Glossary

The Anthropic Cosmological Principle(s)

The **Anthropic Cosmological Principle** is an extension of the **The Copernican Cosmological Principle** and is that not only

on a large scale, the universe is both homogeneous and isotropic (in 3-D space)

but also that

by our very being here, we are viewing "our universe" at a "priveledged" location in spacetime

---

Rationale/Implications

The **rationale** behind the first part is as for the **Copernican Cosmological Principle**. The **impliction** is that

the same laws of physics hold throughout the universe.

The **rationale** behind the second part is as an explanation as to **why the laws of physics (and the universe itself) are the way they are** (at least as seen by us). It is based on some current ideas that the developement of intelligent life on our planet required a series of (apparent) "coincidences" (e.g. see Al Schroeder's links). Thus that the circumstances that permit the developement of intelligent life throughout the universe (or other universes) are rare.

The **Anthropic Cosmological Principle** comes in two "strengths"

Weak The **Weak Anthropic Principle** states that the conditions necessary for the development of sentient beings (capable of asking the question *why is the*

universe the way it is ?) will only exist in a universe where the laws of physics are the way they are as seen by us.

i.e. sentient beings can only evolve and exist in a universe that "happens" to have a density close to that observed (by us), that "happens" to be about as old as ours, that the charge of an electron "happens" to have the value observed (by us).. etc.

Strong

The **Strong Anthropic Principle** takes this one step further to state that there could be many different universes (or regions in a single universe) where the laws of physics are different.
There are yet more flavours of the **Strong Anthropic Principle** dealing with whether of not sentient beings might be able to have evolved in these other "universes". Such metaphysical questions are beyond the scope of the current courses.

As for the **the Copernican Cosmological Principle** , the **Anthropic Cosmological Principle** is essentially a metaphysical statement and, it is still unclear (perhaps never knowable) whether it is true

---

Objections/Arguements Against

Currently few people object to the **Weak Anthropic Principle**. It offers an explanation (to us only-recently sentient beings) as to why out of the infinite universes that could exist (could have existed/will exist ?!?), we "turned up" in the one we did.

There are, however, a number of objections that can be raised concerning the implications/meaning of the **Strong Anthropic Principle** (e.g. see A Brief History of Time, p130)

- Even if there are different universes (or regions in a single universe) where the laws of physics are different, how can any information travel between these entities ? Thus what happens in one universe can have no observational consequences on another, and hence what do we mean when we say other universes "exist" ?
- Many thinkers struggled for thousands of years trying to determine whether Earth & humans occupied a special place in the universe. From the 1400s onwards the tide (gradually) turned against such a concept. According to Stephen Hawking,

p130),
"the strong anthropic principle would claim that this whole vast construction exists simply for our sake"
[although, personally I do not agree that the Strong Anthropic Principle actually "claims" this..]

An Analogy

A (small) sentient being living in the center of a "perfect" loaf of bread.

- There may be obvious structure on small scales (air bubbles etc), but on the large scale the loaf can be considered **uniform** and **isotropic**
- The laws of physics (e.g. which caused the dough to rise) are the same throughout the loaf.
- The loaf might still be rising - but (in this perfect loaf) this happens uniformly & following the same laws throughout the loaf
- However, as an extension to the **Copernican Cosmological Principle**, the sentient being reasons that out of all the possible loaves (ingredients, proportions, open temperatures, baking times etc), they exist in the loaf they do since the conditions were just right, to bake such a loaf. Had they not been (eg. the no yeast added, baking time not long enough etc), then it would not have been possible for them to reach the level they have (if exist at all). This is the **Weak** flavour of the principle.
    - In the **Strong** flavour of the principle, the sentient beings go on to allow for the possibility of the existence of other loaves having been in the open (or other ovens), with different mixtures of ingredients etc.
      Whether the conditions may have been right for other sentient beings to evolve in (a very small number of) these other loaves (most likely in a form v.different to themselves) is a matter of debate. However (most of) the sentient beings see no possiblity of loaf-to-loaf travel in any case...

Additional Notes

See also the

- The Copernican Cosmological Principle

- The Perfect Cosmological Principle

For more information see:

- Al Schroeder's "Anthropic Coinicidence" links
- Daniel J. Berger's "impertinent resume of the Anthropic Principle"
- Daniel J. Berger's Anthropic Principle Links

- **"The Anthropic Cosmological Principle"**
  Author(s): **John D. Barrow** & **Frank J. Tipler**
  Publisher: Oxford Univ. Press
  ISBN 0-19-282147-4 (paperback)

Barrow and Tipler on the Anthropic Principle vs. Divine Design

Dr. William Lane Craig

William Lane Craig is Research Professor of Philosophy at Talbot School of Theology in La Mirada, California. He lives in Atlanta, Georgia, with his wife Jan and their two teenage children Charity and John. At the age of sixteen as a junior in high school, he first heard the message of the Christian gospel and yielded his life to Christ. Dr. Craig pursued his undergraduate studies at Wheaton College (B.A. 1971) and graduate studies at Trinity Evangelical Divinity School (M.A. 1974; M.A. 1975), the University of Birmingham (England) (Ph.D. 1977), and the University of Munich (Germany) (D.Theol. 1984). From 1980-86 he taught Philosophy of Religion at Trinity, during which time he and Jan started their family. In 1987 they moved to Brussels, Belgium, where Dr. Craig pursued research at the University of Louvain until 1994.

Barrow and Tipler's attempt to stave off the inference to divine design by appealing to the Weak Anthropic Principle is demonstrably logically fallacious unless one conjoins to it the metaphysical hypothesis of a World Ensemble. But there is no reason for such a postulate. Their misgivings about the alternative of divine design are shown to be of little significance.

Source: *British Journal for the Philosophy of Science* 38 (1988): 389-395.

NOTE: Dr. Craig uses logic symbols in this document. For users with Macintosh computer systems, for best results please set your browser to view this document using Western MacRoman encoding. In Netscape 3, use Options | Encoding and choose Western MacRoman. For Netscape 4, use View | Encoding and choose Western MacRoman.

In their massive study *The Anthropic Cosmological Principle*, [1986]{1} John Barrow and Frank Tipler provide the most comprehensive analysis to date of the so-called Anthropic Principle and its relation to the classic teleological argument for a Divine Designer of the cosmos. According to their analysis, the Anthropic Principle evolved out of the traditional design argument for God's existence, particularly one version of that argument, the eutaxiological version, which was based on the presence of discernable order and mutual harmony in nature in abstraction from any anthropocentric purpose being in view. Although Barrow and T'ipler believe that the Darwinian theory of evolution undermined biological, anthropocentric versions of the teleological argument, they contend that contemporary science has only served to accentuate the delicate balance, perceived in the eutaxiological version of that argument, of hightly improbable necessary conditions for the evolution and sustenance of intelligent life which obtain in the universe, and the bulk of their book is devoted to surveying the fields of physics and astrophysics, classical cosmology, quantum mechanics, and biochemistry to illustrate their point. These supply the evidence for what F.

R. Tennant [1930], who coined the term *anthropic*, called 'wider teleology'.

Not that Barrow and Tipler are endorsing a design argument; on the contrary, although scientists hostile to teleology are apt to interpret their work as sympathetic to theism and although I have already seen this book cited by two prominent philosophers of religion in support of the teleological argument, the thrust of the book's argument is in the end anti-theistic. As Barrow and Tipler employ it, the Anthropic Principle is essentially an attempt to complete the job, begun by Darwinian evolution, of dismantling the teleological argument by showing that the appearance of design in the physical and cosmological quantities of the universe is just that: an *appearance* due to the self-selection factor imposed on our observations by our own existence. If Barrow and Tipler are correct, then the wider teleological argument of Tennant proves no more effective than the narrow teleological argument of his predecessors.

That brings us to a consideration of the Anthropic Principle itself. Barrow and Tipler distinguish several versions of the Principle, the most basic and least disputable being the Weak Anthropic Principle (WAP):

> WAP: The observed values of all physical and cosmological quantities are not equally probable, but they take on values restricted by the requirement that there exist sites where carbon-based life can evolve and by the requirement that the Universe be old enough for it to have already done so. (p 15)

Barrow and Tipler regard WAP as 'in no way speculative or controversial' (p. 16), since it is 'just a restatement . . . of one of the most important and well established principles of science: that it is essential to take into account the limitations of one's measuring apparatus when interpreting one's observations' (p. 23). For example, if we were calculating the fraction of galaxies that lie within certain ranges of brightness, our observations would be biased toward the brighter ones, since we cannot see the dim ones so easily. Or again, a ratcatcher may say that all rats are bigger than six inches because that is the size of his traps. Similarly, any observed properties of the universe which may initially appear astonishingly improbable can only be seen in their true perspective after we have accounted for the fact that certain properties could not be observed by us, were they to obtain, because we can only observe those compatible with our own existence. 'The basic features of the Universe, including such properties as its shape, size, age, and laws of change must be *observed* to be of a type that allows the evolution of observers, for if intelligent life did not evolve in an otherwise possible universe, it is obvious that no one would be asking the reason for the observed shape, size, age, and so forth of the universe' (pp. 1-2). Thus, our own existence acts as a selection effect in assessing the various properties of the universe. For example, a life form which evolved on an earthlike planet 'must necessarily see the Universe to be at least several billion years old and ... several billion light years across,' for this is the time necessary for production of the elements essential to life and so forth (p. 3).

Now, we might ask, why is the '*observed*' in the quotation in the above paragraph italicized? Why not omit the word altogether? The answer is that the resulting statement:

> 1. The basic features of the universe must be of a type that allows the evolution of observers

is undoubtedly false; for it is not logically or nomologically necessary that the universe embrace intelligent life. Rather what seems to be necessarily true is

> 2. If the universe is observed by observers which have evolved within it, then its basic features must be of a type that allows the evolution of observers within it.

But (2) seems quite trivial; it does nothing to explain why the universe in fact has the basic features it does.

But Barrow and Tipler contend that while (2) appears to be true, but trivial, it has 'far-reaching implications' (p. 2). For the implication of WAP, which they seem to interpret along the lines of (2), is that no explanation of the basic features of the universe need be sought. This contention seems to be intimately connected with what is appropriate to be *surprised at*. The implication of WAP is that we ought not to be surprised at observing the universe to be as it is, for if it were not as it is, we could not observe it. For example, 'No one should be surprised to find the Universe to be as large as it is' (p. 18). '. . . on Anthropic grounds, we should expect to observe a world possessing precisely three spatial dimensions' (p. 247). Or again,

> We should emphasize once again that the enormous improbability of the evolution of intelligent life in general and *Homo sapiens* in particular does *not* mean we should be amazed we exist at all. This would make as much sense as Elizabeth II being amazed she is Queen of England. Even though the probability of a given Briton being monarch is about 10-8, *someone* must be. Only if there is a monarch is it possible for the monarch to calculate the improbability of her particular existence. Similarly, only if an intelligent species does evolve is it possible for its members to ask how probable it is for an intelligent species to evolve. Both are examples of WAP self-selection in action.[110]

---

[110] F. B. Salisbury, *Nature* 224. p. 342 (1969), argued that the enormous improbability of a given gene, which we computed in the text, means that a gene is too unique to come into being by natural selection acting on chance mutations. WAP self-selection refutes this argument, as R. F Doolittle in *scientists confront creationism*, L. R. Godfrey (Norton, NY 1983) has also pointed out (pp. 566, 575).

Here we have a far-reaching implication that goes considerably beyond the apparently trivial WAP. Accordingly, although Barrow and Tipler conflate WAP and the implications thought to follow from it, I want to distinguish these sharply and shall refer to these broader implications as the Anthropic Philosophy. It is this philosophical viewpoint, rather than WAP itself, that, I believe, despite initial impressions, stands opposed to the teleological argument and constitutes scientific naturalism's most recent answer to that argument. According to the Anthropic Philosophy, an attitude of surprise at the delicately balanced features of the universe essential to life is inappropriate; we should expect the universe to look this way. While this does not explain the origin of those features, it shows that no explanation is necesary. Hence, to posit a divine Designer is gratuitous.

Now it needs to he emphasized that what the Anthropic Philosophy does *not* hold, despite

the sloppy statements on this head often made by scientists, is that our existence as observers explains the basic features of the universe. The answer to the question 'Why is the universe isotropic?' given by Collins and Hawking, '. . . the isotrophy of the Universe is a consequence of our existence' (Collins and Hawking [1973], p. 317) is simply irresponsible and brings the Anthropic Philosophy into undeserved disrepute, for literally taken, such an answer would require some form of backward causation whereby the conditions of the early universe were brought about by us acting as efficient causes merely by our observing the heavens. But WAP neither asserts nor implies this; rather WAP holds that we must *observe* the universe to possess certain features (not that the universe must possess certain features) and the Anthropic Philosophy says that therefore these features ought not to surprise us or cry out for explanation. The self-selection effect affects our observations, not the basic features of the universe itself. If the Anthropic Philosophy held that the basic features of the universe were themselves brought about by our observations, then it could be rightly dismissed as fanciful. But the Anthropic Philosophy is much more subtle: it does not try to explain *why* the universe has the basic features it does, but contends that no explanation is *needed,* since we should not be surprised at observing what we do, our observations of those basic features being restricted by our own existence as observers.

But does the Anthropic Philosophy follow from the Anthropic Principle, as Barrow and Tipler claim? Let us concede that it follows from WAP that

> 3. We should not be surprised that we do not observe features of the universe which are incompatible with our own existence.

For if the features of the universe were incompatible with our existence, we should not be here to notice it. Hence, it is not surprising that we do not observe such features. But it follows neither from WAP nor (3) that

> 4. We should not be surprised that we do observe features of the universe which are compatible with out existence.

For although the object of surprise in (4) might at first blush appear to be simply the contrapositive of the object of surprise in (3), this is mistaken. This can be clearly seen by means of an illustration (borrowed from John Leslie): suppose you are dragged before a firing squad of 100 trained marksmen, all of them with rifles aimed at your heart, to be executed. The command is given; you hear the deafening sound of the guns. *And you observe that you are still alive,* that all of the 100 marksmen missed! Now while it is true that

> 5. You should not be surprised that you do not observe that you are dead,

nonetheless it is equally true that

> 6. You should be surprised that you do observe that you are alive.

Since the firing squad's missing you altogether is extremely improbable, the surprise expressed in (6) is wholly appropriate, though you are not surprised that you do not observe that you are dead, since if you were dead you could not observe it. Similarly, while we should not be surprised that we do not observe features of the universe which are incompatible with our existence, it is nevertheless true that

> 7. We should he surprised that we do observe features of the universe which are compatible with our existence,

in view of the enormous improbability, demonstrated repeatedly by Barrow and Tipler, that the universe should possess such features.

The reason the falsity of (7) does not follow from (3) is that subimplication fails for first order predicate calculus. For (3) may he schematized as

$$3'.\ \sim S: (x)\ ([Fx \times \sim Cx]\ E\ \sim Ox)$$

where S: is an operator expressing 'we should he surprised that', *F* is 'is a feature of the universe', *C* is 'is compatible with our existence', and O is 'is observed by us'. And (7) may he schematized as

$$7'.\ S: (\$x)\ ([Fx \times Cx] \times Ox)$$

It is clear that the object of surprise in (7') is not equivalent to the object of surprise in (3'); therefore the truth of (3') does not entail the negation of (7').{2 }

Therefore, the attempt of the Anthropic Philosophy to stave off our surprise at the basic features of the universe fails. It does not after all follow from WAP that our surprise at the basic features of universe is unwarranted or inappropriate and that they do not therefore cry out for explanation. But which features of the universe should thus surprise us?-those which are necessary conditions of our existence and which seem extremely improbable or whose coincidence seems extremely improbable. Thus, we should amend (7) to read

> 7*. We should be surprised that we do observe basic features of the universe which individually or collectively are excessively improbable and are necessary conditions of our own existence.

Against (7*), both the WAP and the Anthropic Philosophy are impotent. But which features are these specifically? Read Barrow and Tipler's book. Once this central fallacy is removed, their volume becomes for the design argument in the twentieth century what Paley's *Natural Theology* was in the nineteenth, *viz*., a compendium of the data of contemporary science which point to a design in nature inexplicable in natural terms and therefore pointing to the Divine Designer.{3}

Now Barrow and Tipler will no doubt contend that I have missed the whole point of WAP. For (7*) is true only if the basic features of our observable universe are co-extensive with the basic features of the Universe as a whole. And it may well be the case that the Universe at large does not in fact display the apparent features of design which our segment d0es. Barrow and Tipler endorse the Many-Worlds Interpretation of quantum physics, but one could also appeal to inflationary models or oscillating models of the Universe in order to generate multiple worlds. If such a wider Universe exists, then it might be argued that all possible universes are actualized and that WAP reveals why surprise at our being in a universe with basic features essential to life is not appropriate.

Objections can be raised against each of the theories proposed for generating many worlds;

but even if we conceded that a multiple universe scenario is unobjectionable, would such a move succeed in rescuing us from teleology and a cosmic Designer? This is not at all obvious. The fundamental assumption behind the Anthropic philosopher's reasoning in this regard seems to be something along the lines of

> 8. If the Universe contains an exhaustively random and infinite number of universes, then anything that can occur with non-vanishing probability will occur somewhere.

But why should we think that the number of universes is actually infinite? This is by no means inevitable, not to mention the paradoxical nature of the existence of an actually infinite number of things. And why should we think that the multiple universes are exhaustively random? Again, this is not a necessary condition of many-worlds hypotheses. In order to elude the teleological argument, we are being asked to assume much more than the mere existence of multiple universes.

In any case, the move on the part of Anthropic philosophers to posit many worlds, even if viable, represents a significant concession because it implies that the popular use of the WAP to refute teleology in a universe whose properties are coextensive with the basic features of our universe is fallacious. In order to stave off the conclusion of a Designer, the Anthropic philosopher must take the metaphysically speculative step of embracing a special kind of multiple universe scenario. That will hardly commend itself to some as any less objectionahle than theism.

We appear then to be confronted with two alternatives: posit either a cosmic Designer or an exhaustively random, infinite number of other worlds. Faced with these options, is not theism just as rational a choice as multiple worlds?

Barrow and Tipler demur, maintaining that 'careful thinkers' would not today 'jump so readily' to a Designer, for (i) the modern viewpoint stresses time's role in nature; but since an unfinished watch does not work, arguments based on omnipresent harmony have been abandoned for arguments based on co-present coincidences; and (ii) scientific models aim to be realistic, but are in fact only approximations of reality; so we hesitate to draw far-reaching conclusions about the nature of ultimate reality from models that are at some level inaccurate (p.30). But Barrow and Tipler seem unduly diffident here. A careful thinker will not readily jump to any conclusions, but why may he not infer a Divine Designer after a careful consideration of the evidence? Point (i) is misleading, since the operations of nature always work; at an earlier time nature is not like an *unfinished* watch, rather it is just a *less complex* watch. In any case, the most powerful design argument will appeal to both present adaptedness and co-present coincidences. Point (ii) loses much of its force in light of two considerations: (a) this is a condition that affects virtually all our knowledge, which is to say that it affects none of it in particular, so that our only recourse is simply to draw conclusions based on what we determine most accurately to reflect reality; fortunately, the evidence at issue here is rather concrete and so possesses a high degree of objectivity. (b) Barrow and Tipler do not feel compelled to exercise such restraint when proposing metaphysically speculative hut naturalistic accounts of the universe's basic features, *e.g.*, their defense of the 'many worlds' interpretation of quantum physics or scenarios for the origin of the universe *ex nihilo,* which leads one to suspect that a double standard is being employed here.

Hence, the Anthropic Principle notwithstanding, I see no reason why a careful thinker may not, on the basis of the teleological argument, rationally infer the existence of a supernatural intelligence which designed the universe.

REFERENCES

Barrow, John and Tipler, Frank (1986): *The Anthropic Cosmological Principle.* Clarendon Press.

Collins, C. B. and Hawking, S. W. (1973): 'Why is the Universe isotropic?' *Astrophysical Journal 180,* 317-34.

Craig, William Lane (1987): Critical review of *The Anthropic Cosmological Principle. International Philosophical Ouarterly.* 27, 437- 47.

Tennant, F. R. (1931) *Philosophical Theology.* 2 vols. Cambridge University Press.

NOTES

{1} For a more wide-ranging review of this book see Craig [1987].

{2} Similarly, the falsity of (6) does not follow from the truth of (5), for (5) may be schematized as ~S: ~ ($x) ([Mx × ~Ax] × Ox), where M is 'is me', Ox is 'is observed by me', and A is 'is alive'. From this it does not follow that ~S: ($x) ([Mx × Ax] × Ox), which is the negation of (6).

{3} Once the central fallacy is thus removed, Barrow and Tipler's argument in the lengthy quotation in the text seems to amount to little more than the old objection that *any* state of affairs is highly improbable and therefore the obtaining of the actual state of affairs requires no special explanation. But this objection is surely misconceived. What unprejudiced and right-minded person could possibly regard a chimpanzee's haphazardly typing out the complete plays and sonnets of Shakespeare as equally probable with any chaotic series of letters? The objection fails to reckon with the difference between randomness, order, and complexity. On the first level of randomness, there is a non- denumerably infinite number of chaotic sequences, *e.g.*, 'adfzwj', each of which is equally improbable and which collectively could serve to exhaust all sequences typed by the ape. But the meta-level of ordered letters, *e.g.*, ,'crystalcrystalcrystal ', need never be produced by his random efforts, were he to type for eternity. Even more improbable is the metameta-level of complexity, in which information is supplied, *e.g.*, 'To be or not to be, that is the question.' Hence, it is fallacious to assert that since *some* set of conditions must obtain in the universe, the actual set is in no way improbable or in need of explanation.

BARROW AND TIPLER'S ANTHROPIC COSMOLOGICAL PRINCIPLE

1. Fred W. Hallberg

Article first published online: 15 DEC 2005

DOI: 10.1111/j.1467-9744.1988.tb00624.x

Issue

Zygon®

Volume 23, Issue 2, (/doi/10.1111/zygo.1988.23.issue-2/issuetoc) pages 139–157, June 1988

Additional Information

How to Cite

Hallberg, F. W. (1988), BARROW AND TIPLER'S ANTHROPIC COSMOLOGICAL PRINCIPLE. Zygon, 23: 139–157. doi: 10.1111/j.1467-9744.1988.tb00624.x

Author Information

Fred W. Hallberg is an associate professor of philosophy at the University of Northern Iowa, Cedar Falls, Iowa 50614.

This paper was presented at the American Academy of Religion Consultation on Theology and Science in Boston, Massachusetts, 5–8 December.

Publication History

1. Issue published online: 15 DEC 2005
2. Article first published online: 15 DEC 2005

- Abstract
- References (/doi/10.1111/j.1467-9744.1988.tb00624.x/references)
- Cited By (/doi/10.1111/j.1467-9744.1988.tb00624.x/citedby)

Show messages

Get PDF (1151K) (/doi/10.1111/j.1467-9744.1988.tb00624.x/pdf)

Keywords:

anthropic principle; evolutionary cosmology; natural theology

Abstract. John D. Barrow and Frank J. Tipler's recently published *Anthropic Cosmological Principle* is an encyclopedic defense of melioristic evolutionary cosmology. They review the history of the idea from ancient times to the present, and defend both a “weak” version, and two “strong” versions of the anthropic principle. I argue the weak version of the anthropic principle is true and important, but that neither of the two strong versions are well grounded in fact. Their “final” anthropic principle is a revision of Teilhard de Chardin's evolutionary cosmology. They rectify Teilhard's factual errors but commit even more serious psychological and religious errors of their own.

Get PDF (1151K) (/doi/10.1111/j.1467-9744.1988.tb00624.x/pdf)

More content like this

Find more content:

- like this article (/advanced/search/results?articleDoi=10.1111/j.1467-9744.1988.tb00624.x&scope=allContent&start=1&resultsPerPage=20)

Find more content written by:

- Fred W. Hallberg (/advanced/search/results?searchRowCriteria[0].queryString="Fred W. Hallberg"&searchRowCriteria[0].fieldName=author&start=1&resultsPerPage=20)

Brad DeLong

Grasping Reality with Every Possible Tentacle: Brad DeLong's Semi-Daily Journal--Fair, Balanced, and Reality-Based 99.4% of the Time

June 22, 2006

A Dialogue on the Anthropic Cosmological Principle

Zoticus: What is this Anthropological Cosmological Principle?

Paracelsus: You mean "*Anthropic* Cosmological Principle.

Zoticus: I do? Anthropic Cosmological Principle.

Paracelsus: Did you see the sun rise this morning?

Zoticus: I did. 5:45. Rising over the north part of the Diablo Ridge. The dog is always puzzled by the sunrise. She stops and looks around, as if the sudden increase in brightness conveys some opportunity or threat...

Paracelsus: OK. The sun rose the furthest north it ever does--in your experience at least--right?

Zoticus: Yes.

Paracelsus: And 5:45 is the earliest the sun ever rises, at least around here, yes?

Zoticus: Yes.

Paracelsus: And if I asked you to explain to me why it was that the sun rises earliest, 5:45, and furthest north on June 21, and does this every year, what answer would you give?

Zoticus: Well, I would say that humans could only evolve on a planet of roughly 4,000 miles in radius in an orbit roughly 93 million miles from a G-type star.... That we could only evolve on a planet that was rotating, hence days and nights.... That the axis of rotation would not be perfectly aligned with the normal to the plane of earth's orbit, hence sometimes the days are longer. And June 21 just happens to be the day that the earth's axis of rotation points closest to the sun.

Paracelsus: So days are of different length--with June 21 the longest--because?

Zoticus: Spontaneous symmetry breaking--some day has to be the longest.

