PHILOSOPHICAL LECTURE

THE POSSIBILITY OF PREDICTION[1]

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I

PREDICTING is supposed to be saying in advance that something will happen: that a war (or an election) will take place, that a car will crash or a marriage survive. If things do so fall out, the prediction is successful; if not, not. Prediction, however, is not confined to the future. One can also predict the present and the past. Suppose I accuse Fred, who claims only to have seen the film, of having read *War and Peace*, and his annotated copy bears me out. I call that a successful prediction, even though he read the book before I said that he did. To call this a prediction I admit flouts usage: 'postdiction' and 'retrodiction' are the correct but unlovely terms prescribed for such a case. I shall do without them. They seem to me superfluous, and what is worse, they are misleading; they mark the wrong distinction. They suggest that the point of predicting something is to do so before it happens; whereas the real point is to do so before it is definitively known to happen—as talk of predicting natural laws, or kinds of elementary particles, or the existence of mathematical proofs, clearly shows. These things are not events that happen after they are predicted; they are not events at all, and they exist, if they do, as much before as after their prediction. Yet it makes perfectly clear sense to talk of predicting them. In these cases it is quite clear what needs to come after the prediction: namely, more decisive evidence for or against its truth. And that, I submit, is all that needs to come after a prediction in any case.

Now echoes of positivism might here combine with the usage that restricts prediction to future events to suggest that it is just

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the more decisive future evidence which is predicted. That is not so. It is the law, or natural kind, or proof which is predicted, not just more evidence for or against it. For one thing, someone who makes such a prediction may have no idea when or where—or even whether—more evidence will be found, nor what form it will take. When Dirac predicted the existence of magnetic monopoles, he did not thereby predict the observation decades later which was said to verify his prediction. And even when the relevant evidence is foreseen, that evidence is still not the prediction's intended point. Eddington went to South America to test General Relativity's prediction of how much light is, and always has been, bent by nearby massive bodies; not merely to test the prediction, footling in itself, that during the coming eclipse there would be a little shift in the image of a star near the sun.

I shall therefore talk of predicting past, present, and timeless matters as well as future ones; that is not good English, I admit, but good English does not here conduce to good philosophy. Still, even in the cognitive sense I intend, prediction does fundamentally, as well as usually, concern future events. There is something about an event's being future which generally limits our present knowledge of it. Much of our life, our more or less anxious planning, for example, the exercise of our free will, depends upon our inability to know as much about the future as about the past; and so does all our prediction. Were our knowledge of the future not so limited, then just as we can now call to mind the knowledge we have acquired, so we could now call to mind our own future knowledge, including our future knowledge of evidence for past, present and timeless matters. And if we could do that, prediction as I mean it would be unknown. For there is no prediction in any serious sense, even of a future event, once our knowledge of it is as complete as it can be. If I know, for instance, when Fred was born, I thereby know the dates of all his birthdays, future as well as past. I can indeed predict that he will see them—that does remain to be seen—but I cannot seriously predict their dates. In the trivial dictionary sense I can: I can state in advance the date of his next birthday. But I need not wait to see if I am right; and if I do wait, there will be nothing relevant for me to see. An anniversary, as opposed to possible celebrations of it, is not in itself a perceptible event, because it is not an event, with causes and effects, at all. Now if Eddington could have known as definately as I know the date of Fred's next birthday what the

upshot of his voyage would be, he would likewise have made no serious prediction which he need, or could, have gone abroad to test; there would likewise have been nothing more for him to go and see. But of course there was something more for him to go and see. As it happens, it was more or less what he predicted it would be. But whatever it had been, its previous inaccessibility to him was what gave his voyage point and made his previous statements about its outcome predictions.

When I refer to the 'more decisive evidence' that settles a prediction's fate, as when I say that Eddington saw what he predicted, I do not mean that that evidence is incorrigible. The memories and records of what Eddington saw are not proof against correction by further observation. But they do record the intended proof, the test, of his original foreseeing. (That they in turn provide grounds for predicting the results of further observation, and that these predictions may not succeed as Eddington's did, indeed raises serious problems in the theory of knowledge; but not any that I need to tackle now.)

