9 The Space–Time World: an Excerpt from *Philosophy and Scientific Realism**

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Anthropocentricity of some Temporal Concepts

There is one feature of common ways of thinking which projects another sort of anthropocentric idea on to the universe at large. One can easily get the idea that the notions of past, present, and future apply objectively to the universe. In contrast, I shall argue that the concepts of past, present, and future have significance relative only to human thought and utterance and do not apply to the universe as such. They contain a hidden anthropocentricity. So also do tenses. On the other hand, the concepts of 'earlier', 'simultaneous', and 'later' are impeccably non-anthropocentric. I shall argue for a view of the world as a four-dimensional continuum of space–time entities, such that out of relation to particular human beings or other language users there is no distinction of 'past', 'present', and 'future'. Moreover, the notion of the flow of time is the result of similar confusions. Our notion of time as flowing, the transitory aspect of time as Broad has called it, is an illusion which prevents us seeing the world as it really is.

The Space–Time World

A man or stone or star is commonly regarded as a three-dimensional object which nevertheless *endures* through time. This enduring through time clearly brings a fourth dimension into the matter, but this fact is obscured by our ordinary language. In our ordinary way of talking we stress the three-dimensionality of bodies, and by our notion of the permanent in change we conceal the fact that bodies extend through time. For philosophical reasons, therefore, it is of interest to discuss a way of talking which does not make use of the notion of the permanent in change. This explicitly four-dimensional way of talking has had important applications in physics. It needs, however, a bit of philosophical tidying up.

In what follows I shall want to make use of tenseless verbs. I shall indicate tenselessness by putting these verbs in italics. Tenseless verbs are familiar in logic and mathematics. When we say that two plus two *equals* four we do not mean that two plus two equals four at the present moment. Nor do we mean that two plus two always equalled four in the past, equals four now, and will

always equal four in the future. This would imply that two plus two will equal four at midnight tonight, which has no clear sense. It could perhaps be taken to mean that if someone says 'two plus two *equals* four' at midnight tonight, then he will speak truly, but then 'at midnight tonight' does not occur in the proposition that is mentioned.

It is perfectly possible to think of things and processes as four-dimensional space–time entities. The instantaneous state of such a four-dimensional space–time solid will be a three-dimensional 'time slice' of the four-dimensional solid. Then instead of talking of things or processes changing or not changing we can now talk of one time slice of a four-dimensional entity *being* different or not different from some other time slice. (Note the tenseless participle of the verb 'to be' in the last sentence.)

When we think four-dimensionally, therefore, we replace the notions of change and staying the same by the notions of the similarity or dissimilarity of time slices of four-dimensional solids. It may be objected that there is one sort of change which cannot be thus accommodated. For of any event, or of any time slice, it may be said on a certain occasion that it is in the future, and that later on it becomes present, and that later still it becomes past. It seems essential to say such things as that, for example, event E was future, is present, and will become past. The notion of change seems to be reintroduced into our four-dimensional scheme of things.

The objector is going too fast. If we are going to eliminate the notion of change we had better, to preserve consistency, eliminate also words such as 'past', 'present', 'future', and 'now'. Let us replace the words 'is past' by the words '*is* earlier than this utterance'. (Note the transition to the tenseless '*is*'.) Similarly, let us replace 'is present' and 'now' by '*is* simultaneous with this utterance', and 'is future' by '*is* later than this utterance'. By 'utterance' here, I mean, in the case of spoken utterances the actual sounds that are uttered. In the case of written sentences (which extend through time) I mean the earliest time slices of such sentences (ink marks on paper). Notice that I am here talking of self-referential *utterances*, not self-referential *sentences*. (The same sentence can be uttered on many occasions.) We can, following Reichenbach, call the utterance itself a 'token', and this sort of reflexivity 'token-reflexivity'. Tenses can also be eliminated, since such a sentence as 'he will run' can be replaced by 'he *runs* at some future time' (with tenseless 'runs') and hence by 'he *runs* later than this utterance'. Similarly, 'he runs' means 'he *runs* (tenseless) simultaneous with this utterance', and 'he ran' means 'he *runs* (tenseless) earlier than this utterance'.[2] All the jobs which can be done by tenses can be done by means of the tenseless way of talking and the self-referential utterance 'this utterance'. Of course, every time you use the words 'this utterance' you refer to a different utterance. So though I have just said that 'all the jobs' we can do with tenses and with words such as 'past', 'present', 'future', and 'now' can be done in our tenseless language together with the self-referential utterance 'this utterance', there is nevertheless one sort of thing that we cannot say in our tenseless language. We cannot translate a sentence of the form 'This event was future, is present and will be past.'