Paracelsus: And 5:45?

Zoticus: No significance: it depends on exactly how tilted the earth's axis of rotation is and what latitude we are at.

Paracelsus: So in answer to the question, "Why does the sun rise at 5:45 on June 21, which is the longest day of the year?" you give an answer that relies partly on spontaneous symmetry breaking, partly on chance and accidents, and partly on the Anthropic Sunrise Principle: Sunrises are very rare in this universe--go to a point at random and you will have to wait a *long* time to see one--but sunrises are common in places where humans have evolved. Hence given that we are humans who have evolved here, we should not be surprised to see a sunrise once a day.

Zoticus: But this doesn't explain why the sunrise is something that everybody sees...

Paracelsus: But "everybody" doesn't see the sunrise, if by "everybody" you mean "observers at every point in space." Only a very few observers in very particular places see the sunrise--hence the right explanation has to be one in terms of chance, contingency, and the Anthropic Sunrise Principle.

Zoticus: But that is unsatisfying.

Apollonius: Permit me, then, to interrupt. June 21 is the longest day of the year because that is the day the sun enters the constellation of the Dioscuri. The stars Castor and Pollux have a unique attraction to Helios--remember,

Castor was the horse-tamer, and they were both sons of Leda the Swan, and brothers of Helen of Troy. Helios--the sun--gathers strength from proximity to Castor and Pollux, and so June 21 is the day that the sun stays up the longest because it is the strongest. Our trained astrologers are hoping to find a way to renormalize our calculations so that we will be able to post-dict your 5:45 number, but there are a substantial number of technological mathematical problems yet to be resolved. We hope that new developments in mathematics--the "zero" it is called--will improve the accuracy of our calculations.

Paracelsus: But that's completely false!

Apollonius: It is, however, satisfying in a way that the Anthropic Sunrise Principle is not.

Zoticus: And the relevance to the Anthropological...

Paracelsus: Anthropic

Zoticus: Anthropic Cosmological Principle.

Paracelsus: Just this: the answers to the big questions physics is now asking may be equally unsatisfying--that the laws of nature are very different elsewhere in places beyond are vision, and are what they are by chance and contingency, and we're here to see them via evolution and the environment we need to survive.

Zoticus: But that's very unsatisfying...

J. Bradford DeLong on June 22, 2006 at 05:45 PM | Permalink

Comments

1
Tyce DeYoung said...
Without taking a position regarding the Anthropic Principle, I think it's a bit of a jump from the Anthropic Sunrise Principle to the Anthropic principle as it applies to cosmology. The existance of areas of the universe without sunrises is easily observed. The existance of universes with less finely tuned values of the vacuum energy, . . . well, let's just say the data is a bit more ambiguous on that point.

Reply June 22, 2006 at 05:57 PM
2
Brad DeLong said...
Re: "The existence of areas of the universe without sunrises is easily observed"

Not in 600 BC it wasn't...

Reply June 22, 2006 at 06:50 PM
3
typekey pseudonym said...
The misanthropic cosmological principle (i.e., "The Universe has it in for us!") has a lot more explanatory power, 'least in my experience.

Reply June 22, 2006 at 07:25 PM
4
Theophrastus Bombastus von Hoehenheim den Sidste said...
Once again, I see that my alter ego is far more intelligent than the creationists. Percy would be proud.

Reply June 22, 2006 at 07:50 PM
5
Robert Waldmann said...
Ah but the most fascinating Anthropic principle is that called the "completely ridiculous anthropic prinicple (CRAP)" by Martin Gardner in "Science Good Bad and Bogus." It addresses the deep deep mystery
of quantum mechanics.

Quantum mechanics goes on and on about probabilities equal to the amplitude of some wave. They are the probabilities that some particle would be "observed" in some state. The problem (which torments you and I know

that) is that, even if we accept the fact that God plays dice, quantum mechanics has no coherent line about when the Dice are cast. It seems to be just probabilities begetting probabilities with no resolution of the uncertainty. Even Shroedinger's cat with 1/(root(2)) of a functioning brain can see that there is a problem (your dog I'm not so sure).

According to CRAP the miracle of observation is a unique attribute of the human soul or something. According to CRAP, if there were no human beings there would be no "observing", wave packets wouldn't collapse, and the world would be all probabilities which are never resolved, Dice waiting for a human hand to cast them.

You got to admit, this argument is CRAP. It seems to me to be close to the nadir of idiocy, the achievement of which is, as I have often writtin, in my view, our Purpose (at least if one attempts to infer the aim of the Creator from his/her creation).

Reply June 22, 2006 at 07:53 PM

6

'As You Know' Bob said...

Just to be a complete pedant (and a total geek), I feel compelled to point out that, stictly speaking, "Earliest Sunrise" actually occurs a week or so _before_ Summer Solstice.

(Has to do with the eccentricity of the Earth's orbit.)

Reply June 22, 2006 at 08:34 PM

7

Brad DeLong said...

I am pwned! Totally pwned!!

Reply June 22, 2006 at 08:38 PM

8

jk said...

Should the random,longitudenal distance from the nearest time zone be included. Or is this inapplicable to a minute reading sundial?

Reply June 22, 2006 at 08:47 PM

9

andres said...

Great. Now if someone can explain to me what pwned is I'll understand what can shift a normally placid economics professor out of his philosophical equilibrium. (Schumpeter believed that all of capitalism's great achievements occurred in out-of-equilibrium situations, and I have faith in the late ugly old codger.) Perhaps he'll get a research paper out of it.

Reply June 22, 2006 at 09:14 PM

10

Brad DeLong said...

http://en.wikipedia.org/wiki/Pwned

Reply June 22, 2006 at 09:25 PM

11

guachi said...

pwned is l33t speak for owned. As in, "I own you". That is, I have defeated you, I am better than you.

Written with a "p", I am guessing, because l33t speak "elite speak" - think the kind of writing 12 year-old boys would use on a computer - involves many intentional misspellings evolving from common unintentional misspellings (the P being next to the O). Another common misspelling is "the" spelled as "teh" - something unintenionally done by many and now sometimes intentionally done.

You will also see this done with the exclamation mark as well. A 12 year-old boy wants to emphasize something and holds down the "!" key. Juvenile boy lifts up on "SHIFT" key too soon. The result is this - !!!!!!!!1111.

A full-blown version of this might be -

You write/do something dumb. I reply "Thats teh Gay!!!!!1111
I pwn you!!!!!1
L33T HaXXorZ FTW!!"

A mockery version will add the writing of "one" with the exclamation points. Like this - !!!!1one!!!11!

Reply June 22, 2006 at 09:33 PM

12

jl;cg said...

Actually because of the precession of the equinoxes the Sun now has entered into Cancer. My birthday is the 21st of June and my astrological tables have changed.

Reply June 23, 2006 at 12:56 AM

13

Sean Carroll said...

Zoticus seems to be an implicit believer in SNAP -- the Super-Narcissistic Anthropic Principle, which holds that the universe must operate in such a way that one would find personally satisfying. He (she?) should keep in mind that the universe doesn't always do that.

Reply June 23, 2006 at 01:22 AM

14

reason said...

I find this interesting as on David Brin's excellent blog we were invaded by a passionate believer in the Arthropic Principle (it seemed to be his reason for existance).-)

Now I don't know much about cosmology (I regard it as an entertaining intellectual game with potential side benefits nothing more). However, I do know about statistics and I see two problems with all the discussion about the AP:
1. Probabilities say nothing about individuals;
2. You can't calculate probabilities unless you know the population you are drawing from - and who knows very much about the population of all possible universes?

If people treat it as a speculative game, that is fine, if people are passionate about it, then I think they have a screw loose. Any other opinions.

Reply June 23, 2006 at 01:41 AM

15

Scott Martens said...

"[...] that the laws of nature are very different elsewhere in places beyond [our] vision, and are what they are by chance and contingency, and we're here to see them via evolution and the environment we need to survive."

Now, can I get anyone to make the same statement about economics?

Reply June 23, 2006 at 02:45 AM

16

Iasius said...

Re Quantum mechanics:
Remember that quantum mechanics is one way of describing the outcome of certain interactions.
In no way does it say how or why. We don't know why it seems to be a reasonable way to calculate the probabilities of what will happen, only that it does.

In other words QM answers only a certain type of question. QM does not tell you with 100% certainty what will happen to one particle, only the possible outcomes and their probabilities.

A fitting analogy IMO is driving a car. You don't need to know what makes it work to drive unless it breaks down.

Also, many people seem to misunderstand what an observer is in QM. An observer is basically any interaction. We (or any other "stuff" in the univese) have no way of knowing what happens to a particle unless something interacts with it. An observer is required to be self-aware for this (ie there were already observers before mankind came along).

QM does not state that probability waves exist, only that they seem to accurately describe the outcome of interactions.
In fact, the question of what happens to a particle while it does not interact with another one is really not a valid question as "something happens" by definition always refers to interactions.

My point is, don't blame QM for not answering a question it was never intended to answer.

Reply June 23, 2006 at 03:12 AM
17
Iasius said...
"An observer is required to be self-aware for this (ie there were already observers before mankind came along)."
Doh! That should read:
"An observer is not required to be self-aware for this (ie there were already observers before mankind came along)."

Reply June 23, 2006 at 03:14 AM
18
NBarnes said...
What is so facinating about the Anthropic Cosmological Principle? I mean, I know I'm posting something a lot less interesting than a lot of people, but.... 'OMG, I'm a THE PERFECT LIFEFORM and the world is created to suit me!? Surely this couldn't happen by accident?'

Bored now. *tears Warren's skin off with a gesture*

The world we observe suits us because we evolved in that world and not some other. If the world were other than it is, we would be other than we are, still suited to this counter-factual world, and boring people would still expound the Xenoanthropic Cosmological Principle.

Reply June 23, 2006 at 04:01 AM
19
larry birnbaum said...
Everything is for the best in this best of all possible worlds.

Reply June 23, 2006 at 05:31 AM
20
shah8 said...
hmmm...

about this observer thing?
FWIW, having done some of the math for it, the main reason observer effects occur is that data has to arrive from the system to the receptors of any data collection device. In very small things, that is enough to make some major changes, if the energy required to send data is removed.

Reply June 23, 2006 at 06:58 AM
21
Bruce Garrett said...
Been reading "The Cosmic Landscape" have we? I just got my copy the other day. It's a fascinating read.

When Hubble (which I work for) found that the expansion of the universe was accelerating, and I heard people saying later that the Cosmological Constant just happened to be exquisitely tuned to producing the kind of universe that could support life, I kinda suspected that the real answer was something like this. The universe was not made to our specifications, we came about because of its. We're simply living in that one out of many universes that just happens to have that particular value for that particular force, because only in that kind of universe do the physical laws support life which can evolve to eventually study it and ask these kinds of questions. We should not be surprised to see the values for the forces we see, because we are here, and not somewhere else. We could not even be, if we were somewhere else.

Why is this unsatisfying? After all...we Did happen. We Are here. There is a reason why, as opposed to a special

magical exception to the rules made just for us. I would much rather be a part of the natural universe, then a supernatural exception to it.

Reply June 23, 2006 at 07:24 AM

22

Ken Muldrew said...

Zoticus is just being polite; he is using "unsatisfying" as a euphamism for "nonsense".

Reply June 23, 2006 at 08:26 AM

23

island said...

If the most accurate cosmological principle is anthropic in nature, then we are the reason that the forces cannot be unified.

Not only that, but the anthropic principle is continually thrust to the surface of the relevant fields of physics and evolutionary science, yet scientists dogmatically ignore the relevant implication for "biocentric preference"... in spite of the fact that it is highly probable that a true anthropic constraint on the forces of the universe will necessarily include the human evolutionary process, which indicates that there exists a mechanism that enables the universe to "leap".

... and yet, Sean Carroll thinks that people that are passionate about it have a screw loose.

... even though he hasn't bothered to find out much about it from me... the "passionate one".

For example, he has no clue that the links to this post on quantum gravity is directly related to anhtropic principle: http://cosmicvariance.com/2006/06/19/the-string-theory-backlash/#comment-35150

Sean Carroll,

You are hereby coordially invited this this page of called, Anthropic Dogma, so that we can all find out whether or not I have a "screw lose", or if maybe you just don't get what all the "passion" is really about.

http://evolutionarydesign.blogspot.com/2006/05/anthropic-dogma.html

Reply June 23, 2006 at 08:32 AM

24

Aaron Bergman said...

The anthropic principle says nothing about probabilities. The principle of mediocrity (or the Copernican principle as I've heard it called) does lead to some Bayesianish notion of probabilties, but I've always found it tremendously problematic.

Reply June 23, 2006 at 08:42 AM

25

Seth Gordon said...

I've heard the Anthropic Principle described as "the closest atheists ever get to God." It seems to me that if you're going to get that close, you might as well go the rest of the way. I mean, with most Western religions, you get a belief that the universe was created for you and some good songs.

Reply June 23, 2006 at 08:46 AM

26

island said...

DING!!!... false assumption

Why would you think that we would be brought into existence for the benefit of us? Doesn't it make more sense that we might arise to the benefit some natural physical process?

How arrogant is it to assume that we are environmentally enabled by the forces of the universe to our benefit, rather than to its benefit?

Right off the bat it should be noted that people *automatically* take the extreme anti-centrist approach, rather than

to even consider what should be the most obvious alternative in a universe that is observationally "less-than-copernican".

Do I sound like a crackpot?... or aren't you simply looking at things backasswards... just like the creationists have CONDITIONED you to do.

And they wonder why I get bent... *eyeroll*

Reply June 23, 2006 at 08:53 AM

27

Jake said...

This dialogue is unsatisfying. The sun rises the furthest in the North on June 21st, because that's what "North" and "June 21st" mean.

It's understood that the orbital and physical parameters of planets vary; the question of why the Earth has 361 days and an axial tilt of 23 degrees as opposed to 300 days and 13 degrees is not an interesting one; there's another planet out there like that one, because of minorly varying conditions in the planetary nebula from which it condensed. No need for any sort of anthropic principle.

Now, "why is the fine structure constant 1 / 137" is a different sort of question, one for which the anthropic principle provides as good of an answer as anything else.

Reply June 23, 2006 at 09:47 AM

28

Maynard Handley said...

"

Been reading "The Cosmic Landscape" have we? I just got my copy the other day. It's a fascinating read.

"

Fascinating read != correct. Freud is a fascinating read. Presented appropriately Gilgamesh is a fascinating read.

To address Brad's larger point, what we have is
- an explanation for the nature of the universe from 2000 years ago that is clearly incorrect and
- a putative explanation for the universe from yesterday.
The assumption in this second explanation is that we now know close to everything that can be known/we need to know about the universe to answer this sort of question. Yet there's no real evidence for this. What if we are still 2000 years away from complete knowledge of the physics and history of the universe?

What we have now is GR and QFT which are assumed to be, conceptually, correct (but which may well be as conceptually misleading as a classical Newtonian world-view is). People like Susskind accept this idea in principle, but then go on to assume that their revision of the world, string theory, has to be correct, on the basis of revelations that have not occurred to the rest of us. The point is that until we have some realistic view of the ultimate structure of the universe, this sort of speculation is as empty (and as worthy of being mocked) as any of the massive extrapolations of the past --- Laplace with his clockwork universe, pre-Mendelian post-Darwinian biologists obsessing over how to avoid blending of traits, geologists of the late 19th century wondering how the sun could provide energy for more than a few million years and so on.
[Note my point, It is a fine thing to say that
"according to current (1910) science, the (classical 19th century)electrons orbiting a (classical 19th century) nucleus will radiate and therefore we have a problem with our model".
It is quite another to go on from this to start saying "Well, as we all know, the science of 1910 is perfect and will never be superceded, therefore ...insert crazy idea here, along with dogmatic insistence that everyone who doesn't agree with you is insane, politically motivated, falsely concious and whatever else..."]

Reply June 23, 2006 at 10:02 AM

29

island said...

"there's another planet out there like that one, because of minorly varying conditions in the planetary nebula from

which it condensed. No need for any sort of anthropic principle."

Nope. This is predicted by the biocentric extension of the AP, and the "goldilocks" constraint tells us that this physics only applies to a fine layer of galaxies that exists on the same evolutionary "plane" as we do. IOW... older and newer systems don't enjoy all of the ecobalanced coincidences that are necessary to carbon based life.

http://www.lns.cornell.edu/spr/2006-02/msg0073181.html

"Now, "why is the fine structure constant 1 / 137" is a different sort of question, one for which the anthropic principle provides as good of an answer as anything else."

"It's a number provided by nature and we should expect that a theory will someday provide a reason for it."
~ Paul Adrian Maurice Dirac ~

This physics fixes Dirac's Large Numbers Hypothesis, where Robert Dicke got his anthropic coincidence from.

Three examples. At least two include causality:

http://www.lns.cornell.edu/spr/2006-03/msg0073465.html
http://www.lns.cornell.edu/spr/2005-06/msg0069755.html
http://www.lns.cornell.edu/spr/2006-02/msg0073320.html

Dirac's "corrected hypothesis defines the mechanism for the AP.

Reply June 23, 2006 at 10:05 AM

30
Rob G said...
Ambrose Bierce on the ostrich;

The absence of a good working pair of wings is no defect, for, as has been ingeniously pointed out, the ostrich does not fly.

Reply June 23, 2006 at 11:34 AM

31
jfaughnan said...
One other comment mentions Bayes theorem.

I hereby challenge our esteemed professor to present part II of this discussion and thereby demonstrate the Bayesian formulation of the anthropic principle.

Reply June 23, 2006 at 12:41 PM

32
Scott said...
Perhaps the anthropic cosmological principle makes not only for bad science, but also for bad theology:

"19. That person does not deserve to be called a theologian who looks upon the invisible things of God as though they were clearly perceptible in those things which have actually happened."

http://www.augustana.edu/Religion/LutherProject/HEIDELBU/Heidelbergdisputation.htm

Reply June 23, 2006 at 12:53 PM

33
island said...
I see that my first comments should not have been aimed at Sean Carroll, and I'm sorry for that, Sean, who also knows how strongly I feel about the AP, yet he also commonly fails to acknowledge the obvious merrit and significance of the points that I make, ergo my erroneous interpretation of the comment by a lack of "reason".

As I've previously aluded to, the principle of mediocrity only applies to galaxies that exist in the same fine layer of evolutionary development as we are, per the physics which derives the "goldilocks" facet of the anthropic coincidences.

This says a lot about "Bayesianish" notions of probabilties for life in our own observed universe, so the solution is only problematic when you start believing in idealized assumptions about the alleged infinite or "multiversitile"

potential of our universe.

But that ain't observed, sports-fans, so it isn't the necessarily preferred theoretical route when empiricism doesn't require all of this crazy wild-haired speculation that we do not observe... and that's only the tip of the assumptionBreakers.

Reply June 23, 2006 at 01:14 PM

34
Sam Taylor said...
What greaat fun! Thanks, Brad.

Reply June 23, 2006 at 03:33 PM

35
wml said...
I think the Anthropic principle is just a restatement of the fact that the conditional probability of A, given you have observed A, is, um, one. I.e. given human beings exist, what is the probability human beings exist?

Another way to look at it (I think this is from Feynman) suppose you hit a golfball at random onto a vast field of grass. The ex ante chance you hit any particular blade of grass may very well be infintesmally small. However, if you go over ex post to the blade that you in fact hit, and opine "OMG what are the chances of all the blades of grass in this vast field I'd land on this exact one! OMG OMG OMG! It's a miracle!!!11eleven!" The answer is, of course, the chance you hit that particular blade of grass, given you hit that blade of grass, is... one. There's nothing magical or special or miraculous about the event... because if you had hit a different blade of grass, you would have made the same observation about THAT blade of grass instead.

Now if you had predicted, ex ante, which blade of grass you would hit, and if you were proven to be correct, THAT would be impressive.

This is why in the social sciences you must make a model first and THEN test it against data. OR at least, observe an empirical regularity in one set of data, and then test the regularity in another set of data. You can not use the same data set to BOTH establish a hypotheis AND test it. Because the data will never reject a hypothesis that came from the data itself.

Therefore, the Anthropic Principle doesn't EXPLAIN anything. That is why its not satisfying. All it can do is calm people down who claim that observing life/solar systems/particular physical constants is a miracle/wonder/mystery. If they had been anything else, either you wouldn't be around to comment on them, or you'd be claiming those different values were miracles/wonders/mysteries.

Baysean updating and Anthropic principle:

Suppose you are playing Let's Make A Deal, and there are two curtains concealing possible mystery prizes. Monty Haul tells you that there is a prize behind each curtain A and B with probability x and y (but does not tell you the value of x or y) and that whether a prize is behind one curtain is independent of the presence of the prize behind the other curtain. There are then 4 possibilities: no prizes (1-x)(1-y), two prizes xy, prize only behind curtain A (x)*(1-y) and a prize only behind curtain B (1-x)*y.

Suppose I then show you what is behind curtain A, and there turns out to be a prize there. What is the conditional probability of a prize behind curtain B, given a prize behind curtain A? Prob(A and B)/Prob(A) = xy/(xy+x(1-y))=y. That is the prior probability. You have learned nothing! NOTHING!!!!

If you want to know if there is life on Rigel 7, and you don't know anything about about Rigel 7, and there is no direct link between life on earth and rigel 7, then telling you that there is life on earth tells you nothing about whether there is life on Rigel 7.

Reply June 23, 2006 at 05:44 PM

36

Maynard Handley said...
The one point to add to wml's point above is that all this Bayesian reasoning, even when it makes sense, is pointless in the absence of knowledge of the relevant probabilities.

To take a slightly different example, consider the Drake equation for the probability of life elsewhere in the universe. OK, some of the numbers in there we know --- number of stars and galaxies and such. Then some of the probabilities we can guess (probability of planets with certain characteristics); but we are guessing. And then you get to something like probability of life evolving ob a planet with certain characteristics, and why even pretend that you have a clue what this number is? You claim the probability is close to 1, and so life elsewhere in the universe has probably happened billions of times; I claim the probability is 10^-50 and so life happened nowhere else; and no-one is the wiser.

And so it is with anthropic reasoning. Even assuming these people talking about multiverses and the landscape and so on have a clue what they are talking about, you reach certain points where you're just sticking in numbers you made up, numbers I could just as easily swing upper or lower by factors of 10^50 or more. And so, once again, what exactly are you learning from your Baysian calculation in the absence of worthwhile probabilities to stick into the equation?

Reply June 23, 2006 at 06:18 PM

37
Bruce Garrett said...
"I think the Anthropic principle is just a restatement of the fact that the conditional probability of A, given you have observed A, is, um, one."

Yeah...that's what I took from it.

"Therefore, the Anthropic Principle doesn't EXPLAIN anything. That is why its not satisfying."

I can accept that sense of unsatisfying. Yes, explanations are good. But what I like about the Anthropic Principle is that it reminds us that we can't take the fact that we're here to observe the universe as proof that the universe must have been created specifically for us to be here. Maybe. But maybe not.

I understand that what Susskind presents in his book is controversial. I am certainly not in any position to critique the ideas he presents as a physicist might. I read books like that not to be swept up in a specific new concept, but to be swept up in the act of exploring concepts and watching them tested against each other. I like watching the process. Watching the process helps me maintain some shred of belief in the human status, which in these George Bush years I desperately need. But I have seen enough exciting new concepts come along, only to get thoroughly blown apart by the evidence in my lifetime, not to get too personally attached to any of them.

Reply June 23, 2006 at 06:49 PM

38
stunster said...
I find it ironic that some scientists are driven to posit an infinity of unobservables so as to avoid positing one unobservable infinite.

I mean, if you're committed to verificationism, what's the point?

The point I'd make is that there is no way
string physics or any other physics can avoid positing an unobservable, spaceless, timeless, infinite reality of some sort. Let
me explain why....

Let's suppose that string physics, or some other development in physics, becomes scientifically established, and is shown to entail a multiverse. Immediately we'd want to know why there is any such thing as this physics, and why there is any such thing as a multiverse.

Well, there's two ways to go at this point.

One way (that favored by Greene) is to say that the physics will turn out to logically necessary and that this follows

from the mathematics exhibiting it. But how would this ultimate theory establish the validity of mathematical reason itself---the very mathematical reason that underlies the ultimate theory?

After all, the construction of the theory would be presupposing the validity of the mathematical reasoning involved, and it would be suggesting that mathematical reason is valid not only for this universe, but for the multiverse as a whole. So where mathematical reason itself comes from is one issue.

A second issue is: why would this universally valid Mathematical Reason be such as to instantiate anything in physical reality, not least ourselves, who can appreciate and grasp and understand it? Or to put it another way, why is there something (even just this multiverse-generating mathematics), rather than nothing at all? Hawking famously asked why the equations would go to the bother of making anything like a universe, and one could ask the same thing about the string (or whatever) equations that make a multiverse. Why, in other words, would the equations be self-instantiating in physical reality? Maybe you'd need another equation for that.... which at some point in this regress just has to be there eternally, instantiating the other equations, etc.

But then one would seem to be left with the choice of either theism, or a form of mathematical Platonism, and in *either* case, one would be positing a non-physical unobservable something as being responsible for both the multiverse and our reasoning about it. Moreover, mathematics itself is an *infinite* structure. And it's physically invisible. (Cf. God)

The trouble with Platonism as an account of reason is that if the Platonic entity itself is suitably to be grasped by mind, then it's deeply puzzling why it should not be *essentially and intimately* connected with mind (or intellect, or consciousness) in the first place, and in fact actually just *be* the content of a mind, or intellect, or consciousness. We never encounter Platonic entities as freestanding objects---they are always encountered as contents of minds. But this suggests an infinite mental content, such as mathematics is, would need an infinite mind, or intellect, or consciousness to comprehend it.

