

# Multi-Solipsism

## The Physical Ontology of the Many-Minds Concept

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Abstract: The missing piece of the great quantum puzzle is an ontological dualism. This is the meaning of the measurement problem: the linear and collapse dynamics operate at different levels of logical type.

As Everett specifically describes, the observer is the physical entity, the measuring instrument, but the protagonist of the collapse dynamics is the record of observations, a structure of information. In humans this forms the perceptual reality: a three-dimensional virtual-reality representation of the world, projected onto the environment, here the 'world hologram'. It is with respect to this entity, and here alone, that collapse effectively operates. This does not fit any ordinary physical frame of reference which is why his formulation is not fully accepted. The solution is that this dynamics operates solely at a different level of logical type.

The world hologram is multiply instantiated, existing in a great number of versions of a quasi-classical world in the many-worlds universe. Since these are all superposed, the physical reality of this entity is their superposition. The result is a class-of-worlds-as-a-world, a second-logical-type frame of reference. This is by definition indeterminate where unobserved. Collapse occurs, effectively, as each observation is made, not because there is change to the physical but because the definition of the class of worlds changes. This provides the ontology of epistemic interpretations such as QBism and many-minds. Schrödinger's cat is retrodicted: it is an inevitable feature of the superposed class of worlds.

As stated by Everett, solipsism fits the facts but it seems philosophically untenable because of the exclusivity. 'Multi-solipsism' solves both problems. At the first, primitive level of logical type, the universe of the unitary wave function is all possible quasi-classical worlds. At the second level of logical type it is all possible versions of a class-of-worlds-as-a-world, a system of non-exclusive solipsisms. This is an overview of the paradigm presented in *The Quantum-Mechanical Frame of Reference* (Soltau, 2019).

# 1 Introduction

Everett (1957) takes the quantum theory at face value, hence the many worlds of the untrammelled linear dynamics; and he demonstrates the *appearance* of collapse within this context. His concept is not accepted because no explanation of this phenomenon can be found in any physical sense. This, however, is precisely Everett's point, though the implications are not fully drawn.

He defines the observer in traditional classical terms: the physical entity that makes observations. As he describes, observations are made by formulating sensory data that are then recorded in the memory. As he clearly states, this entity does not engage in the collapse dynamics. When an observation is made the result:

... is a superposition of states, each element of which assigns a different state to the memory of the observer. (1957, p. 462)

As he demonstrates, the protagonist of the collapse dynamics is not this physical entity, but the field of information defined by the state of the memory produced: the record of observations, here the 'world hologram'. It is: "Judged by the state of the memory" (1957, p. 462) that the system gives rise to the effective enactment of the collapse dynamics, and thus the effective cycle of the standard von Neumann-Dirac formulation of quantum mechanics (1955). Here the term individual is used to refer to the protagonist, the record of observations as the world hologram; the term observer is reserved for the physical entity that makes observations, the measuring instrument.

Everett's formulation makes no sense because the physical environment in which this dynamics operates is taken to be the quasi-classical world of the current scientific worldview, which is obviously not affected by the state of the memory of some observer. This, however, is the category error at the heart of the problems of interpretation. The physics is perfectly correct. It describes the quasi-classical world with precision. But the physical reality encountered by the protagonist, meaning the subject of the dynamics, is a superposition of such worlds, a second-logical-type phenomenon: all possible versions of a quasi-classical world in which it exists. This, therefore, is the domain in which experiments are actually performed, a class-of-worlds-as-a-world. By definition this is indeterminate except where observed. In this light it is clear that Everett's formulation is perfectly correct because he is describing the physics of *this* domain: the physical reality of the protagonist, the relative state.

## 2 The Inside View

The key point is that the two quite different types of frame of reference in science are of very specific significance in the new physics. As stated by Tegmark:

... the development of relativity theory and quantum mechanics has taught us that we must carefully distinguish between two different views of a mathematical structure:

- The *bird perspective* or *outside view*, which is the way a mathematician views it.
- The *frog perspective* or *inside view*, which is the way it is perceived by a [self-aware substructure] in it.

