THEISM, PROBABILITY, BAYES’ THEOREM AND QUANTUM STATES

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ABSTRACT
Richard Swinburne argues that theism is a simple explanation, and is therefore more likely true, on a Bayesian analysis of the probability of theism as a hypothesis, particularly as compared to materialism or physicalism. However, numerous other interpretations of probability are possible, and Swinburne fails to take into account some fairly standard concepts from probability theory, such as the sum of probabilities and the Total Probability Rule, or what exactly he means when he says our universe is improbable. Swinburne also does not address Quantum Bayesianism and Quantum Mechanics and its impact on his theory. This paper addresses these concerns, and concludes we have much work to do to obtain convincing results if Swinburne wants to convince us of his theistic hypothesis.

Keywords: Swinburne, Theism, God, Probability, Frequentism, Total Probability Rule, Bayes’ Theorem, Quantum Bayesianism, Quantum Mechanics.

1. BACKGROUND TO THE PROBLEM
Richard Swinburne presents cosmological argument in defense of theism [1, 2]. God; Swinburne argues, is more likely to bring about an ordered universe than other states [3]. Swinburne argues that both theism and materialism/physicalism [4] can explain, with varying degrees of success, how the universe came to be; both theories fit the evidence [5]. But, Swinburne notes, there is more to scientific explanation than merely fitting the evidence. In particular, theories also should have the appropriate scope and level of simplicity [9]. What Swinburne means by scope is how broad the theory is (how many phenomena it can account for). The more ambitious a theory is (the broader the scope), the less likely it is true [4]. Similarly, he argues, the better a theory fits the evidence and our background knowledge, the more likely it is true [4]. Moreover, the simpler a theory is, the more likely it is to be true [9, 10]. “The simple is more likely than the complex” [11]. “Simplicity is the major determinant of intrinsic probability” [15]. “The simplest explanation is, other things being equal, the most probable” [15]. Parsimony is therefore invoked when hypotheses explain the evidence equally well [14, 15]. There are, of course, an infinite number of other possible explanations which could be drawn from known data, and other hypotheses which could cover all the points to be explained. This is known as the curve-fitting problem [16]. And materialism/physicalism and theism both explain the universe. So the way we will choose the most likely hypothesis is on the basis of its simplicity [17]. So consider two graphs of competing hypotheses [19]. No matter how the data turns out, it will always be possible to draw some curve which can exactly fit the data. But when we are faced with the same data and any number of competing hypotheses, we intuitively prefer the simpler graph [19], unless strong evidence comes forward that the more complex theory is to be preferred. Smooth curves are thus said to be better than irregular ones, and, it is said, postulating fewer entities is better than more entities [20]. Of course, we should at this stage recognize that the question of the best characterization of the simplicity of a scientific hypothesis, is a complex topic. But for the sake of this paper, let’s assume that such theories are understood well enough, and that Swinburne’s model applies. So let’s see whether Swinburne’s notion of simplicity will in fact show that theism is a simple scientific hypothesis. Now: Swinburne acknowledges that materialism/physicalism can account for the facts of the universe, that is, that both theism and physicalism fit the evidence [21]. Similarly, the scope of theism is the same as that of physicalism; they both seek to explain the entire universe, so theism has no obvious advantage there [22]. The key difference; Swinburne argues, is that theism is a simpler explanation [23, 24]. But what does Swinburne mean by “simple”? There are at least two senses of the term “simplicity” that Swinburne seems to use. Following Lewis [23], they are intrinsic (qualitative) and quantitative simplicity [26]. Quantitative simplicity suggests that the hypothesis that “God exists” is a simpler explanation because God is one entity [27]. It’s better; Swinburne seems to think, that one should have only one unexplained simple entity, than lots of unexplained simple entities. So, for example, polytheism would be a more complex hypothesis because it proposes that there are multiple deities [29] who were responsible for making the universe the way that it is. Each deity, in polytheism, has a different appearance, behavior and personality, and as such, each of these deities may have in some way contributed to the creation of the world as it currently stands and left their characteristic marks. Swinburne, however, rejects polytheism [26], as it involves invoking more unexplained explainers than does monotheism, which invokes only one unexplained explainer: God. Thus, theism is quantitatively simpler than polytheism, as it has fewer unexplained parameters or explanations.
The second sense of simplicity that Swinburne seems to rely on is a form of intrinsic (or qualitative) simplicity; how simple the hypothesis is internally \[^{[40]}\]. “A really simple hypothesis is intrinsically more probable than a disjunction of many more complex hypotheses.” \[^{[31]}\]. Thus, many more hypothetical explainers is less simple than one explainer. \[^{[32]}\]. Therefore, physicalism/materialism is complex, because it postulates many entities (it is quantitatively complex), and it does not possess the intrinsic (or qualitative) simplicity of theism. Materialism/physicalism has many unexplained entities; perhaps as many as there were particles involved in the Big Bang. Of course; Swinburne is not denying that these physical entities exist(ing) or could have caused our universe to come to be. He is not, for example, denying the “Big Bang” hypothesis. Rather, he is concerned about the lack of antecedent explanations prior to the Big Bang \[^{[33]}\]. Thus, theism is not denying that something always entails a “why,” or “for what purpose.” A reason \[^{[34]}\]. As evidence for this claim; Swinburne cites the admittedly physicalist model known as “anomalism monism”, explained in Davidson’s *Actions, Reasons, and Causes* \[^{[35]}\]: God keeps everything in existence, and ensures that all particles of the same type are kept alike \[^{[40]}\].

### 1.1. Creation Continuants
Swinburne argues that we cannot explain, within the materialist/physicist paradigm, why we have the laws of the universe that we do and why they continue to operate. Our continued existence, he suggests, could be due to the continuous action of a Person who brings it about, by a basic action, moment by moment \[^{[36]}\]. If the causal series of our universe was begun by the actions of God, it could be the case that the objects of the universe continue to operate under the laws of the universe, because of repeated actions by such a Person \[^{[37]}\]. On top of this; Swinburne claims that it is amazing that all subatomic particles of a particular type are so similar, and that it is God that keeps them the same \[^{[38, 39]}\]. This is the doctrine of creation continuans \[^{[38, 39]}\]: God keeps everything in existence, and ensures that all particles of the same type are kept alike \[^{[40]}\].

### 1.2. God is a beneficial trade-off: Theism and the Neptune Argument
Swinburne argues in effect that God is a trade-off solution \[^{[41]}\]. By adding one entity, God, we get a better explanation. Thus, although theism may be add one entity, it offers greater EP. This is not unheard-of in science, as we know. For example, scientists observed that Uranus has an irregular orbit \[^{[42]}\]. They could only explain this by positing the existence of an additional entity: Neptune. Thus, by suggesting that there was just one extra entity, the explanatory power of science was increased. So, by analogy, if we just add one entity, God, we can explain our complex universe\[^{[43]}\].

