On Some Alleged Consequences Of ‘The Hartle-Hawking Cosmology’

In [3], Quentin Smith claims that ‘the Hartle-Hawking cosmology’ is inconsistent with classical theism in a way which redounds to the discredit of classical theism; and, moreover, that the truth of ‘the Hartle-Hawking cosmology’ would undermine reasoned belief in any other varieties of theism which hold that the universe is created.

I don’t think that Smith manages to substantiate these *prima facie* implausible claims. In particular, I do not think that he manages to provide an intelligible account of what he takes to be the crucial consequence of ‘the Hartle-Hawking cosmology’ — viz. that there is a probability strictly less than 100% and strictly greater than 0% of a universe like ours coming into existence *ex nihilo*. The main purpose of this paper is to explain why it seems to me that this claim is simply incoherent.

There are other points at which Smith’s arguments could be attacked. For example, Markosian (1995) objects to Smith’s assumption, that the claim that God wills that a universe with a given initial state exists *entails* the claim that the objective probability of such a universe coming into existence is 100% (and similarly to Smith’s assumption, that the claim that God wills that Hawking’s wave function law obtain *entails* that the objective probability of our universe coming into existence is (say) 95%). Markosian’s objection relies on the idea that one could evaluate the consequents of these conditionals at times earlier than the times at which the willings in the antecedents occur. However — as I shall go on to argue — it seems to me to be quite doubtful that one should allow that there are times of the kind which Markosian's objection requires. In any case, rather than object to the *entailments* which Smith's argument requires, *I* shall focus my attention on the coherence of the objective probabilities which Smith invokes.

One might also worry about the way in which Smith formulates the problem. He defines 'classical theism' to be 'the theory that there necessarily exists a disembodied person who is necessarily omniscient, omnipotent and omnibenevolent and necessarily the cause of whatever universe there is' (p.238). His main claim is that 'the Hartle-Hawking cosmology' is inconsistent with 'classical theism' thus construed. But this claim may be quite uninteresting: for it may be that 'classical theism' is internally inconsistent; and, even if it is not internally inconsistent, it may be that 'classical theism' is trivially inconsistent with 'the Hartle-Hawking cosmology'. (For example, a reading of Smith's definition which has it that there is only one initial state of the universe which God could create -- all others being inconsistent with his necessary omnibenevolence -- is trivially inconsistent with any theory which assigns non-zero probabilities to non-actual initial states, and may be internally inconsistent as well.) Smith's claim might turn out to be comparatively uninteresting for other reasons. Suppose that most theists would commit themselves to no more than the claim that there is a very good, very wise and very powerful person who created the universe — and suppose further that there are no compelling reasons for them to shift to stronger positions such as the one which Smith outlines. In that case, the important question will be whether *this* position is inconsistent with 'the Hartle-Hawking cosmology'. (Hawking himself seems to claim that his cosmology makes the hypothesis of any kind of creator otiose; if Smith really means to defend Hawking, then surely it is this claim which he ought to be defending.) However, I don't need to fuss about these details: if I am right to claim that Smith's account of 'the Hartle-Hawking cosmology' is incoherent, then the further details of Smith's argument can be safely ignored.

I

To begin, we should hear from Smith:

> Hawking's atheistic dreadnaught is a 'wave function of the universe'. The wave function is $\Psi[h_{ij}, \phi]$. Without bothering overly much about technical niceties, we may take ϕ as representing the matter field of the initial state of the universe, roughly, how much matter this state contains and how it is distributed. h_{ij} may be regarded as representing the metrical structure of the initial state of the universe, that is, the sort of curvature possessed by the three dimensional space of this state. Ψ is the amplitude, which is important since the square of the modulus of the amplitude gives a probability, namely, the probability that the universe will begin to exist with the metric h_{ij} and the matter field ϕ. The square of the modulus of the amplitude is $|\Psi[h_{ij}, \phi]|^2$. As Hartle and Hawking say, this gives us the probability 'for the Universe to appear from nothing', specifically, it gives us the unconditional probability that a universe begins to exist with the metric h_{ij} and matter field ϕ. ...

