

THE BEGINNING OF THE UNIVERSE IN TIME: A MEETING PLACE OF SCIENCE, RELIGION, AND PHILOSOPHY*

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IT is appropriate that I should begin this inaugural lecture by expressing publicly my gratitude to the University of Sydney for the honour that it has done me in appointing me to the Challis Chair of Philosophy. It is above all an honour to have been asked to succeed Professor John Anderson, who occupied this Chair for more than thirty years. Professor Anderson has been the greatest and most independent philosophical thinker in Australia, and his influence has spread far beyond his own subject. He was also my first and my main teacher in philosophy, and my views on many matters owe a great deal to what I learnt from him.

In this inaugural lecture I am speaking not primarily to students of philosophy — though I hope that description applies, officially or unofficially, to some of you at least. I am speaking primarily to my colleagues and to the public, especially to graduates of this University, and part of my task in this lecture is to define what I take to be the scope of my subject, philosophy. This is necessary because different philosophers have held very different views about this. In the past philosophy has often been regarded as the queen of the sciences, as occupying a central place in human knowledge, itself discovering the most general and the most fundamental truths about the universe and laying down, for each of the other sciences, its proper limits and rules of procedure. But today many philosophers restrict their subject to the much more modest task of linguistic analysis: they tell us that philosophy is just talk about talk.

At present let me say merely that my own view lies somewhere between these two extremes, but closer to the grandiose conception of philosophy than to the humble one: exactly where my view lies between these extremes will, I hope, become plain as I go on to discuss the particular question that I have chosen, the question whether the world has a beginning in time or not.

Now this may seem a remote and abstract question, but it has this advantage, that it brings us to a meeting place of philosophy, religion and science. By seeing how philosophy makes contact with these other Departments of thought, and how it behaves in its meeting with them, I may be

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able to show what I take to be its true character and to indicate its proper methods and scope. However, in what follows I shall not merely be stating or laying down my own view. I shall be discussing this as a serious question and as an open one: I shall *argue* in support of what I say. For philosophy is one of the few remaining subjects in which not even the occupant of a chair is entitled to make *ex cathedra* statements.

This question, whether the world had a beginning, and if so, how it began, is a very old question: it is one on which men have speculated and argued for thousands of years. And although it seems remote from our immediate and practical concerns, it has often been felt to be a very important question; a view of the world's beginning, or lack of a beginning, is linked in subtle ways with our whole outlook on the world. Also, though it is an old question it is also a current question, one that has an immediate topical interest. It has this topical interest because at present there are two rival schools of scientific thought that put forward opposite answers to our question, and because observations that are being made now or that are likely to be made in the near future may settle the issue decisively in favour of one or other of the rival scientific theories.

To put it very briefly, the conflict in scientific theory is this:

Observations of distant galaxies seem to show that they are receding from us, and that the more distant the galaxies are the more rapidly they are receding. That is, the universe appears to be expanding. The physicists of one school think they have discovered the laws that govern this expansion, and so claim that they can argue back to a time at which all the matter in the universe was closely packed together. That is, they claim to be able to reconstruct in theory a process by which a "small and dense conglomerate", a "primeval atom", disintegrated or exploded some thousands of millions of years ago; subsequently the galaxies formed and the expansion that we now observe began. This, then, is an evolutionary theory of the origin of the universe. In contrast with this, other physicists have presented a "steady-state" theory; their view is that the universe did not start with one big bang and pass through a process of evolution, but has always been and presumably always will be in much the same state that it is in at present. They accept the observations and the interpretations of them which show that the galaxies are constantly moving further apart, but their theory is that the constant dispersion of matter is compensated for by a continuous coming into existence of new matter throughout the whole of space. All the time the matter that there is, is scattering itself further apart, but all the time more matter is continuously "being created" or rather continuously starting to exist, so that all the time the average concentration of matter in space remains unchanged. Particular galaxies disappear, others come into

existence, but the over-all picture remains much the same for ever. This second theory is therefore picturesquely called the theory of "continuous creation".

