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'What place, then, for a creator?': Hawking on God and Creation

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1 INTRODUCTION

Scientists working in the field of cosmology seem to be irresistibly drawn by the lure of philosophy. Now Stephen Hawking has followed the lead of Fred Hoyle, Carl Sagan, Robert Jastrow, and P. C. W. Davies in speculating on what philosophical implications current cosmological models have for the existence of God. Although his recent, popular best-seller *A Brief History of Time* [1988] is refreshingly free of the acrimony that characterized the works of some of his predecessors, one still might come away with the impression that Hawking is no more sympathetic to theism than they were. A recent article on Hawking's book in the German tabloid *Stern*, for example, headlined, 'Kein Platz für den lieben Gott', and concluded, 'In his system of thought there is no room for a Creator God. Not that God is dead: God never existed'[1] This impression is no doubt abetted by the fact that the book carries an introduction by Sagan, in which he writes,

> This is also a book about God . . . or perhaps about the absence of God. The word God fills these pages. Hawking embarks on a quest to answer Einstein's famous question about whether God had any choice in creating the universe. Hawking is attempting, as he explicitly states, to understand the mind of God. And this makes all the more unexpected the conclusion of the effort, at least so far: a universe with no edge in space, no beginning nor end in time, and nothing for a Creator to do. (p. x)

[1] *Stern* (undated photocopy), p. 209. 'In seinem Gedankengebäude ist für einen schöpferischen Gott kein Raum. Gott ist nicht einmal tot. Gott hat nie existiert.'

2 GOD AS SUFFICIENT REASON

But such a characterization of Hawking's position is quite misleading. In point of fact, it is false that there is no place for God in Hawking's system or that God is absent. For while it is true that he rejects God's role as Creator of the universe in the sense of an efficient cause producing an absolutely first temporal effect, nevertheless Hawking appears to retain God's role as the Sufficient Reason for the existence of the universe, the final answer to the question, 'Why is there something rather than nothing?' He distinguishes between the questions *what* the universe is and *why* the universe is, asserting that scientists have been too occupied with the former question to be able to ask the latter, whereas philosophers, whose job it is to ask why-questions, have been unable to keep up with the technical scientific theories concerning the origin of the universe and so have shunned metaphysical questions in favor of linguistic analysis. But Hawking himself is clear that having (to his satisfaction at least) answered the question what the universe is, he is still left with the unanswered why-question:

> The usual approach of science of constructing a mathematical model cannot answer the questions of why there should be a universe for the model to describe. Why does the universe go to all the bother of existing? Is the unified theory so compelling that it brings about its own existence? Or does it need a creator, and, if so, does he have any other effect on the universe? And who created him? (p. 174)

Pursuing the question why we and the universe exist is a quest that, in Hawking's view, should occupy people in every walk of life. 'If we find the answer to that, it would be the ultimate triumph of human reason—for then we should know the mind of God' (p. 175).

At face value, then, God for Hawking serves as the Sufficient Reason for the existence of the universe. Of course, 'the mind of God' might well be a mere *façon de parler*, signifying something like 'the meaning of existence':[2] but, as Sagan noted, Hawking seems very much in earnest about determining the proper role of God as traditionally conceived in the scheme of things. And it is interesting to note that when a reader of an earlier summary draft of Hawking's book in *American Scientist* (Hawking [1984]), complained that Hawking seemed afraid to admit the existence of a Supreme Being, Hawking countered that 'I thought I had left the question of the existence of a Supreme Being completely open. . . . It would be perfectly consistent with all we know to say that there was a Being who was responsible for the laws of physics' (Hawking [1985], p. 12).

Now it might seem at first somewhat baffling that Hawking senses the need

[2] *Cf.* the remark by Pagels: 'Physicists, regardless of their belief, may invoke God when they feel issues of principle are at stake because the God of the physicists is cosmic order' (Pagels [1982], p. 83).

to explain why the universe exists, since, as we shall see, he proposes a model of the universe according to which the universe is 'completely self-contained and not affected by anything outside itself', is 'neither created nor destroyed', but just *is* (p. 136). On his analysis, the universe is eternal (in the sense that it has neither beginning nor end and exists tenselessly) and therefore has no temporally antecedent cause. But if the cosmos is eternal and uncaused, what sense does it make to ask why it exists?

Leibniz, however, saw the sense of such a question (Leibniz [1697], [1714a], [1714b]). He held that it is intelligible to ask why it is that an eternal being exists, since the existence of such a being is still logically contingent. Since it is possible that nothing exists, why is it that an eternal cosmos exists rather than nothing? There must still be a Sufficient Reason why there exists something—even an eternal something—rather than nothing. Leibniz concluded that this Sufficient Reason can only be found in a metaphysically necessary being, that is, a being whose nature is such that if it exists, it exists in all possible worlds. Hawking would be interested to learn that analytic philosophy in the past two decades has burst the skins of linguistic analysis and that certain analytic philosophers doing metaphysics have defended Leibniz's conception of God as a metaphysically necessary being (Plantinga [1974], pp. 197–221; Adams [1971], pp. 284–91; Rowe [1975], pp. 202–21). Given the existence of such a being, Hawking need not trouble himself about who created God, since God, being metaphysically necessary and ultimate, can have no cause or ground of being.[3]