> Hawking's cosmology ... implies that it is probable (to a degree less than one) that the universe begins to exist with a nonsingular state, namely h_{ij}, ϕ, in accordance with the wave function $\Psi[h_{ij}, \phi]$. (236/7)

This may sound forbiddingly technical; but none of the technicalities will matter. The basic idea divides into two parts, viz: (i) that there is a way of assigning probabilities to possible initial states of universes; and (ii) that these probabilities can be interpreted as unconditional probabilities for the coming into existence *ex nihilo* of universes with those initial states. (Jazzing things up a little, the idea is that there is a wave function, Ψ, the square of the modulus of the amplitude of which gives unconditional probabilities for the coming into existence *ex nihilo* of universes with characteristics determined by the points or regions of the space over which the wave function is defined.)

Two different kinds of objections to these ideas immediately suggest themselves. Firstly — and most importantly — it seems that no coherent sense can be given to the idea that an assignment of possibilities of the kind in question *could* be interpreted as an assigment of unconditional probabilities for the coming into existence *ex nihilo* of universes with given initial states. Secondly, the suggestion that there is a space of (aspects of) initial states of universes over which a wave function can be defined clearly *could* give rise to various difficulties if one tried to assign some kind of substantival existence to the space in question — but it isn't clear that Smith's argument manages to avoid the attribution of some kind of substantival existence to the space in question. I shall consider these objections in turn.

II

It is plain that Smith is supposing that the probabilitites which are to be assigned to possible initial states of the universe are objective probabilities — i.e. they are not measures of epistemic uncertainty and the like, but rather measures of what Lewis calls ‘chances’. One might worry about whether there are any such things — c.f. Markosian’s worries about unconditional probabilities (Markosian (1995:248)) — but I shall simply set this kind of worry aside. (I think that quantum mechanics requires objective chances — but I don’t propose to try to justify this contention here.)

Ordinarily, these objective probabilities must be indexed to worlds and times: events have chances at times in worlds. (E.g. there was a 10% chance at time t_o that this radioactive atom would decay within the next 25 seconds.) But — on the assumption that there is now a determinate, non-probabilistic fact of the matter about the initial state of the actual universe (and, more generally, on the assumption that for any time from the time of the initial state on there is a determinate, non-probabilistic fact of the matter about the initial state of the actual universe) — these indexed objective probabilities can’t be what Smith has in mind. Why? Consider the thought that, at some time t_n, there is a certain objective probability that our world evolved from a given initial state. Given the assumption that there is a determinate, non-probabilistic fact of the matter about the initial state of the universe at any time from the time of the initial state on, this thought must be mistaken: *at any time*, the objective chance that our universe evolved from a given initial state is 1 or 0, depending upon whether or not our universe did evolve from that initial state. Or, more cautiously, *at any time from the initial state of the universe on*, the objective chance that our universe evolved from a given initial state is 1 or 0, depending upon whether or not our universe did evolve from that initial state. If there is a time at which there is a certain objective probability that our world evolve from a given initial state, that time must be a time which precedes the initial state of the universe.

The same point applies if we try to develop Smith's account in the context of an ensemble of universes. Consider the thought that we can assign objective probabilities to the existence of universes with given initial states ('the unconditional probability that a universe begins to exist with [given initial conditions]'). Given the assumption that there are now — and at all other times from the times of the relevant initial states on — determinate, non-probabilistic facts of the matter about the existence of universes with given initial states, this thought must be mistaken: for, at any time (except times prior to the initial states of the universes in question), the objective probability that there is a universe with a given initial state is 1 or 0, depending upon whether or not there is such a universe.

Quite generally, we — here, now — must suppose that objective unconditional probabilities about entirely past events and about temporally unconnected events (e.g. — at least on standard assumptions — the existence of other universes) are 1 or 0; or else we must give up the assumption that there are now determinate, non-probabilistic facts of the matter about entirely past events and temporally unconnected events. Since Smith clearly does suppose that there is now a determinate, non-probabilistic fact of the matter about the intial state of the universe, it seems that he does not have the resources to provide a coherent account of the objective probabilities which figure in his argument.