These are rival scientific theories, but it is not only professional scientists who are acquainted with them and interested in them. The continuous creation account was popularised ten years ago by Dr. Fred Hoyle¹; both the rival theories were explained by Professor A. C. B. Lovell in his Reith Lectures which were broadcast in 1958 and published in 1959,² and early this year the University of Sydney was visited by two distinguished scientists, Dr. Gamow and Dr. Gold, who put forward these sharply contrasting views. This is not being kept as a private scientific issue. Also, as Professor Lovell says, "We may be on the verge of settling by experimental observation which of these two principles is correct".³ This could come by direct observation of very distant regions from which light has taken so long to reach us that we shall see a part of the universe as it was several thousand million years ago, and shall be able to see whether it was just like the present universe or not. Alternatively it may be possible to detect whether there is, in the inter-galactic spaces, the amount of recently-created hydrogen that the steady-state theory demands. If such a decision between the theories is likely to be announced in the near future it would be wise for us to consider in advance just what the metaphysical or theological implications of such a decision would be, whichever way it went.

Undoubtedly some of the popular interest in these rival theories is due to a certain view of their implications. The evolutionary account is thought to lead us back to a single creation of the universe, admittedly at a remote time, but still at a finite distance of time. This may be taken to point to a divine creation of the universe, or at any rate it would mean that the coming into existence of the "primeval atom" would be, "for ever beyond investigation" and no scientific discovery could ever attack the view that this creation was a divine act. On the other hand the continuous creation theory seems more naturalistic, it makes the creation of matter itself a physical process in accordance with a natural law. Professor Lovell clearly thinks that if we can watch creation going on now we shall be able to see that God is not doing the creating, whereas if creation occurred once and for all in a region of time that we can never observe, the way is at least left open for theology. It is ironical, in view of the nineteenth century conflicts between religion and the biological theory of evolution that this time it is the evolutionary doctrine that seems to be on the side of the angels.

¹ F. Hoyle, *The Nature of the Universe* (1950).

² A. C. B. Lovell, *The Individual and the Universe* (1959). cf. also G. Gamow, *The Creation of the Universe* (1952).

³ *op. cit.* p. 104.

But which theory is right? The dispute turns on the question whether new matter has actually been starting to exist or not, and this is an empirical question which, it seems, can be settled by observations. It is therefore quite pointless to use philosophical arguments about this question: neither of these theories can be philosophically more meritorious than the other. It cannot be that one is testable whereas the other is not, for once certain background assumptions are made we have a simple choice between them; it is the very same observation which, if it turns out one way, will confirm the evolutionary theory and disconfirm the steady-state theory and, if it turns out the other way, will confirm the steady-state theory and disconfirm the evolutionary one. To test the one theory is also to test the other. Nor is either theory philosophically superior in any other way, as we can see if we consider exactly what the empirical confirmation of each would imply.

Suppose, first, that the empirical evidence were against the steady-state theory, that it showed that matter is not continuously coming into existence. Then this would indicate that at a certain date the matter in the universe was in a highly concentrated state, and that it has since been dispersing. This would give us a date for the beginning of the process of dispersal, but there would be nothing to show that this was the date at which the universe began. *Either* the universe began then *or* before that date there was a steady state of high concentration *or* before that date there was a reverse process of conglomeration, perhaps an alternation of periods of conglomeration and dispersal, and so on. The confirmation of the evolutionary theory would present us with a choice between these possibilities, and it might leave us unable to decide between them. But *this* undecidability cannot be counted as a defect in the evolutionary theory itself.

It might be argued that while each of these is logically possible, the one to which the evolutionary theory points is the view that the universe itself began when, or just before, the process of dispersal began, because to assert any *other* alternative would be to make an arbitrary assumption. But this argument will not do, for two reasons. First, because any natural law tells us what happens under certain conditions, so that it is conceivable that two different processes, the dispersal and whatever else went before it, could be explained without any causal discontinuity by some single set of laws operating under different conditions. Secondly, because even if this failed, even if we had to put up with a causal discontinuity, the sheer beginning of a universe is at least as great a discontinuity as a change from one law to another would be. The suggestion that the universe began at that date would be as arbitrary an assumption as any other, for the universe's starting to exist would not be part of the empirically established process of dispersal.