II

The prediction of future events, then, is as fundamental as the difference between expecting and experiencing them, and our metaphysics must say how it can happen. What, in the world, prevents us knowing the future as well as we know the past we have experienced? That is the question I would answer. Note that it is the past and not the present I here contrast with the future. I ignore the present because my concern is with experience of the world beyond our immediate sensations; and even present experience of that, we now know, is always of what is past, albeit often only very slightly so. The external present we cannot yet experience, since it will take time for it to affect our senses.

We cannot, incidentally, affect the present either, unlike the future proper, so that our predictions of the present are never products of our intentions, as those of the future often are. I can predict that a door will open in the future because I intend to open it; but that cannot be why I think it is open now. However, this difference between present and future, though important, is not germane to my theme; so for now I shall include the present in the future. On the other hand, I shall exclude anniversaries for reasons I have, I hope, made clear. The future that I mean is what follows from the past in time without following from it in logic.

I must from the start distinguish my problem from the notorious problem of induction: the problem of saying how we can know a prediction will succeed, or estimate at least its chances of success. Suppose I predict, what indeed I believe, that this building will survive this lecture. There are, I trust, solid and sufficient grounds to expect that. If it is melodramatic, it is also true to observe that we are trusting our lives to that prediction; and so no doubt we should. But why should we, even when we know the grounds? For however good they are, those grounds would count for little if we saw and felt the ceiling fall. No one, I take it, emerging from the rubble, would then use the present grounds of my prediction, strong as they are, to defend it against the testimony of his broken limbs. And if this place does stay up until we stop, it will be our future experience of that, not our present grounds for expecting it, which will then assure us of my prediction's success. Why therefore should we now have so much faith in what will then be so negligible a part of our evidence for the truth of my prediction? That is how I would put the problem of induction, and I take it to be deep, difficult, and not yet solved. My business here, however, is not to try and solve it, but to say how it arises: to say what makes the surest expectation less definitive than knowledge of the past can be.

The short answer is that we can only expect future things and events because we cannot yet perceive them. In an hour we shall be able to see, and feel, this building standing then; now, we cannot. It is the future sight, the sound, the smell, and, perhaps above all, the feel of happenings and of things, animals, and people that prediction prepares us for. But why can we not yet perceive the future? The short answer to that is that causes do not follow their effects, and perception is an effect of what is perceived. My seeing, and then my hearing and my feeling, of an explosion, for example, are just a minute fraction of the explosion's multifarious effects. To perceive anything I must let it affect my senses. (That is true, incidentally, even of my own deliberate behaviour. I may know in advance what I intend to say on this occasion; but until I hear myself speak, I can only predict that I will succeed in saying it.)

To perceive something it is not of course enough to be affected by the thing perceived. We do not always perceive what affects us; nor, when we do, do we always perceive it rightly. I could be hit, and never know what hit me; I could see Fred, and mistake him for his brother. We want things so to affect our

senses that we are led to believe them to be as they really are; but that is an ideal not always realized. Happily it is no more my present task to explain how we can make our perceptions reliable, and know that we have done so, than it is to explain the basis of induction. All that matters to me here is that perception needs causation, not what else it needs in order to be accurate. It will be a sufficient reason why we cannot yet perceive the future that the future does not affect the present; in particular, that it does not at present affect our senses. That is why we cannot see, or hear, or smell, or feel future things and events, and must therefore be content to predict them.

I should of course explain why perception needs causation, and what causation is—whether in particular causation is an objective feature of the world; but those I fear must be added to my lengthy list of future tasks. What I shall try to say now is why the future does not affect the present. The simple answer would be to say that the future does not yet exist, and so cannot affect anything. Were that answer right, it would be pointless to look for another. But it is not right; the future exists as much as the past does. My reasons for thinking this are not very original, but they still meet too much resistance (e.g. G. Lloyd 1978) for me just to state the fact. I must try again to sell the case for it, before going on to seek elsewhere a sufficient reason for the future's present impotence.

