that any contingently true proposition is such that it is logically possible that it has an explanation for its obtaining.

In sum: there are various reasons for supposing that the new cosmological argument that Gale and Pruss defend is not a cogent argument for the conclusion that, in the actual world, there is a proposition # such that the BCF for the actual world contains @, #, and the proposition that # explains @. There are very good reasons for supposing that W-PSR – their key principle of sufficient reason – is false; and there are also serious doubts about the use of other key notions – for example, 'conjunctive proposition' and 'atomic proposition' – in the setting up of the proof.

3.8. CRAIG AND THE *KALĀM* ARGUMENTS

There has been extensive discussion of *kalām* cosmological arguments in recent times.[17] Revival of interest in these arguments is primarily due to the publication of Craig (1979a). In the following discussion, I shall focus primarily on the arguments in Craig (1979a); however, I shall supplement this discussion by reference to later publications wherever this seems to me to be appropriate. While Craig has changed his mind about some of the details and emphases in his views, there is a considerable similarity between the doctrines that have been endorsed in his various publications.

Craig (1979a) claims that the following syllogism is a sound and persuasive proof of the existence of an orthodoxly conceived monotheistic god:

1. Everything that begins to exist has a cause of its existence.
2. The universe began to exist.
3. (Therefore) The universe has a cause of its existence.

In support of the second premise, Craig offers four supporting arguments, two *a priori* and two *a posteriori*. These four supporting arguments are as follows:

1.1. An actual infinite cannot exist.
1.2. An infinite temporal regress of events is an actual infinite.
1.3. (Therefore) An infinite temporal regress of events cannot exist.

2.1. The temporal series of events is a collection formed by successive addition.

[17] See, e.g.: Marmura (1957), Hourani (1958), Fakhry (1959), Wolfson (1966, 1976), Goodman (1971), Craig (1979a, 1979b, 1985, 1988, 1991a, 1991b, 1991c, 1992a, 1992b, 1992c, 1993a, 1993b, 1994a, 1994b, 1997a, 1999, 2000, 2003a), Mackie (1982), Wainwright (1982), Sorabji (1983), Conway (1984), Smith (1985, 1987, 1988, 1991 1993a, 1994a, 1995b), Davidson (1987), Goetz (1989), Prevost (1990), Grünbaum (1990, 1991, 1994, 1996, 2000), Oppy (1991, 1995a, 1995b, 1995c, 1996d, 2001b, 2002a, 2002b, 2002c, 2003a), Morriston (1999, 2002a, 2002b), and Oderberg (2002a, 2002b).

2.2. A collection formed by successive addition cannot be an actual infinite.
2.3. (Therefore) The temporal series of events cannot be an actual infinite.

3.1. Scientific observation strongly confirms standard Big Bang cosmology.
3.2. According to standard Big Bang cosmology, the visible universe arose from an initial singularity less than twenty billion years ago.
3.3. (Therefore) The universe began to exist.

4.1. The visible universe is in a state that is far from thermodynamic equilibrium.
4.2. If there were an infinite temporal regress of events, then the visible universe would not be in a state that is far from thermodynamic equilibrium.
4.3. (Therefore) The universe began to exist.

In support of the first premise, Craig offers two supporting arguments, though he also insists that it is not really in need of support: 'it is so intuitively obvious . . . that probably no one in his right mind *really* believes it to be false' (141).

5.1. There is overwhelming empirical support – "the strongest support that experience affords" – for the claim that everything that begins to exist has a cause of its existence.
5.2. (Therefore) Everything that begins to exist has a cause of its existence.

6.1. There can be no objects of knowledge unless there are *a priori* categorial structures of thought.
6.2. There are objects of knowledge.
6.3. If there are *a priori* categorial structures of thought, then it is knowable *a priori* that everything that begins to exist has a cause of its existence.
6.4. (Therefore) Everything that begins to exist has a cause of its existence.

I shall begin by discussing the supporting arguments, before turning to a discussion of the standing of the syllogism that Craig identifies with "the *kalām* cosmological argument".

SUB-ARGUMENT 1. Craig offers an extended defence of the first philosophical sub-argument, including extensive defences for each of the two premises of this sub-argument. We shall begin by examining the reasons that Craig offers for accepting each of the premises of this sub-argument.

In defence of the claim that "an actual infinite cannot exist", Craig offers several different kinds of considerations.

First, Craig argues against Platonism in the philosophy of pure mathematics, that is, against the view that mathematical entities exist. In particular, he argues against the view that Platonism affords a tenable interpretation of Cantor's transfinite numbers. The core of his argument is the claim that 'naïve Cantorian set theory gives rise . . . to irresolvable antinomies' (89), and the allegedly consequential claim that the only tenable responses to this situation are retreat to intuitionism and retreat to a kind of deductivist formalism ("axiomatization").

I think that this argument is very weak. There is good evidence that Cantor did not embrace the *logical* conception of sets that was espoused by Frege and Russell, and that does lead into the labyrinth of paradox; rather, Cantor espoused a *combinatorial* conception of sets that is more or less enshrined in the axioms of ZFC.[18] Moreover, quite apart from the views held by Cantor himself, it is clear that one can – and that many mathematicians do – embrace a Platonist interpretation of the theory of transfinite numbers that is embedded in ZFC. It is a serious mistake to suppose – as Craig does – that Platonists must be wedded to problematic principles of comprehension: there is no reason why Platonists cannot be combinatorialists. Furthermore, there are good reasons not to accept retreat to deductivist formalism: if the line that Craig takes here is seriously pursued, then it surely leads to the claim that classical mathematics should be rejected, and that either some kind of intuitionistic mathematics, or else some kind of finite mathematics, should be accepted in its stead. While this position can be defended, the costs should be noted: on this view, we are committed to the claim that we can form no coherent understanding of the actual infinite. Consequently, when we come to consider an orthodoxly conceived monotheistic god and its attributes, we cannot then say either that an orthodoxly conceived monotheistic god is, or that an orthodoxly conceived monotheistic god's attributes are, actually infinite.