This point is a general one, it would apply to any evolutionary theory at all. You cannot rely on a law L that has been confirmed to have operated

since date X to tell you or even to indicate that the universe began at date X. Various other things could have happened before date X, and you cannot rule these out on the ground that they are inconsistent with law L, because the beginning of the universe at X is equally inconsistent with law L.⁴

In other words, the discovery of a unidirectional process will enable you to say at what date that process began, but it will not enable you to say what happened before that date, and it certainly will not enable you to say that nothing happened before that date. If we see a tree growing, then if we can find the law that governs its growth we can calculate when it began to grow, but this does not tell us how there came to be a seed from which it grew, and it certainly does not tell us that there was no seed or that the seed came from nowhere.

This point is often obscured by the use of the word "universe" in different senses. By "the universe" we may mean this particular system of galaxies that we observe, and this particular process of dispersal in which, if the evolutionary theory is correct, we find them engaged. The universe *in this sense* may well have had a beginning in time, and it is possible that we could by observation and calculation decide at what date it began. But if we use the word "universe" strictly, to mean everything that exists, the whole natural world, then the confirmation of an evolutionary theory is not evidence for a beginning of the universe. To say that the universe began at a certain date is to make a claim whose scope extends beyond the process on which you are relying, whereas to say that a determinate process began at a certain date does not.

Suppose on the other hand that observations confirmed the steady-state theory. This would not tell us that the universe had *no* beginning. To be sure, there is nothing in the steady-state theory to suggest that there *was* a beginning, nothing that marks off any one date from all others as a discontinuity in cosmic history, but there might have been a beginning none the less. Dr. Hoyle obviously regards continuous creation as an alternative to once-for-all creation, but these become alternatives only if we first of all take matter as a fundamental substance and then argue that it must have been created at some time, and this way of thinking can be shown to involve the metaphysical search for ultimates that I shall be describing, and criticising, later. Leaving such arguments aside, all we can say is that the continuous creation of matter is a testable empirical hypothesis, not a solution of the metaphysical problem "Where did everything originally come from?". It is conceivable that as well as the continuous creation of matter there might have been an initial coming into existence of the universe already in its

⁴ See my discussion with Mr. Brian Ellis on these questions in *Australasian Journal of Philosophy*, August, 1955.

steady state. This would indeed involve a causal discontinuity, and the steady-state theory does not *need* to assert any such discontinuity. But, for reasons which I have not time to go into, this creation of the universe in its steady state would be no more of a discontinuity than the creation of a "primeval atom" at the start of an evolutionary process.

The theory that the universe began at a date fixed by the process of dispersal is not, therefore, properly presented as the alternative to the theory of continuous creation. The scientific alternative to continuous creation is the dispersal of a constant quantity of matter, with the fixing of a date at which the dispersal began. It is a sheer confusion to attach to the second alternative a once-for-all creation of the universe. And this confusion leads to three contrasted errors. There is the error of supposing that the empirical confirmation of the evolutionary account would prove that the universe had a beginning in time. There is the converse error of arguing from the metaphysical conviction that there was such a beginning to an acceptance of the evolutionary theory. And there is the opposite error of arguing from a metaphysical denial of a beginning of the universe to an acceptance of the steady-state theory.

