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QUANTUM TELEOLOGY AND THE ORIGIN OF THE UNIVERSE

by Trevor Pitts

This essay was inspired by John Leslie[1], David Deutsch[2], and Frank Tipler[3,4]. Leslie brilliantly critiques the 'fine tuning' required in many fundamental features of the universe to allow life to exist. The many interacting requirements, ranging in sensitivity from one part in 10^{100} down to a few per cent of allowed variation, result in an extremely 'improbable' universe. Leslie analyses, and finds inadequate, the Anthropic Principle[3], which in weak form says that only universes with intelligent life can doubt such improbabilities. Instead, 'creative ethical requirements', mandated by the 'value' of intelligent life (teleologically?) mandate creation by God. He points out that the Anthropic Principle assumes either an infinity of universes or an infinite universe with an infinity of discrete areas with variant universal constants, ratios of fundamental forces, geometries, *et cetera*.

David Deutsch's book is fascinating, defending the Many Worlds Interpretation of Quantum Theory. Supposedly, however, every insignificant neutrino (or anything else) splits the universe into a version for every possible change in trajectory or other variable. How ugly. Since symmetry rules the universe, perhaps we can perform a brutal symmetry operation to figuratively stand the Many Worlds Interpretation on its head and/or turn it inside out to reduce its ugliness, retaining its benefits. Below are certain key aspects of Deutsch's views, paired with 'opposed' postulates in brackets.

1. An infinity of deterministic, parallel universes are equally real. (Only one universe is real, but Hilbert space is hyper-real, containing an infinity of dimensions in which deterministic alternative future universes participate in the moment by moment probabilistic vector summation which collapses into the single reality).

2. Every possible event splits a universe into slightly different copies, so that very late in time there are enormous numbers of alternative possibilities, all realised. (At the origin there are, in primordial Hilbert space, an infinity of possible futures, for an infinity of possible types of universe. As time passes every event prunes the number of future possibilities to those fitting the newly finished past, very late in time there are few options).

3. The wave function never collapses. (It collapses always, forever, the moment of collapse is the only reality).

4. Weird quantum effects are due to interference between closely similar alternative universes. (They are the result of interaction of as-yet undecided immediate future possibilities. Most possibilities or 'amplitudes' cancel each other out due to phase differences, the square of the sum of these amplitudes being the probability of a given outcome).

5. Another time is merely another universe. (Now is all.)

6. Everything is a quantum object. (Macroscopic objects behave classically in the limit, being sufficiently large, dense and warm to collapse their wave functions. To see quantum weirdness it is necessary to limit the scale of the system by isolation from the rest of the universe, or to manipulate tiny particles.)

The usual reasons for adoption of Deutsch's views are threefold. Firstly, the Schrödinger wave equation, or equivalently, the state vector in Hilbert space, continuously and deterministically evolve forward or backward in time[4]. If no one time is preferred, why and when should irreversible collapse to a measured outcome occur? Secondly, in what way is the measuring device/observer combination, itself a quantum system, *sufficiently distinct* from the rest of the wave equation so as to be able to collapse all possibilities to one? Thirdly, experiments show that entangled quantum states instantly 'communicate' their measured state to each other regardless of distance. Deutsch's radical approach satisfies these criteria.

Frank Tipler's *The Physics of Immortality* [5], is a flawed but useful analysis of a universe filled with advanced computer inhabiting civilisations (see Deutsch on virtual reality in ref.2). Deutsch points out that our universe allows a virtual reality to be created which is indistinguishable to its participants from the real thing (whatever that is). In a Tipler-type civilisation, if the choice is between death or being consciously simulated (to the point of feeling more alive than ever before!) within a heaven of one's choosing, the dead will prefer to 'live' in computers. Living aliens also seem likely to choose such simulations as cheaper and more enjoyable than mere reality, assuming their bodies are optimally maintained while they choose to retain a bodily component of existence. Curiously, quantum computers are the ultimately energy efficient basis for such simulations since a unit of energy is only consumed per *completion* of a calculation regardless of the amount of processing[6], so 'environmentally' concerned aliens would prefer them. Tipler envisages massive colonisation of the whole universe by such civilisations. I suspect that the inconceivable level of decadence that could be achieved so cheaply and so safely via such total virtual reality, plus ethical constraints, militate against this arduous, expensive colonisation program.