So far from this last fact being a criticism of the tenseless way of talking, it is, I think, pure gain. The inability to translate talk of events changing in respect of pastness, presentness, and futurity into our tenseless language can be taken simply as a proof of the concealed token reflexivity of tenses and of words such as 'past', 'present', 'future', and 'now'. If 'past' means 'earlier than this utterance' it is going to have a different reference every time it is used. If uttered in 1950 it refers to events earlier than 1950 and if uttered in 1965 it refers to events earlier than 1965. The notion of events 'changing from future to past' is simply a confused acknowledgment of this quite simple sort of fact. Once we see this we banish from the universe much unnecessary mystery.

If past, present, and future were real properties of events, then it would require explanation that an event which becomes present in 1965 becomes present at that date and not at some other (and this would have to be an explanation over and above the explanation of why an event of this sort *occurred* in 1965). Indeed, every event is 'now' at some time or another, and so the notion of 'now' cannot be that of an objective property in nature which singles out some events from others. When we talk in our four-dimensional language of space–time we must clearly talk neither of events nor of things changing, since we have replaced the notion of a thing as the permanent in change by that of a four-dimensional entity, some of whose time slices *are* or *are not* different from others. But even in our language of the permanent in change we must still not think of *events* changing. Things (and processes) come into existence, change, or stay the same, whereas to say that an event (such as the beginning of a football match) 'came into existence' or 'changed' would be absurd. The only exception to this rule is that we *can* say that events 'become present', or 'become past', or even 'become probable' or 'become unlikely'. (On the other hand, it is somewhat strained to say that a *thing* becomes past or probable.) These phenomena of language can be neatly explained once we recognise the fact that utterances of words such as 'past', 'present', and 'future' refer to themselves. So also with 'probable' and 'unlikely', since here 'probable' and 'unlikely' mean 'probable, or unlikely, in terms of *present* evidence'.

Some philosophers have talked as though events 'become' or 'come into existence'. 'Become' is a transitive verb, and so to say that an event 'becomes' must presumably mean that it 'becomes present', and this, we have seen, misleads by concealing the token-reflexivity of 'present' and suggesting that the becoming present of an event is a real change like, for example, the becoming brown of a grassy hillside in summer. Similarly, an event cannot come into existence – a new building can come into existence, but the building of it cannot meaningfully be said to come into existence. (In the four-dimensional way of talking, of course, we must not say even that *things* come into existence – we replace talk of a building coming into existence at *t* by talk of the earliest time slice of the building *being* at *t*.) Some philosophers have erected these misconceptions about the grammar of the verbs 'to become' and 'to come into existence' into a metaphysics, as when, for example, Whitehead said that 'actual occasions become'.

We can also see how misleading it is to talk of the flow of time, or of our advance through time. To say that by next year a year of time will have gone by is simply to say that our conscious experiences of a year later than this utterance *are* (tenseless) a year later than this utterance. Our consciousness does not literally advance into the future, because if it did we could intelligibly ask 'How fast does it advance?' We should need to postulate a hyper-time with reference to which our advance in time could be measured (seconds per hyper-seconds), but there seems to be no reason to postulate such an entity as a hyper-time. (There is still something odd about movement in time even if it is said, as it might be, that the hyper-time has an *order* but no metric. This would rule out talk of 'seconds per hyper-seconds', but it would not affect the fact that change in time would still be a change with respect to hyper-time. Moreover, anyone who thought that time-flow was necessary for time would presumably want to say that hyper-time-flow was necessary for hyper-time. He would therefore be driven to postulate a hyper-hyper-time, and so on without end.)

