

Are You Living Inside a 23rd Century Literary Masterpiece?

The Simulated Realities Trope in Science Fiction and Quantum Fiction

Copyright Ian Irvine (Hobson) 2017, all rights reserved. Published by The Zoetics Institute, 2017.

A version of this article was delivered as a talk/workshop for the Bendigo Writers Council, at Bendigo Library, on May 17th 2017. The author would like to thank the 35 or so writers who participated in the workshop. He would also like to thank Diploma level students enrolled in 'Nonfiction Writing' (2017) at Bendigo Kangan Institute and 'Myths and Symbols' (2017) at Victoria University/Victoria Polytechnic. Special thanks, also, to Gordon and Joanne Reece, John Charalambous Sue King-Smith and Caleb Irvine-Kingsmith for being sounding boards for the ideas herein discussed between February and May 2017.

Paul uncovered his eyes, and looked around the room. Away from a few dazzling patches of direct sunshine, everything glowed softly in the diffuse light: the matte white brick walls, the imitation (imitation) mahogany furniture; even the posters [...] looked harmless, domesticated. Wherever he turned his gaze (if nowhere else), the simulation was utterly convincing; the spotlight of his attention made it so. Hypothetical light rays were being traced backwards from individual rod and cone cells on his simulated retinas, and projected out into the virtual environment to determine exactly what needed to be computed; a lot of detail near the centre of his vision, much less towards the periphery. Objects out of sight didn't 'vanish' entirely, if they influenced the ambient light, but Paul knew that the calculations would rarely be pursued beyond the crudest first-order approximations [...] Everything in the room was as finely resolved, at any given moment, as it needed to be to fool him – no more no less.' [From *Permutation City*, by Greg Egan (pg.2, 1995 edition)]

Many contemporary Sci Fi and Speculative Fiction tropes arise out of the scientific developments of the past 40-50 years. In this article I want to explore the history of a trope loosely associated with the Speculative Fiction sub-genre known as "Quantum Fiction".

A number of tropes are fundamental to this sub-genre: 1) the Simulated Universe/Reality trope (which incorporates versions of Sci fi's Artificial Intelligence – or AI – trope); 2) The Many Worlds/ Many Selves trope¹; 3) the Time Traveler trope; and 4) the Paranormal is Normal trope.²

In this article we will focus on the ways speculative fiction writers have explored the Simulated Reality trope. Hopefully the discussion and accompanying exercise will inspire you to write cutting edge fiction based on innovations to this trope. By the end of the article we will also have considered the possibility that you are living inside a literary/multimedia masterpiece created by unknown writers, artists, etc. living somewhere between 2300 and 2600 CE.

Quantum Fiction arises out of the Insights of the New Physics

Quantum Fiction asks us to understand the human condition and our place in time and space in uniquely post-classical scientific ways.³ It has been described as a kind of 'New Literary

¹ Although most often found in Speculative Fiction genres, these first two tropes have recently found their way into Thrillers, Romances, Westerns, etc. Interestingly, many literary writers have also been using the tropes in "Quantum Fiction" contexts, e.g. Thomas Pynchon, Don DeLillo, Kate Atkinson and Joyce Carol Oates.

² This fourth strand to Quantum Fiction is less often associated with hard core Science Fiction; rather, it is more often associated with subgenres like 'Science Fantasy', 'Gothic Sci Fi' and 'Paranormal Sci Fi' - which have long explored supernatural/paranormal themes. In particular, the line between 'science' and 'magic' is often blurred in these genres, and traditional Fantasy tropes are imported and explained scientifically – e.g. vampires as experiments in genetic engineering. Science Fantasy stories are particularly prone to exaggerating (often to the point of distorting) the real science associated with the New Physics.

³ This is an important point, since the origins of Science Fiction as a genre lie in what some researchers refer to as 'Empirical' (i.e. mechanistic/pre-Quantum) Science. This has been contrasted with 'Idealist Science' as a basis for SF, but I don't feel the term 'Idealist Science' does justice to the revolution in Science (and Sci Fi writing) that I'm discussing here. A

Realism', because it is grounded in contemporary theories about the nature of physical reality. These theories, however, promote a range of counter-intuitive ideas about both the nature of the reality and the nature of the self.⁴ Specifically: 1) everything in the past, present and future, including everything that didn't (or won't) actually happen in a given time-line, may be 'interconnected ('entangled')' with everything else in ways beyond the laws of classical physics; 2) consciousness/mind (i.e. 'the observer') may be active in the creation of visible realities as an agent that collapses super-positional 'wave like' fields of possibility into single particle-based (observed) realities; and 3) randomness and uncertainty are fundamental to the cosmos.

Quantum Psychology and our More Expansive Selves: I want to emphasise that fundamental to Quantum Fiction is the idea that *the self extends beyond the confines of any given 'collapsed' (or branching)⁵ reality into temporal and spatial realms beyond the equations of mechanistic science - not to mention its derivative psychological theories.*⁶ This more expansive (quantum) self is a resident of the multiverse (rather than a single 'universe'); though whether the other worlds of the multiverse are 'real', 'potentially real' or 'computer simulations' of some sort is yet to be determined.

A Plethora of 'Entangled' Sub-Selves: In the case of Hugh Everett's Many Worlds theory, our 'expansive self' supposedly includes other actual selves in parallel/alternative realities that are suppressed (but not completely destroyed) when we make life choices. An Everettian understanding of the 'self' might include the sum of both the chosen *and* the un-chosen life paths made available to us during our lives. Likewise, as we'll see, the 'brain-computer interface' version of the Simulated Worlds trope (Dainton's 'S', or 'soft', version⁷) posits that we possess at least two selves.⁸ The first, however - the one you are experiencing right now - may be locked inside a high fidelity/granulation VR 'simulation' of some sort. Your other - possibly more authentic - self is probably somewhere in the future or some parallel present accessing the "Sim Earth 2017" world history experience from the 'real world'!⁹ Finally, given that one of the features of the 'Time Travel' story trope is the manipulation of the way the self manifests in time, it is clear that this trope also posits 'multiple selves' - one for each alternative time-line.

better summary would be the division between 'Empirical/Mechanistic Science' (and Sci Fi writing) and 'Quantum influenced Science' (and SF writing).

⁴ I've also chosen these tropes because they harbor 'Quantum Fiction' themes I've been exploring in *The City of Quartz* (published 2016) and, more generally in the *Songs of the Interstium* transmedia project.

⁵ That is, 'branching realities' as per the Many Worlds interpretation.

⁶ Psychological systems influenced by quantum mechanics are useful correctives to the scientific view of humanity (including self-identity, consciousness, etc.) that prevailed from the early nineteenth century to the mid-twentieth century. The impact of the New Physics on what are known as the social sciences is also fundamental to 'posthumanism' - a phenomenon I am unable to explore in depth here.

⁷ See also Dainton's 'H' - or 'hard' - version of the simulated world hypothesis. This version theorises that we are computer generated Sims that have somehow become 'conscious' within the confines of our simulated world. In this scenario there is no 'brain in a vat' or other self 'one level' up from our current simulation. See: Dainton, 'Innocence Lost - Simulation Scenarios: Prospects and Consequences' (2002).

⁸ It is worth affirming here that the Simulation Hypothesis could, theoretically, transform and absorb aspects of the Many Worlds/Many Selves theory.

⁹ Though in theory that future self might also be sampling other VR life worlds at the same time - i.e. it may be using technologies that allow it to 'life-switch' or 'life-surf'!

Another dimension to reality uncovered by quantum mechanics is the phenomena of ‘entanglement’ – a phenomena whereby previously entangled particles are able to influence each other at great distances and at velocities faster than the speed of light (indeed ‘instantaneously’). Although we cannot discuss this phenomena to any depth here, it is worth noting that some thinkers propose it as a way in which the various aspects of our proposed ‘expansive quantum self’ might be able to communicate with each other across time, reality branches, etc. After all, it is proposed, our various past, future, co-existing/branching etc. selves are likely to be connected/entangled with each other in complex biological ways.

Realms of the Quantum Unconscious: Most people rarely, if ever, become aware of the various sub-selves proposed by new physics influenced psychologists. In part, this is because quantum phenomena usually ‘decohere’ before they become observable at macro levels of reality. In this article, however, I want to posit the existence of levels to the ‘unconscious’ - as developed by a range of 20th century psychoanalysts (including Freud, Jung, Fromm, Lacan, Grof etc) – that process phenomena associated with the more expansive understanding of the ‘self’ discussed above. I also want to suggest (along with various other theorists) that psychobiological mechanisms may exist that act to **amplify** quantum level phenomena to macro levels of consciousness.

We May be Able to Access the Quantum Unconscious: To say that something is ‘unconscious’ is to say that though it is currently inaccessible to consciousness, it may nevertheless become accessible under certain circumstances. Similarly, just because something is inaccessible to consciousness doesn’t mean that it is not influencing behavior, emotions, etc. in subterranean ways. As we discuss the Simulated Reality trope we will keep in mind the following: 1) that quantum levels to the unconscious may become accessible under certain circumstances, and 2) that phenomena in the quantum unconscious may be influencing our day to day lives in subterranean ways. Imaginative literature and popular quantum influenced psychologies, often assume that we can access the quantum unconscious by either natural intuitive methods, or by way of ‘remarkable’ technologies.

The Programmed or Simulated Universe Trope: Sims and Super-immersed Humans in Advanced Virtual Realities

There are two major strands to this trope: 1. The Informational Universe strand; and 2) the Simulated Universe/Reality strand. Both strands arise out of Digital Physics and projected developments in technologies associated with creating Virtual Reality, Artificial Intelligence and Augmented Reality experiences. We note that projected developments are often based upon approaching innovations in Quantum Computing.