Second, Craig claims that even a 'basic exposition of the Cantorian system itself ought to make it intuitively obvious that it is impossible for an actual infinite to exist in reality' (72). In his view, the "purely conceptual nature" of the Cantorian system is made clear by the nature of transfinite arithmetic (75f.), and, in particular, by the fact that there is no definition of subtraction and division for transfinite cardinals (81). Moreover, this same conclusion is supported by such observations as that there are just as many points in a line as there are in a cube and that there are the same number of points in any lines, and by the "staggering" observation that ε_0 is less than (the limit ordinal that is identified with) $\aleph_1$.

Once again, I think that this argument is very weak. As consideration of Conway's **No** makes clear, there is no reason why one shouldn't have

[18] Zermelo-Fraenkel Set Theory with the Axiom of Choice.

subtraction and division of transfinite ordinals and transfinite cardinals, if this is what one's heart is set upon. Of course, the rules for all of the arithmetic operations look different from the rules that apply in familiar finite arithmetic: but, as Conway emphasises, all of the arithmetic operations are defined only once – for all of the Conway numbers – and a little familiarity quickly breeds the view that these operations are natural. Moreover, it is quite unclear why one should suppose that the allegedly counter-intuitive behaviour of the transfinite ordinals and cardinals somehow casts doubt on the idea that the very smallest transfinite cardinals do find application to "the real world", unless one somehow supposes that classical mathematics should be rejected *in toto* and replaced with an acceptable intuitionistic or finite mathematics. If the Cantorian theory of the transfinite numbers is intelligible, then we can suppose that some parts of it find application "in the real world", while nonetheless granting that most of it does not. We can suppose that there are $\aleph_0$ objects, or **c** spacetime points, without going on to suppose that we can find "real world" applications for much larger Cantorian cardinals.

Third, Craig claims that the kinds of puzzle cases that are discussed in Oppy (2006) show that 'various absurdities would result if an actual infinite were to be instantiated in the real world' (82). As I note in that other work, there are good reasons for claiming that the puzzles to which Craig adverts – primarily Craig's Library and Hilbert's Hotel – actually show no such thing. Apart from the errors that Craig makes in his assessment of the puzzle cases that he discusses, the key point to note is that these puzzle cases simply have no bearing on, for example, the question of whether the world is spatially infinite, or the question of whether the world has an infinite past. At most, it seems that one might suppose that these puzzles show that there cannot be certain kinds of actual infinities; but one could hardly suppose that these puzzles show that there cannot be actual infinities of any kind.

In sum: the defence that Craig offers of the claim that there cannot be an actual infinite is very weak. We should agree that, if one is prepared to reject classical mathematics – and to embrace an intuitionistic or finite alternative – then one will be in a position to deny that there can be actual infinities. However, we have not yet been given any good reason to think that those who accept classical mathematics cannot go on to suppose that there *could be* actual infinities. Moreover, if we do suppose that we have good reason for supposing that there cannot be an actual infinite, then we shall be committed to the claim that there is no sense in which an orthodoxly conceived monotheistic god could be actually infinite; if there is an orthodoxly conceived monotheistic god, then that orthodoxly conceived monotheistic god can know only finitely many things, can perform only finitely many actions, and so forth. And, of course, this worry persists even if we consider ways in which one might argue for the weaker claim that there is no actual infinite; while this weaker claim might be used to support the claim that the past is finite, it also has the consequence that an orthodoxly conceived monotheistic god is actually finite (though perhaps potentially infinite) in every respect.

In defence of the claim that an infinite temporal regress is an actual infinite, Craig begins with the observation that the claim seems 'obvious enough . . . if there has been a sequence composed of an infinite number of events stretching back into the past, then the set of all events would be an actually infinite set' (95). This seems right: an infinite number of events stretching back into the past would form an actually infinite set, as would an infinite number of events stretching into the future. However, Craig claims that an infinite number of events stretching into the future is not an actual infinity, but is rather a merely potential infinity. Consequently, he takes himself to have some work to do to establish that an infinite number of events stretching back into the past is not merely a potential infinity.

First, Craig argues that the past is real in a way that the future is not, because past events have existed: 'they have taken place in the real world, while future events have not since they have not occurred' (96f.). However, it seems to me that, if we are taking tense seriously – that is, if we are rejecting the four-dimensionalist view that is strongly supported by the general theory of relativity – then there is something odd about the way that Craig draws his past/future asymmetry. On the one hand, the past does not exist: while it was the case, it is no longer. On the other hand, the future does not exist: while it will be the case, it is not yet. If there are reasons of the kind that Craig is here countenancing for supposing that the past cannot be infinite, then surely those reasons will carry over to support the contention that the future cannot be infinite. Craig doesn't think that the past is real in the way that the present is: he doesn't suppose that it is possible for there to be travel into the past. Equally, he should be prepared to allow that the future is real in a way in which the past is not: the future is still to come in the real world, while the past is not, since it has already occurred. At the very least, there is plenty of room here for those who are unsympathetic towards actual infinities to conclude that the future must be finite (and then to worry about the consequences of this conclusion for claims about the extent of life after death).

