



Carl Sagan: The Skeptic's Sceptic Part 1

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*In 1985, Carl Sagan, better known for his book and television series *Cosmos*, delivered the Gifford Lectures. The transcripts were only recently published as *The Varieties of Scientific Experience*. Peter S. Williams has written an extended review of the book. His review provides some excellent responses to arguments that Sagan uses and which keep cropping up today.*

This is Part 1 of the review, covering some introductory matters and the significance of life on earth. Read [Part 2](#), [Part 3](#), [Part 4](#).

Carl Sagan's *The Varieties of Scientific Experience*:

A Personal View of the Search for God (Penguin, 2006)

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Introduction

Carl Sagan (1934-1996) - 'the world's best-known scientist in the late twentieth century'[1] - was Professor of Astronomy and Space Sciences, and Director of the Laboratory for Planetary Studies, at Cornell University. Sagan was an astronomer and astrophysicist well known for supporting the 'search for extra terrestrial intelligence' (SETI). He was also a Pulitzer prize-winning science communicator best known for co-writing and presenting the Emmy and Peabody award-winning 1980 PBS television series *Cosmos: A Personal Voyage*, a 13-hour series seen by over 400 million people. Sagan also wrote the science

fiction novel *Contact*, which formed the basis of the 1997 film of the same name.[2]

Sagan was a 'Skeptic', an American term that tends to designate someone who is sceptical about paranormal and supernatural truth claims, but who (so it often seems to me at least) uncritically endorses an atheistic, naturalistic worldview. Sagan was a founding member and Fellow of the 'Committee for the Scientific Investigation of Claims of the Paranormal' (CSICOP), and a member of the Council for Secular Humanism's International Academy of Humanism. Sagan nevertheless resisted the atheist label, describing himself as an agnostic and writing that: 'There is no necessary conflict between science and religion.'[3] He also questioned Skepticism's frequently antagonistic strategy:

'The chief difficulty I see in the sceptical movement is in its polarization: Us vs. Them – the sense that we have a monopoly on the truth; that those other people who believe all these stupid doctrines are morons.'[4]

However, Sagan did argue against the intellectual rectitude and truth of theism, and is thus lauded by many atheism-promoting groups and individuals today. For example, endorsing *The Varieties of Scientific Experience*, atheist Sam Harris writes:

'An unrivalled master at communicating the breadth and beauty of science. It is not an accident that he was also one of the 20th century's most incisive critics of popular delusion. In *The Varieties of Scientific Experience*, the transcript of Sagan's Gifford Lectures, Ann Druyan has unearthed a treasure. It is a treasure of reason, compassion, and scientific awe. It should be the next book you read.'[5]

It is my contention that Sagan's Gifford Lectures, published to commemorate the tenth anniversary of his death, are anything but the 'treasure of reason' Harris depicts.

Sagan's Gifford Lectures

The Gifford Lectures were established by the will of Adam Gifford (d. 1887) to 'promote and diffuse the study of Natural Theology in the widest sense

of the term — in other words, the knowledge of God.’[6] These prestigious lectures (which are not necessarily either *pro* or *anti* knowledge of God), given at Scottish Universities, are often given with a view to publication. Several of these works have become classics in the fields of theology and/or philosophy. Past lecturers include such notables as: Arthur Balfour, William Temple, Basil Mitchell, Richard Swinburne, Peter van Inwagen and John Haldane. Philosopher William James delivered *The Varieties of Religious Experience* as Gifford Lectures in 1900-02. Sagan’s lectures were originally delivered under the title *The Search for Who We Are*, but are now released with a title that plays off this famous predecessor.

In *The Varieties of Scientific Experience: A Personal View of the Search for God* (Penguin, 2006), Sagan’s 1985 Gifford Lectures finally see the light of day in a handsomely presented and illustrated book. The ‘time dilation’ effect involved is doubly telling. In the first place, given the recent vogue for vehemently anti-religious polemics (by the ‘New Atheist’ likes of Richard Dawkins[7], A.C. Grayling,[8] *et al*), Sagan’s book comes as a breath of fresh air from a time when the atheistic pole of the God debate was a good deal calmer and more balanced than it has been of late. Sagan views theism as an understandable intellectual mistake, but one with significant practical benefits overall. In the second place, twenty-two years of scientific investigation since 1985 have left many of Sagan’s scientific speculations buried under the weight of contrary evidence.

