On the Wrongness of Richard Swinburne About The Plausibility of a Multiverse

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Theists often claim that the universe is ordered in a specific way that causes intelligent life to arise in it and that this needs explaining. They offer God as an explanation. Another explanation is that we live in a multiverse. Richard Swinburne, in his book, "Is there a God?", argues that a multiverse explanation, if it involved a "narrow" multiverse – one that gives rise to a specific kind of universe – would merely raise the question of why that particular multiverse existed, and if it involved a "wide" multiverse – one that gives rise to many profoundly different kinds of universe – such a wide multiverse would need to have general rules that were much more complicated than those in any of its individual universes, as it is clearly more complicated to produce different kinds of universe than to produce only one or more of a single given kind. To support this argument, Swinburne uses the analogy of a machine that makes chocolates, saying that a machine which could manufacture many different kinds of chocolates would be more complicated than a machine which could just manufacture one kind. An analogy that uses a computer program that generates other programs shows that Swinburne's claim that a very wide multiverse explanation is complex is flawed. In fact, the generality of such an explanation is so great that it can be shown that we do live in a very wide multiverse – one so wide that it implies a kind of modal realism. Swinburne's "chocolate machine" analogy is flawed. It is a contrived analogy, because it features a machine that makes things of a very specific kind. Swinburne's argument that a very wide multiverse is implausible should therefore be rejected. Swinburne also seems to be inconsistent when he says that the existence of "something" rather than "nothing" needs an explanation. "Nothing" is a totally specific idea, and it should be the most implausible idea we can imagine. Swinburne appeals to specificity when he insists that the properties that our universe has need an explanation, yet when it comes to considering how plausible and natural "nothing" is, he seems to use completely different criteria.

1 INTRODUCTION

Theists often claim that the universe is ordered in a very specific way out all the ways we might imagine it could be, and that this needs an explanation. They may say that the way in which the universe is ordered is specifically suited to the existence of conscious beings like humans. This can sometimes be done by making reference to the so-called "fine-tuning problem" – the idea that the constants in the laws of physics are within very narrow ranges of values in which they would have to be for intelligent life to exist: we might imagine, for example, an alternative universe in which the gravitational constant in the inverse square law of gravity has a different value.

Some theists go even further than claiming mere fine-tuning of the physical constants by God and say that it is not just the values of the physical constants in the laws that need explaining, but the laws themselves. We might imagine many alternative universes with completely different laws, most of which do not allow life: for example, we might imagine a universe without anything remotely like the inverse square law. A theist might also claim that the initial state of our universe seems to have brought about life, when another initial state might not have done. In all of this, the idea is that our universe is just one of many possibilities that we might imagine, most of which would not allow life, and that this needs an explanation. The theistic is arguing from *specificity of the universe*.

The theist typically proposes God as the simplest explanation and challenges the atheist to propose an alternative. A clear implication of this is that the atheist has no explanation, that we must therefore believe that all this was done by God or accept some unbelievably lucky coincidence, and that, as such a lucky coincidence is implausible, we should believe that God exists.

In doing this, the theist is trying to establish a dichotomy: God or belief in some huge coincidence. This could be contested on the grounds that God is no better an explanation than the implausible amount of luck would be. We might also question whether the claimed specificity of the universe really exists, or whether it makes sense to try to explain it. The atheist may, however, attempt to offer an explanation, and one such explanation is the *multiverse*.

The multiverse is a hypothetical structure of which what we commonly call the "universe" is a small part, containing many "universes", all of which can be different.[1] The idea of the multiverse, as a reply to the argument about the specificity of the universe is that, if a multiverse exists which contains or gives rise to a huge number, or even an infinity, of universes, all with different constants in the laws of physics, or even completely different physical laws, then there must be universes in which the physical constants (or the laws themselves if these are varying) are suitable for intelligent life, and it would only appear a lucky coincidence to intelligent beings who inhabit this tiny proportion of universes because they do not see all the universes where conditions are not suitable for life and there is nobody to observe them.

Richard Swinburne, a Christian apologist, in his book, "Is there a God?", replies to the "multiverse answer" by saying that the multiverse does not answer the problem because we have no reason for thinking that a multiverse exists. [1] Further, he says, even if a multiverse did exist, there would still be the same problem of specificity, but now it would apply to the multiverse. A multiverse would have to have its own general laws which dictated the types of universes to which it would give rise, and we might imagine many different multiverses with many different general laws, most of which would not allow intelligent life to exist. Swinburne notes that we might answer this by postulating a very "wide" universe – one which gives rise to universes of very different kinds, but he claims that the rules of such a multiverse would be even more complicated than those of any single one of the different universes which it produces, and this makes such a multiverse implausible.

This article will be showing that Swinburne's views in this respect are wrong.

[1] The word "universe" is being used here in the diminutive sense in which it is often used in cosmology.

2 SWINBURNE'S ARGUMENT AGAINST THE "MULTIVERSE" EXPLANATION

Swinburne gives his objections to the "multiverse answer" in Chapter 4 of "Is there a God?". He claims that we would only ever be justified in believing in a multiverse if one were predicted by some theory of physics, saying:

"But we need a reason to suppose there are any universes other than our own. The only reason we could have is that a theory of physics, which is probable on the evidence we can observe in our universe… has the consequence that universes (or just a single energy 'field) 'give birth' to other universes which differ from each other in their laws and initial conditions…" [1]

Swinburne claims that simple, general laws should describe the workings of a multiverse, and we must have an idea of what those laws are to propose a multiverse in the first place, saying

"The fact that the multiverse is governed by very general laws, simple enough for us to comprehend (as they must be if we are to be justified in postulating a multiverse), means that **all the material objects throughout the multiverse have the same very general simple powers and liabilities as each other**." [1]

What is done in the argument from specificity of the universe, Swinburne now tries to do with the hypothetical multiverse, suggesting that we might imagine many multiverses, most of which do not allow life to exist in any of their universes, making our multiverse (if we happen to be in one) special, saying:

"...instead of the actual multiverse (to which our universe belongs) there could have been a different multiverse (itself governed by laws of quite different kinds, and having quite different initial conditions or other general features) such that at no time would it give birth to a universe which was life-evolving. And **innumerable different possible multiverse** would be like this, **not life-evolving**." [1]

Swinburne thinks that if we are in a multiverse, we need an explanation of why it is one of the special ones that allows life, saying:

"So if we find reason to suppose that our universe does belong to a multiverse, we should try to find an explanation of why that actual multiverse is life-evolving; that is, why its very general laws and initial conditions (or other general features) are such as at some time to lead to the evolution of a universe which would at some time give rise to humans and animals.” [1]

Of course, Swinburne thinks the answer is “God”.

Swinburne defines a “narrow” multiverse as one in which the general form of the laws remains the same across universes, with just the physical constants varying and a wide multiverse as one in which, not just the physical constants vary, but the general form of the laws themselves varies. He acknowledges that a very wide multiverse would contain more different kinds of universe, and so it might seem more likely to give rise to a universe containing life:

“The wider the multiverse (that is, the more universes of very different kinds it contains), the more probable it would be that it would include a universe which is life-evolving. So it might seem that if there exists *any very wide multiverse*, it would be quite probable that it would contain humans.” [1]

But he claims that there is a problem regarding the plausibility of this: a very wide multiverse would have to be much more complicated than any of the single universes to which it gives rise. He says:

“But **the very general laws of a very wide multiverse of this kind would have to be enormously complicated**. Any very general laws, by which some parent universe would produce daughter universes governed by quite different kinds of specific laws from those which operated in the parent universe, would need to be far more complicated that ones which produced universes governed by laws differing from the laws of the parent universe only by containing different constants.” [1]

Swinburne’s reasoning here appears to be that if it is complicated to make one universe, it is even more complicated to make a lot of very different universes. To support his case that a very wide multiverse would need to have enormously complicated general rules, Swinburne uses an analogy of a machine which produces “chocolates and other kinds of sweets”. [1]

Swinburne says that a machine which produces many different kinds of chocolates and other sweets would have to be more complicated than a machine which produces just one general kind in different sizes:

“To take an analogy, a machine which produces chocolates and other sweets of different kinds has to be more complicated than one which merely produces bars of chocolate of the same kind but of different sizes.” [1]

Earlier in his book, Swinburne has argued that a theory should be simple, an idea that is not very controversial. [2] As a very wide multiverse would be so complicated, he argues, a theory proposing a narrow multiverse will always be simpler than a theory proposing a wide one, and the only reason we should ever prefer a wide multiverse is if we have so much observational evidence for it that we are forced to abandon a narrow multiverse theory, even assuming we had to accept one in the first place. However, a wide universe would be so complicated, and the required evidence for it so great, that we are unlikely ever to obtain enough evidence. He says:

“So we would need a lot of new observational evidence (more than we are ever likely to obtain merely by observing our universe, which is all we can do) which couldn’t be explained by supposing that we belonged only to a narrow multiverse, before we would be justified in postulating a wide multiverse.” [1]

Swinburne has thus argued that the “multiverse” explanation is unable to resolve the issue of why the universe seems so specific. His conclusion is that we do have an answer, God, and that we should therefore think that God exists.

This entire argument is deeply flawed, and we will now discuss the problems with it.

3 A VERY WIDE MULTIVERSE WOULD *NOT* NEED TO HAVE COMPLICATED GENERAL LAWS.

An important part of Swinburne’s argument is that a very wide multiverse would have to be based on general rules which were much more complicated than any of the individual universes in it. This idea is wrong. The recipe for making lots of different things can be simpler and can contain less information than the recipe for making any one of them, and this will now be shown by using the analogy of a computer program that makes computer programs.

A computer program is merely a sequence of binary digits (bits), each binary digit being 0 or 1. A computer program can output a sequence of binary digits, so a computer program can produce another computer program.

Suppose we had a computer program, called the "manufacturing program" and we wanted it to output another computer program: say, a copy of a chess playing program. The chess program consists of some sequence of 0s and 1s, and the manufacturing program has to output the same sequence. To do this, the manufacturing program must contain all the information needed to describe the chess playing program. It may be that some shortcuts can be taken: computer programs often involve some redundancy that might be exploited. However, there is still quite a lot of information in the chess program. The manufacturing program must contain quite a lot of information to do this.

Suppose now that we wanted a version of the manufacturing program that could output **every computer program that could ever be produced**. It may seem that this will require infinite information in the manufacturing program. After all, some information is needed to produce one program, such as a chess program, so should we not think that producing an infinity of programs requires an infinite amount of information?