(1998, p. 23; emphasis in original)

On the outside view, defined by the wavefunction, all possible worlds exist, each one a decoherent quasi-classical world. As stated by DeWitt:

The universe is constantly splitting into a stupendous number of branches, all resulting from the measurement-like interactions between its myriads of components. (1970, p. 33)

These are the many worlds of Everett's formulation in the *physical* sense. The inside view is a completely different type of phenomenon. As Tegmark notes this is the record of observations: a structure of information.

### 3 The World Hologram

In humans the record of observations defines the perceptual reality, meaning the field of information that is directly experienced by each individual. This takes the form of a three-dimensional virtual-reality representation of the real world observed:

Our brain constructs a three-dimensional model. It is a virtual reality in the head. (Dawkins, 1998, p. 276)

Every last scrap of our external experience is of virtual reality. (Deutsch, 2011, p. 10).

This is the integrated synthesis of the record of observations, formulated as a three-dimensional virtual reality.

As Deutsch goes on to describe, this neural activity 'in here' is not experienced as such, but forms a field of information mentally projected out into space, seeming to be 'out there'. The net effect is just like that of a hologram. The virtual-reality rendering of the representation of the world is experienced as a three-dimensional field of information, mentally projected onto the three-dimensional physical world to coincide precisely. This is here termed the world hologram.

Objectively, this is simply the interface to physical reality produced by the brain, a vital but mundane part of the navigation equipment of the human observer. In the current paradigm it is obvious this is just an internal structure of information,

produced and utilised by a particular physical observer. In the quantum mechanics of the many-worlds universe, however, it is phenomenon of core significance. This is Everett's state of the memory. In the physics, therefore this is the protagonist of the dynamics because it is with respect to this entity, a structure of information, that there is the appearance of collapse. This is the central point of his formulation. It is solely with respect to the the state of the memory that the collapse dynamics operates.

The world hologram is the self-aware substructure that Tegmark addresses. At first sight the world hologram hardly seems adequate to account for such an identity, but this is whole of the *functional* identity, defining the operational person, memory, character, traits and so on. As Everett states:

... the actions of the machine at a given instant can be regarded as a function of the memory contents only, and all relevant experience of the machine is contained in the memory (1957, p. 457)

Naturally, the accustomed identity is the body-mind, but on the inside view this is indeterminate except where observed: as is everything in this type of physical reality. Thus the world hologram defines the determinacy of the body-mind. As von Baeyer states:

If I am the agent, the objective world is everything outside my mind—including other agents and even my own body. All of that I may, if I chose, treat quantum mechanically and describe by wave- functions. (2016, p. 154)

He is defining the mind here as “... my own experiences and perceptions” i.e. the world hologram. As described in Section ... this is the functional identity.

## 4 World Superposition

In the many-worlds universe, a specific world hologram is multiply instantiated: there is a great number of slightly different versions of a quasi-classical world that contain an observer with a specific world hologram. Moreover, the identical observation records place all the multiple instantiations at the same location in space-time, so all are coincident. As a result there is only a single instance of the world hologram in the unitary system:<sup>1</sup> identical *and* coincident 'copies' of a structure of information cannot be other than a single instance. As this is the identity of the protagonist, this is of key significance: the effective physical environment of the protagonist is the superposition of all these worlds in which it exists.

On the inside view, from within the perceptual reality of the world hologram, the world is the effective superposition of all the quasi-classical worlds in which it is

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1 This addresses a level 3 (or 4) multiverse in Tegmark's (2003) classification, not 1 or 2.

instantiated. In this type of domain, only what has been observed is determinate because only what has been observed is the same in all the different versions of the quasi-classical world superposed. Equally, everything not observed is the superposition of all possible ways it could be. Thus the only determinacy is given by the record of observations, i.e. the world hologram.

