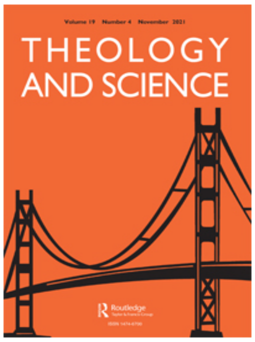

Theology and Science

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rtas20

Is Simplicity that Simple? An Assessment of Richard Swinburne's Argument from Cosmic Fine-Tuning

Emily Qureshi-Hurst

To cite this article: Emily Qureshi-Hurst (2021) Is Simplicity that Simple? An Assessment of Richard Swinburne's Argument from Cosmic Fine-Tuning, Theology and Science, 19:4, 379-389, DOI: 10.1080/14746700.2021.1982250

To link to this article: https://doi.org/10.1080/14746700.2021.1982250

Published online: 12 Oct 2021.

THEOLOGY AND SCIENCE
2021, VOL. 19, NO. 4, 379–389
https://doi.org/10.1080/14746700.2021.1982250

Is Simplicity that Simple? An Assessment of Richard Swinburne's Argument from Cosmic Fine-Tuning

Emily Qureshi-Hurst

Theology and Religion, University of Oxford, Oxford, UK

ABSTRACT
The teleological argument has received a resurgence in recent years. This is thanks to cosmological data which appears to offer new evidence to indicate that the existence of life is the result of contrivance in the face of staggering improbability. Richard Swinburne argues that cosmic fine-tuning gives us good evidence to believe in the creator God of classical theism, who has good reasons to create human agents. I assess Swinburne's use of the "principle of simplicity" as a criterion for selecting the best explanation in this particular case, arguing that it is not as compelling as Swinburne claims.

KEYWORDS
Richard Swinburne; cosmic fine-tuning; parsimony; philosophy of religion; cosmology

Richard Swinburne: An Introduction

Richard Swinburne is a leading living philosopher of religion. The early years of his career focused largely on philosophy of science, though he is best known for his work within the philosophy of religion. His overall project has been to construct a philosophically technical defense of theism, drawing on, among other areas, resources from natural theology, Scripture and science. The influential and rigorous philosophy he has produced over the course of his 50 year career spans great breadth and deserves careful consideration. Of particular note is his trilogy *The Coherence of Theism* (1977), *The Existence of God* (1979), and *Faith and Reason* (1981) with which he made his reputation and began his apologetics project. *The Existence of God*, the book in which he constructs probabilistic arguments for the existence of God, is arguably his most successful work. Its chapter on teleological arguments will form the basis of the subsequent discussion. He argues that scientific insights regarding the origin of the universe and its fine structure constitute good evidence for theism; in effect, that physics leads to God. In this paper I shall examine his presentation of cosmic fine-tuning, focusing on his us of the criterion of simplicity when making probabilistic judgements about its significance.

Teleological Arguments

Teleological arguments begin with observations of features of the natural world which appear to reveal the hand of a designer. This designer is held to be the God of Classical

CONTACT Emily Qureshi-Hurst emily.qureshi-hurst@pmb.ox.ac.uk

Theism in the arguments that concern us here. They began with the ancient Greeks in Plato's *Phaedo* and were taken up with rigor by Thomas Aquinas in the Scholastic period.[1] The greatest work of teleological natural theology, however, was given in William Paley's 1802 work *Natural Theology*.[2] Such arguments have formed a significant part of the body of literature on *theologia naturalis*—the theological enterprise of discerning God in the natural world. Teleological arguments for the existence of God are multifarious. Swinburne himself presents other teleological arguments which emphasize spatial and temporal regularities, however the focus here will be on his argument from cosmic fine-tuning.[3]