Sagan covers four main topics:

- 1) The significance of life on Earth given modern knowledge of cosmology
- 2) The origin of life and the possibility of extra-terrestrial intelligence
- 3) Natural theology (arguments for theism aside from revelation)
- 4) Religious experience

Accordingly, I shall divide my review into four parts, beginning with Sagan’s treatment of the place of humanity in the cosmos.

An Epistemic Aside

It is, however, worth observing at the outset that

Sagan embraces the self-contradictory theory of knowledge (epistemology) that:

‘superstition is... merely belief without evidence.’ (p. 1)

If ‘belief without evidence’ is automatically ‘superstition’, then we are all of us, including Sagan, very superstitious. Every argument rests on logical principles that brook no support (on pain of begging the question), and every empirically grounded statement depends upon the assumed reliability of perceptual practices that are likewise impossible to justify without circularity. Evidence is important, but it is not the be-all and end-all of rationality. Indeed, one cannot coherently celebrate the undoubted virtues of evidential arguments *unless* one also celebrates the virtues of appropriate belief without evidence. It would therefore be better to say that superstition is *belief despite an overwhelming evidential case to the contrary* or *belief formed without proper regard for relevant epistemic duties*.

Sagan quotes Bertrand Russell with approval, asserting that: ‘it is undesirable to believe a proposition when there is no ground whatever for supposing it true.’ (p. 189) In the revealing selected Q&A session a questioner sensibly asks: ‘What grounds would you have for believing that proposition?’ (p. 249) Sagan admits the logical flaw, but instead of retracting his epistemology, flounders on:

‘Yes. That’s a very good question that leads to an infinite regress... So if you wish to have the statement justified in internal logic – that is, a self-consistent closed system – obviously it cannot, because it leads to an infinite regress. But as I was saying, it seems to me that the approach of sceptical scrutiny commends itself to our attention because it has worked so well in the past.’ (p. 249)

Thus Sagan admits that his epistemology is incoherent, but instead of abandoning his self-contradictory and self-excepting position, attempts to justify it with an inference from pragmatic results! Thankfully for the cause of rationality, the proposition that ‘it is undesirable to accept any belief formed without proper regard for relevant epistemic duties’ is not merely logically consistent, but more pragmatically useful if one’s

goal is the truth rather than simply the best metaphysically naturalistic explanation presently available.

Part 1: The significance of life on Earth given modern knowledge of cosmology

Space is Dark and Large, and we are Small by Comparison...

Sagan begins by observing that most of the cosmos is dark. He equates darkness with nothingness: 'I stress that the universe is mainly made of nothing, that something is the exception. Nothing is the rule.' (p. 2) Strictly speaking, this is incorrect, since even a *dark* something is very much a dark *something* (in this case the space-time continuum itself).

Looking at the Solar System, Sagan announces that 'there are four large bodies other than the Sun' (p. 5) and pronounces that 'the rest is debris' (p. 5). Unfortunately, 'debris' carries connotations of insignificance that are not necessarily accurate. Suppose ten chunks of rock had fallen off a cliff (perhaps due to natural weathering), of which five were much larger than the rest; and suppose that one of the smaller rocks had been sculpted into a bust of Carl Sagan. Would it be accurate to describe the sculpted rock as a 'piece of debris' (p. 5)? Obviously, the answer is 'yes' (in one sense) and 'no' (in another). Likewise, whether or not Earth is 'debris' depends on factors besides its size or the origin of the material of which it is made.[9]

Sagan is soon asserting: 'the world that we live on is a tiny and insignificant part of a vast collection of worlds.' (p. 11) Earth may be tiny relative to Saturn and Jupiter, but unless significance is proportional to size, there is no justification in this fact for the assertion that Earth is insignificant. And significance is unrelated to size. Cars are bigger than humans, but humans are more significant than cars. Indeed, some humans are larger than others, but that doesn't make them more significant. Sagan's implicit argument for the insignificance of Earth (and hence the insignificance of life on Earth) is 'size-ist'.

C.S. Lewis pointed out that although our scientific model of creation may have changed:

'The insignificance (by cosmic standards) of the Earth became as much a common-place to the medieval, as to the modern, thinker; it was part of the moralists' stock-in-trade, used, as Cicero uses it, to mortify human ambition.'[10]

For example, Moses Maimonides, writing in his *Guide for the Perplexed* in the 12th century, wrote:

'if man examines the universe as he understands it, he knows how small a part of it he is... mankind and certainly all other species of living things are naught in comparison with all of continuing existence.'[11]

In point of fact, Earth is larger than the average sized thing in the cosmos (and people are in the average size band, between the microscopic and the macroscopic levels).

