Nothing Exists and Only Nothing Exists

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Abstract

Why is there something rather than nothing? About this storied question we challenge the commonly accepted main assumption: the existence of something. We show that it is preferable to conclude that nothing exists, or to be more precise that only “Nothing” exists. We explain how our perceived reality emerges as an illusory self-referential interpretation of Nothing and build a framework to give precise definitions to fundamental concepts such as existence, reality, nothingness and somethingness. We then explore the consequences of this framework and we discover an explanation for the existence of laws of physics in our reality. This result can also be interpreted as the first instance of an assumption-less theory.

Introduction

Why does anything exist at all? Why not nothing? This question has been asked many times in the past and Heidegger called it "the fundamental question of metaphysics”. Among thinkers that do not consider this question ill-posed, multiple classes of explanations have been proposed over the years: God, Nothing is an absurd state, something just is, the existence of a necessary being [leibnitz], infinite recess, and many more.

To hope to get closer to a meaningful answer, one may be interested in figuring out what is truly fundamental, what entities ground anything else. Once this elite set of entities is understood, it should be perhaps possible to understand why such entities must exist. In the language of physics, we are asking what is the least possible number of assumptions we can use to create a theory describing our universe.

Motivated by these questions we explore the limits of what can be described when many of the entities we usually assume are removed. Bringing this limit process to the extreme, we are left with Nothing, a state where no things are present. The (bold) claim of this paper is that this should not be seen as a dead end, but rather a consistent theory of our reality, if one is ready to make a leap into an uncomfortable truth: Nothing exists. If this is correct, our experiences and our reality are an illusion, albeit a coherent one.

Any such statement should evoque an incredulous stare and demand for an explanation on how an apparent something can even arise out of Nothing. We do just that, in the context of a string representation built out of “Nothing building blocks”: we show how observers arise and how their limited observation power makes the experience convincing.

Finally, we explore the role of universe-simulators such as computers in describing our reality, which allows us to draw conclusions on the existence of regularities and laws of physics in our universe.

The main contribution of this paper are the following:

-We answer negatively to why anything exists at all, arguing that Nothing exists.
-We explain how this is compatible with our observations.
-We propose a new sense in which an apparent transition from nothing to something is meaningful.
-We give a mathematical framework to define and use concepts such as existence, somethingness, nothingness.
-Equipped with such a framework we explain why the laws of physics are present in our reality.
-We provide the first instance of an assumption-less theory.

The main inspiration behind this work comes from the latest development in theoretical physics, especially quantum gravity, where the role of space and time is increasingly seen as emergent from a more fundamental timeless theory. This progressive erosion of fundamental concepts leads to the idea of reality being writeable as a static string. That said, no knowledge of these areas will be required to understand the core arguments of this paper. The reader may benefit from being familiar with basic notions of computer science, information theory and algorithmic information theory.

Related Work

TO BE ADDED, to plug references in the whole paper

Main Results

An Assumption-Less Theory

Answering why there is something rather than nothing is deeply tied to understanding what is fundamental, since it allows us to focus our investigation on a few entities. First of all, what do we mean by fundamental entities? The concept of fundamental is a relative attribute between two entities and it is closely related to the concept of grounding or ontological dependence. An entity B is less fundamental than an entity A, or equivalently entity B is grounded by entity A, if the existence of entity A is dependent on the existence of entity B. For instance a mosaic is grounded by the small stones it is made of: without the stones there is no mosaic. Notice how no notion of causation is implied in the concept of grounding, there is no need to introduce time or actions between entities.

Historical trends in theoretical physics have seen theories explaining our universe with increasing levels of simplicity, by unifying different quantities into underlying more fundamental entities and laws. From the fields of quantum theory to the space time in general relativity, few pages of text would suffice to predictively describe the vast majority of phenomena we experience. In this work we want to continue on this trend and bring it to the extreme, investigating how far we can go in describing our universe with a minimal set of assumptions. This should supposedly shed light on why something rather than nothing: since any assumption is describing something, we may be able to justify that postulating the existence of something is an unavoidable state of affairs.