Cosmic Fine-Tuning

Teleological arguments from cosmic fine-tuning begin by observing the fundamental features of the universe that make possible the evolution and existence of complex life and conducting thought-experiments in which these features are different.[4] The universe is perfectly suited to the flourishing of complex life, but "not all initial conditions or laws of nature would lead to, or even permit, the existence of human bodies", argues Swinburne. "If only a very narrow range of laws and initial conditions allow such an evolution, then we may say that the universe is "fine-tuned" for this evolution."[5] Out of the set of all possible universes, a very small proportion is life-conducive. If scientific theories provide the ultimate explanation of our universe, such that God is not responsible for the processes the theory describes, Swinburne argues that such fine-tuning is *a priori* very improbable.[6]

Fine-tuning discourse begins just after the so-called Planck era, approximately 10^{-43} seconds after the Big Bang, when the universe was in an extremely hot dense state. Physicists are currently unable to model the universe in this epoch as General Relativity and Quantum Mechanics break down before this time. Quantum gravitational laws governed, and these are as of yet unknown to the scientific community. Scientific understanding begins in the inflationary period, during which the universe grew by at least a factor of 10^{25} in 10^{-30} seconds or less, from smaller than a sub-atomic particle to roughly the size of a grapefruit.[7] This was an extremely critical period at which point the conditions we observe in the present-day were set. The four fundamental forces crystalized: gravitation, electromagnetic forces between charged particles, the weak nuclear force giving rise to nuclear processes such as decay of neutrons into protons, and the strong nuclear force binding the nuclei of atoms together. Sub-atomic particles and anti-particles were formed, creating the building blocks for the chemical elements crucial for the evolution of life.[8]

A critical factor in the formation of stars and galaxies, necessary places for life to evolve, are the physical constants (so named because they have the same value everywhere and at every time). Of all the possible values of physical constants, only a very narrow range could give rise to a universe which could support life.[9] An example, the cosmological constant Λ, first arose when Einstein's 1915 field equations predicted that the universe was expanding. As this predated Hubble's discovery of an expanding universe, Einstein inserted Λ to stabilize his equations and eliminate expansion. It is the value of the energy density of the vacuum of space, and acts as a counterbalance to gravity. It determines both the rate of the expansion of the universe and gravitational condensations such as stars and galaxies. As the universe was in fact expanding, scientists now assume that Λ has a value of zero. Its minimum possible value is 120 orders of magnitude smaller that its limit (6.128)—a truly staggering range. That it is likely zero is extremely important for the evolution of life. Whilst a change in the value of most constants would have prevented life as we know it emerging, if Λ differed only slightly from its actual value then this would have prevented the emergence of life itself.[10] The universe would either have expanded too rapidly for the formation of stars and galaxies, or collapsed back in on itself soon after the big bang. Due to this highly unlikely state of affairs, many have been motivated to try to establish some deep underlying principle that requires Λ to be zero.[11]

A further feature which Swinburne notes as being fine-tuned relates to carbon. As far as we know, carbon is necessary for all forms of complex intelligent life.[12] An abundance of carbon requires a delicate balance of the four fundamental forces. For example, an increase or decrease of more than 0.5% in the strength of the strong force, or more than 4% in the strength of the electromagnetic force, would lead to negligible amounts of carbon and oxygen being formed, thus making life very unlikely. These variations represent an "infinitesimal range within the range of logically possible values of the forces."[13] The data reveals that, "there are several small islands within the space of possible values of constants and variables within which human life could evolve."[14]

On the basis of all the above data Swinburne claims that it is extremely unlikely that life-conducive conditions have arisen accidentally. His argument is probabilistic. Each set of possible constants and variables, he argues, is roughly equally probably *a priori*. Therefore, the probability of any one set of conditions occurring before making reference to our observations is roughly constant for all possible values. Only a tiny minority of possible values facilitates the production of life, so any randomly occurring universe is far more likely to be sterile than fertile. Therefore, he argues, "given standard theory and no more fundamental explanation thereof (physical or theistic), tuning is *a priori* immensely improbable."[15]