The physical reality assumed in the current scientific paradigm is a specific quasi-classical world, but the reality encountered by each individual protagonist, and thus on which experiments are carried out, is the world superposition: literally a 'many-worlds reality'. This defines the quantum state of the effective physical environment of the individual: the quantum-mechanical sum of the worlds, here the 'quantum-mechanical frame of reference'.

This therefore defines the probabilistic future of this domain. At the same time this is defined solely by the correlations defined by the record of observations: Everett's relative state. Naturally, therefore, the net result is the Bayesian probability of Quantum Bayesianism, now known as QBism (Fuchs et al., 2013). The information defining the Bayesian probability is the same as the information defining the determinacy of the world superposition of the individual, the effective physical environment of the self-aware substructure. *Effectively*, there is no reality to the world except where experienced. This is the resolution of the paradoxes.

## 5 Schrödinger's Cat

Although the physical reality encountered is the superposition of a vast number of worlds, it *appears* to be an ordinary decoherent quasi-classical world. By definition this is the set of all worlds instantiating this specific record of observations, thus all the worlds look identically the same to the individual. So the net result appears to be the view of a specific quasi-classical world. The same principle applies to all classical physics experiments. The world superposition operates exactly like a specific quasi-classical world because the operation of all all the superposed worlds is identically the same to observation: all yield identically the same result in this context.

Exactly the opposite is the case with respect to quantum physics experiments because these reveal what must be happening unobserved. There are different physical states of an object in physical reality, in the same place at the same time. This is the meaning of Schrödinger's cat (1931). Before opening the box the experimenter is present in a great number of worlds, in half of them a dead cat and half with one that survived. On observation the cat is found to be in one state or the other *because* the experimenter is, as a result, present in only half of these worlds, as graphically illustrated in Figure 1 below (Lockwood, 1989, p. 231; adapted).

There are two sets of physical worldlines, dead-cat and alive-cat. Each worldline is in a specific decoherent quasi-classical world. In the lower section, before the crucial

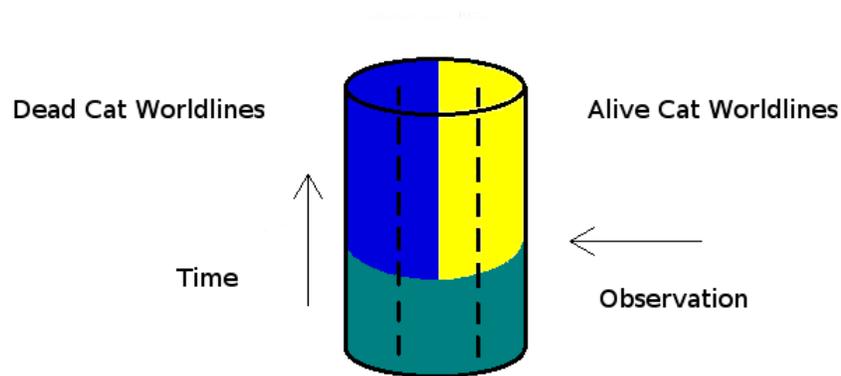


Figure 1: Parallel worlds in the Schrödinger's cat experiment, on observation.

observation is made, the world hologram of the experimenter is the same in the two sets of versions of the world: it contains no information about the current state of the cat. This therefore constitutes a single inside view. Thus the effective physical environment includes both sets of worldlines of the cat, superposed. The cat is literally both alive and dead in this frame of reference.

Once the observation is made, there are two different versions of the experimenter's world hologram, in the different sets of quasi-classical worlds corresponding to the different states of the cat. Thus the physical environment of the experimenter now corresponds to either one state of the cat or the other. This is the enactment of the collapse dynamics, effectively, as described in detail in the following sections. Thus the world of the class-of-worlds-as-a-world retrodicts the reality of Schrödinger's cat. On this view there is no paradox; this is just how a class-of-worlds-as-a-world works. The result is the dynamics of Everett's relative state: the determinacy of the physical reality of the world is relative to the individual.