### 1.3. God is an omnipotent person
But what kind of ultimate simple Being are we talking about? What are his properties? Swinburne argues that a specifically omnipotent Creator is the simplest \[^{[44]}\]. Since zero power and infinite power are the two most simple postulates, it seems likely that God, if he is the simplest being, would either have zero or infinite power. Whilst a god with zero power would be equally simple to an omnipotent God, such a god would nonetheless not be able to explain anything. Thus God’s power must be infinite. Swinburne’s arguments for omniscience, omnipresence, and omnibenevolence, are similar, and we omit them for brevity \[^{[45]}\]. Now, an all-powerful all-good God can be expected to exercise his powers in a certain way, we can expect him to create a universe such as ours \[^{[46]}\]. Swinburne feels that theism — the view that the universe was designed intentionally by a (single, quantitatively simple) person of the utmost (intrinsic) infinite simplicity— is a simpler hypothesis, than physicalism. Thus, theism is a priori more probable because it is simpler \[^{[47]}\]. It is thus more likely the case that God created the universe \[^{[48]}\].

### 1.4. Personal explanations are simpler
Swinburne feels that the hypothesis of theism has a further advantage in its favour because it posits a “personal” explanation. We can infer, based on what we know about a person, what they will likely do \[^{[49]}\] \[^{[50]}\]. Therefore, if we know what God is like, we know what he is likely to do: create a universe. Swinburne says that to intend to do something always entails a “why,” or “for what purpose.” \[^{[51]}\]. We can also know someone’s intentions without knowing his brain states \[^{[52]}\]. Therefore; Swinburne argues, intentions — personal explanations — are not reducible to brain states. “The intention in an action that an agent is performing is not the same as any brain event that might be connected with it” \[^{[53]}\]. As evidence for this claim; Swinburne cites the admittedly physicalist model known as ‘anomalism monism’, explained in Davidson’s *Actions, Reasons, and Causes* \[^{[34]}\]. Swinburne argues, following his interpretation of Davidson, that physicalist interpretations of action invariably refer to mechanisms rather than reasons. However, to intend to perform some action necessarily entails a “why,” or “for what purpose;” a reason \[^{[54]}\]. And, Swinburne argues, we need to posit the existence of a person in order to adequately explain the reasons for an action \[^{[55]}\]. Well, what kind of person would explain our universe? God; Swinburne answers. And contrary to Mackie’s naïve mechanistic model of what a person comprises \[^{[56]}\], God is not a physical kind of person. God is an infinite, disembodied person. God’s will is thus not scientifically explicable \[^{[57]}\]. God’s actions are not mediated; his intentions manifest as basic acts, immediately \[^{[58]}\]. Thus God created the universe ex nihilo as a basic action, an unmediated
rational act \[^{60}\]. Part of the attractiveness of theism, and part of what makes it simple, then, is that it offers a personal explanation rather than a complex mechanical explanation.

1.5. Whether theism is more probable than materialism/physicalism

Swinburne claims that since theism is the most simple hypothesis, and since simplicity is a major determinant of posterior probability \[^{61}\], theism has high posterior probability \[^{62}\]. If the probability of God existing (h) is greater, given an ordered universe (e), P(h|e&k), than the probability of God existing apart from that evidence P(h|k), then, the presence of an ordered universe (e) supports or confirms God’s existence (h) \[^{63}\]. Let’s consider this in terms of Bayes’ Theorem \[^{64}\]. If, for a moment, we take it that materialism/physicalism (h\textsubscript{m}) and theism (h) are of similar explanatory power, it is the factor P(h|k) — the prior probability (PP) — which will lend support to whether theism is more probable than materialism/physicalism. And this factor can be evaluated on the basis of how simple the hypothesis is \[^{65}\]. Bayes’ Theorem is a calculation of the likelihood of any hypothesis, calculated by the product of its explanatory power (EP) and its prior probability (PP) \[^{66}\]:

\[
P(h|e&k) = P(h|k) \frac{P(e|h&k)}{P(e|k)} \tag{67}
\]

Swinburne states that the scope of materialism/physicalism and theism is the same: to explain the universe \[^{68}\]. But since theism is simpler, he argues, it is higher in the PP factor. Hence the probability of theism is higher, even if the EP of materialism and theism are roughly the same. Hence, the calculation as a whole, will yield a higher result for theism, if PP is significantly higher for theism, than it is for materialism/physicalism. It seems a priori improbable that a complex thing like the universe would have started complex. It is more likely, a priori, that something simple, like God, would have been at the start of the universe. Swinburne argues that God is the simplest type of person, as he is infinite in every respect \[^{69}\]. Indeed, God is the simplest explanation because he is the simplest person, as personal explanations do not require mechanistic explanations \[^{70}\]. Thus God has a high prior probability, and so, it is more likely that God would exist than this universe would exist \[^{71}, 72\]. It is also likely that something all-good, like God, would have reason to create a complex universe, capable of supporting life and beings with free-will \[^{73}\]. Thus, Swinburne concludes, “[e]xplanation clearly ends with God.” \[^{74}\].

2. CRITICISMS

2.1. Should we always prefer a simpler theory?

Suppose theism really is simpler than materialism/physicalism. Should we prefer theism on the grounds that it is simpler? Is it not perhaps merely an intuition that science prefers simpler hypotheses? \[^{75}\]. Consider the case of the number of fundamental chemical elements. According to the Ancient Greeks, there were four: earth, air, fire, and water. According to modern chemists, there are 118, of which several are man-made. This is an example of how science has not favoured quantitative parsimony. Consider heredity next. “Meiosis and random genetic drift also may be ‘complicated’ in their way, but that is no basis for supposing they rarely occur.” \[^{76}\]. Modern theories are in some cases, and in some sense of the word, more complex, because the universe just is complex. We don’t, therefore, just accept a theory because it is the simplest or has the fewest explanatory entities \[^{77}, 78, 79\]. We only accept a simpler theory if both competing theories equally well explain the facts, or if both theories’ formulae fit the data. What really counts, is whether the explanation works, or what its strength is, in terms of its ability to predict \[^{80}\]. What counts, then, is explanation \[^{81}\]. Furthermore, background knowledge k also influences how likely a later event will be as predicted by a hypothesis; it’s not just the simplicity of the hypothesis that counts \[^{82}, 83, 84\]. The difference between hypotheses must be judged on concrete reasons or evidence \[^{85}\].

2.2. Whether God is intrinsically (or qualitatively) simple

Leaving aside whether God is a good explanation due to reasons of space, consider this argument about whether God is qualitatively simple.

**Argument a:** For each entity or state in the universe, there is one mental state of God. Therefore, since there are a large number (n) of entities and states in the universe, God is n-complex. Since the universe contains n entities and states, a theistic universe is at least 2n complex. If God is counted as an entity, the theistic universe is 2n+1 complex. But 2n+1 > n, therefore theism is more complex than physicalism.

In detail:

1. God is omnipresent; of infinite extent \[^{86}\]
2. Anything of infinite extent has no boundary \[^{By definition}\]
3. Anything without a boundary has no body \[^{From argument 2}\]
4. Therefore God is disembodied. \[^{From argument 1;2;3}\]
5. If God lacks a body, he must be a mind or spirit, or not exist. \[^{By definition of ‘spirit’}\]
6. If God is a disembodied mind, then his mental states are his parts.
7. There are \( n \) entities/states in the universe.
8. God is omniscient.
9. Therefore God has a mental- or knowledge-state about every entity/state.