III

I start with some more verbal reform. One is supposed to say of events only that they happen or occur; I propose to say as well that they exist, just as things, animals, and people do. My concern is with temporal reality, past, present, and—arguably—future, whether it consists of things or events or both. Among things (in which category, for brevity and without disrespect, I here include animals and people), reality for example presently distinguishes the British Monarch from the American; and among events her Coronation from President Carter's. The distinction between real and imaginary, existent and non-existent, events is just as obvious and important as that between real and imaginary things. It may be, as some philosophers maintain, that events are no more than changes in, or temporal slices of, things; though Professor Davidson (1969) and, even more, the dearth of suitable things—as opposed to events—in microphysics make me doubt that. But if it is so, it will not be because of events we only say in English that they happen or

occur and therefore say only of things that they exist. My reform is meant to forestall that foolish inference. And to forestall another, I shall use the word 'exists' tenselessly, applying it to all reality, whether past, present, or future. This does not presuppose that there is a future: it prevents no one from denying that the future exists, nor from presenting any serious grounds there may be for that denial. It only prevents the conclusion being produced by sleight of tongue. If temporal reality were, as St. Augustine thought, confined to the present, it would not after all be because the word 'exists' is only the present tense of an English verb.

I must emphasize, however, that I do not mean to belittle tense. I do not deny that we need some device for relating events temporally to the present time, and that, amongst other things, is what our simple verbal tenses do. To say something will happen is to say it is later than the present; to say it has happened is to say it is earlier. To say how much (or little) earlier or later, we add adverbial expressions like 'last year', 'this month', and 'tomorrow'. Since they simply make verbal tenses more specific in this respect, I shall call these expressions 'tenses' also. Adverbial tenses could indeed do the job on their own: 'last year' implies the past, just as 'tomorrow' implies the future. In the sentence 'It will happen tomorrow', the use of 'will' to mark the future is superfluous. Whether we use adverbs or verbal conjugation to relate events to the present is immaterial; but that we do so somehow is, I admit, essential. Professor Perry (1979) has convinced me that tense in this sense is an indispensable aspect of our thought. We have to have tensed beliefs and desires to make us act as and (especially) when we do. Mere tenseless beliefs and desires on their own would never induce us to do anything. I have, for example, held for months the tenseless belief that the date of my British Academy lecture is 3 May 1979, and have, on the whole, had a tenseless desire to be here for it. But these have been unchanging mental states, which could not on their own have prompted me to come here on any one day rather than any other. The mental event required to do that was the change this morning from my thinking in tensed terms that the lecture is tomorrow to my thinking that it is today. (Fortunately that change occurred on the right morning!) Now this is a change that had to come if my tensed belief on the subject was to remain true, which it is of course the sole object of all belief to be. The fact is that we need tensed beliefs to act on for the same reason

that we need to keep changing them in order to keep them true: because their truth-values change from time to time. Tenseless beliefs, on the other hand, never change their truth-values, so that we never need to change them just to compensate for the passage of time. And for that very reason, tenseless beliefs can neither be identified with tensed ones nor fill their role in prompting us to timely action.

Our thought needs tenses, therefore, but the world does not. Events' being more or less distant from the present time is not what makes tensed beliefs true or false from time to time; what does that is their having dates. For example, the date of this lecture is 3 May 1979. Given that fact, the date of my tensed belief, that the lecture is today, suffices to fix its truth-value: it is true on the same date as the lecture and false on every other date. Its truth-value is a function solely of these dates; whether they are in their turn past, present, or future makes no odds at all. It cannot: nothing could make this present-tense belief false on the date of this lecture or true on any other date; so in particular this date being more or less past or future could not do so.