There is perhaps a way around this problem, though. And that is to invoke once again the principle of natural selection. It would go like this: We get this universe because it is naturally selected for us within a multiverse. And we get the multiverse described by the equations of string theory (or whatever the final theory is) because it is naturally selected within a multiverse of multiverses. And we get the multiverse of multiverses because it is naturally selected by a multiverse of multiverses of multiverses.... And so on, ad infinitum.

But either way, you have to end up positing a *physically unobservable infinite*. Either, Mathematical Reason (Platonistically conceived). Or, an infinity of universes/multiverses.

But the point of going this route was to *avoid* having to posit a physically unobservable infinite. But it seems to me that point turns out to be self-defeating.

Reply June 24, 2006 at 05:02 AM

39

stunster said...

A coda to my previous comment....There is a good argument for thinking that order must be primitive at some level and cannot all be the result of natural selection. Here it is in a nutshell.

1. For natural selection to work at all, it must work upon some domain.

2. To identify any domain whatsoever in the first place, science must find order of some kind pertaining to that domain.

3. Hence, every domain upon which natural selection is to operate must already be ordered in some way.

4. Hence, natural selection cannot be the sole explanation of order in nature, unless one posits an infinite unobservable or an infinity of unobservables, which defeats the purpose of relying on natural selection in the first

place, which was to explain phenomena without positing anything infinite and/or unobservable.

Some order, at some level of scientific analysis, must be primitive. It can't all be generated by natural selection. Or else, one must posit an infinity of some kind, which by definition must be physically unobservable by finite scientists.

Reply June 24, 2006 at 05:24 AM

40

stunster said...

Confirming my first comment on this issue....

" The other problem is that there's been a split within the string theory community. There are some who have basically decided that whatever this theory is, it has ***infinitely complex possible solutions [known as the string theory landscape]***. As for the dream that there's going to be one solution of string theory and it's going to be the real world, I think a lot of them have given up on that. So they're trying to pursue this idea that string theory really is an infinitely complex thing. I think a lot of other string theorists are well aware that if you go down that road you really can't predict anything and you're in ***danger of leaving what is normal science.***"

(Emphases added)

http://www.discover.com/issues/feb-06/departments/dialogue-woit/

Reply June 24, 2006 at 05:58 AM

41

Stewart said...

I still prefer the arthropic principle: to provide an inordinant number of beetles and their delicious seadwelling cousins.

Reply June 24, 2006 at 06:51 AM

42

'As You Know' Bob said...

"Paracelsus: And if I asked you to explain to me why it was that the sun rises earliest, 5:45, and furthest north on June 21, and does this every year, what answer would you give?"

Brad DeLong: "I am pwned! Totally pwned!!"

Wow. To be fair, Paracelsus is wrong about "earliest sunrise" only by a few seconds, undetectably so without a modern clock.

But now I'm trying to figure out how to modestly add this Nerdly Triumph to my resume: "In 2006, I once Totally Pwned!!! Prof. DeLong on a trivial point of celestial mechanics."

Reply June 25, 2006 at 07:53 AM

43

Robert Ullmann said...

I believe this is a major advance in epistemology...

The Caninical Sunrise Principle:

If there is a Dog, She exists precisely where She can be startled by the sunrise.

Reply June 28, 2006 at 06:35 AM

Comments on this post are closed.

Scottish Journal of Theology

Scottish Journal of Theology / Volume 40 / Issue 01 / February 1987, pp 138-140

DOI: http://dx.doi.org/10.1017/S0036930600017385 (About DOI), Published online: 02 February 2009

Book Reviews

The Anthropic Cosmological Principle. By J. D. Barrow and F. J. Tipler. Oxford, Clarendon Press, 1986. Pp. xx + 706. £25·00.

J. C. Polkinghorne[a1]

[a1]Blean, Canterbury

Home
View the Library
Introductory Essays
List of Award Recipients
Editorial Board & Contributing Editors
Media
About Us
Contact Us

The Anthropic Cosmological Principle

by John D. Barrow , Frank J. Tipler

Introductory Essay by V. V. Raman

This massive volume is dense in content and in ideas. It is an extensive exploration of the Anthropic Principle (AP) by two physicists who have contributed to the field. Whether or not its thesis is universally embraced by all physicists, the book presents with scientific competence an idea that can be seen to emerge from the data of physics. The idea is quite simple: the universe was meant for the emergence of life. The physics is complex. The world we experience results from two sets of factors: the laws of nature (physics), and a certain number of parameters called fundamental constants. “The Holy Grail of modern physics is to explain why these numerical constants… have the particular numerical values they do” [5].

The book first gives a capsule history of design arguments for the universe, from ancient Greek to modern Western thought. There is even a section on Non-Western schools. The authors remind us that “the idea that humanity is important to the cosmos and indeed that the material world was created for man both seem to be present in many cultural traditions” [92] from the Chinese to the Mayan. Next follows a discussion of *Modern Teleology and Anthropic Principles* in which the thoughts of leading Western philosophers are presented. However, “the way in which bcal teleological ideas are used by modern biology and physics (is) carefully distinguished from their indiscriminate global deployment in past centuries” [204].

Technical (mathematical) language is now introduced to explain how the AP was rediscovered in modern science. This is done by tracing “some aspects of the history of coincidences in the physical sciences” [275]. In this context, the authors explain the lore of large numbers, the consequence of coincidence, dimensionless numbers, Dirac’s hypothesis, and more.

The chapter on the Weak AP presents the physics of atoms, molecules, and nuclear forces, of planetary life, neutron stars, and black holes. The idea is to show “how it is possible to construct the gross features of the natural world around us from the knowledge of a few invariant constants of Nature” [359]. A discussion on cosmology follows that talks about the hot big bang, galaxies, the cosmological constant, and creation *ex nihilo*.

The next chapter discusses quantum mechanics. Here the goal is “to show that it is possible to formulate quantum cosmological models in accord with the Many-Worlds interpretation of quantum theory so that the Weak and Strong Anthropic Principles are observationally testable” [505-506]. In the next chapter, life and intelligent life are defined and discussed, the anthropic significance of water is presented, and the role of carbon is explained. We are told that “if the current searches for extra-terrestrial intelligent life succeed…” then Brandon Carter’s argument for the Weak AP will collapse [569]. Then we read about space travel and arguments against the existence of extraterrestrial intelligent life.

The last chapter, on the future of the universe, concludes with the omega point at which “life would have gained control of all matter and forces not only in a single universe, but in all universes whose existence if logically possible” [677].

Back to book details: *The Anthropic Cosmological Principle*

Back to library

Search:

Go

Select category:

Biological Foundations
Buddhism
Christianity
Classics and Historically Influential Works
Creationism
Ecology, Sustainability and Environmental Ethics
Emergence and Complexity
Encyclopedia/Reference
General Science and Religion
Hinduism
History
Islam
Judaism
Medicine, Bioethics and Biotechnology
Naturalism
Philosophical Foundations and Epistemology
Physics, Cosmology and Mathematics
Psychology, Neuroscience and the Cognitive Science of Religion
Taoism and Confucianism
Textbooks, Primers and Introductions to Science and Religion
The Scientific Study of Religion, Anthropology, Ethology and the Social Sciences

Peer-Reviewed Stealth ID Classic : The Anthropic Cosmological Principle (1987)

February 22, 2006 Posted by scordova under Intelligent Design 53 Comments

Frank Tipler co-authored a book with John Barrow entitled The Anthropic Cosmological Principle which was a peer-reviewed book published by Oxford University in 1987.

The principle thesis:

> **Intelligent** information-processing must come into existence in the Universe, and, once it comes into existence, it will never die out.

They derive the thesis from Schrodinger's equation

$$i\hbar\,|\dot{\psi}\rangle = \mathrm{H}\,|\psi\rangle$$

$$\Delta x \Delta p \geq \frac{\hbar}{2}$$

From Schrodinger's equation they derive the following formula:

Universal Wave Function

which predicts, through physical first principles alone, at the end of time that there must be an Intelligent Entity that is conscious, all-powerful, all-knowing, non-material, eternal. By all counts, such an entity would properly be called, "God".

Tipler says in Dembski's book Uncommon Dissent

> (the chapter is available for free at ISCID at the link Tipler on Peer Review):
>
> A recent poll of the members of the National Academy of Sciences, published in Scientific American, indicated that more than ninety percent are atheists. These men and women have built their entire worldview on atheism. They would be exceedingly reluctant to admit that any result of science could be valid if it even suggested that God could exist.
>
> I discovered this the hard way when I published my book The Physics of Immortality. The entire book is devoted to describing what the known laws of physics predict the far future of the universe will be like. Not once in the entire book do I use anything but the known physical laws, the laws of physics that are in all the textbooks, and which agree with all experiments conducted to date. Unfortunately, in the book I gave reasons for believing that the final state of the universeÃ¢â‚¬â€a state outside of space and time, and not materialÃ¢â‚¬â€shouldbe identified with the Judeo-Christian God. (It would take a book to explain why!) My scientific colleagues, atheists to a man, were outraged. Even though the theory of the final state of the universe involved only known physics, my fellow physicists refused even to discuss the theory. If the known laws of physics imply that God exists, then in

> their opinion, this can only mean that the laws of physics have to be wrong. This past September, at a conference held at Windsor Castle, I asked the well known cosmologist Paul Davies what he thought of my theory. He replied that he could find nothing wrong with it mathematically, but he asked what justified my assumption that the known laws of physics were correct. At the same conference, the famous physicist Freeman Dyson refused to discuss my theoryÃ¢â‚¬â€period. I would not encounter such refusals if I had not chosen to point out my theoryÃ¢â‚¬â„¢s theological implications.
>
> ....
> As a physicist, I am aware that quantum mechanics, the central theory of modern physics, is even more deterministic that was the classical mechanics of which Darwin was aware. More than this, quantum mechanics is actually teleological, though physicists donÃ¢â‚¬â„¢t use this loaded word (we call it Ã¢â‚¬Å“unitarityÃ¢â‚¬Â instead of Ã¢â‚¬Å“teleologyÃ¢â‚¬Â). That is, quantum mechanics says that it is completely correct to say that the universeÃ¢â‚¬â„¢s evolution is determined not by how it started in the Big Bang, but by the final state of the universe. Every stage of universal history, including every stage of biological and human history, is determined by the ultimate goal of the universe. And if I am correct that the universal final state is indeed God, then every stage of universal history, in particular every mutation that has ever occurred, or ever will occur in any living being, is determined by the action of God.

Though I do not agree with all of Tipler's ideas (forgive me Frank), the derivation from the Schrodinger equation above has been found reasonable by various scholars. And certainly having someone of John Barrow's reputation as the principle co-author of the book where the derivation was originally given certainly lends a degree of respectability to the idea.

A reasonable possibility from physical laws alone is that ID has a Designer available at the cosmological scale. ID cannot answer whether the Designer of the cosmos is also directly the author of life. For example, we can say Rachmaninoff composed the famous Rachmaninoff 2nd Concerto. If God made Rachmaninoff's ancestors, does this mean we can say God designed the Rachmaninoff 2nd? In like manner, we can't be too quick to say God is the direct author of life even though the laws of physics may predict His existence. ID can only suggest that something is designed. However knowing, through the laws of physics, that God may exist, it certainly makes the design inference a little more palatable.

Salvador Cordova

53 Responses to *Peer-Reviewed Stealth ID Classic : The Anthropic Cosmological Principle (1987)*

1 **ThePolynomial** February 22, 2006 at 4:48 pm

SC – What does O stand for in that final formula? Thanks.

2 **scordova** February 22, 2006 at 4:55 pm

"O" stands for Observations. The exact derivation is on page 471, but one does not really need all the details of the math. If one recalls the idea which Thomas Aquinas offered of a "First Cause", then one might simply say Barrow and Tipler phrase the idea in terms of the laws of physics for an "Ultimate Cause".

The equation reflects the net effect of all the quantum systems and observations of those quantum systems resulting in the universe being one massive quantum system. That massive quantum system must be "Observed" by the Ultimate Observer (God) for the physical world to come into being. It is interestng, they shied away from using the term God in their 1987 book, but chose the term "Ultimate Observer" which is strictly speaking, correct. It was not until 1996 that Tipler equated the Ultimate Observer with God. That's when the idea really raised some ire!

3 **scordova** February 22, 2006 at 5:07 pm

Barrow and Tipler's ideas were actually forseen 12 years before their book by Physicist FJ Belinfante in his book Measurements and time reversal in objective quantum theory

> We thus see how quantum theory requires the existence of God. Of course, it does not ascribe to God defined in this way any of the specific additional qualities that the various existing religious doctrines ascribed to God.

> Acceptance of such doctrines is a matter of faith and beliefÃ¢â‚¬Â¦.
>
> If elementary systems do not Ã¢â‚¬Å“possessÃ¢â‚¬Â quantitatively determinate properties, apparently God determines these properties as we measure them. We also observe the fact, unexplainable but experimentally well established, that God in His decisions about the outcomes of our experiments shows habits so regular that we can express them in the form of statistical laws of natureÃ¢â‚¬Â¦this apparent determinism in macroscopic nature has hidden God and His personal influence on the universe from the eyes of many outstanding scientists.Ã¢â‚¬Â
>
> F.J. Belinfante

4 **GilDodgen** February 22, 2006 at 5:20 pm

Hey, Salvador is a cool guy! Anyone who likes Rachmaninoff can't be all bad. It was Rachmaninoff, and the Second Concerto in particular, that inspired me in the seventh grade to pursue the piano as a career. It would be four more years before I would perform the Rach 2, but that inspired me to major in music. Was this all front-loaded?

5 **scordova** February 22, 2006 at 6:27 pm

Hey Gil,

You're a cool guy too. I wanted to be a professional musician. Piano was my major instrument in college before I graduated as an electrical engineer with a minor in music.

Hey, great minds think alike. 

I wonder if Bill Dembski plays the piano as well?

Salvador

6 **scordova** February 22, 2006 at 6:29 pm

Here is a crude 2-page essay elaborating on Barrow and Tipler's derivation. I hope it shows something of the physical experiments and theory involved.

God in the Equations

Salvador

7 **j** February 22, 2006 at 9:27 pm

Tipler: "quantum mechanics says that it is completely correct to say that the universeÃ¢â‚¬â„¢s evolution is determined not by how it started in the Big Bang, but by the final state of the universe. Every stage of universal history, including every stage of biological and human history, is determined by the ultimate goal of the universe."

This agrees with the observation that evolutionary algorithms must be given a purpose in order to achieve anything creative.

8 **danb** February 22, 2006 at 9:34 pm

While SchrÃƒÂ¶dinger's theory describes how a wave function collapse looks like from outside the wave function, it does not say what observant entities see INSIDE of the wave function. How would we know wether or not the wave function that encapsulates us has collapsed or not? Do Barrow and Tipler treat this conundrum?

9 **saxe17** February 22, 2006 at 9:49 pm

Gil, A little off topic, but I'd like to expose my two and four year old girls to some classical music. What would you recommend?

Saxe

10 **GilDodgen** February 22, 2006 at 11:20 pm

[Off Topic]

Dear Saxe,

Isn't it amazing how random mutation and natural selection produced all the

wonderful musical artistry of the great composers, not to mention the musicians who play this stuff and the people who invented and perfected the art of creating musical instruments? Man, that RM+NS stuff is really cool!

I am particularly fond of the romantic era, and especially the genre of the concerto, which combines the personality of a solo instrument with the richness of an orchestra. The repertoire is so vast, but I would recommend the violin concerti of Beethoven, Brahms, Mendelssohn and Tchaikovsky, and the Emperor (fifth) piano concerto of Beethoven, the second piano concerto of Brahms, the first piano concerto of Tchaikovsky and the second piano concerto of Rachmaninoff. This music is transcendent.

I have recorded three solo piano albums of music by Chopin, Liszt, Rachmaninoff and Gershwin which I am happy to give away for free.

11 **scordova** February 22, 2006 at 11:52 pm

Music is a form of specified complexity. Good music is highly teleological. Here is some specified complexity by Franz Lizst. It was a collection of specified complexity which he designed during his courtship with Princess Carolyn of Russia. It is a lullaby fit for a princess.

I used the piece as my college entrance audition several years ago. My recording of the piece can be downloaded if you right click over the link and do a "save target" to capture the entire Mp3:
Liebestraum in A-flat Major

Another favorite is Rachmaninoff's *18th Variation from Rhapsody on a Theme of Paganini*. You can get a 1-minute sample from Amazon:

Rachmaninoff Samples

12 **valerie** February 23, 2006 at 1:26 am

GilDodgen wrote:
"IsnÃ¢â‚¬â„¢t it amazing how random mutation and natural selection produced all the wonderful musical artistry of the great composers, not to mention the musicians who play this stuff and the people who invented and perfected the art of creating musical instruments? Man, that RM+NS stuff is really cool!"

You said it, Gil. That's why Darwin's theory is so widely considered to be one of the greatest ideas in man's history.

It brings to mind the famous, beautiful closing passage of the Origin of Species:

"There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved."

13 **Srdjan** February 23, 2006 at 3:51 am

Saxe you better start with Bach and Mozart. Liszt, Brahms and Rachmaninoff for two and four years old? Guys give girls some time to evolve

14 **physicist** February 23, 2006 at 5:52 am

It's an interesting idea, but I am unconvinced…

For one thing, there are some mathematical problems with the wavefunction of the universe (though there has been some recent progress, and I think it will be an important concept in quantum gravity). So all considerations of god aside, it is not really known how to make this concept work properly yet.

Secondly, it is not clear to me that the copenhagen interpretation will work for a wavefunction of the universe. the intuition is based on classical measuring devices observing otherwise isolated quantum systems, but the modern interpretation of measurement and wavefunction collapse is that it is an artifact of treating the measuring device classically. So i think the consensus is that if you consider a wavefunction of the universe there is no need for a separate observation process.

These are difficult physical and conceptual issues which we can debate—I certainly don't have all the answers. What I find much less debatable is the inference that a putative observer of the wavefunction of the universe would have the following qualities:

1. Conscious
2. Intelligent
3. Non-Material
4. All Powerful

5. All Knowing
6. Eternal

I can't really find any justification for asserting these qualities—they seem to me more the qualities the author *wants* such an observer to have.

15 **scordova** February 23, 2006 at 6:14 am

danb asked: "While SchrÃƒÂ¶dingerÃ¢â‚¬â„¢s theory describes how a wave function collapse looks like from outside the wave function, it does not say what observant entities see INSIDE of the wave function. How would we know wether or not the wave function that encapsulates us has collapsed or not? Do Barrow and Tipler treat this conundrum? "

In quantum cryptography, we can detect the effect of an intelligent intrusion into a crytographic system because someone's intelligent choice has triggered a collapse. See: http://www.cs.dartmouth.edu/~jford/crypto.html

By way of extension, because we see the universe, we are detecting that some agency is collapsing wave functions in the future.

We are being created through the Ultimate Observer's act of knowing (measurement) in the future. In other words, your question is approaching QM classically (where the past affects the future). But the Quantum idea is the reverse: the future affects the past. The fact we exist is evidence our wave functions are being observed at the end of time and have not yet collapsed in the present. The past and present exist because of what will happen in the future. If our wave functions were already fully collapsed, the world would be at an end.

So to answer your question, observant entities (you and I and everyone) encapsualted inside the Universal wave function would not even exist to make observations in the present world were it not for the Ultimate Observer in the future peering back into time. In a way, our wave functions have collapsed, but in the future. The history of the universe is fixed by a future event.

This rather shocking inference was borne out by experiments in the 1970 with Wheeler's double-slit-delayed-choice experiment which happened actually in Tipler's school, the University of Maryland. We were able to demonstrate the future affects the past in small quantum systems. More amazingly, one could even somewhat re-write the past (quantum erasure experiments) and thus make something anew.

If a future observation affects a small quantum system, by way of extension, all the universe must be affected by a future observation. Barrow and Tipler agrues that through unified guage theory, all features of the universe (not just position and momentum but even physical constants and properties of matter, etc.) arrive through an Ultimate Observation (quantum measurment) at the end of time.

Again, it is basically Thomas Aquinas idea of a "first cause" jazzed up into the language of modern physics where things are driven by an "ultimate cause". The only difference is Aquinas had a philosophical musing, and Barrow and Tipler have the laws of modern physics to make their case. They've given Aquinas' argument some serious teeth through quantum mechanics.

16 **scordova** February 23, 2006 at 6:29 am

Physicist: "ItÃ¢â‚¬â„¢s an interesting idea, but I am unconvincedÃ¢â‚¬Â¦"

Thank you for your informative input. My aim is to show that the idea is at least reasonable from known physical laws alone. If we knew for a fact it were absolutely true, we would no longer be exploring the issue theoretically. It demonstrates that ID at the cosmological scale (and thus implicity at the biological scale) is at least plausible from interpretations of existing physical theories with no reference to any sort of religious text.

17 **physicist** February 23, 2006 at 6:40 am

you're welcome, and I think it is definitely interesting to examine these issues. but i would caution that the conclusions seem highly speculative to me…and there is a lot more work to be done on understanding wavefunctions of the universe before inferring ID and god, to put it mildly!

18 **physicist** February 23, 2006 at 6:42 am

also scordova,

"By way of extension, because we see the universe, we are detecting that some agency is collapsing wave functions in the future."

this is not necessarily true—and what i mean by speculative.

19 **mentok** February 23, 2006 at 7:10 am

I'm sorry scordova but I can't get past the idea of future events influencing the past. A future event does not exist in the present, therefore it cannot influence anything because it doesn't exist. A plan for a future event can affect the present, but the past is gone forever and the future has yet to happen. I do not know how you can resolve this unless you and your friends are advocating time travel. Or am I mistaking what you mean to say? I don't accept Tiplers (and De Chardins) theories about the "Omega Point" i.e the universal apotheosis theory, but I do appreciate a similar line of thought. From my understanding "God" became "God" through a very long process of becoming or evolving to an apotheosis, but it happened a very long time ago, before the universe as we know it existed. The universe we live in is what came about after that period of cosmic evolution due to the intellectual effort of "God".

My experience is that we live in a virtual reality of sorts. Everything we experience is very similar to what you would experience in a computer controlled virtual reality. All matter/energy manifests in a very similar way to how pixels in a VR game create an illusion of reality. The computer controls the pixels which are all essentially the same thing. Through the arrangement of the same thing in a very complicated fashion at a minute level the computer can shape any world the user can imagine. 1's and 0's take on the appearance of people, places, and things. In our universe quantum particles are like pixels in a unviversal computer mtarix, but instead of the "brain" of the computer being in a set location like a hard drive and processor, the universal computer's brain is everywhere, the pixels or quantum particles are part of the brain. The pixels or quantum particles exist within a sub quantum unified field (posessing consciousness, intellect, and ability to control everything within it)which exists in many dimensions which we cannot perceive. Imagine if you were born in a virtual reality holodeck and had no knowledge of computers and virtual reality technology, you would be unable to figure out how the world you live in came into existence because all you would have access to would be the virtual reality dimension. The hardware and software that controls the virtual reality exists in dimensions which are differnt then the virtual reality dimension.

So when we try to figure out how the universe works based on nothing more then what we can see with our eyes or experiment with, we will be unable to reach an accurate depiction. There are too many hidden variables. You may see the souffle, but if you've never seen a kitchen, fire, utensils, or food of any type, any theory you could come up with about the origins of the souffle would be based on a lack of experience with the whole concept of cooking food.

20 **scordova** February 23, 2006 at 9:05 am

As the great Nobel physcist Bohr said, "t if you aren't confused by quantum physics then you haven't really understood it."

Hi Mentok,

I appreciate your point of view. However, we have been able to confirm the future affects the past experimentally. Here is s description of the experiments involved:

http://www.fortunecity.com/ema.....qphil.html

From a purely operational standpoint (as in when money counts) the problem of the future affecting the past is being factored into the design of various nano-molecular computing devices. These devices are so tiny that it is conceivable a current computation may be affected by a future event. When I had done some work with a nano-molecular research team, one of the researchers was exploring this problem, the problem of a "double-slit-delayed-choice" effect on a nano-molecular computation. We had to ensure the archticture prevented or impeded these kinds of undesirable effects.

Ironically, this quantum wierdness is actually desirable for the next generation of quantum computers. I think the following artilce will be very helpful:
http://www.goertzel.org/benzin.....rticle.htm

regards,
Salvador Cordova

21 **scordova** February 23, 2006 at 9:37 am

"...for us physicists believe the separation between past, present, and future is only an illusion, although a convincing one."

–Albert Einstein

22 **jacktone** February 23, 2006 at 9:56 am

Saxe,
Gotta put my 2 cents in on classical music for the kids. You can hardly get any better than Prokokiev's "Peter and the Wolf". There are videos out there that have the the

story interspersed with clips of the orchestra playing. Great stuff.
(another musician-gone-engineer)

23 **jacktone** February 23, 2006 at 10:55 am

Oops, Prokofiev

24 **Joseph** February 23, 2006 at 6:55 pm

Sal writes:
which predicts, through physical first principles alone, at the end of time that there must be an Intelligent Entity that is conscious, all-powerful, all-knowing, non-material, eternal. By all counts, such an entity would properly be called, Ã¢â,¬Å"GodÃ¢â,¬Â.

Personally I would only consider "God" to, not only be able to bring about an orderly, habitable and inhabited universe, but to also grant or deny eternal salvation.

Therefore, playing the DA, I would reject your claim because the formula's output of an Intelligent Entity could still be an uncaring, uninvolved and unknowing (unknowing of what goes on here) entity, that could only be considered "God" in the most liberal use of the word.