We shall begin by considering the current theories of physics and progressively eliminating entities and assumptions from our picture of reality.

To start, it is not hard to imagine unifying gravity and quantum theories into a more fundamental quantum theory of gravity, indeed many proposals have been made for such a theory. In this theory few fundamental entities will describe any physical process happening in the universe.

But let’s go further, beyond purely physical concepts. We can then take a nominalist view of reality, saying that abstract entities do not exist, and are simply labels that we give to material entities. In a similar vein, mathematics and physical theories do not exist, they are simply symbols we use to speak about the physical universe. Ultimately these symbols are patterns of information encoded in our brain, which themselves are specific configurations of the neurons or other smaller constituents of our physical bodies. Mathematical theories and entities not existing include logic, numbers, relations, falsehood and truth.

In line with a materialistic view of reality, the physical constituents of our bodies and the universe can be assumed to be everything that exists. Therefore the mind or the consciousness are emergent patterns from the more fundamental components of our body.

So only physical components remain. We will keep using mathematical theories to describe them, but this description should not be confused with the universe itself they describe. As a further step, we can consider time and space to be non-fundamental. Indeed one can see space and time as emergent properties of a more fundamental purely quantum theory, in which the quantum fields are all that exists. One can then describe the universe given the existing fields.

One could then remove these fields and any concept of relations and separation between them, remaining with a monistic view of reality, in which the single remaining entity, the background, is in fact the whole universe. We shall now remove this entity.

It would seem that now very little is left to build a universe with, but one could still imagine an objective probability distribution of something happening being present. Let us now consider a theory in which there is no notion of probability, randomness or any sort of possibility. No causation, no time, no space, no entities, no potential for any entity to be present.

In case anything else unaccounted for is present, we will remove it. The order in which we removed entities is not really important, any order will do.

Where have we arrived? What is left? By definition, we are left with Nothing [footnote we will use a capital N to distinguish Nothing from the common usage of the word nothing], the result of removing any instance of something. In this theory nothing exists, or alternatively: only Nothing exists. [footnote It's worth paying attention to the language here: Nothing is not something or an entity called Nothing.] Trying to also remove Nothing is pointless, there is nothing to remove in the first place. So we can say that our theory has no assumptions, or equivalently our theory is assuming only Nothing. Notice how an assumption-less theory is unique: any theory with no assumptions is equivalent to the theory we are describing.

This seems like a dead end for a predictive theory. We went too far in our quest to remove assumptions and it seems now impossible to get anything meaningful out of nothing, let alone our whole universe. Since we made no assumptions at all, there is no mechanism able to give us something out of Nothing.

Yet, this raises an interesting possibility. There is no need to get something out of Nothing if nothing exists. If our reality does not exist, there is nothing to generate out of Nothing, or nothing needed to exist to explain it. But we certainly seem to exist.

In the next section we will explain how our perceived reality emerges as an illusory self-referential interpretation of nothing, implying that an assumption-less theory may be the true fundamental description of our reality. In other terms, our reality is grounded by nothing. In the following sections we will conveniently refer to this theory as N-theory ("N" stands for Nothing).

Notice that attempts to knock down the exclusive existence of Nothing with the metaphysical equivalent of the liar paradox (“Nothing exists” as a proposition is something, so there cannot be only Nothing) are unsuccessful, since we are claiming that ontologically nothing exists (including propositions, logic, descriptions, etc.) and the in any case the description we use for Nothing is separated and independent from Nothing itself. See for instance [34].