## 6 The Relative State

This means that individuals live in different versions of the world, as illustrated by Wigner's friend (1961). Since the world superposition is determinate solely where defined by the observations made by this individual, and different individuals have made different observations, their physical realities are different. As in QBism:

This means that reality differs from one agent to another. This is not as strange as it may sound. What is real for an agent rests entirely on what that agent experiences, and different agents have different experiences. (Fuchs et al., 2013, p. 3 )

This is the meaning of Everett's relative state. These are the many worlds of his

formulation in the *many-minds* sense, each one idiosyncratic to the individual. The physical reality of each individual is defined by the record of observations, thus different individuals have different decoherent histories, and different Bayesian probabilistic definitions of the future. As Donald states:

Many-minds interpretation of quantum mechanics extends the many-worlds interpretation by proposing that the distinction between worlds should be made at the level of the mind of an individual observer. (1998)

The concept of world superposition provides a physical ontology for the many-minds interpretations. The world of each individual is a different class-of-worlds-as-a-world, defined by a specific world hologram. As Page (2011) proposes, what fits the facts is a “many-perceptions” interpretation, or “many-views” (Squires, 1996, p. 3). Zeh calls it: “... a *multi-consciousness interpretation*” (2000, p. 9; emphasis in original). The concept presented here is essentially the same as Lockwood's: the preferred basis is the consciousness basis, ie the world hologram.

This kind of observer-dependent situation has been confirmed in recent experimental research. As stated by Proietti et al.

This result lends considerable strength to interpretations of quantum theory already set in an observer-dependent framework and demands for revision of those which are not. (2019, abs)

## 7 The Measurement Problem

Analysis in terms of logical type resolves the intractable paradoxes of the new physics. The physics is unintelligible because there are two incompatible dynamics operating in what is assumed to be a specific monolithic domain; but this is the category error that gives rise to the great paradox. They operate at different levels of logical type. This is the *meaning* of the measurement problem. As stated by Russell (1908) failure to discriminate between different logical types inevitably leads to paradox and nonsense results. There is a fundamental dualism in the ontology of physical reality, as directly evidenced by the total incompatibility of the two fundamental dynamics of quantum mechanics.

As Barrett states of the standard textbook formulation of quantum theory:

... the standard theory is inconsistent since no system can obey both the deterministic and stochastic dynamical laws simultaneously. This is the measurement problem. (1999, p. 15)

All quantum physics experiments ever performed have conformed to this formulation, but it does not seem to make sense. The resolution is that they operate at different

levels of logical type.

The standard von Neumann-Dirac formulation of quantum mechanics defines a cycle of the operation of the two dynamical laws:

Process 1: If a measurement is made, then the system instantaneously and randomly jumps to a state where it either determinately has or determinately does not have the property being measured.

Process 2: If no measurement is made, then the system evolves continuously according to the linear, deterministic dynamics

(Barrett, 2008; adapted)

The system operates these dynamics, collapse and linear, at different levels of logical type. The cycle is illustrated in Figure 2 below. Each of the green space-time images represents the quantum-mechanical frame of reference, defined by a specific quantum state. Deutsch refers to this as a snapshot in the quantum concept of time (1997, p. 278). (Here a snapshot is defined by a class-of-worlds-as-a-world.)

The linear dynamics, Process 2, operates within the context of a specific quantum-mechanical frame of reference, defined by a specific quantum state. This is illustrated by the white arrows in Figure 2: the definition of the positions and states of fundamental particles change with the advance of the time parameter, as defined by the wave function. As this enactment progresses, the next observation is formulated in the neural network of the observer. At the point where this is experienced and added to memory, the definition of the world hologram alters; and as a result the individual is defined as existing in a different snapshot of the world, defined by a different quantum state, as illustrated by the black arrows in Figure 2. Effectively, on the inside view, this is the effective change of the quantum state: the collapse dynamics, Process 1.