10. Therefore God has \( n \) mental- or intrinsic (or qualitative) states.
11. If there are \( n \) entities and states of entities in the universe, and \( n \) mental states of God about those entities and their states, and there is a God, then theism posits \( 2n+1 \) states of being, to materialism/physicalism.

12. \( (2n+1) > n \)
13. Therefore theism is intrinsically (or qualitatively) less simple than materialism/physicalism.
14. Swinburne says that simplicity is the sign of the true.
15. Therefore materialism/physicalism is more likely true.

Such a Being is necessarily more complex than its creation, just as a potter is more complex than a pot. God must be more complex than his own creation in order to conceive and plan ahead for all the states of those entities. Moreover, if creation continuants were the case, then God’s thoughts would have to be constantly dwelling on the activities, positions, energies, functions, futures, pasts, and structural roles, of every single subatomic particle in the universe, as well as the objects that those particles comprise. If God were paying attention to every particle in the universe, it would suggest that he should have thoughts about every particle in the universe, so as to maintain their existence and state. A God of such complexity could not be simple. God must therefore be the most complex possible being, in need of explanation. But if that’s true, God must be less probable than his own creation if probability is a measure of simplicity. So what model of probability is Swinburne using when he argues that simplicity entails higher probability? We will discuss this further on.

2.3. Objections to Argument \( \alpha \) above

One might argue that God is only \( n \) complex when a universe exists, since he would only then have \( n \) thoughts. Thus, it may be argued, God is not always \( n \) complex. This argument would, however, only work if God never contemplated anything. As soon as God contemplates a universe of any size or detail, then his thoughts instantly become as complex as that universe, and God ceases to be infinitely simple. Since God is omniscient and at any time knows the future of the universe he will create, and the future states of particles in that universe, God is always at least \( n \) complex even if the universe doesn’t yet exist, since he has a Divine Plan. Therefore God is the most complex possible being. A further objection, is that this argument depends on a kind of philosophy-of-mind assumption that mental states are somehow separate entities, or that the mind is somehow fragmented, much as is proposed in Dennett’s “multiple drafts” model. Why, in other words, could God’s mind not be just one complex state? For example, a mathematical representation of a superconductor represents states of a myriad of electrons. And I can have a mental state of a set of items. Therefore states with varied contents need not be more than one state. This rebuttal seems compelling. But even if God had a single unified mind, he’d still have \( n \) mental objects, or concepts, in his mind — and that is sufficient to make him at least \( n \)-complex intrinsically (or qualitatively). Just as there being a set of dogs does not mean there is only one dog as soon as one conceives of the set of dogs. God is not a set; remember, God has no boundaries. God is all-inclusive because he is omnipresent. But perhaps God could know formulae or laws, instead of all \( n \) states, and, as is posited in the doctrine of Deism, God could merely have created the laws of the universe, and then “sat back” and let the universe take its course. Hence, God’s omniscience would not be a case of knowing the dealings of every of the \( n \) entities, but rather, it would be the case that God simply knows in a predictive sense, or instrumentalist sense, what will happen with any scenario he contemplates, because he knows his own laws. But if this were true, it would seem to strip God of real omniscience. Another concern might be around whether complexity is proportional to probability. If Swinburne is wrong about this, then God’s being (2\( n+1 \)) complex need not make him an implausible hypothesis; rather, his plausibility would be proportional to something else, like how well he explains \( e \). However, if Swinburne is right that complex things are implausible, then God is implausible. All so brook, C\([91]\) raises a similar objection. Suppose God knows facts about the universe as something akin to Platonic Forms, or as general properties (or sets, again), rather than as discrete? Suppose, for example, that God doesn’t know where every electron is, but does know that electrons all have a certain spin, charge, momentum, etc. If this is true, then God would not have to have \( n \) mental states or “ideas”. But this proposal seems to strip God of omniscience. If God knows everything about us, it seems reasonable that he should know everything about every particle that makes us up, too. Otherwise God’s omniscience is no better than our level of knowledge; we know what people are like, too; but we don’t know everything about them. Lastly, we might also object to the argument by accepting Lewis’ and Sober’ claims\([92]\) that quantitative parsimony is not an issue for a scientific theory. This objection would say that it is not a problem that God has almost infinitely many mental states,
because quantitative parsimony is not required. But even if Lewis and Sober are right on this matter, this still doesn’t mean that God is simple. At the very least, this refutes Swinburne’s claims about divine simplicity.

2.4. Other concerns with simplicity
Complexity, in the sense of having many functional interrelated parts, appears late in nature. The first animals were unicellular; conscious multi-cellular animals came later. Single molecules came before crystals. In cosmology, gas nebulae came before life-bearing planets. In the human realm, spears preceded Boeings. Thus simpler things come before complex things. Creative intelligence is a result of a process of evolution and cannot start out intelligent. Intelligence is complex. Therefore, intelligence must come later [95]. There would have to be an explanation as to how God, a supreme intelligence, came to exist before anything else. Swinburne has not explained in what sense an intelligence could be simple. Secondly, what if the problem with theism is not quantitative parsimony, but qualitative? Theism takes on two new burdens of proof — as to whether any sorts of laws or causes govern the spiritual realm, and the fact that God’s existence introduces a new kind of substance — the spiritual. Consider Lewis’ modal realism, in which all possible worlds are actual [96]. Modal realism is quantitatively not parsimonious, in that there are infinitely many worlds, but the qualitative simplicity of each world lies in the fact that each world is like ours; so it’s not as extravagant a theory as it seems prima facie. But if God is supernatural, he’s fundamentally different to the rest of the universe. God is not qualitatively parsimonious on Lewis’ model, as God introduces a new type of substance — the spiritual [95]. As we saw earlier; Swinburne maintains that the simplest explanation for any action by a person is a personal explanation [98]. But persons are complex because they have desires, needs, wants, mental states, etc., all of which require prior explanations and mechanisms of implementation. Why did God choose this universe? How did he go about moving matter by sheer will? [97]. Lastly, it is also unclear that infinity is the simplest number.