Tipler says, *inter alia*, that a relativistic universe of our type is maximally chaotic. So maximal numbers of Deutsch's alternate universes would be generated, since due to chaos all microscopic fluctuations would produce very many widely different outcomes and thus universes. Deutsch says that 10^{500} universes are required for quantum computer factorisation of only one 250 digit number. So Tipler civilisations would maximally branch this chaos into vastly more universes as their quantum computers crunch away at simulations of ideal personal universes for huge numbers of aliens. 'Opposing' this via my second postulate, primordial Hilbert space is therefore maximally filled (most 'intricate', as defined below) for universes in which life will be common, chaos and relativity rule, and the laws are maximally easy to understand and use, allowing maximal evolution of technical civilisations of Tipler type. I suggest considering the Fermi Paradox as possible support for a non-colonial version of Tipler civilisations. This asks, if advanced civilisations are as likely to exist as experts (e.g. Ref.7) believe, expected to rapidly fill and exploit the galaxies, then: *where are they*? This paradox may be solved if Tipler civilisations 'live' in virtual reality in quantum computers, minimising the use and disturbance of ordinary matter and energy, travelling only virtually within microscopic interstellar probes, if at all. So we are alone in the cosmic nursery, and the Little Green Man will never lift his Burden in order to civilise us.

Let us integrate all the above to produce a speculative approach to quantum cosmogenesis without God or the multiple universes required by the weak version of the Anthropic Principle. Quantum electrodynamics (QED) uses Feynman's manoeuvre of summing over all possible particle paths[8]. A similar path integral approach to quantum gravity sums over possible 4D space-time geometries, leading to a quantum cosmology[9]. My tentative quantum cosmogenesis suggests summing over *all* possible geometries, fine tuning values, and universal futures.

Imagine a graphical depiction of the possible types of universe in many dimensions, each dimension a measure of some critical feature for life's development as above, plus a 'vertical' axis, 'intricacy'. Intricacy is the total number and dimensionality of all possible future state vectors in the primordial Hilbert space (before the Planck time) corresponding to the set of fine-tuned critical features of each potential universe. It seems clear that the more extreme the required fine tuning, the steeper the peak of intricacy on this graph formed by a group of extremely similar, monstrously complex, potential universes. Very little deviation would result in no life and hence minimal intricacy, so there would be no foothills, just an immensely high spike in the graph. Universes collapsing or expanding quickly, or full of black holes or only photons, will achieve little intricacy. Perhaps such opposed options have opposite state vectors in this primordial Hilbert space. Analogously to QED, could such low intricacy options largely cancel each other out, as if they had opposed phases? Even if the ensemble of possible universes is not by this cancellation 'renormalizable' in this radically extended sense, it is clear that this peak cluster has an infinity of minutely distinct universes, each enormously profligate in their occupation of Hilbert space, with enormous total amplitudes. Plausibly, in this 'One World Interpretation', if only one universe collapses into existence, it must derive from this massively dominant fraction of Hilbert space. Collapse into our particular peak option results in certain contingent values of fundamental constants, force ratios, etc. Therefore, this interpretation predicts the impossibility of theoretically calculating these fine-tuned values. They are happenstance, within a narrow optimum range.

This initial collapse, the Big Bang, in my interpretation, foliates space-time across the whole universe at the first moment, forming a kernel of reality which 'decoheres' quantum states next outward in time[10]. Then time expands outward throughout expanding space. Beyond this front, Hilbert space allows, for example, a single particle to go through both of two slits and interact with alternatives to itself to make diffraction patterns as it becomes fully real (i.e. 'measured') by joining the expanding forward edge of reality, now. The present proceeds outward, pruning options by using the relics of past choices to 'decohere' the quantum states of the immediate future. All entangled states of particles are instantaneously decided regardless of spatial separation across this foliation in space-time. To preserve the time symmetry of unitary quantum evolution (see the first usual reason to believe Deutsch, above) we can attach my Symmetrical Time Hypothesis[10] to the One World Interpretation, without materially changing the above argument.

In summary, in this One World Interpretation we can have many (seemingly contradictory) alternative cakes and eat them all. Einstein would be happy, looking backward in time via the present relics of the past he would see one deterministic set of world lines, obeying Lorentz Invariance and General Covariance. He would be 'free' (if one disagrees with him on free will!) to conclude that the future and the past are completely determined. Everett, Deutsch *et al* would have to be satisfied with the relatively few worlds just a Planck time ahead of the moment of creation, now. The mathematically most plausible *a priori* numbers of universes are zero, one and infinity. We can rule out zero, and if we check the One World Interpretation against Occam's razor principle? The wave function collapses only once, forever, choosing one of the perfectly suitable universes for technical civilisation, and allowing us to evolve our future, all for the price of the few assumptions above. Scientists will flourish in this most easily understandable, exploitable and mathematically describable type of universe. It is especially ironical that the less likely (according to Leslie), our type of universe seems, the more it dominates primordial Hilbert space and selects itself into existence. We need an ontology which does not blithely wave away the present as unimportant or an illusion. I believe 'reality' minus now is as silly as a ‘geographer’ saying Earth’s surface is somewhere between the stratosphere and the Earth’s core, and it doesn't matter where. One universe is inherently more plausible than an infinity of them, if William of Occam and his principle of minimal assumption is to be trusted.

References

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