

PHILOSOPHICAL LECTURE
SOME PROBLEMS ABOUT TIME

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WHEN I was invited to give this philosophical lecture and was considering which subject to talk about, I found my mind turning towards a great philosopher, a Fellow of this Academy, who died just forty years ago: John Ellis McTaggart. I consider myself very lucky to have been introduced to McTaggart's work early in my philosophical life; McTaggart sets high standards of clarity, rigour, and seriousness for a young philosopher to try to live up to. I suppose McTaggart is little read nowadays; he was a metaphysician, and metaphysics is not in fashion; even those who stridently call out for metaphysics to be done do not produce any themselves, and ignore the one British metaphysical work of genius in this century. But I make bold to put into McTaggart's mouth the words of one of his favourite poets:

But after, they will know me. If I stoop
Into a dark tremendous sea of cloud,
It is but for a time; I press God's lamp
Close to my breast; its splendour, soon or late,
Will pierce the gloom: I shall emerge one day.

(Browning's Paracelsus)

I shall be talking about a subject that was of central concern for McTaggart—the problems of time. I begin by examining a view of time that is now widely held in one form or another. In its crudest form, this view makes time out to be simply one of the dimensions in which bodies are extended; bodies have not three dimensions but four. An instantaneous solid is as much a mere artificially abstracted aspect of a concrete thing as a surface without depth is; photographs of a man at different ages represent different three-dimensional cross-sections of a four-dimensional whole. Time is only subjectively and relatively distinct from the other dimensions in which things are extended. We may illustrate this by the simile of horizontal and vertical; though at any given point on the Earth's surface a unique vertical direction can be picked out, there is no cosmic distinction of horizontal and vertical, and people at different places on

the Earth will take different directions to be vertical. Or again, as Quine says: 'Just as forward and backward are distinguishable only relative to an orientation, so, according to Einstein's relativity principle, space and time are distinguishable only relative to a velocity'; and he speaks of 'an hour-thick slice of the four-dimensional material world . . . perpendicular to the time axis.'¹

Since Einstein, indeed, this sort of view has been very popular with philosophers who try to understand physics and physicists who try to do philosophy. Some of the arguments used in its favour are decidedly odd. Thus, it is supposed to be supported by the fact that we can represent local motion in a graph with axes representing space and time; the line drawn on the graph-paper is taken to represent a 'world line' or 'four-dimensional worm' stretching through a 'space-time continuum'. We might as well be asked to believe that the use of temperature charts requires the physical existence of 'world lines' in a 'temperature-time continuum'. Obviously the two axes of a graph, though themselves magnitudes of the same sort, may represent quite heterogeneous magnitudes.

Another odd argument is that modern formal logic, in particular quantification theory, can be applied to propositions about physical objects only if these objects are regarded as four-dimensional. This is not at all true. In Quine's *Methods of Logic*, for example, we learn from his precept and practice how to apply modern formal logic to propositions of ordinary language; there is no obstacle to such application, he points out, in the sort of ambiguity that is resolvable by considering 'circumstances of the argument as a whole—speaker, hearer, scene, date, and underlying problem and purpose'; all that we really need is that the sense and reference of expressions should 'stay the same throughout the space of the argument' (op. cit., p. 43). In a later work, *Word and Object*, Quine does indeed pay lip service to the need of four-dimensional talk; but the parts of his book essentially involving such talk could easily be cut out; the great majority of the sentences given as logical examples are in a streamlined version of English, not in four-dimension-ese; and Quine's discussions almost all relate to the mode of significance of terms and the structure of propositions in this near-vernacular language. Thus it is not open to Quine to maintain that if we are to be 'serious about applying modern logic to temporal entities', in particular if we are so to apply quantification theory, then we

¹ *Word and Object*, p. 172.

need 'the four-dimensional view' as 'part and parcel' of what we are doing.¹

Logic would not be much use for arguments about concrete realities if we had to hold that, outside pure mathematics, logic applied only to a language yet to be constructed, one that nobody talks or writes. Logic was a going concern, and was applied to inferences about concrete matters, long before anyone ever dreamed up four-dimensional language. If all these past applications of logic had to be written off as misconceived, we could not have high hopes for future applications to an as yet non-existent language. Quine is certainly not himself prepared to write off so much of logic's past.