Second, Craig claims that some of the puzzles that are discussed in Oppy (2006) – in particular, the Tristram Shandy puzzle – give us additional reason to suppose that the past series of events cannot be infinite. However, despite Craig's claim that 'the Tristram Shandy story. . .tells us that an actually infinite temporal regress is absurd', I think that the discussion in Oppy (2006) shows that that story establishes no such conclusion. As we noted in that earlier discussion, one might think that there are principles of sufficient reason to which one can appeal in order to support the claim that the past series of events cannot be infinite. However, as I note in Oppy (2006), it is a delicate matter to discover a principle of sufficient reason that is both strong enough to yield the desired conclusion and yet not obviously in need of additional argumentative support. At the very least, it seems to me that we have not yet been given any reason at all to suppose that there are non-question-begging arguments in support of the claim that the past series of events cannot be infinite.

In sum: while I am happy to grant that an infinite temporal regress is an actual infinite, I do not think that Craig makes a good case for the claim that the future series of events can be infinite while the past series of events cannot be infinite. While one can insist that a word like "actual" or "real" marks a genuine metaphysical distinction between the past and the future – "the past is actual while the future is merely potential" – it seems to me that it is very hard to give non-question-begging content to this insistence. There are two perspectives – that of the presentist and that of the four-dimensionalist – from which there is no such distinction to be drawn. Since presentism and four-dimensionalism are both susceptible of serious philosophical support, this point alone should suffice to cast doubt on Craig's claim that his arguments 'will be sufficient to convince most people that the universe had a beginning' (99).

As Craig himself notes, there is a gap between the conclusion of the first sub-argument and the second premise of the main argument: perhaps one might think that, while the series of events in the universe is finite in the past, the universe itself is infinite in the past: 'the temporal series of events was preceded by an eternal, quiescent universe, absolutely still' (99). Against this suggestion, Craig offers two arguments, one *a priori* and one *a posteriori*. I do not propose to discuss these arguments here. Whether or not they are cogent, it seems to me to be plausible to suppose that, if the series of events in the universe is finite in the past, then so too is the universe itself. Since the first premise of the first sub-argument is so controversial – and since the considerations that Craig advances on behalf of that premise are so weak – we may perhaps be excused from considering the remainder of the argument in any depth.

SUB-ARGUMENT 2. As Craig observes, in effect, the second sub-argument comes into play only if the first sub-argument fails. If there cannot be an actual infinite, then, *a fortiori*, the temporal series of events cannot be an actual infinite. Consequently, we set aside any reasons that we might have for supposing that there cannot be an actual infinite when we turn to argue for the premises in this argument. If we tacitly appeal to the claim that there cannot be an actual infinite in order to support the premises in the second sub-argument, then we defeat the purpose of propounding this sub-argument.

On behalf of the first premise of this sub-argument – that is, the claim that the temporal series of events is a collection formed by successive addition – Craig observes that it seems "obvious enough". However, as I note in Oppy (2006), if one supposes that time has the structure of the real numbers and if one also supposes that there are continuous processes in time, then one will deny that past events form a *series*, and one will also deny that the collection of past events fall under a relation of *successive addition*. Since we are here not assuming that there cannot be an actual infinite, and since time is modelled by the real numbers in so many of our most successful scientific theories, it is hard to see what grounds one could have for supposing that it is simply "obvious" that past events constitute a series formed by successive addition. At the very least, it seems to me that we need some very substantial independent argument before we are persuaded to accept this premise.

On behalf of the second premise of this sub-argument – that is, the claim that a collection formed by successive addition cannot be an actual infinite – Craig notes that it is tantamount to the claim that it is impossible to count to infinity. He offers the following illustration of what he takes to be the central difficulty: 'Suppose we imagine a man running through empty space on a path of stone slabs, a path constructed such that when the man's foot strikes the last slab, another appears immediately in front of him. It is clear that, even if the man runs for eternity, he will never run across all of the slabs. For every time his foot strikes the last slab, a new one appears in front of him, *ad infinitum*. The traditional cognomen for this is the impossibility of traversing the infinite.' (104)

In Craig's example, the question is not whether the man can run across all of the slabs, but rather whether he can run across infinitely many slabs. For, if he achieves the latter task and yet not the former, he will still have completed an actual infinite by successive addition. If we suppose that the rate at which the slabs appear is constant, then, in any finite amount of time, only finitely many slabs appear: there is no time at which infinitely many slabs have been crossed. However, if the man runs for an infinite amount of time – that is, if, for each n, there is an nth slab that the man crosses – it is nonetheless true that infinitely many slabs are crossed: there is an actually infinite collection that is formed by successive addition. (Of course, Craig will resist this way of characterising matters: given his view that the future is not real, he will insist that it is at best true that infinitely many slabs will be crossed: the collection that is formed here by successive addition is at best "potentially infinite".)