Thus, it seems to me that far from banishing God from reality, Hawking invites us to make Him the basis of reality. Indeed, I think Hawking's book may rightly be read as a discussion of two forms of the cosmological argument: the so-called *kalām* cosmological argument for a temporally First Cause of the universe, which he rejects, and the Leibnizian cosmological argument for a Sufficient Reason of the universe, which he prefers.[4] In this paper, I am not concerned to evaluate the Leibnizian cosmological argument. Like Hawking, I feel the force of Leibniz's reasoning and am inclined to accept it; but unlike Hawking, it seems to me that the *kalām* argument is plausible as well. Accordingly, we need to ask, has Hawking eliminated the need for a Creator?

3 GOD AS METAPHYSICALLY FIRST CAUSE

Now at one level, the answer to that question is an immediate 'No.' For Hawking has a theologically deficient understanding of creation. Traditionally creation was thought to involve two aspects: *creatio originans* and *creatio*

[3] On God as the ground of being for other metaphysically necessary entities see Morris and Menzel [1986] and Menzel [1987]. These bold essays should convince Hawking that the great tradition of metaphysics has been fully restored in analytic philosophy!

[4] On these arguments, as well as the Thomist argument, see Craig [1980].

continuans. The first concerned God's bringing finite reality into being at a point in time before which no such reality existed, whereas the second involved (among other things) God's preservation of finite reality in being moment by moment. Only the first notion involves the idea of a beginning. *Creatio continuans* could involve a universe existing from everlasting to everlasting, that is to say, a universe temporally infinite in both the past and the future at any point of time. Thus, for example, Thomas Aquinas, confronted on the one hand with Aristotelian and Neo-Platonic arguments for the eternity of the world, and, on the other hand, with Arabic *kalām*-style arguments for the finitude of the past, concluded after a lengthy consideration of arguments both *pro* and *contra* that it can be proved neither that the universe had a beginning nor that it did not, but that the question of the temporal origin of the universe must be decided on the basis of divine revelation, that is, the teaching of the Scriptures (Thomas Aquinas *Summa contra gentiles* 2.32–38; *cf. idem, De aeternitate mundi contra murmurantes*). Given this position, it appears at first paradoxical that Aquinas also held that the doctrine of divine *creatio ex nihilo* can be proved (*Summa contra gentiles* 2.16). But once we understand that creation in the sense of *creatio continuans* involves no notion of a temporal beginning the paradox disappears. To affirm that God creates the world out of nothing is to affirm that God is the immediate cause of the world's existence, that there is no metaphysical intermediary between God and the universe.

Actually, what Hawking has done is fail to distinguish from the *kalām* argument yet a third form of the cosmological argument, which we may call the Thomist cosmological argument, that comes to expression in Thomas's Third Way (*Summa theologiae* 1a. 2. 3) and his *De ente et essentia* 3. According to Aquinas, all finite beings, even those like the heavenly spheres or prime matter which have absolutely no potential for generation or corruption and are therefore by nature everlasting, are nevertheless metaphysically contingent in that they are composed of essence and existence, that is to say, their essential properties do not entail that such beings exist. If these essences are to be exemplified, therefore, there must be a being in whom essence and existence are not distinct and which therefore is uncaused, and it is this being which is the Creator of all finite beings, which He produces by instantiating their essences. Hence, *creatio ex nihilo* does not, in Aquinas's view, entail a temporal beginning of the universe.

Even if we maintain, *pace* Aquinas, that a full-blooded doctrine of creation does entail a temporal beginning of the universe, the point remains that this doctrine also entails much more than that, so that even if God did not bring the universe into being at a point of time as in Hawking's model, it is still the case that there is much for Him to do, for without His active and continual bestowal of existence to the universe, the whole of finite reality would be instantly annihilated and lapse into non-being. Thus, any claim that Hawking has eliminated the Creator is seen to be theologically frivolous.

4 GOD AS TEMPORALLY FIRST CAUSE

But has Hawking succeeded even in obviating the role of the Creator as temporally First Cause? This seems to me highly dubious, for Hawking's model is founded on philosophical assumptions that are at best unexamined and unjustified and at worst false. To see this, let us recall the fundamental form of the *kalām* cosmological argument, so that the salient points of Hawking's refutation will emerge.[5] Proponents of that argument have presented a simple syllogism:

(1) Whatever begins to exist has a cause.
(2) The universe began to exist.
(3) Therefore, the universe has a cause.

Analysis of the cause of the universe established in (3) further discloses it to be uncaused, changeless, timeless, immaterial, and personal.