Nor ought any logician to try to accommodate his doctrines to demands made in the name of contemporary physics. Logic must be kept rigid, come what may in the way of physical theories; for only so can it serve as a crowbar to overthrow unsatisfactory theories. Lavoisier remarked that the phlogistonists ascribed different and indeed incompatible properties to phlogiston in order to explain different experimental results; what a good thing there were not then logicians prepared to bend logic in the interests of the phlogiston theory—to say that these were 'complementary' accounts of phlogiston, both true so long as you did not combine them!

The view that time is merely a fourth dimension in which things extend is in any event quite untenable. On this view, the variation of a poker's temperature with time would simply mean that there were different temperatures at different positions along the poker's time-axis. But this, as McTaggart remarked, would no more be a *change* in temperature than a variation of temperature along the poker's length would be.² Similarly for other sorts of change. A man's growth would be regarded as the tapering of a four-dimensional body along its time-axis from later to earlier; but this again would no more be a change than is a poker's tapering along its length towards its point. We thus have a view that really abolishes change, by reducing change to a mere variation of attributes between different parts of a whole. But, as McTaggart again remarked, no change, no time; the view we are discussing countenances talk of a *time* axis, but such talk is inappropriate on these premisses.

¹ 'Mr. Strawson on Logical Theory', *Mind*, October 1953, p. 443. On the previous page of the same article, Quine had quoted the very passage from his own *Methods of Logic* that I quoted just now!

² *The Nature of Existence*, vol. ii, sections 315–16.

The view really commits us to saying that time is an illusion. In Absolute Reality there is a changeless arrangement of four-dimensional solids; in Present Experience certain aspects of this arrangement appear to our perceptions as changes of three-dimensional bodies. McTaggart too thought that time was an illusion—though he had a very different account to give of the Absolute Reality that we misperceive as changeable bodies. But time cannot be an illusion; and certain arguments of McTaggart's own, ironically enough, are readily adapted to prove this.

The arguments in question show that certain features other than time in our experience cannot possibly be illusory. Thus, there really must be error in the universe; for there appears to be error, and if this appearance is false, then again there is error.¹ Parmenides and Mrs. Eddy alike are in a quandary what to say about the 'error of mortal mind'. Again (as mention of Mrs. Eddy reminds me) there is plain incoherence in the optimistic doctrine that misery is only an 'error of mortal mind': if my 'mortal mind' thinks I am miserable, then I am miserable, and it is not an illusion that I am miserable.² (Of course, so far as this goes, it might still be true that our misery would vanish if we all perceived things without illusions; McTaggart could consistently hold that, as he in fact did.) But now, quite similarly, even if my distinction between past, present, and future aspects of physical things is a fragmentary misperception of changeless realities, it remains true that I have various and uncombinable illusions as to which realities are present. I must therefore have these illusions not simultaneously but one after another; and then there is after all real time and real change.

One might perhaps hold that time and change are only in the mind, in the sense that only a mind lives through time and undergoes change; in this sense, misery is 'only in the mind'. But this sense of the phrase must be sharply distinguished from the sense in which a thing's being 'only in the mind' implies its unreality. A man can no more 'only think' he has changing impressions of the world than he can 'only think' he is unhappy.

McTaggart tried to show that there was a difference between error and misery, on the one hand, and time on the other. A state of error or misery cannot be just illusory, because to be under such an illusion would be a state of real error or misery; but a state of self-consciousness that presents itself as temporal need not, he argued, be on that account really temporal.³ This

¹ *The Nature of Existence*, vol. ii, section 510.

² *Ibid.*, section 857.

