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DIVINE INTERVENTION AND THE ORIGIN OF LIFE

Hugh S. Chandler

The 'Intervention Argument' purports to show that God created life on our planet by supernatural intervention. One of its characteristic premises is the claim that if things had been allowed to take their 'natural' course, living organisms would probably not have come into existence here. This paper clarifies the argument and assesses its worth. The upshot is that its plausibility depends upon our estimate of the prior probability of God's intervention, and our guess as to the likelihood that life would have developed naturally on this planet in the absence of such intervention.

I

We assume that God exists. The Intervention Argument is sometimes offered as justification for theism; but this adds unnecessary twists and turns to the basic line of thought.¹ For now, at least, let's concentrate on the hypothesis that physical life is brought into existence by divine intervention, and neglect the problem as to whether there is, or is not, a God of the sort who might thus intervene.

Lucifer's Problem

God somehow causes the Big Bang.² Two or three billion years go by. Various clusters of galaxies have formed; but there is, as yet, no life, that is to say, no physical life.³ There are, of course, Principalities, Powers, Angels, and so on. One of the Angels, Lucifer, is trying to figure out whether or not God is going to produce physical life by intervention.

Lucifer makes the following simplifying assumptions:

- (1) If the universe *wouldn't* produce an abundance of living things naturally (i.e. in the absence of Divine intervention), God will intervene.⁴ Hence, there is no chance that the universe will always be (physically) lifeless.
- (2) If the universe would produce an abundance of life naturally (if 'left to itself,' so to speak) then God will not intervene (in this regard).⁵



	Abundant life would occur naturally	Abundant life would not occur naturally	
?	0		God will intervene
?		0	God will not intervene

The question marks indicate Lucifer's problem. What is a reasonable estimate of the likelihood that God will intervene in the universe? Or, to put it negatively, what is the likelihood that God will not intervene? The two upper cells represent the domain of the proposition 'God will intervene.' The upper left-hand cell represents the domain of the conjunct 'God will intervene even though abundant life would occur naturally.' There is a zero here because Lucifer is assuming there is no chance whatsoever that this conjunct is true. The upper right-hand cell represents the region of the conjunct 'Abundant life would not occur naturally and God will intervene.' The lower left-hand cell represents the domain of 'Abundant life would occur naturally and God will not intervene,' while the lower right-hand cell stands for the domain of 'Abundant life would not occur naturally and God will not intervene.'

Lucifer's simplifying assumptions are, in effect, two conditional probability judgments. Given that abundant life would occur naturally, the probability that God will intervene in the universe is zero, and the probability that he won't is, of course, one. On the other hand, given that abundant life would not occur naturally, the probability that God will intervene is one, and the probability that he won't is zero.

	Abundant life would occur naturally	Abundant life would not occur naturally	
	0	1	God will intervene
	1	0	God will not intervene

It must be admitted that it is possible to find this set-up confusing. We are assuming, or pretending, something which is probably absurd, namely that God creates the physical universe, lets it run for a while, and then decides whether or not to intervene.⁶ He does this by figuring out how much life there would eventually be in this actual universe if he were to abstain from intervention. The likelihood of his intervening is thus dependent upon what he foresees would happen, given his non-intervention.

Suppose that God decides not to intervene. What is the likelihood that there will be abundant life in the universe? Under Lucifer's assumptions, it is *absolutely certain* that life would subsequently be abundant. This is certain since, by hypothesis, God abstains from intervention if, and only if, he foresees that there would be abundant life in the absence of his intervention, and God doesn't make mistakes.

Obviously, it would be absurd for God to take this as the answer to the question he asks himself in trying to decide whether or not to intervene. When God says to himself "Suppose I do not intervene. What would happen then?" he cannot mean "Suppose I decide, after due deliberation, not to intervene; what then?" He knows perfectly well he is incapable of miscalculation.

Our pretense is that Lucifer tries to recapitulate God's calculation. He tries to work out some sort of reasonable assessment of the likelihood that (physical) life would be abundant given God's non-intervention. His problem is *not* the one to which the answer is already obvious.