There is a still deeper reason why the tense of events cannot be what makes tensed beliefs true or false, a reason more pertinent to my enquiry. It is McTaggart's (1908) reason: that dated events cannot in reality have tenses at all. I have said this lecture has a date, May 3; no one, I think, will venture to deny that. Now if the lecture also had tenses, it would have to have them all, since May 3 is (sometime) at every temporal distance from the present. It has been future, it is present, and it will be past. Yet most of these temporal distances are mutually incompatible; if this lecture is today, for example, it cannot also be tomorrow. So events cannot have all tenses. Yet dated events must do, if they have any; and therefore they have none.

I cannot here recount and rebut all the devious ripostes that this sound and simple argument has brought forth; I have followed others in attempting that Sisyphean labour elsewhere (1981, ch. 6; cf. Mink 1960). Here I shall indicate the flaws in just two of the most obvious and influential ones. The most obvious riposte is to point out that only at the same time are tenses incompatible, and events do not have incompatible tenses at the same time. This lecture is today on May 3; it is not then but on May 2 that it was tomorrow; and there is no contradiction in that. Indeed not; but this lecture always was today-on-May-3 and tomorrow-on-May-2; and it always will

be. This riposte makes tenses into unchanging temporal relations between events and dates: namely, the familiar, and tenseless, relations of being simultaneous with and of being more or less earlier or later than them. Of tense as an independent, non-relational property of events, this riposte is no defence at all.

The other influential riposte treats tense as a property of tensed facts; not of the event, this lecture, but of the fact that this lecture is today. Yesterday this fact, like the lecture, had the property of being tomorrow; tomorrow it will have the property of being yesterday. Now that a fact has a tense is itself another fact, whereas that an event has one is not another event. So simple tensed properties of facts can be iterated, unlike those of events, to simulate complex verbal tenses like the future perfect. 'Tomorrow this lecture will have occurred yesterday', for example, is simulated by 'Tomorrow, yesterday, this lecture is today'. That complex fact is incidentally supposed to follow from the simple fact that the lecture is today; and by thus iterating tenses, imposing systems of tense logic have been developed for the formal study of such temporal entailments (see e.g. McArthur 1976).

I have nothing against the systematic study of tenses; but it is misleading to present as logic what is really cosmology. For example, 'Tomorrow this lecture will have occurred yesterday' only follows from 'This lecture is today' if there is always a tomorrow; and that is only true if the world has no end. What is more seriously and pertinently misleading is to purport, in relating tenses, to deal directly with temporal aspects of reality when that is not the case. Facts can no more have incompatible properties than events can, and the fact that this lecture is today, like the lecture, has a date, namely May 3. So the fact, like the lecture, would, if it had any tenses, have to have them all, since May 3 is (sometime) at every temporal distance from the present. And so the argument repeats itself; dated facts cannot in reality have tenses at all. Since tensed facts undeniably have dates, their diverse tenses can only be the diverse but unchanging temporal relations they tenselessly bear to diverse dates; not real non-relational properties of the facts themselves.

Talk of tensed facts simply hypostatizes the truth of tensed beliefs; talk of tensed facts themselves having tenses hypostatizes the way the truth-values of tensed beliefs vary from date to date. To say that on May 2 the fact that this lecture is today has the property of being tomorrow is just to say that on and only on the next day, May 3, would that present tense belief be true.

But what then makes it true is just the tenseless fact that May 3 is this lecture's date; nothing tensed is either wanting or available to make our tensed beliefs about this lecture true. Tense logic deals rightly in the canons of tensed and therefore timely thought; but from the world itself we must make its cloud-capp'd theorems, its formal palaces, . . . dissolve, leave not a rack of tense behind.

Since neither facts nor events can in themselves be present or to any degree past or future, they cannot differ amongst themselves in this respect, nor therefore in any other that depends on such a difference. In particular, they cannot be supposed by virtue of futurity to lack the determinate existence or causal powers they would enjoy if they were past. Futurity cannot in reality be a property of anything dated; so it cannot by these or any other means make dated events or facts unable to affect our senses in advance, thereby preventing our previous perception of them.

IV

I have said that what prevents our previous perception of events is that effects cannot precede their causes. It remains to say why not, if not because later causes would have to be future when their effects occurred. There must be some reason why causes do not follow their effects. That as a rule they do not, everyone agrees. Where philosophers differ is in why that is the rule, and whether it admits exceptions. Having rejected the obvious answer to these questions, I must now offer some alternative.