It is true that sometimes in relativity theory it is said that time 'runs more slowly' in a moving system than it does in a system at rest relative to us. This, however, is not to imply any movement or 'running' of time. What is meant, by this misleading locution, is that according to the conventions of simultaneity of our system of axes the space–time interval between events on our clock is greater than that between simultaneous events on a clock in the moving system, since we are moving relative to the other system, clocks in our system, 'run slow' relative to the moving system. Indeed, so far from relativity leading to difficulties for us, the reverse is the case. The four-dimensional way of talking which we have advocated could still have been possible in pre-relativity days, but it has derived additional theoretical advantages from Minkowski's discovery that the Lorentz transformations of special relativity can be regarded simply as a rotation of axes in space–time. This is not the place to go into an exposition of relativity, but I wish to record the conviction that many of the puzzles and paradoxes of relativity (or rather those things which are sometimes wrongly thought to be puzzles and paradoxes) can most easily be resolved by drawing diagrams of Minkowski space–time, in which most of these at first sight counter-intuitive facts will at once look quite obvious. (We must, of course, bear in mind that the geometry of space–time is not Euclidean.)

If I am right in supposing that 'now' is equivalent to 'simultaneous with this utterance', then I am able, as we have seen, to reject the notion of an objective 'now', the notion that even in past ages when there were perhaps no sentient beings there was nevertheless a moment which was distinguishable as 'the present' or 'now'.[3] An utterance of the word 'now' refers to itself, since it refers to the set of events simultaneous with itself. Now the special theory of relativity shows that there is no unique set of events which is 'now' or 'simultaneous with this utterance'. Which time slice of the four-dimensional manifold constitutes a 'now' depends on the frame of reference in which we are at rest. Our four-dimensional cake can be sliced at different angles. It is worth mentioning this consideration, since I have known one very eminent disciple of Whitehead (and therefore of an objective 'becoming') to have been genuinely worried by it. For our purposes we can easily modify the notions of 'now' or 'present' to mean 'simulta-

neous, relative to the utterer's frame of reference, with this utterance'. Similar modifications must be made for 'past' and 'future'.

The notions of 'past', 'present', and 'future' are more complex than those of 'earlier' and 'later', since the former notions do, and the latter notions do not, involve reference to the utterer's position in space–time. 'Earlier' and 'later' fit into the tenseless locution that I have advocated, whereas 'past', 'present', and 'future' do not.

It may now be objected: 'So much the worse for the tenseless way of talking.' For it may be said that so far from the tensed language being definable in terms of the tenseless one (together with the notion of self-referential utterances), the tenseless 'is' has to be defined in terms of the tensed one. As Wilfrid Sellars has objected,[4] a tenseless sentence 'x is ϕ at t' is equivalent to the tensed one 'Either x was ϕ at t or is ϕ at t or will be ϕ at t.' So 'x is ϕ at t' is not like '7 is a prime number', which does *not* mean '7 was, is, or will be a prime number'.

Now there is, I agree, a difference between 'x is ϕ at t' and '7 it a prime number'. But it does not appear to be happily expressed by saying that the former sentence is not really tenseless. It is better expressed by saying that '*is* a prime number at such and such a time' is not a meaningful predicate. The difference can be brought out within the *predicates* of 'x is ϕ at t' and '7 *is* a prime number' and has nothing to do with the copula. It is true that in extending the tenseless way of talking from pure mathematics to discourse about the space–time world it is natural to introduce 'x *is* ϕ at t' via the locution 'x was, is, or will be ϕ at t'. This is because it is tacitly agreed that x is a space–time entity and so earlier, simultaneous with or later than our present utterance, though in the present context which it is does not matter. But though it is natural to wean users of tensed language from their tenses in this way, it is by no means logically necessary that a tenseless language should be introduced in this manner.

A fable may be of use here. Consider a tribe whose religious and social life depended on the exact numerical age in years of the king, and that for this reason their very language made a difference between three sorts of numbers: those numbers which were less than the number of years which was the king's age, the number which was equal to this number, and the numbers which were greater than this number. Indeed, our tribe do not think of the three sorts of numbers as numbers, but believe that there are three sort of entities, alphas, betas, and gammas. They are, of course, slightly puzzled that every year (until the king dies) a gamma becomes a beta and a beta becomes an alpha. Someone might get the bright idea of introducing the notion of number as 'number = alpha or beta or gamma'. Would this show that the notion of 'number' had anything to do with the age of the king? It has indeed been introduced by reference to notions that have to do with the age of the king, but in such a way that this kingly reference 'cancels out'. Sellars argues that Tom, in 1955, Dick, in 1956, and Harry, in 1957, could agree that Eisenhower should be (tenselessly) President in 1956, but that their reasons would be different. Tom's reason would be 'Eisenhower will be President in 1956', Dick's reason would be 'Eisenhower is President in 1956', and Harry's reason would be 'Eisenhower was President in 1956'. These considerations, says Sellars, make it quite clear that