Interpreting Fine-Tuning Teleologically

The teleological significance of this data forms the basis of Swinburne's argument. By virtue of its inductive form, such an argument must make probabilistic judgements. He uses Bayes' theorem to articulate these probabilities,[16] suggesting that in a Godless universe, with *e* as the evolution of human bodies, *h* as theism, and *k* as the evidence of a universe conforming to simple natural laws $P(e|{-h}\&k)$ is very low. Given *h*, however, the probability of *e* is increased significantly. On the hypothesis of theism, God has good reason to bring forth "embodied humanly free agents" and a world in which these agents can use their powers and sensibilities to interact with each other and the world in a meaningful sense.[17]

Theism leads us to expect a world that is simple and ordered at the phenomenal level, and complex and highly structured at the micro-level. This allows complex organisms to evolve from single-celled organisms and then navigate their way through life with relative ease, with the opportunity to create and engage with systems of meaning. The universe appears fit for this purpose, and as contemporary physics seems to indicate that such a universe is highly unlikely, Swinburne argues that fine-tuning is good evidence for theism. He is arguing for a causal explanation of the phenomena "in terms of the intentional action of a person", namely God, who directly and deliberately fine-tuned the universe in order that human lives may emerge.[18] Swinburne has intended to show that $P(e|h\&k) > P(e|{-h}\&k)$. Fine-tuning is highly unlikely on an atheistic hypothesis, he argues, whilst theism renders it probable. He claims this is "a powerful C-inductive argument for the existence of God."[19] By C-inductive, he means that the premises add to the probability of the conclusion. *h* is more likely than it would be without (*e&k*), as opposed to P-inductive arguments in which the premises make the conclusion probable, that is, more likely than not to occur: $P(h|e\&k) = >½$. The following sections will assess this argument and establish whether, as Swinburne argues, physics leads to God.

Is Theism The Only Possibility?

Some naturalistic alternatives must be considered before concluding whether physics leads to God. A popular naturalistic interpretation of fine-tuning is known as the Weak Anthropic Principle (WAP).[20] WAP maintains that "what we can expect to observe must be restricted by the conditions necessary for our presence as observers."[21] It is grounded on observation selection effects. Whilst observed values of all physical and cosmological quantities are not equally probable, they take on values restricted by the requirements that carbon-based life can evolve, and that enough time has passed for this to occur. Rather than postulating divine intention, WAP insists we remain conscious of the limits imposed on our observations by the position from which we observe. In this case, such limits refer to the fact that we could not observe anything other than conditions suited to the existence of intelligent life. However improbable life-conducive conditions are, we could not possibly have found ourselves in an uninhabitable region of the universe.

WAP is intended to demonstrate that the force of the argument from fine-tuning is lost when considering the restrictions our location imposes on our observations. Swinburne and others respond that this misses what is truly at stake. It is not that we observe life-conducive conditions, but rather that they are there in the first place. Swinburne offers an analogy to illustrate this: imagine you are being held captive by a madman with a machine which shuffles ten packs of cards and draws a card from each at random. If the machine draws an Ace of Hearts from each pack, you will live. Any other result will trigger a fatal explosion. The machine miraculously draws an Ace of Hearts from every pack. Though you could not observe another outcome, as all other outcomes would involve your death and inability to observe anything, the extremely unlikely event of your survival would drive you to suppose that the machine was rigged in some way. It requires a deeper explanation.[22] This analogy draws out a problem with WAP in that it cannot sufficiently account for the improbability of the conditions we observe. Alone, WAP does not defuse Swinburne's teleological argument from fine-tuning.