The rule is not just a piece of stipulation. By 'effect' we do not simply mean the later of two causally connected events; nor conversely by 'later' do we simply mean the temporal relation an effect has to its cause. If we did, observing the one relation would settle immediately whether the other obtained, and that is not so. I know for example that my speaking these words is the cause, not an effect, of your hearing them; but that knowledge does not immediately rule out the possibility of discovering that you hear them before I speak. Likewise the temporal order of events can be seen without settling their causal relation; can be seen indeed when they are known to be causally unrelated. Suppose, to take a more exotic example, I see a nearby alphabet successively illuminated from 'A' to 'Z' by a remote rotating laser beam. Each of these twenty-six 'illuminations' is an effect of the remote emission of coherent light. None need be, because none is, a cause or effect of any of the others (which is

why, for instance, there is no relativistic upper limit to the speed of the beam's traverse: it could traverse the alphabet faster than the speed of light). But my knowledge of this lack of causal connection does not prevent my seeing which way the beam moves, that 'A' is lit up before 'B' and not vice versa. Our perception of causal and temporal order seems therefore independent, and their correlation a contingency which might not always hold.

In fact it really must hold, basically because of a unique feature of our direct perception of temporal order: namely, that it must itself consist of temporally ordered perceptions, whose order is causally determined. Take the successive lighting of the letters 'A' and 'B'. Causation does not link these two events, but it must link my perceptions of them if I am to see 'A' precede 'B'. To do that I must of course see 'A' and see 'B', and see 'A' first; but that is not enough. Had I forgotten seeing 'A' when I saw 'B', I should at no time have perceived their temporal order. For that, my seeing 'B' must include or accompany some memory-trace of my seeing 'A'. That, I submit, is what makes me perceive that 'A' precedes 'B'; and it is a causal process (though not of course one I need to be aware of). The trace that accompanies my seeing 'B' is an effect of my seeing 'A', not a cause of it; and this causal order suffices to fix which temporal order I perceive. But then it suffices also to fix, for me, the temporal order of my perceptions. I cannot both see 'A' precede 'B' and see 'A' after I see 'B'.

This causal mechanism determines my direct perception of the order of all outside events, including my own actions. You could perhaps hear me before I speak, but I cannot perceive myself to do so. My hearing must not only be itself an effect of my speaking, it must also include or accompany another effect, a memory-trace of that event; and that, for me, will settle which came first. Again the causal fixes the perceived temporal order.

That might, however, be so for me without being so in fact. If effects could precede their causes, could I not see 'A' after its memory-trace occurs in me along with my seeing 'B', and so mistake the objective order in which I see these two events? In trying to show that this cannot be, I must take care to avoid begging the question against backwards causation. Now I must of course admit that we can mistake or fail to see the temporal order of outside events; our sense of time is naturally limited. We can, for example, no more see a millisecond interval without

an action replay than we can see an atom without a field-ion microscope. Our perception in such cases is indirect and inferential, but it is still perception; it still serves to settle the fate of predictions. And, more to the point, it may outweigh direct perception when the two conflict. Microphones, for example, persuade us that a distant bell really sounds when we see the clapper strike, not later, as we directly hear it sound. So our direct perception we know can deceive us in temporal as in other matters. We could see 'A' lit up before 'B' when that was not the case: if the laser's traverse of the alphabet did exceed the speed of light, another observer could equally well see 'A' lit up after 'B'; and objectively neither of those two events would be later than the other.

But, for this very reason, neither 'A' nor 'B' could, according to the Special Theory of Relativity, be the cause of the other in such a case. So, that I can mistake the temporal order of outside events does not disprove its correlation with their causal order, since I could equally well mistake that. The crucial question is whether I can conceive myself to be wrong about the temporal order of my own perceptions. I could misremember them, of course, but that is neither here nor there: could they fail to be in the temporal order my causal mechanism makes me perceive them to be in? I submit not: no other test of temporal order can compete with the causally determined temporal order of our perceptions. They are data for all our knowledge of time.