4.1. *Hawking's critique*

Hawking is vaguely aware of the tradition of this argument in Christian, Muslim, and Jewish thought and presents a somewhat muddled version of it in chapter one (p. 7). But it is interesting that, unlike Davies, Hawking does not attack premise (1); on the contrary, he implicitly assents to it. Hawking repeatedly states that on the classical GTR Big Bang model of the universe an initial space-time singularity is unavoidable, and he does not dispute that the origin of the universe must therefore require a supernatural cause. He points out that one could identify the Big Bang as the instant at which God created the universe (p. 9). He thinks that a number of attempts to avoid the Big Bang were probably motivated by the feeling that a beginning of time 'smacks of divine intervention' (p. 46). It is not clear what part such a motivation plays in Hawking's own proposal, but he touts his model as preferable because 'There would be no singularities at which the laws of science broke down and no edge of space-time at which one would have to appeal to God or some new law to set the boundary conditions for space-time' (p. 136). On Hawking's view, then, given the classical Big Bang model, the inference to a Creator or temporally First Cause seems natural and unobjectionable.

Hawking's strategy is rather to dispute premise (2). Typically, proponents of *kalām* supported (2) by arguing against the possibility of an infinite temporal regress of events. This tradition eventually became enshrined in the thesis of Kant's First Antinomy concerning time.[6] Hawking's response to this line of argument is very ingenious. He claims that the argument of the thesis and antithesis 'are both based on his unspoken assumption that time continues back forever, whether or not the universe had existed forever', but that this

[5] For exposition and defense of the *kālam* argument, see Craig [1979a, b, c], [1985].
[6] For discussion, see Craig [1979d].

assumption is false because '. . . the concept of time has no meaning before the beginning of the universe' (p. 8). This brief retort is somewhat muddled, but I think the sense of it is the following: In the antithesis Kant assumes that 'Since the beginning is an existence which is preceded by a time in which the thing is not, there must have been a preceding time in which the world was not, *i.e.* an empty time' (Kant [1781], A427–28/B455–56, p. 397). But on some version of a relational view of time, time does not exist apart from change; therefore, the first event marked the inception of time. Thus, there was no empty time prior to the beginning of the universe. In the thesis, on the other hand, Kant states, 'If we assume that the world has no beginning in time, then up to every given moment an eternity has elapsed and there has passed away in the world an infinite series of successive states of things' (Kant [1781], A427–28/B455–56, p. 397). To my knowledge, scarcely anyone has ever thought to call into question this apparently innocuous assumption, but it is precisely here that Hawking launches his attack. Unlike other detractors of Kant's argument, Hawking does not dispute the impossibility of forming an actual infinite by successive addition; rather he challenges the more fundamental assumption that a beginningless universe entails an infinite past. The central thrust of Hawking's book and of his proposed cosmological model is to show that a beginningless universe may be temporally finite. Hence, *kalām*-style arguments aimed at proving the finitude of the past need not be disputed, for such arguments do not succeed in establishing (2), that the universe began to exist. Therefore, the universe need not have a cause, and God's role as Creator is circumscribed to that envisioned in the Thomist and Leibnizian versions of the cosmological argument.

This is a highly original, if not unique, line of attack on the *kalām* cosmological argument, and it will be interesting to see how Hawking essays to put it through.[7] It is Hawking's belief that the introduction of quantum mechanics into the GTR-based Big Bang model will be the key to success. Noting that at the Big Bang the density of the universe and the curvature of space-time become infinite, Hawking explains that '. . . there must have been a time in the very early universe when the universe was so small, that one could no longer ignore the small scale effects of . . . quantum mechanics' and that the initial singularity predicted by the GTR 'can disappear once quantum effects are taken into account' (pp. 50–1). What is needed here is a quantum theory of gravity, and although Hawking admits that no such theory exists, still he insists that we do have a good idea of what some of its central features

[7] One feels a bit diffident about criticizing someone's views as they are expressed in a popular exposition of his thought rather than in his technical papers. But the fact is that it is only in his popular exposition that Hawking feels free to reflect philosophically on the metaphysical implications of his model. For example, imaginary time, which plays so critical a role in his thought, is scarcely even mentioned in his relevant technical paper (Hartle & Hawking [1983], p. 2960). In any case, I have in no instance based my criticism on the infelicities inherent in popular exposition of technical subjects.

will be (p. 133). First, it will incorporate Feynman's sum-over-histories approach to quantum mechanics. According to this approach to quantum theory, an elementary particle does not follow a single path between two space-time points (that is, have a single history), but it is rather conceived as taking all possible paths connecting those points. In order to calculate the probability of a particle's passing through any given space-time point, one sums the waves associated with every possible history that passes through that point, histories represented by waves having equal amplitude and opposite phase mutually cancelling so that only the most probable histories remain. But in order to do this without generating intractable infinities, Hawking explains, one must use imaginary numbers for the values of the time co-ordinate. When this is done, it 'has an interesting effect on space-time: the distinction between time and space disappears completely' (p. 134). The resulting space-time is Euclidian.

The second feature which any theory of quantum gravity must possess is that the gravitational field is represented by curved space-time. When this feature of the theory is combined with the first, the analogue of the history of a particle now becomes a complete curved space-time that represents the history of the whole universe. Moreover, 'To avoid the technical difficulties in actually performing the sum over histories, these curved space-times must be taken to be Euclidean. That is, time is imaginary and is indistinguishable from directions in space' (p. 135).