25 **scordova** February 23, 2006 at 7:16 pm

Josehph wrote: "Therefore, playing the DA, I would reject your claim because the formulaÃ¢â,¬â„¢s output of an Intelligent Entity could still be an uncaring, uninvolved and unknowing (unknowing of what goes on here) entity, that could only be considered Ã¢â,¬Å"GodÃ¢â,¬Â in the most liberal use of the word."

Well, I can almost appreciate why you say that. But the equations would say nothing of God's other possible attributes (such as whether he is benevolent, forgiving, etc.). They are simply silent on those matters. We don't reject the existence of gravity because it does not answer questions of God's character. If quantum theory predicts His existence, we don't need to reject the inference simply because it says nothing of His character either. It merely offers the possiblity He exists. Answers about His character must come from somewhere else.

26 **GilDodgen** February 23, 2006 at 9:53 pm

Gil said: "IsnÃ¢â,¬â„¢t it amazing how random mutation and natural selection produced all the wonderful musical artistry of the great composers, not to mention the musicians who play this stuff and the people who invented and perfected the art of creating musical instruments? Man, that RM+NS stuff is really cool!"

Valerie replied: "You said it, Gil. ThatÃ¢â,¬â„¢s why DarwinÃ¢â,¬â„¢s theory is so widely considered to be one of the greatest ideas in manÃ¢â,¬â„¢s history."

Dear Valerie,

You are obviously a very sweet and good person, and, I must admit that you have exhibited tremendous courage in defense of your thesis. You are very articulate and express yourself very well. However, the notion that random events zapping nucleotides can produce a piano concerto, the pianist, the orchestra and the musical instruments, is just plain silly, to put it mildly. You only have 10^80 subatomic particles and 10^17 seconds in the history of the universe to accomplish all this.

Darwin's idea was clever in his day, when people didn't know much about how things work.

27 **mentok** February 23, 2006 at 10:52 pm

scardova: I still don't see how a theory which predicts that a future event can influence the here and now can be taken as a realistic viewpoint. Someone may come up with interesting theoretical constructs which may be interesting theories on paper, but in reality the future doesn't exist. The past doesn't exist. All that exists anywhere exists in the ever present now. Since the future doesn't exist there is no possibility of something happening there nor something which is happening there to somehow travel back in time to affect our time. The double slit test or other tests showing the faster then light connections of particles at great distances can be explained without resort to the impossible made possible by a theory.

I am actuyally quite surprised that physicists could believe in time travel (if you do), just because Einstein theorized about it that doesn't change the simple fact that the future and the past will never exist in any other space time then the space time they occupy while they happen. Once an event in time passes it is gone forever. Any future event does not exist, any past event does not exist. Since you guys are theorizing about future events affecting current events what you are doing is

theorizing that something that doesn't exist is influencing something. The most we can say on this and not fall into the realm of science fiction is that the past may be affecting us with a future goal in mind (consciously or unconsciously), no different then if you made a plan last year to grow some tomatoes and you planted some seeds and now you have tomatoes. In the past a plan may have been made for the future and now we are being affected by that plan for a future event, but that is not the same as theorizing that an actual future event which has occured in the future is influencing our current reality or that a past event can affect our present directly. Maybe I'm reading you guys wrong? Are you saying that a plan from the past of some type with a future goal in mind is affecting us or are you saying an actual future event is influencing us through some type of time travel back in time?

28 **physicist** February 24, 2006 at 4:17 am

Mentok

conventional quantum mechanics doesn't predict communication of information backward in time. So I think there is no sense in which an observer `influences' the past in any planned, intentional way.

In fact, I suppose this lack of transfer of information somewhat scuppers the interpretation of the proposed final observer as a guiding/designing force.

In any case, as I've said above extrapolating any of this to a wavefunction of the universe is *highly* speculative, and it's far from obvious that the extrapolation is necessary or even makes sense (either physically or mathematically). So I wouldn't rely on this proposal at all!

29 **Joseph** February 24, 2006 at 6:51 am

Again playing the DA (devil's advocate):

Sal:
But the equations would say nothing of GodÃ¢â‚¬â„¢s other possible attributes (such as whether he is benevolent, forgiving, etc.). They are simply silent on those matters. We donÃ¢â‚¬â„¢t reject the existence of gravity because it does not answer questions of GodÃ¢â‚¬â„¢s character. If quantum theory predicts His existence, we donÃ¢â‚¬â„¢t need to reject the inference simply because it says nothing of His character either. It merely offers the possiblity He exists. Answers about His character must come from somewhere else.

My point is that "God" is all about character. For without character we could have a designer with seemingly "God-like" qualities, but on closer inspection those qualities evaporate like liquid nitro exposed to the tropical sun.

Quantum theory may predict an existence, but to say that existence is "God" still requires faith.

30 **scordova** February 24, 2006 at 7:57 am

"Quantum theory may predict an existence, but to say that existence is Ã¢â‚¬Å"GodÃ¢â‚¬Â still requires faith."

I think it is fair to say it requires faith to accept that this Existence is the God whom a person of faith would call God. I agree with that.

As Belinfante said above, "Acceptance of such doctrines is a matter of faith and belief",

Salvador

31 **scordova** February 24, 2006 at 8:28 am

Physcist and Mentok,

I think your comments offer very reasonable skepticism and highlight very valid concerns. George Murphy (physicist and minister, and no friend of ID) was the one who introduced me to the idea. He commented though he didn't fully accept the idea, he could not completely reject it either.

I'm of the opinion, Barrow and Tipler have made a good enough case that it deserves more exploration. I don't think the idea of the Omega Point as Tipler has formulated will succeed (sorry Frank), however, the idea of an Ultimate Observer seems at least plausible, if not inevitable.

If every atom in the present is subject to a boundary condition defined in the future, it would stand to reason the future of every atom in the universe deeply influences the present state of that atom. By way of induction, the destination of the universe is more, or at least equally influential, than it's past. This strikes me as a very straight forward and simple deduction.

The double slit experiment (which is covered sophomore or junior university physics), no matter how wierd the results, makes sense mathematically, albeit in a very counter intuitive way. If a photon's behavior in the present is affected by a future observation, why should this not be the case for every atom and every photon that ever existed? Thus, an ultimate observation seems like a reasonable and logical consequence of what we observe in the lab.

I think the following reservation by physisict is very reasonable, however: "In fact, I suppose this lack of transfer of information somewhat scuppers the interpretation of the proposed final observer as a guiding/designing force."

Belinfante offers his idea regarding this, and I think I shall read his ideas some more. I think physcist concern here is worth giving one pause.

I want to say, I appreciate all of the discomfort expressed over Barrow and Tipler's ideas by several of the participants, and your objections evidence a reasonable and healthy level of skepticism. I appreciate your willingness to pond these ideas.

32 **mentok** February 24, 2006 at 12:39 pm

scardova you wrote:

"If a photonÃ¢â‚¬â„¢s behavior in the present is affected by a future observation, why should this not be the case for every atom and every photon that ever existed?"

How can any "affected behavior" of a photon be said to be caused by a future observation when we have no way of of ever seeing into the future in order to see the cause of the effect? If we see a photon being affected how is it possible to know that the cause of that behavior is from a future event? Since the future has not yet happened it seems to be impossible for any future event to directly influence the present. I can easily understand how a future event can influence the present if that future event is like the tomato analogy i.e of a goal set forth in the past for a future result which will affect our present time, but any theory which includes time travel needs to be better throught out.

33 **scordova** February 24, 2006 at 1:31 pm

Mentok asked: "How can any Ã¢â‚¬Å"affected behaviorÃ¢â‚¬Â of a photon be said to be caused by a future observation when we have no way of of ever seeing into the future in order to see the cause of the effect? "

This is an inferenced based on the double-slit-delayed-choice experiement which the Shrodinger Wave funciton predicts. The result of the experiment demonstrated that present day choices affected the past history of a photon. That means for example, if we conducted an experiment over a vast distance, say on the order of the diameter of the orbit of Mars, my observation of a photon from mars at 6pm February 23,2006 is affecting the behavior of that photon in the past at 3pm February 23, 2006.

If this is true, then it stands to reason the photons around us today are being affected by a future observation in the future.

What is hard is not the idea, it is the acceptance of the idea. Let me encourage you to look at:
http://www.geocities.com/sunja.....icles.html

I sincerely appreciate your inquiry into this, and I'm sorry if I'm doing a poor job explaining. Please let me know if the above link was helpful.

Salvador

34 **physicist** February 24, 2006 at 1:54 pm

Scordova

I'm glad you appreciated my comments. one good thing is that it at least encourages people to think about the weird things we definitely *do* know about quantum mechanics!

35 **mentok** February 24, 2006 at 6:04 pm

scordova you wrote:

"if we conducted an experiment over a vast distance, say on the order of the diameter of the orbit of Mars, my observation of a photon from mars at 6pm February 23,2006 is affecting the behavior of that photon in the past at 3pm February 23, 2006."

The problem with this theory is that it will always be impossible to verify it, and it goes against logic. The problem is the nature of time in that it is a continuous

stream, there is no future and there is no past, there is only now at all times. There was a past and there will be a future but they do not exist. So nothing from the future exists, therefore there is nothing that can affect the present from non existent time, the same goes for the past.

No one knows if time is continuous or quantized. Many suspect that both time and space must be quantized in any quantum theory of gravity. Here's a nice discussion of it. -ds

36 **Raevmo** February 25, 2006 at 4:32 pm

"As the great Nobel physcist Bohr said, Ã¢â‚¬Å"t if you arenÃ¢â‚¬â„¢t confused by quantum physics then you havenÃ¢â‚¬â„¢t really understood it.Ã¢â‚¬Â"
Maybe so, but that doesn't imply that if you ARE confused you HAVE really understood it.
Although quantum physics is quite successfull it will probably be replaced at some point by an even more successfull theory that need not imply the things that some of you think quantum physics (and general relativity and what not) implies about the "ultimate observer". There are plenty of examples of scientific theories which were claimed to be "equivalent" to some obscure passage in the bible (but of course in different words), but then later it turned out the scientific theory had to be rejected because of contradictory facts.

37 **danb** February 26, 2006 at 7:20 pm

scordova says: "In quantum cryptography, we can detect the effect of an intelligent intrusion into a crytographic system because someoneÃ¢â‚¬â„¢s intelligent choice has triggered a collapse. See: http://www.cs.dartmouth.edu/~jford/crypto.html

By way of extension, because we see the universe, we are detecting that some agency is collapsing wave functions in the future."

But Scordova, quantum cryptography does not specify what things look like **from within the wave uncollapsed wavefunction**, which is where we would be right now, if some outside intelligence hadn't collapsed our wavefunction. How do we know that both cases wouldn't look **identical and indistinguishable** from each other? And since we can't compare the two how possibly can we arrive at the "we must be in a collapsed wave function" conclusion?

38 **scordova** February 27, 2006 at 6:46 am

I did not say we are in a collapsed state, I pointed out future observation collapses our wave function. The considerations above where I mentioned the photons from Mars suggests that the photons emitted in the present might have an observation in the future. After all, what observed us to give definition to the physical world which constitutes our planet and our own minds and bodies?

Salvador

39 **danb** February 27, 2006 at 4:32 pm

Sal says: "I did not say we are in a collapsed state, I pointed out future observation collapses our wave function. The considerations above where I mentioned the photons from Mars suggests that the photons emitted in the present might have an observation in the future."

I don't see how this future observation requires any omnipotence.

Sal says: "After all, what observed us to give definition to the physical world which constitutes our planet and our own minds and bodies?"

On what grounds do you base your claim that we need to be observed to define our physical world? How do you know you aren't living in an **unobserved** and **uncollapsed** wave function? Do you see what I'm asking? If you were living in an uncollapsed wave function, what would it look like?

40 **terrylmirll** February 27, 2006 at 9:37 pm

All this talk about quantum physics has left me thinking about a film I caught last summer titled "What the [Bleep] Do We Know?" Has anyone out there seen it, and if so, what are your feelings about it?

Personally, I was fascinated by the sense of smarmy spiritualism that seems to go hand in glove with notions of quantum effects and observer-based reality. I found myself intrigued by what the film had to say, yet I was also rather dubious about a film showcasing commentary, on the one hand, by the likes of Drs. Fred Alan Wolf and John Hagelin, and on the other, by Ms. JZ Knight "channeling" the spirit of Ramtha the Enlightened One.

By the way, in the coming sequel to "What the [Bleep", called "Down the Rabbit Hole," one segment is devoted to the famous double-slit experiment referenced above. I suppose the notion of the future shaping the past is counterintuitive, but then, if an electron behaves either like a particle or like a wave depending upon whether or not it is being observed, I would imagine there's a lot of room for discussion.

I saw part of it, decided it was a waste of time, and changed the channel. -ds

41 **scordova** February 27, 2006 at 10:46 pm

"How do you know you arenÃ¢â‚¬â„¢t living in an unobserved and uncollapsed wave function? "

You're question delves into the possibility of no collapse. One solution is Everett's many worlds. That is the photons around us that get emitted never get observed, they remain indeterminate. Reality splits off into may worlds. Your question, mathematically speaking delves into the possiblity of the Many Worlds Interpretation (MWI). In a sense it is not completely outrageous in as much as a quantum computer relies on a system being in multiple states simultaneously!

However, there has been an experiment which would favor John Cramer's transactional interpretation (TI), and thus this argues against the many-worlds interpretation (MWI). The experiment basically showed that the MWI of the quantum law was inconsistent with that law.

danb asked, "If you were living in an uncollapsed wave function, what would it look like? "

I suppose, you would not know it from an unobserved one. You have made a good point in other words. However, for an unobserved universe to happen, then, the many world's interpretation (MWI) would likely have to be true, but as I pointed out, that interpretation may have been experimentally demonstrated to be false, not to mention, that seems no less outrageous than to presume the existence of some all-powerful Observer.

One thing that can happen however, is if the Ultimate Observer chooses to reveal Himself by some show of power at the end of time, then I would not presume it was an illusion if He so chose to do so. Experimental confirmation. I hold out hope that may one day happen. 

"I donÃ¢â‚¬â„¢t see how this future observation requires any omnipotence."

With respect to the universe, if the observation brought the universe into existence, it is all powerful by definition, at least with respect to this universe.

Salvador

42 **scordova** February 27, 2006 at 11:02 pm

Danb,

If I may ask, do you think physics precludes the existence of the Ultimate Observer?

I think Barrow and Tipler have certainly made a good case from science alone that He could exist. That is, the possiblity of some All-Knwowing intelligence is on the table, completely independent of religious texts.

That in itself, at least give ID a possible "mechanism" for various features of the universe.

Salvador

43 **danb** February 27, 2006 at 11:11 pm

Sal says: "However, there has been an experiment which would favor John CramerÃ¢â‚¬â„¢s transactional interpretation (TI), and thus this argues against the many-worlds interpretation (MWI). The experiment basically showed that the MWI of the quantum law was inconsistent with that law."

What experiment is this? Please do not keep us in suspense.

Sal says: "With respect to the universe, if the observation brought the universe into existence, it is all powerful by definition, at least with respect to this universe."

Where did you look up this definition? Human observation is capable of collapsing wave functions. In fact, every wave function we've measured we've collapsed! Why aren't humans capable of collapsing all of the universe that we can observe? (And since we haven't seen any more than that, what's left?) I'll save the "source of the universe/source of God" argument for another time. I'm only concerned with what is required by quantum mechanics.

44 **danb** February 27, 2006 at 11:19 pm

Sal asks: "If I may ask, do you think physics precludes the existence of the Ultimate Observer? "

Of course, not. I'm just stating that physics does not *require* an Ultimate Observer. As far as I know, no one has proven or disproven God, or can. I'd be very suspect of any such proof anyway. There are many snake oil peddlers that just want to tell you what you want to hear. I wouldn't suggest looking for confirmation of your faith in proofs. It kind of defeats the point of faith, doesn't it?

-Danb

45 **scordova** February 28, 2006 at 8:26 am

danb wrote: "Why arenÃ¢â‚¬â„¢t humans capable of collapsing all of the universe that we can observe?"

Technically speaking, we've collapsed the parts we have observed. We haven't observed the whole universe, that would entail measurement of every atom. Saying you see a star, doesn't imply that you've measured every quantum system in the star.

danb wrote: "What experiment is this? Please do not keep us in suspense."

Rregarding the experiment:
Professor John Cramer on Quantum Mechanics
Professor John Cramer's website:
"A 50 minute discussion of quantum paradoxes and interpretations, with emphasis on new data **(The Afshar Experiment) that appears to falsify the Copenhagen and Many-Worlds Interpretations**, but is consistent with the Transactional Interpretation. "

Cramer on QM

I should note, although Cramer drops the need for an observer proximally, it does not negate the regress problem which leads to a non-material mind somewhere in the pipeline. The question of a regress to some ultimate cause remains as well as a regress to a non-material cause, even if the copenhagen interpretation has become antiquated.

46 **scordova** February 28, 2006 at 8:37 am

John Cramer's website at University of Washington:
http://faculty.washington.edu/jcramer/

47 **[quote mine] Richard Dawkins : " the presence of a creative deity in the universe is clearly a scientific hypothesis" | Uncommon Descent** September 26, 2006 at 6:36 pm

[...] I have said argued several times I think science can legitimately hypothesize God being a causal agent of nature. See Peer Reviewed Stealth ID Classic: The Anthropic Cosmological Principle (1987) for a discussion of the God hypothesis based purely on physics with no appeal to philosophy or theology whatsoever. [...]

48 **Many worlds, one God? Shift happens | Uncommon Descent** September 27, 2006 at 3:55 pm

[...] In the Peer-Reviewed Stealth ID Classic : The Anthropic Cosmological Principle

(1987), John Barrow and Frank Tipler argue the case for MWI. Several presumed the book was generally unfriendly to ID. For example see Barrow and Tipler on the Anthropic Principle vs. Divine Design by William Lane Craig. I highly respect Craig, but I will argue that Barrow and Tipler are more friendly to ID than they have been given credit for. [...]

49 **"there is a strangeness in the air", a quasi ID-friendly essay in Dennett and Hofstadter's 1981 book on intelligence | Uncommon Descent** May 23, 2007 at 10:31 am

[...] [For the reader's benefit, the science of the universal wave function and God are described here: Peer-Reviewed Stealth ID Classic : The Anthropic Cosmological Principle (1987).] [...]

50 **If the universe is a computer, who is the computer maker? | Uncommon Descent** May 23, 2007 at 11:26 am

[...] Frank Tipler is a student of Wheeler. Tipler and co-author Barrow explicitly extend Wheeler's hypothesis in Peer-Reviewed Stealth ID Classic : The Anthropic Cosmological Principle (1987). Instead Tipler and Barrow suggest some sort of Ultimate Observer in the distant future. They call their idea the Final Antrhopic Principle (FAP). The Ultimate Observer they call the Omega Point (I refer to it as Omega for short). They argue the properties of Omega must be that it is eternal, all-powerful, all knowing, non-material and intelligent. These properties are straight forward deductions of physical law.... [...]

51 **Who are the (multiple) designers? James Shapiro offers some compelling answers | Uncommon Descent** May 26, 2007 at 6:44 pm

[...] In the case of engineered products we often might think of designers (plural) versus a designer (singular). It may be that some Ultimate Intelligence created the universe and (by way of extension) engineers. But even for those of us who accept that there is an Ultimate Intelligence, it is not customary to say that God made automobiles and airplanes and genetically engineered food. [...]

52 **World Renowned Cosmologist Frank Tipler on Sci Phi Show! | Uncommon Descent** May 31, 2007 at 2:15 am

[...] Tipler is author of The Anthropic Cosmological Principle (1987), one of the 3 ID books which began the modern ID movement. [...]

53 **The Quantum Enigma of Consciousness and the Identity of the Designer | Uncommon Descent** February 17, 2010 at 3:16 am

[...] the thread Peer Reviewed Stealth ID Classic I point out Tipler's comment: I discovered this the hard way when I published my book The [...]

Leave a Reply

You must be logged in to post a comment.

« The Real Threat Is "Absolutism" — Yes, Absolutely! There is "teeth" to ID »

Recent Posts

- Popular Science shuts down comments, citing the presence of dissent from the scientific consensus
- New at The Best Schools
- Bees in the news – form living chains with their feet to repair holes in honeycomb
- The end is near ...
- Thoughtful atheist philosopher on why he thinks ID valuable but ultimately

Sponsored Links

Popular Posts

- A world-famous chemist tells the truth: there's *no* scientist alive today who understands macroevolution (25,175)
- 10 + 1 Questions For Professor Myers (15,275)
- A Whale of a Problem for Evolution: Ancient Whale Jawbone Found in Antartica (14,901)
- UB Sets It Out Step-By-Step (12,816)

Anthropic Principle: A Precise Plan for Humanity

By Dr. Hugh Ross January 1, 2002

Human beings climb. Always have, always will. First hills, then mountains, then pinnacles so high they're called "death zones." That's as high as legs could carry them, but not high enough. So people invented balloons, blimps, airplanes, and spacecraft, the higher the better—to a point.

At first, scaling heights made people feel big and powerful. Then they began to feel small, utterly insignificant even, in the hugeness of the cosmos. Today, ironically, the same forces that once shrank humanity's perception of himself now magnify him beyond the wildest imagination, yet with no basis for pride and every reason for humility. Those forces, insatiable curiosity, and capacity for inquiry have lifted humans to a vista, an insight called the anthropic principle, that carries their gaze to the edge of the universe and beyond.

The anthropic principle says that the universe appears "designed" for the sake of human life. More than a century of astronomy and physics research yields this unexpected observation: the emergence of humans and human civilization requires physical constants, laws, and properties that fall within certain narrow ranges—and this truth applies not only to the cosmos as a whole but also to the galaxy, planetary system, and planet humans occupy. To state the principle more dramatically, a preponderance of physical evidence points to humanity as the central theme of the cosmos.

Support for the anthropic principle comes from an unwavering and unmistakable trend line within the data: the more astronomers learn about the universe and the requirements of human existence, the more severe the limitations they find governing the structure and development of the universe to accommodate those requirements. In other words, additional discoveries are leading to more indicators of large-scale and small-scale fine-tuning.

In 1961, astronomers acknowledged just two characteristics of the universe as "fine-tuned" to make physical life possible.[1] The more obvious one was the ratio of the gravitational force constant to the electromagnetic force constant. It cannot differ from its value by any more than one part in 10^{40} (one part in ten thousand trillion trillion trillion) without eliminating the possibility for life. Today, the number of known cosmic characteristics recognized as fine-tuned for life—any conceivable kind of physical life—stands at thirty-eight.[2] Of these, the most sensitive is the space energy density (the self-stretching property of the universe). Its value cannot vary by more than one part in 10^{120} and still allow for the kinds of stars and planets physical life requires.[3]

Evidence of specific preparation for human existence shows up in the characteristics of the solar system, as well. In the early 1960s astronomers could identify just a few solar system characteristics that required fine-tuning for human life to be possible. By the end of 2001, astronomers had identified more than 150 finely-tuned characteristics.[4] In the 1960s the odds that any given planet in the universe would possess the necessary conditions to support intelligent physical life were shown to be less than one in ten thousand.[5] In 2001 those odds shrank to less than one in a number so large it might as well be infinity (10^{173}).[6]

An account of scientific evidence in support of the anthropic principle fills several books.[7] The authors' religious beliefs run the gamut from agnosticism to deism to theism, but virtually every research astronomer alive today agrees that the universe

manifests exquisite fine-tuning for life.[8]

The Revolt Against a Revolution

This view of humanity as the focal point of the cosmos represents the historic overthrow of an idea rooted in an ancient revolution, the Copernican revolution. For the first fifteen centuries of the Christian era, Western science assumed that Earth's inhabitants, humans in particular, occupied the central position in the universe. When Nicolaus Copernicus revived the ancient Greek proof that the Sun, rather than Earth, holds the central position in Earth's system of planets, a new scientific perspective took root.[9] From this perspective, the Copernican principle, emerged the philosophical notion that humans occupy no privileged or exceptional position in the universe. For the past four hundred years, this principle has been the reigning paradigm of science and society. And, during the past forty years, an extension of it, the mediocrity principle, has grown increasingly prevalent. The mediocrity principle asserts that humanity is not special in any way and that human origin and development have likely been duplicated on billions of other sites throughout the cosmos.

The anthropic principle, emerging almost simultaneously with the mediocrity principle, emphatically contradicts it, exposing a distortion of Copernican thinking. The anthropic principle makes this obvious and crucial distinction: while humanity's place in the universe is not *spatially* central, it does not necessarily follow that humanity's place is not central, or special, in *any* way.

Few people yet realize that current cosmological research demonstrates a physical universe with no spatial center. All the matter and energy of the universe reside on the three-dimensional surface of the expanding four-dimensional universe. Just as all Earth's cities reside on the planet's two-dimensional surface and none can be identified as geographically central to all others, likewise none of the galaxies, stars, and planets hold the center position on the cosmic 3-D surface.

In one sense, the anthropic principle is possible because Copernicus was right. What makes humanity's location in the cosmos unique, or special, is that Earth resides away from the center of any astronomical system, such as Earth's galaxy. Humanity lives in a unique location—and moment—in cosmic space-time that allows not only for the possibility of human existence but also for the opportunity to discover that human existence represents a miracle, a special case.