Out of nothing

First of all, what do we mean by “our reality does not exist”? We certainly do experience it, all the time! To understand the meaning, let’s consider Santa Claus’s reality. It is a well known fact (in adult age!) that Santa Claus does not exist, yet we can clearly imagine Santa Claus’s reality, a reality where Santa Claus does exist and uses magic to bring presents around the world. We can for instance imagine Santa Claus contemplating the obviousness that his reality exists, unaware of being inside a fictional reality that we created. The claim of this paper is that we are Santa Claus. Where this analogy breaks down is when considering who “creates” the fictional reality. Santa Claus’s reality is a shared mental pattern of the human species. Instead our reality (or the tower of realities below us) is a pattern ultimately grounded by Nothing.

A pattern in what? And who observes the pattern? That is, how does our reality emerge from Nothing? To understand it, take the concept of Nothing and without loss of generality let’s label it 0. Here, notice how “take” has no real meaning, there is no passage of time, the symbol 0 does not exist and so on; but let’s pretend this is possible for now, we will relax this assumption later and we will give a more formal explanation of these concepts. Right now let’s focus on an intuitive understanding of the emergence of our reality. Adding Nothing still gives Nothing, so we can imagine the symbol 00 representing the addition of nothing to itself. Or borrowing symbols from traditional mathematics we could write 0 = 0 + 0. For simplicity let’s now define 00=1, or 0 + 0 = 1. This of course implies 0=1 and indeed 0=00=1, since ultimately 0 is the only existing concept. What we are really doing is just relabelling Nothing. Similarly 0 = 00 = 000 = 0000…., which using 1 for ease of notation we can write as 0 = 0010101011111010010101 0…. where the string on the right can be arbitrarily long.

If we now focus on the binary string itself, armed with enough patience we can find the encoding of a computer[footnote: For instance we could find a substring with the definition of a Turing Machine, an abstract model of computation]. If we look long enough we may be lucky enough to spot the encoding of a running computer program with our reality as an output, including human observers seeing and experiencing our universe, together with mathematics, eyes, language and everything else we use to explore it.

This is our reality: the encoding of the string. But deep down it is a trivial encoding, equating every symbol and every possible combination of symbols to 0. We never moved from the starting position.

It’s worth recapping what “happened” here:

1. Only Nothing Exists.

2. We defined some symbols grounded by Nothing and built a string out of those symbols. These symbols, the concept of a string, etc. does not exist at step 1, but appeared here at step 2 nonetheless.
3. The complexity of the string grew enough to find patterns into it, as defined by some encoding of our choice. In fact inside those patterns we found a pattern able to describe our universe.
4. Given our universe and the languages we used to describe it, we now have all the concepts which we encountered in step 2, which justify how we transitioned from step 1 to step 2 in the first place. Notice that the steps are not in chronological order, as the concept of time emerges somewhere in the string describing our universe.

Some words about the encoding of our universe into the string:

1. The symbol “0” itself has only meaning inside our apparent reality. There is nothing special about this symbol, or any other symbol.
2. There is nothing specific about the encoding of the string or the fact that we found our reality encoded as a computer program, it is simply a convenient way to find our reality out of Nothing, but it is not the only way. Another way for instance would be to encode our reality “directly”, by using a dictionary matching substrings to elementary particles and laws of physics.
3. Who chooses the encoding? We choose it by interpreting the string that makes us in a language that we are familiar with (mathematics, computer science, etc.) of our choice.

The meaning of Nothing → something

Does the transition Nothing → something, let alone Nothing → our reality, ever truly happen? Does step 1 ever lead to step 2? No. The transition Nothing —> something never really happens, it is just our interpretation of how we came to be (we did not at the most fundamental level, there is no mechanism for it), a metaphor using terms and notation from our reality. In particular, N-theory is part of our reality too and does not have any fundamental status.

Another angle to understand this illusory transition is the following: the transition nothing —> something is something that “could" happen in principle. Once that something exists, it could behave in a certain way, for instance exactly as our universe. But it always remains at the level of “could”, while nothing actually is. So, we live in a potentially existing universe, and what we see is our potentially existing experience. How “likely” something is in one reality or in the overall space of all possible realities will be explained shortly.