This is a feature of perception unique to time: that our direct perception of temporal order has itself to have the property perceived. My seeing of a shape or colour need not itself be shaped or coloured; the output from my optic nerve must correlate with what I see, but it need not resemble it. With time, it must: the temporal order of events is ultimately perceived, directly or indirectly, only in the perceived temporal order of our own perceptions, and that is fixed by their causal order. But these perceptions are themselves events in space and time; their causal order therefore fixes the direction of objective time as well.

But what if our perceptions here did not all agree? Well, for that to happen they would have, with other events, to form a closed causal loop. If events could form such loops, our causal criterion might not suffice to give time a direction at all; and it would certainly admit exceptions to any general correlation. Suppose for example we could have four events: e_1 causing e_2,

causing e_3, causing e_1. Is e_1 earlier than e_2, or later? Whichever it is, there will be backwards causation: either of e_1 by e_3, of e_3 by e_2, or of e_2 by e_1. I must show therefore that such loops cannot occur, which I propose to do by extending the argument of Professor Dummett's (1964) famous tale of backwards causation; only I shall use a simpler and less exotic example than he did.

Suppose people at any time t_1 claim the ability at a later time t_2 to affect events at an earlier time t_0. Anything observable will do: suppose for instance that their shaving at t_2 is claimed to make them bleed at t_0. One man might of course coincidentally both bleed and shave; we therefore suppose enough cases to make coincidence incredible. Now by t_1 we can see who bled at t_0 and who did not; and we ask half of each group to shave at t_2 and the others to refrain. They try to comply (or we should have no test) and at t_3, later than t_2, we look at the results. They can show one of three things. If the men do as we ask, bleeding at t_0 will not correlate at all with shaving at t_2, and the causal claim will be disproved. For it to be true, there must be some non-coincidental correlation; and that could happen in one of two ways. First, some of the bleeders might find themselves unable to shave at t_2 or some of the others find themselves constrained to. Some such constraints could be coincidental, and so irrelevant; again we suppose enough cases for coincidence not to be sufficient explanation. Then indeed we have causation, but the wrong way round: somehow, bleeding at t_0 constrains some men to shave at t_2, or not bleeding prevents them. But unless some men are so constrained, there is only one other way the required causal correlation can survive: some records of the men's state at t_0 must turn out to be wrong. We thought that only half of those we asked to shave had bled before; that fraction must now turn out significantly higher. Again, some such errors in our records might coincidentally occur; so again we must suppose enough cases to rule that irrelevant explanation out. But then the fact supposed must be that of some men we can by no means reliably perceive whether or not they bleed at t_0 until we can see whether they shave at t_2. Now how can that be? Perception here is merely some effect, in the predominant forward causal order of events, of the event perceived; and the effects required to see a man bleed (or not) are not esoteric: light reflected from his skin will do. If that perception is in no way possible before t_2, it can only be because the man's bleeding (or not) reflects no light, and has no other effects whatever by which it could somehow be detected, before that time.

But that is to say that the bleeding (or the failure to bleed) did not occur before then. No material thing or event that has any effects at all can occupy a region of space–time without having some effects there (this, incidentally, being the proper significance of the maxim 'No action at a distance'). After all, if things did not have to have effects where—and when—they are, time-travel would be absurdly easy: dreaming, or thinking, accurately of the past, or seeing it through telescopes, would suffice to take us there. But that is evidently not so; we cannot suppose a thing or event to be deprived of its normal effects merely by being itself an effect of a later cause. If its normal effects are all absent from a region of space–time, so is the event.

These supposed cases, where the bleeding (or lack of it) are not perceptible before t_2, are therefore irrelevant to the experiment (because in them the effect did not in fact occur before its alleged cause), and so we must delete them from our list of cases. But they were only supposed to be there in the first place in order to preserve whatever correlation between shaving and bleeding causation here requires; and without these spurious cases in the list, the correlation will fail. In short, therefore, however weak the correlation required, no non-coincidental outcome of the experiment can show the later event to cause the earlier.