A) DIGITAL PHYSICS – THE INFORMATIONAL UNIVERSE¹⁰ Digital physics is a relatively new science discipline that sees information and communication processes as fundamental to reality. Digital physicists have reached a point where many (for example, Max Tegmark, David Deutsch and String Theorists like Leonard Susskind) are prepared to argue that space, time, matter itself and other phenomena long studied by theoretical physicists, are not originating aspects of reality. They are, rather, secondary phenomena emanating from a

¹⁰ This category corresponds to Whitworth’s classification ‘Calculating Universe Hypothesis’ p7. ‘The Physical World as Virtual Reality’, 2007.

deeper non-local layer of reality. That layer is described as 'informational'.¹¹ All matter - including all space - is believed to contain information (bits and qubits). Each piece of information carries with it information exchange processes/protocols that are embedded in the more physical manifestation of matter and energy.¹²

Nothing exists without the influence of this informational (that is: computational) substrata to the universe. *Everything computes*.¹³ We should note here that the idea of the 'computational universe' was needed before physicists and philosophers could formulate advanced 'Simulated Reality' theories.¹⁴

B) DEVELOPMENTS IN CYBERSPACE and the SIMULATED UNIVERSE HYPOTHESES¹⁵

The fact that contemporary human societies have already progressed to the point where they can create 'virtual' and 'augmented' reality experiences capable of tricking human sense organs like hearing, sight and spatial awareness to various degrees (what is known as 'degrees of immersiveness') led some philosophers and digital physicists to ponder future developments to these technologies - specifically future levels of participant 'super-immersion' in high fidelity virtual realities. Simulations can be created by civilizations that are either *subject to* (Options One and Two below) or *not subject to* (Option Three below) the 'universal constants' that prevail in our universe.

Option One: Developments in Cyberspace – Supercomputers and the Internet of Things

Many writers have pondered how VR, AI and AR technologies might develop into the future. The idea that computer processing power will increase exponentially due to the development of disruptive game-changing technologies – e.g. functional high speed quantum computers, brain-computer interfaces for VR, the ability to embed consciousness in software etc. – has led many writers to explore 'voluntary' and 'aware' forms of super-immersion in VR or AR worlds. In these stories characters, on the whole, are aware that they inhabit a simulation and thus typically experience two conscious selves. Put simply, the immersed self *knows* it possesses a body with memories, etc. situated outside the simulated world, even if it is temporarily unaware of that body.¹⁶

These kinds of stories explore the opportunities, threats, etc. associated with the development of ever more connected and super-immersive communication technologies. They also explore the social consequences of such technologies.

¹¹ Here 'informational' also encompasses laws of information exchange/ communication (computation) – 'information' is not seen as merely passive.

¹² We may say that apparently inanimate matter, energy and space contain computational rules (that we can represent mathematically) about how to behave when interacting with other types of matter/energy etc..

¹³ We may, however, understand 'inanimate matter' as relatively inflexible when it comes to information exchange processes. Animate matter (organic forms of life) on the other hand (which displays various levels of consciousness), is more flexible in the way it 'computes' the environments it interacts with - and the information embedded in those environments - and in the way it responds to stimuli (though many response reflexes are still more or less automated).

¹⁴ However, although the universe may behave like a quantum computer it doesn't necessarily follow that we are living inside a simulated reality.

¹⁵ This category corresponds to Whitworth's classification 'Calculated Universe Hypothesis' p7. 'The Physical World as Virtual Reality', 2007.

¹⁶ For example book and films like: *Snowcrash*, *Neuromancer* and *Inception* – though with *Inception* and *Neuromancer* some of the characters struggle to tell the difference between the digital realities they inhabit and their origin or real world.

Option Two: Ancestor Simulations and Other Simulations Created in the Future (also: “S” and “H” Type Simulations):

The philosopher Nick Bostrom¹⁷ links cosmological insights concerning the vastness and age of the known cosmos, to the likely existence (in the past, present or future) of advanced civilisations ('posthuman civilizations') capable of developing 'super-immersive' virtual reality technologies. After exploring three outcomes associated with these technologies, Bostrom proposes (as the third outcome) that we may already be living inside a future 'ancestor simulation' themed around a 21st century earth that no longer exists in the originating reality. He also acknowledges elsewhere, that we could just as easily be living inside a 'fictional' or 'counterfactual' earth simulation i.e. the earth we are currently experiencing may never have actually existed or it may only be an approximation of the real 'historical earth' of the early 21st century. His argument is founded upon extrapolating accelerating global VR and AR uptake trends (e.g. the evolution of VR computer games, VR movies, workplace simulations, VR social networking sites, etc) into the future.

The simulation designers-programmers in this scenario could be humans, aliens or human-cybernetic hybrids of some description living in a more real (analog/classical?) version of a universe not unlike our own. Whether we (i.e. the simulation participants) are real 'future' people; digitised (therefore A.I.) consciousnesses (i.e. computer generated Sims of some sort); uploaded human consciousnesses now confined to the simulation; aliens inhabiting human avatars; or hybrids inhabiting human avatars of some description is a question Bostrom feels ill-equipped to answer.¹⁸

The super-simulation designers who exist outside the simulation (i.e. in the 'real' present) will likely have access to technologies that permit the following¹⁹:

- a) The computerized creation of highly realistic 'simulated humans' within the simulated reality (this is the so-called “H” or hard-drive version of the simulation

¹⁷ 'Are you Living in a Computer Simulation?' *Philosophical Quarterly*, Vol. 53, No 211, pp: 243-255 (2003, first version 2001).

¹⁸ As we ponder Bostrom's hypothesis, we should note his implicit acceptance of projected developments linked to our growing willingness to augment ourselves through 'cyborg technologies'. Put differently: our attempts to merge with, and subjugate ourselves to, all manner of intelligent machines (AIs), suggests that the entity accessing/entering Bostrom's proposed early 21st century Earth Simulation (via the 23rd century 'Origin Reality') will almost certainly be some sort of technology augmented (evolved?) human - if it is not already an 'in-world' Sim or 'Origin World' situated conscious Robot. When we merge such insights with projected future developments related to the Internet of Things and Quantum Computing (not to mention the likely development of technologies that will allow phenomena associated with 'quantum weirdness' e.g. entanglement, non-locality and retro-causality, to manifest at ever larger macrocosmic scales), we might be disposed to conclude that the evolved/augmented humans inhabiting 21st century avatars would have to be constantly interacting/merging with 'super-networked' AIs in the Origin World (again, if they are not already fully-fledged Sims or conscious Robots). This would make our 'Earth 2017' simulation the product of both human and AI creativity – a kind of 'cyborg literary masterpiece of the 23rd century CE!' We should also mention the possibility that our 23rd century self is a "human-AI-Quantum Computer" hybrid some part of which is being projected backward in time for some reason – though such an argument initiates the Time Travel trope at the expense of 'purer' forms of the Simulation trope, since we would need to see ourselves in a 'Many Worlds/Many Timelines' variant of a *real* Earth 2017 rather than a *simulated* 'Earth 2017'. In such a scenario we would speculate about the influence of a future cyborg civilization possessing quantum computer technologies capable of manipulating the past for its own purposes. Popular SF stories have recently begun exploring this development to the Time Travel trope.

¹⁹ The different terminology and definitions associated with “S” and “H” level simulations comes from Barry Dainton's paper: 'Innocence Lost - Simulation Scenarios: Prospects and Consequences' (2002). However the division is implicit to many fictional renditions of simulated realities - dating back to Galouye's novel *Simulacron-3* (1964) at least. Anders Hammarstrom formulates the “S” and “H” argument as the “Brains in Vats” V “Minds in Simulations” argument. See: 'I Sim: an Exploration of the Simulation Argument'.

hypothesis as formulated by Dainton in 2002). Such Sims may even have attained a degree of consciousness. We also note the future possibility of uploading sentient digitized versions of previously ‘organic/real’ humans etc. to a VR environment. In this scenario the ‘uploaded humans’ would be part-sentient (conscious?) and partly synthetic entities (they are ‘digital orphans’ since they have no ‘Origin World body to return to). In this “H” version of the Simulation trope, computer created Sims and ‘uploaded humans’ can be: *aware, unconsciously aware, partly aware and partly unaware or completely unaware* of their Sim or ‘orphaned’ status. In many of these stories, the movement from *unawareness* to *awareness* of one’s true ‘status’ is narrated as a profoundly disturbing experience.

- b) Beings from the ‘originating world’ may be able to inhabit a computer generated ‘avatar’ in the simulated reality that is indistinguishable, in terms of ‘authenticity’, from the experience of ‘self’ in the originating reality (this is the so-called “S” version of Dainton’s version of the simulation hypothesis). This possibility presumes that technologies will be (have been?) developed that permit high levels of participant ‘super-immersion’ in simulated worlds. In practice this would demand technologies that can enforce ‘entry amnesia’ (as per the start of *The Matrix* series). Highly advanced brain-computer interfaces/implants would also be needed to make this version of the hypothesis viable. Finally, there is the issue of caring for the ‘Origin World’ body whilst it is in the simulation in an unaware state. [Please note that Appendix Two lists some key terms used by VR experts whilst speculating about how VR technologies would need to evolve to facilitate viable “S” type simulations that seem as real as life in the ‘origin reality’.]

In stories influenced by the “S” version of this option we find that future people can be: *unconsciously aware, completely unaware* (i.e. forgetful of the originating world for some reason) or *part of the time aware and part of the time unaware* when they enter and experience the simulated reality. Likewise, the future people can either: 1) enter the VR world voluntarily (at least to begin with) or 2) stumble or be thrown into the VR against their will.

Is Knowledge of the ‘Origin World’ and ‘Origin Self’ Stored in the Quantum Unconscious?