But what if we suppose that the time lapse between slabs decreases according to a geometric ratio, and that the man is replaced by a bouncing ball whose height of bounce decreases according to the same geometric ratio? If the ball hits the first slab at one minute to twelve, the second slab at $^1/_2$ minute to twelve, the third slab at $^1/_4$ minute to twelve, and so on, then the ball can come to rest on a slab at twelve, having made infinitely many bounces on different slabs in the interval between one minute to twelve and twelve. In this example, we have a process – the bouncing of the ball – that plainly does form an actual infinite by successive addition. Consequently, we don't need to challenge Craig's view about the reality of the future in order to reject the second premise of the argument under discussion: there are perfectly ordinary processes that involve formation of an actual infinite by successive addition in not obviously impossible worlds (in which space and time are composed of points, and there are no quantum or thermodynamical effects to rule out the precise application of classical kinematics to the motion of a bouncing ball). Since Craig has – for the purposes of this argument – renounced the claim that there cannot be actual infinities, it is quite unclear what reason we are supposed to have for rejecting this counter-example to the alleged impossibility of forming actual infinities by successive addition.[19]

To strengthen the case for the second premise in this sub-argument, Craig adverts to his discussions of Zeno's paradoxes and the first Kantian antinomy. But, as the discussion in Oppy (2006) makes clear, there is nothing in either Zeno's paradoxes or the first Kantian antinomy to support the claim that a collection formed by successive addition cannot be actually infinite. In his discussion of Zeno's paradoxes, Craig claims that all supertasks are impossible because the completion of a supertask requires the performance of an 'infinitieth' task, that is, a last task immediately before the end state is achieved. Thus, for example, in his examination of Thomson's lamp, Craig writes that: 'in the real world, the state of the lamp [at the end of the manipulations of the switch] . . . is determined by the state of the lamp at the prior instant, which would be the "infinitieth" moment in the series' (180). But, of course, the assumption that there must be an *immediately* prior instant is precisely what proponents of the possibility of this kind of supertask deny: if time is a continuum, then there is no instant that is immediately prior to a given instant.

If anything, the second of Craig's philosophical sub-arguments fares even worse than the first: there is no clear and uncontroversial support to be given to either of the two premises in this argument. While there are views that entail that a temporal series of events cannot be infinite – for example, the view that, as a matter of necessity, there are only finitely many temporal

[19] Craig (1979a: 186n12) does say that 'a real ball is never perfectly resilient and so never bounces an infinite number of times before coming to rest'. If this is the claim that, in the actual world, balls are not perfectly resilient, then it seems unexceptionable: there are good thermodynamical – and quantum mechanical – reasons for denying that balls are perfectly resilient. Consequently, there are also good reasons for denying that, in worlds sufficiently like the actual world, balls are perfectly resilient: if you hold fixed enough of the actual laws and the actual boundary conditions, then you will surely have a world in which balls are not perfectly resilient. But nothing that we have said so far rules out acceptance of the claim that there are possible worlds governed by physical laws that are not altogether unlike the laws that obtain in our world, and yet in which balls are perfectly resilient. Moreover, it is precisely a claim of this form that is accepted by defenders of the possibility of supertasks, such as Benacerraf (1962) and Earman and Norton (1996). Despite Craig's numerous assertions that his opponents confuse "real possibilities" with "merely mathematical possibilities", it seems to me that it is rather Craig's insistence on the simple – and under-explained – division between "real possibilities" and "merely mathematical possibilities" that causes him to misrepresent the views of those whom he attacks. Possible worlds governed by laws and boundary conditions that are similar in some – but not all – ways to the laws and boundary conditions that govern the actual world are "real" possible worlds: worlds in which there are concrete, physical objects, and not merely numbers, sets, and other mathematical "abstractions".

atoms – one requires some quite heavy duty metaphysical assumptions in order to adequately support the conclusion of the second philosophical sub-argument. If we suppose, as Craig suggests, that he is looking for arguments that ought to persuade more or less any reasonable person, then it is surely clear that neither of Craig's philosophical sub-arguments comes anywhere near to meeting this standard.

SUB-ARGUMENT 3. Study of the large-scale history and structure of the universe is one of the more speculative branches of physical science. Following Kragh (1996: 6f.), we may suppose that modern scientific cosmology-dates from work done in 1917 on global solutions to the field equations of general relativity. From Einstein's initial work until the mid-1960s, there was a substantial division of opinion amongst cosmologists, with many leading figures inclining towards steady-state theories. However, a variety of considerations – including the discovery of the cosmic background radiation by Penzias and Wilson in 1965 – motivated subsequent widespread acceptance of the idea that the visible universe is the result of expansion from an earlier state of much greater density and temperature. Subsequent developments – including the analysis of the COBE data – show that there is a very good fit between standard Big Bang models of the universe and empirical data back to quite early stages in the history of the visible universe. Even allowing for the speculative and volatile nature of scientific cosmology, it seems to me to be plausible to allow that there are non-initial segments of standard Big Bang models that are well confirmed by the empirical data.

Despite the good fit between non-initial segments of standard Big Bang models and empirical data, there are very few cosmologists who suppose that standard Big Bang models are well confirmed over the entire history of the universe. The sticking point, of course, is the account of the very earliest history of the universe. In standard Big Bang models, there is an initial blow-up scalar polynomial singularity, that is, a point at which physical components of the curvature tensor diverge. There are very few theorists who are prepared to allow that this is a true representation of the earliest history of the universe. On a straight interpretation of the FRW models, there is no first moment at which the universe exists, but physical components of the curvature tensor diverge as $t \to 0$. Since Craig is a vociferous opponent of the actual infinite, he cannot possibly suppose that either of these features of the FRW models corresponds to anything in reality. But then, before we can draw any conclusions about the nature of the very earliest universe, we need to be presented with suitably modified FRW models in which these problematic features have been removed.