The program to produce all computer programs is actually very small and simple. Any computer program is a sequence of 0s and 1s, but any sequence of 0s and 1s can also be understood as a binary number, so any computer program corresponds to a number. For example, a very short list of 0s and 1s, such as 01101101, could be understood as the binary equivalent of the decimal number 109: any computer program, viewed as a sequence of 0s and 1s with place-dependent weighting given to the bits, would correspond to a number in this way. For a program to output every possible computer program, all it need do is start at 0 and start counting 1,2,3,4,etc. without end, outputting each number in binary. When the program is started, the first number it will output is 0, then 1, then 2 in binary, which is 10, then 3 in binary, which is 11, then 100 for 4, 101 for 5, followed by 110, 111, 1000, 1001, 1010 and so on. Every sequence of binary digits will be produced eventually. Our chess program is one of these sequences, so we must merely wait for it.

Of course, we will be waiting for a long time for a particular program like the chess program to appear, because there will be an enormous number of programs for the manufacturing program to get through before it gets to it, and most of the sequences produced will not correspond to anything meaningful, but that is not the point: the point is that it is possible for a program to produce every other program that can exist, while being extremely short and simple itself.

Some people may object to the fact that the manufacturing program has to run forever. This really should not be an issue, and an objection like this would be a distraction, but we will deal with it by limiting the manufacturing program to outputting only *some* of the possible computer programs that could exist: those corresponding to the binary numbers from zero to some very high value, N. We could select N arbitrarily: for example, we could make N a randomly chosen sequence of one million bits, and this would mean that by the time that N is outputted and the manufacturing program halts, every program with less than one million bits *must* have been outputted. By making N large enough, we can ensure that, by the time N is outputted and the manufacturing program halts, every program every written by a human, or that will be written in the next 1,000 years, will have been outputted.

This brings us to the issue of information content and complexity. If we make N some sequence of one million randomly selected bits, then the manufacturing program will have to be large enough to store this information. However, this is still an insignificantly small amount of information considering the huge number of programs that it creates. The one million random bits of N would contribute to the complexity of *some particular instance* of manufacturing program, but to view this as meaning that the manufacturing program would have to be complex would be flawed: there is no requirement for any particular sequence of bits in N. If we wanted to output all programs ever made by humans, we need to make sure that N is a large enough value, but the exact value does not matter as long as N is large enough. Many different manufacturing programs, with many different values for N would do just as well. There is no specific requirement for N beyond its minimum size. When we think of something as complex, we normally think of it as having to take a specific form, and this is not really the case for N: it is not very specific.

Further, we could avoid even having to store all the digits in N if we make N a very large number that is easy to represent with minimum information. We could say, for example that N is $2^{1,000,000,000,000}$. This would mean that the very last program outputted would be 10000000...etc., with the full sequence being 1,000,000,000,001 bits long. The manufacturing program would now produce every program with 1,000,000,000,000 bits or less, as well as the last program, corresponding to N – but there would be no need to store, explicitly, all the 1,000,000,000,000 digits of N: the manufacturing program could just be set to stop after producing a program which is 1,000,00,000,000 digits long – and it can find this out just by looking at the number of digits. A manufacturing program expressed like this would produce a huge number of programs, but would be simple and would need hardly any information to store it.

All this should serve as a refutation by example of Swinburne's claim that a very wide multiverse would need to be much more complicated than any one of the universes to which it gave rise. An infinity of computer programs – every program that can be conceived – can be generated by a single, very simple and short program.

If the idea of infinity bothers us, a huge number of computer programs – including every program up to some given length – can be generated by any one of many different programs – each with a different value for N, the number corresponding to the very last program outputted. Each such program, even with the need to store value of N, would be relatively small considering how many programs it produces. Such programs would not be *required* to be very complex: the value of N would constitute information, but it would be arbitrary information: there would be no specific requirement for the bits in it. Any associated "complexity" would be incidental.

Further, we could dispense even with almost all of the information needed to store N by making N a number that is easy to represent, such as $2^{1,000,000,000,000}$. Such a manufacturing program could create a huge number of programs – yet it would be very simple and would contain hardly contain any information itself. A simple thing *can* make lots of different things.

There is still the issue of Swinburne's "chocolate machine" analogy. It may seem intuitively obvious that Swinburne's chocolate-making machine must be more complicated if it is to make more different kinds of chocolates – and we have a lot of experience of how machines work, and what is needed for them to work, in everyday life. We will return to the "chocolate machine" analogy later. For now, we will deal with another issue: Swinburne's claim that an enormous amount of evidence should be needed to postulate a very wide multiverse.

4 A MAXIMALLY WIDE MULTIVERSE SHOULD BE EXPECTED.

4.1 A huge amount of observational evidence should *not* be needed to accept a wide multiverse theory.

Swinburne says that we should need observational evidence to accept a multiverse theory and that, even if observational evidence forced us to accept one, it is unlikely that we should ever accept one postulating a *wide* multiverse – one giving rise to universes with very different physical laws. Swinburne says that a theory postulating a wide multiverse would be so complicated, and an alternative theory postulating a narrow multiverse so much simpler, that we should need a huge amount of observational evidence before we prefer the wide multiverse theory – so much that we are never likely to get this by observing reality, which is all we can do.

Ironically, such an idea would actually be more appropriately deployed against Swinburne's own "God" hypothesis. In the matter of multiverses, this thinking is flawed. We have already shown that a very wide multiverse would not have to be based on general rules that are more complicated than those of any individual universes, so the claim that a theory postulating a very wide multiverse would need this impractically large amount of observational evidence should be seen as flawed. We can go further, however. We will now make an argument that we might have reason to accept a very wide multiverse hypothesis without *any* specific observational evidence – that the existence of a very wide multiverse can be justified on philosophical grounds alone. If successful, such an argument would clearly refute Swinburne's argument that we will never have enough evidence to take such an idea seriously.

We have previously used the argument that is about to be given in an earlier article, part of a series proposing a specific ontology. [4] We are using it again here because it is important with regard to refuting Swinburne's argument. (The version of the argument given here has been produced by editing the previous version.) The argument has therefore been previously presented in the context of this ontology that we were proposing. The argument is more general than that and does not rely on any specific ontology. Here, it will be presented in a more general form.

The argument is in two parts. First it will be shown that an observer should regard himself as existing within an infinite "ontological structure" of some kind, and then it will be shown that this infinite structure corresponds to the observer being in a very wide multiverse. In fact, it will be shown to be the widest multiverse that can be imagined: one corresponding to a kind of modal realism [5], a philosophical view in which all possible worlds exists.

The argument will now be given, starting with the first part in which it is shown that an observer should believe that he is within some infinite ontological structure.

4.2 The structure of reality is infinite.

You experience perceptions, and, unless you are a solipsist, you relate those perceptions to something beyond yourself called "reality". By perceptions, here, we mean any experience – both inner or outer – that seems basic.

If you were to look out on reality from your vantage point and described, formally, what lay before you, your description would be about things and relationships between things. Some of those things would be "close" to you in an ontological sense of the word: they would relate directly to your perceptions. Other things would be less close to you: they would not relate directly to your perceptions, but they would relate directly to things that related to your perceptions. Other things would be "further out" still – being related by varying degrees of indirectness to your perceptions. The ontologically closest things of all to you, of course, would be the basic inner and outer perceptions that you experience. We have here, then, the basis of an *observer-centred world* description.

We will start using numbers to describe how many "relationships" something is away from your basic perceptions: we will consider this as a kind of "ontological distance". The closest things are your basic perceptions – inner and outer – and these are "zero relationships" away from you. The next closest things are those things which relate directly to your basic perceptions, and these are "1 relationship" away from you. The next closest things are those which relate directly to the things that are 1 relationship away from you, and these are 2 relationships away from you, and so on.

Your "local reality" will be any part of reality that is being considered consisting of the things within some given ontological distance – within some given number of relationships – of you. For example, you might consider your local reality out to ten relationships away from you.

It will be assumed that your local reality, out to some number of connections, C_1, away from you, can be formally described, and that this formal description can be represented by an algorithm. You do not know, however, *which* algorithm. This does not prevent you from considering the probabilities that local reality has various features.

If you want to know the probability that your local reality, out to some number of relationships, C_1, away from you, has some feature, you can use the following approach:

For some integer n, make a list of all algorithms with a length of n binary digits (bits) or less that describe (that is to say "construct") a structure of local reality that is consistent with the basic perceptions of which you have direct knowledge. Count the number of algorithms in the list, N_{Total}

Count the number of algorithms in the list which describe versions of your local reality with structures of relationships with the feature in which you are interested, $N_{Feature}$.

You should treat the situation *as if* the algorithm describing local reality is one of the algorithms in the list. The probability that it is one of the algorithms with the feature in which you are interested is therefore given by:

$$\text{Probability (Feature)} = N_{Feature} / N_{Total}$$

For a more accurate probability you can repeat the calculation with a higher value of the maximum algorithm length, n, and as n tends to infinity the probability should converge on some value.

Suppose you have been considering your local reality out to some number of relationships, C_1, away from "you", and you have some idea of the statistics that describe the possibilities for it.

You now wonder what is further out – what the larger reality – if any – is in which the local reality you have been considering is embedded. You consider the local reality out to a larger number of connections, C_2, away from you, where $C_2 > C_1$. For some maximum description length, n, you will have a large number of descriptions, and these descriptions will tend to describe versions of local reality extending out as far as C_2 relationships away, as there are more ways of specifying a larger structure of relationships than a small one. Some of the descriptions will refer to versions of local reality that still only extend as far out as C_1 relationships away, but they will be a very small amount of the total number of possible descriptions, and as the maximum allowed description length, n, is made larger then the proportion of the total number of descriptions that are of versions of local reality only extending out as far as C_1 relationships away will become smaller, because it is imposing a restrictive requirement on the kind of description permitted. This can be said for any C_1: you should always expect local reality to extend beyond any boundary that you imagine.

Further, when you consider the possible versions of local reality out to some number of relationships, C_1, away from you, for maximum description lengths of up to n bits, as n tends to infinity, the proportion of the descriptions corresponding to structures of relationships that extend out to C_1 will become higher: for a very large value of n, hardly any versions of local reality will not extend out as far as C_1 relationships away: there are more ways to describe a very large local reality than one that has to be arbitrarily small.

All this amounts to a proof that reality, from your perspective, is infinite. This does not necessarily mean that reality is spatially or temporally infinite – though this is not ruled out – but rather that the structure of relationships must extend infinitely.