Earth may be but one world in 'a vast collection of worlds' (p. 11), and our Sun may be 'one of a vast multitude' (p. 11) – but neither are at all 'average'. We now know that when Sagan states that 'the average star is in no major way different from the Sun' (p. 23) he is wrong. As Benjamin Wiker reports:

'Our sun is not a typical star but is one of the 9 percent most massive stars in our galaxy, and is also very stable. Further, the sun hits the Goldilocks mean for life – neither too hot (like a blue or white star) nor too cold (like a red star) – and its peak emission is right at the visible part of the electromagnetic spectrum – the very, very thin band where not only vision is possible but also photosynthesis.'[12]

Even if Sagan didn't have the scientific facts wrong here, is an average student with average looks, average grades and average interests thereby *insignificant*? Just as there is no inherent relationship between significance and size, so there is no inherent relationship between significance and mediocrity in the mathematical sense.

God and the Copernican Myth of Insignificance

Sagan thinks that modern scientific knowledge that we are not 'in the centre of the galaxy, where things are clearly important' (p. 24) has a negative

implication for theism (although quite what the implication is meant to be is never spelt out). According to Sagan, Earth is:

‘somewhere out in the galactic boondocks, the extreme suburbs, where the action isn’t. We are situated in a very unremarkable, unprepossessing location in this great Milky Way Galaxy.’ (p. 24)

The implicit argument here seems to be something like this: the belief that humans are significant is a corollary of theism that is, somehow, falsified by the empirical observation that we don’t live in the centre of the cosmos. This ‘somehow’ is to be cashed out as the principle that significance is related to location (that the ‘centre of the galaxy’ is ‘where things are clearly important’) and that our failure to inhabit this central location therefore implies our lack of metaphysical significance, and thereby entails that theism is false.

Sagan presents us with a lovely turn of phrase, but a terrible argument that suffers from multiple problems. For instance, as far as we know we *are* the only action in the cosmos, at least as far as intelligent life goes, and hence, by definition, the action is wherever we are. We are not in the centre of the Galaxy. Therefore, the action is *not* in the centre of the galaxy. It’s *here*. In other words, all the available evidence is *against* the principle that significance is related to the centrality of one’s location in space.

It should be obvious that the link between location and significance presupposed by Sagan’s argument is non-existent. Is someone standing in the middle of a room necessarily more important than someone leaning against one of the walls? Is the centre of a sphere more important than its surface? The importance of a thing has nothing to do with its spatial position. As Keith Ward writes: ‘It does not follow that, just because we are not physically at the centre of the universe, we are not central to God’s plans.’[13]

The picture of the cosmos developed by the ancient Greeks (principally Aristotle and Ptolemy) had Earth in the middle being circled by a series of nested, concentric spheres containing the planets and the stars. At first this model was a good fit with the available evidence. Over the years various observations were made that didn’t

fit this model, but which could be made to fit by adding circles within circles (called ‘epicycles’) in order to obtain ever more complex and accurate movements from the heavenly bodies. Eventually, astronomers like Copernicus (1473–1543) argued that the old model was needlessly complicated, and that it was simpler to suppose that the Earth and the other planets were orbiting the Sun. This shift, from a model with Earth at the centre to one with the Sun at the centre, is known as ‘the Copernican revolution’.

Ironically, Sagan’s ‘locationist’ argument actually depends upon a false metaphysical principle relating significance to location, a principle skeptics like Sagan misattribute to the Christians who opposed the Copernican Revolution, a principle that the Christians who made the Copernican Revolution would not have accepted, but which Skeptics themselves apparently believe (at least when presenting arguments against theism). In the pre-Copernican scheme of things, the centre of the universe was seen more as the dumping ground at the bottom, rather than the nerve-centre at the heart of the universe. Sagan is wrong to think of the Ptolemaic view regarding Earth as a universal high point that Copernicus reduced to lowly insignificance. As philosopher Robert C. Koons argues:

‘It is sometimes thought that our displacement from the centre of the universe by Copernicus somehow contradicted at least Christian theism. But this seems to be based on the erroneous assumption that everything believed by ancient Christians was taken by them as equally essential to their theology. Ancient Christians knew that the earth was spherical and that the universe is immensely large compared to the earth. And although they all believed (until about the fourteenth century) that the earth was the centre of the universe, they did not think that there was anything special about being there, since it was hell, rather than the terrestrial surface, that lay at the very centre. From the ancient perspective, it was the periphery of the cosmos, and not the centre, that took pride of place. The outermost sphere was the source of all terrestrial life and motion. The centre was a kind of sump in which all that was gross and base settled.’[14]

Nancy Pearcey and Charles Thaxton explain:

'in medieval cosmology the centre of the universe was not a place of special significance. Quite the contrary, it was the locus of evil. At the very centre of the universe was Hell, then the earth, then (moving outwards from the centre) the progressively nobler spheres of the heavens. In this scheme of things, humanity's central location was no compliment, nor was its loss a demotion. In fact, in Copernicus's own day a common objection to his theory was that it elevated mankind *above* his true station. In medieval cosmology, human significance was rooted not in the earth's central location but in the regard God shows toward it. Hence the idea that Copernican theory threatened the Christian teaching of human significance is an anachronism.'[15]

For example, Galileo, through his literary mouthpiece (Salvati) argued that the Copernican revolution actually *promoted* humanity:

'we seek to ennoble and perfect [the earth] when we strive to make it like the celestial bodies, and, as it were, place it in heaven, from which your philosophers [i.e. Aristotle] have banished it.'[16]

Indeed, Sagan flatly contradicts his own Copernican argument against theism. Under the pre-Copernican scheme, Sagan observes that 'The Earth... had all the corruption of the universe localized here.' (p. 36); and yet *in the very next paragraph* Sagan asserts that in the Copernican scheme: 'the Earth was demoted.' (p. 36)

Sagan contradicts his Copernican argument in another way as well, in the very act of attempting to push the supposedly sharp blade of his argument deeper into the heart of theism:

'there was the hope that, well, at least maybe our galaxy was at the centre of all the other galaxies, all those many billions of other galaxies. But modern views have it that there is no such thing as a centre of the universe...' (p. 37)

In the first sentence Sagan invokes the (false) principle that significance is related to location, and that centrality equals significance whereas non-centrality equals insignificance. He thereby implies that we are insignificant because *not even our galaxy is in a central location*. In the second sentence Sagan informs us that: 'there is no such thing as a centre of the universe'. But *if there is no*

central location in the universe then there cannot possibly be any non-central location in the universe! Sagan says:

'one of the central points of special relativity is that there are no privileged frames of reference, that we are not in an important position or state of motion.' (p. 40)

But if there are 'no privileged frames of reference', then not only is the concept of an 'important' or 'privileged' position incoherent, *so is the concept of a non-important or under-privileged position!*

Contemporary science actually stands Sagan's 'Copernican' objection on its head; for we now know that the great age, and hence size of the universe in comparison with Earth, as well as the non-central solar and galactic location of Earth, are just some of the many finely-tuned physical preconditions for the existence of life that make the here and now of planet earth very special indeed.[17]

The Galileo Affair

Talking of Galileo (as we were a little while back), when Sagan comments that 'The Catholic Church threatened Galileo with torture if he persisted in the heresy that it was the Earth that moved and not the Sun and the rest of the celestial bodies' (p. 37-38), he is invoking a myth beloved by skeptics. Galileo's problems with the Catholic inquisition stemmed not so much from a conflict between 'science' and 'faith' as from a conflict of personalities on the one hand, and a conflict with the scientific mainstream of his day on the other.

In the first place, historian of science Ronald Numbers explains that Galileo: 'had gone out of his way to insult the Pope [Urban VIII], who had previously supported him. He put the Pope's favourite argument against heliocentrism into the mouth of the character Simplicio - the simple-minded person'[18] in his *Dialogue on the Great World Systems*. As J. Bronowski comments: 'It may be that the Pope felt Simplicio to be a caricature of himself; certainly he felt insulted.'[19] As a result Galileo:

'was summoned down to Rome by the Inquisition [and] lived in the Tuscan palace. And then when he was asked to move into the Vatican, to the

palace of the Inquisition, one of the officials in the Inquisition vacated his three-room apartment so that the distinguished guest, Galileo, could have a nice apartment. And they allowed him to have his meals catered by the chef at the Tuscan embassy. Ultimately, he was under house arrest in his villa outside of Florence... for his theological heresies, not for his Copernicanism. He happened to be a Copernican, but that's not what got him into trouble.'[20]