What we have been doing so far belongs to the critical part of philosophy: we have been examining arguments to see what conclusions they really support. But it is a further question whether philosophy has also a constructive function, whether it can arrive at positive conclusions by characteristically philosophical reasoning. Although constructive metaphysics is out of fashion at present, a scientist like Professor Lovell seems to think that once we have reached the limits of scientific investigation the region beyond these limits is a safe playground for metaphysicians and theologians where they can play without restraint and without any danger of bumping their heads against any hard facts. But this kind of tolerant concession is not what we want. We should see whether constructive reasoning in metaphysics is correct or not, and if it is not correct it is no more permissible beyond the limits of scientific investigation than within those limits. And it is particularly important to examine these metaphysical arguments because they creep into the thinking of scientists and are there likely to cloak themselves with an authority to which they have no right. It is conventional, these days, to be on one's guard against metaphysical dogmas, but science has so much prestige that we are liable to accept these same dogmas without protest when they come dressed up as the latest discoveries of science.

The metaphysical argument for a beginning of the universe is one of a number of attempts that have been made to set up *ultimates* of various kinds. For example, we tend to think that there must be some ultimate particles of which things are made. A material object has parts, and these parts

can be divided into further parts. But is there a limit to this process? It was once thought that the ultimate constituents of things were the particles to which, for this very reason, the name of "atoms" was given, and although these are no longer regarded as indivisible many of us are still inclined to believe that there must be some ultimate particles, that things must in the end be made up of items that cannot be further divided.

In the same way we are inclined to think that there must have been a first event. One event is preceded in time by another, and this in turn is preceded by yet another event, and so on. But this series of steps backward in time must, we feel, come to an end: there must be some event, whether we can discover it or not, which was not preceded by any other; that is, there must have been a beginning of the universe in time.

Now any argument of this sort sets up a series but argues that the series must be terminated somewhere. But why must it be terminated? If a thing has parts, and its parts have parts, and so on, why should it not be "and so on for ever"? And similarly if one event is preceded by another event, and this by another event, and so on, why should it not be "and so on for ever"? Different reasons may be given. One suggested reason is that if the series were infinite it would be incomprehensible, that our minds would be unable to grasp it. But this is a bad reason, first because the world is under no obligation to let us wrap our thoughts around it, and secondly because there is a way in which we can quite well comprehend the infinite: we have no difficulty in understanding a *rule* which generates an infinite series, such as the rule "Every event is preceded by some other event". Another suggested reason is that infinity cannot be real because it would be indeterminate, while what is there must be determinate, it must be exactly as it is. But this notion that an infinite series is indeterminate results from a confusion of the reality, what is there, with our approach to it. What is indeterminate is our retracing of the series, our looking back from one event to its predecessor and then to *its* predecessor and so on—or, in the parallel argument, our going from an object to its parts and then to *their* parts, and so on. But what is there is simply that the world is such that this retracing would be endless: what is there is just that any object has parts which are themselves objects or that for every event there is a preceding event. What is there is not indeterminate, though it is such that our retracing is undetermined. A third suggested reason for saying that such a series must be terminated is that the members of the series depend one on another in such a way that if the series were not terminated the whole series could not subsist, it would have nothing to depend upon. Each event rests on a preceding event, just as one book in a pile may rest upon another. But if this went on for ever there would be nothing really holding up the books, or correspondingly, the

events. The pile of books would collapse physically, and the series of events would, I suppose, collapse metaphysically. But this reason will not do either. The notion that each event rests on its predecessor implies that every event needs a predecessor to rest upon: thus the very same notion that is given as a reason for saying that the series must be terminated is equally a reason for saying that it cannot be terminated, but must go on for ever. As Immanuel Kant pointed out, for each metaphysical argument in this style there is a corresponding counter-argument which is equally plausible and appeals to the same notion of dependence.⁵ But something that is an equally good reason for each of two contrary conclusions is not a good reason for either of them. Besides, no satisfactory account can be given of what this dependence of one event on its predecessor is, nor can anyone say what kind of a disaster the metaphysical collapse would be if this support were lacking.