The dominant naturalistic alternative to theism in explaining fine-tuning is the multiverse hypothesis. As Rubenstein explains: "our one, visible world constitutes the universe (a sphere 40 billion light years in radius also called our "Hubble volume" or "observable universe"), whereas the greater ensemble of unseen worlds constitutes the multiverse."[23] Multiverse theory holds that our universe is one of many (possibly infinite) universes all of which have different properties. Robert B. Mann describes it as a "super-Copernican" revolution, as it further displaces the centrality of our cosmic position.[24] The multiverse is generated by several theories and comes in many forms; it became a scientifically credible concept through quantum physics and cosmology.[25]

One such theory is string theory, a quantum theory of gravity which holds that at the most fundamental level reality is comprised of strings vibrating at different frequencies to give rise to the various sub-atomic particles. The equations of string theory have up to 10^{500} solutions.[26] Physicists have interpreted this as implying that our universe may be one of 10^{500} universe domains each governed by different laws, constants and variables. Many of these universe domains would be uninhabitable, but probabilistically it is almost certain that some, such as our own, would allow the emergence of life.

A multiverse also emerges from the aforementioned cosmic inflationary theory[27], which posits the existence of a state of matter known as a false vacuum. Its negative pressure energy would have caused the universe to double in size every 10^{-34} seconds. Some unknown mechanism causes this to stop after 10^{-32} seconds, yielding a sliver of true vacuum that contains our observable universe. This false vacuum causes bubbles of true vacuum to bud off generating a multiplicity of universes. Mann argues that if all possible universes are physically instantiated, then the special features of our universe occur because all possible features occur somewhere in the multiverse.[28] If this is the case then the WAP has force—we should expect to observe a life-conducive environment as our observations are restricted by the fact that we are life. Our existence forbids us from observing anything else. To amend the famous words of Martin Luther: "here I stand; I can be in no place other." *Ex hypothesi*, the probabilistic power of the argument from fine-tuning is lost.

Simplicity

To decide between a naturalistic and a theistic interpretation of fine-tuning, some criteria are required. Swinburne offers four criteria and argues whichever explanation best satisfies these criteria should be favored. The kind of explanation to which he is referring is causal explanation—the factor(s) that are operative in bring about some event. The first *a posteriori* criterion is yielding the data, namely the explanans leads us to expect the explanandum with deductive certainty or inductive probability. The second *posteriori* criterion is that the hypothesis must fit with background knowledge, i.e. we are more likely to believe that Mary baked the loaf of bread if Mary is a baker.

The first *a priori* criterion he outlines is content: the greater the content the less likely it is to be true, as the likelihood that it contains some falsity increases. The second *a priori* criterion is one which is woven through the fabric of Swinburne's writing. It is *simplex sigillum veri*—the simple is a sign of the true. It is also known as Ockham's razor: the simplest option is most likely to be true, all other things being equal. Swinburne justifies this scientifically, arguing that "science requires us to postulate the simplest explanation of the data" (Swinburne, 2004, p. 165). The most detailed articulation of the criterion of simplicity is found in *Simplicity as Evidence for Truth,* in which he argues that "it is an ultimate *a priori* epistemic principle that simplicity is evidence of truth."[29]

In *Simplicity as Evidence for Truth,* he "aim[s] to show the nature and force of the criterion of simplicity by considering cases of conflicting theories where the other criteria for choice between them are equally satisfied."[30] He also argues that the criterion of background knowledge can be reduced to yielding the data and simplicity. As one can construct an infinite number of theories which yield the same data with the same degree of inductive probability, but whose predictions differ, "without the criterion of simplicity we can make no step beyond the observable data."[31] He illustrates this with a straightforward example.

x	0	1	2	3	4	5	6
y	0	2	4	6	8	10	12

Consider the above relation between two variables x and y. An obvious formula suggests itself, namely $y = 2x$; it yields the data in that from any x value one can deduce the corresponding y value. Consequently, he argues, it satisfies the criterion of yielding the data maximally well. Yet other formulas also satisfy this criterion. Consider:

$$Y = 2x + x(x-1)(x-2)(x-3)(x-4)(x-5)(x-6)z$$

This second formula yields the data equally well. Moreover, as Swinburne notes, there are an infinite number of formulae of that form, according to the filling you give to z, which may be a constant or some function of x. Thus, it also maximally satisfies that criterion. The formulas are not equivalent, however, as they make totally different predictions; it is important to select the right one in order to have the correct theory with the appropriate predictive power. Swinburne argues that if our lives depended on predicting the correct value for x=9, we would think it utterly irrational to make any other prediction than y=18.[32]