To return for a moment to our theory of the ‘quantum unconscious’ discussed earlier, we might note that Dainton’s “S” simulation theory presupposes some sort of: a) technology enforced ‘entry amnesia’ (i.e. memories of the originating world and memories of entering the simulation would need to be locked away from consciousness whilst entering the simulation). Likewise, b) technology enforced suppression of Origin World experiences happening to the Origin World self *whilst* the inhabited avatar experiences events in the simulation would also need to be continually inaccessible to the avatar inhabited self – though not necessarily to the Origin World self. Fictional works exploring this trope usually allow characters to access what I’m calling the ‘quantum unconscious’, to unlock information about their ‘Origin World’ and/or ‘Origin Self’. ²⁰

²⁰ Note: We might find it difficult to believe that such a large amount of ‘origin world’ material/information could be locked away for long periods of time in a person’s ‘quantum unconscious’. However, everyday psychological experiences related to dreams, day-dreams, psychoactive drug experiences, certain disease experiences, repressed childhood memories and hypnosis vouch for the fact that such repressions are routine aspects of the average person’s mental life. In particular we seem able to: a) lock away entire sequences of experience (e.g. vivid memories stretching back to our childhoods) in the

We should also note that the simulation-generating 'computer' could be a mass produced (and 'internet of things' networked) system that individuals access together with millions (or billions) of other real 'future people'. Finally, if the beings creating the simulation are similar in some respects to ourselves, the simulation could be influenced by any number of factors in the 'Origin World' that we could identify with e.g. the 'aesthetic preferences', 'consumer preferences and choices', 'work and family commitments', 'travel interests' etc. of the designers and their target audience.²¹

We should also note the possibility that our proposed simulated reality involves both Sims and Avatars (Option C). This would mean that some of the people - maybe even *all* of the people - around us are actually 'Sims' of some description (in the 'H' – or 'hard' - sense of the term as proposed by Dainton).

Option Three: Godlike Beings in an 'Originating Universe' Create Simulated Worlds with Different "Universal Constants": A third option is that incomprehensibly different, near Godlike, entities living in an environment with different 'universal constants' - including space-time constants - created the 'Quantum super-computer' that generates and regulates our reality. Given they may not be recognizably 'human' their purpose may be all but inscrutable to humans in this life world/creation. Never-the-less, we may still be talking about a 'Designer' or 'Designers' of some kind of 'computer + consciousness' hybrid - maybe even a kind of 'computer + consciousness' 'hive mind' of some sort.²² Overall, this option suggests that we may be conscious Sims of some sort – though the notion of a 'Sim' becomes somewhat irrelevant due to the unknown nature of both the creative entity (or entities) and the different universal constants operating in the originating universe.²³ The Origin World may not be the source of a simulation, in this scenario – rather it may simply be reproducing life on a vast scale.

unconscious for many years at a time; and b) in the case of dreams and to a lesser extent day dreams, enter dream-generated 'realities' that are completely locked off from the our sleeping body's lived reality/world. This phenomenon can lead to an experience of believing, whilst dreaming, that our dream self is all that exists and is unfolding only in a specific time and place. When we dream a high school experience as a forty year old adult, for example, our entire adult self, i.e. decades of post-high school memories/experiences, may be completely inaccessible to our dreaming self as the dream unfolds. For all intents and purposes the origin world of our sleeping body as well as decades of later experiences associated with that body *don't exist* for the duration of the dream. The amnesia generating and maintaining technologies of futuristic VR specialists could, in theory, target the parts of the brain that modulate memory retrieval. As with the high school dream discussed above, entire sequences of our origin world existence could be inaccessible (but also 'potentially accessible') as we go about our lives in a simulated reality.

²¹ PS: if people really want to believe that aliens are influencing our earth, it might be more useful to search for them as VR universe designers or hackers working behind the scenes to generate, regulate, hack, etc the VR world we are perhaps already inhabiting.

²² Unless, that is, we are one of those entities in a state of 'forgetfulness' – probably having accepted significant limitations - whilst in this simulation.

²³ Another option is that the information projecting 'cellular automaton' that created, projects and regulates our universe was itself randomly and spontaneously created without conscious intervention/work (design) by any form of organic life, intelligent or otherwise. (In formulations of this approach the universe itself comes close to being seen as some kind of vast 'life form'). The capacity of quantum fields or some other substrata of the universe (or multiverse) to generate universes that can support life/consciousness would then be seen as either accidental or the result of the living universe itself. Alternatively, the creative impetus/cellular automaton that created our universe may still exist somewhere else in the Multiverse - perhaps as another nested, bubble or brane universe (i.e. a vast life form with possibly quite different 'universal constants'). NOTE: this option rejects the notion of a 'Simulated Universe' but accepts the theory of an 'Informational Universe' to some extent.

Interestingly, the godlike beings of the originating universe may well have the power to inhabit human or animal 'avatars' in our simulated reality. This phenomena is, of course, documented in many human spiritual systems (though classical science rejects such a possibility).

The Big Questions and the Scientific Evidence for Simulated Realities

Both Option Two above (which includes "S" and "H" type simulations) and Option Three suggest some intriguing questions: What is the nature of the originating reality that, presumably, is 'projecting' the virtual reality/ holographic universe we seem to inhabit? If we are living inside a simulated reality how can we prove it and what is the purpose of the experience?²⁴ What types of interaction occur between the Origin World and the Simulated World – and to what degree are inhabitants of the Origin World dependent upon the VR world and its inhabitants?²⁵ I want to argue that we can approach such questions from two perspectives: scientific and intuitive (i.e. artistic-visionary).

New Science Approaches

Like the Many Worlds/ Many Selves trope, the 'simulated universe' trope might have remained a mere interesting thought experiment if not for the fact that many aspects of physical reality seem amenable to the proposition that the universe has computational/informational foundations. Physicists are currently conducting experiments that may eventually confirm or disprove the hypothesis.²⁶ In the mean time, some of the intractable conundrums and paradoxes of modern physics seem to become comprehensible when one adopts 'informational' and even 'simulated reality' perspectives (Please See Appendix 1 for a list).

Intuitive Approaches: Artistic/Literary and Visionary Approaches

The development over the past 60 or so years of the "S" version of Option One above invites writers and artists generally, to reflect upon the way more traditional 'VR experiences', i.e. oral story-telling, reading, art observation, listening to music, etc - are rapidly mutating into all-encompassing technology mediated VR experiences (multi sensual and highly granulated/pixelated), that increasingly blur the lines between physical reality and virtual realities. 'Second Life' and so-called MMORPGs (or 'massively multiplayer online role-playing games') offer state of the art VR experiences that point the way to the future of simulations.

²⁴ Some of these questions are explored by the following writers: David Deutsche, *The Fabric of Reality*, Chapt. 5 'Virtual Reality' 1998; Mark Solomon, *On Computer Simulated Universes*, 2015; Jim Elvidge, *The Universe Solved*, 2007; Brian Whitworth, 'The Physical World as Virtual Reality', *CDMTCS-316*, December 2007.

²⁵ This is an interesting question. Many discussions of the simulation hypothesis fail to project into the future key WWW and Internet of Things trends/developments. Underlying such trends is not only: projected, near exponential, growth in computer processing power; similar growth in VR uptake among humans globally; and finally, the development of ever more 'real' VR technologies, but also increased Origin World dependence on simulated realities for a range of Origin world needs/functions. The increased interpenetration and interdependence of VRs and the WWW with our Origin world (real world?) means that a futuristic civilisation running us as a simulation would likely be highly dependent on the relational exchanges taking place between the worlds. Of course, this really depends upon the purpose of our 'simulation'. The fact that near total 'entry amnesia' seems to hold for consciousnesses inhabiting avatars in our world, suggests that 'entertainment' might be the most likely purpose of our particular simulation – not a promising conclusion since it implies less 'Origin world dependence' upon participant well-being!

²⁶ Some theorists, however, have suggested that if 'entry amnesia' is a condition of participating in the simulation, the programmers may reprogram (i.e. 'patch' or 'update') any scientific experiments that threaten to definitively prove that we are in a simulation!

Whether we currently live in a ‘simulated reality’ or not, this trope (with its AI subtext) allows us to critically explore humanity’s recent full-throttle escape/retreat into high tech virtual worlds via gaming, online socializing in simulated realities (e.g. Second Life and The Sims), etc. In less than a hundred years it will be very difficult indeed for humans to tell the difference between ‘reality’ and the many ‘simulated realities’ they will undoubtedly be required to ‘inhabit’ for work, education, entertainment, etc. purposes during their lives.²⁷

This will almost certainly be the case if VR technologies are developed that can:

- 1) safely evoke various degrees of *originating world ‘amnesia’* as one enters virtual worlds – probably to heighten the ‘realism’ of experiences (allowing for ‘suspension of disbelief’).
- 2) maintain ‘in-world’ memory and identity continuity whilst participants move back and forth between worlds. This would allow for unbroken experiences of the virtual self (when ‘in world’ and in a state of ‘amnesia’) whilst allowing the originating self to function in the originating world.
- 3) compress ‘time’ *in-world* and generate believable back-story for sections of the story line that the participant hasn’t actually experienced. Such a technology might allow participants to put their avatars on ‘remote’ whilst they go about their business in the originating world. Upon returning (after another dose of ‘entry amnesia’) they might be none the wiser that, say, 2 months of their simulated life had passed without them actually being ‘present’.

Origin World Identity Retrieval Whilst Inhabiting a Simulation: Finally, any intuitive approach to the possibility that we are living in a simulation would usually involve us attempting to access what I’ve called the ‘quantum unconscious’ to: 1) assist us in our pursuits whilst in the simulation; or 2) retrieve aspects of our Origin World self – both its history before we entered the simulation and the experiences it is having in the Origin World whilst part of it is also in the simulation. We might speculate, however, that attempts to secure ‘trans-simulation’ advantages or to activate ‘Origin World’ identity ‘retrieval’ whilst in a simulation may or may not be permitted by the beings (or algorithms) that maintain the simulation.

From “S” and “H” Level Simulated Worlds to Life Inside a 23rd Century Literary Masterpiece

There is also another reason that intuitive – i.e. artistic and visionary – approaches to the Simulation Hypothesis should be taken seriously. I propose that we can build upon Bostrom’s hypothesis (including its patches/modifications, as well as Dainton’s work on “S” and “H” version Sims), by adding something important to Bostrom’s third possibility regarding whether we might be living inside a simulation. If his first two proposals don’t hold – i.e. 1) if the human species **doesn’t become** extinct before the post-human stage; and 2) if a lot of post-human societies **do choose to create** high fidelity simulated realities – then we progress to his third proposal:

- (3) We are almost certainly living inside a computer simulation.²⁸

²⁷ Many people are already experiencing this issue – it is sometimes labeled ‘VR psychosis’. Millions of others are already living large segments of their lives in simulated realities – many are experiencing their VR escapism as a kind of addiction. Such problems look set to contribute to a global epidemic in the near future.