My example I admit is trivial; but the argument it exemplifies is not. It is not restricted to cases of human perception and decision. It indeed turns on causation having amongst other things to be what enables perception to settle predictions; which is why the perception of an earlier event cannot causally depend on, and so anticipate, what is still only a predictable perception of a later one. But any perceiver, actual or possible, large or small, long- or short-lived, near- or far-sighted, will do. The argument applies to all events perceptible to, and hence predictable by, any conceivable sentient being (and whether any events not so perceptible can sensibly be credited with locations in space–time, I take leave to doubt). In particular, therefore, the Universe itself can no more be a closed causal loop than it can contain one. If it were, every supposedly later event would also always be earlier, always in fact perceptible via its own normal effects, and so not predictably later at all: which makes the supposition senseless.

As to human decision, in my example the decision whether to shave or not, that is completely incidental. That the example

involves a decision just eases our assessment of the counterfactuals which distinguish causation from coincidence: what would, at least statistically, have happened had those perceived to bleed not shaved. In deciding on our own actions, we have continually to assess the counterfactual consequences of alternatives, so we can think about such a case with practised ease. But nothing depends on the shaving being a deliberate action; and in fact, of course, it is not only in cases of decision that we have to settle whether a correlation (or the lack of it) is coincidental; which is all that matters in my argument.

I conclude that in no case can we make sense of perceptible events forming closed causal loops. Hence in particular we cannot fit other people's perceptions of temporal order into such loops with our own; and therefore we cannot suppose the temporal order they perceive to clash with that of our perceptions.

All supposed cases of later events causing earlier ones, which might enable their perception in advance, reduce in fact to supposing closed causal loops. The causal and temporal orders are not really divorced when such examples are put forward. In Dummett's example and in mine, the supposed direction of time is just that of the predominant causation on which the perception of the events involved depends. Likewise in time-travel tales, the test of locally reversed time is causal. It is not supposed to be a coincidence that Dr Who appears in 1679 with the scarf he put on a minute before in 1979. His time travel consists precisely in his 1679 appearance being an effect of his 1979 activities. On the strength of that alone is a closed time-loop supposed between these two events: his side of the loop, inside the Tardis, taking a minute one way; ours, outside, taking three hundred years the other. Within each side of the loop, it is taken for granted that causal and temporal order coincide; the time-loop is perforce a causal one.

A causal loop is all that matters to any of these tales: the shaving's allegedly earlier effect, like Dr Who's travel, is made temporally backwards only by forming a loop in the predominant causal order of events. We therefore lose nothing (except confusion) in insisting on the coincidence of causal and temporal order. That does not rule out my example; it merely makes the shaving's alleged effect locally later as well as globally earlier. The stipulation does not beg the question of backwards causation; merely reduces it explicitly to the only substantive question that is in fact involved: namely, whether events can form causal loops.

The answer to that question, I have argued, is 'No'. Backwards causation is therefore impossible, and that is why it does not happen. An event's effects never precede it; in particular, therefore, its effects on our senses never do so. That is the reason why we cannot, at any time, perceive later events, and therefore can, and can only, predict them.

V

Prediction then is made possible by the lack of backwards causation; but that does not perhaps make all prediction possible. Some perceptions may be unpredictable. I do not mean unpredictable in the usual but erroneous sense, implied by indeterminism, of there being no reason to predict. Predictions don't need reasons; even if I pick my winners with a pin, I still expect my bookmaker to admit that I predicted them and to pay me my winnings. I mean literally unpredictable: such that it is impossible to anticipate the statement of a perception. Some singular predictions have been held to be impossible in this sense (see Godfrey-Smith 1978), and I want in conclusion to consider briefly why that might be so.