(Talk about ‘the initial state of the universe’ in this section may seem problematic: surely, we don’t need to commit ourselves to the claim that there was a first instant of time, even if we do want to accept that the universe is temporally bounded in the past. Agreed. But this talk is harmless, since we could talk instead about ‘some suitably small initial segment of the universe’, without needing to make any substantive changes to the argument. Since it is simpler to persist with the fiction that there is a first instant of time, I shall continue to do so — nothing substantial turns on this pretence.)

III

The only way out — it seems to me — is for Smith to allow that the space over which the objective probabilities are to be distributed has some kind of independent, determinate, non-probabilistic reality: given just the existence of this space, there are objective probabilities concerning the existence of universes with certain initial states. Or, rather, given just the existence of this space, there are objective probabilities about the *coming* *into* existence of universes with certain initial states. And in the qualification lies the rub: it is not enough that the space over which the probabilities are distributed is invested with some kind of independent reality, it must also be invested with temporal properties — i.e. it must be supposed to be somehow temporally (and causally) antecedent to our universe. In order for there to be objective probabilities about the *coming into* existence of universes with certain initial states, there must be times which precede the coming into existence of the universes in question — and, in order for this to be possible, there must be a temporal space over which the probabilities can be distributed.

Even if the suggestion is coherent — about which more later — it is clearly disastrous for Smith's argument. In particular, if this is the right way to interpret 'the Hartle-Hawking cosmology', then it is clearly NOT the case that it involves 'a Universe appearing from nothing': if the objective probabilities invoked in Smith's interpretation of the model are intelligible, then this is precisely because there are other temporally prior entities upon which the existence of the Universe depends. Yet, if this point is conceded, then classical theism — or, at least, something very much like it — can embrace 'the Hartle-Hawking cosmology' while nonetheless insisting that it was God who created those prior entities.

It should be noted here that, on this kind of account, God would be a cause — perhaps indeed *the* cause — of the universe. If I point a gun at you and arrange for it to be triggered if a certain radioactive particle decays within a certain period of time, and if the particle decays within that period of time leading to your death, then I have caused your death. Smith's argument — in sections 3-5 of his paper — is undermined by, among other things, his failure to consider alternatives in which God creates temporal entities — hence, entities other than laws — which in turn lead to the existence of universes. Moreover, even if all God does is to will that a certain law obtains, and if it is a consequence of that law that there is a 95% chance that a universe should arise, and if a universe does arise, then — *pace* Smith — God is the cause of the existence of the universe.

IV

Although it is dubious whether it is coherent — let alone consistent with modern physics — to suppose that there are entities or states or spaces which are temporally prior to the universe, it seems plausible to suggest that the informal gloss which Hartle and Hawking place on their 'wave function for the Universe' does commit them to such a supposition. For consider: 'One can interpret the functional integral over all compact four geometries bounded by a given three geometry as giving the amplitude for that three-geometry to arise from a zero three-geometry, i.e. a single point. In other words, the ground state is the amplitude for the Universe to appear from nothing.' (p.2961)

Even ignoring the fact that a single point is not nothing, it seems very doubtful that this claim about possible interpretations of the functional integral can be correct. In particular, there is the following obvious question: why is it correct (or natural) to interpret the functional integral as giving the amplitude for that geometry to *arise* from a zero geometry; and, more basically, what could be meant by the description 'the amplitude for a three-geometry to *arise* from a zero-geometry'? It is one thing to develop a device which assigns probabilities to three-geometries (of a certain kind); it is quite another to say that this device yields probabilities which are amplitudes for those geometries to *arise* from a zero geometry.

The temporal (and causal) implications of 'arise' are not the only difficulties here. There are, after all, lots of initial states of the universe which get assigned non-zero probabilities. But if the probabilities in question are probabilities for the emergence *ex nihilo* of universes with given initial states, then we have objective probabilities for the emergence of lots of universes distinct from ours. Should we think that some (most, all) of these universes exist? If not, why not? (Note how Smith switches back and forth between talk of probabilities for 'a universe' to emerge from nothing, and talk of probabilities for 'the universe' to emerge from nothing.) Of course, on at least some interpretations of quantum mechanics, ordinary wave functions 'collapse' to unique values under some conditions — but why should there be taken to be this kind of 'collapse' if there isn't any prior state for the collapse to precede from? Unless the emergence of one universe prevents the emergence of any other, then it is hard to understand how there can be mere probabilities for universes to emerge — and yet it is equally hard to understand how 'the Hartle-Hawking cosmology' requires or ensures that the emergence of one universe prevents the emergence of any other. (Remember: the universes 'come from nothing': so it's not as if there is a pre-existing arena which only one universe can occupy.)