²⁸ ‘Are you living inside a computer simulation?’ Nick Bostrom, 2003, p 1.

I feel that we would need to add something important to this third possibility.

If (3) is correct then it is highly likely that (4) i.e. that our Simulation has been created by beings with highly developed creative/artistic sensibilities, follows. It is possible that we are living inside a 23rd to 26th century “multimedia VR literary masterpiece”. This conclusion follows if we extrapolate current VR gaming, AR, AI, Transmedia and Internet of Things developments only a few centuries into the future. We don’t know, however, whether the creators/maintainers would be humans, evolved humans, aliens, human-animal/insect etc. hybrids or human-robot/AI hybrids. Never-the-less, given the complexity of the simulation (i.e. its advanced programming) as well as the many marvelous cultural artifacts built into the program (e.g. Shakespeare, Homer, the Upanishads, Aboriginal Dreamtime stories etc.), we could surmise that the creators and moderators are likely working for a future, state of the art, ‘Quantum VR Publishing Collective’ of some description. As per current trends, “Earth 2017” would likely be the result of ‘collaborative creativity’ on a truly epic scale. There is also the possibility that our simulated reality is ‘interacting’, though in unseen ways, with its Origin World on multiple levels.

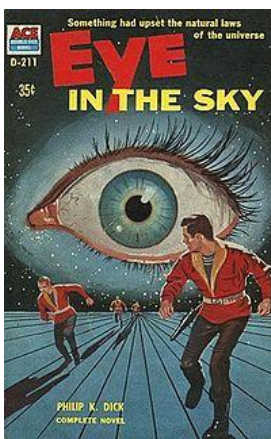
If Bostrom’s third proposition is correct we perhaps have the most important argument ever made for the importance of the Creative Arts, Humanities and Sciences to intelligent, conscious life forms such as ourselves. Taking Proposal Three of his argument to its logical conclusion we can state the following: the concept many humans associate with “God” may be a 23rd to 26th Century “Multimedia Publishing Collective”! In that case, if you want to please “God” you should, above all else, value and safeguard manifestations of the sciences, humanities and creative arts whenever you come across them.

Let us now discuss the ways the various versions of the ‘simulated reality’ trope have played out in fiction and film over the past 60 or so years. We note that the trope has become steadily more popular since the late 1960s.

Simulated Realities in Fiction and Film

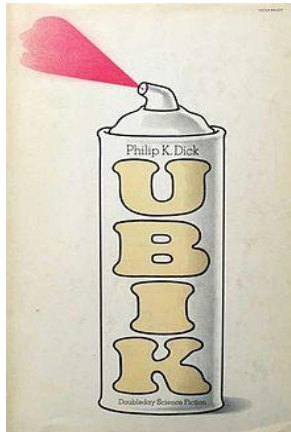


Writers intrigued by the future of VR, AI and AR technologies as well as those fascinated by the possibility that we may be living in a simulated reality without knowing it, have responded creatively to the many questions we’ve been pondering in this paper: ‘Who or what designed and constructed the super-immersive computer network?’ ‘Why was it constructed?’ ‘Why are people embedded in it?’ ‘What is the nature of the world of origin and self of origin?’ ‘Am I a Sim or a super-immersed human (or other consciousness) partially resident elsewhere?’ The answers to these questions obviously depend on which of the ‘Simulated Worlds’ options detailed earlier we feel drawn to. All three options generate a range of interesting answers to such questions.



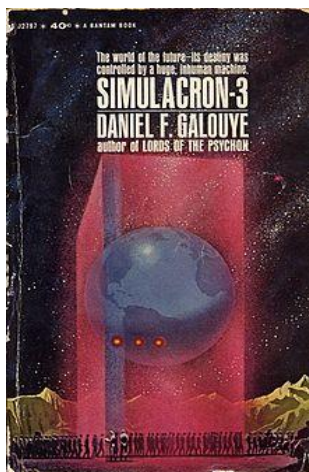
Like the Many Worlds trope, the trope didn't really take off until the 1960s, though Philip K Dick's short story 'The Trouble With Bubbles' (1953), as well as his novels *Eye in the Sky* (1957) and *Time Out of Joint* (1959), are classified by some experts as early examples. (As is Ray Bradbury's short story 'The Veldt', 1951). Perhaps the definitive

moment pointing the way to films like *The Matrix* series (1993-2003), *Avatar*, *Lawnmower Man* (1992) etc, is Daniel F. Galouye's remarkable novel *Simulacron-3* (1964) - later made into one of the world's first films exploring the mature version of the trope, i.e. *World on a Wire*, 1973 and later filmed as *The Thirteenth Floor* (1999). Philip K. Dick's novels *The Three Stigmata of Palmer Eldritch* (1965) and *Ubik* (1969) should also be mentioned.²⁹ Another early movie exploration is the otherwise unremarkable western *Welcome to Blood City* (1977).



It was not, however, until the advent of String Theory and its cross-overs with Digital Physics and Information Theory in the late 1980s and 1990s, that the trope mutated into its current form. By the turn of the millennium it was beginning to dawn on spec fiction enthusiasts of all descriptions that the universe might be a complex 'quantum computer'. It was but a short step for some to imagine 'simulated universe experiences' in which a mind/consciousness - unaware of its origin body - is hooked up to a computer with some sort of 'interface' + 'high fidelity display'. The imaginative leap (paralleled in the real world) from analog/Turing Machine computations to quantum computations helped put the trope on steroids - largely because it allowed it to expand to encompass

various long running tropes in SF associated with 'quantum weirdness' - including tropes arising out of the hugely popular 'Many Worlds' theory, as well as AI, time travel and other SF staples. The promise that Quantum Computers will be able to process data at exponentially faster rates also fed the trope.



Fiction writers and filmmakers have explored many explanations to do with why humans might end up in a high-fidelity Simulation. We could enter VR worlds as students studying subjects via super-immersive multimedia methods (as per *The Lawnmower Man*, 1992); we could enter them as cyber tourists (something explored by way of VR memory implants in the 1990 movie *Total Recall* - based on a story by Philip K. Dick); we may seek advanced entertainment experiences via 26th century technologies analogous to films or novels in our era. Perhaps we are seeking professional development (the cyber equivalent of attending training or a conference, etc.) as professionals researching topics of interest to communities in the future, i.e. in a real parallel present. Maybe we are seeking inspiration as future artists. Perhaps we

might be testing or even reviewing a virtual reality game, or maybe we simply admiring the handy-work of other designers/ creators. Then again, maybe we enter as 'VR addicts' escaping our future lives for some reason (e.g. Ragle Gumm in *Time Out of Joint*, a 1959 novel by Philip K. Dick or the 'gargoyles' addicted to the 'metaverse' experience in Neil Stephenson's 1992 novel *Snowcrash*).

²⁹ Philip K. Dick's much publicized 1977 description concerning how this trope developed in his fiction is available as a video on the WWW. At a French SF convention he told a transfixed audience that after he'd written a number of stories about 'counterfactual worlds' in the 50s and 60s a dark haired woman visited to inform him that some of the worlds he'd been exploring were real. She also told him that he was living inside a computer generated reality.

There is also the possibility that we are prisoners of some sort undergoing some kind of VR punishment/hell (as in *Surface Detail*, the Iain M. Banks novel of 2010). Or, perhaps we entered the VR world voluntarily but for some reason became trapped amnesiacs (the situation experienced by Meg when her 'Dreamatron' malfunctions between work shifts, trapping her in an idyllic simulation of a picnic. In: 'Dreams for Sale', the Episode Two of *The Twilight Zone*, 1985-86). Or maybe our real 'future bodies' are being farmed or coerced in some way by future (or current) aliens as we live out our days in a pleasantly nostalgic VR earth world program (*The Matrix* series)! Continuing the dystopian theme for a moment, we might enter a VR world as revolutionaries to destroy or disable it from within (a theme explored in *Tron* [1982] and *The Lawnmower Man*). Then again, maybe we are being entertained aboard a space ship – i.e. indulging in VR reconstructions of the earth in 2017 as a historical reality or perhaps as a fictional world (as per the human characters in K.A. Applegate's novel series *Remnants* (2001-2003). It's also possible we're here for moral, spiritual or personal development reasons - some kind of VR therapy or therapeutic intervention (as per the endlessly reincarnating versions of 'G' in the movie *The Nines* (2007). Then again, maybe we are actually aliens sampling the 'interspecies' dimensions of a program designed to let us understand humans by becoming humans for a time (a reversal of the VR trope explored in *Avatar* the movie).

Let us return to a moment to Galouye's work, since he set the ball rolling back in 1964 with his novel *Simulacron-3*. In that work he postulated a world of about 10,000 Sims who didn't know that they were Sims. The Sims were created to road test marketing programs for advertisers and were designed as the ultimate 'average community'. Data from the simulation was being used for predictive purposes by a human creator/programmer capable of entering the otherwise 'hermetically sealed' Simulacron-3 'environment' in order to interact with the Sims.

To summarise: there are an almost infinite number of reasons why people might find themselves in Simulations. Let us conclude this section by listing some of the more generalist reason-categories for accessing a simulated reality: education; entertainment; ancestor tracking; incarceration/hellish punishment; escapism; cognitive tourism; professional development; aesthetic appreciation; interspecies transmigration; alien anthropology (or other) experiences; to undergo medical or therapeutic treatments; to conduct or participate in scientific or social scientific experiments, etc.

Writers might like to use the categories discussed above to create new stories, movies, poems, plays, etc.. The following worksheet has been designed to assist writers working in Speculative Fiction genres to develop stories based upon the Simulated Realities trope. [Please Note: it is up to creators to check, via detailed reading and research, whether they are accidentally repeating specific developments to the trope articulated by other writers.]

Worksheet for the Workshop: Are You Living Inside a 23rd Century Literary Masterpiece? ³⁰

1. Character's name: _____

2. Where is the character situated as the story begins? Write a brief description:

3. Is the character currently

AWARE UNCONSCIOUSLY AWARE or COMPLETELY UNAWARE

... of the fact that he or she is inside a simulation? (circle one)

4. Did the character enter the simulation

VOLUNTARILY INVOLUNTARILY or BY ACCIDENT

(circle one option)

5. Is the character:

a SIM, ("H" type A)

an UPLOADED CONSCIOUSNESS (Digital ghost of former human) ("H" type B) or

a HUMAN INHABITING an AVATAR ("S" type)?

