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GOD IS RANDOM
A NOVEL ARGUMENT FOR THE EXISTENCE OF GOD

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Abstract

Applying the concepts of Kolmogorov-Chaitin complexity and Turing's uncomputability from the computability and algorithmic information theories to the irreducible and incomputable randomness of Quantum mechanics, a novel argument for the existence of God is presented. Concepts of 'transintelligence' and 'transcausality' are introduced, and from them, it is posited that our Universe must be epistemologically and ontologically an open universe. The proposed idea also proffers a new perspective on the nonlocal nature and the infamous wavefunction collapse problem of Quantum mechanics.

Keywords: irreducible quantum randomness, uncomputability, God, transcausation, transintelligence

1. Introduction

Randomness is unpalatable. People generally have noetic aversion to randomness. Random things are associated with lack of organization, order, and purposeful design, and it poses an undue burden on the intellect as the latter reflexively attempts to find a pattern and/or meaning behind them. Traditional theism holds that the telltale sign of God - a supremely intelligent being, among other attributes - is the absence of randomness and presence of order and design in the Universe. In agreement with that strand of thought, atheism holds that there can be no God, precisely because the natural laws seem to be driven by mindless, i.e., random, processes. Randomness thus universally seems to be viewed as an anti-thesis of intelligent behaviour.

The concepts of chance and randomness are closely related, albeit one can outline subtle differences between the two [1, 2]. However, I will not differentiate between chance and randomness in this paper. Specifically, I will deem any event or pattern that is unpredictable in space and time to be chancy and random [3]. Defining intelligence is even a harder task, which is not the purport of this essay. But to get my idea across, I will define intelligence as information reception, processing, and creation capability.

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Are randomness and intelligence indeed so at odds with each other? In this paper, I will argue that contrary to the common sense notion mentioned above, randomness and intelligence are related; specifically, I will propound the idea that the epistemic cost of unpredictable randomness is infinite intelligence, and thereby present a new *a posteriori* argument for the existence of God from the irreducible randomness of the quantum world.

2. Information, not matter-energy, as the ultimate currency in Physics

The traditional view of the fundamental building block of existence in Physics has been that of matter and energy, both of which was shown to be equivalent by Einstein. However, matter has been shown by atomic and Nuclear physics to consist mostly of empty space. Indeed, there have recently been some physicists such as John A. Wheeler, Anton Zeilinger, Paul Davies, Seth Lloyd and others who espouse and promulgate a related but different basis for physical existence: information. Information is increasingly taking on a pivotal role in black hole physics, Cosmology, and modern Physics in general [4]. According to this view, Quantum physics points towards an information-theoretic existence [5-8]. Reality rests upon ‘yes’ or ‘no’ binary answers (bits) given by nature to questions posed by observers (human or nonhuman). No questions, no answers, no reality. What fundamentally seems to animate existence is not mass, not energy, but information [9, 10].

Recently, some philosophers and theologians have also been arguing for an information-based existence in its modern sense. Philosophical theologian Keith Ward argues for an ultimate informational principle, which he identifies with God, as the basis of the existence of our Universe [11]. The said principle contains the set of all possible states in phase space with a value-based rule for selecting the states that will be actualized. Another philosophical theologian John F. Haught similarly proposes that we view the Cosmos and its evolution as an information system and informational process, respectively [12]. Haught opines that the observed delicate coexistence of order and novelty in our Universe lends itself to a paradigm of an evolving informational universe from which complexity and meaning naturally emerges.

This informational viewpoint of nature is, as it were, melding ontology and epistemology into what can be called ‘ontepistomology’, whereby the mode of existence seems to be information-based. What exists at the quantum scale seems not to be mechanical in character, but rather epistemic and informational. In fact, although the physics of the microscopic scale is referred to as Quantum mechanics, there is really nothing ‘mechanical’ about it as there is no underlying mechanism, and, as mentioned before, this is a point most physicists agree upon [13, 14].

Let us qualify and then make precise the concept of information. Philosophers and scientists usually distinguish between three types of information [11, 15, 16]:

(i) Shannon information, which deals with the signal carrying capacity of a physical system;
(ii) pattern-forming information, which deals with function-performing, shaping and construction capability of a code such as a computer program or DNA;
(iii) semantic information, which has to do with the meaning carried in a signal about something for someone.

In this essay, I will be referring to the second type of information, for it is the most basic one of all — that is, the other two have to be expressed in terms of the second one, as noted by Gregersen [16].