A singular prediction is one about a specific event, or thing, or person; as opposed to a general prediction of there being (or not being) one or more events, things, or people of some sort. That there will be twenty-seven murders in London in May 2079 is a prediction that is general about murders and people, and singular about London. That a certain Jack will be one of the victims appears to be a singular prediction about that Jack. The singularity of such a prediction has, however, been denied, usually on the grounds that its apparent subject, Jack, being as yet unconceived, does not yet exist; and so, like all mere possibilities, lacks a determinate identity. Only his existence could pick one particular Jack out of all the similar people there might be in London in 2079, and that existence as yet is not available. The prediction therefore cannot, it is thought, be about any one possible future Jack rather than any other, and is instead supposed to be that there will that month be a murder of some Jack or other. Suppose there is, suppose it is a Jack Smith; still we cannot say now that the prediction is about him in particular, since it would succeed just as well were he to shoot a Jack Jones—or even another Jack Smith—instead of getting shot himself. Any murdered Jack would do; so the prediction is really general, not singular as it appears to be.

Now not all singular predictions are supposed to be

impossible. Once Jack Smith comes to exist, we can predict of him that he will be murdered, just as we can later observe whether or not he is. That prediction really is singular about Jack: no other murdered Jack would satisfy it. But then Jack in this case is not future at the time the prediction is made. His murder is future, but the prediction is only general about the murder: it says only that there will be such an event. It doesn't try to give the event a particular identity; any of the many possible ways Jack could be murdered that month will do. So even in this case, the rule survives that predictions of later things and events are not singular.

Whether this rule is right or not, I obviously cannot accept the reason I cited for it. Futurity, I have argued, is a fictitious property of anything that has a date; and as such, it can deprive no real event, thing, or person of anything. In particular, it cannot deprive people of determinate existence and identity. Any actual future Jack is as much marked off by existence from his innumerable possible variants as is any past or present Jack. Provided our prediction is detailed enough to pick out just one of the actual Jacks, his mere futurity cannot prevent it being a singular prediction about that very man. However, it is undeniably hard to believe in singular predictions about things and events too far ahead; the so-called 'generality of predictions' thesis that I am considering does have some intuitive appeal. Can we find another basis for it?

Let me vary the example. Bertrand Russell could have written about Leibniz, as in fact he did. It is not so easy to conceive of Leibniz writing specifically about Russell, however interested and prescient he might have been. Now too much should not be made of this: since Russell was necessarily wholly imperceptible to anyone of or before Leibniz's time, it is hardly credible that Leibniz could have known enough to pick Russell out from all his contemporaries; and that fact may well suffice to explain why we believe that Leibniz could not have referred to him. But suppose for the sake of argument that Leibniz could have known enough: what then? It is admittedly hard to assess consequences of incredible suppositions; but I can conceive that even then Leibniz's predictions would not really have been singular. That would be so if, as some philosophers have suggested, referring to a person (or thing or event) has to be among the direct or indirect effects of his or her life (Kripke 1972). The idea roughly is that what makes Russell's work about Leibniz is not just that Russell knew a lot, but that his know-

ledge of the relevant texts, for example, can be traced back causally, through their successive printings, to Leibniz's own activities in writing them. If that sort of causal connection is necessary for referring to people, then indeed Leibniz could not have referred to Russell, however much he knew. Since no effects of Russell's life could precede it, none, in particular, could link Russell to Leibniz in the way Leibniz's writing is linked to Russell. So Leibniz, on this view, would be confined to general predictions about twentieth-century philosophy; Russell's work might as a matter of fact have verified them, but the work of anyone satisfying Leibniz's descriptions would have done as well.

How much truth there is in causal accounts of reference I do not know (see Evans 1973; Altham 1973); and the topic is in any case too large to tackle here. I wish only to remark that, on such accounts, the lack of backwards causation could limit, as well as create, possibilities for singular prediction. The intuition that they are somewhat limited has undoubtedly encouraged the thought that future entities must therefore be less real, substantial, or definite than past and present ones. But that, we now see, not only cannot be the explanation, it need not be. The intuition may survive; but its proper philosophical application is to assessing theories about how we can refer to things and events far off in space and time, not to bolstering the myth that the business of prediction is to speak of what has not yet come to be.

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