(circle one option))

6. Who Created and Maintains the Simulation?

"FUTURE, HIGHLY EVOLVED HUMANS"

"A (QUANTUM) COMPUTER NETWORK (OR OTHER DEVICE)"

"ALIENS" or

"ROBOT-HUMAN", "HUMAN-ALIEN" or "ROBOT-ALIEN" HYBRID/S of some description

Briefly Describe the Creators of the Simulation:

7. Why is the main character in the Simulation (i.e. the purpose of the experience)?

8. Why did the Simulation's creators construct the simulation and why did they place/allow etc. the main character to enter it (if they permitted him/her to enter it)?

9. Will the main character realise that he or she is in a simulation at some point in your story? Yes/No (Circle), if "YES", when will this happen and how will he/she find out? Briefly describe:

10. Is there 'communication' between the Simulated World and the Origin World throughout the story? If so, what form does the communication take? Briefly describe.

11. If the character is an "S" simulation (i.e. a human inhabiting an avatar) where in the Origin World is his/her body? Briefly Describe:

³⁰ This worksheet copyright Ian Irvine (Hobson) May 15th 2017, all rights reserved.

Existential, Emotional and Mind Expanding Consequences of Pondering VR/Programmed Reality Story Tropes

The Virtual Reality/Programmed Reality trope has the power to make people question every aspect of their understanding of reality. Such an experience can be either liberating or terrifying. If we genuinely engage with the trope's many facets we may experience something akin to Existential Panic as we struggle to prove or disprove the various possibilities.

The idea that parts of our existence and identity are situated elsewhere (perhaps in the future, perhaps somewhere else) but are veiled from us for some reason, may even produce feelings of powerlessness and paranoia. What is happening to our bodies in the origin reality - are we organic batteries for aliens as per *The Matrix*? Similarly, questions like: 'Am I a mere simulation of a human?' and 'Am I an uploaded remnant of myself i.e. Am I already dead?' (a VR subtheme explored in Philip K Dick's 1969 novel *Ubik*) suggest disturbing consequences if answered in the affirmative. Another question arising out of the trope is: 'How many of the people around me are real and how many are Sims (computer generated humans)?' If we answer, 'some', 'many' or 'all', of course, we may feel trapped inside a nightmare realm best explored by Horror writers! Mental illness beckons if this aspect of the trope is taken too seriously. We are, in truth, talking about radical forms of 'derealisation' here, likewise, inevitable forms of alienation from the simulated world we previously took to be 'reality'.

From a more optimistic perspective, pondering such ideas may allow us to re-examine our life purpose - we may ask: Why am I here? Is there something I'm supposed to achieve? What am I supposed to learn? What is the nature of reality and what is my place in it? Am I happy with the way I'm currently living my life? Some may find themselves reviewing specific moments of their lives in the light of a VR/PR paradigm - they may ask: Have I had experiences that suggest 'program glitches', 'patching', 'the presence of Origin World intelligences/interventions', 'error correction sub routines', 'game of life cheat options', 'reliving *a level* options', 'character switching traces/memories', 'out of simulation assistance', etc.? Such phenomena may have been formulated as inexplicable paranormal experiences, coincidences, synchronicities or déjà vu experiences (phenomena proposed by Philip K. Dick as indicative that we live inside a computer simulation back in the 1970s). We might also ask: Do I possess 'free will' or is everything determined in advance by the program?' and 'Did I arrive here with a pre-programmed destiny/mission/life goal?' Likewise, we could ask: 'Do I possess a higher (more expansive) self and if so, where is it and how does it manifest (can it manifest) in the simulated world?'

These, of course, are questions traditionally posed and answered by philosophers and theologians. However, if we explore them deeply as readers and writers of Sci Fi and Quantum Fiction, an 'unexamined life' may gradually become an 'examined life'. Ready-made but incomplete reality paradigms may be reassessed and in the process we may become more sensitive to the wonders of our world (whether it be a 'counterfeit/simulated' creation, the real deal or something in between).

It is worth concluding this discussion by suggesting that phenomena associated with another trope of Quantum Fiction, i.e. the 'Many Worlds/Many Selves' trope, could manifest in story worlds featuring Options Two and Three of the Simulated Realities approach to reality, especially if the interface between the 'Origin World and its projected 'Simulations/Virtual Realities' is some sort of futuristic, networked supercomputer. The programming of such a

supercomputer could easily offer VR participants the ability to follow/live out a range of 'life-lines' arising out of the 'in-world' decisions participants make. The 'non-collapsed' options/realities would, in some sense, remain on the supercomputer's network drives as real but discarded 'super-positional possibilities'. They would amount to 'virtual potentials' – and their sum would equal all the unlived moments of our myriad unlived lives.

Similarly, if the Many Worlds interpretation of Quantum mechanics is correct, we would need to acknowledge the existence of possible universes in which advanced future civilizations are currently running the "Earth 2017" simulation (i.e. our reality). Likewise, and following on from other quantum anomalies, the process of OBSERVING/EXPLORING these and other quantum fiction tropes, may cause them to become manifest as part of our reality. If so, it is worth asking the reader a question: are we - you and I, reader and author – right this minute co-authoring a 23rd to 26th century CE Literary-Multimedia masterpiece,³¹ by virtue of the fact that we're exploring future VR-based story-telling possibilities?

³¹ Of course there is the possibility that 'Earth 2017' is in fact the VR equivalent (for the proposed 'advanced future civilization') of what in our era is called 'a trashy airport novel.'

APPENDIX 1: Possible Basis in Theoretical Physics for “S” and “H” Versions of the Simulation Hypothesis

Some of the intractable conundrums and paradoxes of modern physics appear to become comprehensible when one adopts 'informational' and even 'simulated reality' perspectives. A brief list follows (Please note: I've adapted insights from a number of theorists to assemble this list)³²:

1. The problems associated with the 26 'Universal Constants' being arranged just so in our universe in order to allow life, consciousness etc. to come into existence and evolve. These constants and their interactions with each other amount to - say some physicists - a universe 'programme' designed by somebody or something prior to the Big Bang. Digital physicists suggest that these constants are more than mere mathematical equations developed to describe the universe, rather they are computational commands embedded in the universe in order to make things happen as they do. Interestingly, 'glitches' in the history and spatial/local readings (in parts of the universe) of some of these constants may confirm that the universe is a simulation.
2. The phenomena of 'spooky action at a distance' (i.e. 'entanglement' phenomena) and 'non-locality' recorded during experiments that confirm the existence of something Einstein declared impossible, i.e. faster than light communications between elementary particles (at the quantum level). Some digital physicists argue that in a computer simulated universe all 'simulated' space-time coordinates are in fact equal distance from the proposed super-computer's hard-drive. The 'non-local' mysteries, however, don't show up until people inside the world (or Sims) develop in-world technologies that can probe beyond the ordinary limits of the in-world human senses.
3. Experiments suggest that at quantum levels time, space and light, among other things, are 'quantized' (i.e. come in discrete energy bundles emerging out of 'quantum fields' with, literally nothing in between). Put differently: 'display level pixilation properties' (to adopt VR speak for a moment) exist in reality. Although reality looks 'continuous' to our human senses, at the quantum level it in fact consists of discrete 'quantized' events. Life is thus a phenomenon analogous to watching pre-digital movie – such movies were constructed out of 'discrete frames' that tricked humans into believing in 'continuous' movement.
4. The famous double slit experiment that confirmed the weird behaviour of matter at the quantum level – i.e. 'wave-particle duality' linked to the so called 'observer effect' - seems to parallel what happens in VR games. Until a game participant focuses on something in the game world it only exists as mere (data) 'potential' rather than as solid reality. Is 'participant focusing' in a game world a bit like the real world 'observation' act that apparently triggers 'wave function collapse' into a specific particle-based reality? If we are living inside a computer simulation the world just outside of our sense range would be stored on a hard drive until our acts and observations cause parts of it to be 'retrieved'/'rendered' i.e. to become real to us. From the perspective of computation, the observer affect saves on 'processing power'.
5. The Quantum Eraser experiment. Not only do particle/waves of elementary matter behave differently (i.e. they 'collapse') when observed, but the quantum eraser experiment seems to suggest that when observation is delayed something strange happens to 'time'. A kind of backwards (in time) correction of wave collapse occurs. If reality is virtual this otherwise inexplicable phenomenon could be perfectly understandable since time and space as we know it - being generated non-locally as accessible information on a 'hard drive' - would only 'render' the past (i.e. the back-story of a particular universe) when needed. The two 'particle state' realities encountered in the eraser experiment, could, from the perspective of the Simulation Hypothesis, each come from different virtual universes with different back stories. Time seems to backtrack but really the Simulation

³² See in particular: Brian Whitworth, 'The Physical World as Virtual Reality', p.9-10, 2007; Jim Elvidge, Chapt. 7, of *The Universe Solved*, 2007;

Machine has been tricked into revealing the two universes that come into existence as a result of two different participant decisions.

6. Warped space-time around large objects. In the IT world heavily 'rendered' i.e. highly detailed, 'objects' require extra processing power. This often results in a kind of slowing down of game world 'space-time' as the computer struggles to process the extra data. Some physicists have suggested that the informational nature of the universe is what really causes the distortions to space time that occur around massive interstellar objects.

7. Cosmologists and physicist are coming to the belief that what we naively take to be the 'empty spaces' between planets, solar systems, galaxies etc are, from an information perspective, merely 'simulations of empty spaces'. Mysterious forms of dark energy and dark matter seem to underlie those so called empty spaces. To digital physicists this is consistent with the fact that in VR worlds 'empty space' is always rich with information and information exchange processes and has to be processed as such ... despite apparently being empty. Empty space still has to 'compute'.

8. String theorists have apparently found computer code – specifically Extended Check Code - in the equations developed to describe the 'super symmetric' cosmos (though there is some controversy about what exactly this means). James Gates, one of the finders, says that this code may well be evidence of 'error correction coding' embedded into nature. NOTE: Critics say that such codes are ubiquitous in nature (e.g. as feedback loops in genetic coding) and are thus nothing special.