A related concept to information is randomness. Randomness is, like the concept of infinity, a difficult concept to grapple with. Randomness is an asymptotic property, meaning finite variations will not affect its degree of randomness. For example, an infinite string, say X, can begin with a billion zeros, a very regular and non-random behaviour, but that does not mean that X is not random. But since we are finite creatures and can only deal with finite objects, strings, computer programs, etc., it is paramount to have a concept or definition that will enable us to talk meaningfully about information and randomness.

Propitiously, we do have a very powerful mathematical tool from the algorithmic information theory to calculate the information and randomness content of pattern-forming or coding information in the concept of Kolmogorov-Chaitin information or complexity, also known as program-size complexity [17]. The Kolmogorov-Chaitin complexity of an object is simply the minimum computational wherewithal needed to specify the object. Put another way, the Kolmogorov-Chaitin complexity of an object is a measure of the absolute information content of the object. Following Chaitin, I will define it as follows [18]. For a string B of size n bits, the Kolmogorov-Chaitin complexity, H, of B is given as:

$$H(B) = n + H(n) \tag{1}$$

What equation (1) says is that for a given string, its Kolmogorov-Chaitin complexity cannot be much larger than the size of the string. If a string cannot be reproduced by a computer program, whose size is smaller than the string itself, then we say that this string is Kolmogorov-Chaitin random, meaning that it cannot be compressed to a size any smaller than itself. In the latter sense, randomness is defined as 'incompressibility' and 'irreducibility', and which I will refer occasionally as 'perfect randomness'. But is 'incompressibility/irreducibility' concordant with my earlier definition of randomness as 'unpredictability'? We first note that incompressibility/irreducibility of an object, which could be a string or a physical theory's predictions of a phenomenon, means that there cannot be a concise program/theory that enables the scientist to predict the outcome of the string or phenomenon other than employing the whole string or, in the case of the natural phenomenon, carrying out the experiment to obtain the results. Therefore, since physical theories are nothing more than some sort of algorithms

— as Chaitin pointed out, comparable to computer programs\ - not being able to have a deterministic theory for some natural phenomena, e.g. the quantum events, implies that the relevant phenomena are incompressible/irreducible and hence unpredictable. The latter point thus implies that the statistical randomness (e.g., Martin-Löf and Solovay's definitions of randomness) as encountered in the Physical sciences is equivalent to the Kolmogorov-Chaitin or program-size randomness of the algorithmic information theory. The technical proof of the said equivalence is given by Chaitin in reference [18].

Before proceeding to the next section, we need to state a most astonishing feature of Kolmogorov-Chaitin complexity: uncomputability [19]. It is impossible to calculate or find the shortest program that will output a given string [20]. This is a direct result of Turing's halting or uncomputability problem, which, in turn, is effectively a version of Gödel's incompleteness theorem. Briefly, the halting problem states that it is impossible to have a general computer program that will decide which program will halt and which will not. Gödel's incompleteness theorem states that if a formal axiomatic system is complete, then it will produce inconsistent theorems, if - on the other hand — it is a consistent formal axiomatic system, then it will be incomplete, meaning it will not have anything to say about infinitely many true mathematical statements.

3. Types of randomness

Having thus defined randomness as incompressibility/irreducibility/ unpredictability, one can make a natural distinction between two types of randomness:

i) Pseudo-randomness is reducible randomness. Such randomness can be reduced to a formula, hence contains a finite amount of information as measured by Kolmogorov-Chaitin complexity.

A good example to reducible randomness is the mathematical constant

$$\pi = 3.14159265358979 32\ldots \tag{2}$$

which is not Kolmogorov-Chaitin random as there is a concise formula that can calculate/predict its digits to any precision. Likewise the physical theories of general relativity and Newtonian mechanics can be viewed to represent reducible natural phenomena in their respective frameworks.

ii) (Perfect) randomness is irreducible or incomputable randomness. This is the Kolmogorov-Chaitin randomness. Any piece of information/program/ observation data must be laid out as is since it cannot be reduced using a formula. The information content of such randomness increases indefinitely with the length of the string, or if it is a dynamic system, with time. In the limiting case, the information content reaches infinity.