The principle of simplicity, as Swinburne calls it, is frequently used in science. Even when scientists seek to falsify theories by making further predictions, an infinite number of highly complex theories remain which could explain the data equally well. This is supported by Kevin T. Kelly, who, in his paper *A New Solution to the Puzzle of Simplicity,* argues that, "(1) always choosing the simplest theory compatible with experience, and (2) hanging onto it while it remains simplest, is both necessary and sufficient for efficiency."[33] Swinburne hangs his entire argument on this criterion of hypothesis selection.

I will now demonstrate that it cannot bear this weight, and begins to crumble under more in-depth scrutiny. From the outset, it is important to note that there are more criteria involved in hypothesis selection. Scientific endeavor is far more complex than the formula in Swinburne's above example, and as such a more complex methodology for selecting viable theories is necessary. In focusing so narrowly on simplicity, Swinburne ignores other criteria that may be used.[34] Moreover, simplicity does not entail veracity. Swinburne has conflated the goal of science with the reality of the world it seeks to explain. This point is made by A.N. Whitehead: "The aim of science is to seek the simplest explanations of complex facts. We are apt to fall into the error of thinking that the facts are simple because simplicity is the goal of our quest. The guiding motto in the life of every natural philosopher should be: seek simplicity and distrust it."[35] One cannot make the *a priori* assumption that the world is simple, despite seeking the simplest formulation of the laws that govern it. When assessing Swinburne's use of simplicity, Robert

Burns argues that "it is a *non-sequitur* to assume that scientific interest in simple theories indicates commitment to cosmic simplicity as a probable fact."[36]

A good indication of whether simplicity is useful in determining theory selection is whether it can be substantiated in the history of science. One should not make the question-begging assumption that the universe is simple *a priori* and then proceed with one's investigation with the simplicity principle firmly in hand. If simplicity is to be preferred, this should have manifested in history. Burns quotes R. Harré who points out that the history of science is not a journey toward simplicity, indeed it is quite the reverse.[37]

A case-in-point example of increasing theoretical complexity is the Standard Model of particle physics. It is a highly complex model describing the seventeen fundamental particles and their interactions. The Standard Model developed throughout the twentieth century like a patchwork quilt, with contributions from countless physicists and mathematicians. It is simple neither in its formulation nor its construction, but is a highly accurate theory. If the criterion of simplicity was the only deciding factor in whether this piecemeal model was to be accepted, it is hard to imagine that it would have made the cut. Less accurate simple theories have often to give way to more complex ones. Though there are exceptions, simplicity is seldom the single deciding factor.

One might respond that the simplicity principle favors the simplest theory that *fits with the background evidence*, not just which theory happens to be most simple. Simple theories have given way to more complex ones due to new evidence, so although historically theories have increased in complexity, they have become the new simplest theory that fits with the background evidence. Yet Burns argues that these examples are too much of a *prima facie* challenge to Swinburne's thesis to be ignored. Though scientific orthodoxy has moved toward complexity, the simplicity principle still assumes a simple world when choosing between two theories which equally account for the background evidence. This is not vindicated in the history of science. Is this principle, then, strong enough to bear the weight Swinburne puts on its shoulders?

To establish this we must interrogate precisely what Swinburne means by simplicity. Simplicity can be understood in a variety of ways. By favoring theism by virtue of its simplicity Swinburne's argument is made vulnerable by alternative definitions of the term. He claims that "the simplest theory is that which postulates few substances, few kinds of substances, [and] mathematically simple properties of substances determining their mode of interaction with other substances (i.e. mathematically simple laws of nature.)"[38] So simplicity is constituted in once sense by the number of things postulated, in another sense the number of kinds of thing postulated.[39] A third sense, often used in science, is the simplicity of the mathematical formalism.[40]

Using the criterion of simplicity to determine the preferred explanation of fine-tuning yields different results depending on the definition of simplicity with which one is working. He argues that theism is far simpler than the multiverse: "it would be the height of irrationality to postulate innumerable universes just to explain the particular features of our universe when we can do so by postulating just one additional entity—God."[41] Whether this is true, however, depends with which criterion of simplicity one chooses to work.