On the basis of these two features, Hawking proposes a model in which space-time is the four-dimensional analogue to the surface of a sphere. It is finite, but boundless, and so possesses no initial or terminal singularities. Hawking writes,

> In the classical theory of gravity, which is based on real space-time, there are only two possible ways the universe can behave: either it has existed for an infinite time, or else it had a beginning at a singularity at some finite time in the past. In the quantum theory of gravity, on the other hand, a third possibility arises. Because one is using Euclidean space-times, in which the time direction is on the same footing as directions in space, it is possible for space-time to be finite in extent and yet to have no singularities that formed a boundary or edge. . . .
> . . . There would be no singularities at which the laws of science broke down and no edge of space-time at which one would have to appeal to God or some new law to set the boundary conditions for space-time. . . .The universe would be completely self-contained and not affected by anything outside itself. It would be neither created nor destroyed. It would just BE. (pp. 135–6)

Hawking emphasizes that his model is merely a proposal, and so far as he describes it, it makes no unique successful predictions, which would be necessary to transform it from a metaphysical theory to a plausible scientific theory. Still Hawking believes that

> The idea that space and time may form a closed surface without boundary . . . has profound implications for the role of God in the affairs of the universe. . . . So long as the universe had a beginning, we could suppose it had a creator. But if the universe is really completely self-contained, having no boundary or edge, it would have neither beginning nor end. What place, then, for a creator? (pp. 140–1)

4.2 Assessment

Unfortunately, Hawking's model is rife with controversial philosophical assumptions, to which he gives no attention. Since Hawking is trying to explain how the universe could exist without the necessity of God's bringing it into being at a point of time, it is evident that he construes his theory to be, not merely an engaging mathematical model, but a realistic description of the universe. On a non-realist interpretation of science, there would be no contradiction between his model and temporal *creatio ex nihilo*. Hence, the central question that needs to be addressed in assessing his model as an alternative to divine creation is whether it represents a realistic picture of the world.

Now to me at least it seems painfully obvious that Hawking faces severe difficulties here. Both Quantum Theory and Relativity Theory inspire acute philosophical questions as to the extent to which they picture reality. To begin with Quantum Theory, most philosophers and reflective physicists would not disagree with the remarks of Hawking's erstwhile collaborator Roger Penrose:

> I should begin by expressing my general attitude to present-day quantum theory, by which I mean standard, non-relativistic quantum mechanics. The theory has, indeed, two powerful bodies of fact in its favour, and only one thing against it. First, in its favour are all the marvelous agreements that the theory has had with every experimental result to date. Second, and to me almost as important, it is a theory of astonishing and profound mathematical beauty. The one thing that can be said against it is that it makes absolutely no sense! (Penrose [1986], p. 129)

Does Hawking believe, for example, that Feynman's sum-over-histories approach describes what really happens, that an elementary particle really does follow all possible space-time paths until its wave function is collapsed by measurement? I think most people would find this fantastic. If he does interpret this approach realistically, then what justification is there for such an interpretation? Why not a Copenhagen Interpretation which eschews realism altogether with regard to the quantum world? Or an alternative version of the Copenhagen Interpretation which holds that no quantum reality exists until it is measured? Why not hold that the uncollapsed wave function is, in Bohr's words, 'only an abstract quantum mechanical description' rather than a description of how nature is? A disavowal of realism on the quantum level does not imply a rejection of a critical realism on the macroscopic level. Or why not

interpret quantum mechanics as a statistical theory about ensembles of particles rather than about the behavior of any individual particle? On this interpretation, the wave function describes the collective behavior of particles in identical systems, and we could quit worrying about the measurement problem. Or again, what about a Neo-realist interpretation along the lines of the de Broglie–Bohm pilot wave? A non-local hidden variables theory, in which a particle follows a definite space-time trajectory, is compatible with all the experiment and evidence for quantum theory, is mathematically rigorous and complete, and yet avoids the philosophical difficulties occasioned by the typical wave functional analysis. Obviously, it is not my intention to endorse any one of these views, but merely to point out that a realistic interpretation of Feynman's sum-over-histories approach on Hawking's part would be gratuitous.

In general, I think we should do well to reflect on de Broglie's attitude to the mathematical formalism of Quantum Theory. As Georges Lochak notes, 'He does not consider that mathematical models have any ontological value, especially geometrical representations in abstract spaces; he sees them as practical mathematical instruments among others and only uses them as such . . .' (Lochak [1984], p. 20). The principle of the superposition of wave functions is a case in point. Simply because a mathematical model is operationally successful, we are not entitled to construe its representations physically. Feynman himself gave this sharp advice: 'I think it is safe to say that no one understands quantum mechanics. Do not keep saying to yourself, if you possibly can avoid it, "But how can it be like that?" because you will go "down the drain" into a blind alley from which nobody has yet escaped. Nobody can know how it can be like that.'[8] One can use the equations without taking them as literal representations of reality.