A review of these metaphysical arguments shows, then, that they are quite inconclusive. For any series of the kind under discussion the argument that it must come to an end and the counter-argument that it cannot come to an end are found to rely on a common assumption: this assumption must be rejected, and then both the argument and the counter-argument collapse. In the case we are considering there is no necessity for the series of events traced backwards in time to come to an end, but equally there is no necessity for it *not* to come to an end. There might be a beginning of the universe and there might not: for all that these arguments show the question remains open. And a similar comment can be made on all the other metaphysical discussions that fall into the same pattern: we have no good reason for setting up an ultimate at the end of each series, but equally we have no good reason for ruling out the ultimate and saying that each such series *must* go on for ever.

When the metaphysical arguments on either side are explicitly stated, we have little difficulty in rejecting them, especially when we see how they cancel one another out. None the less, I think that considerations of these kinds are implicit within the thinking of the rival scientific schools, that the rival scientists favour one theory or the other partly for metaphysical reasons which are all the more influential because they are not made explicit.

These metaphysical arguments are important in another way. Creation is a religious concept as well as a scientific and philosophical one. When religious views develop a systematic body of reasoned doctrine, a theology, it is upon arguments of these kinds that they rely. So far as it is a matter of emotion, of wish or preference, of feeling that it would be a good thing if there were a divine creator of the world, religion has other foundations.

⁵ See Kant, *Critique of Pure Reason*, Transcendental Dialectic, Book II, Chapter II.

But in so far as religion soberly asserts that there actually is a divine creator, it relies on just such metaphysical considerations as we have been examining: the supposed rational necessity for a creator is a variant of the supposed rational necessity for a beginning of the universe.

Indeed the notion of a divine creator is the notion of something which stands, as it were, before the first event and yet which is not itself an event and therefore does not need anything to stand before it: it terminates the series in a way that yet allows every genuine event to have a predecessor. But this variant of the metaphysical argument is open to even greater objections. There is still the objection that no account can be given of the kind of support that events are alleged to need from their predecessors, and besides, since the creator is supposed not to be an event in time and yet to provide this support, it appears that the support that is needed and given has nothing essentially to do with temporal precedence at all. The theological "solution" has simply changed the terms of the problem.

This will become clearer if we go back to Professor Lovell's belief that a theological account of creation will be safer from attack if creation is located at one date several thousand million years ago than if it is found to be going on all the time. Why should this be so? What could we observe in either case? What aspect of creation is protected from observation by mere remoteness in time? Surely all that we could observe now, if the continuous creation theory were correct, would be that some matter was in existence now that was not there before. And correspondingly if the evolutionary theory were correct, then even if we could observe what we shall never in fact be able to observe, the genesis of the "primeval atom", all that we could observe would be that some matter was in existence at that date, at the birth of the universe, which was not there before. In neither case could we observe creation in any sense except that of something's starting to exist and since we could not possibly observe creation in any further sense it would be misleading to say that in either case we would have *failed* to observe it: there is nothing that we could have looked out for but failed to detect. On the one hand this shows how elusive, how empty of positive content, the notion of creation is— and Professor A. N. Prior has recently pointed out that there are logical as well as epistemological difficulties in this notion of making something start to exist. On the other hand it shows that there is really no greater difficulty in holding God responsible for continuous creation than in holding him responsible for the one big bang twenty thousand million years or so ago. And conversely, since divine creation does not provide a temporal predecessor for the first event, it does not solve any problem about the first event which arises if and only if there *is* a first event. Divine creation is no more of an advantage to the

evolutionary cosmologist than it is to one who believes in a steady state. If there is some as yet totally undefined deficiency in the natural world, if it needs, not events endlessly preceding events, but a metaphysical support of another kind, then it could just as well receive this support continuously as once for all at the start. This remains, however, an empty possibility, and when the arguments are examined theology receives no support from metaphysics. Nor, as we saw earlier, does it receive any support from either of the rival physical theories.

So far, then, the score is still even, and we have failed to find either in science or in metaphysics or in theology any good reason for asserting either that the universe had a beginning in time or that it did not. There are indeed other arguments which I cannot examine in detail this evening, such as the argument that a beginning of the universe is impossible because a beginning of the world *in* time would require the unacceptable concept of a time before the world began that was empty of all events, while a beginning *of* time itself, along with the world, would do violence to our concept of time. All I can say is that this argument can be dismissed because it contains internal confusions, and because we cannot allow our concepts to dictate to the facts.