A simple way of thinking about this is in terms of "nothing" being a very specific answer to the question of what is out there: in fact it is the most specific answer possible, as there is only *one* way to have *nothing*, whereas there is an *infinity* of ways of having *something*. To put this another way:

Nothing is more specific than nothing.

And specificity is the opposite of what we should want in an "explanation".

The kind of argument used here could be presented in terms of partial models and their amount of information content or specificity across possible worlds: a partial model corresponding to the structure being limited to some size will have an infinitely small measure across possible worlds.

The previous version of the argument just given assumed an ontology in which objects were made so basic that they lost all their internal properties and a description of reality was reduced to nothing except relationships between objects [4] (a move previously made by Max Tegmark in developing an ontological view [7,8,9]). As we said in the previous article, the argument does not require a specific ontology, so it is not necessary to go as far as this reduction of everything to relationships. However, reduction of things to relationships makes a lot of sense. A formal description should be expressed in terms of the simplest entities possible – the simplest "ontological building blocks", and any attempt to simplify would seem to end up like this.

4.3 The infinite reality, as seen from your perspective, corresponds to a maximally wide multiverse.

An infinite reality from your perspective does not, in itself, imply a wide multiverse. A wide multiverse implies a lot of variation throughout reality, but reality could conceivably be infinite and quite boring. For example, as local reality gets larger, it could just be an extension of local reality as you know it, or it could, in principle, consist of an infinity of duplications of local reality as you know it. Why then, should you expect to live in a very wide multiverse?

Suppose you consider the local reality, out to some number of relationships, C_1, away from you. You should expect, for reasons already discussed, that your local reality will be structured in a certain way – that there will be some kind of pattern of which your basic perceptions are a part. Suppose now that you consider local reality out to C_2 relationships away. Should you expect that this pattern will continue – that reality is just more of the same? This would be unjustifiably restrictive. In principle, local reality *could* have the same pattern out to C_2, but there are more ways for this pattern to be merely a special case of some more general pattern, simply because general things have lots of special cases and there are lots of ways for something to exist as a special case of something else. To demand that some larger pattern is exactly the kind of pattern as that seen in our local reality is to put a very restrictive requirement on it, while to demand merely that some larger pattern has some *part* of it that is the same kind of pattern seen in your local reality is less restrictive, because the pattern can have lots of such parts – and each such part effectively amounts to a "different attempt": the more general reality, of which your local reality is a special case, is effectively getting more chances to "enter the lottery".

Now, someone could create a straw man from this and say that it tells us not to expect any structure at all in reality, even locally. If local reality out to C_1 is merely a special case of larger reality, why expect anything beyond what you have directly experienced to match your expectations in any way? Why not say, instead, that everything that you know is simply a special case of a larger pattern and that we can have no idea what exists beyond your immediate perception?

Such a view, however, is treating the larger part of reality out to C_2 as if it is some arbitrary, random arrangement of things, and local reality out to C_1 just happens to be a small part of it – with no relationship to any other part of it. The larger pattern, however, is being viewed as having a *formal description*, and a formal description corresponding to a pattern which just happened to have the local reality out to C_1 as a special case and everything else not resembling it at all would be very complicated and specific: the proportion of formal descriptions corresponding to such formal descriptions would be small. The proportion would be much greater for formal descriptions corresponding to structures, out to C_2, in which the larger pattern was a more general case of C_1, but was still something like it. In fact, we have shown earlier, with the method of calculating probabilities in 4.2, that knowing something about a part of the reality should tell you something about larger patterns in it, so if this were not the case, it would conflict with such ideas.

Now, suppose you know what local reality is like out to C_2 (and you cannot know with certainty, of course, but we are just supposing). What you know about is a general case of which local reality out to C_1 is a part. Suppose that you now look further out – as far out as C_3 which is twice as far as C_2. Again, what you should find out there should be a general case of which local reality out to C_2 is a special case – but there should still be some kind of general pattern. Local reality out to C_2 is itself, however, a general case of local reality out to C_1, so things have now become more general still. As you look further out into reality, the reality local to you should become an increasingly special case of some more general case, but even if you look very far out and find some very general case, that general case will itself become a special case on looking further out. The conclusion – that you are living in a very wide multiverse – should seem inescapable.

4.4 Modal realism appears to be true.

The multiverse in which this argument suggests you live is not merely a very wide multiverse. No matter how far you look out into reality, what you find will turn out to be merely a special case of some more general case when you look further. There is no limit to the generality: the multiverse in which you live is *maximally wide*. Such a multiverse would seem to include every imaginable world and modal realism appears to be true.

Another way of viewing this is that, as has been discussed previously, you can expect what you know about reality very locally to tell you about reality further out, but as you go further out, what you actually know about reality very locally to you represents a progressively smaller piece of it, so what it tells you about reality becomes increasingly less useful. If you look out to some small extent, you should still have strong expectations of what reality will be like, because you have seen a lot of it, but if you look very far out indeed you should have hardly any idea at all about what reality is like, because you have seen hardly any of it – and there are many ways in which your piece of reality could exist in some larger reality. As far as you are concerned, reality, so far out, is effectively "anything goes" – and you should expect any conceivable special case to be a part of reality somewhere.

All this means that, if you know about a small part of local reality, as you look further out, the part of local reality that you know about should become part of an increasingly general pattern. If you go far enough out (in an ontological sense, rather than a spatial sense) you should see "places" like your own, with the same laws of physics and physical constants, but with different arrangements of matter. By going further out still, you should see a reality consisting of worlds like your own, with the same laws of physics and physical constants. Further out still, you should expect to find worlds with different laws of physics.

How general things should be, very far out, depends on what you regard as conceivable. If you find it conceivable, further out still, even concepts such as space and time will be revealed as provincial, and will be seen not to apply in most of reality. That would not mean that there was "nowhere else" with space and time: other worlds with space and time would exist – somewhere. In fact, pretty much anything you can imagine would exist "out there" – but there may be little reason to think that concepts like space and time are an important part of reality – that they are anything more than provincial concepts in the rare "islands" where they exist.

A consideration in statistical ontology, then, seems to oblige us to accept the widest multiverse we can imagine: a multiverse corresponding to a kind of modal realism.

It should be noted that this kind of view is rather inimical to the "God" idea in general, and not just to Swinburne's argument, because it suggests that *nothing* should be expected to be non-contingent. Instead, anything that can be found will turn out to be part of something more general, which will itself turn out to be part of something more general and so on: there can never be any "ultimate" explanation – just an infinite chain of generalizations. William Lane Craig's "Kalām cosmological argument" [6] in particular comes out of this quite badly, because the idea of time becomes provincial, and the Kalam cosmological argument treats the idea of some kind of profound "cause" as important.

4.5 Formal Descriptions that Turn Inwards

There is one issue that we have ignored up to now, and we ignored it in the version of this argument in the previous article. [4] Some of the descriptions of the structure of local reality will "turn inwards", describing the structure in great detail, with the detail ever-increasing – like someone viewing the Mandelbrot set on a computer screen and repeatedly zooming in. The problem with such descriptions is that they do not tell you about how the structure extends outwards, or in what kind of larger structure your local reality might be embedded. If a lot of the algorithms with maximum lengths up to some value, n, do this, they will be using up the information that they are "allowed" by their maximum lengths to describe this detail, and they will not be telling you much about what is "out there" – in what kind of structure your local reality might be embedded. For the purposes of what we are doing here, therefore, it makes sense to limit the amount of "detail" or "depth" allowed in some way. This may look like a contrivance – a way to force algorithms to start describing the reality that we are arguing exists "out there" – but is, in fact, merely choosing to focus on a particular area of reality. If all of the available information in an algorithm is used up in specifying how to "fill in" some part of the immediate local reality with a huge amount of detail and nothing else, this is not implying that nothing exists "out there", but rather that this algorithm is not telling us about it. Focusing algorithms on the part of reality that interests us should seem reasonable. If it seems obvious that these algorithms will then be forced to start describing a wide multiverse, this is not because what we are doing is contrived: rather it is because there obviously is one.

This suggests something else: what if instead of focusing on formal descriptions that turned outwards, we focused on ones that turned inwards? There is the suggestion here that the modal realism may be even more extensive than it appears – that your own local reality may itself be a general case of an infinity of special cases.

4.6 Modal realism should make intuitive sense.

The argument for modal realism given here should agree with intuition. You might conceivably have no reason for thinking that space and time extend beyond your immediate experience, but you do, because you *generalize*. You take what you know and assume that it is part of something more general – that the space you experience around you with arrangements of objects is a special case of some larger space that extends with more varied arrangements of objects, that the time you have experienced with specific events is a special case of some time that extends further into the past – before you started experiencing time – and further into the future – beyond the present, with more events. You assume that patterns of arrangements of matter in space and events in time are special instances of more general patterns, and that natural laws tell you about these patterns. Even if you are not consciously aware of it, you already generalize as you look out into the world: you need to do so in order to function in it. Generalization is how we really attempt to explain things.

In fact, this gives us a partial answer, possibly, to Hume's problem of induction. One reason that we may feel entitled to generalize about the external world is that that is all that the external world *is*. If we are not to say that the external world is a generalization of our perceptions, what purpose does it serve even to postulate that the thing exists, that there is *anything* out there? Viewed this way, Hume's problem of induction seems to become merely another way of asking why we should not subscribe to solipsism.

And solipsism is essentially what you are doing if you deny that we should generalize like this. Someone who denied that his perceptions were a special case of something more general, and instead refused to extend reality beyond his basic perceptions into something more general, would be a solipsist, but to accept this idea of extending reality beyond yourself and then *selectively* apply it – to insist that you can generalize about arrangements of matter or events in time, but not to a greater extent – could be viewed as a "little solipsism".

4.7 The Approach to Formal Descriptions that Turn Inwards

There is one part of the argument that needs some defending. We said, in 4.5, that some algorithms describing the local structure of relationships will "turn inwards" and start describing some the structure with ever increasing detail, like someone looking at the Mandelbrot set on a computer screen and zooming in repeatedly. We said that we should remove such algorithms from consideration. This may look like an attempt to "rig" things to get the results that we want: after all, if we stop algorithms from focusing on ever-increasing detail locally – if we stop them from going "downwards", then is it not obvious that they must go outwards, and generalize as they do, finding the infinite and general multiverse that we are claiming? Are we not just forcing this? In fact, all that we are doing here is focusing on what we are interested in. If a lot of algorithms "use up" all their information describing very deep, local aspects of reality this does not mean that, in the reality described by one of those algorithms, reality "further" out does not exist: it just means that the algorithm does not have enough information to tell us about it. We can deal with this issue by focusing on algorithms that tell us about the things that interest us. When we focus on what is "out there", and see the probability space being dominated by descriptions of a wider, more general reality it may seem obvious that this would be the result of "looking there", but this is only because the kind of modal realism being argued for here is obvious anyway: when we look out into reality, and focus our attention outwards, we see things. The algorithms, if they "disagreed" with this would be quite free to be uncooperative as we focused on what is "out there": they could just stop describing things – and that, of course, is not going to happen.