³ *Op. cit.*, section 511.

distinction is sound, so far as it goes; however, it misses the point that temporal appearance requires the existence of diverse *and uncombinable* impressions as to what is present. I am not arguing that *each single* state of self-consciousness must really be temporal because it presents itself as temporal; I am arguing that the *variety* of states each person experiences must really be, as it appears to be, a change in his experience, because these states are combinable only in succession, and not simultaneously.

However, we might try modifying the view of a four-dimensional and changeless *physical* reality by allowing that there is real change in the world of experience. There would then be a set of observing minds each of which continuously 'moved on' from one part of the four-dimensional physical world to another; though the ordered cross-sections of four-dimensional bodies would then appear to an observing mind as earlier and later, they would not really stand in temporal relations—only in the experiences of the observing minds would there be real time and change.

To make this story consistent, the observing minds must be supposed incorporeal and physically dimensionless; otherwise there would, contrary to hypothesis, be real change in the physical world. How then can mind be said to *move*? We need not make heavy weather of this; a simple analogy may help us out. The order of printed words on a page is an unchanging spatial order; but it appears as a temporal order to a reader whose attention moves on from word to word and from line to line—and surely nobody will have felt a difficulty over my use of 'moves on' in this context.

The theory I have just sketched is *one* theory of time to be found in the opening discourse of the Time Traveller in Wells; and it is a theory that lends itself to speculative developments. Why should we assume that an observing mind's attention must always travel on in one direction like that of a slow, plodding, reader? Even normal minds may sometimes slip back to a part of the physical continuum that their attention has already scanned; Wells in fact gives us this 'explanation' of vivid reminiscence. And why should not a practised observer learn a skill like that of the practised reader, of looking before and after, seeing, for example, by anticipation those parts of the physical continuum that he would observe only later on by the normal movement of his focus of observation?

This whole theory, though, is open to the gravest objections. It incorporates an extreme form of Cartesian dualism: the

human body is a changeless four-dimensional solid, the human mind a changeable dimensionless entity that reads off data for its *cogitationes* along one dimension of this solid. The theory is thus exposed to all the general arguments against Cartesian dualism; and also, to certain special objections. Though admitting an inability to understand the mind's power to move the body, Descartes did not venture to deny this power; even the Occasionalist disciples of Descartes, who did deny such a power to the mind, held that God would miraculously tamper with our normally automatic bodily machinery so that within limits it should move as we wish. On the theory we are now considering, there is no time or change except in minds; the four-dimensional physical world is an absolutely fixed order, not to be altered by any will, human or divine. The mind just cannot interfere with what will physically come to be; in fact, the very phrase I just used is only a loose manner of referring to those regions of the changeless four-dimensional world which a given mind is next going to observe.

Such a view would reduce the will of man to an impotent chimera, buzzing in a void and feeding upon second intentions (in the words of the perhaps legendary medieval conundrum). It may be beneath the dignity of philosophy to say 'We know our will is free, Sir, and there's an end on't'; but we do know that our plans and purposes radically alter our physical environment, and there's an end on't; any contrary theory, however plausibly argued, just has to be false.

The view that our decisions cannot bring about physical changes may be called *fatalism*. Fatalism has a bad name among philosophers, like solipsism; arguments in favour of either will be dismissed as ingenious sophistries, and a reduction of a thesis to either counts as checkmate in the philosophical game. Determinists are mostly anxious to repudiate fatalism: to maintain only that human designs are predictable from causes, not that they do not have effects. I think this defence is open only to some varieties of determinist; other determinists evade fatalism only by a sort of doublethink; indeed, it sometimes looks as though doublethink were being deliberately advocated as a way out of free-will puzzles. Be that as it may, fatalism naked and undisguised has a strong imaginative and emotional appeal for many people. John Buchan was such a person; in his admirable novel *The Gap in the Curtain* he worked out the consequences of that purely mental 'time-travel' into the future which, as we just saw, would be allowed as a theoretical possibility by the theory

of mental observers' scanning an unchanging physical world. I will not spoil this novel, for those of you who have not read it, by giving away the plot; I will just remark that the fatalism is consistently upheld. Buchan's characters merely get a glimpse of the future, with no power to change it; as in Oriental tales of Fate, what is to be comes to pass regardless of man's designs.

