between the subject and the now. Again, just one of the difficulties will be establishing that the relationship is sufficiently close that the externality of the subject with respect to the physical carries over to the now with respect to time. Whether or not this turns out to be possible, the close relationship between the now and the subject clearly explains why Einstein's attempts to locate the former in the physical world were unsuccessful. On the other hand, given that the above is a physicalist account, the situation surely represents a singular example of a philosophical 'having one's cake and eating it too'. It seems safe to say that the now is not quite the mysterious entity that it has for so long been considered to be.

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[19] Schopenhauer's argument is not as well known as it should be: Grünbaum, for example, was unaware of it when I mentioned it to him.

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