Earth's particular location gives humans a special window to the solar system, the Milky Way galaxy, and the universe itself. In virtually any other galaxy or at any other location in Earth's galaxy and at every other time in cosmic history, the view to the surrounding area would be so unstable and/or so occluded that the form, structure, size, and other characteristics of the galaxy and universe would remain obscure to any sentient observers.[10] Earth's creatures enjoy a special view to the splendors of the cosmos. Nowhere else and at no other time in the universe would such glory be visible.[11]

The importance of the anthropic principle can hardly be overstated. It returns legitimacy and respectability to the human species as a worthy, even *primary*, subject of scientific research. Further, the anthropic principle has the potential to bring about a paradigm shift arguably as profound as any shift in human remembrance.

Cosmic Anticipation

As early as the 1980s, physicist Paul Davies concluded that the physical evidence for design of the universe and of Earth for human life could rightly be described as overwhelming.[12] Today, no physicist or astronomer who has researched the question denies that the universe, the Milky Way galaxy, and the solar system possess compelling hallmarks of intentional design for human life. Many researchers have commented over the past twenty years that it seems the universe "knew" humans were coming.

Brandon Carter, the British mathematician who coined the term "anthropic principle" (1974),[13] noted the strange inequity of a universe that spends about 15 billion years "preparing" for the existence of a creature that has the potential to survive no more than 10 million years (optimistically).[14] Carter formalized this enormous imbalance between the time required to produce the possibility for human life and the brevity of the species' (potential) survival as the "anthropic principle inequality."[15]

In response, some researchers speculated that the human species might represent an anomaly, an exception to the rule (e.g., a late bloomer or a more fragile species) among many possible intelligent life forms elsewhere in the cosmos. However, Carter and (later) astrophysicists John Barrow and Frank Tipler demonstrated that the inequality exists for virtually any conceivable intelligent species under any conceivable life-support conditions.[16] Roughly 15 billion years represents a minimum preparation time for advanced life: 11 billion toward formation of a stable planetary system, one with the right chemical and physical conditions for primitive life, and four billion more years toward preparation of a planet within that system, one richly layered with the biodeposits necessary for civilized intelligent life. Even this long time and convergence of "just right" conditions reflect miraculous efficiency.

Moreover the physical and biological conditions necessary to support an intelligent civilized species do not last indefinitely. They are subject to continuous change: the Sun continues to brighten, Earth's rotation period lengthens, Earth's plate tectonic activity declines, and Earth's atmospheric composition varies. In just 10 million years or less, Earth will lose its ability to sustain human life. In fact, this estimate of the human habitability time window may be grossly optimistic. In all likelihood, a nearby supernova eruption, a climatic perturbation, a social or environmental upheaval, or the genetic accumulation of negative mutations will doom the species to extinction sometime sooner than twenty thousand years from now.[17]

These figures demonstrate that the inequality is extreme. The survival time for advanced intelligent physical life is only a millionth as long as the time required to produce the conditions necessary for its survival.

Another British mathematical physicist, Roger Penrose, was among the first to give voice to a philosophical conclusion: the extremely high level of fine-tuning astronomers and physicists discern powerfully suggests a purpose behind the universe.[18] That the design is so focused on providing a home for humanity implies that a significant, even central, part of the purpose for the universe is anthropic. Specifically, the universe was created for the express benefit of humanity.

Given the awesome capacities necessary to create and design the universe, the purpose for humanity must be significant indeed. Further, given that human survivability is cosmically brief means that humanity's purpose can and must be fulfilled quickly. The rapid fulfillment of a profoundly significant purpose for humanity—that's the message of the Bible. No other "revelation" makes such perfect sense of everything humanity observes and experiences.

Purpose, Destiny, and Hope

Distinguished astrophysicists Lawrence Krauss and Glenn Starkman recently analyzed the ultimate consequences of the measured self-stretching property of the universe.[19] They deduced that the universe from now on will expand at a faster and faster rate. This exponentially increasing cosmic expansion means that astronomers will see less and less of the universe as time goes on. Thus, knowledge of the universe will decrease with time. Eventually, the cosmic expansion will be so rapid that intelligent beings will lose the capacity to draw adequate energy for work from the heat flow of the universe. All forms of knowledge, then, will necessarily decrease. Inevitably, heat flow will be so tiny that all metabolic reactions will cease, and with their ceasing, all possibility for physical life will end. "Consciousness is eventually lost."[20]

Krauss and Starkman's response—an expression of despair—betrays their presumption that humanity's destiny must lie within this universe. An important aspect of the biblical message is that God has an existence and a plan for humanity *beyond* the confines of the cosmos. His plan involves the cosmos but does not end there. Throughout the Old and New Testaments, God reveals His plan to prepare those humans for a paradise vastly superior to anything Earth can offer, a new creation completely beyond the physics and dimensions of the universe.

Therefore, the biblical basis for purpose, destiny, and hope supersedes the limitations, even predicts the limitations and cessation, of the universe. The anthropic principle becomes personal, however, with the commonsense observation that human beings universally and uniquely yearn for a sense of destiny and purpose. Human beings stay alive not just by the powerful instinct to survive possessed by all living creatures, but by a unique and universal awareness that they exist for a reason beyond mere physical survival.

The Christ Connection

Those people who need hard data to affirm their sense of destiny can find it. The space-time theorems of general relativity prove that an *Entity* transcending matter, energy, space, and time is the *cause* of the universe in which humanity lives.[21] Of all the gods, forces, or principles that people have proposed throughout human history to explain the existence and operation of the universe, only the God of the Bible is consistent with the characteristics of the *cause* established in these space-time theorems.[22] Only the Bible predicts and explains the anthropic principle.

True to their inquisitive and skeptical nature, some scientists and philosophers have challenged the validity of the anthropic principle and certainly of its implications for the Christian worldview and faith. Stephen Hawking and Carl Sagan argued that the design of such a vast cosmos for such an infinitesimal creature seems wasteful, thus inconsistent with the character of the Christian's all-wise, all-powerful God.[23] Such a God, they imply, would have fulfilled His purpose of providing humanity a home by creating just one planet in one planetary system in a relatively tiny and short-lived cosmos.

This argument fails to consider, however, that purpose governs what a person (or God) *does* as opposed to what he *can* do. Given the physics of the universe, the laws and properties for which the Bible reveals a specific divine purpose (see "The Physics of Sin," page 00), the universe is the necessary size and age. A universe either slightly

less massive or more massive than what researchers observe would be unsuitable for human life.[24] In a human frame of reference, God's provision of such an enormous universe so carefully "machined" for billions of years for human benefit makes a compelling statement about His care for humanity—and His purposefulness.

Some skeptics have attempted to trivialize the anthropic principle with the assertion that humans simply would not be here to observe the universe unless the extremely unlikely did somehow happen to take place. British philosopher Richard Swinburne responded to this notion with a simple illustration.[25] He points out that the survivor of a firing squad execution would not attribute his or her survival to a lucky accident. Rather, the survivor would conclude that either the rifles were loaded with blanks or that each of the executioners missed on purpose. The measured fine-tuning of the universe tells us that Someone purposed for humans to exist for a certain period of time.

Another argument claims that there is nothing remarkable about the fine-tuning of the universe *if* an infinitude of universes exist, each with a different set of characteristics. In this case, chance could dictate that at least one would manifest the characteristics necessary for human life.

The fallacy in this appeal represents a form of the gambler's fallacy. A gambler might conclude that an ordinary coin could land on heads a hundred thousand consecutive times if he rationalizes that $2^{100,000}$ coins exist (though he cannot see them), each being flipped 100,000 times by $2^{100,000}$ coin flippers. Statistically, one of these coins could come up heads 100,000 times. Such thinking is considered fallacious, however, because the gambler has no evidence for the existence of the other coins, coin flippers, or distinct results. With a sample size of one, the only rational conclusion to draw is that someone "fixed" the coin to land on heads. In the case of the universe, no evidence can be found for the existence of other universes. In fact, the principles of relativity dictate that the space-time envelope of a universe that contains observers can never overlap that of any other universe(s). Thus, the sample size for human observers is one and always will be one, and the conclusion that Someone purposed, or fixed, the universe for human existence remains compelling.

Testing the Conclusion

The anthropic principle invites testing. A skeptic not yet persuaded that the fine-tuning of the universe reflects more than a lucky coin toss can choose to examine the universe, the "coin," more closely. If the anthropic principle and its implications for transcendent design are false, research will discover declining evidence for fine-tuning and existing evidence will be erased by new data. If, on the other hand, the anthropic principle and its implications are true, research will yield an increase in both the number of fine-tuned characteristics and the degree of fine-tuning. Based on the accumulating evidence, to bet on the anthropic principle seems safer than taking another breath. The anthropic principle energizes humanity's climb on the pinnacles of Truth.

Subjects: Constants of Physics, Earth/Moon Design, Galaxy Design, Geophysical Design, Laws of Physics, Life Design, Life on Other Planets, Naturalism, Philosophy of Science, Scientists, Solar System Design, TCM - Cosmic Design, TCM - Life Design, TCM - Two Creations, Two Creation Model, Universe Design, Worldviews

Dr. Hugh Ross

Reasons to Believe emerged from my passion to research, develop, and proclaim the most powerful new reasons to believe in Christ as Creator, Lord, and Savior and to use those new reasons to reach people for Christ. Read more about Dr. Hugh Ross.

References:

1. Robert H. Dicke, "Dirac's Cosmology and Mach's Principle," *Nature* 192 (1961), 440-41.
2. Hugh Ross, "Fine-Tuning for Life in the Universe," Appendix C, *Lights in the Sky and Little Green Men* (Colorado Springs, CO: NavPress, 2002), in press.
3. Lawrence M. Krauss, "The End of the Age Problem and the Case for a Cosmological Constant Revisited," *Astrophysical Journal* 501 (1998): 461-66.
4. Hugh Ross, "Probability for a Life Support Body," Appendix B, *Lights in the Sky and Little Green Men* (Colorado Springs, CO: NavPress, 2002), in press. It is also posted on the Reasons To Believe Web site at www.reasons.org.
5. I. S. Shklovskii and Carl Sagan, *Intelligent Life in the Universe* (San Francisco: Holden-Day, 1966), 342-61.
6. Ross, "Probability for a Life Support Body," Appendix B, *Lights in the Sky and Little Green Men*.
7. John D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle* (New York: Oxford University Press, 1986); F. Bertola and U. Curi, eds., *The Anthropic Principle* (Cambridge: Cambridge University Press, 1993); Paul Davies, *The Cosmic Blueprint* (New York: Simon & Schuster, 1988); Michael J. Denton, *Nature's Destiny* (New York: The Free Press, 1998); George Greenstein, *The Symbiotic Universe* (New York: William Morrow, 1988); Hugh Ross, *The Creator and the Cosmos,* 3d ed.(Colorado Springs, CO: NavPress, 2001); Peter D. Ward and Donald Brownlee, *Rare Earth* (New York: Copernicus, 2000).
8. Quotes from nineteen astronomers who have done research on the anthropic principle may be found in Hugh Ross, *The Creator and the Cosmos,* 3d ed., 157-60.
9. Hugh Ross, *The Fingerprint of God,* 2d ed. (Orange, CA: Promise, 1991), 12-13, 20.
10. Raymond E. White III and William C. Keel, "Direct Measurement of the Optical Depth in a Spiral Galaxy," *Nature* 359 (1992), 129-30; W. C. Keel and Raymond E. White III, "HST and ISO Mapping of Dust in Silhouetted Spiral Galaxies," *American Astronomical Society Meeting,* 191, no. 75.01, December, 1997; Raymond E. White III, William C. Keel, and Christopher J. Conselice, "Seeing Galaxies Through Thick and Thin. I Optical Opacity Measures in Overlapping Galaxies," *Astrophysical Journal* 542 (2000): 761-78; Ross, *The Creator and the Cosmos,* 3d ed., 178-79.
11. Guillermo Gonzalez, "The Measurability of the Universe: A Record of the Creator's Design," *Facts for Faith* 4 (Q4 2000), 42-48.
12. Paul Davies, *The Cosmic Blueprint* (New York: Simon & Schuster, 1988), 203.
13. Brandon Carter, "Large Number Coincidences and the Anthropic Principle in Cosmology," *Proceedings of the International Astronomical Union Symposium, No. 63: Confrontation of Cosmological Theories with Observational Data,* ed. M. S. Longair (Dordrecht-Holland/Boston, U.S.A.: D. Reidel, 1974), 291-98.
14. Brandon Carter, "The Anthropic Principle and Its Implications for Biological Evolution," *Philosophical Transactions of the Royal Society, Series A* 370 (1983): 347-60.
15. Carter, "The Anthropic Principle,"347-60.
16. John D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle* (New York: Oxford University Press, 1986), 556-70.
17. Adam Eyre-Walker and Peter D. Keightley, "High Genomic Deleterious Mutation Rates in Hominids," *Nature* 397 (1999), 344-47; James F. Crow, "The Odds of Losing at Genetic Roulette," *Nature* 397 (1999), 293-94; Hugh Ross, "Aliens from Another World," *Facts for Faith* 6 (Q2 2001), 30-31.
18. Roger Penrose, in the movie *A Brief History of Time* (Burbank, CA: Paramount Pictures Inc., 1992).
19. Lawrence M. Krauss and Glenn D. Starkman, "Life, the Universe, and Nothing: Life and Death in an Ever-Expanding Universe," *Astrophysical Journal* 531 (2000): 22-30.
20. Krauss and Starkman, p. 28.
21. Stephen Hawking and Roger Penrose, "The Singularities of Gravitational Collapse and Cosmology," *Proceedings of the Royal Society of London, Series A* 314(1970), 529-48; Jacob D. Bekenstein, "Nonsingular General-Relativistic Cosmologies," *Physical Review, D* 11 (1975): 2072-75; Leonard Parker and Yi Wang, "Avoidance of Singularities in Relativity Through Two-Body Interactions," *Physical Review, D* 42 (1990): 1877-83; Arvind Borde, "Open and Closed Universes, Initial Singularities, and Inflation," *Physical Review, D* 50 (1994): 3692-702; Arvind Borde and Alexander Vilenkin, "Eternal Inflation and the Initial Singularity," *Physical Review Letters* 72 (1994): 3305-8; Arvind Borde and Alexander Vilenkin, "Violation of the Weak Energy Condition in Inflating Spacetimes," *Physical Review, D* 56 (1997): 717-23.
22. Ross, *The Creator and the Cosmos,* 3d ed., 101-18.
23. Stephen Hawking, *A Brief History of Time* (New York: Bantam Books, 1988), 126; Hugh Ross, "The Haste to Conclude Waste," *Facts & Faith* 11, no. 3 (1997), 1-3. This is a commentary on the 1997 movie *Contact* based on Carl Sagan's 1985 novel by the same name.
24. Ross, *The Creator and the Cosmos,* 3d ed., 51-54, 150-51.
25. Richard Swinburne, "Argument from the Fine-Tuning of the Universe," *Physical Cosmology and Philosophy,* ed. John Leslie (New York: Macmillan, 1991), 165.

Why This Universe?

Toward a Taxonomy of Possible Explanations

ROBERT LAWRENCE KUHN

WHEN I WAS 12, IN THE SUMMER BETWEEN seventh and eighth grades, a sudden realization struck such fright that I strove desperately to blot it out, to eradicate the disruptive idea as if it were a lethal mind virus. My body shuddered with dread; an abyss had yawned open. Five decades later I feel its frigid blast still.

Why not Nothing?[1] *What if everything had always been Nothing? Not just emptiness, not just blankness, and not just emptiness and blankness forever, but not even the existence of emptiness, not even the meaning of blankness, and no forever. Wouldn't it have been easier, simpler, more logical, to have Nothing rather than something?*[2]

The question would become my life partner, and even as I learned the rich philosophical legacy of Nothing,[3] I do not pass a day without its disquieting presence. I am haunted. Here we are, human beings, conscious and abruptly self-aware, with lives fleetingly short, engulfed by a vast, seemingly oblivious cosmos of unimaginable enormity.[4] While "Why Not Nothing?" may seem impenetrable, "Why This Universe?", revivified by remarkable advances in cosmology, may be accessible. While they are not at all the same question, perhaps if we can begin to decipher the latter, we can begin to decrypt the former. "Why This Universe" assumes there is "Something" and seeks the root reason of why it works for us.

I am the creator and host of the PBS television series *Closer To Truth*, and for the past several years I have been bringing together scientists and scholars to examine the meaning and implications of state-of-the-art science. The next *Closer To Truth* series, now in production, focuses on cosmology and fundamental physics, philosophy of cosmology, philosophy of religion, and philosophical theology, and thus I have been interviewing cosmologists, physicists, philosophers, and theologians, asking them, among other questions, "Why This Universe?" From their many answers, and from my own night musings, I have constructed a taxonomy[5] that I present here as a heuristic to help get our minds around this ultimate and perennial question.

The Problem to be Solved

In recent years, the search for scientific explanations of reality has been energized by increasing recognition that the laws of physics and the constants that are embedded in these laws all seem exquisitely "fine tuned" to allow, or to enable, the existence of stars and planets and the emergence of life and mind. If the laws of physics had much differed, if the values of their constants had much changed, or if the initial conditions of the universe had much varied, what we know to exist would not exist since all things of size and substance would not have formed. Stephen Hawking presented the problem this way:

> Why is the universe so close to the dividing line between collapsing again and expanding indefinitely? In order to be as close as we are now, the rate of expansion early on had to be chosen fantastically accurately. If the rate of expansion one second after the big bang had been less by one part in 10^{10}, the universe would have collapsed after a few million years. If it had been greater by one part in 10^{10}, the universe would have been essentially empty after a few million years. In neither case would it have lasted long enough for life to develop. Thus one either has to appeal to the anthropic principle or find some physical explanation of why the universe is the way it is.[6]

To Roger Penrose, the "extraordinary degree of precision (or 'fine tuning') that seems to be required for the Big Bang of the nature that we appear to observe…in phase-space-volume terms, is one part in $10^{10^{123}}$ at least." Penrose sees "two possible routes to addressing this question…We might take the position that the initial condition was an 'act of God….or we might seek some scientific/mathematical theory." His strong inclination, he says, "is certainly to try to see how far we can get with the second possibility."[7]

To Steven Weinberg, it is "peculiar" that the calculated value of the vacuum energy of empty space (due to quantum fluctuations in known fields at well-understood energies) is "larger than

observationally allowed by 10^{56}," and if this were to be cancelled "by simply including a suitable cosmological constant in the Einstein field equations [General Relativity], the cancellation would have to be exact to 56 decimal places." Weinberg states "No symmetry argument or adjustment mechanism could be found that would explain such a cancellation."[8]

To Leonard Susskind, "the best efforts of the best physicists, using our best theories, predict Einstein's cosmological constant incorrectly by 120 orders of magnitude!" "That's so bad," he says, "it's funny." He adds that "for a bunch of numbers, none of them particularly small, to cancel one another to such precision would be a numerical coincidence so incredibly absurd that there must be some other answer."[9]

The problem to be solved is even broader than this. Sir Martin Rees, Britain's Astronomer Royal, presents "just six numbers" that he argues are necessary for our emergence from the Big Bang. A minuscule change in any one of these numbers would have made the universe and life, as we know them, impossible.[10] Deeper still, what requires explanation is not only this apparent fine-tuning but also the more fundamental fact that there are laws of physics at all, that we find regularity in nature.

What of our astonishingly good fortune? In 1938 Paul Dirac saw coincidences in cosmic and atomic physics;[11] in 1961 Robert Dicke noted that the age of the universe "now" is conditioned by biological factors;[12] and in 1973 Brandon Carter used the phrase "Anthropic Principle," which in his original formulation simply draws attention to such uncontroversial truths as that the universe must be such as to admit, at some stage, the appearance of observers within it.[13] Others then took up this oddly evocative idea, calling what seems to be a tautological statement the "Weak Anthropic Principle," as distinguished from what they defined as the "Strong Anthropic Principle," which makes the teleological claim that the universe *must* have those properties that allow or require intelligent life to develop.[14] Steven Weinberg used anthropic reasoning more rigorously to provide an upper limit on the vacuum energy (cosmological constant) and to give some idea of its expected value. He argued that "it is natural for scientists to find themselves in a subuniverse in which the vacuum energy takes a value suitable for the appearance of scientists."[15]

Although the (Weak) Anthropic Principle appears perfectly obvious—some say that a logical tautology cannot be an informative statement about the universe—inverting its orientation may elicit an explanatory surprise: What we can expect to observe must be restricted by the conditions necessary for our presence as observers. Such expectations then suggest, perhaps inevitably, the startling insight that there could be infinite numbers of separate regions or domains or "universes," each immense in its own right, each with different laws and values—and because the overwhelming majority of these regions, domains, or universes would be non-life-permitting, it would be hardly remarkable that we do not find ourselves in them nor do we observe them. One could conclude, therefore, that while our universe seems to be incredibly fine-tuned for the purpose of producing human beings, and therefore so specially designed for us, it is in fact neither.

Since the 1970s, theists have invoked this fine-tuning argument as empirical evidence for a creator by asserting that there are only two explanations: God or chance. However to pose such a stark and simplistic choice is to construct a false and misleading dichotomy. Since the Anthropic Principle leads to multiple universes, a "multiverse," other possible

explanations are made manifest. I have documented 27 such explanations—a constellation of what I'll call "ultimate reality generators" in a kind of typology of cosmological conjecture. I'm sure there are more, or some could be subdivided, but generally the taxonomy can be structured with four overarching categories: One Universe Models, Multiple Universe Models, Nonphysical Causes, and Illusions. My claim is that the set of these four categories is universally exhaustive, meaning that whatever the true explanation of "Why This Universe?" it would have to be classified into one (or more) of these categories (irrespective of whether we ever discover or discern that true explanation).[16]

Yet the set of the 27 possible explanations which compose the categories is not universally exhaustive nor is there practical hope of making it so. Therefore unless we can ever answer the "Why This Universe?" question with certainty and finality (a dubious prospect), there will be other explanations out there that cannot be logically excluded. Further, while it might seem tidy for these explanations to be mutually exclusive—meaning that no two can both be right—such simplicity cannot be achieved. The explanations, and their categories, can be combined in any number of ways—in series, in parallel, and/or nested.

The 27 possible explanations, or ultimate reality generators that follow, are based on criteria that are logically permissible, a logic that for some may seem lenient. I do not, however, confuse speculation with science. Logical possibilities should not be mistaken for scientific theories or even scientific possibilities.[17] A physicist's speculations do not morph, as if by cosmological alchemy or professional courtesy, from metaphysics into established physics. That said, some of the more intriguing metaphysical possibilities are being proffered by physicists.[18]

I provide scant analysis of the explanations; all are subject to withering attack from experts, as well they should be. And to the critique that the lines of the taxonomy are drawn too sharply, or that my explanations overlap, I can only empathize and encourage the critic to offer a more refined version.

1. One Universe Models

We begin with traditional nontheistic explanations (traditionally, one recalls, there was only one universe), which also include a radically nontraditional explanation and the philosophical positions that the question makes no sense and that even if it did make sense it would still be unanswerable.

1.1 Meaningless Question. Big "Why" questions such as "Why This Universe?" are words without meaning and sounds without sense; this emptiness of content is epitomized by the ultimate "Why" question—"Why Not Nothing?"[19] As a matter of language, to ask for the ultimate explanation of existence is to ask a question that has no meaning. Human semantics and syntax, and perhaps the human mind itself, are utterly incapable of attaching intelligibility to this concept. Words transcend boundaries of ordinary usage so as to lose their grounding.[20] The deep incoherence here is confirmed by the fact that only two kinds of possible answers are permissible—an infinite regress of causation or something that is inherently self-existing—neither of which can be confirmable or even cogent. (Logical positivism verifies propositions as cognitively meaningful only by sensory facts or logical grammar.)

1.2 Brute Fact. The question makes sense but no answer is possible, even in principle. There has been and is only one universe and its laws seem fine-tuned to human existence simply because this is the way it is; the universe and all its workings stand as a "brute fact"[21] of existence, a terminus of a series of explanations that can brook no further explanation.[22] All things just happen to be and "there is no hint of necessity to reduce this arbitrariness" (Robert Nozick).[23]

1.3 Necessary / Only Way. There has been and is only one universe and its laws seem fine-tuned to human existence because, due to the deep essence of these laws, they must take the form that they do and the values of their constants must be the only quantities they could have. It could never be the case that these laws or values could have any other form or quantity. Finding this "deep essence" is the hope of Grand Unification Theory or Theory of Everything (TOE); in technical terms, there would be no free parameters in the mathematical equations; all would be determined, derived or deduced from fundamental

principles.[24] As for the existence of life and mind in this only-way explanation, the laws of biology must be embedded within the laws of physics either inextricably or by happenstance. (And we are fortunate, wildly fortunate, I guess).

1.4 Almost Necessary / Limited Ways. Physical laws have only a small range in which they can vary, such that the number of possible universes is highly constrained. This means that what would appear on the surface to be most improbable, i.e., a universe that just happens to be hospitable for life and mind, is in its deep structure most probable. (As with 1.3, of which this is a variant, the presence of life and mind still cries out for explanation.)

1.5 Temporal Selection. Even though physical laws or the values of their constants may change, regularly or arbitrarily, we have been living during (or at the end of) an extended period of time during which these laws and values happen to have been, for some reason or for no reason, within a range consistent with the existence of stars and planets and the emergence of life and mind. This temporal selection can operate during periods of time following one big bang in a single universe or during vastly greater periods of time following sequential big bangs in an oscillating single universe of endless expansions and contractions.