We find it easy to imagine the future as a country into which we are travelling and which is there before we travel into it; a country of which we might get a Pisgah sight through a break in the clouds before we actually get there. Here it is interesting to notice the change of meaning that has happened to the phrases 'the next world' or 'the world to come'. They originally meant the *age* to come, *vitam venturi saeculi*, which is to follow the return of Messiah; nowadays, to many people, they suggest some other *place*, as when one calls Mars 'another world'.

The fundamental difficulty about this picture is quite different from the obvious one. At the price of adopting dualistic fatalism, one can, as I have shown, make some kind of sense out of this talk about travelling; it is not the travelling that raises the real difficulty, but the destination. What *is* (say) the England of 1984? Is there really such an object *in rerum natura*, distinct from the England of 1965?

It is very natural to talk this way: very natural to think of the successive phases in an object's history as ordered parts of the object itself—somehow like the segments of a worm's body. I shall here borrow an example from McTaggart; he, of course, did not believe in Time, but his example suits well enough for recent statements of this view, for example, by Quine and J. J. C. Smart. The phrase 'St. Paul's in the nineteenth century' would designate an individual, and so would, for example, 'St. Paul's in 1801'; and these must be two distinct individuals, for many predications that are true of St. Paul's in (the whole of) the nineteenth century are false of St. Paul's in 1801 and vice versa. Moreover, 'St. Paul's in 1801' will designate a part of the whole designated by 'St. Paul's in the nineteenth century'; and if we take the individuals designated by 'St. Paul's in 1801', 'St. Paul's in 1802', up to 'St. Paul's in 1900', they will together include all the content of the individual designated by 'St. Paul's in the nineteenth century'.¹

¹ *The Nature of Existence*, vol. i, section 163. It is of no present concern that McTaggart chose to use the word 'substance' where I use 'individual'. He was clearly assuming that the Christian era begins on 1 January A.D. 1, so that the nineteenth century runs from 1 January 1801 to 31 December 1900.

I think this account involves an erroneous analysis of propositions into subject and predicate. Let us consider one sort of predications that might be used to discriminate the individuals designated by phrases like 'St. Paul's in 1856': if you were answering the question 'How many visitors were there?' you might have to give a different answer for each year of the nineteenth century and of course a different answer again for the century as a whole. We can certainly consider a proposition: 'There were n visitors to St. Paul's in 1856', as a predication about St. Paul's; I have chosen this example to show that the problem I am raising does not arise from superficial grammatical considerations, for here we have in any case a logical subject of predication that is not a grammatical subject.¹ The question is whether we can also analyse the same proposition as a predication about St. Paul's in 1856; as attaching to the subject 'St. Paul's in 1856' the predicate: 'There were n visitors to . . .'. This analysis is not excluded because the other is possible; we may surely analyse 'Queen Anne's hat was red' equally well as predicating of Queen Anne's hat that it was red and as predicating of Queen Anne that she had a red hat; similarly, it could be argued, our example *both* predicates something of St. Paul's *and* predicates something of St. Paul's in 1856. But I think the second analysis can be excluded on other grounds; phrases like 'St. Paul's in 1856' cannot be taken as logical subjects at all.

Let us shift to another example: 'McTaggart in 1901 was a philosopher holding Hegel's dialectic to be valid, and McTaggart in 1921 was a philosopher not holding Hegel's dialectic to be valid.' If we regarded 'McTaggart in 1901' and 'McTaggart in 1921' as designating two individuals, then we must also say they designate two philosophers: one philosopher believing Hegel's dialectic to be valid, and another philosopher believing Hegel's dialectic not to be valid. To be sure, on the view I am criticizing the phrases 'McTaggart in 1901' and 'McTaggart in 1921' would not designate two philosophers, but two temporal slices of one philosopher. But just that is the trouble: for a predicate like 'philosopher believing so-and-so' can of course be