This can be demonstrated by appealing to ontological parsimony, generally explained through Quine's notion of ontological commitment. Quine advocates simplicity as a good criterion for selecting both a *desirable* and *probable* theory.[42] He outlines a sufficient condition for a theory being more parsimonious than another, namely that it has fewer ontological commitments. A theory *T* has an ontological commitment *F* iff *T* entails that *F* exists. Ontological parsimony, Quine argues, is a good way of framing a theory's simplicity and thus desirability and probability. In this analysis, a crucial distinction must be made between *quantitative* and *qualitative* parsimony: the former refers to the number of entities and the latter to the kind of entity. Swinburne's first two simplicity criteria, fewer numbers of entities and fewer kinds of entities, echo this quantitative/qualitative ontological distinction.

The multiverse is less quantitatively ontologically parsimonious than theism as it is committed to the existence of many universes whilst theism posits just one God. It is, however, far more qualitatively ontologically parsimonious. By observing our universe, we have strong empirical evidence to support the claim that universes are members of a kind that exist. Their existence is ontologically unproblematic. Whether multiple universes *do* exist is a different question from whether they *can* exist—the latter is settled even if the former is up for debate. In theological tradition God, on the other hand, is a being wholly other and of a radically different kind to any object within our contingent universe. Postulating the existence of such a being requires commitment to a radically higher ontology, which is far less qualitatively ontologically parsimonious than positing the existence of many more universes. Swinburne uses a quantitative notion of simplicity. I contend that qualitative ontological parsimony is to be favored in arguments such as this. Multiverse theory requires ontological commitments to entities of a kind we already know exists; it requires a smaller ontological leap than theism.

The third definition of simplicity noted above, namely simple mathematical formalism, cannot be used when deciding between a theistic and a naturalistic interpretation of fine-tuning. A theory is mathematically simple if it uses few variables, mathematical entities and relations. Multiverse theory is generated by mathematics, so it is liable to mathematical analysis. But it is impossible to translate theism into mathematical terms. It is not a hypothesis of that kind. Theism posits a creator God who is omnipotent, benevolent, and transcendent; a divine subject who is radically and wholly other. Objectifying God or attempting to translate the rich and diverse tapestry of theism to mathematics would be philosophically reductionist and theologically unjustifiable.

As Michael Heller argues, "one can appeal to methodological analysis in order to show that theological questions transcend the limitations inherent in the very nature of the scientific method."[43] God is not a feature of scientific theories, and theism is not a hypothesis with relevant similarity to a claim of science. It is not liable to empirical verification or falsification, as, by his very nature, God transcends the empirical sphere. Can theism really be called a hypothesis, and, if not, does the principle of simplicity apply? There is not theological warrant for any analytic attempt to quantify theism or to operationalize the variable "God" in a mathematical sense. Mathematically, at least, the principle of simplicity is not relevant to the issue at hand.

It would be unfair to say that Swinburne explicitly claims theism is simpler mathematically than a naturalistic interpretation of fine-tuning such as the multiverse. Yet many of the examples he gives in which simplicity determines theory selection are mathematic. For example, the formula quoted above ($y = 2x$), or Newton's law of gravitation.[44] In demonstrating that a mathematically defined notion of simplicity is a good criterion of theory choice, he hasn't sufficiently justified the claim that a different notion of simplicity can decide between theism and a naturalistic interpretation of fine-tuning. By justifying simplicity as determining preferred mathematical formulations of physical theories, and then employing the principle of simplicity in the choice between theism and a naturalistic alternative in a different sense, he is at best making a philosophically unjustified move. At worst, he is committing the fallacy of equivocation whereby a term is defined ambiguously and then used in different ways in different parts of the argument. Committing this fallacy undermines the appropriateness for the notion of simplicity as a criterion for hypothesis selection in the case at hand.