the tenseless present, introduced via 'was, is, or will be', is quite other than the tenseless present of mathematics. As against this, I would say this: the fact that, since they speak from different temporal perspectives, Tom, Dick, and Harry give different reasons for saying 'Eisenhower *is* (tenseless) President in 1956' does not show that they mean anything non-tenseless. For a reason 'q' offered for 'p' in the explanation 'p because q', may well contain extraneous and irrelevant elements. It does not therefore seem to me that Sellars has given any convincing reason for saying that there is any important difference between the tenseless '*is*' of 'Eisenhower *is* President in 1956' and '7 + 5 *is* equal to 12'. Of course Eisenhower is a temporal entity, and so 'in 1956' has sense in relation to him, and numbers are non-temporal entities, and so there is no question of 'in 1956' in the case of the second proposition. This distinction can perfectly well be made explicit in the *predicates* of the two sentences and need not be done in the *copulae*. This also explains why it is natural (though there is no need to suppose that it is logically *necessary*) to introduce the tenseless *is* in the case of 'Eisenhower *is* President in 1956' *via* the idiom 'was, is, or will be', whereas it would, as Sellars notes, not be natural to do so in cases like '7 + 5 *is* equal to 12'.

A sentence of the form 'x is ϕ at t' is, of course, not timeless, any more than 'x is ϕ at such and such a place at t' is *spaceless*. Timelessness is not the same as tenselessness, '7 *is* a prime number' is both tenseless and timeless. (There is no sense in saying '7 *is* a prime number at t.') The tenseless way of talking does not therefore imply that physical things or events are eternal in the way in which the number 7 is.

As we have already noted, it is sometimes said that 'this utterance' is to be analysed as 'the utterance which is *now*'. If so, of course, tenses or the notions of past, present, and future *are* fundamental. My reply to this move is to say that this is simply a dogmatic rejection of the analysis in terms of token-reflexiveness. On this analysis 'now' is elucidated in terms of 'this utterance', and not vice-versa. This seems to me to be a perfectly legitimate procedure. How does one settle the argument with someone who says that 'this utterance' has to be analysed in terms of 'utterance now'? Any analysis is a way of looking at language, and there is no one way. I advocate my way, because it fits our ordinary way of talking much more closely to our scientific way of looking at the world and it avoids unnecessary mystification. If someone is adamant that his analysis is the correct analysis of ordinary language I am prepared to concede him this rather empty point. Ordinary language is, then, on his account, more at variance with science than is my version of ordinary language. Nevertheless, the two analyses are in practice pretty well equivalent: in ordinary life a linguist will detect no difference between 'ordinary language', as in accordance with my analysis, and 'ordinary language', as in accordance with my opponent's analysis. Our ordinary language is just not quite so 'ordinary' as is our opponent's, but it is just as good even for ordinary purposes. It is perhaps more 'ordinary' to say that sugar 'melts' than that it 'dissolves', but the greater scientific correctness of the latter locution does not in any way unfit it for even the most practical purposes. Similarly, the additional theoretical advantages of looking at temporal language in the present way suggest that we should prefer this analysis to the other. Perhaps the objector is saying that

the present analysis is impossible for any language, whether 'ordinary' or scientific. But it is not at all evident why the objector should think that an utterance like 'this utterance' cannot be *directly* self-referential. We hear a token of the form 'this utterance' and simply understand that this token utterance is the one referred to. We can at a later date *say* what the utterance referred to was: we can enumerate sufficient of its characteristics to identify it. It is always logically possible, of course, that some *other* utterance should possess this list of characteristics – we can misidentify an utterance just as we can misidentify a stone, a tree, or a person. But in fact we need not and do not. Moreover, if we *did* misidentify it, how would the proposal to elucidate 'this' in terms of 'now' have prevented us?