2.5. Whether God has the highest prior probability
Let us now return to Bayes’ Theorem: \( P(h|e&k) = P(e|h&k) \times P(h|k) / P(e|k) \). Swinburne argues that \( P(e|h&k) \) is greater for theism [99]. If this is so, then Bayes’ Theorem yields \( P(h|e&k) \) greater for theism than materialism/physicalism, as long as the other factors are held equal. Let us, for now, disregard \( P(e|k) \), and consider the other two values that determine the posterior probability of our competing hypotheses. These two values are: the prior probability, \( P(h|k) \), and the hypotheses’ ability to explain the evidence, \( P(e|h&k) \). Let’s assume that \( P(e|h&k) \) is marginally better for theism. In other words; Swinburne’s argument hinges on whether he can make the case that theism really is the simplest hypothesis. But what if the prior probability of theism is much smaller than that of materialism/physicalism, due to Argument a? Recall that Swinburne argues that a simple explanation is more likely true [79]. By inference, then, a more complex explanation is less likely true. Thus, if the prior probability (PP) of the hypothesis can be measured on its intrinsic (or qualitative) complexity or simplicity: for theism will be equal to \( 1/(2n+1) \) as opposed to materialism/physicalism’s \( 1/n \), as claimed in Argument a. This means that even if \( P(e|h&k) \) is a bit higher for theism, it will be made lower by the multiplication with the lower PP of theism. Obviously, if \( P(e|h&k) \) for theism is very much higher than \( P(e|h&k) \) for materialism/physicalism, the PP might not matter as much. Brown [100] and Resnik [101], moreover, point out that if we keep performing an experiment and getting enough evidence, eventually our background knowledge will build up so that we get to the true probability. If this is true, then PP doesn’t matter. Over time, the PP will turn out to be irrelevant, because the weight of evidence will come up to its correct level statistically. Let’s take an example. If you and I are about to flip a coin and you guess that the probability of heads is 0.8, and I guess it’s 0.2, those would be our prior probabilities. But, over time, repeating the flip, the evidence and the background knowledge will start to turn out closer and closer to 0.5, the true value. Our PPs in this case would become ever more irrelevant as more evidence came in [100]. We can however only know of this one case of existence — our universe. So we can’t say very much about how probable it was, or be able to talk about ‘repeated experiments’ to get more accurate prior probabilities — more on this below.

2.6. The Complexity Quotient
Gwiazda [100] argues that Swinburne needs to provide numbers to make his argument more plausible [104]. He also argues that by Swinburne’s own estimates, theism is at most twice as probable as the universe. Here is his argument. Suppose we take W as the claim ‘one wooden block exists’. And suppose we recognise that the wooden block could have a variety of shapes andcolours, namely: \( w_1 = \text{“one small light wooden block exists”}; w_2 = \text{“one large light wooden block exists”}; w_3 = \text{“one small dark wooden block exists”}; w_4 = \text{“one large dark wooden block exists”}. \) Let’s assume that these versions of W are equiprobable. Thus the probability of W being any particular one of \( w_{1...4}\) is given by

\[ P(W|k) = 4 \times P(w_i|k) \]

Which mathematically implies that
P(W|k) / Pr(w_i|k) = 4 \hspace{1cm} [105]

Gwiazda calls the quotient P(h|k)/P(e|k) “the complexity quotient”: how complex a hypothesis h is, in comparison to the evidence e that it is meant to explain [109]. Remember now that the value of P(e|k) has to be ≥ P(e|h&k) x P(h|k) to ensure that the posterior probability is never greater than 1.0. Thus, substituting 1 for P(h|e&k) and Swinburne’s own value of 0.5 for P(e|h&k) [107], we find the following result:

\[
P(h|e&k) = P(e|e&k) P(h|k) / P(e|k) \]  
1 \geq P(e|e&k) P(h|k) / P(e|k) \hspace{1cm} [As argued above. ibid.] 
1 \geq (0.5) P(h|k) / P(e|k) \hspace{1cm} [108] 
2 x 1 \geq 2 x (0.5) P(h|k) / P(e|k) \hspace{1cm} [Multiplying throughout by 2] 
2 \geq P(h|k) / P(e|k)

From this, we can derive:

2 x P(e|k) \geq P(h|k)

Which means that h has a maximum probability double that of the universe e. But if theism is at most twice as probable as the universe, it seems to not be really that simple, since the universe is very complex, and Swinburne is tying complexity to probability. If e really was complex, and h really as simple as Swinburne insists [109], then ratio of probability should be much higher than 2.0 [109].

Since Bayes’ Theorem must yield P(h|e&k) ≤ 1, from probability theory, it follows that P(e|e&k) = 0.5, unless P(h|k) and P(e|k) are similar values. “Put loosely, great complexity is not likely to spring forth from great simplicity.” So either Swinburne must abandon his estimate of P(e|e&k) = 0.5, or he must abandon the claim that God is very simple [111].

But is Gwiazda right about this? There are two related problems. The first trouble is that P(e|k) is not hypothesis-independent, as one might assume from glancing at the version of Bayes’ Theorem that Swinburne uniformly prefers. The Total Probability Rule [112], is as follows:

\[TPR: \quad P(e|k) = P(h|k) P(e|h&k) + P(\neg h|k) P(e|\neg h&k)\]

If we substitute this into Bayes’ Theorem as Swinburne uses it, we obtain:

\[P(h|e&k) = P(e|e&k) P(h|k) / [ P(e|e&k) P(h|k) + P(e|\neg h&k) P(\neg h|k) ] \]

In fact, this latter statement is quite simply the more complete version of Bayes’ Theorem. And for more than two hypotheses, the denominator acquires a sigma sign (Σ) for summation of the individual hypotheses. P(e|k) is thus not hypothesis-independent, since it is equivalent to Hacking’s TPR. Gwiazda’s ratio of 2 x P(e|k) ≥ P(h|k) is, therefore, strongly constrained by P(e|k). If e renders e more probable, the evidence e must always be more probable than or at least as probable as the hypothesis h. The higher P(e|k) or the value of TPR, the lower the value of the ratio in Bayes’ Theorem. The point is, since P(e|k) is not in fact hypothesis-independent, since it expands to TPR, it follows that we cannot make P(e|k) as arbitrarily low as Swinburne would like. Indeed, there might be other complex theories which have low complexity quotients and vice versa [114]. Let’s see, furthermore, why this value “2.0” is problematic. Suppose Gwiazda claims that 2 x P(e|k) ≥ P(h|k). This, by subject-of-formula, means that 2 ≥ P(h|k) / P(e|k). But since P(e|k) = TPR, it follows that the ratio P(h|k) / P(e|k) should never be greater than 1.0. In other words, the inequality should be something like 1 ≥ P(h|k) / P(e|k). This suggests that either Gwiazda has made some mistake, or he has found a significant error in Swinburne. Stating that 2 ≥ P(h|k) / P(e|k) implies that the probability of the hypothesis is greater than the value of TPR or the probability of the evidence; it claims that God is more likely to exist than this universe, since “2 ≥” implies a range of values for P(h|k) / P(e|k) of [1,2] — otherwise we’d have “1 ≥.” Thus, the value of P(e|k) cannot be very small relative to P(h|k). Of course, a ratio of two probabilities is no longer a probability; hence the figure of 2.0 is not the issue. What is of concern is that Gwiazda fails to indicate that P(e|k) is not independent of h, since P(e|k) = TPR, and this places constraints on the possible values. The higher P(h|k) the more the disjunct places constraints on the prior probability. In order for Swinburne’s argument to hold true, then, something like this would need to be true: P(h)/P(\neg h) > P(e|\neg h)/P(e|h) [115]. In other words, the probability of the hypothesis (divided by the probability of its being false), would have to be greater than the probability of the evidence (divided by the probability of the universe not arising at all). Yet to get a reasonable range of values here, given Swinburne’s own value of 0.5 for P(e|h), the value of P(h) — the prior probability of theism — would have to be small, no larger than 0.2. Which is not what Swinburne wants; it implies that in a best-case scenario, a probability of 1:5 with the odds against theism. Thus the 0.5 value must be wrong.