Nor would this kind of "selective" approach to algorithms be a special process. There are many situations in which we may want to know about some part or aspect of local reality, and in which we may focus on formal descriptions that tell us about that part of reality, so that we can distinguish between the possibility of one thing and the possibility of another, by doing the statistics. For example, if you are in your garden and you see some rustling in some plants, you may wonder if it is being caused by a cat or by the wind. In principle, you might consider a large set of possible formal descriptions of the situation, all of which are consistent with your basic perceptions, and analyze the statistics of them – looking at how many of them describe a cat making the plants move and how many of them describe the wind doing it. You may decide to focus your attention only on those algorithms which actually say anything about the subject – which describe that part of reality. In doing so, you can distinguish between the "cat theory" and the "wind theory". The focusing on a particular part of reality in such a process would probably not be viewed as particularly controversial: it is likely that anyone having problems with this would have, instead, objections about the entire idea. What we are doing here, however – in selecting a particular kind of formal description that tells us about some area of reality to distinguish between one thing and another thing – is no different from selecting a particular kind of formal description that tells us about some area of reality to distinguish between *something* and *nothing*. What we are doing with such a selection process – in fact what we are doing in all the process discussed in this argument – is something that would seem to work reliably as a general process for finding out about reality – so it would be inconsistent to throw it out when it starts to tell us that modal realism is true. And if it seems that it has to tell us this, because of the way that it works, then we should be aware that, for anything that it makes a claim of likely existence about, it has to tell us that thing probably exists too because of the way that it works. In a way, modal realism is implied by the method – generalization – that we are using, but to apply that method inconsistently is something that we have no grounds for doing.

All this means that the quest for an "ultimate explanation" can only take us in the direction of more generalization. It may seem that an explanation should be about causality – that it should tell us what came before something – but then we would want to know the rules that told us about how things happen over time, and here we need to look for generalization in the form of physical laws. (An example, here would be Newton's inverse square law of gravity, which was found by generalizing from the falling of objects on the earth and the movement of planets in the solar system.) When we have an idea of what the laws are, the question can always be asked: "*Why* do the laws apply?" Any such question can only make sense if it is asking for further generalization still. When such further generalization is given, it will be in the form of some more general framework, into which that for which we were demanding an explanation is a special case – and then we can ask: "*Why* does that general framework apply?" – and the answer can only be in the form of further generalization. The ultimate explanation – the kind of modal realism argued for here – is something that we never arrive at: instead it recedes before us like the speed of light does before an accelerating astronaut. Theists tend to insist on asking "Why?" at every stage like this, or something equivalent, but we can always answer their questions with more generalization. The theist may claim that he is not asking for more generalization, but that is the only way in which we can view the theist's continual "Why?" questions as being coherent. There is no *ultimate* explanation to be found: just more generalization.

The kind of argument used here has something in common with other arguments in statistical ontology. For example, Eliezer Yudkowsky has argued that the many-worlds interpretation of quantum mechanics [10,11] is almost certainly true. [12] A related consideration of the issue has been given by Tegmark. [13] The argument given here is a more extreme version of this kind of argument, with the difference that, as the specificity of "nothing" – of the alternative to the kind of modal realism argued for here – is total, the argument suggests that the probability of modal realism being true is not merely high: it is actually *certain* that this is the case. Of course, we can always raise "residual" doubts about things that we can know from logical arguments. We can even argue for some kind of residual doubt in mathematics. However, the argument given here is telling us that we can be as certain that we live in a maximally wide multiverse – that a kind of modal realism is true – as we can be of anything relating to the outside world. We find ourselves, then, in the strange position of having reason to be more sure of modal realism being true than we can be of the many-worlds interpretation of quantum mechanics being true, even though it might seem an even more extreme idea.

4.8 How can there be many ways of having *everything*?

There may *seem* to be a paradox in the argument. We have said:

Nothing is more specific than nothing.

And we have ended up with modal realism, but could it not be said that modal realism is equally specific? If you have a description of everything, could it not be said that it can only take one form – a description of everything? We are used to thinking in terms of "everything" implying a lack of possibilities. For example, people often ask what you buy the person who has everything – the idea being that there are no possibilities. But have we not just seen an argument that suggests that expanding our view of reality makes it more general *and* creates more possibilities? Is this not a contradiction?

There is no contradiction here. The way that we have reached modal realism is by expanding our view *from our perspective*, so that it encompasses progressively more, and we have shown that there will always be more there, and that it will become increasingly general. We are talking here about an *observer-centred world*, where the description of reality is everything that exists "around" your perceptions. As the world view starts to become more general, there can be increasing uncertainty about what the description of the world is around you, which means there are more ways "for things to be".

One way of imaging this is in terms of increasing uncertainty about "where you are" in the multiverse. As your idea of reality becomes more general, there is more scope for situations like yours to exist, in different parts of reality, and there is increasing uncertainty about which of these situations is yours.

While thinking in terms of "where you are in a multiverse" may be useful in gaining an understanding of why this contradiction does not exist, we have to say that we prefer to avoid such a view: it is better if we can just realize that observer-centred worlds can approach modal realism and become increasingly general as the number of possibilities increases. It is our opinion that, because we are obliged to do our statistics in terms of observer-centred possible worlds, that is probably the only thing that we can really coherently discuss. Ideally, all of our discussion should be in terms of what exists from our vantage point. This is not a claim of solipsism: no claim is being made that the world is not "out there". Rather, it is being suggested that the only coherent way of expressing a description of the world is as a description of an observer-centred world.

This does not, incidentally, imply that things only exist when being observed: an observer-centred world description can talk about things that might be out there, that have different probabilities of being out there, that have been out there or that will be out there. This is merely about how a description of the world can be expressed. There is no implication, here, that some kind of intelligence must exist and be observing everything else for it to exist: the idea is merely that *any description of the world must be from some vantage point*.

In a sense, this means that modal realism is one of those things, like singularities behind event horizons, that we never actually confront directly. The kind of modal realism discovered here is somewhat of a philosophical abstraction – like the "infinitely small" *dx* or *dy* in differential calculus (at least as many people imagine it). As we expand our world view, we should expect it to become more general and to become more like modal realism, but we can never actually expand our world view to infinity while constructing any real model of the world. Modal realism, therefore, is what things will *tend* to being like as you look at more of reality beyond yourself.

4.9 Is this multiverse supposed to be *simple*?

We should now consider what is meant by the idea that an explanation for the universe should be "simple" rather than "complex". There is a kind of simplicity to generality, as Tegmark points out in his own argument for a multiverse [7,8,9]: Describing *everything* really takes no information at all, whereas describing *something* does take information. We might think of this in the following way: that any description of a "thing" is really telling you its "address" in "everything". When a thing is described in general terms we might think of the description as corresponding to a set of different things – to a range of addresses" in "everything". When a thing is described in very specific terms, its address is being given more precisely. Specificity, then, means having a lot of information in the description of a thing.

We would have a minor issue with this – and it really is minor. Our justification for a maximally wide multiverse is based on showing that an observer-centred world can be extended without limit, and that as it is extended, the observer's situation will become part of a progressively more general pattern. This tends towards a maximally wide multiverse – or a kind of modal realism – but we can never quite reach that. This idea of a wide multiverse containing everything in which you exist "somewhere" is a kind of abstraction that will always be over your horizon. This could be debated – but it is not a very important point in discussions of what exists and what does not. as long as we understand what we are doing. Really, this is more about semantics, and there is no problem with the idea of a wide multiverse in which you live "somewhere" as a kind of philosophical abstraction – as what your world view tends to approach as you expand it. In everyday language, there should be no issue with saying that we live "somewhere in a multiverse" corresponding to a kind of modal realism. In fact, we use that kind of language ourselves in this article.

If you think in terms of a very wide multiverse in which you live "somewhere" then the full description of reality is very simple – in fact it is maximally simple – and we can see why: it is completely general. If we restrict ourselves to making descriptions of reality in terms of observer-centred worlds then this full description of reality – in which everything is maximally simple – becomes an abstraction that is beyond you. Instead, as you expand your world view things become progressively more general, in that your own "local" situation becomes an increasingly special case.

Does this mean that your local reality becomes simpler as you extend it? In a sense it does not: as you extend your world view, your position in it becomes progressively more specific and more information is needed to describe it. That would make your position progressively more complex. However, none of this means that a multiverse theory itself should be considered as "complex", or that we should think, as Swinburne would have us believe, that a multiverse would *need* to be very complex to produce all the universes that it contains or to which it gives rise. None of this is about any *specific* complexity being required to explain your local situation. Rather, it is about the fact that as you extend your world view you see an increasingly general pattern and there are many complex ways in which you could find yourself as a special case in such a general pattern: the complexity, here, is really *incidental* and the important point is that a statement of the general features that your situation must have in all of these possibilities – across all the possible "multiverse-type" situations in which you could exist as a special case in all these general patterns – is actually maximally simple: nothing specific is required, because these kinds of expansive situations are going to fill up the set of possibilities anyway as you expand your world view. In this sense – the important one – in which being "simple" means imposing few or no specific demands on reality, a multiverse theory is simple. On the other hand, a theory which is not simple, in the sense that it makes specific demands on reality, will tend to be correct in only a small proportion of possible situations. This means that a simple theory can be preferred in a complex local reality, because it will tend to be true in more of the possible local realities that we can imagine.

It should be noted that complexity can be viewed in different ways. One way is in terms of the amount of information needed to describe something and other ways would be in terms of various features that something might have. For the kind of discussion we have been having, the distinction should not really matter much. However, the discussion does seem to favour a view of complexity in terms of information-content, as the amount of information in a theory should give us an idea of the specificity which it is attempting to impose on reality.

The important idea that should come out of this is that complexity or simplicity per se are not *fundamentally* important, and that we should not expect reality to be simple, but rather that what we should be interested in is the specificity of a some claim about reality – the proportion of world views we can formally describe, out to some ontological "distance", in which that claim is true – and that ideas of simplicity and complexity are useful in that they give us information about the specificity of claims. This is all about *specificity*.