That's enough of that. Here is a start towards formulating some of the relevant considerations. As an irresponsible shot in the dark, I suppose there are now something like three hundred million (3×10^8) galaxies in the universe.⁷ Let's pretend this is about all there will ever be.

Consider our own galaxy. It contains roughly one hundred billion (10^{11}) stars. How many of these stars have planets? The answer is as yet unclear; but let's assume that about half of them do. On a conservative view, physical life requires heavy elements—that means that physical life can only occur on planets belonging to second generation stars (stars formed in part from the debris of earlier stars).⁸ The number of candidate planets is thus again cut in half. Since we are being conservative, we will also assume that life requires lots of water (as opposed to liquid ammonia, liquid methane, or whatever). Furthermore, the natural emergence of life, if it can occur at all, can only occur in a region of 'energy flux.' For this we need a nice source of heat and a direction in which heat can be lost. (An 'energy flux' is the engine that propels the formation and subsequent evolution of the complex molecules necessary to life as we know it.) Let's say we are down to about 10^7 'good candidate' planets.⁹

Lucifer can predict all this. (He is good at physics, chemistry, astronomy, imaginary biology, and big numbers). Now he might ask himself the follow-

ing question. Given an arbitrary good candidate planet (X), and, say 6 billion years during which a sizeable portion of its water is in a nice energy flux, what is the probability that life would emerge on X without supernatural intervention? [Notice that the problem has shifted temporarily from trying to estimate the likelihood of abundant life in the universe, or in our galaxy, given non-intervention in the universe, or in our galaxy, to estimating the probability of life on a random good candidate planet given non-intervention on that planet.]

Suppose there is just one chance in a hundred (0.01) that life would develop on planet X, given that God does not intervene there. [Don't ask me where I got that number—I just *made it up!*¹⁰] On this supposition, and given that God does not intervene on X, the probability that life will *not* develop on X must be 0.99. Now we can begin to solve Lucifer's problem. Planet X is a good candidate planet somewhere in our galaxy. For any such planet, the probability that it would be lifeless throughout its duration in the absence of divine intervention is 0.99 (or so we are pretending). Hence, given *two* such planets, the probability of *both of them* being lifeless, given that God doesn't intervene on either of them, is $(0.99 \times 0.99) = 0.9801$. (The probability of two independent events is the probability of the first times the probability of the second.¹¹) But then the probability of natural life occurring on at least one of the two planets must be $(1 - 0.9801) = 0.0199$. (The probability of there being life on at least one is the probability of it *not* being the case that *both* are lifeless.) The probability of natural life occurring on at least one of three good candidate planets is $1 - (0.99 \times 0.99 \times 0.99) = 0.0297$. As we add more planets, the likelihood of natural life creeps up. By the time we get to seventy good candidate planets, the probability of life occurring on at least one of them (in the absence of divine intervention) is better than fifty/fifty. Two hundred and thirty planets bring the probability to 0.9. Four hundred and fifty-nine planets push it to 0.99. Of course we never get absolute certainty (probability 1). Given any number of good candidate planets, there is still *some* chance that natural life will not occur on any of them.

This line of thought, by itself, doesn't settle Lucifer's problem. As you remember, he is trying to figure out whether life is likely to be '*abundant*' given God's non-intervention. How much life is there likely to be?

It seems permissible to assume that most if not all of the alleged 3×10^8 galaxies in the universe are roughly like ours in regard to the proportion of good candidate planets to bad. On that assumption, it seems reasonable to bet that the proportion of planets that would naturally have life on them in a given galaxy tends to approximate the probability of there being natural life on any given good candidate planet.¹² Consequently, the best bet would be that the number of planets in our galaxy that would naturally generate life is roughly one hundred thousand $(10^7 \times 0.01) = 10^5$. If Lucifer's thinking

mirrors ours, he must conclude that the universe will almost certainly contain more than enough life, given that God doesn't intervene anywhere (in this regard). Taking into account the wide margin of error for the super soft numbers that have been used, let's pretend he decides that the probability of abundant life occurring naturally in the universe as a whole is about 0.999. This, plus his assumptions about God's general policy in regard to intervention, leads him to conclude that God probably won't intervene.¹³ The completed diagram of the situation looks like this:

	Abundant life would occur naturally	Abundant life would not occur naturally	
0.001	0	0.001	God will intervene
0.999	0.999	0	God will not intervene
	0.999	0.001	

[The 0.001 at the upper left-hand side of the square represents the probability that God will intervene ($0.001 + 0$). Similarly, the 0.001 at the bottom of the right-hand side represents the probability that abundant life would not occur naturally.]

How sensitive is this general line of thought to changes in the estimate of the likelihood of life on a good candidate planet given God's non-intervention there? Of course if that probability had been put higher (as might quite reasonably have been done) the likelihood of God's non-intervention could only go up. The more interesting question is this: how far *down* must that estimate go in order to make God's intervention a good bet? Suppose we said the probability of life arising naturally on a good candidate planet is one in a million (0.000001). In that case, it would be reasonable to bet that life would develop on about ten planets in our galaxy ($10^7 \times 0.000001 = 10$), and, consequently (perhaps) on about $10 \times (3 \times 10^8) = 3 \times 10^9$ planets in the universe. According to our somewhat arbitrary stipulation, God would regard that as skimpy (see footnote 4).

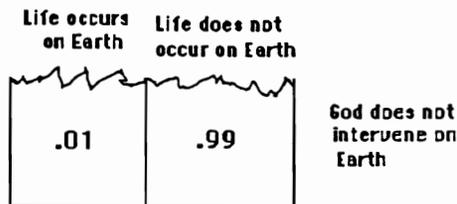
The Intervention Argument

As I understand it, the Intervention Argument goes as follows. Consider the situation on planet Earth before there was any life here:

- (1) Given that God intervenes to produce life on Earth, there is no chance at all that there will be no life on Earth. (Hence the conjunct “God intervenes to produce life on Earth; but life does not occur on Earth” has zero probability.)
- (2) If God does not intervene to produce life on Earth, the probability that life will occur here is very low.
- (3) It is just as reasonable to bet that God will intervene to produce life on Earth as that he won’t. (The reasonable subjective probability is in the vicinity of fifty-fifty.)¹⁴
- (4) But there *will be* life on Earth.
- (5) Consequently it is very likely that God will intervene to produce life on Earth.

Premise (1) is obviously true; and so is (4).

In regard to (2), presumably Earth was a typical good candidate planet. Suppose, then, that we stick with my wild (but conservative) guess as to the probability of life occurring on such a planet in the absence of God’s intervention.



The argument is, in effect, simply an application of Bayes’ theorem to the data supplied by the premises.¹⁵ We are trying to find the probability of God’s intervention on Earth, given that there *is* life on earth. Using ‘Pr(x | y)’ to mean ‘the probability of x given y,’ Bayes’ theorem says:

$$\Pr(\text{Int} \mid \text{Life}) = \frac{\Pr(\text{Int}) \times \Pr(\text{Life} \mid \text{Int})}{[\Pr(\text{Int}) \times \Pr(\text{Life} \mid \text{Int})] + [\Pr(\text{Non-Int}) \times \Pr(\text{Life} \mid \text{Non-Int})]}$$

Premise (3) says that Pr(Int) and Pr(Non-Int) are both 0.5. Premise (1) tells us that Pr(Life | Int) = 1. And premise (2)—fleshed out by my wild guess—gives us that Pr(Life | Non-Int) = 0.01.

At this point we either do a bit of arithmetic, or try the diagrammatic approach. The following array might be helpful:

	Life occurs on Earth	Life does not occur on Earth	
.5	.5	0	God intervenes on Earth
.5	.005	.495	God does not intervene on Earth
	.505	.495	

[Those who are puzzled by the numbers in the bottom half of the array might find it helpful to be reminded that $(0.5 \times 0.01) = 0.005$ and $(0.5 \times 0.99) = 0.495$.]