Strictly speaking, uncomputability and algorithmic irreducibility are not exactly equivalent [21]. Suppose the following random binary sequence is incomputable and algorithmically irreducible.

$$s_1 s_2 s_3 s_4 s_5 \ldots \tag{3}$$

Now, construct from equation (3) the following sequence

$$s_1 11 s_2 11 s_3 11 s_4 11 s_5 \ldots \quad (4)$$

Both sequences are still incomputable, but only equation (3) is algorithmically irreducible. Because equation (4) can be algorithmically reduced as it has a repeating pattern of 11s. This distinction, however, does not affect the validity of the argument presented here as the fulcrum of the argument rests on the uncomputability trait because even if one has an incomputable but algorithmically reducible pattern, the extent of the algorithmic reducibility is limited by its uncomputability, beyond which point the pattern will be necessarily irreducible.

Examples to irreducible/incomputable randomness are Chaitin's omega number (Ω) and quantum phenomena. Ω is the probability that a randomly chosen computer program will halt. It is defined as follows [18, p. 22]:

$$\Omega = \sum_{p\ halts} 2^{-|p|} \quad (5)$$

where $|p|$ is the length in bits of computer program p, and the sum is over all the programs that halt. It turns out that the digits of Ω are incomputable and irreducibly random. Ω is a very interesting number in that it holds the answers to the questions of number theory, for example the likes of Fermat's last theorem (which, of course, was solved by Andrew Wiles) and Goldbach's conjecture [22]. This is because such theorems and conjectures can be recast as a computer program, which can run and try all possibilities. The program will halt when and if it finds numbers contradicting the theorem or conjecture at hand; it will run indefinitely if it cannot find any contradictory examples and thus proving that the theorem or conjecture is indeed valid. Since Ω contains the halting probability of such programs, knowing all the digits of Ω hypothetically then would reveal the answers to all the questions in number theory [23]. Furthermore, by the irreducibly random character of Ω, Chaitin has effectively shown that Physics is not the only discipline that has an immanent randomness, but Mathematics also has truths for no apparent reason [18, p. 23].

In the case of quantum phenomena, although the Schrödinger equation is deterministic for the wavefunction itself, the physically meaningful entity is the square of the modulus of the wavefunction, and that corresponds to a probability, resulting in an indeterministic/unpredictable reality. More on the randomness of the quantum world is in the next section.

4. Irreducible randomness of the quantum world

According to Quantum physics an irreducible and ineluctable randomness forms the basis of the laws of nature at the atomic and subatomic scales. The unpredictability and uncertainty of quantum processes arise from an immanent indeterminism, apparently without any mechanism [13, p. 316; 14, p. 115].

No physicist will ever know when an excited atom will get de-excited to its ground state, or tell us the exact time of the next decay of a sample of cesium-137 radioisotope. Similarly, the realization/observation of only one eigenstate from many possible eigenstates (in a superposition of the said states) in an experiment is not only unpredictable, but the manner in which it happens seems to be beyond our hacking. The latter issue goes by the capricious name of 'wavefunction collapse'. The time evolution of a quantum state is governed by the Schrödinger equation and is called unitary evolution. The problem is that wavefunction collapse is not a continuous process, and the Schrödinger equation does not tell us anything about it. We simply don't have any clue as to how a superposed quantum system, upon measurement, reduces to a particular state and why. Wavefunction collapse seems to be a non-algorithmic process.

Most physicists agree on the inherent random nature of the microscopic scale. However, a small fraction of them still invests hope in the so-called hidden-variables theories, a trend that dates back to no lesser figures than Albert Einstein and David Bohm [24, 25]. The hidden-variables models purport to have an underlying guiding mechanism beneath the seemingly random nature of quantum mechanics. However, all the experiments done on the subject so far, particularly by the research groups of Aspect and Zeilinger, do point to an inherent irreducible randomness at the microscopic scale [7, 8]. Indeed, Calude, Svozil, and co-workers have recently demonstrated the uncomputability and irreducibility of the quantum randomness both theoretically and experimentally [21; 26; C.S. Calude, M.J. Dinneen, M. Dumitrescu and K. Svozil, *How Random is Quantum Randomness?*, CDMTCS Research Reports, CDMTCS-372, 2009].

Our ignorance of the state of individual quantum events, which is not due to some technical or theoretical limitation we have, but rather due to a primordial irreducibility, is so deep that we cannot predict and know what is happening — or even, whether anything is happening at all — at that level unless we perform experiments on them, let alone predicting and derandomizing their state of affairs in advance. Thus, the random character of nature seems to be inexorably unpredictable, and hence irreducible. Nature at the quantum level seems to create perfect randomness as opposed to pseudo-randomness, which in principle is decodable and predictable. So much so that physicists mostly gave up on the idea of causality applying at the quantum level, implying that there is no cause for physical events at the atomic and subatomic level [27]. We are used to such situations in the classical landscape (e.g., in chaos theory) but with the important difference of having causality at work. At the quantum level we discover, à la John A. Wheeler, "law without law" [5, p. 283].