The construction of models that give an accurate representation of the very earliest universe is a matter of considerable current research activity. Since it seems plausible to suppose that the very earliest universe is a domain in which quantum mechanical considerations will be important, there is a widely held view that we shall not have our suitably modified FRW models until we understand how to unify quantum mechanics and general relativity in a quantum gravitational theory. But, at the time of writing, there is no reason to suppose that we are at all close to the construction of a satisfying theory of this kind. Consequently, we are in no position to draw any conclusions about the very earliest parts of the universe from the current state of cosmological theorising.

If we are prepared to leave the domain of properly scientific theorising, then we might suppose that – despite the lack of any decent scientific model of the earliest parts of the universe – we can nonetheless conclude from the available scientific data – and, in particular, from the goodness of fit between non-initial segments of standard Big Bang models and that data – that the universe "began to exist". After all, one might suppose, the very use of the terminology "the earliest parts of the universe" is surely an acknowledgment that there was "an absolute beginning of the universe about fifteen billion years ago" (130).

There are at least four reasons to be cautious here.

First, as noted by Earman (1995: 205f.), models of the Big Bang – such as the standard FRW models – are, in themselves, entirely neutral on the question of whether they model "an absolute beginning" of the physical universe. Whether the metric in an FRW model can be extended through the initial singularity depends upon the continuity/differentiability conditions that are placed on that metric. We might follow Geroch and Traschen in demanding that any physically meaningful extension of the metric should be *regular*; in that case, we shall conclude that there is no physically meaningful extension of the metric in a standard FRW model. However, at the very least, it is clear that we need some further justification for the claim that standard Big Bang models do in fact model "an absolute beginning" of the physical universe. Consequently, we are far from having good reason to suppose that not yet developed quantum-gravitational replacements for these standard Big Bang models will model "an absolute beginning" of the *physical* universe.

Second, as also noted by Earman (1995: 207), even if we suppose that there can be no physically meaningful extension of the metric through the initial singularity in standard FRW models, it does not follow that there can be no mathematically meaningful extension of the metric through that singularity. While it might be thought that this point supports the hypothesis that there might be a temporal domain in which God can perform the activities that result in the creation of the universe, it should be noted that this hypothesis also leaves room for the suggestion that there is some other cause for the creation of the universe that is part of an infinite regress of contingent causes. If we suppose that there can be a mathematically meaningful extension of the metric through the initial singularity in an FRW model, and if we suppose that there can be causation in the domain of that extension, then there is nothing in the empirical data that allegedly supports the claim that there is such a singularity to rule out the claim that there is an infinite regress of contingent causes. At the very least, we should be very cautious in our treatment of the claim that we have good reason to suppose that not yet developed quantum-gravitational replacements for standard Big Bang models will model "an absolute beginning" of the *contingent* universe.

Third, as argued by Grünbaum (1991), even if we suppose that there is no meaningful extension of the metric through the initial singularity in standard FRW models, it is a mistake to suppose that there is "an absolute beginning" in these models. If there are no meaningful extensions of the metric through the initial singularity in standard FRW models, then, equally, there are no meaningful extensions of the metric to $t = 0$ in these models. As Earman (1995: 208f.) notes, in the standard Big Bang models, for every time t there is an earlier time t', and the state of the universe at t' is a causal determinant of the state of the universe at t. Thus, it turns out that, even in the standard Big Bang models, there is no "absolute beginning" of the physical universe. Once again, the properties of standard Big Bang models give us no reason at all to suppose that not yet developed quantum-gravitational replacements for these standard Big Bang models will model "an absolute beginning" of the *physical* universe.

Fourth, despite the difficulties that we have noted thus far, one might suppose that there is surely good reason to claim that modern scientific cosmology makes it plausible to claim that the universe is finite in the past: there have been no more than twenty billion years during which the physical universe has existed. Since this seems right, one might then go on to suggest that there is, after all, a perfectly good sense in which modern scientific cosmology supports the claim that the universe began to exist: something begins to exist iff it is finite in the past, whence, since the universe is finite in the past, it follows that the universe began to exist. However, the important point to keep in mind now is whether the first premise of the *kalām* argument is true under this interpretation of "begins to exist": is it true that anything that begins to exists has a cause of its beginning to exist under this interpretation of "begins to exist"? We shall return to this point later.

In view of the considerations that have been adduced here, it seems to me that we should conclude that there is no good reason to suppose that current scientific cosmology supports the contention that there was an "absolute beginning" of the universe about fifteen billion years ago. Given the current state of scientific cosmology, it does seem highly plausible to suppose that the visible universe is no more than twenty billion years old; but there are various reasons why support for this contention does not readily translate into support for the contention that the universe had an "absolute beginning" no more then twenty billion years ago. Unless we accept the claim that something begins to exist iff it is finite in the past, we have no reason to find any merit in the third of Craig's sub-arguments.

SUB-ARGUMENT 4. It would take us very far afield to try to give a proper discussion of the second of Craig's empirical arguments. For the purposes of the current work, it suffices to note that there is no stronger argument for an "absolute beginning" in the thermodynamical considerations to which Craig appeals than there is in contemporary scientific cosmology. At best, the thermodynamical considerations can establish only that the *physical* universe is finite in the past: they cannot establish that there is no infinite regress in the *contingent* universe; and neither can they establish that there was an initial state of the universe at $t = 0$. Unless we accept the claim that something begins to exist iff it is finite in the past, we have no reason to find any merit in the fourth of Craig's sub-arguments.