¹ Anyone disturbed by this sort of subject-predicate analysis may be reminded that it has an Aristotelian precedent. Aristotle analyses 'There is a single science of (a pair of) contraries' into subject '(pair of) contraries', predicate 'there being a single science of them'; and he explains this as meaning, not that contraries *are* there being a single science of them, but that *it is true to say of them* that there is a single science of them. (*Analytica Priora* 48^b 4 ff.)

true only of a philosopher, not of a temporal slice of a philosopher. So if our example, which is a plain and true¹ empirical proposition, were construed as a conjunction of two predications about temporal slices of McTaggart, then it would turn out necessarily false; which is an absurd result. The absurdity does not come about just for my chosen example; it arises equally for Quine's example 'Tabby at t is eating mice';² for a cat can eat mice at time t , but a temporal slice of a cat, Tabby-at- t , cannot eat mice anyhow.

The friends of temporal slices will no doubt here pray leave to amend the examples so that they contain predicates fitting temporal slices, instead of predicates like 'philosopher believing so-and-so' or 'cat eating mice', which fit living beings and not temporal slices of living beings. But we ought not to grant them leave to amend. The whole ground for treating, for example, 'McTaggart in 1901' and 'McTaggart in 1921' as designating two distinct individuals was that we seemed to find predicates true of the one and false of the other. But now we find that such predicates as appear in ordinary empirical propositions are often of a kind that could not be true of temporal slices; so the ground for recognizing temporal slices as distinct individuals has been undercut; and we ought to reject temporal slices from our ontology, rather than cast around for new-fashioned predicates to distinguish them by.

I conclude that temporal slices are merely 'dreams of our language'. It is no less a mistake to treat 'McTaggart in 1901' and 'McTaggart in 1921' as designating individuals than it would be so to treat 'nobody' or 'somebody'. If we take the name 'McTaggart' as logical subject of both clauses in our example, no such troubles arise; for, on the face of it, the predicates we are attaching to this subject are a compatible pair, namely 'philosopher believing in 1901 that Hegel's dialectic is valid' and 'philosopher not believing in 1921 that Hegel's dialectic is valid'.

Predicates of this sort, in which dates are mentioned, are a long way above the most fundamental level of temporal discourse. Our ability to keep track of the date and the time of day depends on a set of enormously complicated natural phenomena; such phenomena, serving 'for signs and for seasons and for days and for years', might easily not have been available. We can easily imagine rational beings, living on a cloud-bound planet

¹ Cf. *The Nature of Existence*, vol. i, sections 48-50.

² *Word and Object*, p. 173.

like Venus, who had no ready means of keeping dates or telling the time, and were too well endowed by Nature with the necessities and amenities of life to feel any need to contrive such means. Clearly, such creatures might still speak of one thing's happening at the same time as another, or after another, and might have past, present, and future tenses in their language. This is grass-roots temporal discourse; it is perverse to try to analyse it by means of the vastly more complex notions that are involved in saying 'in 1901' or 'at time t '.

In particular, it is definitely wrong to analyse an unsophisticated simultaneity proposition, like 'Peter was writing a letter and (at the same time) Jenny was practising the piano', in terms of what happened at some one time t —'For some time t , Peter was writing a letter at t and Jenny was practising the piano at t .' Such a use of 'at the same time' as we have here does not involve any reference to an apparatus or technique for telling the time (and still less, a reference to Absolute Time). On the contrary, telling the time depends on knowing some of these primitive simultaneity propositions to be true. Telling the time by an ordinary clock involves observing that the long hand points (say) to the 12 and the short hand *at the same time* points to the 6; clearly we do not need another clock to verify that it *is* at the same time. A physicist may protest that he simply cannot understand 'at the same time' except via elaborate stipulations about observing instruments; his protest may be dismissed out of hand, for he could not describe the set-up of any apparatus except by certain conditions' having to be fulfilled *together*, i.e. simultaneously, by the parts of the apparatus.