The self-reference of specific utterances of words such as 'here' and 'now' is sufficient to deal with the following puzzle: it is logically possible that in remote regions of space–time the universe might repeat itself exactly.[5] We cannot therefore uniquely single out an entity (say this table) by referring to it by means of some set of properties – elsewhere in the universe there might be another table with exactly the same qualities and relations to other objects. A token-reflexive expression can, however, uniquely pick out this table – 'this table is near the utterance of *this token*'. Of course there may well be other Smarts in other regions of space–time uttering precisely similar tokens, but they can all refer uniquely to their environments by token-reflexive means. There is, however, no need for words such as 'now' or tenses – 'this utterance' or 'this token' is always enough to do the trick. Sellars makes a similar point when he argues that token-reflexives are needed to distinguish the real world from fictional worlds. (The real world is a system of entities which includes *this*.) There are obvious difficulties here, which perhaps can be got round only if one accepts Sellars' own interesting but debatable views on the concept of existence. I should wish to say too, however, that tenses and words such as 'present' or 'now' are unimportant here, and that a simple token-reflexive device (corresponding to 'this utterance') is enough to do the trick. For cosmological *theory*, moreover, token-reflexivity is *not* needed. Here one can simply assert, as part of the theory, either that the universe repeats itself in remote parts of space–time or that it does not. It is only in *applying* the theory to observations that unique references have actually to be made.

It should be hardly necessary, at this stage, I should hope, to emphasise that when in the tenseless way of talking we banish tenses, we really must banish them. Thus, when we say that future events exist we do *not* mean that they exist now (present tense). The view of the world as a four-dimensional manifold does not therefore imply that, as some people seem to have thought, the future is already 'laid up'. To say that the future is already laid up is to say that future events exist *now*, whereas when I say of future events that they *exist* (tenselessly) I am doing so simply because, in this case, they *will* exist. The tensed and tenseless locutions are like oil and water – they do not mix, and if you try to mix them you get into needless trouble. We can now see also that the view of the world as a space–time manifold no more implies determinism than it does the fatalistic view that the future 'is already laid up'. It is compatible both with determinism and with indeterminism, i.e. both with the view that earlier time slices of the universe are determinately related by laws of nature to later time slices and with the view that they are not so related.

When we use tenses and token-reflexive words such as 'past', 'present', and 'future', we are using a language which causes us to see the universe very much from the perspective of our position in space–time. Our view of the world thus acquires a certain anthropocentricity, which can best be eliminated by passing to a tenseless language. By the use of such expressions as 'earlier than this utterance' and 'later than this utterance' we make quite explicit the reference to our particular position in space–time. Once we recognise this anthropocentric reference and bring it out into the open we are less likely to project it on to the universe. The tenseless and minimally token-reflexive language enables us to see the world, in Spinoza's phrase, *sub specie aeternitatis*.

Notes

1 This vivid expression is used by J. H. Woodger. See his 'Technique of Theory Construction', *International Encyclopedia of Unified Science*, vol. 2, no. 5 (University of Chicago Press, 1939).
2 H. Reichenbach has given an excellent discussion of tenses and similar notions in terms of 'token-reflexivity' in §§ 50–1 of his *Elements of Symbolic Logic* (New York, Macmillan, 1947).
3 See the passage from H. Bergmann, *Der Kampf um das Kausalgesetz in der jüngsten Physik* (Braunschweig, 1929), pp. 27–8, which is quoted in A. Grünbaum's paper 'Carnap's Views on the Foundations of Geometry', in P. A. Schilpp (ed.), *The Philosophy of Rudolf Carnap* (La Salle, Ill.: Open Court, 1963). Grünbaum's paper contains an excellent critique of the idea of an objective 'now'.
4 In his essay 'Time and the World Order', in H. Feigl and G. Maxwell (eds), *Minnesota Studies in the Philosophy of Science*, vol. III (University of Minnesota Press, 1962), pp. 527–616, see p. 533.
5 See A. W. Burks, 'A Theory of Proper Names', *Philosophical Studies*, vol. 2, (1951), pp. 36–45, and N. L. Wilson, 'The Identity of Indiscernibles and the Symmetrical Universe', *Mind*, vol. 62 (1953), pp. 506–11.