Before we turn to an examination of the sub-arguments that Craig (1979a) offers in support of the first premise in his *kalām* cosmological argument, it is worth pausing to assess the overall contribution that the first four sub-arguments make in supporting the second premise in the *kalām* cosmological argument. I claim that the two *a priori* arguments are very weak indeed: they give no serious support to the claim that the physical universe began to exist. Moreover, I claim that the two *a posteriori* arguments at best support the claim that the physical universe is finite in the past. If we do not accept the claim that something begins to exist iff it is finite in the past, then we shall conclude that the two *a posteriori* arguments also fail to give substantial support to the claim that the physical universe began to exist.

SUB-ARGUMENT 5. As we have already noted, Craig claims that there is no real need to offer support for the claim that everything that begins to exist has a cause of its existence: the truth of this claim is allegedly so immediately apparent that no sane person could fail to recognise it. Nonetheless, he does go on to say that the claim has overwhelming empirical support: "it is repeatedly confirmed in our experience. Constantly verified and never falsified, the causal proposition can be taken as an empirical generalisation enjoying the strongest support experience affords" (145).

Whether or not we suppose that we are dealing here with an empirical generalisation, we are entitled to ask for clarification of the meaning of the claim whose truth is allegedly so evident that no sane person can reject it. On the one hand, we need to know more about what it takes for something to count as "beginning to exist"; on the other hand, we need to know more about what it takes for something to count as "a cause [of the existence of some thing]".

One might suppose – roughly following Grünbaum (1990) – that an object x begins to exist at a time t just in case: (1) x exists at t; (2) there are times prior to t; and (3) there is no time prior to t at which x exists.[20]

[20] In place of (3), Grunbaum actually offers:

(3′) There is a temporal interval (t', t) immediately prior to t at which x does not exist.

Unlike the formulation in the main text, this formulation allows for the possibility of intermittent existents, i.e., objects that come into and go out of existence. It is not clear to me that one ought to allow that this is a possibility. In any case, the question of the possibility

Moreover, one might suppose that an object x begins to exist just in case there is some time t at which x begins to exist. On these assumptions, it does not seem immediately objectionable to claim that anything that begins to exist has a cause of its beginning to exist; and neither does it seem immediately objectionable to suggest that this claim finds strong empirical support. However, of course, it should also be noted that – whether or not we accord any reality to the time $t = 0$ in standard Big Bang models of the universe – it is not true on the current assumptions that the universe – as modelled in standard Big Bang cosmology – began to exist. If we accept this account of what it is for something to begin to exist, then Craig's *kalām* argument is in ruins.

One might suppose – roughly following Craig (1992a) – that an object x begins to exist at a time t just in case: (1) x exists at t; and (2) there is no time prior to t at which x exists. Moreover, again, one might suppose that an object x begins to exist just in case there is some time t at which x begins to exist. On these assumptions, provided that we accord reality to the time $t = 0$ in standard Big Bang models of the universe, it does turn out to be true that the universe – as modelled in standard Big Bang cosmology – begins to exist. However, if we do not accord any reality to the time $t = 0$ in standard Big Bang models of the universe, then, on these assumptions, it is not true that the universe – as modelled in standard Big Bang cosmology – begins to exist. Since – as we have already seen – there is good reason to deny that the time $t = 0$ is accorded any reality in standard Big Bang cosmology, we again have reason to hold that, on this account of what it is for something to begin to exist, Craig's *kalām* argument is in ruins. Moreover, even if we do suppose that we can accord reality to the time $t = 0$ in standard Big Bang models of the universe, we now have to confront the question of whether it is plausible to claim that there is strong empirical support for the universal generalisation that *everything* that begins to exist has a cause for its beginning to exist, on the current construal of "begins to exist". The answer to this question seems plainly to be negative. In experience, we only ever meet with objects whose coming into existence is preceded by times at which those objects do not exist. Nothing in experience bears on the question of the causal antecedents of objects that begin to exist at $t = 0$. So, on the current account of what it is for something to begin to exist, the key premise in Craig's fifth sub-argument should be rejected: it is not true, on this account of what it is for something to begin to exist, that there is "the strongest support that experience affords" for the claim that everything that begins to exist has a cause of its beginning to exist.

of intermittent objects is clearly tangential to the issues that are the primary focus of the present discussion. Those who are concerned about the failure of the subsequent discussion in the main text to address this alleged possibility are free to make the necessary – and straightforward – amendments.

One might suppose that an object x begins to exist at a time t just in case: (1) x exists at all times in some open or closed interval (t, t'); and (2) x exists at no times in any open interval (t'', t). Moreover, again, one might suppose that an object x begins to exist just in case there is some time t at which x begins to exist. On these assumptions, even if we accord no reality to the time $t = 0$ in standard Big Bang models of the universe, it turns out that the universe – as modelled in standard Big Bang cosmology – begins to exist at $t = 0$. However, as presaged by the discussion in the previous paragraph, we now have to face the question of whether it is plausible to claim that there is strong empirical support for the universal generalisation that *everything* that begins to exist has a cause for its beginning to exist, on the current construal of "begins to exist". Once again, it seems to me that the answer to this question is negative. There is nothing in our experience that provides support for the universal generalisation that, if an object x exists at all times in some open or closed interval (t, t'), and at no times in any open interval (t'', t), then there is a cause of the existence of that object in the open or closed intervals (t, t'). In particular, nothing in experience bears on the question of the causal antecedents of objects that – in the sense now at issue – "begin to exist" at $t = 0$. So, once again, on the current account of what it is for something to begin to exist, the key premise in Craig's fifth sub-argument should be rejected: it is not true, on this account of what it is for something to begin to exist, that there is "the strongest support that experience affords" for the claim that everything that begins to exist has a cause of its beginning to exist.