Simplicity does not have the argumentative power Swinburne claims it does. There are serious ambiguities in his definition of simplicity, and each interpretation yields different results for interpreting fine-tuning. Swinburne has chosen a criterion which is difficult to pin down, and as such his argument loses persuasive power. Even more damaging is the fact that simplicity as a criterion for scientific theories cannot reliably be substantiated in the history of science. This is not to say that simplicity is never useful. It is to say that it fails to have the argumentative force Swinburne claims that it does. The principle of simplicity is not strong enough to establish theism as a significantly preferable hypothesis to the multiverse.

Concluding Remarks

Swinburne's teleological argument from cosmic fine-tuning is based on the probability of theism given the simplicity of the theory in its explanatory power when accounting for fine-tuning. Given theism, he argues, we should expect a universe in which rational, conscious beings can emerge. He does not believe that scientific naturalism can sufficiently account for the phenomena. Yet the multiverse is a viable naturalistic alternative to the hypothesis of theism. It is a theory very much in its infancy, but it may later be established on firmer ground as physics moves toward a quantum theory of gravity. Swinburne himself acknowledges that "disagreements at an initial stage about simplicity may prove irrelevant when new data turn up."[45] At this stage, however, the debate remains open.

When deciding whether to accept the multiverse, theism, or remain agnostic until further developments arise, the choice is not an obvious one. However it is my belief that at the present time Swinburne has not provided justification for a commitment to a higher ontology by his own criterion of simplicity. It is ambiguous in its definition, and each definition yields a different result for which interpretation of fine-tuning should be favored. Moreover, there are many other criteria for scientific theory selection to which Swinburne does not give enough attention. In the light of contemporary science, I cannot accept Swinburne's conclusion that physics leads to God. Nevertheless, his argument is rigorous in its use of both technical philosophy and contemporary physics, and philosophers of religion owe him thanks for his important contributions to this debate.

Notes

1. Barrow and Tipler 2009, 31–49.
2. McGrath 2011, 85–107.
3. Swinburne 2004, 153–171.
4. McGrath 2009, 115.

5. Swinburne 2004, 172.
6. Swinburne 2004, 227.
7. Inflation is widely accepted but not yet conclusively proven.
8. Barrow and Tipler 2009, 372.
9. Further analysis of the fine balancing of the universe's constants is provided by: Rees 2000, 2–4.
10. Rubenstein 2014, 15–16.
11. Barrow and Tipler 2009, 412–414.
12. With the possible exception of silicon (Barrow & Tipler, 2009, pp. 545–548).
13. Swinburne 2004, 175.
14. Swinburne 2009, 227.
15. Swinburne 2009, 227.
16. Bayes' theorem is a tool for calculating the conditional probability of certain events or judgements, and it holds that a hypothesis is confirmed by any body of data that its truth renders probable. Extensive analysis of Swinburne's use of Bayes' theorem is not within the scope of this paper.
17. Swinburne 2004, 188.
18. Swinburne 2004, 23.
19. Swinburne 2004, 189.
20. Extensive discussion of WAP can be found in (Barrow & Tipler, 2009).
21. Carter 1974, 291.
22. Swinburne 2004, 156.
23. Rubenstein 2014, 5.
24. Mann 2014, 25.
25. For the history of the multiverse concept, see (Rubenstein, 2014).
26. Mann 2014, 34.
27. A third multiverse theory is the Everett interpretation of Quantum Mechanics (Everett, 1957).
28. Mann 2014, 35.
29. Swinburne 1997, 1.
30. Swinburne 1997, 15.
31. Swinburne 1997, 15.
32. Swinburne 1997, 15–16.
33. Kelly 2007, 561. Note: *efficiency*, not truth.
34. For a discussion of criteria used in theory selection, see (Birken, 2017).
35. Whitehead 1964, 163.
36. Burns 1999, 198.
37. Burns 1999, 187.
38. Swinburne, 2004, p. 84.
39. Swinburne 1997, 24.
40. Swinburne 1997, 26–27.
41. Swinburne 2004, 165.
42. Quine 1981, 47.
43. Heller 1994, 99.
44. Swinburne 1997, 38–39.
45. Swinburne 1997, 35.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Notes on Contributor