9. 'Quantum tunneling phenomena' observed in the real world seem to parallel phenomena certain game designers observe when attempting to contain and maintain smaller rendered objects in digital and VR environments over time. If our reality is a 'quantum computer simulation' this would make sense.

We could go on listing the various types of physical problems and phenomena that look different once one adopts perspectives arising out digital physics - with its emphasis on information and information exchange (communication). However, like the Many Worlds/Many Selves theory, the more extreme version of the Programmed Universe theory (i.e. the Simulation Hypothesis) arises directly from theories formulated by world-class physicists trying to make sense of ground breaking quantum experiments and cosmological discoveries.

APPENDIX 2 - VR Terminology (as developed by scientists etc. from a range of disciplines)

The “S” version of the simulation hypothesis – i.e. the notion that beings from outside the simulation can enter the simulation by inhabiting ‘avatars’ – is based upon assumed developments in computing and VR technologies over the next 200 years or so. Such developments are roughly linked to Moore’s Law, which predicts increases to computer processing power into the future. What follows is a brief summary of the terms we might use to describe advanced futuristic VR and computational technologies that are likely to exist in the period 2300-2600 CE (assuming we do not become extinct as a species before those centuries). Many of these technological developments will need to happen if the “S” (or even the “H”) version of the Simulation Hypothesis is correct. We will see that ‘processing power’, ‘neural-computer interfaces’, ‘in world flexibility’ and the issue of ‘entry amnesia’ are central to the “S” version of the hypothesis (and consequently to my proposed Amendment to Bostrom’s version of the Simulation Argument).

Origin World and Simulated World: According to David Deutsche it is likely that many of the simulated worlds of the future will be based upon a ‘real’ or ‘origin’ world of some description. If we are in a ‘simulated world’ – e.g. as Sims or Embedded Consciousnesses of some description – we are, nevertheless, being constantly influenced by the invisible rules/physical laws of the ‘Origin World’ even as we experience the ‘**in-world**’ rules of the **simulated world**. In theory, the number of simulated worlds created in the future may be almost infinite, giving rise to concepts like ‘**nested simulated worlds**’ i.e. simulated worlds nested within other simulated worlds. Similarly, a single simulated world may, in the future, facilitate (as **processing power** and **rendering fidelity** increases) an infinite number of in-world behavioral-interactive options – leading to an apparent experience of ‘free-will’ for participants: something mostly absent for contemporary VR participants.

Neural-Computer Interfaces: We are moving rapidly from the primitive VR suits, goggles, screens and wires of the 1970s-90s to the much higher speed, ‘connected’ and possibly ‘mobile’ Wifi/Internet of Things ‘neural interfaces’ of the future. Put simply, origin world participants in the virtual worlds of the future may possess high-tech ‘implants’ designed to substitute ‘Origin World’ sensory inputs for ‘Virtual World’ inputs. The same neural interfaces may also be used to deliver and maintain ‘entry amnesia’ in *some* Virtual Realities. Finally, such implants would (given current IT trends) almost certainly be linked to a quantum supercomputer network of some description – a network with feedback loops etc. capable of providing periodic programme patches, updates, etc.. This network would also likely facilitate both ‘in-game’ and ‘between worlds’ communications for participating ‘embedded consciousness’ possessing ‘real bodies’ that would perhaps be dispersed across the geography of the Origin World. [Here we are extrapolating current MMORPG developments into the future].

In-World Experiences and Super-immersion: ‘In-world experience’ refers to the actual experience of being in a ‘simulated world’. Presumably there would be a range of reasons for entering a ‘simulated world’ and the ‘in-world experience’ might either fulfill or fail to fulfill the participating consciousness’s purpose for visiting/interacting with the simulated world. **Super-immersion** is a term coined for a presumed moment in the future in which VR immersion technologies make it difficult for a participant to tell the difference between reality and the simulated world – as happens to the main character’s wife in the movie *Inception*. We are, however, rapidly moving from today’s two or three senses VR experiences to a future in which all the senses will be engaged in super-immersive experiences – probably by way of neural interface technologies. Such interfaces, according to Deutsche and many others, will be capable of intercepting and manipulating CNS messages to the brain centers that interpret sensual inputs.

Tracking, Rendering and Display Fidelity (also Computer Processing Power): Moore’s Law suggests the exponential growth of computer technologies generally (and therefore VR technologies) into the future. As a consequence, many VR experts are asking: what will happen to ‘rendering’, ‘tracking’ and ‘display’ technologies (technologies fundamental to realistic/super-immersive simulations) as we

move to high speed Quantum computation technologies in the next twenty years or so? Experts predict that we may well reach world simulation fidelities/granulations that match the known fidelities/granulations of universal constants theorized as fundamental to our universe (i.e. Planck's length, Planck time, the cosmological constant etc.) within 200-500 years. However, we will see high fidelity VR experiences capable of challenging the ability of our senses to tell the difference between reality and simulations (without specialized technologies) much earlier, perhaps 30-100 years due to presumed advances in 'rendering', 'tracking' and 'display' technologies.

VR Programme Anomalies, Glitches, Hacking, Patching, Updates etc. If we are in a VR/simulation experience of some sort the future (really: 'elsewhere in the present') supercomputer regulating the experience will likely be a flawed, and therefore evolving, perhaps constantly upgrading, quantum computer network of some description – probably dispersed across the geographical territories controlled by the Origin World society running the simulation. A consciousness within the program may occasionally experience reality glitches and anomalies ('reality violations') that seem inexplicable. Despite the advanced levels of '**Entry Amnesia**' associated, with a future network computer's capacity to manipulate '**in-world**' temporal experiences VR world participants might still retain intuitive understandings of their originating reality (in a sense they never really leave the originating world since it permeates the VR world in various ways). This intuitive part of the self might interpret glitches and anomalies as evidence that it is in a simulation – thus eroding 'suspension of disbelief'. We might contrast 'technical glitches/anomalies' related to physical reality violations with intuited universe-wide anomalies, i.e. philosophical, theological etc. riddles and enigmas that do not sit well with an 'in-world' consciousness. Some examples are: 'the problem of evil', 'the problem of suffering', 'the mind-body problem' etc. The values associated with the design of a given 'universe' may clash with the intuited values that the participant holds to in his/her Origin World.

Entry Amnesia (hopefully voluntary, but perhaps involuntary): 'Entry Amnesia' can be defined as a super-immersive VR evolution of what we currently refer to as 'Suspension of Disbelief'. This is theorized as the moment we give ourselves over to more traditional VR experiences, e.g. reading a book, watching a movie, listening to music, etc. If we do not experience '**entry amnesia**' we will be unable to experience the full pleasure associated with the VR experience. Note: Entry amnesia may be linked to '**in-world**' time manipulation technologies.

Backstory Creation and Error Correction Coding: VR worlds display greater or lesser 'fidelity/granulation' in terms of in-world options/choices and backstory credibility ('backstory rendering'). Presuming a participating consciousness has been administered a dose of 'entry level amnesia' prior to entering the simulation, he or she will likely take 'backstory' as a given. We are talking about implanted 'memories' used to help integrate in-world subjectivity by maintaining a cohesive historically layered sense of self in its relationship with the external world. As David Deutsche points out, in his book *The Fabric of Reality*, to make such a complex, many layered world believable the advanced computer network would need to be able to track the actions etc. of a stupendous number of embedded participants: humans; human Sims; animal, plant and insect Sims; etc. not to mention changes in the physical world that accumulate over time.

Futuristic VR Technologies that Meddle with Time? The fascinating thing about such insights is that future computer networks assisted by advanced '**neural interface technologies**' (in combination with advanced ways of initiating '**entry amnesia**'), may also be able to: a) skip participants forward or backwards through a life narrative without any of them noticing inconsistencies (like contemporary gamers who don't like how a section of a game turns out). Similarly: b) participants may be able to pause simulated experiences without the in-world parts of consciousness noticing whilst another walled off part attends to chores etc. in the '**Origin World**'. This to say, that in the future neural to computer interfaces may be developed that permit people to suspend disbelief in select parts of our brain that enjoy super-immersive experiences. Only the originating self (not the immersed part of the self) would then be aware of its apparently split experience of reality.

VR World-Origin World Interactions (the Phenomena of the ‘Interpenetration of Worlds’): Many early explorations of the Simulated Reality trope presumed what amounted to hermetically sealed VR worlds, i.e. simulated worlds accessible to only a small number of beings in the Origin World. Such an assumption has rarely been challenged since if we are indeed living inside some kind of advanced simulation we would have to acknowledge that everyone we know seems to have undergone some kind of ‘entry amnesia’ experience to get here. Also, the great majority of people appear to be unaware of any interactions unfolding between themselves (‘in-world’) and the Origin World of the proposed advanced civilization. In short: it is hard for us to believe that our proposed Origin World/Civilisation is in any meaningful way **dependent** upon what is unfolding in our particular simulation. However, the development of Massively Multiplayer Online Role-Playing Games (MMORPGs) over the past 20 years or so, not to mention the appearance of online sites like *Second Life* have revealed a dimension to the future of VR technologies that is rarely acknowledged: the ever-increasing **dependence** of our (apparent) Origin World on interactions unfolding between people embedded in avatars inside VR and AR spaces. Indeed, the interpenetration of the real world by VR worlds is clearly accelerating as more and more people become dependent upon VR worlds for work, social interactions, education, entertainment, etc.. If we project this accelerating ‘**interpenetration of worlds**’ phenomena into the future we would expect post-human civilizations capable of running advanced simulations to develop some or even most of their simulations in ways that ‘merge’ VR worlds with the Origin World in technologically advanced ways. This would mean that either: 1) our particular world is an exception to the likely trend (i.e. for some reason it is ‘hermetically sealed’); or 2) our simulated world is indeed interacting continuously with life in the Origin World but our consciousness of these interactions is erased/forbidden etc. by the rules/programming of the simulation for some reason.