In the second place, as Steve Fuller recounts:

'Galileo, that 17th century icon of scientific heroism, overplayed his hand by fabricating experimental results and embellishing observational accounts... Even Galileo's most sympathetic critics found his appeal to the telescope as a scientific instrument rather puzzling. He lacked any principled explanation – a theory of optics – for how this Dutch toy, essentially a spyglass, enabled him to see lunar craters and sunspots. Moreover, the lenses that Galileo improvised for his own telescope were so full of distortion that observers not already convinced of his interpretation could make little sense of what they saw through them.'[21]

While the Catholic church of the period certainly doesn't come out of the Galileo incident smelling of roses, the 'science' versus 'faith' portrayal of the affair beloved by Sagan *et al* is historical revisionism plain and simple.

Is Earth Just 'One of Many'?

According to Sagan, the Copernican revolution threatens belief in human significance by opening up the way for doubt about the Earth being *the* Earth:

'You know the phrase... *the* world, or *the* Earth. What is the definite article saying? It's saying there is only one. And that goes straight back to pre-Copernican times... if Copernicus were right, then the earth would be demoted, no longer *the* Earth, *the* World, but just a world, *an* earth, one of many.' (p. 36-37)

Of course, the mere existence of other planets (something we have known about for a rather long time – in our own solar system at least) does not mean that the Earth is not a special, or an

unusual place. The Earth is still, to the best of our knowledge, *the* Earth. Show me another! Unfortunately, the philosophical belief that Earth is not special in any way, a belief accepted and in no small part propagated by Sagan, continues to warp scientific investigation of the cosmos and the presentation such exploration receives in the media.

A 'New Earth'?

On Wednesday April 25th 2007 various news media made a song and dance over the discovery of Gliese 581c:

'a planet outside our solar system that is potentially habitable, with Earth-like temperatures, a find researchers described Tuesday as a big step in the search for "life in the universe."'[22]

However, a big step does not a completed journey make. Just how 'habitable' is 'habitable', and just how 'Earth-like' is 'Earth-like'? Well, as Seth Borenstein of the associated press admitted: 'There's still a lot that is unknown about the new planet, which could be deemed inhospitable to life once more is known about it...' [23] Borenstein observed:

'it's worth noting that scientists' requirements for habitability count Mars in that category: a size relatively similar to Earth's with temperatures that would permit liquid water. However, this is the first outside our solar system that meets those standards.'[24]

Of course, as far as we know, Mars is lifeless (at best it may support some bacteriological life – life that may have transferred there from Earth). Moreover:

'Based on theory, 581c should have an atmosphere, but *what's in that atmosphere is still a mystery and if it's too thick that could make the planet's surface temperature too hot...* "You need more work to say it's got water or it doesn't have water," said retired NASA astronomer Steve Maran, press officer for the American Astronomical Society...' [25]

Gliese 581c (in the constellation of Libra) has an orbit that would permit liquid water *if* there is H₂O and *if* it has the right sort of

atmosphere. David Charbonneau of the Harvard-Smithsonian Center for Astrophysics in Cambridge Massachusetts comments:

'If the planet is a rocky super-Earth, then perhaps it has a surface with liquid water and life... If instead the planet is a "sub-Neptune", then it would have a large gas envelope that buries the surface below, making it inhospitable for life.'[26]

As Sara Seager, a planet expert at the Massachusetts Institute of Technology, said: *'if the planet had an atmosphere more massive than Venus', then the surface would likely be too hot for liquid water.'*[27]

The *Daily Mail* newspaper made the discovery of Gliese 581c front page news, proclaiming:

'The New Earth - does the discovery of a planet just like ours means there IS life out there?'

This is tabloid sensationalism. The third planet orbiting Gliese 581 is *not* 'just like ours' and does *not* qualify as a 'new earth'. The article by *Daily Mail* science editor Michael Hanlon is a little more down to earth (if you'll excuse the pun), because it does put in some qualifications, such as that this is:

'possibly the most extraordinary world to have been discovered by astronomers... The Earth-like planet that could be covered in oceans and may support life... It probably has a substantial atmosphere and may be covered with large amounts of water - necessary for life.'[28]