Now it might be said that Hawking's use of Feynman's sum-over-histories approach may be merely instrumental and that no commitment to a physical description is implied. But it is not evident that such a response will work for Hawking. For his model, based on the application of quantum theory to classical geometrodynamics, must posit the existence of a super-space which is ontologically prior to the approximations of classical space-time that are slices of this super-space. This super-space is no *ens fictum*, but the primary reality. The various 3-geometries surrounding the classical space-time slice in super-space are fluctuations of the classical slice. By 'summing the histories' of these 3-geometries one can construct a leaf of history in super-space which can be mapped onto a space-time manifold. Since, as we have seen, Hawking takes the wave function of a particle to be the analogue of a physical space-time that represents the history of the universe, an instrumentalist interpretation of the sum-over-histories approach leads to an equally instrumentalist, non-realist view of space-time, which betrays Hawking's whole intent.

[8] Cited in Herbert [1985], p. xiii.

In short, Hawking's wave-functional analysis of the universe requires the Many Worlds Interpretation of quantum physics, and in another place Hawking admits as much (Hawking [1983], pp. 192–3). But why should we adopt this interpretation of quantum physics with its bloated ontology and miraculous splitting of the universe? John Barrow ([1988], p. 156) has recently remarked that the Many Worlds Interpretation is 'essential' to quantum cosmology because without it one is left, on the standard Copenhagen Interpretation, with the question, 'Who or what collapses the wave function of the universe?'—some Ultimate Observer outside of space and time? This answer has obvious theistic implications. Indeed, although 'the theologians have not been very eager to ascribe to God the role of Ultimate Observer who brings the entire quantum Universe into being', still Barrow admits that 'such a picture is logically consistent with the mathematics. To escape this step cosmologists have been forced to invoke Everett's "Many Worlds" interpretation of quantum theory in order to make any sense of quantum cosmology' (Barrow [1988], p. 232). 'It is no coincidence', he says, 'that all the main supporters of the Many Worlds interpretation of quantum reality are involved in quantum cosmology' (Barrow [1988], p. 156). But if we, like most physicists, find the Many Worlds interpretation outlandish, then quantum cosmology, far from obviating the place of a Creator, might be seen to create for Him a dramatic new role. Again, my intention is not to endorse this view, but simply to underscore the fact that a realist construal of Hawking's account involves extravagant and dubious metaphysical commitments, such that his model can hardly be said to have eliminated the place of a Creator.

The impression that Hawking's model is thoroughly non-realist is heightened by his use of imaginary time in summing the waves for particle histories and, hence, in his final model of space-time. But does anyone seriously believe that one has thereby done anything more than perform a mathematical operation on paper, that one has thereby altered the nature of time itself? Hawking asserts, 'Imaginary time may sound like science fiction but it is in fact a well-defined mathematical concept' (p. 134). But that is not the issue; the question is whether that mathematical concept has any counterpart in physical reality. Already in 1920, Eddington suggested that his readers who found it difficult to think in terms of the unfamiliar non-Euclidean geometry of relativistic space-time might evade that difficulty by means of the 'dodge' of using imaginary numbers for the time co-ordinate, but he thought it 'not very profitable' to speculate on the implications of this, for 'it can scarcely be regarded as more than an analytical device' (Eddington [1920], p. 48). Imaginary time was merely an illustrative tool which 'certainly do[es] not correspond to any physical reality' (Eddington [1920], p. 181). Even Hawking himself maintains, 'In any case, as far as everyday quantum mechanics is concerned, we may regard our use of imaginary time and Euclidean space-time as merely a mathematical device (or trick) to calculate answers about real

space-time' (pp. 134–5). But now in his model this imaginary time and Euclidean space-time are suddenly supposed to be, not merely conceptual devices, but actual representations (however unimaginable) of physical reality. This 'ontologizing' of mathematical operations is not only neither explained nor justified, but, is, to my mind, metaphysically absurd. For what possible physical meaning can we give to imaginary time? Having the opposite sign of ordinary 'real' time, would imaginary time be a sort of negative time? But what intelligible sense can be given, for example, to a physical object's enduring for, say, two negative hours, or an event's having occurred two negative years ago or going to occur in two negative years? If we are A-theorists and take temporal becoming as objective and real, what does it mean to speak of the lapse of negative time or the becoming of events in negative time? Since imaginary time is on Hawking's view merely another spatial dimension, he admits that there is no direction to time, even though the ordinary time with which we are acquainted is asymmetric (p. 144). But is the whole of the temporal reality we know (including Hawking's thermodynamic, cosmological, and psychological arrows of time) then illusory? Could anything be more obvious than that imaginary time is a mathematical fiction?[9]

Hawking recognizes that the history of the universe in real (=ordinary) time would look very different than its history in imaginary time. In real time, the universe expands from a singularity and collapses back again into a singularity. 'Only if we could picture the universe in terms of imaginary time would there be no singularities. . . . When one goes back to the real time in which we live, however, there will still appear to be singularities' (pp. 138–9). This might lead one to conclude that Hawking's model is a mere mathematical construct without ontological import. Instead, Hawking draws the astounding conclusion,

> This might suggest that the so-called imaginary time is really the real time, and that what we call real time is just a figment of our imaginations. In real time, the universe has a beginning and an end at singularities that form a boundary to space-time and at which the laws of science break down. But in imaginary time, there are no singularities or boundaries. So maybe what we call imaginary time is really more basic, and what we call real is just an idea that we invent to help us describe what we think the universe is like. (p. 139)

I can think of no more egregious example of self-deception than this. One employs mathematical devices (tricks) such as sum-over-histories and changing the sign of the time co-ordinate in order to construct a model space-time, a model which is physically unintelligible, and then one invests that model with reality and declares that the time in which we live is in fact unreal.