Simultaneity is involved in empirical statements; but it is not an empirical relation like neighbourhood in space. The natural expression for simultaneity is not a relative term like 'simultaneous with', but a conjunction like 'while' joining clauses; it is an accident of English idiom that 'at the same time' seems to refer to a certain *time* that has to be *the same*, and the words for 'at the same time' in other languages—Latin *simul*, Greek $\epsilon\mu\alpha$, Polish *razem*—have no such suggestion.

These conjunctions joining clauses no more stand for a proper relation than, for example, 'or' does. If I say I can see with my myopic eyes something over there that is *either* a hawk *or* a hand-saw, I do not claim to observe a hawk in the act of being an alternative to a hand-saw; to try to conceive a relation of alternativeness between such concrete objects would soon land us in paradoxes. Like alternativeness, simultaneity is not a

relational concept, but is one of those concepts called transcendental by the medievals, formal in Wittgenstein's *Tractatus*, and topic-neutral by Ryle; the last term is the most informative of the three—it shows us that these concepts are not departmental but crop up in discourse generally.

Because of this topic-neutrality, 'at the same time' belongs not to a special science but to logic; its laws are logical laws, like the so-called De Morgan laws for 'or'. Physicists may have interesting things to tell us about the physical possibilities of synchronizing clocks by the transmission of electromagnetic signals; but this information is wholly irrelevant to the logic of basic simultaneity propositions. Our practical grasp of this logic is not to be called in question on account of recondite physics; for without such a practical grasp we could not understand even elementary propositions in physics, so a physicist who casts doubt upon it is sawing off the branch he sits upon. And a theoretical account of this logic must be given not by physicists but by logicians.

I remarked just now that the natural, primitive, way to speak of simultaneity is to use a conjunction joining clauses, rather than a relational term like 'simultaneous with'. In general, I think we need to get events expressed in a propositional style, rather than by using name-like phrases (what Kotarbiński has called 'onomatoids'). We need, that is to say, propositions like 'Wellington fought Napoleon at Waterloo after George III first went mad', rather than 'George III's first attack of madness is earlier than the Battle of Waterloo'.

Some years ago philosophers were all the while talking of people and things as being 'logical constructions out of events'. This was a topsy-turvy view: nobody ever has talked or is going to talk a language containing no names of people or things but only names of events, and the claim that our language could in principle be replaced by such a language is perfectly idle. On the other hand, any sentence in which an event is represented by a noun-phrase like 'Queen Anne's death' appears to be easily replaceable by an equivalent one in which this onomatoid is paraphrased away; we could use instead a clause attaching some part of the verb 'to die' to the subject 'Queen Anne'. Any ordinary sentence, that is, will allow of such paraphrase; philosophical sentences like 'Queen Anne's death is a particular' may resist translation, but we can get on very well without them. On the other hand, 'Queen Anne's death is a past event' goes over into 'Queen Anne has died' (or 'is dead'), and 'The news of Queen Anne's death made Lord Bolingbroke swear' goes over

into 'Lord Bolingbroke swore because he heard Queen Anne had died'. Cutting out the onomatoids in this way, we get a manner of speaking in which persons and things are mentioned but events do not even appear to be mentioned; so far from its being people and things that are logical constructions out of events, events are logical constructions out of people and things.

McTaggart's proof that time is unreal has often been criticized on the score that it essentially depends on treating 'past', 'present', and 'future' as logical predicates in propositions like 'Queen Anne's death is past'. I think I could show that this is too easy a way of dismissing McTaggart; some at least of his arguments could be restated so as to avoid the criticism. Anyhow, the critics have oddly failed to see that if the ostensible predicate 'past' in 'Queen Anne's death is past' is not to be parsed as a logical predicate, then equally the phrase 'Queen Anne's death' is not to be regarded as being, or even going proxy for, a logical subject.