5. Quantum randomness implies 'transintelligence'

By virtue of the fact that Kolmogorov-Chaitin complexity is incomputable, a direct implication of which is that in an informational/computational universe, as is argued in this paper, physically computing and displaying an irreducible randomness requires infinite amount of computational resources, i.e., an infinitely capable Turing machine. The latter is referred to as an oracle in computability theory and was first introduced by Turing [28]. An oracle is a hypothetical device that is assumed to 'compute' the incomputable. An oracle is physically unimplementable. It is a useful computational concept not unlike the concept of infinity in Mathematics. But in the context of my proposal of a computational universe, it achieves an existential status. Because if there is irreducible randomness generated and displayed by our informational/computational universe, then the pertinent calculation (called hypercomputation) does exist and it must be done by a real oracle, i.e., an infinitely capable 'computer'.

In fact, as noted by Calude and Svozil recently, if one could tap into this hypercomputation of the quantum, which outperforms our computers, then it could be used to our great advantage in, for instance, primality tests or the know-it-all Chaitin omega number that requires such oracles [29]. Since these constructions contain an unbounded amount of information, it is evident that there is an unbounded amount of information packed in the irreducible and incomputable randomness of the quantum, asymptoting to infinity given enough time.

The significance of the impossibility results of modern Physics and Mathematics is much deeper and far-reaching than recognized. The significance is due to their fundamental nature, their scope, and their being about how nature behaves, i.e., its ontology — in the case of Quantum mechanics — and what we can know about it, i.e., its epistemology — in the case of Mathematics. I am convinced that the quantum randomness and its mathematical counterparts, i.e., Gödel's incompleteness theorem, Turing's uncomputability, and Chaitin's mathematical randomness idea must all compel us to one sobering conclusion: our Universe is ontologically and epistemologically open. By 'openness' I mean incompleteness, that is, whatever system we attempt to analyze to achieve a consistent picture, which is what Science always tries to do, it will always fail to account for itself by itself, requiring a larger system and framework within which to make sense. Quantum mechanics was viewed by Einstein to be incomplete precisely for this reason, as the quantum irreducibility implied incompleteness. Similarly in Mathematics through Gödel's theorem, extending the scope of a complete but inconsistent formal axiomatic system to obtain consistency will make it necessarily incomplete, meaning unable to encompass and prove infinitely many mathematical truths.

I therefore aver that Quantum mechanics points to an ontological openness, Gödel's and Chaitin's results point to an epistemological openness, and Turing's uncomputability — combined with the previous two — points to an oracle, a hyper-intelligence.

One way of seeing this openness is as follows. Perfect randomness is when the result of an event is independent of the past and future influences. That means the event is not determined by any physical cause although it transpires in our physical universe, but rather by what I will call a 'transcause,' a cause originating beyond our phenomenal level. Furthermore, the independence of such random behaviour of the past and future influences — a sort of memorylessness — is, I assert, indistinguishable from having a timeless omniscience, as the knowledge of the past and the future must really be known to truly render a correlationless behaviour. Thus, the introduced 'transcausality', by virtue of its having infinite computational wherewithal, implies the existence and intervention of a metaphysical and categorically-different intelligence, which I will name ‘transintelligence’. ‘Transcausality’ necessarily implies non-locality, which is a fundamental feature of Quantum mechanics. Furthermore, the discontinuous and seemingly non-algorithmic character of wavefunction collapse also dovetails well with the idea of ‘transcausality.’

This ‘openness,’ ‘transcausality’ and ‘transintelligence’ can also possibly explain the seemingly impossible genius moments of giants such as Einstein and Ramanujan as a sort of ‘revelation’. Ramanujan, for example, is said to have figured out about 3900 mathematical results without proofs [C.S. Calude and K. Tadaki, Spectral Representation of Some Computably Enumerable Sets With an Application to Quantum Provability, arXiv:1303.5502 [quant-ph], 2013]. Most of these have been proven to be correct. So he must have done it non-algorithmically as proofs require a mechanical and algorithmic process. Roger Penrose avers that human thinking process is non-algorithmic, i.e., incomputable [30]. David Bohm also believed that the thinking process is not a logical process and, in fact, he likened the production of new ideas to a quantum jump [14, p. 170]. We are familiar with the fact that groundbreaking ideas and thoughts are not readily achieved by mere logical reflection, otherwise they would occur much more frequently than they do in reality, as we have billions of otherwise healthy human brains available.