On these assumptions, the probability of life occurring on Earth (one way or the other—either naturally or by divine intervention) is 0.505 (i.e. $0.5 + 0.005$). Hence, of course the probability of the planet's being lifeless is 0.495.

Now, given that there is life here, what is the probability that God produced it by intervention? The rather surprising result is that we can be almost certain that this is what happened (0.5 divided by 0.505 is roughly 0.99).

Life occurs on Earth	
.99	God intervenes on Earth
.01	God does not intervene on Earth

But why should we accept premise (3)? That is to say, why should we put the prior probability of God’s intervention on our planet at .5? This seems to me a serious defect in the argument as stated. According to our story, Lucifer came to believe that God would almost certainly leave each and every planet in the universe to its own natural devices in regard to the occurrence, or non-occurrence, of life. I take it there was nothing *special* about Earth that made God particularly eager that there should be life on it. Prior to the occurrence of life, it was, presumably, just one among the 10^7 good candidate planets in our galaxy.

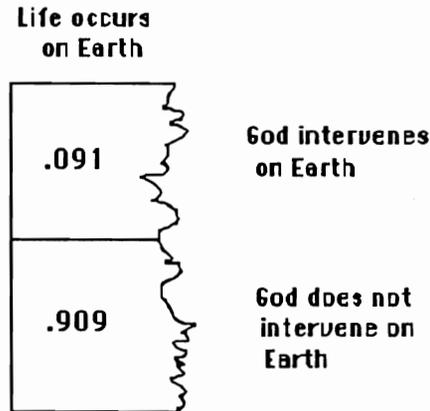
Imagine this situation: God has decided to intervene in the universe in order to guarantee abundant life. What should his policy of intervention be? There are all sorts of options. He might, for example, stay close to the alleged minimum and create life on only 1% of the good candidate planets. On the other hand, he might go to the other extreme and create life on every single one of them.

Pretend that if God were to intervene in the universe he would create life on about 60% of the good candidate planets. Under this pretence, should we put the prior probability of God’s intervention on Earth at 0.6? Certainly *not*. In fact, if we accept Lucifer’s estimate of the prior probability of God’s intervention in the universe, then the prior probability of God creating life on Earth would be just 0.0006 (i.e. 0.001×0.6).

Let’s assume that if God were to intervene in the universe he would create life on *all* the good candidate planets.¹⁶ Hence (still following Lucifer) the prior probability of intervention on a given good candidate planet is 0.001. This assumption, together with premise (1) and the assumption that the probability of life occurring naturally on Earth was one in a hundred, yields the following display:

	Life occurs on Earth	Life does not occur on Earth	
.001	.001	0	God intervenes on Earth
.999	.00999	.98901	God does not intervene on Earth
	.01099	.98901	

Now the prior probability of there being life on Earth even though God does not intervene is .00999 (i.e. 0.01×0.999). And the probability of life occurring on our planet (one way or the other) is 0.01099 (i.e. $0.001 + 0.00999$). More importantly, the probability that God has intervened, given that there *is* life on Earth, is about nine chances out of a hundred (roughly 0.091). That is to say, given the existence of life on earth, the best bet by far is that it occurred naturally (probability: about 0.909).



The upshot is that the outcome of this probabilistic reasoning depends, in large measure, upon our estimate of the prior probability of God's intervening to produce life on Earth. And this, in turn, is dependent upon our estimate of (a) the prior probability of God's intervention in the universe, and (b) the percentage of good candidate planets he would decide to intervene upon. If we judge that the likelihood of life developing on Earth in the absence of God's intervention is one in a hundred or better, and our estimate of the probability of God's intervention here is roughly like Lucifer's, we will conclude that God probably did *not* intervene to produce life on our planet.