1.6 Self Explaining. The universe is self-creating and self-directing, and therefore self-explaining. In Paul Davies' formulation, the emergence of consciousness (human and perhaps other) somehow animates a kind of backward causation to select from among the untold laws and countless values that seem possible at the beginning of the universe to actualize those that would prove consistent with the later evolution of life and mind. In this teleological schema the universe and mind eventually meld and become one, so that it could be the case that the purpose of the universe is to allow it to engineer its own self-awareness.[25]

Note: Quentin Smith theorizes that the "universe caused itself to begin to exist." By this he means that the universe is a succession of states, each state caused by earlier states, and the Big Bang singularity prevents there from being a first instant. Thus in the earliest hour, there are infinitely many zero-duration instantaneous states of the universe, each caused by earlier states, but with no earliest state.[26] This model, like other atheistic mechanisms that obviate the need for a First Cause or preclude the possibility that God exists, could empower any of these One Universe Models. Similarly, if information is somehow fundamental to reality (as opposed to it being constructed by the human mind to allow us to represent reality), an idea defended by Seth Lloyd ("It from Bit"), information *per se* would undergird or endow these One Universe models (and, for that matter, Multiverse Models as well).[27] Independently, should limitless domains of our possibly infinite universe exist beyond our visible horizon,[28] these domains would still be included in One Universe Models. We would have an inestimably larger universe to be sure but we would still have only one universe to explain.

2. Multiple Universe (Multiverse) Models

There are innumerable universes (and/or, depending on one's definition of "universe," causally disconnected domains within one spatiotemporal setting), each bringing forth new universes ceaselessly, boundlessly, in a multiverse.[29] What's more, there are perhaps immeasurable extra dimensions, with all universes and dimensions possessing different sets of laws and values in capricious combinations, yet all somehow coexisting in the never ending, unfurling fabric of the totality of reality. Our reality is the only reality, but there is a whole lot more of it than ever imagined. This means that in the context of this multi-universe, multi-dimensional amalgam, the *meaningful* fine tuning of our universe is a mirage. The fine tuning itself is real, but it is not the product of purpose. Rather it is a statistical surety that is predicted by force, since only in a universe in which observers exist could observers observe (the Weak Anthropic Principle).[30] Thus, the laws and values engendering sentient life in our universe are not a "fortuitous coincidence" but rather a guaranteed certainty entirely explained by physical principles and natural law.

2.1 Multiverse by Disconnected Regions (Spatial). Generated by fundamental properties of spacetime that induce mechanisms to spawn multiple universes—for example, eternal chaotic inflation (i.e., unceasing phase transitions and bubble nucleations of spacetime) which causes

spatial domains to erupt, squeeze off in some way, expand (perhaps), and separate themselves forever without possibility of causal contact (Alan Guth,[31] Andre Linde,[32] Alex Vilenkin[33]).

2.2 Multiverse by Cycles (Temporal). Generated by an endless sequence of cosmic epochs, each of which begins with a "bang" and ends with a "crunch." In the Steinhardt-Turok model, it involves cycles of slow accelerated expansions followed by contractions that produce the homogeneity, flatness, and energy needed to begin the next cycle (with each cycle lasting perhaps a trillion years).[34] Roger Penrose postulates a "conformal cyclic cosmology," where an initial space-time singularity can be represented as a smooth past boundary to the conformal geometry of space-time. With conformal invariance both in the remote future and at the Big-Bang origin, he argues, the two situations are physically identical, so that the remote future of one phase of the universe becomes the Big Bang of the next. Though the suggestion is his own he calls it "outrageous."[35]

2.3 Multiverse by Sequential Selection (Temporal). Generated by fertile black holes out of which new universes are created continuously by "bouncing" into new big bangs (instead of collapsing into stagnant singularities). Applying principles of biological evolution to universal development, and assuming that the constants of physics could change in each new universe, Lee Smolin hypothesizes a cosmic natural selection that would favor black holes in sequential ("offspring") universes, thus increasing over time the number of black holes in sequential universes, because the more black holes there are, the more universes they generate.[36] A multiverse generating system that favors black holes might also favor galaxies and stars (rather than amorphous hydrogen gas), but jumping all the way to favor life and mind, however, is a leap of larger magnitude.

2.4 Multiverse by String Theory (with Minuscule Extra Dimensions). String theory postulates a vast "landscape" of different "false vacua," with each such "ground state" harboring different values of the constants of physics (such that on occasion some are consistent with the emergence of life). Structured with six, seven or more extra dimensions of subatomic size, string theory thus generates its own kind of multiple universes (Leonard Susskind).[37]

2.5 Multiverse by Large Extra Dimensions. Generated by large, macroscopic extra dimensions which exist in reality (not just in mathematics), perhaps in infinite numbers, forms and structures, yet which cannot be seen or apprehended (except perhaps by the "leakage" of gravity).[38] Multiple universes generated by extra dimensions may also be cyclical.[39]

2.6 Multiverse by Quantum Branching or Selection. Generated by the many-worlds interpretation of quantum theory as formulated by Hugh Everett and John Wheeler in which the world forks at every instant so that different and parallel "histories" are forming continuously and exponentially, with all of them existing in some meta-reality.[40] This means that whenever any quantum object is in any quantum state a new universe will form so that in this perpetual process an incalculable number of parallel universes come into existence, with each universe representing each unique possible state of every possible object. Stephen Hawking has conceptualized this staggering cascade of "branching universes" as a kind of retro-selection, in which current decisions or observations in some sense select from among immense numbers of possible universal histories, that exist simultaneously and represent every state of every object and which the universe has somehow already lived.[41]

2.7 Multiverse by Mathematics. Generated by Max Tegmark's hypothesis that every conceivable mathematical form or structure corresponds to a physical parallel universe which actually exists.[42]

2.8 Multiverse by All Possibilities. Generated by the hypothesis that each and every logically possible mode of existence is a real thing and really exists, that possible worlds are as real as the actual world, and that being merely possible rather than actual just means existing somewhere else (David Lewis's "modal realism";[43] Robert Nozick's "principle of fecundity"[44]).

Note: For Paul Davies, "The multiverse does not provide a complete account of existence, because it still requires a lot of unexplained and very 'convenient' physics to make it work." There has to be, he says, a "universe-generating mechanism" and "some sort of ingenious selection still has to be made," and that unless all possible worlds really exist (2.7 and 2.8), "a multiverse which contains less than everything implies a rule that separates what exists from what is possible but does not exist,"—a rule that "remains unexplained." And regarding all possible worlds really

existing, Davies states, "A theory which can explain anything at all really explains nothing."[45] According to Richard Swinburne, arguing for theism, the problem is not solved by invoking multiple universes: the issue that would remain, he says, is why our multiple universe would have the particular characteristic it does, that is, of producing at least one universe fine-tuned for life. And to postulate a mechanism that produces every kind of universe, he adds, would be to postulate a mechanism of enormous complexity in order to explain the existence of our universe, which would go far beyond the simplest explanation of the data of our universe as well as raise the question of why things are like that.[46] According to Quentin Smith, arguing for atheism, it cannot yet be determined if a multiverse, which he calls speculation not science, is even logically possible.[47]

3. Nonphysical Causes

This universe, however unfathomable, is fine-tuned to human existence because a nonphysical Cause made it this way. The Cause may be a Person, Being, Mind, Force, Power, Entity, Unity, Presence, Principle, Law, Proto-Law, Stuff or Feature. It is likely transcendent and surely irreducible; it exists beyond the boundaries and constraints of physical law, matter, energy, space and time; and while it is the Cause it does not itself have or need a Cause. There is blur and overlap among these explanations, yet each is sufficiently different in how it claims to generate ultimate reality, and sufficiently opposed to the claims of its competitors, as to warrant distinction.

3.1 Theistic Person. A Supreme Being who in Christian philosophy is portrayed as incorporeal, omnipotent, omniscient, perfectly free, perfectly good, necessarily existent and the creator of all things, and who is also a "person" with person-like characteristics such as beliefs, intents and purposes; a "divine being" (as defined by Richard Swinburne[48]), a theistic God (as defended by Alvin Plantinga[49]) with a "nature."[50] In Judaic-Christian tradition, the existence-as-essence Name offered to Moses—"I am that I am."[51] In Islamic philosophy, the concepts of Unity, the Absolute, Beyond-Being.[52] In modern thought, God as underlying fundamental reality, entailing the meaning of universe and life (George Ellis);[53] God as working through special divine action, interventionist or noninterventionist (Robert John Russell).[54] The affirmative creative act of this theistic God may bring the universe into being by a creation from nothing (*creatio ex nihilo*),[55] or may be a continuing creative sustenance of the universe (*creatio continua*), or both.[56] A theistic explanation of ultimate reality is logically compatible with both One Universe and Multiverse Models.[57]

3.2 Ultimate Mind. A Supreme Consciousness that hovers between a personal theistic God and an impersonal deistic first cause; a nonpareil artist who contemplates limitless possibilities; a quasi Being with real thoughts who determines to actualize certain worlds (Keith Ward).[58] Understanding this kind of God does not begin with an all-powerful "person" but rather with an unfathomable reservoir of potentialities as expressed in all possible universes, for which Ultimate Mind is the only and necessary basis.

3.3. Deistic First Cause. An impersonal Primal Force, Power or Law that set the universe in motion but is neither aware of its existence nor involved with its activity. The idea requires initializing powers but rejects beliefs, intents and purposes, active consciousness, self-awareness or even passive awareness. There is no interaction with creatures (humans).[59]

3.4 Pantheistic Substance. Pantheism equates God with nature in that God is all and all is God.[60] The universe (all matter, energy, forces and laws) is identical with a ubiquitous metaphysical entity or stuff, which to Baruch Spinoza possessed unlimited attributes and was the uncaused "substance" of all that exists. The pantheistic "God," nontheistic and impersonal, is the paragon of immanence in that it is neither external to the world nor transcendent of it. In diverse forms, pantheism appears in Western philosophy (Plotinus's "One," Hegel's "Absolute"), process theology, and some Eastern religions (Taoism; later Buddhism; Hinduism where Brahman is all of existence).[61] Pantheism finds a unity in everything that exists and in this unity a sense of the divine.[62]

3.5 Spirit Realms. Planes, orbs, levels, domains and dimensions of spirit existence as the true, most basic form of reality. Described by mystics, mediums, and occult practitioners, and exemplified by mystic, polytheistic and animistic

religions, these spirit realms are populated by the presence of sundry spirit beings and laced with complex spiritual rituals and schemas (some good, some evil).[63]

3.6 Consciousness as Cause. Pure Consciousness as the fundamental stuff of reality out of which the physical world is generated or expressed.[64] It is the explanation claimed or typified by certain philosophical and quasi-theological systems, Eastern religions, mystic religions, and cosmic consciousness devotees, and by some who accept the actuality of paranormal phenomena.[65] For example, Buddhism and Rigpa in Tibetan Buddhism[66] (omniscience or enlightenment without limit).[67] Even some physicists ponder the pre-existence of mind.[68]

3.7 Being and Non-Being as Cause. Being and Non-Being as ineffable dyadic states that have such maximal inherent potency that either one can somehow bring all things into existence. In Taoism, the invisible Tao (Way) gives rise to the universe; all is the product of Being, and Being is the product of Not-being.[69] In Hinduism, it is the Brahman (unchanging, infinite, immanent, transcendent).[70] The Ground of All Being; Great Chain of Being; Great Nest of Spirit (Ken Wilbur).[71]

3.8 Abstract Objects / Platonic Forms as Cause. Although philosophers deny that abstract objects can have causal effects on concrete objects (abstract objects are often defined as causally inert), their potential, say as a collective, to be an explanatory source of ultimate reality cannot be logically excluded. (This assumes that abstract objects, like mathematics, universals and logic, manifest real existence on some plane of existence not in spacetime.) Platonic Forms, abstract entities that are perfect and immutable and exist independently of the world of perceptions, are occasionally suspected of possessing some kind of causal or quasi-casual powers.[72]

3.9 Principle or Feature of Sufficient Power. An all-embracing cosmic principle beyond being and existence, such as Plato's "the Good" or John Leslie's "ethical requiredness"[73] or Nicholas Rescher's "cosmic values,"[74] or some defining characteristic so central to ultimate reality and so supremely profound that it has both creative imperative and causative potency to bring about being and existence. Derek Parfit says it might be no conincidence if, of the countless cosmic possibilities or ways reality might be, one has a very special feature, *and* is the possibility that obtains (actually exists). "Reality might be this way," he says, "because this way had this feature." He calls this special feature the "Selector," and two candidates he considers are "being law-governed and having simple laws."[75]

Note: Cyclical universes of Eastern religious traditions can be consistent with all of these non-physical ultimate reality generators,[76] although the Western Theistic Person (3.1) would normally be excluded. To Derek Parfit, if we take the apparent fine-turning of the universe to support, not some multiverse or many-worlds hypothesis, but some theistic hypothesis, this should invoke a creator who may be omnipotent, and omniscient, but who isn't wholly good, or indeed significantly good. What we can see of reality, he says, counts very strongly against this hypothesis.[77]

4. Illusions

This universe, everything we think we know, is not real. Facts are fiction; nothing is fundamental; all is veneer, through and through.

4.1 Idealism. As argued by generations of idealistic philosophers, all material things are manifestations of consciousness or assemblies of mind, so that while the physical world appears to be composed of non-mental stuff, it is not.[78]

4.2 Simulation in Actual Reality. We exist merely or marginally in someone's or something's simulation, in an artificial world that actually exists in terms of having physical particles and forces and galaxies and stars, but that entirety is not what it seems because that entirety is derivative not original. Andre Linde analyzes "baby universe formation" and then asks, "Does this mean that our universe was created not by a divine design but by a physicist hacker?"[79] Paul Davies speaks of "fake universes," and of those beings who created them as "false gods;" and he ponders that if multiple universes really exist, the great majority of them may be fakes because some of them (there are so many) would have spawned, at some time or another, unthinkably superior beings who would have

had the capacity to create these fake universes—and once they could have done so they would have done so, creating immensely many fake universes and thereby swamping the real ones.[80]

4.3 Simulation in Virtual Reality. We exist merely or marginally in someone's or something's simulation, in an artificial sensory construction that is an imitation of what reality might be but is not; for example, a *Matrix*-like world in which all perceptions are fed directly into the human nervous system ("brains in vats") or into our disembodied consciousness. Alternatively, we exist as processes generated by pure software running inside cosmic quantum supercomputers.[81]

4.4 Solipsism. The universe is wholly the creation of one's own mind and thereby exists entirely in and for that mind.[82]

A Work in Process

If it seems improbable that human thought can make distinguishing progress among these categories and explanations, consider the formulating progress already made. Two centuries ago the available options were largely Nonphysical Causes (Category 3) structured simplistically. A century ago scientists assumed that our own galaxy, the Milky Way, was the entire universe. Today we grasp the monumental immensity of the cosmos.

How to explore "Why Not Nothing?" A taxonomy of possible explanations for "Why This Universe?" may suggest new seas to sail, if only by loosening our mental moorings from the one or two cultural conditioned explanations that are generally and uncritically accepted.[83] Nonetheless there remains a great gulf between the two questions: even if we eventually obtain the explanation of this universe we may still have made no progress on why there is something rather than nothing.[84]

Cosmological visions are overwhelming, but I am oddly preoccupied with something else. How is it that we humans have such farsighted understanding after only a few thousand years of historical consciousness, only a few hundred years of effective science, and only a few decades of cosmological observations? Maybe it's still too early in the game. Maybe answers have been with us all along. This is a work in process and diverse contributions are needed.[85] ▼

The author thanks Paul Davies, John Leslie, Derek Parfit, Robert John Russell, Michael Shermer, Quentin Smith, Richard Swinburne, and Keith Ward for their comments and suggestions.

Endnotes and References

1. Quentin Smith would reformulate my awestruck "Why not Nothing?…." so as to satisfy an analytical philosopher. He points out (in a personal communication) that it is a logical fallacy to talk about "nothing," to treat "nothing" as if it were "something" (with properties). To say "there might have been nothing" implies "it is possible that there is nothing". "There is" means "something is." So "there is nothing" means "something is nothing," which is a logical contradiction. His suggestion is to remove "nothing" and replace it by "not something" or "not anything", since one can talk about what we mean by "nothing" by referring to *something* or *anything* of which there are no instances (i.e., the concept of "something" has the property of not being instantiated). The common sense way to talk about Nothing is to talk about something and negate it, to deny that there is something. Smith would rewrite my lines about like this: "*There is something. But why? There might not ever have been anything at all. Why are there existents rather than no existents?* As for Nothing being "easier," Smith says that the word connotes that it would have been easier for "God," and God he does not like at all. So my passage becomes, "*Wouldn't it have been* easier *if there were not even one thing, in the sense that there is no causal activity, whereas things require causes to bring them into existence? Wouldn't it have been* simpler *in the sense that there are zero things if there are no things, and that as a number zero is simpler than one, two, three or any other number? Wouldn't it have been* more logical *in the sense that the laws of logic do not imply there are things and if there are things, that fact is inexplicable in terms of the laws of logic?"* (For euphony, as well as simplicity, I will continue to use "Nothing"—Quentin, my apologies.)
2. No argument, only the fact of the matter, dissuades me from continuing to sense, following Leibniz, that Nothing, no universe, is simpler and easier, the least arbitrary and most logical descriptor of ultimate reality (Leibniz, Gottfried. 1714. *The Principles of Nature and Grace)*. An empty world, Nothing, would then be followed by, in order of increasing complexity, illogic and oddity: infinite numbers of universes (for parsimony, "all" is second only to "none"), one universe (it's all we know but inconceivable to explain), few-but-not-many universes (maybe there's some simple generating principle at work), innumerable-but-finite numbers of universes, and many-but-not-innumerable universes. Peter van Inwagen argues that since there can be infinitely many non-empty worlds (populated by things, any things at all), but only one empty world ("Nothing"), the likelihood that any given world is non-empty (not Nothing) is maximally probable (i.e., the probability of Nothing is zero). van Inwagen, Peter. 1996. "Why Is There Anything at All?" *Proceedings of the Aristotelian Society*, pp. 95-110. The argument is fascinating and hinges on two assumptions: (i) all possible populated worlds have the same probability and (ii) the probability of the empty world (Nothing) is no different than that of any of the infinite number of possible populated worlds. While recognizing that the empty world is vastly, even infinitely, easer to *describe*, van Inwagen reasons that this should not increase its relative probability unless "one is covertly thinking that there is something that is outside the 'Reality'…[like] a 'pre-cosmic selection machine', not a part of Reality" (for Leibniz this was God)….or "something that determines that *there being nothing* is the 'default setting' on the control-board of Reality." "But there could be no such thing," van Inwagen argues, "for nothing is outside Reality," and he concludes, tentatively, that "the simplicity

of the empty world provides us with no reason to regard it as more probable than any other possible world." Yet I find it hard to get out of my head the sense that the *a priori* probability of an empty world (Nothing) is greater than that of any possible populated world (Something) in that to have Something seems to require a second step (and likely many more), a process or rule or capricious happening that generates whatever is populating whatever world. If so, any given possible world (Something) would be less parsimonious than the empty world (Nothing), which would mean that the probability of the empty world (Nothing) would be greater than zero.

3. Martin Heidegger famously called "Why is there something rather than nothing?" the fundamental question of metaphysics. Heideggar, Martin, 1959. *Introduction to Metaphysics*. New Haven: Yale University Press. Leibniz. 1714. Parfit, Derek. 1998. "Why Anything? Why This?" *London Review of Books*. January 22, pp. 24-27 and February 5, pp. 22-25. van Inwagen. 1996. (van Inwagen says "we can make some progress…if we do not panic.") Leslie, John. 1998. *Modern Cosmology and Philosophy*. Amherst, N.Y: Prometheus Books. Rundle, Bede. 2004. *Why is there Something Rather than Nothing*. Oxford: Clarendon Press. (Rundle seeks "what might be possible in areas where it is so easy to think that we have come to a dead end.") Leslie, John. 2005. Review of *Why is there Something Rather than Nothing* by Bede Rundle. *MIND*. January 2005. Nagel, Thomas. 2004. Review of *Why is there Something Rather than Nothing* by Bede Rundle. *Times Literary Supplement*. May 7. "*Nothing."* Stanford Encyclopedia of Philosophy. http://plato.stanford.edu/entries/nothingness/. Carlson, Erik and Erik J. Olsson. 1998. "The Presumption of Nothingness." *Ratio*, XIV, 2001: 203-221. Nozick, Robert. 1981. "Why is there Something Rather than Nothing," *Philosophical Explanations*. Cambridge, MA: Harvard University Press, Ch. 2. Nozick's aim is "to loosen our feeling of being trapped by a question with no possible answer." He says that "the question cuts so deep, however, that any approach that stands a chance of yielding an answer will look extremely weird. Someone who proposes a non-strange answer shows he didn't understand the question." "Only one thing," he says, "could leave nothing at all unexplained: a fact that explains itself," He calls this "explanatory self-subsumption."

4. To Quentin Smith, grasping the universe as a world-whole and asking "Why?" engenders global awe, feeling-sensations that tower and swell over us in response to the stunning immensity of it all. The more we consider this ultimate question of existence, he believes, the more our socio-culture would improve. (Personal communication and Smith, Quentin. 1986. *The Felt Meanings of the World: A Metaphysics of Feeling*. West Lafayette, Indiana: Purdue University Press.) Arthur Witherall argues "that a feeling of awe [wonder, astonishment, and various other affective states] at the existence of something rather than nothing is appropriate and desirable," perhaps because "there is a fact-transcendent meaning to the existence of the world." (Witherall, Arthur. Forthcoming, *Journal of Philosophical Research — http://www.hedweb.com/witherall/existence.htm, 2006*). Santayana describes existence as "logically inane and morally comic" and "a truly monstrous excrescence and superfluity." (Santayana, George. 1955. *Scepticism and Animal Faith*. New York: Dover Publications, p. 48).

5. This is new territory and the first step in methodical exploration is often to construct a taxonomy. How could we: (i) discern and describe all possible explanations of ultimate reality (devised by human intelligence or imagined by human speculation); and then (ii) classify and array these possible explanations into categories so that we might assess and compare their essence, efficacy, explanatory potency and interrelationships?

6. Hawking, Stephen. 1996. "Quantum Cosmology." In Hawking, Stephen and Roger Penrose. *The Nature of Space and Time*. Princeton, NJ: Princeton University Press, pp. 89-90.

7. Penrose, Roger. 2005. *The Road to Reality: A Complete Guide to the Laws of the Universe*. New York: Knopf, p. 726-732, 762-765. Penrose's analysis of the "extraordinary 'specialness' of the Big Bang" is based on the Second Law of Thermodynamics and the "absurdly low entropy" [i.e., highly organized] state of the very early universe.

8. Weinberg, Steven. 2007. "Living in the Multiverse." In Carr, Bernard, ed. *Universe or Multiverse*. Cambridge, UK: Cambridge University Press.

9. Susskind, Leonard. 2005. *The Cosmic Landscape: String Theory and the Illusion of Intelligent Design*. Boston MA: Little, Brown, p. 66, 78-82.

10. Rees, Martin. 2000. *Just Six Numbers: The Deep Forces That Shape the Universe*. New York: Basic Books. Following are Rees' six numbers:

    $N = 10^{36}$, the ratio of the strength of electric forces that hold atoms together to the force of gravity between them such that if N had just a few less zeros, only a short-lived and miniature universe could exist, which would have been too young and too small for life to evolve.

    ε (epsilon) = .007, a definition of how firmly atomic nuclei bind together such that if E were .006 or .008 matter could not exist as it does.

    Ω (omega) = ~1, the amount of matter in the universe, such that if Ω were too high the universe would have collapsed long ago and if Ω were too low no galaxies would have formed.

    λ (lambda) = ~0.7, the cosmological constant, the positive energy of empty space, an "antigravity" force that is causing the universe to expand at an accelerating rate, such that if λ were much larger the universe would have expanded too rapidly for stars and galaxies to have formed.

    $Q = 1/100{,}000$, a description of how the fabric of the universe depends on the ratio of two fundamental energies, such that if Q were smaller the universe would be inert and featureless and if Q were much larger the universe would be violent and dominated by giant black holes.

    $D = 3$, the number of dimensions in which we live such that if D were 2 or 4 life could not exist.

11. Dirac, P.A.M. 1938. *Proceedings of the Royal Society* A165, 199-208. Dirac noted that for some unexplained reason the ratio of the electrostatic force to the gravitational force between an electron and a proton is roughly equal to the age of the universe divided by an elementary time constant, which suggested to him that the expansion rate of the macroscopic universe was somehow linked to the microscopic subatomic world (and that gravity varied with time). Although his inference was in error, Dirac's observation enabled a novel way of thinking about the universe.

12. Dicke, Robert H. 1961. "Dirac's cosmology and Mach's principle." *Nature* 192: 440. In order for the universe to host biological observers, it has to be sufficiently old so that carbon would already have been synthesized in stars and sufficiently young so that main sequence stars and stable planetary systems would still continue to exist ("golden age"). Dicke, Robert H. 1970. *Gravitation and the Universe*. Philadelphia: American Philosophical Society.

13. Carter, Brandon. 1973. "Large Number Coincidences and the Anthropic Principle in Cosmology," reprinted in Leslie, John. 1999. *Modern Philosophy and Cosmology*. Amherst, NY: Prometheus Books.

14. Barrow, John D. and Frank Tipler. 1986. *The Anthropic Cosmological Principle*. New York: Oxford University Press.

15. Weinberg, 2007, op cit. Weinberg, Steven. 1987, "Anthropic Bound on the Cosmological Constant." *Physical Review Letters* 59, 22 2607-2610.

16. Methodologically, I first try to expand the possible explanations and their categories, striving to be universally exhaustive—my objective here—and only later try, in some way, to cull them by data, analysis or reasoning. (Falsification for most of these "ultimate reality generators"is unrealistic.) After Paul Davies presents the pros and cons of the various main positions he proffers to answer the ultimate questions of existence, he asks a droll but deeply profound question, "Did I leave any out?" Davies, Paul. 2006. *The Goldilocks Enigma: Why is the Universe Just Right for Life*? London: Allen Lane / Penguin Books, p. 302.