2.7. The Sum of Probabilities

Gwiazda [105] also points out that the total probability of any range of possible exclusive and exhaustive explanations or hypotheses must add up to 1.0. So, where h_p is polytheism, h_m is materialism/physicalism, h_n is ‘no explanation,’ and h_i is monotheism, then

\[P(h_p) + P(h_m) + P(h_n) + P(h_i) = 1.0\]
Gwiazda then points out that Swinburne admits that P(h) may be very small, say, 0.001 \cite{117, 118, 119}. If that is the case, then the other factors, P(h), P(h), and P(h) must add up to 0.999 \cite{120}. However, if P(h) is much lower than P(h), since P(h) is simpler, it means that P(h) P(h) and P(h) must make up the bulk of that remaining 0.999 \cite{121}. However; Swinburne argues that P(h) is much lower than P(h) \cite{122}. So the trouble is, unless Swinburne wants to claim that P(h) is a larger value (which he should), then we have to explain how the other small values make up the bulk of the probability of 1.0. Thus Swinburne has to argue that theism is highly probable, if the other possible hypotheses are highly improbable. Now, presumably Swinburne is committed to the view that theism is a highly probable explanation for the universe. So if we rule out a "no explanation" option, and if one of these values P(h), say — is actually closer to half, then at least one of the other values, P(h), perhaps, must also be close to half, if P(h) is really small. Which means, in a worst-case scenario, unless Swinburne states that P(h) is very high, he has to admit that P(h) is closer to the value of P(h) than he may like.

2.8. What model of likelihood or probability?
We cannot calculate the probability of this universe coming to be, since it is a single case, and we cannot calculate the probability of a single case. Consider the probability that a card drawn randomly from a standard deck of cards is an ace. The probability can be calculated by dividing the number of aces by the number of cards, i.e., \( \frac{4}{52} \). This view of probability, which is called 'frequentism,' relies on a series of trials. Swinburne \cite{123} calls this “Statistical probability” — “a measure of the proportion of events of some kind in a population” \cite{124}, it is “a proportion of events, either in an actual class or in a hypothetical class” \cite{125}. But if probability is to be measured by how many times an event has occurred in a range of possible events, then the probability of this universe coming to be must be calculated by dividing the number of universes that might have been like ours, by the number of universes that have ever existed. We would need to know how long these other universes generally lived, whether they supported life, and whether they had regular laws. Now, if we do not know how many times an ordered universe has come into being (how frequently a universe occurs), and we do not know how many universes have ever existed, we therefore cannot calculate how probable our universe’s coming-to-be was. Thus, if we cannot calculate the probability of our universe coming to be, it may be meaningless to talk of its probability at all \cite{126, 127, 128}. If the probability of the universe coming to be cannot be assessed, then the theist cannot make his claim that this universe coming to be would be improbable without God. While Swinburne is aware of this problem \cite{129}, he fails to successfully address it. The difficulty is known as the reference class problem. By defining a “reference class” or group of entities which seem to be similar, we can compare the particular token or entity to that class to see if it belongs \cite{130}. But in the case of the universe, as Hájek puts it, “no single reference class seems to be the canonical one” \cite{131}. We can’t compare this universe to anything because we do not in fact know about any other universes. Alan Hájek \cite{132} and Michael Resnik \cite{133} also dispute the frequentist model of probability, upon which Swinburne’s argument might well depend. Frequentism is useless for a single case \cite{134} such as this universe. You can’t get a probability value for one event (such as the Big Bang) unless you know of other similar events. Here are a few more difficulties:

i. Universal generalisations (“all”) and existential claims (“is”) are absolutes and single cases. Thus they have no probabilities, if frequentism is true.

ii. The existence of other objects in the universe is implied by a frequentist understanding of probability. If anything has a probability, on a frequentist model, it has to have been measured against others of the same class, so the other members must exist \cite{135}. This means that if the universe-coming-to-be has a probability, there must be other universes coming to be, if frequentism is true. But “statements of probability about a mind, an object, or an event, seem to be simply irrelevant to the existence of other minds, other objects, other events of the same sort” \cite{136}.

iii. A die which has never been tossed still has a chance of \( \frac{1}{6} \) of coming up 6, even if we don’t toss it \cite{137}. So the actual tosses (the frequency, which is zero in this case, because it’s never tossed) is irrelevant to its chances.

iv. A coin tossed an odd number of times biases in favour of one of the sides. Therefore there is no such thing as a fair coin which is tossed an odd number of times; it will always be biased to one side. So a coin’s fairness is a function of how many times it is tossed. This makes no sense. Thus frequentism is absurd \cite{138}. There are two possible escape routes: hypothetical frequentism (e.g. “were the world to be instantiated many times, ours would be rare”), and propensity theory. Hypothetical frequentism says that the measure of probability is taken over a run of possible events, such as the set of all possible universes. The problem with hypothetical frequentism is you can’t say which portion of a run or sequence of events (e.g. a series of coin tosses) represents an accurate and representative sample of things that have come to be. So, on this model, we might just hit a run of life-bearing universes for a short while, and then have infinite ages of time without life. So our being in a life-bearing world has no bearing on the run of all possible worlds.

But in fact, this would be an instance of the Gambler’s Fallacy. This fallacy goes roughly as follows: If \( n \) heads have emerged from all the \( n \) coin tosses so far, and no tails have emerged, and if the coin is fair — that is, it falls equally often on heads as it does on tails — then one should start betting on tails, because “things will change soon”
Prima facie, this seems like a very rational idea. But why is it a fallacy? Because it implies that the previous events (n heads) will somehow predetermined a new arrival of tails. But if the coin really is fair, then it will be unbiased, i.e. it will not favour heads over tails, and each individual toss or trial will be independent of prior trials, which prior trials will not determine future trials. If prior trials did predetermined future trials, then the coin would be dependent on prior trials and therefore not be random or fair \[140\]. So, just because we’ve only seen a run of heads (living worlds) now, it doesn’t mean that it “has to” change to tails (dead worlds) now; it could change to a long run of tails tomorrow, or next year, or never. If the coin is fair, then the reasoning that it will ‘change soon’ is faulty, because previous tosses of the coin do not bias the coin for future tosses. Hence, this is called the Gambler’s Fallacy \[141\]. It seems, then, that Swinburne should go for propensity theory; that to say something is ‘improbable’ is to say that it does not have a propensity or tendency to produce certain results. Swinburne has to argue that, in a manner of speaking, the coin is biased in favour of living universes, i.e., that God would make such a world as ours. Thus, on the propensity model, Swinburne’s claim amounts to the idea that the Big Bang was not such that it would likely produce this specific universe, but God is the sort of being that would create such a universe. However, Stenger disagrees. He argues that this is indeed just the sort of universe that a Big Bang would produce; and indeed, there’s nothing to say that God would produce precisely this world and no other. Differences between possible worlds that God could choose to create, would likely have a normal (bell curve) or Gaussian distribution \[142\]. Universes which obey quantum symmetries like ours could be a statistical norm \[143\]. This means that statistically speaking, we are likely to be in a hospitable (living) universe, not the other way around, since the physics required to make our universe follows from basic equations. All the conservations of matter, energy, charge, and so on, are mathematical necessities within the Standard Model \[144, 145\].