It is also worth stressing that the relation between nothing and our reality is a grounding relation, not a causal relation.

In summary, out of Nothing it is possible to have an illusion, an entity which fundamentally does not exist, self-referentially explaining to itself how it came out of Nothing.

Strings of Nothing

We argued that strings of Nothing building blocks are a convenient representation, as opposed to directly presenting the realities they encode. In this and in the next chapter we will further show why this is the case.

How many strings are there? All of them. More precisely, all the finite and infinite strings over the binary alphabet can be generated (in computer science lingo, respectively the Kleene star Σ^* and the SIGMA_omega Σ^ω, that is SIGMA_INFINITE Σ^∞). In the absence of any cost (including time) to add a symbol, all the strings indeed will be generated with no exception. Or equivalently, if a particular illusion is possible, all possible illusions should be possible too.

Now, it may seem paradoxical that an infinite amount of information can be extracted from Nothing, but actually there is no contradiction since a set containing all possible combinations contains no information. There is only one state associated with it, which is the state of all the possible combinations of symbols. This is analogous to the information content of the Borges's library of Babel or the digit-strings found in the digits of the number pi, which is conjectured to be a normal number. Yet, a lucky observer experiencing a particularly meaningfully ordered room of the library of Babel may be under the erroneous impression that the whole has meaning.

This is exactly what is happening to us: being part of one of the strings we are limited in our appreciation of the set of all strings, and we are tricked into seeing something meaningful.

The existence of all possible strings is reminiscent of modal realism, in which all possible worlds exist, are causally separated and are as real as our world. Some core differences between strings and worlds are that strings are far from being irreducible and more importantly that the strings are only meta-existent (only Nothing exists). Speaking of existence, we can now use the string formalism to define important concepts such as Nothing, Something and existence.

Definition of something and nothing, existence

Here we present some definitions together with the intuitive understanding behind the definition (the latter should not be taken literally).

Definition: Somethingness, S: s $\rightarrow$ N, S(s) = l - 1, where l is the length of the string representation in base 0. So S("1") = 1 = S("00"), while S("0")=0.
Intuition: Long strings have many properties (substring defined as properties), so high somethingness objects can be characterised in many ways.

Definition: Something, s such that S(s) > 0.
Intuition: A blob with some features, where the features are defined by some language defined on the blob itself.

Definition: Nothing, s such that S(s) = 0.
Intuition: A blob with no features and without the blob.

Definition: s-existence (string-reality), sE: t, s → {0,1}, equal 1 if t is in s, and 0 otherwise.
Intuition: The object can be found inside such a universe.

Definition: u-existence (universal-reality), uE: t, SIGMA_INFINITE → [0,1], uE(s) = 2^(-(l-1))=2^(-S(s))
Intuition: Objects which can be found often and inside a large number of universes are more fundamental.

Definition: Being real, u(E(t)) = sup(uE(s)) for all possible s.
Intuition: A fundamental object.

Definition: Being meta-real, u(E(t)) < sup(uE(s)) for all possible s.
Intuition: A non fundamental object.

In this string representations things can “borrow” 0 and 1s to establish themselves, by giving up on being real and existing at the core level. Only Nothing is real, having the highest possible universal-reality value. Somethingness is inversely correlated to u-existence: long strings exist in a smaller region of the string space.

On Something existing instead

Can something exist? Said differently, is the lone existence of nothing we discussed necessary?

Here we present 4 arguments in favour of the necessity. None turn out to be decisive for similar reasons.

1.

Perhaps the strongest argument for necessity is the following: A system built out of Nothing is the only system which can prove its consistency, since the whole system is still Nothing. Indeed a Something system cannot normally prove its consistency or completely describe itself from the inside, but this is possible in the case of Nothing, since the whole is equal to the system to be proven, to the inside and the outside. The trouble with this argument is that while a well-behaved theory of Something should satisfy consistency requirements, Something itself may not require the need for a description or consistency, similarly to how Nothing doesn't.