17. "Modal logic" allows an infinite number of logical possibilities that are (or seem) scientifically impossible. Smith, Quentin. Personal communication.

18. That the explanation for the universe may be hard to understand is no surprise to Derek Parfit. "If there is some explanation of the whole of reality, we should not expect this explanation to fit neatly into some familiar category. This extraordinary question may have an extra-ordinary answer." Parfit. January 22, 1998.

19. Those who contend that "Why Not Nothing?" is a Meaningless Question (1.1) often rely on what they believe to be logical contradictions in the concepts "Nothing" and "Something." For example, they argue that the statement "There is Nothing" has no referent and makes no legitimate claim; something more, such as a location of the Nothing, must be specified to complete it and make it meaningful, but any such addition contradicts itself in that by specifying Something it destroys Nothing (as it were). Rundle. 2004. Olsson, Erik, J. 2005. *Notre Dame Philosophical Reviews*. March 3. http://ndpr.nd.edu/review.cfm?id=2081. See Endnote 1. In like manner, the question "Why is there Something?" makes a simple logical mistake in that it presupposes an antecedent condition that can explain that Something, but there can be no such antecedent condition because it too must be subsumed in the Something which must be explained. Edwards, Paul. 1967. "Why" in Edwards, Paul, ed. *The Encyclopedia of Philosophy*. New York: Macmillan, vol. 8, pp. 300-301. Witherall, 2006.

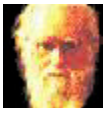
20. Nagel, 1981. As John Leslie puts this view, "Metaphysical efforts to explain the cosmos offend against grammar in Wittgenstein's sense." Leslie, 2005.
21. To be a brute fact, a universe does not depend on any particular universe-generating mechanism—Big Bang, steady state, complex cyclicals can all fit the brute fact framework. A multiverse or surely a God can be a brute fact. The point is that there must be a terminal explanation: a brute fact is as far as you can ever get, even in principle.
22. Bertrand Russell said "The universe is just there, and that's all." Russell, Bertrand and F.C. Copleston. 1964. "The Existence of God." In Hick, John, ed.. *Problems of Philosophy Series*. New York: Macmillan & Co., p. 175. Parfit states that "If it is random what reality is like, the Universe not only has no cause. It has no explanation of any kind." Of the explanatory possibilities, he later notes that Brute Fact "seems to describe the simplest, since its claim is only that reality has no explanation." Parfit. February 5, 1998. Smith, Quentin. 1997. "Simplicity and Why the Universe Exists." *Philosophy* 71: 125-32.
23. Nozick, 1981.
24. Weinberg, Steven. 1983. *Dreams of a Final Theory: The Scientist's Search for the Ultimate Laws of Nature*. New York: Vintage Books. Witten, Edward. 2002. "Universe on a String." *Astronomy* magazine (June 2002). Gell-Mann, Murray. 1994. *The Quark and the Jaguar*. New York: W.H. Freeman. Greene, Brian. 2003. *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory.* Reissue edition. New York: W.W. Norton.
25. Davies, 2006. Davies, Paul. 1993. *The Mind of God*. London: Penguin. Personal communication. Davies, Paul. 2005. In Harper, Charles L., Jr., ed. *Spiritual Information: 100 Perspectives on Science and Religion.* West Conshohocken, PA: Templeton Foundation Press.
26. Smith, Quentin. 2007. "Kalam Cosmological Arguments for Atheism." In Martin, Michael, ed., *The Cambridge Companion for Atheism*. Smith, Quentin. 1999. "The Reason the Universe Exists is that it Caused Itself to Exist", *Philosophy*, Vol. 74, pp. 136-146. Personal communication.
27. Lloyd, Seth. 2006. *Programming the Universe: A Quantum Computer Scientist Takes On the Cosmos*. New York: Knopf.
28. To any observers, the visible horizon of the universe that they see, the farthest they can ever see, is bounded by the speed of light multiplied by the age of the universe such that light could have traveled only so far in so long. (In special relativity, a 'light cone" is the geometric pattern describing the temporal evolution of a flash of light in Minkowski spacetime. Wikipedia, http://en.wikipedia.org/wiki/Light_cone.)
29. Rees, Martin J. 1998. *Before the Beginning: Our Universe and Others*. New York: Perseus Books. Rees, Martin J. 2004. *Our Cosmic Habitat*. Princeton, NJ: Princeton University Press. Rees, Martin J. 1999. "Exploring Our Universe and Others," *Scientific American*, December. Leslie, John. 1989. *Universes*. London: Routledge. Davies, 2006, p. 299. Personal communication.
30. Weinberg, 1987. Weinberg, 2007. Personal communication. There is hardly unanimity about the Anthropic Principle among physicists, some of whom characterize it as betraying the quest to find fundamental first principles that can explain the universe and predict its constituents. David Gross "hates" it, comparing it to a virus—"Once you get the bug, you can't get rid of it." Overbye, Dennis. 2003. "Zillions of Universes? Or Did Ours Get Lucky?" *New York Times*. October 28. Personal communication.
31. Guth, Alan. 1981. "The Inflationary Universe: A Possible Solution to the Horizon and Flatness Problems." *Phys. Rev. D* 23, 347. Guth, Alan. 1997. *The Inflationary Universe: The Quest for a New Theory of Cosmic Origins*. Boston: Addison-Wesley.
32. Linde, Andrei. 1982. "A New Inflationary Universe Scenario: A Possible Solution of the Horizon, Flatness, Homogeneity, Isotropy and Primordial Monopole Problems." *Phys. Lett. B* 108, 389. Linde, Andrei. 1990. *Particle Physics and Inflationary Cosmology*. Chur, Switzerland: Harwood. Linde, Andrei. 2005. "Inflation and String Cosmology." *J. Phys. Conf.* Ser. 24 151–60. Linde, Andrei. 1991. "The Self-Reproducing Inflationary Universe." *Scientific American*, November 1991, 48-55. Linde, Andrei. 2005. "Current understanding of inflation." *New Astron.Rev.* 49:35-41. Linde, Andrei. 2005. "Choose Your Own Universe," in Harper, 2005.
33. Vilenkin, Alex. 2006. *Many Worlds in One: The Search for Other Universes.* New York: Hill and Wang.
34. Steinhardt, Paul J. and Neil Turok. 2002. "A Cyclic Model of the Universe." *Science,* May 2002: Vol. 296. no. 5572, pp. 1436–1439. The authors claim that a cyclical model may solve the cosmological constant problem—why it is so vanishingly small and yet not zero—by "relaxing" it naturally over vast numbers of cycles and periods of time exponentially older than the Big Bang estimate. Steinhardt, Paul J. and Neil Turok. 2006. "Why the Cosmological Constant is Small and Positive." *Science* 26 May 2006: Vol. 312. no. 5777, pp. 1180–1183. The oscillating universe hypothesis was earlier suggested by John Wheeler, who in the 1960s posited this scenario in connection with standard recontracting Friedman cosmological models (I thank Paul Davies for the reference).
35. Penrose, Roger. "Before the Big Bang: An Outrageous New Perspective and Its Implications for Particle Physics." *Proceedings of the EPAC* 2006, Edinburgh, Scotland.
36. Smolin, Lee. 1992. "Did the universe evolve?" *Classical and Quantum Gravity* 9, 173–191. Smolin, Lee. 1997. *The Life of the Cosmos*. New York: Oxford University Press. Since a black hole is said to have at its center a "singularity," a point at which infinitely strong gravity causes matter to have infinite density and zero volume and the curvature of spacetime is infinite and ceases to exist as we know it, and since the Big Bang is said to begin under similar conditions, the idea that the latter is engendered by the former seems less far-fetched. In 1990 Quentin Smith proposed that our Big Bang is a black hole in another universe, but said that it could not be a genuine scientific theory unless a new solution to Einstein's ten field equations of general relativity could be developed, Smith, Quentin. 1990. "A Natural Explanation of the Existence and Laws of Our Universe," *Australasian Journal of Philosophy* 68, pp. 22-43. It is a theory that Smith has since given up. Personal communication. Smolin called his theory a "fantasy."
37. Susskind, Leonard, "The anthropic landscape of string theory." arXiv:hep-th/0302219. Susskind, 2005. The string theory landscape is said to have ~10^{500} expressions.
38. Randall, Lisa. 2006. *Warped Passage: Unraveling the Mysteries of the Universe's Hidden Dimensions*. New York: Harper Perennial. Krauss, Lawrence. 2005. *Hidden in the Mirror: The Mysterious Allure of Extra Dimensions, from Plato to String Theory and Beyond*. New York: Viking.
39. An "ekpyrotic" mechanism for generating universes postulates immeasurable three-dimensional "branes" (within one of which our universe exists) moving through higher-dimensional space such that when one brane in some way collides with another, a contracting, empty universe is energized to expand and form matter in a hot Big Bang. Khoury, Justin, Burt A. Ovrut, Paul J. Steinhardt and Neil Turok. 2002. "Density Perturbations in the Ekpyrotic Scenario." *Phys. Rev. D*66 046005. Ostriker, Jeremiah P. and Paul Steinhardt, "The Quintessential Universe." *Scientific American*, January 2001, pp. 46-53.
40. Everett, Hugh. 1957. "Relative State' Formulation of Quantum Mechanics." *Reviews of Modern Physics* 29, No.3, 1957, pp. 454-462. Reprinted in DeWitt. B.S. and N. Graham, eds. 1973. *The Many-Worlds Interpretation of Quantum Mechanics.* Princeton NJ: Princeton University Press, pp. 141-149. Wheeler, John Archibald. 1998. *Geons, Black Holes & Quantum Foam*. New York: W.W. Norton, pp. 268-270. Deustch, David. 1997. *The Fabric of Reality*. London: Penguin Books.
41. Getler, Amanda. 2006. "Exploring Stephen Hawking's Flexiverse." *New Scientist*, April 2006.
42. Tegmark, Max. 2003. "Parallel Universes." *Scientific American*, May 2003, pp. 41-51.
43. Lewis, David. 1986. *On the Plurality of Worlds*. Oxford, UK: Blackwell Publishing, p.2. Lewis writes, "I advocate a thesis of plurality of worlds, or *modal realism,* which holds that our world is but one world among many. There are countless other worlds…so many other worlds, in fact, that absolutely *every* way that a world could possibly be is a way that some world *is*."
44. Nozick. 1981. Nozick seeks to "dissolve the inegalitarian class distinction between nothing and something, treating them on a par…., not treating nonexisting or nonobtaining as more natural or privileged…" One way to do this, he proposes, "is to say that all possibilities are realized." He thus defines the "principle of fecundity" as "All possible worlds obtain." Nozick, 1981, p. 127-128, 131.
45. Davies, 2006, pp. 298-299.
46. Personal communication.
47. Personal communication.
48. Swinburne, Richard. 2004. *The Existence of God* (second edition). Oxford: Clarendon/Oxford University Press. Swinburne, Richard. 1993. *The Coherence of Theism* (revised edition). Oxford: Clarendon/Oxford University Press. Swinburne, Richard. 1994. *The Christian God.* Oxford: Clarendon/Oxford University Press. Swinburne, Richard. 1996. *Is There a God*? Oxford: Clarendon/Oxford University Press. In his influential book, *The Existence of God*, Swinburne builds a "cumulative case" of inductive arguments to assert (not prove) the claim that the proposition "God exists" is more probable than not. He begins with a description of what he means by God. ("In understanding God as a person, while

being fair to the Judaic and Islamic view of God, I am oversimplifying the Christian view.") Swinburne states: "I take the proposition 'God exists' (and the equivalent proposition 'There is a God') to be logically equivalent to 'there exists necessarily a person without a body (i.e., a spirit) who necessarily is eternal, perfectly free, omnipotent, omniscient, perfectly good, and the creator of all things'. I use 'God' as the name of the person picked out by this description." Swinburne then defines each of his terms. By God being a person, Swinburne means "an individual with basic powers (to act internationally), purposes, and beliefs." By God's being eternal, he understands that "he always has existed and always will exist." By God's being perfectly free, he understands that "no object or event or state (including past states of Himself) in any way causally influences him to do the action that he does—his own choice at the moment of action alone determines what he does." By God's being omnipotent, he understands that "he is able to do whatever it is logically possible (i.e., coherent to suppose) that he can do." By God's being omniscient, he understands that "he knows whatever it is logically possible that he know." By God's being perfectly good, he understands that "he always does a morally best action (when there is one), and does no morally bad action." By his being the creator of all things, he understands that "everything that exists at each moment of time (apart from himself) exists because, at that moment of time, he makes it exist, or permits it to exists." The claim that there is a God, Swinburne states, is called theism.

49. Plantinga, Alvin. 1983. "Reason and Belief in God," in Plantinga, Alvin and Nicholas Wolterstorff, eds. *Faith and Rationality: Reason and Belief in God.* Notre Dame, IN: University of Notre Dame Press. Plantinga argues famously that theistic belief does not, in general, need argument or evidence to be rational and justified; belief in God, in Plantinga's well-known terminology, is "properly basic." This means that belief in God is such that one may properly accept it without evidence, that is, without the evidential support of other beliefs. "Perhaps the theist," Plantinga asserts, "is entirely within his epistemic rights in *starting from* belief in God [even if he has no argument or evidence at all], taking that proposition to be one of the ones probability with respect to which determines the rational propriety of *other* beliefs he holds." Notwithstanding this position, Plantinga presents his own arguments for God's existence: Plantinga, Alvin. "Two Dozen (or so) Theistic Arguments." Lecture notes. http://www.calvin.edu/academic/philosophy/virtual_library/articles/plantinga_alvin/two_dozen_or_so_theistic_arguments.pdf.
50. Philosophical discussions of God's Nature, which much occupied medieval theologians (Scholastics), seem arcane and irrelevant today but may probe the structure and meaning of a theistic God, and as such may help advise whether such a Being really exists. Take the traditional doctrine of "Divine Simplicity" (which is anything but simple): God is utterly devoid of complexity; no distinctions can be made in God; God has no "parts." Plantinga describes the doctrine: "We cannot distinguish him from his nature, or his nature from his existence, or his existence from his other properties; he is the very same thing as his nature, existence, goodness, wisdom, power, and the like. And this is a dark saying indeed." Plantinga, Alvin. 1980. *Does God Have a Nature?* Milwaukee: Marquette University Press.
51. In the Bible, names are often declarations of the essence of things. "Adam" means earth, soil, reddish-brownish stuff, from which, as the story goes, God made Adam—"Adam" the stuff was what Adam the man literally *was*. The Hebrew underlying "I am that I am"—first person singular imperfect form of the verb "To Be"—is perhaps more accurately but less euphonically translated "I-continue to-be that which I-continue to-be." Hence, since name is essence, and here the Name means existence, God's existence is his essence. A God of this Name can claim to be without need of further explanation, not in the sense that a further explanation cannot be known but in the sense that it cannot exist.
52. Nasr, Seyyed Hossein. 2006. *Islamic Philosophy from Its Origin to the Present: Philosophy in the Land of Prophecy*. Suny Series in Islam. Albany, NY: State University of New York Press. Nasr, Seyyed Hossein, Randall E. Auxier and Luican W. Stone, eds. 2000. *The Philosophy of Seyyed Hossein Nasr*. Library of Living Philosophers Series. Chicago and La Salle, IL: Open Court Publishing Company.
53. Ellis, George F. R. 2002. "Natures of Existence (Temporal and Eternal)." In Ellis, George F. R., ed., *The Far-Future Universe: Eschatology from a Cosmic Perspective*. Philadelphia, PA: Templeton Foundation Press.
54. Russell, Robert John. 2002. "Eschatology and Physical Cosmology—A Preliminary Reflection." In Ellis. 2002. Russell, Robert John, Nancey Murphy and Arthur Peacocke, eds. 1997. *Chaos and Complexity: Scientific Perspectives on Divine Action*. Vatican City State: Vatican Observatory Publications.
55. Craig, William Lane. 1991. "The Existence of God and the Beginning of the Universe." *Truth: A Journal of Modern Thought* 3: 85-96. Copan, Paul and William Lane Craig. 2004. *Creation out of Nothing: A Biblical, Philosophical and Scientific Exploration*. Grand Rapids, MI: Baker Academic. Craig, William Lane and Quentin Smith. 1993. *Theism, Atheism, and Big Bang Cosmology*. Oxford: Clarendon Press.
56. To John Polkinghorne, a mathematical physicist turned Anglian priest, the Big Bang is "scientifically very interesting but theologically neutral." He asserts that Christian doctrine, which he says never had a stake in the Big Bang vs. Steady State debate, has often erroneously been supposed to be "principally concerned with initiation, with the primary instant." Rather, he says, its concern is "not just with what God did, but with what God is doing; its subject is ontological origin, not temporal beginning." Polkinghorne, John. 1995. *Serious Talk: Science and Religion in Dialogue.* Valley Forge, PA: Trinity Press International, p. 64.
57. Theists debate among themselves whether the Judeo-Christian God is theologically compatible with a multiverse. While many theists denounce multiple universes as a naturalistic substitute for God—they argue that accepting a God is far simpler than postulating a multiverse—some theists now break tradition by claiming that a multiverse reveals an even grander grandeur of the Creator. Collins, Robin. 2007. "A Theistic Perspective on the Multiverse Hypothesis." In Carr, 2007. Collins, Robin. 2005. "Design and the Designer: New Concepts, New Challenges." In Harper, 2005.
58. Ward, Keith. 2006. *Pascal's Fire: Scientific Faith and Religious Understanding*. Oxford: Oneworld Publications. Personal communication. Ward's blurring of personal / impersonal models of God, he says, is influenced by the Brahman / Isvara distinction in Indian philosophy, with resonances in Eastern Orthodox theology (the distinction between *ousia* and *economia*).
59. "Deism," *Dictionary of the History of Ideas,* http://etext.lib.virginia.edu/cgi-local/DHI/dhi.cgi?id=dv1-77. Deist website: http://www.deism.com/.
60. Levine, Michael, "Pantheism", *The Stanford Encyclopedia of Philosophy (Spring 2006 Edition)*, Edward N. Zalta (ed.), http://plato.stanford.edu/archives/spr2006/entries/pantheism/. H. P. Owen proposes a more formal definition: "'Pantheism' … signifies the belief that every existing entity is only one Being; and that all other forms of reality are either modes (or appearances) of it or identical with it." Owen, H. P. 1971. *Concepts of Deity*. London: Macmillan. Pantheism is distinguished from Deism in that, while both sport nontheistic, impersonal Gods, the former allows no separation between God and the world while the latter revels in it. Pantheism's many variations take contrasting positions on metaphysical issues: its fundamental substance can be real or unreal, changing or changeless, etc.
61. *Panentheism*, a word that is a manufactured cognate of pantheism, is the doctrine that the universe is in God but God is more than the universe—i.e., it combines the robust immanence of pantheism (God is truly "in" the world) with the ultimate transcendence of theism (God exceeds the world in His ontological "otherness"). More formally, panentheism is "The belief that the Being of God includes and penetrates the whole universe, so that every part of it exists in Him, but (against pantheism) that His Being is more than, and is not exhausted by, the universe." Cross, F. L. and E. A. Livingstone, eds. 1985. *Oxford Dictionary of the Christian Church*. 2nd ed. Oxford: Oxford University Press, p. 1027. Panentheism, a recent formulation, is the guiding philosophy of Charles Hartshorne, process theologians, and some who seek harmony between science and religion. Clayton, Philip and Arthur Peacocke, eds. 2004. *In Whom We Live and Move and Have Our Being: Panentheistic Reflections on God's Presence in a Scientific World*, Grand Rapids, MI: Eerdmans. *Acosmic pantheism* considers the world merely an appearance and fundamentally unreal (it is more characteristic of some Hindu and Buddhist traditions). *Panpsychism*, the belief that every entity in the universe is to some extent sentient, amalgamates Pantheism (3.4) with Consciousness as Cause (3.6).
62. MacIntyre, Alasdair. 1967. "Pantheism." In *Encyclopedia of Philosophy*. Edwards, Paul, ed. New York: Macmillan and Free Press. John Leslie derives pantheism from his thesis that "ethical requiredness" (see endnote 73) is the ultimate reality generator. Leslie, John. 2001, *Infinite Minds: A Philosophical Cosmology*. Oxford: Oxford University Press, pp. 39-41, 126-130, 215-216.
63. A wide range of conflating examples include Spiritualism, Spiritism, Animism, Occultism, New

Age religions of all kinds, Edgar Cayce and those like him, Theosophy and its sort, forms of Gnosticism—the list is as tedious as it is endless.

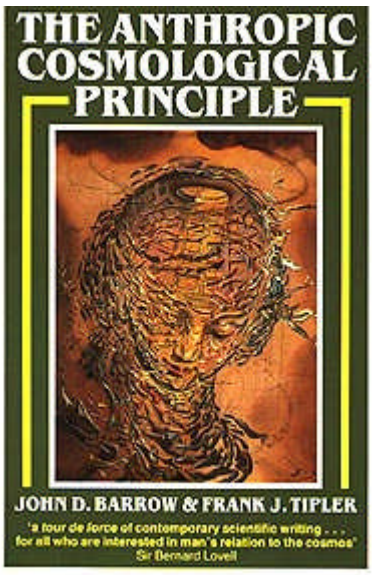
64. According to Amit Goswami, a quantum physicist inspired by Hindu philosophy, "everything starts with consciousness. That is, consciousness is the ground of all being" which imposes "downward causation" on everything else. Goswami, Amit. 1995. *The Self-Aware Universe: How Consciousness Creates the Material World*. New York: Tarcher.
65. There are copious, fanciful schemes that attempt to make consciousness fundamental; many disparate philosophies and world systems take "cosmic mind" as the source of all reality (e.g., http://primordality.com/).
66. To the Dalai Lama, consciousness (in its subtle form), which has no beginning, explains the world. Although he rejects any commencement of creation ("Creation is therefore not possible"), he asserts that the "creator of the world" in Buddhism is "the mind" and "collective karmic impressions, accumulated individually, are at the origin of the creation of a world." Dalai Lama XIV, Marianne Dresser and Alison Anderson. 1996. *Beyond Dogma: Dialogues & Discourses*. Berkeley, CA: North Atlantic Books.
67. Rigpa is considered to be a truth so universal, so primordial, that it goes beyond all limits, and beyond even religion itself (http://www.rigpa.org/).
68. Vilenkin, 2006, p. 205.
69. Taoism, an indigenous religion of China, is centered on "The Way," the path to understanding of the foundations and true nature of heaven and earth. Its scriptures are the relatively short (81 chapters, 5000 Chinese characters) *Dao De Jing* (*Tao Te Ching*), its essence signaled by its famous first verse: "The Tao that can be told is not the eternal Tao" (chapter 1; translation, Gia-Fu Feng & Jane English, 1972). "For though all creatures under heaven are the products of Being, Being itself is the product of Not-being" (chapter 40; translation, Arthur Waley).
70. Wikipedia, http://en.wikipedia.org/wiki/Brahman. Robert Nozick, in his exploration of "Why is there Something Rather Than Nothing," quotes the beginning of the Hindu Vedas' Hymn of Creation, "Nonbeing then existed not nor being," and then shows how Being and Nonbeing do not exhaust all possibilities—outside a certain domain, he says, a thing may be neither. Nozick thus suggests that "It is plausible that whatever every existent thing comes from, their source, falls outside the categories of existence and nonexistence." Nozick. 1981, p. 150, 152.
71. Wilber, Ken. 1995. *Sex, Ecology, Spirituality: The Spirit of Evolution*. Boston: Shambhala Publications. Thompson, William Irwin. 1996. *Coming into Being: Artifacts and Texts in the Evolution of Consciousness*. New York: St. Martin's Press.
72. Penrose, Roger. 2006. "The Big Questions: What is Reality?" *New Scientist*, November 18.
73. Leslie, John. 2001. Leslie, John. 1979. *Value and Existence*. Oxford: Blackwell. Personal communication. Leslie states, "A force of *creative ethical requirement* or…a principle that consistent groups of ethical requirements, ethical demands for the actual presence of this or that situation, can sometimes bring about their own fulfillment. The cosmos might exist because its existence was ethically necessary, without the aid of an omnipotent being who chose to do something about this." Although Leslie surmises, "a divine person might well head the list of the things that the creative force would have created," his preferred position is "a cosmos of infinitely many unified realms of consciousness, each of them infinitely rich… a picture of *infinitely many minds each one worth calling 'divine"* and each one "expected to include knowledge of absolutely everything worth knowing." Leslie, 2002, p. v-vi.
74. Rescher, Nicholas. 1984. *The Riddle of Existence: An Essay in Idealistic Metaphysics*. Lanham, MD: University Press of America. Rescher's "cosmic values" are simplicity, economy, elegance, harmony, and the like, which are maximized by what he calls "proto-laws" as they bring about the existence of the spatiotemporal laws and concrete objects of the actual universe. Witherall. 2006.
75. Parfit. January 22, 1998 and February 5, 1998. Parfit suggests that if reality were as full as it could be ("All Worlds Hypothesis"), that would not be a coincidence. "We can reasonably assume that, if this possibility obtains, that is because it is maximal, or at this extreme. On this Maximalist View, it is a fundamental truth that being possible, and part of the fullest way that reality could be, is sufficient for being actual. That is the highest law governing reality." It does not stop there. Parfit conceptualizes the "Selector" as some special feature that actualizes a real world from among countless cosmic possibilities. "It would determine, not that reality be a certain way, but that it be determined in a certain way how reality is to be." Then, to the extent that there are competing credible Selectors, rules would be needed to select among them, which may be followed by higher level Selectors and rules. Can it ever stop? Parfit concludes by stating that "just as the simplest cosmic possibility is that nothing ever exists, the simplest explanatory possibility is that there is no Selector. So we should not expect simplicity at both the factual and explanatory levels. If there is no Selector, we should not expect that there would also be no Universe." It seems that we arrive back at Brute Fact, which radiates a bit more color now, and we are enlightened by the journey.
76. In Tao, the only motion is returning. *Dao De Jing,* chapter 6; translation, Arthur Waley
77. Personal communication. To give the other side equal time, theists have a plethora of explanations or justifications of evil – some of them innovative and sophisticated, the "Free-Will Defense" being only the most common among a legion of others (a summary of which would exhaust an article about like this one).
78. "Idealism" *Wikipedia*, http://en.wikipedia.org/wiki/Idealism. Goswami, 1995.
79. Linde, Andrei. 1992. "Hard Art of the Universe Creation." *Nucl. Phys. B*372 421-442. Using a stochastic approach to quantum tunneling, Linde develops a method to create "the universe in a laboratory." He concludes by observing that this would be "a very difficult job," but if it is true, "Hopefully, he [the other-worldly physicist hacker] did not make too many mistakes…"
80. Davies, 2006.
81. Bostrom, Nick. 2003. "Are You Living in a Computer Simulation?" *Philosophical Quarterly*, Vol. 53, No. 211, pp. 243-255. Bostrom, Nick. 2005. "Why Make a Matrix? And Why You Might Be In One." In Irwin, William, ed. *More Matrix and Philosophy: Revolutions and Reloaded Decoded.* Chicago: IL: Open Court Publishing Company. "Life's a Sim and Then You're Deleted" *New Scientist*, 27 July 2002. Another kind of Simulation in Virtual Reality (4.3) is Frank Tipler's notion of a general resurrection just before a Big Crunch at what he calls the "Omega Point," which would be brought about by an almost infinite amount of computational power generated by a universe whose inward gravitational rush is accelerating exponentially. Tipler, Frank. 1997. *The Physics of Immortality: Modern Cosmology, God and the Resurrection of the Dead*. New York: Anchor Books.
82. "Solipsism" *Wikipedia,* http://en.wikipedia.org/wiki/Solipsism.
83. If the problem is turned from explaining the fine-tuning of this universe to the more profound problem of explaining the fundamental essence or existence of ultimate reality (defined physically)—Why Not Nothing?—the categories and explanations shift. The new taxonomy would ask two overarching questions: (i) "Of What does Ultimate Reality Consist?" and (ii) "By What (If Anything) is Ultimate Reality Caused?" or "For What Reason (If Any) Does Ultimate Reality Exist?" Under the "Consist" question, we have categories of One Universe and Multiple Universes (cataloguing exhaustively every kind of possible multiple universe). Under the "Cause" or "Reason" question, we take all the explanations listed under "One Universe Models" in the text, but here label the category "Natural Explanations," to distinguish it from the "Nonphysical Causes" and "Illusions" categories (the subcategory explanations of these remaining largely the same).
84 van Inwagen, Peter. 2002. *Metaphysics* (Second Edition). Boulder, CO: Westview Press, p. 132. See also Endnotes 2 and 75 above. Derek Parfit states: "Reality might be some way because that way is the best, or the simplest, or the least arbitrary, or because its obtaining makes reality as full and varied as it could be, or because its fundamental laws are, in some way, as elegant as they could be." Parfit, February 5, 1998.
85. That the universe may have popped into existence through some sort of cosmic spontaneous combustion, emerging from the "nothing" of empty space (i.e., vacuum energy generated by quantum fluctuations, unstable high energy "false vacua") or from "quantum tunneling" (Vilenkin, 2006), may be the proximal cause of why we have a universe in the first place, but of itself it cannot be the reason why the universe we have works so well for us. Universe-generating mechanisms of themselves, such as unprompted eternal chaotic inflation or uncaused nucleations in spacetime, do not address, much less solve, the fine-tuning problem. Nor can vacuum energy or quantum tunneling or anything of the like be the ultimate cause of the universe, because, however hackneyed, the still-standing, still-unanswered question remains "from where did those laws come?