Hawking defends his position by arguing that '. . . a scientific theory is just a

[9] As Mary Cleugh nicely puts it, 'What is the wildest absurdity of dreams is merely altering the sign to the physicist' (Cleugh [1937], p. 46).

mathematical model we make to describe our observations: it exists only in our minds. So it is meaningless to ask: Which is real, "real" or "imaginary" time? It is simply a matter of which is the more useful description' (p. 139). But this reasoning is fallacious and relapses into an instrumentalist view of science which contradicts Hawking's realist expressions and intentions. One may adopt a sort of nominalist view of the ontological status of theories themselves, but this says absolutely nothing about whether those theories are meant to describe, in approximate limits, physical reality or are merely pragmatic instruments for making new discoveries and advancing technology. I should like to know on what theory of meaning Hawking dismisses the question concerning physical time as meaningless. We seem to see here the vestige of a defunct positivism, which surfaces elsewhere in Hawking's book (pp. 55, 126). But a verificationist theory of meaning is today widely recognized as being simply indefensible.[10] The question Hawking brushes aside is not only obviously meaningful, but crucial for the purposes of his book, for only if he can prove that imaginary time is ontologically real and real time fictitious has he succeeded in obviating the need for a Creator. Which brings us again to his scientific realism: it seems clear that for Hawking the ontological status of time is not just a matter of the more useful description. He believes that 'The eventual goal of science is to provide a single theory that describes the whole universe' and that this goal should be pursued even though the theory 'may not even affect our lifestyle' (pp. 10, 13; *cf.* his remarks in [1982], p. 563). Hawking yearns to understand 'the underlying order of the world' (p. 13). Knowing the mind of God is for him not just a matter of pragmatic utility. Thus, he both needs and believes in scientific realism.

To address as meaningful, then, the question posed above, it is evident that imaginary time is not ontological time. This is apparent not only from its physically unintelligible nature, but also from the fact that it transforms time into a spatial dimension, thus confounding the distinction between space and time. According to Hawking, the use of imaginary numbers 'has an interesting effect on space-time: the distinction between time and space disappears completely . . . there is no difference between the time direction and directions in space . . . time is imaginary and is indistinguishable from directions in space' (pp. 134–5). This decisively disqualifies Hawking's model as a representation of reality, since in fact time is not ontologically a spatial dimension. Contemporary expositors of the Special Theory of Relativity have

[10] Healey describes the contemporary attitude toward positivism:

> 'Positivists attempted to impose restrictions on the content of scientific theories in order to ensure that they were empirically meaningful. An effect of these restrictions was to limit both the claims to truth of theoretical sentences only distantly related to observation, and the claims to existence of unobservable theoretical entities. More recently positivism has come under such sustained attack that opposition to it has become almost orthodoxy in the philosophy of science' (Healey [1981], p. vii). For a disinterested and devastating critique of positivism, see Suppe [1977], pp. 62–118.

been exercised to disassociate themselves from the frequent statements of early proponents of the theory to the effect that Einstein's theory had made time the fourth dimension of space.[11] B-theorists of time have been especially sensitive to the allegation by A-theorists that they have been guilty of 'spatializing' time and have pointed to the opposite sign of the time co-ordinate as evidence that the temporal dimension is in fact not a mere fourth dimension of space. By changing the sign, Hawking conflates the temporal dimension with the spatial ones. Hawking apparently feels justified in this move because he, like certain early interpreters of STR, believes that STR itself treats time as a spatial dimension. He writes, 'In relativity, there is no real distinction between the space and time co-ordinates, just as there is no real difference between any two space co-ordinates. (p. 24). He justifies this statement by pointing out that one could construct a new time co-ordinate by combining the old time co-ordinate with one of the spatial co-ordinates.

In spatializing time, Hawking implicitly rejects an A-theory and identifies himself as a B-theorist. His statement concerning the universe as he models it that 'It would just BE' is an expression of the tenseless character of its existence. Unfortunately, he provides no justification whatsoever for adopting a B-theory of time. Perhaps he thinks that STR entails a B-theory; but A-theorists have argued repeatedly that the Special Theory is neutral with regard to the issue of temporal becoming, and the most sophisticated B-theorists do not appeal to it as proof of their view.[12] The debate between the A-theory and the B-theory is controversial. But in the absence of some overwhelming proof of the B-theory, I see no reason to abandon our experience of temporal becoming as objective. D. H. Mellor, himself a B-theorist, agrees, commenting, 'Tense is so striking an aspect of reality that only the most compelling argument justifies denying it: namely, that the tensed view of time is self-contradictory and so cannot be true' (Mellow [1981], p. 5). Mellor accordingly tries to rehabilitate McTaggart's proof against the objectivity of the A-series, but, to my thinking, to no avail.[13] Moreover, it seems to me (although space does not permit me to argue it here) that no B-theorist has successfully defended that theory against the incoherence that if external becoming is mind-dependent, still the subjective experience of becoming is objective, that is, there is an objective succession of contents of consciousness, so that becoming in the mental realm is real. If an A-theory of time is correct, then Hawking's model is clearly a mere mathematical abstraction.