4.10 Isn't this just an ontological argument?

Swinburne claims that observational evidence would be needed for a multiverse, and that an impractically large amount of observational evidence would be needed for a very wide multiverse. We have disagreed with that claim, arguing instead that we should expect to find ourselves in a very wide multiverse – in fact one so wide that it implies a kind of modal realism – just from philosophy, without reference to any specific observational data.

This may seem suspicious, and it might seem inconsistent coming from an atheist author.[2] Many theologians have attempted to make arguments showing that a God exists just from the definition of "God" – without any dependence on any specific observational evidence or specific features of the world. [14] Ontological arguments for God tend to be rejected by atheists as being absurd. Even many theologians do not find them viable. It could be claimed that our attempted proof that we are in a very wide multiverse is itself an ontological argument, given that it reaches this conclusion without reference to specific observational evidence and instead argues that we must be in such a multiverse purely on philosophical grounds, and that it should not be taken seriously on that basis.

We must admit that, yes, what we have just made *is* an ontological argument for a maximally wide multiverse and a kind of modal realism. However, this does not mean that it should be viewed as suspect just because ontological arguments for God tend to be viewed as suspect. An ontological argument for God fails because reality is free to take many forms, most of which will not include a God. The whole basis of the ontological argument we have used, however, is that the claim that we are not in very wide multiverse is the most specific claim that can be made. The argument works in a different way to other arguments, appealing to *specificity,* or lack of it, as an indication of what exists, and this puts it on much firmer ground. In fact, the argument is merely a special case of what do all the time: we base the likelihood of claims being true on their generality, and the argument made here is merely that a very wide multiverse will "swallow up" all of the "probability space" as you expand your world view: it is maximally general.

5 ANSWERING SWINBURNE'S "CHOCOLATE MACHINE" ANALOGY

5.1 The Apparent Contradiction Between the "Manufacturing Program" Analogy and the "Chocolate Machine" Analogy

We will now deal with the "chocolate machine" analogy used by Swinburne. Swinburne says that a machine which produces many different kinds of chocolates and other sweets will be more complex than one that only has to produce chocolates of the same general kind in different sizes. He says:

"To take an analogy, a machine which produces chocolates and other sweets of different kinds has to be more complicated than one which merely produces bars of chocolate of the same kind but of different sizes." [1]

This may *seem* intuitively attractive. In fact, we could take Swinburne's analogy to a greater extreme to make it seem more powerful: we could imagine a machine that produced even more different kinds of things, such as chocolates, cars and pizzas, but there is the matter of the "manufacturing program" analogy that we provided earlier.

Earlier, we used the analogy of a "manufacturing program" to show that a description that implies the existence of many different things can be simpler than one which implies just one. Swinburne's "chocolate machine" analogy, however, may seem to suggest that a thing that makes many different kinds of things must be more complicated than a machine which makes things of the same general kind. Swinburne's analogy therefore seems to be contradicting ours. It must be the case that at least one of the analogies does not indicate the general truths that we or Swinburne think that it does. We will show now that the problem lies with Swinburne's "chocolate machine" analogy: it does not at all suggest what Swinburne thinks it suggests.

[2] We are aware that our previous writing will have left little doubt about our opinions in these matters.

5.2 The Main Problem with the "Chocolate Machine" Analogy: its Specificity

To see what the main problem is with the "chocolate machine" analogy we will consider some special cases of the "manufacturing program" analogy that we earlier described. We showed that a small computer program containing little information, or one which contains some fairly arbitrary information (a value of N containing many digits which can be one of many arbitrary values) can make a lot of different programs – if we are prepared to accept that most of the programs will be nonsense and only a small proportion will be of any interest.

This may seem to be contradicted by Swinburne's "chocolate machine" analogy, but we do not need to go that far to find what might appear to be a contradiction. If the manufacturing program is to produce a single program, and nothing else, it must contain all the specific information needed to produce that program. For example, if it is to produce just a chess playing program, then it must contain all the information needed to produce the chess playing program. How can this be the case? How can it require less specific information to make something than is required to make many things that include that thing? Now, we are not saying here that this should be doubted, or that it is not obvious that it is the case: the example we provided makes it clear that it happens. Rather, we are saying that there is an underlying reason for this that needs to be articulated.

If making a huge set of programs is simpler, or takes little information, then this might suggest that making more programs is easier than making few programs – that it gets easier as you increase the numbers – but this is not necessarily the case, as will be shown now with another example.

Suppose we want the manufacturing program to produce just *two* programs – let us say, a program to play chess and a program for *Pac-Man* (a 1980s videogame). If we think that making many programs is easier than making few we might think that a manufacturing program to do this can be simpler, or contain less specific information, than one needed to produce either program individually, but of course this is not the case. A manufacturing program to produce a chess program and a program for Pac-Man, will be more complicated than the one needed to produce either by itself. This does not necessarily mean that the shortest manufacturing program that produces both programs is as long as the combined lengths of the manufacturing programs that produce each individually, as it is likely that the chess and Pac-Man programs have some features in common, and this can be exploited in expressing the program to make both more efficiently, but it should be clear that this will not make it possible for the manufacturing program to be shorter than the one required to produce just one of the programs: in this instance, making two programs seems *more* complicated than making just one.

But is it always the case that making two programs is more complicated than making one? As we have seen, any program corresponds to a binary number. Suppose we took the number corresponding to the chess program, X_{Chess}, and added one to it, giving $X_{Chess}+1$, corresponding to a new program that we will call "Chess Plus One". "Chess Plus One", of course, is not likely to be different from the chess program in any interesting way. At best it will only be a "damaged" version of it. There is no way that adding one to the number for the chess program is going to give, say, an accountancy program or a word processing program. That is not the point, however. How complicated is it for a manufacturing program to make the chess program and the "Chess Plus One" program? It should be clear that it will only be slightly more complicated than it is to make the chess program by itself. The manufacturing program need merely contain the number X_{Chess} and a small amount of logic to output the program corresponding to X_{Chess}, before adding 1 to X_{Chess}, giving $X_{Chess}+1$ and then outputting the program corresponding to this number.

Why is this case simpler than outputting two completely different programs, such as the chess program and the Pac-Man program? It is not that "Chess Plus One" is simple: it is not. Rather it is that the manufacturing program in this case is outputting a range of programs –and given the lower value of the range, X_{Chess}, the upper value, $X_{Chess}+1$ is specified in a very simple way – by adding one to it.

We will explore this idea of outputting a range of programs further. Suppose we now want the manufacturing program to produce programs for chess and Pac-Man, as before, but also a third program, *Space Invaders* (a 1970s videogame).

Let us say that the number corresponding to the chess program is X_{Chess}, the number corresponding to the Pac-Man program is X_{PacMan}, and the number corresponding to the Space Invaders program is $X_{SpaceInvaders}$. Further let us say that the smallest of the three numbers is X_{Chess}, the largest is X_{PacMan} and $X_{SpaceInvaders}$ is mid-way between them, so:

$$X_{Chess} < X_{SpaceInvaders} < X_{PacMan}$$

Outputting each of these three programs, and nothing else, is clearly still going to be much more complicated than outputting just one of them: adding the Space Invaders program has made things even more complicated.

Suppose now that we want the manufacturing program to output the chess program, the Pac-Man program and the Space Invaders program, but we will also permit it to output all the programs "between" the chess program and the Pac-Man program – that is to say, we will permit it to output all the programs corresponding to numbers between X_{Chess} and X_{PacMan}, one of which, of course, will be the Space Invaders program. This makes things simpler. The program needs to contain the numbers X_{Chess} and X_{PacMan}. It needs to start at X_{Chess} and output this program, and then keep adding one to this number, outputting each corresponding program in turn, until it outputs X_{PacMan}, after which it stops. That is to say, it goes:

$$X_{Chess}, X_{Chess+1}, X_{Chess+2}, \ldots, X_{PacMan-1}, X_{PacMan}$$

and, somewhere in the middle of this sequence, the program corresponding to $X_{Space\ Invaders}$ will be outputted:

$$X_{Chess}, \ldots, X_{SpaceInvaders}, \ldots, X_{PacMan}$$

The fact that the Space Invaders program is being outputted, though, is not adding much to the complexity. The program needs to have the values for X_{Chess} and X_{PacMan} stored, which is where most of its complexity lies, but the program can use some very simple logic to output the programs corresponding to the entire range between these values, and the Space Invaders program is included in this because it is part of that range. (It is likely that the amount of information that needs to be stored to represent the X_{Chess} and X_{PacMan} values can be reduced due to common features of the chess program and the Pac-Man program, but this is unimportant, here.)

The manufacturing program can be thought of as outputting programs corresponding to *ranges* of numbers, and the complexity comes from having to specify the lower and upper boundaries of the ranges, but if a range of programs is already being output, no further complexity is added by requiring the output of a program that is already in the middle of the range. In the example just considered, the complexity came from having to specify the lower and upper boundaries, X_{Chess} and X_{PacMan}, and once this was done, the program corresponding to $X_{SpaceInvaders}$, its number being in this range, was automatically included.

Outputting a single program corresponding to the number $X_{Program}$ is merely a special case of outputting a *range* of programs, in which the lower and upper boundaries are both the same: $X_{Program}$. That is to say, it involves outputting all programs corresponding to a number that is greater than or equal to $X_{Program}$ and less than or equal to $X_{Program}$. Of course, there is some minor difference between the logic needed to output a single program and the logic needed to run through a range of programs, but this is trivial.

This explains why outputting exactly two of the programs – the chess program and the Pac-Man program – is more complicated than outputting just one of them. There are two ranges involved here, with boundaries that need to be specified. The first range corresponds to the chess program and has the lower and upper boundaries both equal to X_{Chess}. The second range corresponds to the Pac-Man program and has the lower and upper boundaries both equal to X_{PacMan}. There are four boundaries here – two for each program – and the manufacturing program must contain these values, but the four lower and upper boundaries only involve two different values – X_{Chess} and X_{PacMan} – so the program must have these two values stored, with whatever specificity and complexity that involves.

Changing the manufacturing program from one that outputs just the chess program and the Pac-Man program to one that outputs those programs *and* all the programs in-between – everything in the range X_{Chess} to X_{PacMan} – changes little. There are now just two boundaries – a lower boundary, X_{Chess}, and an upper boundary, X_{PacMan}. The upper boundary corresponding to the chess program and the lower boundary corresponding to the chess program are gone now, as there is just a single range, but these boundaries only used the X_{Chess} and X_{PacMan} values anyway, so the program needs the same values – X_{Chess} and X_{PacMan} – stored that would be needed just to produce the chess and Pac-Man programs by themselves: the only difference is a minor change in the manufacturing program's logic.