In view of these problems, it seems plausible to suggest that one might look for other interpretations of the functional integral. Moreover, it seems that other interpretations should not be hard to come by: for most of the standard interpretations of quantum mechanics, there will be a corresponding interpretation of the functional integral. For example, there will be an interpretation according to which it is an ‘eternally’ chancy matter what ‘the boundary’ of the universe is like, since there was no collapse of the wave function on ‘the boundary’ (this amounts to giving up the assumption that there is now a determinate, non-probabilistic fact of the matter about the initial state of the universe). And there will be an interpretation according to which there are many worlds, only some of which have the same kind of ‘boundary’ as our world (here, *modulo* problems about cardinality which need to be finessed, the probabilities give the percentages of worlds which have given kinds of ‘boundaries’). And so on.

Perhaps there will be insurmountable problems for other attempted interpretations of the functional integral. (I don’t have the technical expertise to tell.) If not, then we can be confident that these interpretations will not require the [incoherent] idea that the functional integral yields an amplitude for ‘the universe to appear from nothing’ — and hence we shall not have any reason (of the kind which Smith provides) to think that the interpretation is incompatible with classical theism. On the other hand, if no other interpretation can be provided, then we can either (i) refuse to give any serious interpretation of the ‘probabilities’ allegedly defined by the functional integral (while otherwise continuing to endorse ‘the Hartle-Hawking cosmology’); or else — as Smith himself acknowledges — (ii) reject ‘the Hartle-Hawking cosmology’ as an adequate cosmological theory. Of course, neither of these options poses any particular threat to classical theism.

(It is worth noting that the second of these options — i.e. refusing to accept 'the Hartle-Hawking cosomology' — is particularly attractive, to a much greater extent than Smith himself allows; after all, the simple fact is that even most physicists don't think that 'the Hartle-Hawking cosmology' gives a true description of the early universe. Given the state of current investigations into the early universe — a state marked by widespread disagreement even about the vocabulary in which the theory ought to be couched— it is massively implausible to think that a demonstration that classical theism is inconsistent with 'the Hartle-Hawking cosmology' would present any sort of obstacle to current reasonable theistic belief.)

V

In sum, then: there is no reason at all to think that 'the Hartle-Hawking cosmology' has dramatic consequences for classical theism (or for any other kind of religious belief). However, it should not be too quickly concluded that there are no prospects for rehabilitating Smith's argument.

Markosian (1995:248) suggests, *inter alia*, that if there were an argument from 'the Hartle-Hawking cosmology' to the rejection of classical theism, then there would be an argument from orthodox quantum mechanics — or, indeed, from any other non-determinstic theory which traffics in objective chances — to the rejection of classical theism. The idea, I take it, would be something like this: Consider an allegedly chancy event — e.g. the decay of a radioactive particle. Quantum mechanics assigns a certain value, strictly greater than zero and strictly less than one, to the chance that this particle will decay in a given period of time. But if God wills every detail of the world, and if there is, in advance of the event, a fact of the matter about what the particle will do — suppose, e.g., that it will decay in the given time — then it seems that quantum mechanics must be wrong — since, under our supposition, the objective chance that the particle will decay is one.

Of course, this is a familiar argument, and one that has nothing at all to do with 'the Hartle-Hawking cosmology'. Moreover, there are various strategies which might be employed in response — e.g. one could deny that God wills the outcome of genuinely chancy events, whether or not God knows what these outcomes will be; or one could deny that God so much as knows what the outcomes of genuinely chancy events will be; or one can give an epistemic interpretation to the quantum-mechanical probabilities (factoring out the information that God knows in advance what the outcomes will be); or one can deny that God's knowledge (and/or willing) has any effect on the objectively chancy status of the event; and so on.

Since this is familiar territory, I shall say no more about it here.

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