The Anthropic Cosmological Principle

Review *by* Gert Korthof
updated 6 Aug 2001 (first published: 4 Jun 1998)

The Anthropic Cosmological Principle is the most impressive book I read the last decade. If this book does anything: it places life on earth in its cosmological context. Life and the universe will never be the same after this book!



It is well known that there would be no life without the sun and that the rotation of the earth causes day and night and the seasons. These influences have an undeniable effect on life on earth. But this is all trivial compared with what John Barrow and Frank Tipler have to offer in this book. Slowly one begins to realise, working one's way through the chapters, that the existence of the sun, the earth, but also the chemical elements are the outcome of a process, just as the existence of life and the diversity of life forms is the outcome of a process.

Since Copernicus we are no longer the centre of the universe. And our planet is so small compared to the vastness of the universe. However, we should not be surprised to observe that the universe is so large. No astronomer could exist in one

that was significantly smaller. The universe needs to be as big as it is in order to evolve just a single carbon-based life-form. The universe also needs to be as old (15 billion years) as it is to evolve carbon-based life. This is because carbon is produced in stars, and this process takes over 10 billion years. The whole universe is so big and so old *for us*? Designed for us? *The Anthropic Cosmological Principle* is an invaluable source of information for atheists and theists alike. There are difficult sections with a lot of mathematics, but these can be skipped without problem.

Fine tuning

Most interesting I found the summing up of 'life-supporting' (life enabling) properties of the cosmos:

- the production of a mixture of Hydrogen and Helium after the Big Bang
- long living hydrogen burning stars
- the production of the elements C, O, N, S in a star
- the distance of a planet (earth) to the star (sun): not too far, not too close
- the minimum size of the planet (to hold an atmosphere)
- atomic and molecular stability
- the unique properties of such a simple molecule as water

and much, much more.
I wished that the astronomy, chemistry and biology lessons in my education had been integrated in the way Barrow and Tipler do it in their book. It shows close connections between seemingly unrelated facts such as the production of Carbon in the interior of the sun; the very useful chemical properties of Carbon and the fact that all life on Earth is based on Carbon. Usually biology textbooks ignore these connections. A good example of a modern evolution textbook where biology is placed in its cosmological context is Monroe Strickberger (5). The architects of the

neo-Darwinian synthesis tried to unify biology by integrating all separate biological disciplines into one biological science. What Barrow and Tipler have done is extending this synthesis to include both biology and cosmology, and relevant parts of physics and chemistry.

Whether or not one claims that fine tuning is extremely precise and cannot be a coincidence, and whether or not one gives a theistic or atheistic interpretation of the facts, the lasting contribution to science of Barrow and Tipler is that they show that the building blocks of life are not produced on Earth but in the cosmos. So we cannot understand life without understanding the building blocks of life (7). And those building blocks cannot be understood without knowing the processes that produced those building blocks. And these facts are true independent of the Anthropic Cosmological Principle itself.

Evolution-Creation controversy.

Ever since reading this book, I was amazed that Intelligent Design Creationists like Phillip Johnson, Michael Denton(*1986*), Michael Behe and William Dembski, who focus their attacks on biological evolution, hardly exploited the 'fine-tuning' argument to prove the existence of a designer. It is so obvious, that I fail to see why they don't use the argument. Maybe those creationists don't like that evolution is taken for granted by Barrow and Tipler. Or maybe they are just too convinced of the association of evolution and atheism, to see that a universe with evolution could be designed. If fine tuning is preparation, if fine tuning is about initial conditions, then evolution is inescapably associated with fine tuning. Maybe the 'preparation' of the cosmos for life on Earth did take a little bit too long? Just as the 'preparation' of the Earth for humans did take a little bit too long? If the ultimate goal of the preparations was to create humans, then the processes assigned to the job didn't seem to be very efficient. Indeed there is a contrast between 'intelligent fine tuning', and the subsequent inefficient processes. Maybe that's the reason why Young Earth Creationists (*'one week is enough'*) decided that the Earth and the cosmos are young, thereby eliminating the long preparation time and making creation more efficient (*but why one earthly week?*).

It would be very difficult for creationists who committed themselves in public and in print to the incompatibility of Darwinistic evolution and theism, to abandon that view in favour of the 'fine tuning' argument. Michael Denton is the only writer I know of who did exactly this (3). Theists who do accept fine tuning, like Swinburne (1), as far as I know never had a problem with biological evolution. To make the matter even more complicated: the theists Hugh Ross (2) and Dean Overman (6) believe that *both* fine tuning and the creation of life is done by God. Whenever the Anthropic Principle is used to explain away fine tuning, one can expect theists to object (4).

On the other hand it is good to notice that Barrow and Tipler, considering their interest in designed features of the universe, do not think for a moment that the origin of life and the origin of humans needed (divine) intervention. One cannot find a trace of doubt in their book that life evolved. (As if it were enough to fine tune the initial conditions of the universe and all the rest would follow ...). A good illustration of the confidence in evolution is the 'Biological Constraints on the age of the earth' (page 159). They call it the first successful use of an anthropic argument. Their argument runs like this:
As the time to evolve humans was at least 1 billion years, and since solar energy was necessary all the time for life, the sun **must** have been stable for at least 1 billion years. This again restricts possible sizes and the composition of the sun. So biological evolution restricts cosmology. This shows that the authors take evolution as a fact, as known background knowledge. Maybe they are so used to an evolving universe, the birth and death of stars, (etc.) that biological evolution seems only natural. Let the biologists find out the details about evolution.

I think there are problems with the claim that the universe has been designed for humans. For example the probability that humans evolved, is very low. So: fine tuning is fine, but as long as evolution depends on a directionless random process, the fine tuning only creates the *necessary conditions*, but does not give a guarantee that humans and even life itself would occur.

Do Barrow and Tipler believe in Design?

Clearly they are not Young-Earth-Creationists! But they are deeply interested in design (95 pages on the history of design arguments) and purpose in biology (another 95 pages). They do see themselves in the age old tradition of design arguments. They are interested in everything that has been rejected by mainstream science (Teilhard de Chardin, etc.). I found it extremely difficult to pin them down. Let us have a closer look at the Anthropic Principle in operation when applied to a familiar anti-Darwinist argument: the improbability argument of the origin of genes en proteins. The following quote *was found in the footnotes* :

"Salisbury argued that the enormous improbability of a given gene, which we computed in the text, means that a gene is too unique to come into being by natural selection acting on chance mutations. **WAP self-selection refutes this argument**, as Doolittle in Scientists confront creationism, ... has also pointed out. " (p575). [WAP=Weak Anthropic Principle]. (bold is mine).

So WAP refutes **any** argument against evolution and even Darwinism, because WE ARE THERE ! And this conclusion is delegated to the footnotes. So: *no matter how improbable the evolution of life and humans and no matter how many unresolved problems in neo-Darwinism, WE ARE THERE !* So there must be something wrong with the calculation in question. So any argument telling us we could not have evolved, simply and clearly *must* be wrong. It is obvious that the authors implicitly reject any (divine) intervention in natural processes. And everyone who accepts that science works exclusively with natural causes, must come to the same conclusion. WAP can eliminate theories and calculations that 'deny' our existence, but has nothing to say about which theory explaining our existence, is right.

It is a mystery why Barrow and Tipler are so deeply interested in design. Maybe they do not have a problem with the initial conditions of the universe being 'designed', as long as everything after that is not disturbed by 'interventions'. -

 **"The Anthropic**

Cosmological Principle."
by John D. Barrow & Frank J. Tipler
Oxford University Press.
1986
paperback reprint 1994
706 pages

Contents:

(each chapter closes with References)

Notes:

1. See my review on this site of Richard Swinburne's *Is there a God?*.
2. A good online summary of the constants of physics and the parameters of the planet earth is given in Design and the Anthropic Principle by Hugh Ross. At the same time the article is a good illustration of a theist who accepts **both** the fine tuning argument and the impossibility of spontaneous origin of life as design proofs. [*if life had to be specially created, there must be something wrong with the fine tuning?*]
3. Michael Denton(1998) *Nature's Destiny. How The Laws of Biology Reveal Purpose In The Universe*. See review on this site.
4. For example the theist William Lane Craig in: "Barrow and Tipler on the Anthropic Principle vs. Divine Design". Craig perceives the Anthropic Principle as anti-theistic. He criticises Barrow & Tipler's claim that we should not be surprised to observe a fine tuned universe and so don't need an explanation for the fine tuning. We *should* be surprised and we *do* need an explanation according to Craig. The need for an explanation is not explained away by the Anthropic Principle. Of course Craig gives a theistic explanation.
5. Monroe Strickberger(2000) *Evolution*. Third Edition.

(review on this site)

6. See review on this site. Note the conflict between fine-tuning and anti-evolution.
7. Proponents of 'Artificial Life' (life created in the computer) claim they don't need Carbon to create life. Of course not! However life on Earth is definitely Carbon-based!

Further Reading:

- A critical discussion of the fine tuning argument is: "Intelligent Design. Humans, Cockroaches, and the Laws of Physics" by Victor J. Stenger, professor of physics and astronomy at the University of Hawaii. Recently (2003) he published *Has Science Found God? The latest Results in the Search for Purpose in the Universe*, in which he discusses the origin of the universe and fine tuning of physcial constants.
- "Out in the cold", New Scientist 10 June 2000, pp33-35 discusses the criticism of cosmologist Paul Steinhardt, who claims that the anthropic principle is sloppy and unscientific, and why.
- William Lane Craig: "Barrow and Tipler on the Anthropic Principle vs. Divine Design", a theistic interpretation.
- Anthropic Reasoning and the Contemporary Design Argument in Astrophysics: A Reply to Robert Klee by Mark A. Walker and Milan M. Ćirković. (undated, visited on 19 Feb 2004) An interesting read.
- Lynn Rotschild and Adrian Lister (ed) (2003) *Evolution on planet Earth. The impact of the physical environment*, (publishers information). A fascinating review of all physical influences on the evolution of life on earth by specialists in different fields. The earth's atmosphere (oxygen and carbon dioxide levels), solar radiation, panspermia, gravity, temperature, continental drift, climate and extraterrestrial conditions for life. We will never have a complete theory of evolution and full understanding of evolution without the physical factors! Many illustrations. Textbook-like layout.
- Nick Bostrom (2002) *Anthropic Bias: Observation Selections Effects in Science and Philosophy (Studies in Philosophy)* (publishers information) for anyone interested in fine tuning, anthropic coincidences and observation selection effects. It offers new conceptual and methodological tools for thinking about the large-scale structure of the world and the place of observers within it.
- Victor J. Stenger (2004) Is the Universe Fine-Tuned for Us? in: Matt Young and Taner Edis (2004) Why Intelligent Design Fails: A Scientific Critique of the New Creationism contains a critique of the anthropic principle. [10 Jul 2005]
- A Universe Right For You --- A book by J.M.Cohen © 2006. This is a history of our universe, told from an anthropic perspective. [3 Feb 2006]
- Geoff Brumfiel (2006) Outrageous fortune News feature NATURE|Vol 439|5 January 2006. Very useful and clearly written article about anthropic principle and the relation with string theory. With quotes from David Gross and Leonard Susskind. [3

Feb 2006]

- A popular mainstream introduction into Astrobiology is: *Astrobiology : A Brief Introduction* by Kevin W. Plaxco & Michael Gross (2006). This is essential scientific background knowledge for those interested in 'fine-tuning' of the universe for life and the origin of life itself. Chapters: What is life? Origins of a habitable universe and planet, Primordial soup, Origin of life, Origin of cells, Evolution of life on earth, Life in extreme environments, Search for extraterrestrial life. [4 Jul 2006]
- Fred Spier (2011) *Big History and the Future of Humanity*, Wiley-Blackwell, paperback. Big History is the approach to history in which the human past is placed within the framework of cosmic history, from the beginning of the universe up until life on Earth today.

guestbook (moderated)	home: Towards the Third Evolutionary Synthesis	http://wasdarwinwrong.com/kortho17.htm
	First published: 4 Jun 98	Last update: 6 Aug 2001. Further Reading: 4 Jul 2006

Disclaimer

An impertinent resume of the Anthropic Cosmological Principle

by Daniel Berger

While the so-called anthropic *coincidences* are at least arguably important, the **ANTHROPIC COSMOLOGICAL PRINCIPLE** -- which attempts to *answer* the anthropic coincidences -- seems a failed enterprise. I will consider four statements of the Anthropic Principle, and reject all of them.

A TECHNICAL NOTE: I use "universe" to mean the volume of space that is observationally accessible to us. I use "super-universe" to mean a hypothetical infinite spacetime continuum, which obeys laws sufficiently similar to those in our universe that we can make meaningful statements about it.

"IF WE WEREN'T HERE, WE WOULDN'T BE HERE."

The **WEAK ANTHROPIC PRINCIPLE** (WAP) states simply, "If conditions weren't right for us to be here, we wouldn't very well be here to remark on the fact." Of course this is no answer to the presumed improbability of a universe which happens to contain us, or even intelligence at all (much less life!). (1)

WAP advocates may point out that we can't say anything, scientifically, about the likelihood of our particular universe from a single example. This at least puts a respectable face on treating our own existence as a brute fact. However, the underlying premise is that science is the only, or at least the most reliable, way of knowing.

Because this premise is less than certain, many of those who espouse the WAP advocate many universes, so that we just happen to be in the one that contains us. Nick Bostrom (2) points out that the Anthropic Principle may be considered presumptive evidence for many universes "in the absence of any plausible alternative." Unfortunately, there is no *observational* or *experimental* ("scientific") evidence whatsoever for any universe besides the one we inhabit. And even the idea has serious problems, both physical and philosophical (I would like to say *meta*physical, but that's not always a respectable term, even to philosophers).

Hawking's work on black hole thermodynamics has closed off the possibility of infinite -- or even more than two or three -- serial universes *via* cycles of alternating Big Bangs and Big Crunches. (3) So advocates of multiple universes usually claim that very many (or infinite) parallel universes are generated as vacuum fluctuations within a super-universe at heat death. This is a respectable hypothesis, since the Universe appears to have zero overall energy within very large observational error bars. (4)

BUT this just pushes the question back a step: whence came the vacuum? A vacuum is not "nothing," seething as it is with fields and virtual particles governed by definite laws. And whence came those laws? It can be argued that any universe generator which is able to produce occasional fruitful, "fine-tuned" universes must itself be fine-tuned. (5)

Return to the top of this file

"ONLY A UNIVERSE WITH US IS POSSIBLE."

The **STRONG ANTHROPIC PRINCIPLE** (SAP) attempts to argue, without a shred of evidence,

that for some reason *fruitfulness is a necessary property of universes.* While we can easily conceive of universes that could never develop life or intelligence, the SAP maintains that no such universes are actually possible.

The SAP rests on the so-called Copernican Principle (6), which says that we must not presume to inhabit aught but the most unexceptional of places. Therefore, if we're here, in this particular universe, this universe *must be* the most probable of all possible universes. Shades of Dr. Pangloss! (7)

Unfortunately, no evidence whatsoever exists for this contention, or for the Copernican Principle, for that matter. Like Occam's Razor (8), it's a presumptive preference which has been known to be fruitful, nothing more.

The SAP *should not* be confused with the assertion that, if God created the Universe, of course it'll be fruitful, otherwise what'd be the point?

Return to the top of this file

"IF WE WEREN'T HERE, THE UNIVERSE COULDN'T EXIST."

The **PARTICIPATORY ANTHROPIC PRINCIPLE** (PAP) takes a page from the Copenhagen Interpretation of Quantum Mechanics as well as from the Bell-Bohm idea of deep connectedness between events and objects once in contact. (Of course the Big Bang requires that everything in the universe *was* once in contact with everything else.)

The Copenhagen Interpretation argues that the quantum world is not actualized until and unless a measurement is made; thus an observer is required to actualize each quantum event as one thing or another (the "collapse of the wave function"). The PAP extends this to the universe as a whole, saying that *only universes with observers at some point in their history can become real.* The PAP tries to provide a basis for the bald assertion of the SAP.

Apart from some reputedly rather serious philosophical problems with the whole idea, ~~totally unpublicized~~ Nobel-prize-winning experimental work has shown that

1. The wave function "collapses" very well on its own, thank you very much. No observer appears to be required. (9) This has been given a name: "quantum decoherence."
2. Particular quantum states *can* in fact be observed and measured, more than once and reproducibly, without destroying them (or tipping them into one or another alternative). Quantum states therefore have real existence; they're just delicate, like a pencil balanced on its point. Like the pencil, they can decay in any direction; like the pencil, there's nothing mysterious about them. (10)

This is not my own interpretation. The observer-independent reproducibility and collapse of quantum states are central to the field of quantum computing.

Return to the top of this file

"THE UNIVERSE R US."

The **FINAL ANTHROPIC PRINCIPLE** pontificates, "Intelligence is a necessary property of Universes, and once Intelligence comes into existence, It can never be destroyed." The first half is simply the SAP; the rest flies off into rather interesting territory.

Frank Tipler and others assert that Intelligence, as dubiously distinct from individual intelligent beings, is self-perpetuating and, at least subjectively, eternal. Furthermore, it will grow more and more powerful until it becomes "God" or something very similar. (11)

Tipler is actually taking a page from Fr. Pierre Teilhard de Chardin, the French Jesuit mystic paleontologist, who decided that God is the culmination of universal evolution (the "Omega Point"). And all the time you thought God created the Universe, not the other way 'round! But then, God (as realized by the Universe) also creates the Universe that brings Him into being... This is the PAP with a vengeance! (12)

Interested readers are referred, not to Teilhard's writings which are impenetrably confusing, but to Robert Heinlein's classic short story, "All You Zombies."

> While I have merely cast ridicule on the Final Anthropic Principle, it is possible to do more by way of refuting it. See Milan M. Cirkovic and Nick Bostrom, "The Cosmological Constant and the Final Anthropic Hypothesis," *Astrophysics and Space Science*, **274**, 675-687 (2000). An early draft may be found on the LANL preprint server. Thanks to Professor Cirkovic for calling this article to my attention.

Return to the top of this file

Further reading:

Dan Berger's Anthropic Principle links

John D. Barrow and Frank Tipler, *The Anthropic Cosmological Principle*, Oxford University Press, 1988.

Excellent discussions of quantum mechanics and its implications are provided by John Polkinghorne, *The Quantum World*, Princeton University Press, 1984; by Jim Baggott, *The Meaning of Quantum Theory*, Oxford University Press, 1992; and by Werner Heisenberg, *Physics and Philosophy*, Harper & Row, 1958.

Return to the top of this file

References:

1. Nick Bostrom, a professional philosopher, contends that Baysian probability analysis allows one to take the WAP more seriously; see his site, anthropic-principle.com.
   Return

2. Private correspondence; see Note 1.
   Return

3. I am ashamed to say that I cannot remember my source for this, but the work was published, I think, after *A Brief History of Time*.

   P.J. Steinhardt and N. Turok (*Science*, **296**, 1436-1439, 2002) offer a theory that gets around the entropic embargo on serial multiple universes by using universe-universe collisions to generate new Big Bangs. No experimental evidence, of course; Alan Guth, originator of the theory of cosmic inflation, says that whether this is plausible depends on how the physics of the hypothetical collisions works out. See the news item in *Science*, **296**, 639 (2002).

   Return

4. See, for example, Martin A. Bucher and David N. Spergel, "Inflation in a Low-Density Universe," *Scientific American*, January 1999.
   Return

5. The Many Universes Interpretation of quantum mechanics (see the sources listed above) says that *every* possible quantum event occurs, but when more than one is possible, the different possible events result in the generation of one universe for each possibility. This is sometimes used as a convenient way of generating an infinite number of possible universes. But again, the source of the physical laws which define the ensemble of universes is not addressed.
   Return

6. The Copernican Principle is used to predict the impending extinction of the human race by J.R. Gott, "Implications of the Copernican principle for our future prospects," *Nature* **363**, 315-319 (1993). Gott's argument (based on one by Brandon Carter) is called the Doomsday Argument and is fully discussed here by Nick Bostrom.
   Return

7. Of course, Dr. Pangloss is the Liebnitzean optimist in Voltaire's immortal yet impertinent novel, *Candide*.
   Return

8. For an analysis of the limitations of Occam's Razor--which says that, of two explanations, the simpler is to be preferred if it explains all the facts -- see Hoffmann, Minkin and Carpenter, "Ockham's Razor and Chemistry," *HYLE* **3**, 3-28 (1997). It seems straightforward to apply this analysis to the Copernican Principle.
Return

9. See the report in *Science* **274**, 1615 (1996). The original article was published by S. Haroche, J.-M. Raimond, M. Brune *et al* in *Physical Review Letters* (9 Dec 1996).
Return

10. See the report in *Science* **285**, 307 (1999). Original article G. Nogues, A. Rauschenbeutel, S. Osnaghi, M. Brune, J.-M. Raimond and S. Haroche, *Nature* **400**, 239 (1999). Or read about it in *Scientific American*, October 1999 issue.
Return

11. I'm strongly reminded of Isaac Asimov's short story, "The Last Question." Perhaps Tipler should pay at least token royalties to the Good Doctor's estate. But I forgot -- Tipler doesn't consider his story to be fiction.
Return

12. According to John Haught's book, *God After Darwin: A Theology of Evolution*, the previous paragraph is a caricature of Teilhard -- and indeed, as I note in the next paragraph, I was unable to make head or tail of Teilhard's writings. Haught says that Teilhard merely took the Eternal nature of God seriously: God is as much in the future as in the past.
Return

Return to the top of this file

Return to

Essays Home page