Just as Everett describes, the addition of a new correlation with the world equates to the effective collapse of the wave function: there is the appearance of collapse. This is a completely different type of phenomenon to the linear dynamics. It is operating at a

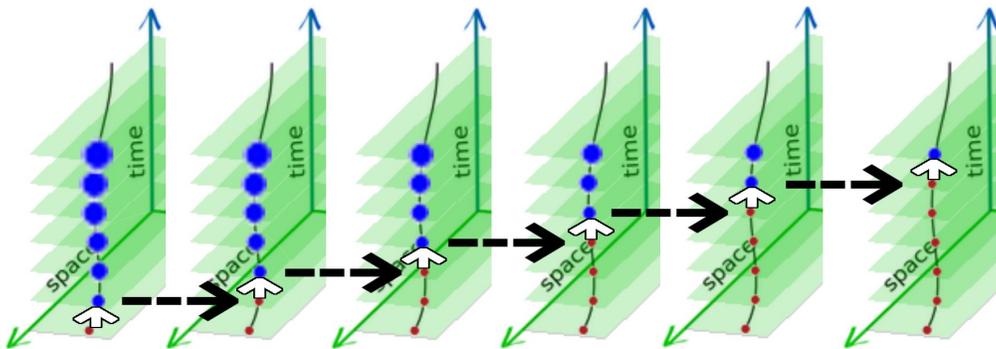


Figure 2: A sequence of snapshots in the quantum concept of time.

higher level of logical type. As Lockwood states, this is a: "... dimension running, so to speak, perpendicular to time and space." (1989, p. 232; emphasis added).

Only one black arrow is shown at each transition in Figure 2 as an example, but really there should be a profusion of these arrows, spreading out radially from each point of observation. As Lockwood continues:

This dimension can be thought of as of arbitrary finite size, and divided into as many regions as there are eigenstates of the corresponding observable, each with a size that is proportional to the square modulus of the coefficient associated with the corresponding eigenstate, as it figures in the superposition. (ibid).

On the inside view the collapse dynamics is enacted, while on the outside view this is a virtual phenomenon: it only appears to happen. As Everett states, referring to the standard formulation :

... we were able to show that all phenomena will *seem* to follow the predictions of this scheme to any observer. (1973, p. 110; emphasis in original)

Collapse of the state vector is only possible *effectively*. This is a second-logical-type phenomenon, meta to the existence of all possible state vectors. It is of higher logical type to the linear dynamics operating in a specific quantum-mechanical frame of reference, a specific quasi-classical world. The linear dynamics operates within one physical snapshot. The collapse dynamics operates the sequence of snapshots.

## 8 Relative Onticity

In the standard formulation, each of the two quantum mechanical dynamics is causal on the other, alternately. The making of the observation comes about because of the progression of the linear dynamics, defined by the quantum state. Then, as the observation is made, the collapse dynamics changes the quantum state, and thus the linear dynamics. Clearly this cannot occur all in the same domain, hence the measurement problem. As has been shown, however, the dynamics operate at different levels of logical type. This is the explanation of relative onticity. As Atmanspacher states:

The central point of the concept of relative onticity is that states and properties of a system, which belong to an epistemic description in a particular domain, can be considered as ontic from the perspective of another domain. (2005, p. 19)

In the context of the quasi-classical world, physical reality is ontic and the world hologram is epistemic: the result of observation. But in the second-logical-type context of the reality of the world hologram, this field of information, the record of

observations, is ontic, and the quantum state of the physical environment is epistemic, the result of observation. In each domain there is a unilateral onticity.