I thus posit that the information-laden perfect randomness observed in nature at the microscopic level entails the existence of an ‘oracle’, a transintelligence, namely, an omniscient being. To further identify this Being with God - who is conceptually defined as omniscient, omnipotent, and morally perfect - is not facilely accomplished, albeit such identification is not uncommon [31]. The transintelligent being inferred in this article must be omniscient and omnipotent due to the proposed ontological (creation/selection of quantum events) and epistemological (information-theoretic nature of the irreducible randomness of the quantum world) connection. Linking omniscience/omnipotence to moral perfection, as assumed or done in various forms of ontological argument (e.g., in Plantinga’s modal argument [32]), is beyond the scope of this paper [33].

If an existence-of-God argument is viewed as composed of two parts: the first — and the most essential of the two - to establish the existence of a supernatural being (whom I will still refer to as God), the other to relate that being to God of religion, this essay purports to have established the first part [31, p. 20].

Nevertheless, I will argue that this inferred infinitely intelligent being to be a personal being. I reason as follows. We human beings are familiar with two kinds of explanations for all the events in the Universe: nomological and axiological [11]. The nomological explanations are grounded in laws and principles as found in the physical sciences. The axiological explanations are not grounded in laws but rather in values, motivations, and intentions. There is no law in physics that describes the intention and will behind a particular plan or design. As advanced by the prominent cosmologist George F.R. Ellis, there is no variable in Physics that corresponds to intention and will [34]. Physics all but ignores such degrees of freedom. For example, Physics cannot explain the curve of the glass in spectacles because it is shaped to fit a person's individual eyes and taste. The axiological explanations are thus 'personal' explanations. The word 'personal' is very much in the same vein as the word 'irreducible', as they both signify uniqueness, atypicality, and a degree of arbitrariness.

Since there is no mechanism or algorithm for the irreducible randomness of the quantum world, nomological explanations do not apply here. In other words, there is no conventional scientific explanation of the irreducible randomness of the quantum phenomena in the form of physical laws and principles. Therefore, the explanation must be axiological, i.e., value/intention-based or 'personal'. Thus the inferred infinitely intelligent being must be a personal being.

But can't there be a brute-factual reason for why something exists, and hence no need for an explanation? How about having more than one god or oracle, for example, to explain the irreducible randomness talked about here? My answer to both of these questions is no, as will be elucidated in Section 7.

Let me summarize my a posteriori argument for the existence of God syllogistically as follows:

1. According to Quantum mechanics, the Universe is animated by irreducible randomness at its core.
2. According to Turing's uncomputability and Kolmogorov-Chaitin complexity, computation of irreducible randomness requires an oracle, which, in the currency of our computational know-how, is infinitely capable.
3. Since no scientific explanation, in the form of physical laws, can account for the irreducible randomness of the quantum world, an infinitely-capable intelligent being, God, must exist.

6. Link between intelligence and randomness

So far, using the irreducible and incomputable randomness of the quantum and Turing's uncomputability theorem, I have argued for the proposal

$$Irreducible\ Randomness \leftrightarrow Absolute\ Intelligence.$$

My novel argument for the existence of a transintelligent being, i.e. God, rests on this relation. What follows in this section is just a curious tinkering with this idea, and the validity or invalidity of what will be claimed in the remainder of this section has no bearing on the main argument of this essay.

The question is can we as well extend the above relational link to reducible randomness in the form of

$$Reducible\ Randomness \leftrightarrow Finite\ Intelligence?$$

And ultimately generalizing both to

$$Randomness \leftrightarrow Intelligence?$$

It is not obvious prima facie that randomness has anything to do with intelligence. Random events and processes are encountered in nature that seem not to be the result of any intelligent agent or mechanism, for example, weather patterns and cloud shapes.

At the conceptual level, randomness, defined as unpredictability, does call for an epistemic and intelligent agent for its recognition (and in this article, I am arguing for the reverse relationship: generating (irreducible) randomness requires (infinite) intelligence). In this sense there seems to be an alluring similarity between the sets {the Universe, consciousness} and {randomness, intelligence}. The link between the Universe and consciousness has been hotly debated with the advent of Quantum mechanics. Can the Universe with all its properties be said to exist without conscious being or beings to observe it? [5, p. 23] At the quantum level, physicists' experiment-based answer to that question has been 'no' [6].