REFERENCES

Scientific/Academic References:

- Aguirre, Foster and Merali (editors). *It from Bit or Bit from It?: On Physics and Information*, Springer, 2015.
- Alberts, Crystal. 'Freud is Finished, Einstein's Next': Don DeLillo's *Cosmopolis*, Chaos Theory, and Quantum Entanglement', *Orbit: Writing Around Pynchon*, 4(2): 7, pp. 1-28, May 2016
- Andrade, Eugenio. 'The Organization of Nature: Semiotic Agents as Intermediaries between Digital and Informational Spaces', *SEED Journal* p.56-84, 2007.
- D'Ariano, Giacomo Mauro. 'A Quantum-Digital Universe', *Advanced Science Letters*, Vol. 17 pp; 130-135 (October 2012).
- Barad, Karen. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*, Duke university Press, 2007.
- Jeffrey A. Barrett and Peter Byrne (editors) and Hugh Everett. *The Everett Interpretation of Quantum Mechanics: Collected Works (1955-1980) with Commentary*, Princeton University Press, 2012.
- Jonathon Barrett, Simon Saunders, Adrian Kent and David Wallace (editors). *Many Worlds? Everett, Quantum Theory and Reality*, OUP, 2010.
- Barrow, John D. 'Living in a Simulated Universe', in *Universe or Multiverse?* Bernard Carr, Ed. Cambridge University Press: pp. 481-486, 2007.
- Silas Beane, Zohreh Davoudi and Martin Savage. 'Constraints on the Universe as a Numerical Simulation' *The Physics arXiv Blog* (October 10, 2012).
- Black, Jeremy. *Other Pasts, Different Presents, Alternative Futures*, Indiana University Press, 2015.
- Jim Blascovich and Jeremy Bailenson. *Infinite Reality: Avatars, Eternal life, New Worlds, and the Dawn of the Virtual Revolution*, Harper Collins e-books, Feb 2011.
- Bostrom, Nick. 'Are you Living in a Computer Simulation?' *Philosophical Quarterly*, Vol. 53, No 211, pp: 243-255 (2003, first version 2001).
- Bostrom, Nick. 'The Simulation Argument FAQ', 2011. Accessed via Nick Bostrom's website: May 6, 2017 www.simulation-argument.com
- Bostrom, Nick. 'The Simulation Argument: Reply to Weatherson', *Philosophical Quarterly*, Vol. 55, no. 218, pp.90-97, 2005.
- Bostrom, Nick. 'The Simulation Argument: Some Explanations', *Analysis*, Vol. 69, No. 3 pp. 458-261, 2009.
- Bostrom, Nick & Kulczcki, Marcin. 'A Patch for the Simulation Argument', *Analysis*, Vol. 71, No. 1, pp54-61, 2011.
- Dirk Bouwmeester, Artur Ekert and Anton Zeilinger (editors). *The Physics of Quantum Information*, Springer, 2001, 2nd edition.
- Braidotti, Rosi. *The Posthuman*, Polity Press, 2013.
- J. R. Brown and P.C.W. Davies. *The Ghost in the Atom: A Discussion of the Mysteries of Quantum Physics*, Cambridge University Press, 2000. [First published 1986]
- Byrne, Peter. *The Many Worlds of Hugh Everett III: Multiple Universes, Mutual Assured Destruction and the Meltdown of a Nuclear Family*, Oxford University Press, 2010.
- Calude, C.S. 'Dialogues in Quantum Computing', *CDMTCS Research Reports Series*, June 2003.
- Chaitin, Gregory. 'Epistemology as Information Theory: From Leibniz to Ω ', *arXiv:math*, June 2005.
- Chalmers, David. 'The Matrix as Metaphysics', in *Philosophers Explore the Matrix*, C. Grau Ed. OUP, 2005.
- Christiansen, Peder Voetmann. 'The Semiotic Flora of Elementary Particles', *Roskilde*: Roskilde Universitet, 2003.
- Coale, Samuel Chase. *Quirks of the Quantum: Postmodernism and Contemporary American Fiction*, University of Virginia Press, 2012.
- Cottam, Ron and Taborsky, Edwina. 'A Dialogue on Causality, Relations and Other Things', *SEED Journal*, Vol. 4, No. 2, pp. 61-80, 2004.
- Currivan, Jude. *The Cosmic Hologram: Information at the Center of Creation*, Inner Traditions, 2017.
- Dainton, Barry. 'Innocence Lost - Simulation Scenarios: Prospects and Consequences' (2002).

Davies, Paul and Gregersen, Niels Henrik (editors). *Information and the Nature of Reality: From Physics to Metaphysics*, Cambridge University Press, 2014.

DeBerry, Stephen. *Quantum Psychology: Steps to a Postmodern Ecology of Being*, Praeger Publishers, 1993.

Deutsche, David. *The Beginning of Infinity*, Allen Lane (Penguin), 2011.

Deutsche, David. *The Fabric of Reality*, Penguin, 1998.

Deutsche, David. 'Quantum Theory, the Church-Turing Principle and the Universal Quantum Computer', *Proceedings of the Royal Society of London. Series A. Mathematical and Physical Sciences*, Vol. 400, No. 1818 pp: 97-117, July 8. 1985.

Gordana Dogic-Crnkovic and Vincent C. Muller. 'A Dialogue Concerning Two World Systems: Info-Computational vs. Mechanistic', 33 pages, 2009.

Elvidge, Jim. 'The Singularity, Infomania and Programmed Reality', *Graham Hancock Blog* Nov. 15, 2010. Accessed 6.4.2017 via: <https://grahamhancock.com/elvidgej5/>

Elvidge, Jim. *The Universe Solved*, A.T. Press, 2008.

Emspak, Jesse (and other editors of *Scientific American*). *Seeking the Multiverse: Possibilities in Parallel*, Scientific American, 2013.

Evans, Richard J. *Altered Pasts: Counterfactuals in History*, Brandeis University Press, 2013.

Fontana, Giorgio. 'Why we Live in a Computational Universe', *The Physics arXiv Blog*, 2005.

Francis, Matthew. 'Is this Life Real?', *Aeon* (online) Jan. 2014. Accessed 6/4/17 via: <https://aeon.co/essays/is-reality-a-computer-simulation-does-it-matter>

Gibbs, Philip. 'A Universe Programmed with Strings of Qubits', *The Physics arXiv Blog* (June 2011).

Gilder, Louisa. *The Age of Entanglement: When Quantum Physics was Reborn*, Alfred A. Knopf, 2008.

Goswami, Amit. *Quantum Creativity: Think Quantum, Be Creative*, Hay House Inc. 2014.

Green, Michael. *Quantum Physics and Ultimate Reality: Mystical Writings of the Great Physicists*, Amazon Kindle Direct Publishing, 2013.

Gribbin, John and Mary. *In Search of the Multiverse*, Allen Lane (Penguin Books), 2009.

Kevin R. Grazier and Stephen Cass (editors). *Hollyweird Science: From Quantum Quirks to the Multiverse*, Springer, 2015.

Haisch, Bernard. *The Purpose-Guided Universe: Believing in Einstein, Darwin and God*, New Page ebooks, 2010.

S. Hameroff, S. Kak, R. Penrose and R. Schild (editors). *Cosmology of Consciousness: Quantum Physics and Neuroscience of Mind*, Vol. 3 (papers from *Journal of Cosmology* Vols. 3, 13 and 14). Cosmology Science Publishers, 2011.

S. Hameroff, S. Kak and R. Penrose (editors). *Quantum Physics of Consciousness* (papers selected from *Journal of Cosmology* Vols. 3 and 14) Cosmology Science Publishers, 2011.

Hammarstrom, Anders.: 'I Sim: an Exploration of the Simulation Argument', 2008. As accessed from Nick Bostrom's website April 2017: www.simulation-argument.com

Hanson, Robin. 'How to Live in a Simulation', *Journal of Evolution and Technology*, Vol. 7, 2001.

Hanson, Robin. *The Age of Em: Work, Love and Life When Robots Rule the Earth*, OUP, 2016.

Hayes, Brian. 'Debugging the Universe', *International Journal of Theoretical Physics*, Vol. 42, Issue 2, pp 277–295, Feb. 2003.

Hayles, Katherine N. 'Unfinished Work: From Cyborg to Cognisphere', *Theory, Culture and Society*, 23 (7-8): p. 159-166, 2006

Hellekson, Karen. *The Alternate History: Refiguring Historical Time*, The Kent State University Press, 2001.

Jarrell, Donald, W. *At the Edge of Time: Reality, Time and Meaning in a Virtual World*, Create Space Independent Publishing, 2012 and 2014.

Jenkins, Peter S. 'Historical Simulations – Motivational, Ethical and Legal Issues' *Journal of Futures Studies*, Vol. 11, No. 1, pp. 23-42, 2006.

Johnson, David Kyle. 'Natural Evil and the Simulation Hypothesis', *Philo*, Fall-Winter Issue, Vol. 14, no. 2, 2011.

Jones, Andrew Zimmerman, 'Are We Living in a Computer Simulation?', Posted 8th July 2015 to PBS.org, accessed: 6 April 2017. <http://www.pbs.org/wgbh/nova/blogs/physics/2015/07/are-we-living-in-a-computer-simulation/>

Kafatos, Menas and Nadeau, Robert. *The Non-Local Universe: The New Physics and Matters of the Mind*, OUP paperback, 2001.

Kaku, Michio. *Hyperspace: A Scientific Odyssey through Parallel Universes, Time Warps and the Tenth Dimension*, OUP, 1994.

Kaku, Michio. *Physics of the Impossible: A Scientific Exploration into the World of Phasers, Force Fields, Teleportation and Time Travel*, Doubleday 2008.

Kauffman, Stuart. *Humanity in a Creative Universe*, Oxford University Press, 2016.

Kirby, Vicki. *Quantum Anthropologies: Life at Large*, Duke University Press, 2011.

Kurzweil, Ray. *The Singularity is Near: When Humans Transcend Biology*, Duckworth Overlook, 2008 impression.

Lewis, Peter J. *Quantum Ontology: A Guide to the Metaphysics of Quantum Mechanics*, OUP, 2016.

Lloyd, Seth. *Programming the Universe*, Vintage Books, 2007.