3. QUANTUM UNCERTAINTY AND BAYES’ THEOREM

3.1. Quantum Interference Effects

Some recent work has been done on integrating quantum probability with Bayes’ formula. Some authors use the personal probability interpretation of Bayes’ Theorem (as Swinburne does) to come up with what amounts to a relativist or instrumentalist interpretation of quantum mechanics known as QBism, in which “the quantum state assignments are relative to the one who makes them” \[146\]. Conte argues, comparatively, that Bayes’ Theorem can however take a quantum-probabilistic effect on the values of the individual probabilities of decisions \[147\]. In quantum mechanics, we have compatible or incompatible entities (observables). Quantum entities are said to be incompatible when we can not assign simultaneously defined values to them, as a result of their measurement. Quantum states may thus be subjected to the “quantum interference effect.” Any quantum state, moreover, can have more than the usual Boolean (true or false) values; this is called the case of a quantum “superposition” state \[148\]. In a superposition, the state is simultaneously both true and false at the same time, until interfered with, e.g. by an observer. When such interaction occurs, the superposition reverts to one of the Boolean conditions or states, i.e. the wave function collapses. Hence, Conte explains \[149\]: “Let us [suppose] that we have two basic questions [or hypotheses] that we call A and B. Let us also assume that they are dichotomic, that is to say, only two values are possible for A and B respectively. A=1 for example means YES, or A=-1, for example means NO. The same thing happens for B. Still let us [suppose] that A and B are variables intrinsically affected by uncertainty, or if you like, from indetermination. This is to say that we have a probability for A to be +1, (or -1), [represented] P(A=+1) and P(A=-1). The same thing for B, P(B=+1) and P(B=-1). Let us consider two possible cases. In the first case, we pose only question A, and the next case, we pose question B, and soon after again, A. In the first case, we have probabilities P(A=+1) and P(A=-1). In the second case we have P(A=+1/B=+1), P(A=+1/B=-1), P(A=-1/B=+1) and P(A=-1/B=-1). For the standard Bayes’ Theorem, we have

\[
\]

and a similar relation for P(A=-1). This is in the classical Bayes theorem.\[150\]

Now let us consider instead that the situation we are investigating is under the domain of the quantum mechanics: Bayes is violated. (i) it is no [longer] true that P(A=+1) = P(B=+1)\(P(A=+1/B=+1)+P(B=-1)P(A=+1/B=-1)\). And a similar relation for P(A=-1) [So now the Bayesian formula] acquires a quantum “Interference Term”:

\[
\]

... the simultaneous presence of questions A and B give interference so that the classical Bayes Theorem is violated; P(A=+1)=P(B=+1)\(P(A=+1/B=+1)+P(B=-1)P(A=+1/B=-1)\) is no longer true, and similarly for P(A=-1). We have to now add a further term that accounts for the interference between B and A. 0 is an angle that measures the interference between the two questions (or hypotheses) A and B. If cos \(\theta\) is zero we have no interference; we have no quantum mechanics and we go back to classical Bayes. If, however, the cosine of \(\theta\) is not zero, this means that A and B interfere and quantum mechanics has a role. As an example, we consider for a selected question that may be +1 or -1. And we have probabilities P(A=+1) and P(A=-1).
Now we consider a combined question $B$ and $A$ with probabilities $P(B=+1)$, $P(B=-1)$ and $P(A=+1/B=+1)$ and $P(A=+1/B=-1)$. We estimate $P(A=+1)$ and $P(A=-1)$ in one case and also estimate $P(B=+1)$, $P(B=-1)$ and $P(A=+1/B=+1)$ and $P(A=+1/B=-1)$. In the first and second case, we should find that $P(A=+1) = P(B=+1)P(A=+1/B=+1) + P(B=-1)P(A=+1/B=-1)$, and a similar relation for $P(A=-1)$. If instead, $A$ and $B$ interfere, such equality will be violated, and will be violated in relation of an added term that is called the quantum interference term $2\sqrt{(P(B=+1)P(B=-1)P(A=+1/B=+1)P(A=+1/B=-1)) \cos \theta}$. The value of $\theta$ expresses the level of interference. Ask a subject the question $A$ or vice versa.

The Hawking/Penrose version of the Big Bang hypothesis, which does not preclude God, but which perhaps gives the collapse of the universal wave function at $t\approx0$, as opposed to the Creationist hypothesis \cite{154}. Without interference from God, as Craig observes, the wave function would likely not have collapsed into an existing-universe, but would have stayed in a superposition state, or collapsed into some kind of non-existence state \cite{155}. Thus, if $A$ is theism (or rather a theory that predicts that God would create this universe), and $B$ is materialism or physicalism, the question is: Does the hypothesis of materialism interfere with the hypothesis of theism? Consider the following. For any two hypotheses, (or as Conte calls them because of his experimental setup, ‘questions’), the sum of probabilities, quantum or otherwise, is still 1.0 \cite{156}. Now, the hypothesis of materialism contains, amongst other things, the Hawking/Penrose version of the Big Bang hypothesis, that the universe started with an uncertain quantum state before entering the Cosmic Inflation period \cite{157,158}. Thus materialism $\psi_m$ can have a quantum-uncertain truth state, where the wave function is $\psi_m$, such that $\psi_m$ is either “The universe starts with a Big Bang and an Inflation period” or “the universe does not start.” Suppose we now represent $\psi_m$ as Conte’s $B$. This means that perhaps the Big Bang inflation period hypothesis could be true ($B=+1$), or it might not be true ($B=-1$). Does this affect theism? Well, it seems to depend on whether theism and materialism are mutually exclusive and jointly exhaustive hypotheses. If they are mutually exclusive and jointly exhaustive, it seems to me that $B$ will have an effect on $A$, and the “interference term” will have to be applied to Bayes’ equation. This would only be true in the sense that the state of $B$ might affect the probability of $A$.

However, if theism and materialism’s Big Bang are not mutually exclusive and jointly exhaustive hypotheses, then it seems that $B$ would not significantly influence $A$. Thus far, both Swinburne and his atheistic opponents have assumed that theism and materialism’s Big Bang are ipso facto incompatible. They are incompatible insofar as the Big Bang excludes the existence or necessity of spiritual entities, such as God. However, if we take a version of the Big Bang theory which does not preclude God, but which perhaps gives the collapse of the universal wave function at $t\approx0$ to

\begin{eqnarray}
QIT &=& 2\sqrt{(P(h)P(\neg h)P(e|h)P(e|\neg h)) \cos \theta}.
\end{eqnarray}

Naturally, the interference term has to be such that the entirety sums up to $\leq 1.0$, since probabilities cannot exceed 1.0.

### 3.2. The Relevance of Quantum Mechanics to Theism

Now we can see the relevance of quantum mechanics to the question of theism. There are four probabilities that we can assess with this new methodology:

- i. The probability of the truth of theism;
- ii. The probability that God would have initiated the Big Bang or created this universe;
- iii. The probability of the truth of physicalism/materialism;
- iv. The probability of this universe coming to be, given the collapse of the wavefunction at $t\approx0$ \cite{158}.