[footnote] One could argue that Something may pass those consistency checks, after all one could relabel Nothing as Something. In our string notation, Something = “0”. But this is simply a semantic trick, which is contrary to any reasonable expectation we have on Something, that is not to behave as Nothing by definition.

2.

Similarly, Nothing is stable against any action or relation, including the “removal of”, “the absence of” and the “transformation into”. All of these simply map to Nothing itself. A similar critique to the above applies.

3.

Let’s assume something does exist. One could for instance imagine the whole universe existing as a brute fact or a single entity existing and giving rise to our experience in a similar fashion to N-theory, but with S in place of N. Even though such a theory can explain our experience, we just showed a similar theory which achieves the same result, but with fewer assumptions (namely not assuming the existence of something). Making use of parsimony arguments (Occam’s Razor) one must conclude that everything else being equal we should favour the explanation using less assumptions, therefore we should conclude that only nothing exists. Yet, Occam’s Razor has significance in our perceived reality, in which the concept of parsimony can be defined. So ultimately we cannot invoke this principle to discriminate against the possibility of something existing instead.

4.

Another argument can be made about the uniqueness of Nothing, given its featureless nature. Something by definition must have some feature, which implies more than one possibility for the feature and possibly the absence of it. But again, the preference for a theory with a unique configuration (with no adjustable parameters) is a bias of our perceived reality, not of the fundamental reality.

In conclusion, we argued that even though our experience can be reconstructed from Nothing only, something may exist after all. That is proving the necessity of N-theory seems too much to ask.

Nevertheless, when comparing the two alternative possibilities as theories explaining our reality, based on parsimony it is more economical to conclude that nothing exists, as we do for any other theory explaining observations.

Discussion

In this section we discuss various aspects and consequences of N-theory.

On the existence of the laws of physics

From N-theory we can derive the existence of the laws of physics in our universe.
To understand how, firstly let’s notice that the essence of the law of physics boils down to the presence of order in our universe. There exist repeatable processes, following the same patterns, as opposed to a chaotic universe in which the outcome of the same experiment

can give different results. So, we claim that N-theory can explain the existence of an ordered universe.

At a first glance it may seem that N-theory could indicate the exact opposite of order, indeed all possible strings are present, including gibberish universes. Even if we employ an anthropic argument to filter only the strings that feature enough order and complexity to sustain our experience there is a vast amount of universes identical to our universe in which the laws of physics do not exist. In some of those universes a ball left in mid air will fall, in others it will go up, in others it will explode without reason. In fact these gibberish universes vastly outnumber well-behaved universes due to combinatorics.

A key question now arises: how is our universe encoded in the string? A naive way to encode our universe is to do it directly: encode every single elementary particle and relationship between them and let them evolve. But there is a much more compact way of encoding our universe, which is to encode a computer simulating our universe. These computers are more likely to generate our ordered experience, indeed it is a well known fact that computer induced distributions on random inputs favour simple strings over complex strings for a given string length.

The typical example here is taking a monkey and tasking it to write the entire work of Shakespeare, which we assume to be 1 million bits long. The monkey will simply press keys at random. If we give the monkey a typewriter, the monkey will manage to reproduce it with probability 2^-1M. But if we give the monkey a computer, the computer will take the randomly written monkey keyboard input as a computer program and let the computer program perform the output. The probability of printing a string x given a random input is equal to the universal probability PU(x) [to add formula] which is roughly equal to 2^-K(x) where K is the Kolmogorov Complexity, that is the length of the shortest computer program outputting x. Given the compressibility of the english text, one can approximate K(Shakespeare) = 250000, so P= 2^-250000, which is incredibly more likely than obtaining Shakespeare from the typewriter monkey.