Nevertheless, the tone of the article is so upbeat that only careful readers are likely to spot the true significance of the occasional 'could' and 'may'. Large print announces: 'evidence that life - just like us - might be out there.' [29] However, the simplistic leap from 'there may be water' (given the right sort of atmosphere) to 'there may be life' flies in the face of all the evidence. Water is necessary for life, but (as we'll see in Part II) there's a lot more to life than water! Hanlon does at least admit: 'If there is life there it would have to cope with the higher gravity and solar radiation from its sun', and that: 'Just because Gliese 581c is habitable [which can mean being like Mars] does not mean that it is inhabited.'[30]

While the *Daily Mail* may be thinking in terms of life 'just like us', even those scientists who think there may be life on 581c are generally thinking in terms of *microbial* life. In point of fact, there is currently a lack of the evidence we'd expect if 581c was inhabited by a technologically advanced civilization: 'According to Seth Shostak, of the Search for Extraterrestrial Intelligence Institute in California, the Gliese system is now a prime target for a radio search. "We had actually looked at this system before but only for a few minutes. We heard nothing..."[31] What if we look again and still find nothing? Will this count as evidence against the philosophical assumptions about an easy origin of life and evolution of intelligent life that underpin much SETI research? After all, this is the best candidate for ET's home so far discovered: 'its sun is an ancient star - in fact, it is one of the oldest stars in the galaxy, and extremely stable. If there is life, it has had many billions of years to evolve.'[32] On this point, it is interesting to note Hanlon admitting:

'We don't understand how life began on our world, let alone how it could arise anywhere else. There may be an awful lot of bugs and bacteria out there, and only a few worlds with what we would recognize as plants and animals. Or, of course, there may be nothing.'[33]

If we don't understand how life began (within a non-teleological framework), then it is surely premature to be making statements about life on 581c supported by nothing besides the *possibility* that there *may* be liquid water there, *if* it doesn't have the wrong sort of atmosphere!

Darwinist Nick Matzke cautions:

'A planet that massive might have the problem of being so smooth it has a global ocean, which probably would make it tough to produce the concentration mechanisms (evaporation in pools etc.) that might be required for the origin of life...'[34]

Astronomer Guillermo Gonzalez is similarly downbeat concerning the chances of life on Gliese 581c:

'the host star being an M dwarf [poses] problems for habitability. The smallest planet's eccentricity is comparable to that of Mercury, so it is probably locked into a 3:2 spin-orbit resonance. So [581c]

will experience large temperature variations over the course of its orbit. What's more, because its rotation is slower, it should have a weaker magnetic field and be subject to enhanced solar wind stripping of its atmosphere. Finally, the fact that it has a mass at least 5x Earth's means that it will have a high surface gravity and less surface relief than the Earth - meaning no dry land.[35]

Gliese 581c is the first non-Gas giant discovered within the so-called 'goldilocks' zone of 'habitable' orbits around its star. Hence it *might* have a temperature in the right 'goldilocks' zone, depending on what the atmosphere is like. *If* it does have the right temperature, then it might have liquid water, which is another necessary condition for life. However, the recipe for life is more complicated than 'a big rock, liquid water and a star plus time'; and even if 581c has liquid water, it suffers from several habitability drawbacks (including large temperature variations, inadequate shielding against the solar wind from its M dwarf star that would strip away its atmosphere, and high gravity[36]). More recently:

'simulations of the climate on Gliese 581c created by Werner von Bloh of the Institute for Climate Impact Research in Germany and his team suggest the planet is no Earthly paradise, but rather a faraway Venus, where carbon dioxide and methane in the atmosphere create a runaway greenhouse effect that warms the planet well above 212 degrees Fahrenheit (100 Celsius), boiling away liquid water and with it any promise of life.'[37]

Serious Odds

Astronomer Hugh Ross lists 200 parameters required for a life-bearing planet. Comparing the chances of a planet falling within all of these parameters by chance alone with our best estimate of the total number of planets in the universe (10²²) he estimates that there is 'less than 1 chance in 10²¹⁵' of even one habitable planet existing in the universe.[38] Elsewhere, Ross argues:

'fewer than a trillionth of a trillionth of a percent of all stars will have a planet capable of sustaining advanced life. Considering that the observable universe contains less than a trillion galaxies,

each averaging a hundred billion stars, we can see that not even one planet would be expected, by natural processes alone, to possess the necessary conditions to sustain life.'[39]

Offering 'a revised Drake equation' for calculating the number of intelligent civilizations in our Galaxy (more about the 'Drake equation' in Part II), astronomer Guillermo Gonzalez and philosopher Jay W. Richards conclude:

'the probability that the Milky Way Galaxy contains even one advanced civilization is likely to be much less than one. This is an interesting result, of course, since we exist.'[40]

Astrobiologists Peter D. Ward and Donald Brownlee agree:

'If some god-like being could be given the opportunity to plan a sequence of events with the express goal of duplicating our "Garden of Eden", that power would face a formidable task. With the best intentions, *but limited by natural laws and materials*, it is unlikely that Earth could ever be truly replicated.'[41]

The fact that we exist, then, naturally suggests the hypothesis that the causes of our existence were not limited to natural laws and materials.