Of these above, only (i) and (iii) are apparently incompatible; (ii) might be compatible with either (i) or (iii) or (iv).

The purpose of Swinburne’s argument is to discuss the probability of the universe having come to exist (given that it exists). Swinburne claims that the eventuation of this universe is improbable. Suppose we consider the physical start of the universe at $t\approx0$, as opposed to the Creationist hypothesis \cite{155}. Without interference from God, as Craig observes, the wave function would likely not have collapsed into an existing-universe, but would have stayed in a superposition state, or collapsed into some kind of non-existence state \cite{156}. Thus, if $A$ is theism (or rather a theory that predicts that God would create this universe), and $B$ is materialism or physicalism, the question is: Does the hypothesis of materialism interfere with the hypothesis of theism? Consider the following. For any two hypotheses, (or as Conte calls them because of his experimental setup, ‘questions’), the sum of probabilities, quantum or otherwise, is still 1.0 \cite{156}. Now, the hypothesis of materialism contains, amongst other things, the Hawking/Penrose version of the Big Bang hypothesis, that the universe started with an uncertain quantum state before entering the Cosmic Inflation period \cite{157,158}. Thus materialism $\psi_m$ can have a quantum-uncertain truth state, where the wave function is $\psi_m$, such that $\psi_m$ is either “The universe starts with a Big Bang and an Inflation period” or “the universe does not start.” Suppose we now represent $\psi_m$ as Conte’s $B$. This means that perhaps the Big Bang inflation period hypothesis could be true ($B=+1$), or it might not be true ($B=-1$). Does this affect theism? Well, it seems to depend on whether theism and materialism are mutually exclusive and jointly exhaustive hypotheses. If they are mutually exclusive and jointly exhaustive, it seems to me that $B$ will have an effect on $A$, and the “interference term” will have to be applied to Bayes’ equation. This would only be true in the sense that the state of $B$ might affect the probability of $A$.
God, then God might well use the Big Bang or Cosmic Inflation to realise the creation of the universe. There might also be other hypotheses than theism that are relevant, e.g. polytheism, pantheism, and so on. Those hypotheses will be incompatible with monotheism. But there’s nothing inherent in the Big Bang model that precludes a theistic start to the Big Bang. It is only the case that theism would be false if the Big Bang model necessarily precluded theism. So whether this is the case turns on the compatibility of hypotheses A and B (theism and theistic-exclusive materialism). More precisely, given the QIT, only if the probability of A or B, or cos θ, goes to zero, does the QIT go to zero \([159]\). Only under those potential conditions would quantum states and probabilities have no bearing on the initial conditions of realization of either hypothesis, or their probabilities. We do not know, ab initio, whether theism or pure physicalism are true \([160]\). Thus, the start of the universe is best described as quantum indeterminate. Another interesting consideration that emerges from this discussion is the question of what sort of world God would create \([161]\). Suppose there is a small infinite set of different possible worlds, say an integer or real number \(N\), that are good, and the sort of worlds that God would create. In such a scenario, it seems reasonable to assume that the decision as to which world to create would be represented, presumably, in God’s mind, as a quantum uncertain state \(ψ_N\) until such time as God decides to actually proceed and create the world (universe). In other words, God’s decision initiates the wave-function collapse that leads to the realization of a particular world. The trouble with this is that it suggests that God’s perfect freedom is a function of quantum-derived free-will, yet presumably God is not bound up in matter/physical reality, which is inherently quantum uncertain. For God’s decisions to be quantum, we’d have to propose some sort of model in which God was described as somehow bound by quantum mechanics, which would make quantum mechanics, not God, into the prima cause. A final consideration is the role of the observer or theorist in proposing (i) to (iii) above. God’s existence, it seems, could not logically depend on some third-arty quantum state, such that when a theist believes in God, some wave function collapses and God comes into existence. Thus it seems that at least (i) should be traditionally construed. One way to rescue (i) — the quantum-probability of theism — is to predicate its probability on the how likely it is that this universe would come to exist in and of its own accord. If the universe would not likely have come to existence without an intelligent being causing the wave function collapse of the quantum state at \(t=0\), then we could say, that the probability of that event happening is equal to the probability of theism being true. Likewise the reverse would be true. It certainly seems true that if (iii) is true, that either (ii) or (iv) could be true.