Lloyd, Seth. 'The Computational Universe', *The Physics arXiv Blog* v5, 2005-6. Accessed 6/4/17 via: <http://arxiv.org/abs/quant-ph/0501135>

Lloyd, Seth. 'The Universe as Quantum Computer'. Chapter in *A Computable Universe: Understanding and Exploring Nature as Computation*, H. Zenil ed., World Scientific, 2012.

Manly, Steven, Dr. *Visions of the Multiverse*, New Page Books, 2010.

Mayfield, John, E. *The Engine of Complexity: Evolution as Computation*, Columbia University Press, 2013.

Moskowitz, Clara. 'Are We Living in a Computer Simulation?', *Scientific American - Physics* (online), April 7, 2016. Accessed April 6th 2017. <https://www.scientificamerican.com/article/are-we-living-in-a-computer-simulation/>

Nishida, yohei. 'The Relationship Between Autopoiesis Theory and Biosemiotics: On Philosophical Suppositions as Bases for a New Information Theory', *Triple C* 9 (2) p. 424-433, 2011.

Nite, Sky. *Virtual Reality Insider*, New Dimension Entertainment, Inc. Version 2.1, July 2015.

Noth, Wilfred (editor). *Semiotic Bodies, Aesthetic Embodiments and Cyberbodies*, Kassel University Press, 2006.

O'Neill, Rob. 'This Virtual World', *Computerworld New Zealand*, p.10-11, Jan 21st 2008.

Oppermann, Serpil. 'Quantum Physics and Literature', *Anglia Journal of English*, 'Special Issue: Literature and Science', 133(1) pp: 87-104, 2015.

Jane Prophet and Helen Prichard. 'Performative Apparatus and Diffractive Practices: An Account of Artificial Life Art', *Artificial Life* 21: p:332-343, 2015.

Radin, Dean. *Entangled Minds: Extrasensory Experiences in a Quantum Reality*, Paraview Pocket Books, 2006.

Rubenstein, Mary-Jane. *Worlds Without End: The Many Lives of the Multiverse*, Columbia University Press, 2014.

Scoble, Robert. And Israel, Shel. *The Fourth Transformation: How Augmented Reality and Artificial Intelligence Will Change Everything*, Patrick Brewster Press, 2017.

Smart, John M. 'The Transcension Hypothesis'. *Acta Astronautica*, 16 Dec 2011, updated 2012 and accessed 6.4.2017 via: <http://accelerating.org/articles/transcensionhypothesis.html>

Solomon, Mark. *On Computer Simulated Universes*, Lithp Preth, 2013.

Solomon, Mark. *The Evolution of Simulated Universes*, Lithp Preth, 2013.

Stapp, Henry P. *The Mindful Universe: Quantum Mechanics and the Participating Observer*, Springer, 2007.

Steinhart, Eric. *Your Digital Afterlives: Computational Theories of Life after Death*, Palgrave Macmillan, 2014.

Strehle, Susan. *Fiction in the Quantum Universe*, University of North Carolina Press, 1992.

Susskind, L. 'The World as a Hologram', *J. Math. Phys.*, 36, 6377- 6396 (1995).

Taborsky, Edwina. 'The Methodology of Semiotic Morphology: An Introduction', *SEED Journal*, Vol. 5, No. 2, pp: 5-26, December 2005.

Tegmark, Max. *Our Mathematical Universe*, Penguin (Vintage), 2015.

Theiss, Derek J. *Relativism, Alternate History and the Forgetful Reader: Reading Science Fiction and Historiography*, Lexington Books, 2015.

Vedral, Vlatko. *Decoding Reality: the Universe as Quantum Information*, OUP, 2010.

Vidal, Clement. 'Computational and Biological Analogies for Understanding Fine-Tuned Parameters in Physics', *Foundations of Science*, Volume 15, Issue 4, pp 375–393, November 2010.

Weatherson, Brian. 'Are You a Sim?' *Philosophical Quarterly*, Vol. 53: 425-31, 2003.

Wendt, Alexander. *Quantum Mind and Social Science: Unifying Physical and Social Ontology*, Cambridge University Press, 2015.

Whitworth, Brian. 'The Physical World as Virtual Reality', *CDMTCS-316*, December 2007.

Whitworth, Brian. 'Exploring the Virtual Reality Conjecture', (latest version accessed April 2017 via: <http://brianwhitworth.com>)

Whitworth, Brian. 'Simulating Space and Time', *Prespacetime Journal* 1(2) p.218-243, 2010 (latest version accessed April 2017: via <http://brianwhitworth.com/BW-VRT2.pdf>)

Whitworth, Brian. 'The Emergence of the Physical World from Information Processing', *Quantum Biosystems*, 2(1), p.221-249.

Whitworth, Brian. 'What is Reality?' (Version 2, of the draft 7th chapter of a book on Quantum Realism. Accessed April 2017 via: <http://brianwhitworth.com/WhatIsRealityVersion2.pdf>

Whitworth, Brian. 'Quantum Realism: Chapter 3 – The Light of Existence', 2012 V2. Accessed April 2017 via: <https://arxiv.org/abs/1011.5705>

Whitworth, Brian. 'Quantum Realism – Chapter 4 - The Matter Glitch: An Alternative to the Standard Model' (latest version 2014). Accessed April 2017 via: <http://brianwhitworth.com/BW-VRT4.pdf>

Williams, Conrad, B. *What is the Matrix? Jean Baudrillard and Simulation in the Wachowski Brothers' Matrix Series*, 2010.

Wiseman, H.M. 'From Einstein's Theorem to Bell's Theorem: A History of Quantum Nonlocality', *Contemporary Physics* 47(2) · March 2006.

Witzany, Guenther. 'Natural History of Life: History of Communication Logics and Dynamics', *SEED Journal*, Vol. 5, No. 1, pp. 30-59, 2005.

Wolfram, Stephen. *Computation and the Future of the Human Condition*. Based on a talk given by Wolfram at *H+ Summit @ Harvard*, June 12th 2010. This ebook version accessed via Kindle Store, April 2017.

Zenil, Hector. *A Computable Universe*, World Scientific, 2013.

Danah Zohar and Ian Marshall, *The Quantum Society: Mind, Physics and a New Social Vision*, Quill/William Morrow, 1994.

Zohar, Danah (in collaboration with Ian Marshall). *The Quantum Self: Human Nature and Consciousness Defined by the New Physics*, William Morrow Press, 1990.

ALSO ...

Contributor: 'The Measurement That Would Reveal the World as a Computer Simulation' *MIT Technology Review*, Oct. 2012. Accessed 6.4.2017 via: <https://www.technologyreview.com/s/429561/the-measurement-that-would-reveal-the-universe-as-a-computer-simulation/>

Editors/contributors. *How Consciousness Became the Universe: Quantum Physics, Cosmology, Evolution, Neuroscience and Parallel Universes*. Cosmology Science Publishers, 2015 and 2016.

Editors/contributors (R. Joseph ed?). *Quantum Physics of the Paranormal: Premonitions, Precognition, Death, Altered States of Consciousness*, Cosmology Science Publishers, Cambridge 2014.

Editors/contributors. *Quantum Physics of God: Neuroscience of Spirits, Souls, Dreams, Prophecy, Paranormal, Near Death*, Cosmology Science Publishers, 2015.

Webre, Alfred Lambremont. *The Dimensional Ecology of the Omniverse*, Universe Books, 2014.

Editors/contributors. *Possibilities in Parallel: Seeking the Multiverse*, Scientific American (Eds.), 2013.

Literature References:

Applegate, K.A. *The Remnants* (novel series), 2001-03.

Atkinson, Kate. *Life After Life* (novel), Reagan Arthur Books, 2013.

Bradbury, Ray. *The Veldt* (short story), 1951.

Delany, Samuel R. *Stars in My Pocket Like Grains of Sand* (1984), Gollancz eBook (and Orion Publishing Orion), 2013.

Dick, Philip K. *Eye in the Sky* (novel), 1957.
 Dick, Philip K. *Ubik* (novel), 1969.
 Dick, Philip K. 'The Electric Ant' (short story), 1969.
 Egan, Greg. *Permutation City*, (1994) Gollancz eBook (and Orion Publishing), 2010.
 Galouye, Daniel F. *Simulacron-3* (novel), 1964.
 Gibson, William. *Neuromancer* (novel), 1984.
 Harris, Wilson. *The Carnival Trilogy*, (1985) Faber and Faber, 2013.
 Irvine-Hobson, Ian. *The City of Quartz* (novel), 2016.
 Knight, Damon. 'You're Another' (short story), 1955.
 Platt, Charles. *Silicon Man* (1991) and *Protektor* (1996), Stairway Press, 2015.
 Stephensen, Neil. *Snow Crash* (novel), 1992.

Film, Television, Youtube and Podcast References:

Avatar (2009)
Brainstorm (1985)
The Lawnmower Man (1992)
The Matrix (series, 1993-2003)
The Thirteenth Floor (1999)
Total Recall (1990)
Tron (1982)
The Twilight Zone (1st season, Episode 2, 1985-86).
Welcome to Blood City (1977)
World on a Wire (1973)
 'Rebooting the Universe' MODERATOR: John Hockenberry PARTICIPANTS: Edward Fredkin, Fotini Markopoulou-Kalamara, Jürgen Schmidhuber and Seth Lloyd. (youtube copy of a conversation held at *World Science Festival* June 2011, Accessed 4.10.17 Via: <https://www.youtube.com/watch?v=atMuFCpxnUQ>)
 '2016 Isaac Asimov Memorial Debate: Is the Universe a Simulation?' Participants: Neil deGrasse Tyson, David Chalmers, Zohreh Davoudi, James Gates, Lisa Randall and Max Tegmark. (youtube copy of a conversation held in April 2016. Accessed 10th April 2017 via <https://www.youtube.com/watch?v=wgSZA3NPpBs>)
 Brian Whitworth and Jeff Young. 'Imagining Our World as a Virtual Reality', *The Chronicle of Higher Education*, April 1st 2008, Podcast/Interview. Accessed April 2017, via: <http://www.chronicle.com/article/Audio-Imagining-Our-World-as/63403/>