[11] See the interesting citations in Meyerson [1925], pp. 354–5. In his comments on Meyerson's book, Einstein repudiated the 'extravagances of the popularizers and even many scientists' who construed STR to teach that time is a spatial dimension: 'Time and space are fused into one and the same *continuum*, but this continuum is not isotropic. The element of spatial distance and the element of duration remain distinct in nature . . .' (Einstein [1928], p. 367).

[12] For A-theoretic approaches to STR, see Capek [1966], Stein [1968], Denbigh [1978], Whitrow [1980], pp. 283–307, 371, and Dieks [1988]. Grünbaum [1968] makes no appeal to STR to defend a B-theory.

[13] See refutations in Horwich [1987], pp. 26–7.

Whether the opposite sign of the time co-ordinate in the relativity equations is sufficient to establish a 'real difference' between time and space dimensions in the Special Theory need not be adjudicated here. If it is not sufficient, that only goes to show that the mathematical formalism of the theory is insufficient to capture the ontology of time and space, but is a useful mathematical abstraction from reality.[14] That time and space are ontologically distinct is evident from the fact that a series of mental events alone is sufficient to set up a temporal series of events even in the absence of spatial events.[15] Imagine, for example, that God led up to creation by counting, '1, 2, 3, . . . *fiat lux*!' In that case, time begins with the first mental event of counting, though the physical universe does not appear until later. Clearly, then, time and space are ontologically distinct.

But what, then, of the oft-repeated claim of Minkowski that, 'Henceforth, space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality' (Minkowski [1908], p. 75)? This claim is based on one of the most widespread and persistent errors concerning the interpretation of the Special Theory that exists, namely, the failure to distinguish between what we may call measured or empirical time and ontological or real time. According to Hawking, '. . . the theory of relativity put an end to the idea of absolute time. . . . The theory of relativity does force us to change fundamentally our ideas of space and time. We must accept that time is not completely separate from and independent of space, but is combined with it to form an object called space-time' (pp. 21, 23). Nothing could be farther from the truth. Einstein did not eliminate absolute simultaneity: he merely redefined it. In the absence of a detectable aether, Einstein, under the influence of Ernst Mach's positivism,[16] believed that it was quite literally meaningless to speak of events' occurring absolutely simultaneously because there was no empirical means of determining that simultaneity. By proposing to redefine simultaneity in terms of the light signal method of synchronization, Einstein was able to give meaning to the notion of

[14] See helpful discussions in Cleugh [1937], pp. 46–69, and Kroes [1985], pp. 60–96.

[15] On Minkowski space-time, Wenzl cautions, 'From the standpoint of the physicist, this is a thoroughly consistent solution. But the physicist will [doubtless] understand the objection, raised by philosophy, that time is by no means merely a physical matter. Time is, as Kant put it, the form not merely of our outer but also of our inner sense. . . . Should our experiences of successiveness and of memory be mere illusion. . .?' (Wenzl [1949], pp. 587–8)

[16] The positivistic foundations of Einstein's STR are widely recognized by historians of science, but are surprisingly rarely discussed by philosophers exploring the philosophical foundations of that theory. For discussion, see Holton [1970], pp. 167–77, Frank [1949], Reichenbach [1949], Bridgman [1949], Lenzen [1949]. According to Sklar, 'Certainly the original arguments in favor of the relativistic viewpoint are rife with verificationist presuppositions about meaning, etc. And despite Einstein's later disavowal of the verificationist point of view, no one to my knowledge has provided an adequate account of the foundations of relativity which isn't verificationist in essence' (Sklar [1981], p. 141). 'I can see no way of rejecting the old aether-compensatory theories . . . without invoking a verificationist critique of some kind or other' (*ibid.*, p. 132).

simultaneity, only now the simultaneity was relative due to the invariant velocity of light. In so doing, Einstein established a sort of empirical time, which would be subject to dilation and in which the occurrence of identical events could be variously measured. But it is evident that he did nothing to 'put an end' to absolute time or absolute simultaneity.[17] To say that those notions are meaningless is to revert to the dead dogmas of positivism and the verificationist theory of meaning. J. S. Bell asserts that apart from matters of style, it is primarily this philosophical positivism which serves to differentiate the received interpretation from the Lorentz–Larmor interpretation, which distinguishes between empirical, local time and ontological, real time. Bell writes,

> The difference of philosophy is this. Since it is experimentally impossible to say which of two uniformly moving systems is *really* at rest, Einstein declares the notions 'really resting' and 'really moving' as meaningless. For him, only the relative motion of two or more uniformly moving objects is real. Lorentz, on the other hand, preferred the view that there is indeed a state of *real* rest, defined by the 'aether,' even though the laws of physics conspire to prevent us identifying it experimentally. The facts of physics do not oblige us to accept one philosophy rather than the other (Bell [1987], p. 77).