What about the case in which three programs – the chess program, the Pac-Man program and the Space Invaders program – and nothing else are to be outputted by the manufacturing program? Here, there are three ranges. The first range corresponds to the chess program and has lower and upper boundaries of X_{Chess}. After that range – which is just one program – has been outputted, nothing else is outputted until the Space Invaders program – which has a number between X_{Chess} and X_{PacMan}. Outputting the Space Invaders program is equivalent to outputting a range of programs with the lower and upper boundaries both $X_{SpaceInvaders}$. After the Space Invaders program is outputted, there is another "gap" before the Pac-Man program is outputted. This is equivalent to the output of a range of programs with lower and upper boundaries both X_{PacMan}. To output the three programs and nothing else, therefore, the manufacturing program must have three values stored: X_{Chess}, $X_{SpaceInvaders}$ and X_{PacMan}.

Let us now consider the case in which all three programs – the chess program, the Pac-Man program and the Space Invaders program – and all the other programs with numbers in the range from X_{Chess} to X_{PacMan} are to be outputted by the manufacturing program. The manufacturing program is now outputting only one range of programs, which happens to contain the Space Invaders program in the middle. The lower boundary of this range is X_{Chess} and the upper boundary is X_{PacMan}: everything in-between is outputted. The program therefore needs to have just two values stored: X_{Chess} and X_{PacMan}. This is in contrast to the program that outputted just the chess program, the Pac-Man program and the Space Invaders program, which had to have three values stored: X_{Chess}, $X_{SpaceInvaders}$ and X_{PacMan}.

Outputting the entire range of programs needs less information – and less complexity – because it involves outputting a single range of programs – a single contiguous set – with only two boundaries, whereas when three specific programs are needed and nothing else, this single range is broken up into three separate ranges – it is no longer contiguous – and more boundaries are needed.

This is not about numbers of programs per se, but rather it is about continuous ranges – contiguous sets of programs. Outputting many programs will be simpler than outputting few programs *if* it means that the gaps between the few programs are effectively filled with more programs so that boundaries disappear and do not need to be specified.

In the example just considered, the three programs – the chess program, the Pac-Man program and the Space Invaders program – being outputted as part of a continuous range of lots of other programs, the lower and upper ranges – the X_{Chess} and X_{PacMan} values – are still very specific and need to be stored. This information is equivalent to the programs themselves, and if we consider the chess and Pac-Man programs complex it means that the manufacturing program has at least the degree of complexity associated with storing both of them (though, as has been pointed out, the sharing of common features between them might reduce this a bit). However, with just this amount of information and complexity, the manufacturing program is able to produce a potentially *enormous* range of programs corresponding to the values between X_{Chess} and X_{PacMan}.

We do not even need all the complexity involved in storing the X_{Chess} and X_{PacMan} values. We could just make the manufacturing program produce all the programs in some continuous range, with a lower boundary of zero and an upper boundary of some number which is larger than X_{PacMan}, but which can be encoded with less information. We could make the upper boundary a power of 2, for example. This would give a manufacturing program which can produce the entire range of programs between these lower and upper boundaries – and this would include the chess program, the Pac-Man program and the Space Invaders program – but this program would be simple and hardly information would be needed to describe it. It is the fact that it is outputting a continuous range of programs that allows this.

We could make the lower boundary zero and the upper boundary some very large number which an be expressed with minimal information, such as $2^{1,000,000,000,000}$ and we would have a very short and simple manufacturing program that could, given enough time, produce every program that has ever been written by anyone, and a lot more besides.

Another possibility is to use lower and upper boundaries that are small enough and large enough, respectively, to ensure that the range of values includes those corresponding to programs that we want, but are otherwise quite arbitrary values – or we could make the lower boundary zero and just make the upper boundary large enough to ensure that the range of values includes those corresponding to programs that we want, but otherwise quite arbitrary – which is the approach that we will consider now.

If we want a manufacturing program that outputs the chess program, the Pac-Man program and the Space Invaders program, and we can accept it outputting lots of other programs as well, then we can make the lower boundary zero and the upper boundary some number that is greater than X_{PacMan} but otherwise quite arbitrary. The resulting manufacturing program would output the chess program, the Space Invaders program, the Pac-Man program and many other programs included in its range. In fact, any program shorter than the Pac-Man program would be outputted. We could ensure that the upper boundary exceeds some even larger value – large enough that its binary representation contains more bits than any program ever written by a human – but is otherwise quite arbitrary, and the manufacturing program would output every program ever written by a human.

Now, such a version of the manufacturing program might or might not be complex, depending on how you define "complexity", and the actual sequence of bits corresponding to the value of the upper boundary, which is where almost all of the program's information is (the amount of information in the program's logic being trivial). You might define "complexity" in a way such that whether or not the sequence of bits corresponding to the upper boundary is complex depends on whether it has various properties, or you might define "complexity" in a way such that the complexity of the sequence of bits corresponding to the upper boundary depends on how much information is needed to represent it: viewing complexity this way, some values, such as $2^{1,000,000,000,000}$ would be considered simple as not much information would be needed to represent them, while other values which are close to being random sequences of bits would be considered more complex as all the bits of such a number would be needed to represent it.

It may seem that there is a requirement for the manufacturing program actually to output all the programs in some range for the task of outputting the programs in that range to be simple. In fact, there is one way in which output of the entire range can be avoided. Suppose we imagine a version of the manufacturing program which runs through some range of programs, but makes runs some kind of simple logic that makes a Yes/No decision before outputting each program – only outputting a particular program if the answer is "Yes". A version of the manufacturing program like this would not be outputting the entire range, but it would still not really be contradicting what has been said: the program's logic is essentially the same, and the main point is that there is no complex selection process going on beyond what is necessary to produce the list of programs in the range. In fact, the logical possibility of making such a program would imply that there would be another, relatively economical way of encoding the descriptions of the programs that have to be produced – the rules needed to generate them – in which they do form a continuous range. In other words, there would be some simple way of enumerating them.

While the discussion here is about the simplicity or otherwise of Swinburne's chocolate machine analogy, it is also clearly relevant to the plausibility of various things existing in nature. We might also consider the situation in which the manufacturing program runs through a list of programs and some effectively random decision-making process intervenes to decide which of these are outputted. This might mean that we could imagine many ways in which some effectively random subset of the programs in the range was produced. Suppose we found some equivalent collection of things in nature, and it looked as though it had some from some range of items like that, but that only some subset had been produced. This would not make the existence of such things implausible. The main point here would be that the selection from the range of programs would appear to be a random one of many possible such selections: there would be no specific kind of complexity being required in it. It would be like getting an unlikely, but also unremarkable hand in a game of cards.

Generalizing, we can take all this as meaning that it is simple to make lots of things when they are members of a set which can be described in a simple way, and when the things being made are not selected from the set according to some very complex rule.

However the term "complexity" is defined, such complexity as might be found in the bits of some large but otherwise arbitrary upper boundary (and in the lower boundary too if we are allowing that to be arbitrary) should not be viewed as meaning that the manufacturing program must somehow be complicated to output all these programs. We have seen that the manufacturing program can take very simple forms and still output huge numbers of different programs. Because the task of outputting a huge number of programs is simple – in the sense that a minimal amount of information is needed to do it – it can be done in many different ways, with many different and arbitrary values for the upper boundary. The point here is that any complexity in the upper boundary is merely incidental: it is not an important part of the explanation of how the manufacturing program can produce all these programs. Any such complexity is merely associated with a particular version of the manufacturing program and is not associated with any specific feature that manufacturing programs in general need to have to do this. A manufacturing program that outputted a very large range of programs could be specified in many different ways – some of which would be simple and some of which would be complex. It is the fact that *the simplicity of the task*, in a sense, allows the manufacturing program to exist in many different ways that is important: the important feature of the requirement for a manufacturing program that works in this way is *lack of specificity*. This should seem relevant to the previous argument for the existence of a wide multiverse which considered the probability of local reality having some feature as being associated with the "number of ways" it could have that feature as a proportion of the total "number of ways" things could be.[3]

All this is about Swinburne's "chocolate machine" analogy, which is supposed to contradict the idea that it can be simple to make lots of different things. Let us return to Swinburne's analogy now and apply what has come out of the above consideration. As a reminder, this is what Swinburne said:

"To take an analogy, a machine which produces chocolates and other sweets of different kinds has to be more complicated than one which merely produces bars of chocolate of the same kind but of different sizes." [1]

Given what was just said about the "manufacturing program" analogy, Swinburne's attempt to use it to show that it is more complicated to make things of many very different kinds than to make things of one kind with minor variations – such as in size – should be seen to be flawed.

Despite what Swinburne says about it being more complicated to make many very different things than to make one thing, we have just seen examples, provided by the "manufacturing program" analogy, that refute this in extreme ways – such as generating all programs ever written by any human anywhere from a very small computer program or one with arbitrary information it. Using the understanding we have gained from the "manufacturing program" analogy, we can explain why Swinburne's analogy seems to involve high complexity, and we can show why it is unsuitable as an analogy for a very wide multiverse.

Suppose we make some version of Swinburne's "chocolate machine", and it is a more general machine that makes many different kinds of chocolates and sweets. Let us say that it makes Mars Bars, Milky Way bars, Galaxy bars, Aero Bars, and some other kinds, each in varying sizes. Such a machine will clearly be much more complicated than the machine needed to produce just one general kind of chocolate or sweet.

That making more kinds of sweets complicates the machine, however, should not surprise us. Looking at things in terms of "ranges", if we are to be able to describe how to make all these sweets and chocolates with minimal information and complexity, it should be possible to consider each type of chocolate or sweet being produced as having some formally expressed recipe, expressed in bits, in some reasonably economical way, regard each such sequence of bits as a number, put them in order and find that the numbers form a continuous sequence with lower and upper boundaries that can be expressed with little information or that can be assigned

[3] It should be noted that discussion of the "number of ways" here is a bit simplistic: we are really talking about counting things as values tend to infinity.

arbitrary values. (If we can assign the lower and upper boundaries arbitrary values it does not mean that any given machine to do this would be simple – but rather that it does not have to have any *specific* complexity.) Viewing things in terms of sets, it should be possible to describe, formally, a set to which all the chocolates and sweets produced by the machine belong, and from which the chocolates and sweets produced by the machine are not selected in any complicated, highly specific way.