So we reach some interesting conclusions:

- Simulated universes are more compact, so they are more u-existent.
- We are likely to be simulated, rather than encoded “directly”. (here and in the following likely is synonym of being more u-existent)
- If we interpret the computer program code as the laws of physics, we are then likely to be in a universe with laws of physics.

The simulations we are considering are different from the ancestor-kind simulations in which the simulators are conscious entities; we are instead considering randomly instantiated computer simulations. While ancestor simulations can be shown to be unlikely under reasonable assumptions, here we argued that random simulations heavily outnumber non simulated realities.

It’s worth stressing that there is nothing special about computers, any reality simulator would do, where by simulator we mean a system able to simulate another system with less complexity/resources than the simulated system. But computers happen to be well

understood and practical, as opposed to simulators such as dreaming brains, brains-in-a-vat, and so on, so we will restrict to them.

On Science, Quantum Gravity and the Theory of Everything

In light of N-theory, how can we interpret the quest for a theory of quantum gravity, or of a Theory of Everything (ToE)? The traditional view of finding a mathematical theory able to explain all the physical phenomena present in our universe can be seen at the search for the encoding of the computer program running our universe.

What is science in N-theory? Traditionally science can be seen as the paradigm of creating a theory, performing an experiment and measuring the results. Since we have only access to the strings in which we are s-existent, science is the study of the strings in which our universe s-exists. In fact it is only the study of the substrings in which our universe is encoded.

The larger SIGMA_INFINITE space of all strings seems inaccessible to science. The good news is that we are present in almost all the space (a finite string has measure 1 in the set of all possible infinite binary strings). The final boundary of science seems to be to figure out the shortest program compatible with our universe, which perhaps deserves the name of Final Theory of Everything. Indeed even though different computer programs can give rise to the same universe, the shortest encoding is not merely more aesthetically pleasing, it is more u-existent.

[footnote] Of course one could give up on the usual computer programming definitions and choose a trivial encoding in which our whole universe is encoded in a very short string, or even a single character, but this would be pointless for the sake of extracting predictions for our universe. We will not enter into technicalities about the choice of the encoding chosen to represent the strings, similarly to how Kolmogorov complexities (length of the shortest program associated to a given string) are relative to the chosen language but the overhead of changing language is bounded.

One could hope to then answer a further question: why these laws of physics? Or equivalently, why this universe? Indeed one could hope that our universe is simulated by a program with a very special length: the length of the shortest computer program capable of simulating an observer experiencing a universe (:= L_sso). While there are other important lengths such as the shortest computer program capable of simulating self-aware entities, self-replicating entities or life, simulating an observer seems to be the minimum required to have a pattern in the string which can unequivocally relate to our experience. Indeed our experience of the universe may be apparent on multiple levels, buried under a tower of simulations, but it requires experiencing the universe in the first place. If our universe can be simulated with a program of length L_sso, that would make our universe more u-existent than any other universe, explaining why these physics laws and not others.

Conclusions

We argued how starting from Nothing only one can obtain a consistent description of how our reality emerges, where the consistency is from the perspective of us observing the universe. We argued that these observations are illusory, a self-referential manifestation of Nothing, since fundamentally Nothing exists. We labelled this assumption-less theory N-theory.

We argued for N-theory to be a possible explanation for our observations and therefore to be the preferred explanation in light of parsimony. We outlined some unsuccessful attempts to argue for the necessity of this result. It is an interesting open issue to establish if a necessary argument can be ruled out altogether or if necessity can be established.

We introduced precise definitions of concepts such as Nothing, Something and existence, based on a description in terms of binary string encoding grounded by Nothing. Such encoding is not unique, but it is useful thanks to the familiarity of this encoding in the context of computer science. It is an interesting question to ask if different strings encodings or different representations altogether can lead to further insights.

No attempt is made in this work to discuss morality and the right reaction to this “ultimate nihilistic” viewpoint, but it is certainly not the author's intention to imply that we should not live to the fullest in our reality (apparent or not).