It's a good bet that sketchy formulations of the intervention argument are often expressions of innocent and understandable intellectual confusion. The reasoner simply assumes without thought that the prior probability of God's intervention on our planet is substantially greater than the probability that life would occur here naturally. (One can easily be unaware of this crucial assumption when the argument is presented in a sketchy way.) On the other hand, no doubt, some theists honestly believe that the probability of life occurring naturally is more or less zero. Given this extremist view, and a moderate estimate of the prior probability of God's intervention, the argument would yield the conclusion that God probably intervened.¹⁷

NOTES

1. I don't recall seeing the argument in print; but, like many people, I have heard it a good number of times.

2. I assume there was a Big Bang. There is room for some skepticism here.

3. The terms 'alive,' 'life' and 'living' are not sharply defined. We take angels, amoebas, and mushrooms to be living things, but candle-flames, quartz crystals, and magnetic fields, to be non-living.

4. There are various problems in regard to this claim. Here are two: (1) What counts as an 'abundance' of life in this context? (2) Does 'divine intervention' include intervention by supernatural entities other than God in compliance with his wishes? In regard to the first problem, let's permit a fairly wide degree of latitude. If the average galaxy contains less than one hundred life-bearing planets, let's say life is *not* 'abundant.' If the average is one hundred thousand (10^5) or more, that's plenty. [There are a large number of galaxies in the universe.] In regard to the second problem, for the sake of simplicity, let's say that any supernatural intervention undertaken in obedience to God's will counts as 'divine intervention.' Of course this leaves open the possibility that life might be brought about by a supernatural entity who is, so to speak, acting on her own, perhaps even as an act of rebellion. We ignore this possibility.

5. Talk about 'intervention' in what follows is to be understood as intervention in order to bring it about that there is physical life on a planet or in the universe as a whole. Repetition of the parenthetical remark 'in this regard' gets tiresome.

6. From the point of view of sober theology, it would probably be better to think of God *first* deciding whether to create a universe into which he will intervene or one in which such intervention will not be necessary, and *then* creating a universe of the preferable kind. On this view, the more likely we think it is that abundant life would occur naturally (if God did not intervene), the more likely we should take it to be that God decided that non-intervention was preferable.

7. The truth is that there is simply not enough data to justify even a rough guess here.

8. The heavy elements, up to and including iron, were formed in the cores of massive stars.

9. The general line of thought and some of the numbers in this paragraph are taken from Paul M. Churchland's *Matter and Consciousness*, Revised Edition (MIT Press, Cambridge, MA, 1988), pp. 170-71. See also Gerald Feinberg and Robert Shapiro, *Life Beyond Earth* (William Morrow and Company, New York, 1980) [Churchland recommends this book]. When (or if) someone comes up with a really plausible story as to how living organisms were generated by natural processes, it will be possible to make the description of a 'good candidate' planet much more precise. Perhaps I should also add that the division of planets into just two kinds (good candidates, and bad) is simplistic. There are gradations here.

10. A more plausible but much less precise hypothesis would be that the probability of life occurring naturally on an arbitrarily selected good candidate planet is somewhere between 0.99 (ninety-nine out of a hundred) and 0.01 (one in a hundred).

11. In fact these events are *not* entirely independent. For example, the probability of

there being life on Mars (eventually) is greatly enhanced by the fact that there is intelligent life on a nearby planet. In the discussion that follows, I disregard this complication (*viz.* the tendency of life to spread across nearby habitable planets).

12. My move here is analogous to the move that makes it reasonable to bet that there will be something *fairly* close to 50 heads and 50 tails in any given sequence of 100 tosses. Such sequences will differ in this regard; but the *tendency* is for them to mirror the probability of getting heads as against the probability of getting tails on a single toss.

13. If the probability of abundant life occurring naturally is 0.999, then the probability that abundant life would not occur if the universe were left to its own devices must be 0.001. But then, under Lucifer's assumptions, this must also be the probability that God will intervene.

14. The alleged grounds for this assessment might be that we have no more reason to bet one way than the other. In any case, I am going to claim that this assessment is implausible.

15. The theorem is named after Thomas Bayes, a Presbyterian minister, who did important early work in the theory of probability.

16. This assumption simplifies computation, and maximizes the probability of God's intervention on Earth.

17. In writing this paper, I had the help and encouragement of my colleague Robert McKim.