Similar arguments can be made for randomness and intelligence. Can randomness truly exist without an intelligent and conscious being to judge it so? This question becomes more significant especially due to the fact that at the quantum scale the world seems to be resting on perfect randomness, and our own intelligence and consciousness is a direct product of this randomness.

Today, computers are employed to create pseudo-random numbers to be used in various applications, mostly for scientific, engineering, gambling, and video gaming purposes. Computers can never generate irreducible randomness as they will always, by definition, use some algorithms to come up with these pseudo-random numbers. The latter is in line with von Neumann's warning about being in a 'state of sin' if one expects random digits produced by an arithmetical procedure. But as computers become more 'intelligent', they generate more and more sophisticated pseudo-random numbers.

Human beings display and develop the above-mentioned nexus between intelligence and randomizing and derandomizing capabilities throughout their lives, starting with the common game of hide-and-seek. In fact, we can say that our success in life partly depends on it. Only an intelligent agent would make sure that the same 'random' result is not repeated over and over again like a broken record. Put another way, it is more difficult to make a perfectly true die (randomness) than to make a loaded die (bias). In the same vein, the more knowledgeable and intelligent we humans become, the less 'random', nature appears to us. The quality of randomizing and derandomizing is limited by the level of intelligence.

A support for this idea comes from Stephen Wolfram, the author of A New Kind of Science (NKS), who asserts in NKS that intelligence might exist at very small scales, and might have spread throughout the Universe creating as an artefact all that we see around us. Indeed, he argues that most things in the universe carry out universal computation [35]. Accordingly, we can perhaps argue that inanimate objects such as weather and clouds, which display randomness, do also have 'intelligence'.

Allow me to end this section by presenting an observation of mine. One beautiful breezy afternoon, a playful spectacle caught my eye as I was gazing mesmerizingly at a clear blue sky: a small but nimble bird was trying to catch a fly. The fly was displaying mischievous random trajectories, and the bird was trying to out-predict and outsmart the fly.

It is evident that that fly species developed randomness to outmanoeuvre its enemies; and that bird species developed the relevant intelligence to undo that randomness. One can imagine the bird putting that intelligence to good use by creating its own random trajectories to outsmart a larger bird of prey.

7. Potential threats and objections

7.1. Hidden-variables theories

As mentioned earlier, the hidden-variables theories pose a serious threat to the irreducible randomness claim of the orthodox interpretation of Quantum mechanics. Thus, my construction as given here would collapse squarely if a mechanism — as sought out by various non-local hidden-variables models — behind the observed perfect quantum randomness is found. Needless to say, with a potential mechanism at its roots, the quantum randomness would lose its irreducible character.

7.2. Many-worlds interpretation

The many-worlds interpretation (MWI) of quantum mechanics claims to avoid the wavefunction collapse and random character thereof. However, since there are no experimentally meaningful implications and causal connections among the infinitely many worlds of the MWI, the wavefunction collapse does still exist for each of the ‘worlds’. Furthermore, the MWI critically depends on the unitary-evolution assumption, whose universal validity is not a priori obvious.

Similarly, the determinism it claims to save is problematic. Indeterminism is still what each world perceives. So from their perspective this hardly helps. Probability is still probability. If I stick my hand in a bag filled with six differently coloured but otherwise identical marbles, to pick one marble, how does the ‘thinking’ (i.e., hallucinating) that all the other possibilities will spring into existence will change the reality for me?

Penrose seems to have a similar issue with the MWI, namely, that it is not adequate as a description of our physical reality because we do observe a discontinuous wavefunction collapse (he calls it “the reduction of the state”) when the superpositions of sufficiently different states are involved [30, p. xxvii]. The random character of Quantum mechanics likewise is, from the perspective of a given ‘isolated’ observer, as deep as in the Copenhagen interpretation.

7.3. What if the information content of the Universe is finite?

Seth Lloyd and Paul Davies argue that the Universe can only have a finite number of bits to work with at a given time [36]. They call this the informational bound of the Universe and it is about 10^{122}. As noted by Davies, there are two scenarios here: one is that the knowledge of the potential future states of the Universe is not contained in this cosmological information bound, and exists in a more Platonic fashion, independent of the bound (an ontologically and epistemologically open universe). This possibility does not pose any threat to my argument because the irreducible character of the state of the Universe will be rooted in the Platonic and separate existence and not in the material/energetic bits of the bound.