Since verificationism is hopelessly flawed as a theory of meaning, it is idle to talk about STR's 'forcing' us to change our fundamental ideas of space and time. Lawrence Sklar concludes, 'One thing is certain. Acceptance of relativity cannot force one into the acceptance or rejection of any of the traditional metaphysical views about the reality of past and future' (Sklar [1981], p. 140).

Of course, Hawking might retort that ontological time is scientifically useless and may therefore be left to the metaphysician. Granted, but then the point is surely this: *Hawking is doing metaphysics*. When he begins to speculate about the nature of space and time and to claim that he has eliminated the need for a Creator, then he has, as I said, entered the realm of the philosopher, and here he must be prepared to do battle with philosophical weapons on a broader conceptual field or else retreat within the walls of a limited scientific domain.

What is ironic is that even within that restricted domain there may now be empirical evidence for rejecting the received interpretation of STR. For the experimental results of the Aspect experiments on the inequalities predicted by Bell's Theorem have apparently established that widely separated elementary particles are in some way correlated such that measurements on one result instantly in the collapse of the wave function of the other, so that locality is violated. Even a hidden variables interpretation of the fabled EPR experiment must be a non-local theory. Nor is the violation of locality dependent upon the validity of quantum theory: it can be demonstrated on the macro-level, so that

[17] Cleugh hits the essential point: 'It cannot be too often emphasized that physics is concerned with the measurement of time, rather than with the essentially metaphysical question as to its nature': '. . . however useful "*t*" may be for physics, its *complete* identification with Time is fallacious' (Cleugh [1937], pp. 51, 30).

even if quantum theory should be superseded, any new theory will apparently have to include non-locality. But these data contradict the received interpretation of STR, not because non-locality posits super-luminal signals, but rather because it goes to establish empirically relations of absolute simultaneity. Hence, disclaimers that STR is not violated because no signal or information is sent from one particle to another are beside the point. Rather the salient point is that the collapse of the wave function in both correlated particles occurs *simultaneously*, wholly apart from considerations of synchronization by light signals. Karl Popper thus regards the Aspect experiments as the first crucial test between Lorentz's and Einstein's interpretation of STR, commenting,

> The reason for this assertion is that the mere existence of an infinite velocity entails that of an absolute simultaneity and thereby of an absolute space. Whether or not an infinite velocity can be attained *in the transmission of signals* is irrelevant for this argument: the one inertial system for which Einsteinian simultaneity coincides with absolute simultaneity . . . would be the system at absolute rest—whether or not this system at absolute rest can be experimentally identified (Popper [1984], p. 54).

The establishment of non-local correlations in space-time could thus vindicate even within the scientific domain the validity of Lorentz's distinction between local time and real time in opposition to the positivistic conflation of the two in the received view.

What this lengthy excursus goes to show is that it is metaphysically misguided to identify ontological time as a dimension of space. Since Hawking reduces empirical time to a spatial dimension and conflates empirical time with ontological time, he winds up with a tenselessly existing space-time which he wishes to pass off as reality. Add to these errors the fact that the time involved is imaginary, and the metaphysical absurdity of Hawking's vision of the world seems starkly apparent.

5 CONCLUSION

There are many other things which one should like to say about Hawking's view (for example, his misuse of the anthropic principle), but I think enough has been said to answer his fundamental question, 'What place, then, for a Creator?' We have seen that contrary to popular impression, God plays for Hawking an important role as a sort of Leibnizian Sufficient Reason for the universe. With regard to God's role as Creator, we saw that Hawking failed to distinguish between *creatio originans* and *creatio continuans*, so that even if God failed to play the former role, He may still carry out the latter as a sort of Thomistic ground of being. But finally we have seen that Hawking's critique of God's assuming the office of temporally First Cause as demonstrated by the *kalām* cosmological argument is rife with unexamined and unjustified

philosophical assumptions, assumptions that, when examined, degenerate to metaphysical absurdity. The success of Hawking's model appears to depend on a realist application of Feynman's sum-over-histories approach to the derivation of space-time from an ontologically prior super-space, a construal which is implausible and in any case unjustified. Essential to Hawking's scheme is the identification of imaginary time with physical time, a construal which is again never justified and is in any case physically unintelligible. Hawking's model depends, moreover, on certain questionable philosophical assumptions about Relativity Theory as well, for example, the identification of time as a dimension of space, a move which is extremely dubious, since time can exist without space. Hawking's appeal to the Special Theory to justify this move rests on an interpretation of that theory which fails to distinguish empirical time from ontological time, an interpretation essentially dependent on a defunct positivistic theory of meaning and now perhaps called into question by empirical facts as well. Any attempt to interpret the temporal dimension as a tenselessly existing spatial dimension betrays the true nature of time.

The postulate of metaphysical super-space, the metamorphosis of real to imaginary time, the conflation of time and space: all these seem extravagant lengths to which to go in order to avoid classical theism's doctrine of *creatio ex nihilo*—which forces us and Hawking to confront squarely a different question: What price, then, for no Creator?

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