4. \textbf{Conclusion}

Theism is not intrinsically simpler than materialism/physicalism because we have to take God’s mind and the complex ideas that he has into account, and preferably explain their origins. As for the question of numeric simplicity: if we take God’s mental states as entities, then theism posits at least \(2n+1\) entities, against materialism/physicalism’s \(an\) entities. If we take God as just one entity, theism still posits \(n+1\) entities to materialism/physicalism’s \(n\), and God still has to have a complex mind. Therefore theism is always more complex and, if Swinburne is right that a more complex theory is less probable, then theism is always less probable than materialism/physicalism. Furthermore, even if theism were simpler than materialism/physicalism, we needn’t accept theism for that reason; many theories in science which currently find favor are more complex than their predecessors, and yet are more successful. We then saw some arguments about what type of probability Swinburne has in mind, and we saw that his inclination was towards frequentism. However, Hájek lists numerous problems with frequentists, and this leaves Swinburne with only the escape route of propensity theory; a theist has to argue that God is a being such that he would want to create this universe. Then, as we saw from Gwiazda; Swinburne needs to pay more attention to the implications of his guessed numbers; a value of 0.5 for \(P(\text{elk})\) renders his entire argument mathematically impossible, and the values for \(P(\text{hij})\) then have to be in a similar ballpark in order to get a high posterior probability for theism. In other words, for theism to be probable, we have to give theism a relatively low prior probability, which is not what Swinburne wants. Moreover, if we add up the probabilities of competing hypotheses in \(P(\text{e})\), using TPR, we find that either theism has to be very probable \(a \text{ priori}\), or else Swinburne has to accept that it is of a similar level of probability to other competing hypotheses. Lastly, we saw that whether theism is true or not, on a quantum mechanics interpretation of “facts”, depends on whether or not theism and the Big Bang theory are mutually exclusive and jointly exhaustive explanations. If we assume that they are mutually exclusive, then the truth of the Big Bang theory seems to entail, through sheer physics, that theism is false, and vice versa. Theism only becomes plausible, cosmologically speaking, on a quantum mechanical interpretation of the cosmos, if we use theism to explain why the universe’s wave function collapsed at \(t=0\). However, this raises questions of whether God takes a quantum-mechanical explanation, whether God has free-will, and so on. Hence, I conclude, Swinburne has thus far failed to adequately defend the hypothesis that theism is a more probable explanation for this universe than materialism/physicalism, due to its simplicity and high probability, as he has omitted many considerations from probability theory which have direct bearing on his argument.
[4]. The view that there is only the physical or material; that the spiritual does not exist.
[5]. Let’s leave this as an assumption for now.
[10]. Hájek, 2009: 213, cites Lewis as having this view as well (simplicity, strength, and fit to the data). See also Hájek, 1997: 217. We will see more from Lewis later in this paper.
[12]. Swinburne, 2004: 108
[13]. Swinburne, 2004: 145
[14]. Sober, 1994: 147
[15]. Swinburne, 2004: 68
[16]. Swinburne, 2004: 58-9
[17]. Swinburne, 2001: 82: 84-5
[18]. Swinburne, 2004: 56-8, 2001: 84: 95
[19]. Swinburne, 2004: 55
[21]. Swinburne seems to be of the view that materialism/physicalism explains what we see, but not how it came about. So his concession that materialism/physicalism has explanatory value vis à vis how the universe came about, is somewhat confusing. We should probably presume that he thinks that materialism/physicalism’s explanation is good except that it’s perhaps “not as good” as theism, when it comes to the question of the ultimate origins of the universe.
[22]. Swinburne, 2004: 72: 108
[26]. Lewis, 1973: 87
[27]. Swinburne, 2001: 85-7
[28]. cf. Swinburne, 2004: 146-7
[29]. Swinburne, 2004: 145-7
[31]. Swinburne, 2004: 146, my emphasis
[32]. Swinburne, 2004: 106
[33]. Swinburne, 2004: 106
[34]. Swinburne, 2004: 142-3; Swinburne, 1991: 145: 297; Swinburne, 2001: 75
[35]. Swinburne, 2004: 144
[40]. Swinburne, 2004: 142-3; Swinburne, 1991: 145: 297; Swinburne, 2001: 75
[42]. Swinburne, 2001: 97
[43]. Swinburne, 2004: 108: 165
[46]. Swinburne, 2004: 107
To avoid giving Swinburne a poor hearing here, let’s not go into detail about whether \( P(e|h&k)/P(e|k) \) is suitably described as the explanatory power. In part, there is a problem with this view, since we could not expect the factor \( P(e|h&k) \) to be larger than \( P(e|k) \) alone, since probabilities calculated by Bayes’ Theorem (and generally speaking) must be between 1.0 and 0. Making \( P(e|h&k) \) larger than \( P(e|k) \) would render the explanatory power greater than 1.0, i.e. more than certain, due to its being in the numerator. This means that by mathematical necessity, \( P(e|k) \) alone must be higher than \( P(e|h&k) \). Hacking expands \( P(e|k) \) into the Total Probability Rule, which factors into the hypothesis’ probability. Hacking shows how to derive the simpler version of Bayes’ Theorem that Swinburne uses, from a more complex statement thereof, \[ \frac{P(e|h&k)P(h|k)}{P(e|h&k)P(h|k) + P(e|\neg h&k)P(\neg h|k)} \], for two mutually exclusive hypotheses \( h \) and \( \neg h \). (Hacking, 2008: 59: 70).

Swinburne does not take this into account. What this means is that Swinburne can’t assume that \( P(e|h&k) > P(e|k) \) without considering TPR. Hacking, I. (2008). An Introduction to Probability and Inductive Logic. Cambridge.

[73]. Swinburne, 2004: 151
[74]. Swinburne, 2004: 108
[75]. Sober, 1994: 153
[76]. Sober, 1994: 145
[77]. Swinburne, 2001: 101-102
[78]. Lewis, 1973: 87
[80]. as Swinburne says, 2004: 30
[81]. Swinburne, 2001: 95
[82]. Sober, 1994: 152
[84]. Sober, 1994: 139
[85]. Sober, 1994: 153
[86]. Swinburne, 2004: 94 et seq.
[87]. Dawkins: 136-43
[88]. Walmsley, G., 2011, personal communication
[90]. Pitman, M., 2011, personal communication
[91]. 2011, personal communication
[93]. Dawkins: 31
[94]. Other varieties of multiple universes be addressed in a subsequent paper.
[95]. cf. Lewis, 1973: 87
[96]. Swinburne, 2004: 49-50
[97]. There may be some sense in which we can declare God a simple substance and just say that he is just simple, like he is just infinite. But we need argumentation as to why we should accept this declaration. It is not obvious that God should be a simple undifferentiated substance, since everything we know about such substances is that they’re causally uninteresting, and more importantly, unintelligent.
[98]. Swinburne, 2004: 109
[102]. cf. Swinburne, 2001: 58
[104]. Gwiazda, 2009: 357-358
[105]. Gwiazda, 2009: 368
[106]. Gwiazda, 2009: 360
[107]. Swinburne, 2004: 338-9
[108]. Swinburne, 2004: 338-9: P(e|h_t) = 0.5
[109]. Swinburne, 2004: 336
[110]. Gwiazda, 2009: 360
[111]. Gwiazda, 2009: 361
[112]. TPR, derived in Hacking: 59: 70
[114]. Thanks to Ritchie, J. Personal communication, Apr. 2013, for clarifying the problems with Gwiazda and Swinburne’s value of 0.5.
[115]. Ritchie, J. Personal communication, April 2013.
[117]. Swinburne, 2004: 112
[118]. Swinburne’s words: “If, as I suggested, P(h|k) might be very small (so improbable is it a priori that there should exist anything at all)” (Swinburne, 2004: 112).
[119]. Gwiazda, 2009: 361
[120]. Gwiazda, 2009: 362
[121]. Gwiazda, 2009: 361
[122]. Swinburne, 2004: 147; Gwiazda, 2009: 362
[123]. 2001
[124]. Swinburne, 2001: 56
[125]. Swinburne, 2001: 57
[128]. Hájek himself does not hold this view of probability, but he explains it in his paper.
[129]. Swinburne, 2004: 134-5
[130]. Hájek’s example
[131]. Hájek, 1997: 214

Hájek, 2009: 218
Hájek, 2009: 219
Hájek, 2009: 220
Hájek, 2009: 222-223
Hacking, 2008: 23 et seq.
Hacking, 2008: 30: 33: 30
Hacking, 2008: 32
Vilenkin in Stenger, 2011: 229
Stenger, 2011: 233
Stenger, 2011: 235
Conte, 2009: 5
Personal communication, 2013, edited. In Conte’s explanations, / is to be read “given”. Swinburne uses |, whereas Conte uses / as modulus. Also note that the formulation A=+1 is not meant to be an equation within the equation per se, it is merely giving a symbolic value for the quantum state of A. I quote in full, as I would not be able to explain more tersely. Square brackets represent my edits for readability. The formulae cited are derived in his 2009 paper: 5-6.
This is the same as Hacking’s TPR: P(e|k) = P(h|k)P(e|h&k) + P(¬h|k)P(e|¬h&k), where we’re substituting P(A=+1) for P(e), and P(B=+1) for P(h). Similarly, P(B=−1) replaces P(¬h).
Conte’s experiment involved asking subjects or participants questions that interefere.
Conte, 2009: 6
The approximate quantum-uncertain time at which the Big Bang occurred, or approximately time zero, the start of time.
Conte, Personal communication, 2013
Conte, 2009: 3
Hence my use of t=0 instead of t=0.
Conte, E. 2013. Personal communication.
Conte, E. 2013. Personal communication.
I mention this here for the sake of completeness; I will not go into the discussion in any depth, as it represents an extensive body of literature.