The second possibility is that there is nothing but the bits of the Universe (an ontologically and epistemologically closed universe) and the knowledge of the potential future states of the Universe is contained in the bound. In that case, one can argue that there cannot be any irreducibility about the Universe, but just a technical incapability of computation on our part as the bound is pretty large. In other words, the quantum randomness is just an illusion, and one day the mechanism of how the Universe flips from one state to the next will in principle be determined. If this is indeed the case, my argument of course would fail as it is critically predicated on the irreducible nature of the quantum randomness. This is not unlike the danger the hidden-variables models pose to my thesis.

It must be proleptically mentioned that in the second scenario, an irreducibility argument cannot be tenable because any irreducibility would imply an open universe as was argued above by me using the famous four impossibility results of modern Physics and Mathematics: the irreducible quantum randomness, Gödel’s incompleteness, Turing’s uncomputability, and Chaitin’s mathematical randomness.

7.4. Can’t the irreducible randomness be a brute fact, and not have any reason behind it?

The brute-fact argument is a stultifying argument. It is no different than the attitude of those religious anti-science types who oppose to any detailed scientific investigation, discussion, and even medical treatment, by saying that it is all done by God, and this is the end of story. In Science, we stand ready to go wherever our scientific journeys, observations and data take us, but we never settle on the above-mentioned stultifying conclusions, except when we are unable to draw conclusions due to lack of a better understanding, or unwilling to go to the full distance of the implications of our analysis.

Can my argument and approach here be accused of committing this brute-fact type error? The answer is affirmative if, as acknowledged in this ‘potential objections’ section, there is an underlying mechanism and the quantum randomness turns out to be reducible after all. But if our understanding is not lacking but rather sound regarding the quantum randomness, that is, it is indeed an irreducible randomness, then we are compelled to confront the 'edge' of our existence, not unlike the protagonists of the science fiction movie *The Thirteenth Floor*, when, at the end, they come face to face with the 'edge' of their digital world.

As referenced several times in the body of this article, so far all the investigations, experimental and theoretical, point to the irreducible nature of randomness as encountered in quantum phenomena. In the presented argument, I simply extend our tools and concepts about computability (i.e. Turing's halting or uncomputability problem, Kolmogorov-Chaitin complexity, etc.), which we so successfully implement in the design, manufacturing, and operation of our super powerful and dependable computers and their computational capabilities, to the behaviour of nature that we observe and learn about at the atomic and subatomic levels. In other words, if one were to describe the irreducible quantum randomness in the language of the computability and algorithmic information theories, then the result is what is presented here.

7.5. Why not an infinite but creaturely intelligence?

It might be argued that the infinitely-capable intelligent being inferred here does not have to be associated with God, as an infinite but creaturely intelligence would also qualify. My problem with such a line of objection is that irreducible randomness requires a hypercomputation which, according to computability theory, can only be performed by an infinitely-capable Turing machine, i.e., an oracle [28]. But an oracle is, as mentioned before, physically unimplementable. So that must mean that the oracle inferred in this paper cannot be 'creaturely', because creaturely oracle is not possible. As such, the oracle deduced here must be in a uniquely different category than found in the conceptual toolbox of computability theory as we are talking about an existing and real 'oracle', revealing itself unmistakably in the form of observed quantum randomness, and not an unimplementable one.

7.6. Can't the irreducible randomness be, perhaps, due to more than one God or oracle acting in the Universe autonomously?

Notwithstanding the irreducible quantum randomness, there is a surviving order and consistency in quantum phenomena, for example in the form of the law of conservation of energy at the quantum level, or the deterministic evolution of the wavefunction in the Schrödinger equation, or the on-average constancy of decay rate of a given sample of radioactive atoms even though the timing of disintegration of those isotopes is unpredictable. Such global order and consistency would be difficult to explain by multiple incongruous and distinct gods or oracles.

But what if they conspire to do so? Indeed, in computability theory there can be oracles of different complexity classes. There will always be an oracle with a higher complexity class. The uncomputability of the halting problem applies to oracles as well. An oracle of a given complexity can solve a halting problem of a Turing machine, or an oracle of lesser complexity, but will not be able to tell whether itself will halt or not. For that, an oracle of yet higher hierarchy is required, all in the spirit of Cantor's diagonal argument. This fact is reiterated by Penrose as follows: "It is some sort of never-ending capability of being able to 'stand back' and contemplate whatever structure had been considered previously. This seems to be a quality that consciousness is able to achieve, but how one incorporates this kind of thing into a physical theory is hard to imagine, as our present-day theories stand." [30]

Therefore, if these 'nested' oracles conspire to cooperate to produce the observed universe with its irreducible randomness and emerging order and harmony, as was remarked upon above, they must be, by Leibniz's principle of the identity of indiscernibles, and for all practical purposes, one harmonious whole.

