

this if they are to make a significant contribution to the interface between science and faith. The rather good bibliography at the end of this book would be a guide to the competition – there are some excellent books in this area already. Not recommended.

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**Stephen Hawking and Leonard Mlodinow**

***The Grand Design: New Answers to the Ultimate Questions of Life***

London: Bantam Press, 2010. 200 pp. hb. £18.99. ISBN-13 978-0593058299

This book was notoriously heralded by a front page splash in *The Times* headlined ‘Hawking: God did not create Universe’. The book does indeed make some startling claims, for example: philosophy is dead and has been superseded by science; M-theory is the ultimate theory of everything; the universe creates itself out of nothing – hence God is not needed; and a multiverse explains the fine-tuning.

The claim that philosophy is dead is on the first page of text (5). Yet most of the subject matter of the book is philosophical! Only a couple of pages later Hawking says he adopts ‘model-dependent realism’, a philosophical position if ever there was one! Hawking defines his concept by saying ‘it is pointless to ask whether a model is real, only whether it agrees with observations. If there are two models that both agree with observation... then one cannot say that one is more real than another.’ (46). This deceptively innocuous formulation leads to quite bizarre statements in practice.

Hawking is not the most reliable guide to theology and history. For example, he rightly states that St Augustine believed that time is ‘a property of the world that God created and that time did not exist

before the creation’ (50). However, then he says, ‘That is a possible model, which is favoured by those who maintain that the account given in Genesis is literally true’, but the big bang theory is ‘more useful’, even though neither model is ‘more real than the other’ (50-51). This is deeply confusing not least because (a) Augustine himself did not take Genesis literally, and (b) Augustine’s view is entirely compatible with the big bang theory! However, notwithstanding what comes later, Hawking admits at this point that it is not clear that we can take time back beyond the big bang because the present laws of physics may break down (51).

Hawking informs us that the 219 heresies condemned by Bishop Tempier of Paris in 1277 included the idea that nature follows laws, because this would conflict with God’s omnipotence (24-25). It is true that a prime consideration was God’s absolute power to do whatever he wills (and so not to be *bound* by ‘natural laws’ – if that is even an appropriate term in this period). However, Hawking omits to tell us that also condemned were the notions that God could not create several universes or more than 3 dimensions – significant in view of Hawking’s espousal of these ideas! Pierre Duhem and other philosophers have considered the condemnations as liberating for science.

Among other philosophical positions Hawking adopts are determinism, which renders miracles impossible, and reductionism. Echoing Dawkins he writes that ‘it seems that we are no more than biological machines and that free will is just an illusion’ (32). Even more significantly, Hawking has bought into Wheeler’s ‘it-from-bit’ interpretation of quantum theory, namely that we create the history of the universe by observing it (82, 140). He also interprets the Feynman sum-over-histories approach to quantum theory in a realist way, so that all possible histories of the universe are real, and we ‘select’ a set of histories, no matter how improba-

ble, which are compatible with our own existence. Add into this heady mix the no-boundary proposal whereby time becomes imaginary (space-like) in the earliest epoch, which Hawking developed with Jim Hartle, and which appeared in popular form first in *A Brief History of Time*, and you end up, he says, with a universe that has no beginning in time. Hence you avoid the need to invoke God to light the blue touch paper to set it going (134, 180) – again, repeating what he said in the earlier book.

Regarding this last point, if time has become space-like (i.e. a fourth space dimension) it is very difficult to see how time can ‘flow’ and the universe evolve from the 4-space at all. Of course, even if we accept Hawking’s mathematics, we do not have to accept his philosophy: we can perfectly well accept only real time in the mathematical sense as ontologically real, and the universe beginning at the point where (real) 3-space and real time intersect the 4-space where time becomes imaginary; and nor do we have to ontologise all the histories in the Feynman sum, merely regard them as a useful calculating device.

Another claim is that ‘M-theory predicts that a great many universes were created out of nothing. Their creation does not require the intervention of a supernatural being or god. Rather, these multiple universes arise naturally from physical law.’ (8-9). There is no mention here of the speculative nature of M-theory, the overarching generalisation of string theory, and that serious questions have been raised over its lack of predictions and observational or experimental support. That goes particularly for the claim about many universes. More significantly, the idea that the universe can create itself out of nothing, as Hawking expresses it later, is inherently self-contradictory. Apparently gravity can do the trick because its negative energy balances the positive energy needed to create matter (180). Contra Hawking, this sleight of hand does not mean that the

universe creates itself out of nothing, and if gravity and the laws of nature were responsible, one really would be entitled to ask where these come from in the first place and the quantum vacuum on which they act. As Hawking himself put it so eloquently in *A Brief History of Time*, ‘What is it that breathes fire into the equations and makes a universe for them to describe?’

Hawking describes how our existence imposes constraints on the form and content of the laws of nature (155). These include Fred Hoyle’s discovery of the constraint on the strong nuclear force necessary for carbon and oxygen, essential for life, to be manufactured inside stars, and the remarkable fine-tuning, to 1 part in  $10^{120}$ , of the cosmological constant. Whereas this might lead in the direction of a new argument from design, Hawking assures us ‘That is not the answer of modern science.’ (164, though he confuses such an argument with the modern Intelligent Design phenomenon in the US.) Hawking’s answer is the multiverse, though it is not at all clear either that he has established this or why, even if he had, that the question would not simply shift from ‘Why this universe?’ to ‘Why this multiverse?’ Given that M-theory scarcely qualifies as a theory at all, the claim that it is the unique logical possibility is highly problematic.

This is a book readers of this journal should read. It is beautifully produced and written in a deceptively easy style, considering the esoteric subjects with which it deals, and it is laced with Hawking’s quirky humour. But be prepared to take its exaggerated claims with a large pinch of salt.

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