In his lectures on Logical Atomism, Bertrand Russell forcibly argued that a phrase like 'the Kaiser's death' is not even a description, let alone a name, of an object nameable by a proper name, but rather goes proxy for the corresponding proposition 'The Kaiser is dead'. For example, people might in 1918 assert or deny or doubt the Kaiser's death; this shows that the onomatoid 'the Kaiser's death' goes proxy for a clause 'The Kaiser is dead'. (Observe that it would be nonsense to speak of asserting or denying the Kaiser's *spiked helmet*—this phrase *is* a description of a nameable object.)

To be sure, later on in the same course of lectures Russell tells us that a person or thing is 'a series of classes of particulars, and therefore a logical fiction'.¹ This often happens with a work of Russell's: you pays your money and you takes your pick. I have no hesitation which of the two views I should pick. For the first, there are sound logical reasons; for the second, there is only an ontological prejudice of Russell's—'the things that are really real last a very short time'.²

There is more than this wrong with Russell's treatment of persons. He is trying to ride two theories of classes at once: the no-class theory (that classes are fictions) and what we may call the composition theory (that classes are composed of their members and series of their terms). Only the composition theory, *plus* the segmented-worm idea of a person's temporal parts, can make

¹ *Logic and Knowledge* (Allen & Unwin, 1956), pp. 186–9.

² *Ibid.*, p. 274.

it plausible that a series of classes is what a person is; Russell then concludes that, being a series of classes, a person is a fiction, by jumping over to the no-class theory. I doubt the staying power of either horse; to try to ride both at once is really desperate.

If my own arguments are sound, time-order and space-order are radically different. We can indeed verbally use such forms as 'A is between B and C' for either sort of order; but I think this only leads to confusion. Spatial order relates individual objects: Bill is between Tom and Joe. We can get grammatically similar sentences about time-order by using onomatoids like 'the Battle of Waterloo'; but the logically perspicuous way to represent time-order is a complex sentence whose sub-clauses *report* (not name) events, these clauses being joined by temporal conjunctions like 'and then', 'and at the same time', 'while', etc. Such conjunctions, which form narrative propositions out of simpler ones, are of course quite different in category from relative terms that form propositions out of names or name-substitutes; and time 'relations' are not to be spoken of in the same logical tone of voice as space relations.

If in '*x* adjoins *y*' we replace the schematic letters by names or descriptions of bodies, the resulting proposition will not be even a description, let alone a name, of something that can itself adjoin a body. On the other hand, if we replace the letters in '*p* and then *q*' by narrative propositions like 'Queen Anne died' or 'Wellington defeated Napoleon', the result is again a narrative proposition reporting a course of events; and this can be used to build up more complex narrative propositions, of such forms as 'while *r*, (*p* and then *q*)'. Nothing analogous to this is possible for propositions describing spatial order: '*x* is between (*y* is above *w*) and *z*' gives us mere gibberish if we replace the schematic letters by names.

Miss Anscombe has raised an interesting objection to this argument. She rightly remarked that from a grammatical point of view 'where' will serve as a conjunction forming sentences out of sentences just as well as 'when' will. To give an example: we may join 'The Dome of the Rock was built' and 'Solomon's Temple was built' either with 'when' or with 'where' so as to make sense; the 'when' proposition is of course false, but that is no objection to it as a logical example. Some medieval logicians did in fact class both conjunctions as means of forming 'hypotheticals', i.e. complex propositions, out of simpler propositions; there were temporal hypotheticals and local hypotheticals. But without going into the analysis of local hypotheticals, we can

quickly see that their logic does not run at all parallel to that of temporal hypotheticals. For, as I just now remarked, a temporal hypothetical ' p and then q ' can be used as a clause in a more complex one such as 'while r , (p and then q)'. We can play no similar tricks with local hypotheticals: 'where r , (p to the south-east of where q)'—e.g. 'Where the Dome of the Rock was built, (the Pyramids were built to the south-east of where the Parthenon was built)'—is just not an intelligible build-up for a proposition. The Pyramids just *were* built to the south-east of where the Parthenon was built; this just *is* so, and there's no sense in trying to say *where* it was so. The more we try to assimilate space and time, the more we shall find ourselves logically impeded from doing so.