Burnt to a Crisp?

Looking forward, Sagan predicts that the Earth will one day be burnt to a crisp by the aging sun as it expands, and he suggests that this has negative implications for the belief that humans were created on purpose:

'Some 5 or 6 or 7 billion years from now, the Sun will become a red giant star and will engulf the orbits of Mercury and Venus and probably the Earth... it is not our most pressing problem. But it is something to bear in mind. It has theological implications.' (p. 20.)

Presumably the underlying thought here is that if life on Earth is special to its Creator then the Creator surely would not allow it to be extinguished, and that since it would seem that life on Earth will be extinguished in a few billion years time, the obvious conclusion is that life on Earth is not in fact special to its Creator, perhaps

because it doesn't have one after all. However, *neither conclusion is at all obvious*. Indeed, I'm not convinced that such an event would have any theological implications – unless one thinks that biblical Christianity predicts that humans never settle off-world. But nor am I convinced that such an event *will* happen.

Of course, such an event will happen *if* the universe continues to exist (and to run according to the known laws of physics) for long enough. But whether or not the universe does *that* is, for the theist, something very much in the hands of its Creator, who is thought by them to sustain the universe in existence from one moment to the next. Hence, if one does think the bible predicts that people will not leave Earth before the creation of 'the new heavens and earth', one would then be left pitting one inference (to the conclusion that God will bring cosmic history to an end before 5-7 billion years are up) against another inference (that God will not bring cosmic history to an end before 5-7 billion years are up). As Sagan writes in the similar context of the possibility that humanity will destroy itself in a nuclear war:

'we would have to conclude either (a) that an omnipotent and omniscient God did not create the universe, that is, that He was an inexpert cosmic engineer, or (b) that human beings will not self-destruct. Either alternative, it seems to me, is a matter of some interest, would be worth knowing.' (p. 59)

Sagan's reason for preferring the anti-Christian (though not exactly anti-theistic) fork of this dilemma, that 'there is a dangerous fatalism lurking here' (p. 59), is plainly *question-begging*. If Christianity entails that humanity as a species will not destroy itself, or be destroyed, then accepting this prediction would constitute a 'dangerous fatalism' (one that might lead to our destruction) *only if Christianity is not true*. Besides which, multiple forms of self-interest would surely mitigate against Sagan's (hypothetical) 'dangerous [optimistic] fatalism', since this does nothing to guarantee individual, or familial, or national, or racial survival.

It will be a long time before we are in a position to empirically demonstrate which prediction - that God will bring cosmic history to an end before 5-7

billion years are up or that that God will not bring cosmic history to an end before 5-7 billion years are up - is correct. Besides which, the latter prediction admits of multiple interpretations; ranging from the reading of scripture requiring the predicted cap to cosmic history simply being mistaken, to Christianity's being false, through to Atheism being true. Since we're currently 5-7 billion years off even needing to debate which of these interpretations is the most plausible, I think we can afford to let sleeping dogs lie.

Sagan invests in arguments to the effect that modern scientific knowledge should disabuse us of the theistic notion that humans and the planet we inhabit are special or significant parts of the cosmos, and should thereby disabuse us of any theistic belief which entails that humans are significant in the sight of God. Each and every one of these arguments is based upon implausible philosophical claims - such as that metaphysical significance is related to physical size or location.

Moreover, advances in scientific knowledge since 1985 have shown that several of Sagan's empirical premises (such as that the Sun is an average star) are simply incorrect. Indeed, Sagan himself explicitly affirms scientific views that undermine his argument from the 'non-centrality' of the Earth in the cosmos (i.e. that there is no 'centre' of the cosmos).

The exact same evidence that Sagan seeks to use in establishing the insignificance of life on Earth (e.g. Earth's life-crucial non-central location in our galaxy) actually justify a multi-factorial 'anthropic principle' that many see as grounding a strong argument to precisely the *opposite* conclusion.

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