8. Further discussion

Supposing that my thesis for the existence of God is tenable, then — except for a limited number of cases, in the grand scheme of things — in what other pattern will a finite being perceive Him, an infinitely intelligent and absolute being, other than randomness? When I speak to my cat, Misha, as though he were human, the sounds I produce do surely appear as nothing but random to him, as they do not elicit any response from him other than perplexity. Only a small fraction of those sounds uttered - such as 'here kitty kitty' — will appear non-random to Misha, and most likely elicit some response from him. Similarly, most of my daily activities and actions at home will seem absolutely random to Misha, except for a small number of them such as opening up a canned cat food to present to him.

Here I must note that my cat's failing to understand me is not a practical failing, rather it is an in-principle failing: can a cat ever become a human being? My answer is no, because if a cat turns into a human being then it is a human being, not a cat anymore. Therefore a cat in principle can never become a human being! Just as a human being cannot become the infinitely intelligent being talked about in this paper.

Having emboldened by the prodigious success of the Newtonian physics, traditional theists sought God in a perfectly ordered, deterministic Laplacian universe. This worldview overreached itself by unwarrantably extending the range of intelligible and derandomizable events in the totality of the Universe, from the smallest to the largest, without any limit. To make an allegory with my cat Misha, this is like him assuming that just because he derandomizes a few of what I utter and do at home, he can in principle deconstruct all of my utterances and actions in his home-universe.

Thus, the presented randomness argument for the existence of God here goes counter to the traditional theistic viewpoint, which maintains that order, not randomness, is the telltale sign of God. My argument has turned this traditional theistic reasoning on its head. Namely, the traditional theist says: "God exists! Just behold the *order* in the Universe". I say: "God exists! Just behold the *irreducible randomness* in the Universe".

Quantum physics and Molecular biology have taught us that microscopic physical world and molecular biological mutations are random. Decay of a radioactive nuclide, or mutation of a gene, appear to us, and are indeed, probabilistic and random. I herein argue that it could not be otherwise. It is so because God's actions are imperceptible and unpredictable to us, and beyond our hacking. In some sense, perfect randomness observed at the quantum scale is a telltale sign of God. In short, at the risk of disappointing Einstein, God will necessarily appear to us to be playing dice.

My argument therefore also undercuts the position of those atheists who, having observed mindless and random processes in nature, rush to fallaciously argue that since the existence of God and the said processes are at variance with each other, God cannot exist. Their situation, I aver, is like my cat Misha hypothetically getting frustrated at the fact that he only finds a small fraction of my actions to be non-random and then hurriedly giving up all hope in me.

9. Conclusions

Physics has answered many long-standing questions about the Universe: from the Big Bang to the current and future state of affairs of the Universe. Following Carl Sagan's formula of "a universe with no edge in space, no beginning or end in time, and nothing for a Creator to do", some take this dazzling history of success in laying bare the seeming self-sufficiency and self-consistency of the Universe as the proof that there is no need and place for God in it [27, p. 9; 37]. They naively overlook the significant role the perfect randomness of the quantum plays in shaping the Universe we live in, compared with the so-called fundamental laws of nature. As Murray Gell-Mann noted "a huge amount of information in the Universe around us comes from those accidents (*referring to the quantum chance outcomes*), and not just from the fundamental laws" [M. Gell-Mann, *Beauty and Truth in Physics* [Video file], December 2007, http://www.ted.com/talks/murray_gell_mann_on_beauty_and_truth_in_physics.html].

I hereby presented an epistemic and ontological 'edge' Sagan talks about in the form of a novel argument, based on the irreducible randomness of the quantum world, and how that randomness implies an open universe and 'transcausality,' and entails a personal being with infinite intelligence. 'Transcausality' offers a new perspective on the non-local character and the wave-function-collapse problem of Quantum mechanics. I claim that the said randomness, which, according to Quantum mechanics, permeates the whole Universe, is not only a conduit for perpetual divine control and intervention - a whole lot for a Creator to do, but also a gaping hole and Trojan horse in the fortress of those who argue for the demise of the Old One [38].

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