Unless there is some other account of what it is for something to begin to exist that has been overlooked here, it seems to me that we are entitled to conclude – prior to any discussion of the use of the expression "a cause [of the existence of some thing]" – that the fifth of Craig's sub-arguments is extremely weak. While – for all that we have argued so far – there may be senses of "begins to exist" in which there is empirical support for the claim that it is true that everything that begins to exist has a cause of its beginning to exist, those are not senses in which there is any support for the claim that the universe began to exist.

SUB-ARGUMENT 6. Craig (1979a: 148) is ambivalent about the merit of the sixth sub-argument, and with good reason. Even if one accepts the highly controversial neo-Kantian assumption that there can be no objects of knowledge unless there are *a priori* categorial structures of thought, it is utterly unclear why one should suppose that, if there are *a priori* categorial structures of thought, then it is knowable *a priori* that *everything* that begins to exist has a cause of its beginning to exist. In particular, the claim – in itself highly controversial – that there can be rational thought only if there is a causal structure in the world that is reflected in the categorial structure of thought, supplies no evident support for the further claim that the categorial structure in question must accurately reflect the causal structure of the world at or very near to $t = 0$. The reasons that we gave above for rejecting the fifth of Craig's sub-arguments carry over, more or less unchanged, as reasons for rejecting the sixth of his sub-arguments: there is nothing in *our* current experience, or in *our* ways of thinking about the current state of the world, that both provides substantive support for the claim that *everything* that begins to exist has a cause of its existence and yet does not undermine the claim that the universe began to exist.

Even if we are prepared to dismiss the sub-arguments that Craig offers in support of the first premise in his major syllogism, we must still confront his contention that the truth of this premise is so immediately apparent that no sane person could really fail to accept it. There are various comments that one might make about this apparently gratuitous slur on the many thoughtful atheists who have failed to accept that there is a sense of "begin to exist" in which it is true both that the universe began to exist and that everything that begins to exist has a cause of its existence.

First, if one is prepared to accept that conceivability is a good guide to possibility, then it is hard to see how one can deny that it is possible that there be physical universes that have no cause of their existence, since it seems plainly true that it is conceivable that there be physical universes that have no cause of their existence. Of course, as we noted in Oppy (2006), one can deny that conceivability is a good guide to possibility – but then one must be prepared to pay the costs of this denial. Moreover, if one accepts the claim that conceivability is a good guide to possibility, then, at the very least, one has some serious explaining to do if one wishes to maintain that physical universes that have no cause of their existence are merely "logical" – but not "real" – possibilities.[21]

Second, as we have already noted, there are hard questions to be asked about the meaning of the expression "a cause [of the existence of some thing]". Craig (1992a: 235) says clearly that he is here talking about *efficient* causes – and not about material causes, or formal causes, or final causes, or constitutive causes, or the like. Plausibly, then, the claim that we are investigating can be restated as the claim that any event of the coming into existence of a thing is an efficient effect of some other – distinct, independent – event or events.

[21] It should be noted that the sense of possibility at issue here is plainly not that "narrow" logical possibility that is constituted by freedom from inconsistency in first-order logic. I take it that, however the notion of "conceivability" is spelt out, it is not conceivable that $2 + 1 = 7$, or that some prime numbers weigh more than Jackie Gleason. Uncaused physical universes are conceivable in a way in which these "narrow" logical possibilities are not. (Cf. Craig (1993b: 2) for the accusation that I conflate "narrow" logical possibility with "broad" logical possibility, i.e., with the kind of possibility that he denies to uncaused physical universes.)

This restatement still leaves open the question of what we should count as a 'thing'. If 'things' include states of affairs, then the claim is plausibly interpreted to be a kind of principle of sufficient reasons: every contingent state of affairs has an efficient cause, or the like. As I argue in Oppy (2006), there is good reason to reject any strong principle of this type; in particular, it is worth noting that no libertarian about freedom can suppose that every contingent state of affairs has an efficient cause. On the other hand, if 'things' are not meant to include states of affairs, but rather are to be limited to 'individual particulars', or the like, then it is worth asking why we should suppose that this more limited principle is worthy of belief when the more extensive principle plainly is not. I see no reason to accept that untutored intuition finds any more merit in the more limited principle than it finds in the more extensive principles; moreover, I see no evident reason why the kinds of arguments that Craig offered should not be taken to support the more extensive principles no less strongly than they support the more limited principle. If there can be contingent states of affairs that have no efficient cause of their coming to obtain, then why can't there be 'individual particulars' that have no efficient cause of their coming into existence?

Third, there are apparently possible cases that might be taken to controvert the claim that every 'individual particular' has an efficient cause of its coming into existence. Suppose, for example, that there is a kind of subatomic particle – an X-particle – that is unstable, and that can decay in one of two ways, but for which it is an objectively chancy matter which type of decay occurs when this kind of particle decays. On the one hand, an X-particle can decay into an α-particle and a γ-particle; on the other hand, an X-particle can decay into a β-particle and a δ-particle. Suppose, now, that a particular X-particle decays into an α-particle and a γ-particle. Is there an efficient cause of the coming into existence of the α-particle in this case? Plainly enough, there is a material cause: the existence of the X-particle is a material cause of the existence of the α-particle. But it might be said that the objectively chancy nature of the decay process yields the result that the existence of the X-particle is not an efficient cause of the existence of the α-particle; and it might be further suggested that there is no other plausible candidate efficient cause for the existence of the α-particle.