Emily Qureshi-Hurst is a philosopher based at the University of Oxford. Her research focuses on the philosophical questions raised by interactions between science and religion, particularly

physics and Christianity. Emily has written on issues in the philosophy of religion, the philosophy of time (including issues in special and general relativity, quantum mechanics, and temporal experience), the philosophy of physics, and the philosophy of social media. She has also participated in cross-disciplinary collaborations with scholars from philosophy, theology, and physics.

Works Cited

Barrow, John. D., & Tipler, Frank. J. 2009. The Anthropic Cosmological Principle. Oxford: Oxford University Press.

Birken, Sarah. A. 2017. "Criteria for selecting implementation science theories and frameworks: results from an international survey." Implementation Science, 12, 124.

Burns, Robert. M. 1999. "Richard Swinburne on Simplicity in Natural Science." Heythrop Journal 40, 184–206.

Carter, Brandon. 1974. "Large Number Coincidences and The Anthropic Principle in Cosmology." In M. Longair, Confrontation of Cosmological Theory with Observational Data (pp. 291–298). Dordrecht: Reidel.

Einstein, Albert. [1920] 2010. Relativity: The Special and General Theory. London: Martino Publishing.

Everett, Hugh. 1957. "'Relative State' Formulation of Quantum Mechanics." Review of Modern Physics, 29, 454–462.

Heller, Michael. 1994. On Theological Interpretations of Physical Creation. In Robert. J. Russell, Nancy. Murphy, & Christopher. J. Isham, Quantum Cosmology and the Laws of Nature: Scientific Perspectives on Divine Action. 91–102. Notre Dame: University of Notre Dame Press.

Kelly, Kevin. T. 2007. "A New Solution to the Puzzle of Simplicity." Philosophy of Science 74, no. 5, 561–573.

Mann, Robert. B. 2014. "Puzzled by Particularity." In K. J. Kraay, God and the Multiverse: Scientific, Philosophical, and Theological Perspectives. 25–45. London: Routledge.

McGrath, Alister. 2009. A Fine-Tuned Universe: The Quest for God in Science and Theology. Louisville: Westminster John Knox Press.

McGrath, Alister. 2011. Darwinism and the Divine: Evolutionary Thought and Natural Theology. Oxford: Wiley-Blackwell.

Quine, Willard. V. 1981. On Simple Theories of a Complex World. In J. R. Gregg, & F. T. Harris, Form and Strategy in Science. 47–51. D Reidel Publishing Company / Dordrecht-Holland.

Rees, Martin. 2000. Just Six Numbers: The Deep Forces That Shape the Universe. London: Phoenix.

Rubenstein, Mary.-Jane. 2014. Worlds Without End: The Many Lives of The Multiverse. New York: Columbia University Press.

Swinburne, Richard. 1997. Simplicity as Evidence for Truth. Milwaukee: Marquette University Press.

Swinburne, Richard. 2004. The Existence of God, second edition. Oxford: Clarendon Press.

Swinburne, Richard. 2009. "The Universe Makes It Probable That There Is A God." In M. Y. Stewart, Science and Religion in Dialogue Volume 1. 203–234. Chichester: Wiley-Blackwell.

Whitehead, Alfred. North. [1920] 1964. The Concept of Nature. Cambridge: Cambridge University Press.