If this condition is not met, we will still have a simpler machine if the descriptions of the sweets and chocolates group together to form a relatively small number of continuous ranges, so that a minimum of boundaries are needed. This is clearly not the case. The way that these recipes are encoded cannot contain the assumption that all recipes make sweets and chocolates that anyone would want to eat or buy, or even that all recipes make something that people would call a "sweet" or a "chocolate": they must just be about how matter is going to be arranged to make things. Most conceivable recipes would make something that nobody would want to eat or buy, or that does not look like a properly produced sweet or chocolate. In fact, most recipes will just produce a mess.

Viewing things in terms of "ranges", suppose we arranged the recipes for all these sweets and chocolates in order – treating the sequence of bits in each recipe as a binary number. The sweets and chocolates that we are imagining making here – Mars Bars, Milky Way bars, etc. are very specific selections from the list of possible recipes. In particular, they are selected on the basis of their desirability as sweet and chocolate products. Almost all the things that could be made by recipes like this will not have any desirability as sweet or chocolate products. "Between" the specific products that we want the machine to make, there will be vast numbers of other possible products that are undesirable or are just a mess, or even if desirable in some way are not the specific products that we want to make. Every kind of product, therefore, will add new lower and upper boundaries and increase the complexity of the operation. It will not be possible for the machine to work like the manufacturing program in our thought experiment with its single range.

Nor can we have some simple process which runs through the recipes for various items with the ones we want being selected in some simple way: the ones we want represent a complex, very specific selection from the set of objects that we can imagine some simple machine making. We could force the particular chocolates made by the machine into a continuous range by specifying the recipes in some contrived way that did this – you can force *anything* into a continuous list by doing that – but this would merely make the recipes very complex: it would be a contrivance and would not solve the problem. We discussed, earlier, the possibility of effectively random selection from the range. This will not solve the problem either: a specific collection of sweets and chocolates is needed, so it cannot be random.

Further, it would be ideal, for reducing complexity with a single range if the lower and upper bounds could be expressed with minimal information – or at least little specific complexity would be needed if they could be arbitrary. This condition, however, is not even close to being relevant: we do not even have the single range there, or even few ranges in comparison to the number of sweets and chocolates.

We might imagine a version of Swinburne's chocolate machine that did not have this limitation – that would produce a continuous range of sweets and chocolates which included the ones we wanted to make, such as Mars Bars and Milky Way bars. Such a machine would probably make billions of different products, and hardly any would be of interest. If you were to watch the machine working, it would probably just appear to be making a mess. You might have to come back at the right moment to "catch" it making one of the products that it is supposed to make.

Swinburne's "chocolate machine" analogy seeks to persuade us that a machine producing very specific things would be more complicated than any of those single things, but our "manufacturing program" thought experiment showed that anyway: making lots of specific things is more complex than making simple things, or can be done in few ways, while making lots of things without enforcing any specific requirement on what they are like can be simple, or can be done in many ways.

Swinburne's analogy is inappropriate as a comparison with a very wide multiverse because it involves a system that is producing very specific things – things that people will recognize as sweets and chocolates, that will look attractive and that people will want to buy and eat. The things made by Swinburne's chocolate machine meet a complex requirement. It is as if they have been through a complex selection process before they go onto the list of "things that will be made by the machine". It is the complexity associated with this specificity that makes its task very complex. The whole point of a very wide multiverse, on the other hand, is that there are no such restrictions. It is not producing or containing a range of things which meet some complex requirement. It is not producing or containing things that all appear to have gone through some complex selection process. A lot of what it produces or contains might appear to be a random mess – specifically the kind of thing which is *not* produced in Swinburne's chocolate machine analogy.

Swinburne's chocolate machine analogy has things backwards. It is presenting us with a machine that only produces a specific kind of thing when this is supposed to be what is *explained* by a multiverse view – not to be the view itself: it confuses what is supposed to be explained with the explanation.

5.3 Further Comments on Swinburne's "Chocolate Machine" Analogy

Our complaint about Swinburne's chocolate machine has been that it is too specific – it makes things of a special kind – and that is what makes it complex. Against this, someone could argue from incredulity – that it is hard to imagine a simple machine that makes all these billions of different things, some of which are sweets and chocolates and some of which are not.

A problem here is caused by our everyday concept of what a machine is, and the limitations of everyday machines. An everyday machine is generally deliberately designed to be specific: the people buying the products of these machines have specific requirements and expectations, and they expect the products from the machine to be of some predictable kind. Now, suppose we imagine some chain of causation that gives rise to something. Some event happens early on, then another, then another and so on – ultimately ending up with the specific thing. We might imagine various "forks" in this process, where the process might have been directed down a branch towards making some other thing. The early stages in the process might be imagined as very general and able to produce many different things, and as the process continues, specific steps are selected, and taken, which move the process in the direction of a specific product.

Because machines made by humans tend to need to be predictable, they tend to intervene at a very late stage of this chain of causality. In other words, a machine that makes chocolates is built to work "very close", in a causal sense, to the specific end-products that it makes. A "machine" tends to be adapted towards a specific end-point of this causal sequence – though we might argue that machines such as industrial robots are intended to be more general. One way of viewing this is that this tree of causation has occurred in the design of the machine. The designer of the machine has made some basic decision, where he could have chosen one thing or another – and he has taken the decision to go down a particular route to get a machine which manufactures the products he wants, then he has taken a further decision, and so on. An everyday machine tends to be the end-point of some route through this tree of decisions which adapt it to making some specific thing. Effectively, each time the designer makes a decision he is specifying what the machine is to make in more detail.

This means that the idea of adapting an everyday machine to producing very different things is usually not practical: it would mean going right back through this chain of decisions to an earlier stage and changing the machine completely.

Further, machines made by humans have to work with what is already there, in some specific situation that humans find themselves in when they use the machine, and they often have to work in indirect ways. This means that some of the complexity that might appear to be involved in a manufacturing process might not really be because the task is really complicated, but rather because a more direct route is not accessible to us. In a sense, to solve a problem, humans have to "grab" specific things from the environment or from science and use them to achieve a specific end.

An example for this is provided by transmutation of elements. Humans can do this to a limited degree, but they do not have general control of the process. Suppose we wanted a machine to turn hydrogen, through transmutation, into any other element in the periodic table. Such a machine would be beyond our current capabilities, even though we can already do some limited transmutation. Is this because more general transmutation is more complicated? This is, in fact, not the case. Transmutation of hydrogen into other elements is *easy*. You need merely get a lot of hydrogen and leave it in space, so that gravitational collapse occurs. As this happens, fusion reactions start and transmutation of elements begins. The process starts to run through the periodic table, making progressively heavier elements. Humans might imagine making a transmutation machine that worked on that principle – yet it is currently beyond us in a way that does not really relate to the complexity of the process itself. We might imagine future humans actually doing something like this (though it may be hard to think of a reason why they would want to, especially given the very long wait for results), and the process performed by those future humans would be complicated: we can imagine all the technology to collect and deliver the hydrogen, the whole administrative structure of the project, and so on, but this is not really any complexity in the basic process of transmutation, but rather complexity associated with the limited position of humans in reality when they try to get access to something that their position does not predispose them to access easily.

As a further example of this, consider a man at the bottom of a deep hole. In the hole with the man, are various things that might, if combined in some complicated way, allow the man to make a structure to climb out of the hole. Outside the hole, above the man, near the edge, is some cheese, some bread and a knife. The man is challenged to make some cheese sandwiches. To do this, he needs to climb out of the hole, but to do this he must do various complicated things with the other items in the hole to build something that allows him to climb out. To the man, therefore, making the cheese sandwiches is a complex task – but it would clearly be absurd to say that this means that cheese sandwiches are complicated. It is the man's limited position in reality that makes the production of cheese sandwiches complicated. We need to be careful with analogies about making things.

If we did try to build a general version of Swinburne's chocolate machine, then, it may not look as machines generally look. We will now consider two possible ways it might be done: molecular nanotechnology and robotics.

One way in which we might imagine such a machine working is with K. Eric Drexler's idea of "molecular nanotechnology". [15,16,17] This is the idea of machines that can work in a very general way at a nanometre scale, able to make practically anything that can be made out of atoms and specified formally. We might imagine a nanotechnology version of Swinburne's machine, with some supply of raw ingredients being fed into it through pipes, and some computer program directing the machinery to make things. The program run could be like the one in the "manufacturing program" analogy: it could just step through every recipe within some "range". Nanotechnology that can work in this way is currently beyond human capabilities, and solving the problems needed to build such a machine would be complex, but this does not mean that such a machine would actually be complex. It should be noted that there is some criticism that questions the feasibility of Drexler's idea, some of this coming from Richard Smalley, who said that the idea of "mechanosynthesis" used by Drexler is not viable, and that things like bone can only be made in complex, indirect ways [18], but if such criticism proved to be well-founded it would merely bring us back to the earlier point: that human technology often has to work in indirect ways that complicate things beyond any actual complexity intrinsic to the things being made.

We might imagine another version of Swinburne's chocolate machine, which I will call "the robot chef". This machine has a set of manipulators, that work like human hands and fingers, maybe sensory devices, such as cameras, a feed of ingredients that would typically be used by a machine to make sweets and chocolates – through pipes, and a control computer. We might give the machine access to some simple tools, such as knives, and it should not be too unreasonable imagining it having access to some tools that can change shape to some degree, such as moulds, or maybe some tools that can be used to produce other tools that may be needed for particular sweets. We could just use some variation of a machine like this that behaves randomly. It will make a huge variety of things given enough time. We can then simply wait for our sweets. Alternatively, we could write a program that behaves like the very general program in our "manufacturing program" analogy, stepping through all the possible control programs in sequence.

The possibility, even in some philosophical sense, of such a machine should be devastating to Swinburne's position, because it should show just how absurd and contrived his "chocolate machine" analogy is. Of course, such a machine would spend almost all of its time making a useless mess rather than any useful products, but it is the fact that it can hit on all the specific sweets and chocolates we want occasionally, and that it can do this without the huge complexity that Swinburne claims it would need, that exposes the fatal contrivance in his analogy.

Some people will find the idea of such a machine absurd, making an issue of the time it would take to produce anything useful, but to do this would be desperation and, it should seem, an admission that Swinburne's attack on the multiverse hypothesis has failed and you need something else. Any criticism of such a form about a general machine like this is essentially about the huge time scale it needs to operate, but a very wide multiverse is able to generate or contain all these different possibilities because of its huge "size" in some kind of general sense of the word. Saying that such a machine is implausible, as an analogy for a multiverse, because it would take too long to make certain things, is really saying nothing more than that a very wide multiverse would be implausible on account of being so large.