I don't say that it is obviously right to assert that, in the case described, there is no efficient cause for the existence of the α-particle. However, I do think that this case makes it clear that, before we can assent to the claim that there is an efficient cause for the coming into existence of any thing, we need to be told a lot more about the analysis of efficient causation. There are many different philosophical theories of efficient causation, and some of those theories allow that, in the case described, there is no efficient cause for the existence of the α-particle. Of course, those theories that allow that, in the case described, there is no efficient cause for the existence of the α-particle may be mistaken; but we need to move beyond the level of appeal to untutored intuition in order to decide whether or not this is really so.

While there is clearly more to be said on this topic, I think that I have already said enough to justify the contention that it is not in the least bit obvious that everything that begins to exist has an efficient cause of its beginning to exist. For all that has been argued so far, it may be that it is nonetheless true that everything that begins to exist has an efficient cause of its beginning to exist – but, at the very least, those who suppose that it is true have much work to do to convince those who do not agree with them.[22]

Conclusion

So far, I have argued: (1) that the two premises in Craig's major *kalām* syllogism receive no adequate support from the sub-arguments that he advances on their behalf, and (2) that there is no good reason to accept Craig's contention that the first premise is so obvious as not to stand in need of any support. On the basis of this prior argumentation, I think that it is reasonable to conclude that Craig's case is unpersuasive: there is nothing in his major syllogism, nor in the supporting arguments that he advances on behalf of the premises in this major syllogism, that should persuade any reasonable person not already convinced of the truth of the conclusion of that syllogism to accept that the universe has a cause of its existence. Of course, this is not to say that there is good reason to reject the claim that the universe has a cause of its existence; and neither is it to say that there are no theists whose belief that the universe has a cause of its existence is reasonable. To argue for either of those contentions would be to engage in a project vastly different from the one that I have undertaken here: for all that I have tried

[22] One possible response to this criticism – if it is deemed to be telling – would be to amend the first premise in the *kalām* syllogism to the claim that everything that begins to exist has either an efficient cause or a *material* cause of its beginning to exist. While there is no less support in experience, or in consideration of the Kantian categories, for the claim that everything that begins to exist has a material cause for its beginning to exist – and while there is equally no less support in untutored intuition for this claim – it is plain that one could not argue for the existence of an immaterial God on the basis of this premise. However, it is not clear that the move to the weaker, disjunctive claim improves matters much: for the *kalām* syllogism is not intended to issue in the conclusion that the universe has either an efficient cause or a material cause for its beginning to exist. At the very least, one needs further supporting argument in order to get from the weaker, disjunctive claim to the desired conclusion that the universe has an efficient cause for its beginning to exist. (It is perhaps worth noting that there are various places in which Craig has addressed the question of whether pair production in a quantum mechanical vacuum constitutes violation of the principle that everything that comes into existence has a cause of its coming into existence – see, e.g., Craig (1979: 165) and Craig (1997a: 241). While one can correctly insist that there is a *material* cause for the coming into existence of particles that are produced in this way, it is highly doubtful whether one is entitled to claim that there is an *efficient* cause for this coming into existence.)

to do is to show why one ought not to suppose that Craig's *arguments* are good.

3.9. SMITH'S ATHEOLOGICAL COSMOLOGICAL ARGUMENTS

In a series of publications for the late 1980s, Quentin Smith (1988, 1991, 1993b, 1993c, 1994b, 1995a, 1995b, 1997a, 1997b, 1999, 2000) defends the claim that work in modern scientific cosmology actually supports the conclusion that our universe is not the product of the creative activities of a supernatural agent. There are a number of different particular conclusions for which Smith argues in these works. *First*, Smith argues that Craig's empirical arguments for supernatural creation from the evidence of physical cosmology fail. Of course, I agree with Smith's conclusion on this matter, and I do not propose to evaluate his criticisms of Craig's arguments here. *Second*, Smith argues that work in modern scientific cosmology strongly supports the conclusion that our universe began to exist, but that there was no 'external' cause – and, in particular, no supernatural perfect cause – of its beginning to exist. Despite his rejection of an 'external' cause – and, in particular, a perfect supernatural cause – for the beginning of the universe, Smith does allow that there is an 'internal' cause for the beginning of the universe. *Third*, Smith argues that, if the Hartle-Hawking cosmology were true of our universe, then it would strongly support the claim that our universe is not the product of the creative activities of a supernatural agent.

3.9.1. The Central Argument

The central argument for the alleged inconsistency between Big Bang cosmology and classical theism is presented in Smith (1991: 200f.):

1. If God exists and there is an earliest state E of the universe, then God created E.
2. God is omniscient, omnipotent, and perfectly benevolent.
3. An animate universe is better than an inanimate universe.
4. (Therefore) If God created E, then E is ensured to contain animate creatures or to lead to a subsequent state of the universe that contains animate creatures.
5. There is an earliest state of the universe, and it is the Big Bang singularity.
6. The earliest state of the universe is inanimate.
7. The Big Bang singularity is inherently unpredictable and lawless, and consequently there is no guarantee that it will emit a maximal configuration of particles that will evolve into an animate state of the universe.