At this point, if not sooner, we are tempted to take refuge in the sceptical view that the question can never be settled, and perhaps to go on to the logical positivist conclusion that it is therefore a meaningless question, an unreal issue. I do not deny that some such answer as this has its attractions when we lack the mental energy to consider any more arguments, but I would insist that even if the question turns out to be undecidable it is none the less a real and meaningful question. One of the complications that I have ignored is that the question whether the universe had a beginning or not can be obscured by juggling with the time-scale, by varying the conventions for the measurement of time, but however time is measured the hard factual question remains whether the series of events has or has not a beginning, and this hard, factual question remains even if the beginning, if there were one, would be not only forever concealed from observation but also shielded from theoretical calculation.

But I do not believe that the sceptical view is quite correct: there is still one consideration which, while it does not settle the question, still supports one answer rather than the other. As we have seen, a beginning of the universe would be an uncaused event, a causal discontinuity. In so far, therefore, as our general experience gives evidence of determinism, of pervasive causal order, it gives evidence, though not conclusive evidence, *against* a temporal beginning of the world. Our experience being as it is, it gives at least a presumption against any such uncaused event. Such a

presumption cannot, of course, be used to support, say, the steady-state theory against an evolutionary one, for, as I have said, an evolutionary cosmology as such is not committed to a causal discontinuity: this particular direction of evolution could have succeeded some other process in a causally lawful manner. And in any case the choice between steady-state and evolutionary theories should be capable of being made, now or later, on fairly direct observational grounds. But, as we have seen, the question whether the universe in the strict sense has a beginning cannot be settled in any such direct way, so it seems reasonable to seek an answer to this question from a presumption founded on very general considerations. Admittedly this is only a presumption: admittedly the universe might for all we know have had a beginning. But equally, as Bertrand Russell has pointed out, the universe might, for all we *know*, have had a beginning just five minutes ago, and all our supposed memories and records might have simply begun to exist at that time. If the world that we observe is causally regular, then however far back we go we shall always find a complex system, and the beginning to exist of a complex system twenty thousand million years ago is no less improbable in principle than the beginning to exist of a complex system five minutes ago: it is only less of a strain on our imagination.

In conclusion, I do not propose to sum up what I have said, but rather to remind you of what I have not said. We were faced with a problem which was, to all appearances, a meeting place of science, religion and philosophy. Each of the three disciplines seemed to have a finger in this pie. Now modern philosophers are very fond of dealing with this kind of problem by explaining that there is not one pie, but three, so that each of the three disciplines can have a pie of its own. In other words, they would try to distinguish a scientific question, a religious question, and a philosophical question, and give each subject full authority to deal with its own question as it likes. But this is not what I have done and not what I would want to do. There is just one simple question here, though different lines of thought are brought to bear upon it, and it would surely be a sign of intellectual timidity or weakness to avoid controversial issues, to shut questions up into private professional compartments. We can, indeed, take care to distinguish lines of thought that really bear upon an issue from those that only appear to do so, but we can draw these distinctions only by initially admitting the different lines of thought to a common field of discussion. An absolute separation of fields can be secured only by radical and arbitrary restrictions. Religious thought, for example, can be shielded from contacts with either science or philosophy, but only by cutting all the metaphysics out of religion, by developing a religion without a theology or even in the end a religion without assertions, without any factual claims at all. Philosophy

can be shielded from contact with religion or science by trivialising it, by turning it into a mere survey of the uses of language. However, there is no reason for avoiding common issues except the intellectually indefensible purpose of avoiding controversy because it might cause offence. I hope I have shown that philosophy has no need to bury itself in a private sphere, that it has still something to contribute to the discussion of common issues, and that it can even suggest an answer, however tentative and with whatever sceptical reservations, to the otherwise insoluble problem of the beginning of the universe in time.