6 SWINBURNE ON "NOTHING"

An important idea in our argument has been that "nothing" is not a natural state of affairs (or lack of one: the semantics argument here could get silly), but is actually the most specific idea imaginable. There may be many ways to arrange the grains of sand on a beach, or there may be many ways for different laws of physics to act, but there is only one way that there can be nothing – and that is by having nothing. The specificity of nothing is total, and that makes its implausibility total.

This total specificity of nothing seems to be lost on theists like Swinburne, who argue that "nothing" should be a more natural state of affairs than "something", and that we should therefore want to know why anything exists at all. Swinburne says:

"It is extraordinary that there should exist anything at all. Surely the most natural state of affairs is simply nothing: no universe, no God, nothing. But there is something. And so many things. Maybe chance could have thrown up the odd electron. But so many particles!" [3]

As we have said earlier, it really only makes sense to consider reality in terms of observer-centred worlds, so the question of "Why is there something rather than nothing?" would really become one of "Why, when I look into reality, do I see something rather than nothing?" This is not an attempt to use some kind of anthropic argument to say that something must exist for you to look out on it. An observer centred world is merely a view of reality from some vantage point, and you might even wonder why your own cognitive faculties exist in "your" observer-centred world.

Nothing should not seem a natural possibility for your local reality because of its high specificity. If we accept the concept of "things" at all – that it makes sense to talk about a reality consisting of things and relationships between them, then as soon as we have done that we are obliged to accept that the more ways there are for a situation with some feature to exist, the more likely it is that that situation exists – and yet there is only one way for nothing to exist. The very idea of things implies that there are lots of things. At this point a theist might ask why the possibility of things existing makes sense. Why do we not live in a reality where the concept of "things" is nothing more than a mathematical abstraction – if that? Whether that is a well-formed question or not, there is no way that God can possibly answer it: he is, himself, a "thing". You need to accept the logical possibility of being in a reality with things before you can accept the possibility of God – and once you have done that, the idea of "nothing" is made implausible by statistical ontology.

Exactly *what* is it about "nothing" that theists like Swinburne find so "natural"? In arguing for the existence of God, Swinburne makes an issue of the specificity of our universe and all the other ways things might have been. [1] Yet, when it comes to thinking about "nothing", Swinburne seems to throw out this idea of "all the other ways things might have been" and instead appeals to some different measure of plausibility – some "obviousness" that less stuff is more likely than more stuff – even though more stuff means less of the specificity of which he seems to disapprove when it comes to multiverses, and less stuff means more of this specificity. It seems that Swinburne is using different criteria for deciding what is "obvious" – what is plausible – for different things.

Are we supposed to think that theists like Swinburne like specificity, or not?

7 CONCLUSION

Theists often claim that the universe is ordered in a specific way that causes humans, or intelligent life in general, to arise in it and that this needs explaining. God is offered as a possible explanation, and anyone disagreeing with this is challenged to offer a better explanation. One response we might offer is that no explanation is needed, or that the universe is not as specific as claimed by theists. Further, we might question the idea that God is plausible as an explanation anyway. If we want to offer an explanation, we can suggest that we are in a multiverse – a very large system of many universes, of which our universe is just a small part. If a multiverse contains many universes, then the chance that it should contain some that allow the existence of life should seem higher. Most of the universes would be inhospitable to life, or would even be in a disordered state, but observers would never see those universes. Observers would only ever see the universes which are ordered in such a way as to allow the existence of intelligent life. This can be considered to be an application of the weak anthropic principle.

In his book, "Is there a God?", Richard Swinburne argues against the multiverse explanation as an alternative to God. He says that if a multiverse were narrow in the sense that it contained universes all of the same general kind, such as ones with the same general laws of physics, varying only in some limited way, such as with regards to the values of the physical constants, we would still have the problem of why the general rules of the multiverse which determined the general kinds of universes that existed applied, and some other rules that a multiverse might have that made the universes to which it gave rise inhospitable to the existence of life. Swinburne says that we might try to deal with this by postulating a very wide multiverse – one that gives rise to universes of many, very different kinds, but he says that such a multiverse would need to be much more complex than any of the individual universes to which it gave rise. Because of this, says Swinburne, any observational evidence that we are likely to obtain could be more plausibly explained by a narrow multiverse – if we even have to resort to multiverse explanations at all. The amount of observational evidence needed before we would have to prefer a wide multiverse over a narrow multiverse would be enormous, and we are never likely to obtain enough evidence for a wide multiverse by observing reality, which is all we can do.

Swinburne uses an analogy to support his argument: that of a machine that makes chocolates and other sweets. Swinburne says that a machine which made many different kinds of chocolates and other sweets would have to be more complicated than a machine which merely made one kind of sweet.

Swinburne's argument is severely flawed.

Swinburne's claim that a wide multiverse would need to have general rules that are much more complicated than any of the individual universes to which it gives rise can be refuted by example. A computer program which generates many other computer programs can be very short and simple, even though it may be generating programs that are very complicated.

Swinburne's claim that a huge amount of observational evidence should be needed for us to believe in a wide multiverse has been refuted in the most extreme way possible: by showing that no observational evidence at all should be needed to think that we are in a wide multiverse – that, on philosophical grounds alone, we should think that we are in a maximally wide multiverse that implies a kind of modal realism.

The first step in such an argument is to demonstrate that, from your point of view, an infinite structure of relationships between things extends from your basic perceptions. Your view of reality involves things that are associated, directly or indirectly, with your perceptions and with each other, by relationships. You can consider the set of possible formal descriptions of your "local reality" out to some number of relationships, C_1, away from your basic perceptions, with the description length being limited to some maximum value, and the probability that your local reality has some feature should be regarded as the proportion of such descriptions of this local reality that have that feature. Your local reality out to C_1 relationships away should be considered as being embedded in some larger, formally described reality – and here, we are not assuming that anything is out there: the formal description of this larger reality, in principle, could merely not say *anything*. To find out what your local reality is like "further out" you can increase the number of relationships out from your basic perceptions to which you will look to some greater value, C_2, and consider the set of formally expressed descriptions of such a local reality. The requirement that a formal description of reality only describes one that extends out to C_1 is extremely specific – it limits the kinds of local realities that can be described – and as C_2 increases it gets still more specific, meaning that the proportion of formal descriptions of local reality in which the pattern of relationships only extends out to C_1 tends towards zero. This means that you should be sure that the pattern of relationships in your local reality will extend further than C_1. C_1, however could be any number – so the pattern of relationships – the structure of your local reality – should be expected to extend without end from where you are. An infinite structure of relationships has therefore been established.

The next step is to show that this infinite structure corresponds to a very wide multiverse. Consider your immediate local reality, out to some number of relationships, C_1, away from your basic perceptions. You can construct a set of possible formal descriptions for that local reality, and so obtain an idea of the probabilities that it has various features.

Consider a larger version of your local reality, out to C_2, in which your immediate local reality out to C_1 is embedded. In principle, the pattern of relationships in your immediate local reality out to C_1 could be the same pattern that you see out to C_2, but this would be restrictive: there are not many ways for a corresponding formal description to be expressed. There are many more ways for a formal description of local reality out to C_2 to be expressed in which your local reality out to C_1 is a special case. This effect will become more pronounced as C_2 is increased, effectively making it certain that local reality out to C_1 is a special case of some more general pattern.

But this argument could then be applied again to local reality out to C_2. We could look beyond C_2, out to C_3, and use the same argument to say that local reality out to C_2 must be a special case of some more general pattern.

Some formal descriptions of local reality would "turn inwards", describing some part of local reality in ever-increasing detail. We should limit the "depth" or "level of detail" of such descriptions in some way to ensure that the formal descriptions we are studying are "looking outwards". This may seem a contrived way to get the set of formal descriptions describing a larger reality – but it is only a special case of focusing on some part of reality and examining the statistics of its possible descriptions. That it may seem obvious that a maximally wide multiverse has to follow from all this is merely due to the obvious truth in the idea.

The implication of this is that, as you look "further out" from your basic perceptions, your local reality should become increasingly general, and your own immediately local situation should become an increasingly special case. The implication is that you are in a very wide multiverse. In fact, it is a maximally wide multiverse, implying a kind of modal realism.

Swinburne's argument that we should need a huge amount of observational evidence to accept a very wide multiverse is therefore refuted: we should expect, purely on philosophical grounds and without any specific observational evidence at all, to be living in one.

It may seem like an extreme step to believe in modal realism, but it should really seem natural. We only have the idea of an external reality at all because we generalize from our basic perceptions, and we apply this generalization in increasing degrees to form our world view. The nature of what we do here is often hidden by us because we do it intuitively. For us to stop generalizing at some point, and not to think that what we knew about was a special case of something else would be inconsistent: if you do that, you may as well believe that the basic perceptions that you experience right now are a special case, and that there is no reason to believe in everything else. That, of course, would be solipsism, but we can consider this refusal that some people will have to extend generalization past some point to be a "little solipsism".

Swinburne uses the "chocolate machine" analogy to support his argument, pointing out that a machine which produces chocolates and other sweets that can produce many different kinds of chocolates and other sweets would be more complicated than one which produced just one kind of sweet in different sizes. The intended implication is that a multiverse would need to be more complicated than any of the individual universes to which it gives rise.

The problem with Swinburne's "chocolate machine" analogy is that it is contrived. It uses the example of a machine which produces things of a specific kind – all satisfying some particular, complicated requirement. The analogy is contradicted by the computer program analogy described earlier. A consideration of the computer program analogy shows that making many different things is simple when the descriptions form a "continuous range". Generalizing, we can take this as meaning that it is simple to make lots of things when they are members of a set which can be described in a simple way, and when the things being made are not selected from this set according to some more complex rule. Swinburne's analogy does not meet this requirement.

Swinburne, like many other theists, seems to think that the existence of "nothing" is more natural – that we need an explanation of why there is "something" rather than "nothing". However, this looks like a double standard. He seems to find the claimed specificity of the universe – the fact that we are in this universe when many different possible universes in which life does not exist might be imagined – implausible, and in need of an explanation. Yet when it comes to the idea of "nothing" – an idea that is obviously specific – Swinburne seems to use different criteria when deciding what seems plausible.

Swinburne's argument that a very wide multiverse is implausible has thus been refuted. As his case for the existence of God relies, to some extent, on this argument, his case for the existence of God has been weakened.

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