I am strongly inclined to maintain that the rules for our grass-roots employment of temporal conjunctions—not only 'at the same time', but also 'before' and 'after'—belong to the domain of formal logic. This claim is highly disputable, and I can here only sketch my reasons for it. They derive from the branch of logic called modal logic—the logic of necessity and possibility. Tie-ups between modal logic and our elementary temporal discourse might well have been suspected; for is not the future precisely the domain of unrealized possibility? Arthur Prior was a pioneer in these researches, and further work has been done by a band of younger logicians, including Hintikka, Dummett, Lemmon, and Kripke. The March 1965 number of the *Journal of Symbolic Logic* contains an important article on the adequacy of certain modal-logic calculi for dealing with temporal order.¹ I feel confident that much progress will be made in these researches; I am not invoking anyone's authority, but you can see that the idea of clearing up time problems with tools of modal logic is not just a programme vaguely sketched by me here and now. Nor would it be fair to say that calling these researches 'logic' is an arbitrary bit of nomenclature; modal logic is traditionally a part of logic, from Aristotle onwards; and the systems now being used in tense logic are based on modal systems originally devised by Lewis and Langford with no such application in mind.

People have long felt inclined to ascribe to some truths about time the same necessity as logical truths have: one could as easily describe a world in which *modus ponens* broke down as a world in which time was two-dimensional or the past was changeable. If I turn out to have been right in my conjecture

¹ R. A. Bull, 'An Algebraic Study of Diodorean Modal Systems'.

about the possibility of reducing to modal logic the rules that govern temporal discourse, then this feeling will have been a divination of the truth. Geometrical truths, as is well known, are not necessary in this way; we can describe without contradiction a world whose geometry is non-Euclidean just as well as a Euclidean world. But if these basic truths about time are logical, then a world differing from ours in regard to them is a mere chimera.

However this may be, it is certain that there is a category-difference between space and time order, between events and individuals; and this can be brought out in quite ordinary language. But sometimes important things are too close to us to be clearly visible, or are concealed like faces in a puzzle picture; the labour of bringing them into plain view is then not wasted. And mistakes and confusions about this sort of thing are both common—witness the reams of nonsense about time you can find in bookshops—and of some practical importance. Squandering vast sums on foolish enterprises is an everyday occurrence; we may yet be witnesses of a 'time race' between East and West. Will the U.S. time explorer get back and eliminate Lenin before his Russian rival gets back even earlier and eliminates George Washington? In a few years the world may be anxiously waiting for the answer. If such spectacular folly once gets under way because governments have been convinced of some nonsensical theory, a logician will not waste effort on protests that will certainly go unheeded; he need not, after all, lose any sleep about who is going to succeed, and he could be glad that destructive efforts were directed where they would only squander human resources in a silly way.

One does what one can, though, against the Kingdom of Darkness; and perhaps less spectacular follies can be cured by exposing them to the light. Let me just instance a sophistry often used on one side of a current controversy. Some people are wont to say that it cannot make any significant moral difference whether you avoid something you wish to avoid by interposing a spatial barrier or by interposing a temporal barrier. If we do not let ourselves be fooled by the merely verbal assimilation of temporal and spatial barriers, the principle is really not a bit plausible; we need only test it on a case that rouses nobody's passions.

Let us suppose that it is my duty to organize a meeting in Cambridge. I fix a date for the meeting; then I suddenly realize that that ass Smith, whose presence would be disastrous, is

coming to Cambridge for the day on that date, and will certainly attend given this opportunity. I may avoid this disaster either by changing the date of the meeting—'interposing a temporal barrier'—or by locking Smith in his hotel room—'interposing a spatial barrier'. It really is not morally indifferent which of these methods I adopt.

When we find writers copying from one another the false moral principle I have just attacked—particularly when we find one of them supporting it with talk of 'space-time'—we may be pretty confident what the trouble is; here we have, to use Hobbes's phrase, Darkness from Vain Philosophy. It is not for me here and now to enter upon a discussion 'of the Benefit that proceedeth from this Darkness, and to whom it accrueth'.