## 9 The Third Logical Type

As stated by Goldstein:

In Einstein's physics, there is no passage of time, no unidirectional flow from the fixed past and toward the uncertain future. The temporal component of space-time is as static as its spatial components; physical time is as still as physical space. It is all laid out, the whole spread of events, in the tenseless four-dimensional space-time manifold. (2005, p. 254)

Nonetheless time passes, and the dynamics of physics are somehow enacted as observed in universal operation. Weyl presents the natural solution:

The objective world simply *is*, it does not *happen*. Only to the gaze of my consciousness, crawling upward along the life line of my body, does a section of this world come to life as a fleeting image in space which continuously changes in time. (1949, p. 116: emphasis in original)

In other words, the frame of reference of consciousness crawls upward along the four-dimensional space-time worldline; and thus the events along the worldline in space-time are encountered in sequence. It is logically identical to an ordinary movie. As Tegmark states: "So life is like a movie, and space-time is like the DVD" (Kuhn, 2015). Effectively time passes, in experience. As Tegmark states, the movie does not run; but as Weyl describes, effectively it does, as is universally experienced.

This also naturally explains the great paradox of the present moment, the Now as Einstein dubbed it. As he stated, this distinction: "... does not and cannot occur within physics." (Carnap, 1963, p. 37). But as Mermin points out, the present moment:

... is evident to each and every one of us as undeniably real. How can there be no place in physics for something as obvious as that? (2014)

Weyl's explanation resolves the whole issue. The Now is the moving frame of reference of consciousness. The problem is that this requires it to be a phenomenon quite other to the physical world on which science is based. That, however, is the whole point. As Weyl declared: "... the consciousness in this function does not belong to the world" (1934, p. 1).

In this case the logical types in the operational system are the same as in a movie system. The frames of the movie film are of the first, primitive logical type. The movie, the set of frames, is of the second. The iterator is of a third logical type, operational on all movies: the set of all sets of frames. It is universal to the system.

Similarly, the moments in time, events along the worldline, are first-logical-type phenomena, the sequence is like the movie film, second-logical-type. The moving frame of reference is third-logical-type. This is what breathes fire into the equations. This is how reality actually works.

## 10 The Origin

It is easy to assume that the sentience is 'in here', in the brain, behind the eyes. This, however, is simply the location of the origin of the perspective to which the world hologram is formulated. This is certainly a key feature of the virtual-reality representation of the world, the world hologram, the product of sapience, but it tells us nothing about the sentience, the experiencing consciousness. This has no known explanation. It is a total enigma. As Fodor states, it is completely inexplicable:

Nobody has the slightest idea how anything material could be conscious.  
So much for our philosophy of consciousness. (1992)

The answer is it cannot. This is the whole point.

The world hologram is formulated with respect to a specific point of view, at a specific location. This is the origin of the perspective of the three-dimensional, virtual-reality representation of the world. The experience of the world hologram, from the perspective of the origin, by the sentience, explains how and why the inside view comes to be experienced from the inside. This, however, does not in any sense mean that the sentience is a brain phenomenon. This the experience *of* the world hologram, produced *by* the brain, *by* the consciousness that is not of this world.<sup>2</sup>

Taken literally, this explains how the dynamics of quantum mechanics come to be enacted. As with relativity, the quantum universe is static. Here both pillars of the new physics are in full agreement. As stated by Barbour: “The quantum universe just is. It is static.” (1999, p. 256). However, since the state vector defines the time-evolution of the world, the experience *of* the state vector must necessarily be the experience *of* the time-evolution of the system defined by the state vector. In other words, to use Nagel's (1974) famous term, this is what it is like to experience the reality of the state vector. It is the definition of the change of the physical reality, so for consciousness to experience the state vector is to experience that changing of the reality. The experience of the wave function is the experience of its function in action. This is a purely subjective explanation, but this is precisely the conclusion forced on the science given the static nature of the universe according to both pillars of the new physics. As Davies states: “... it appears that the flow of time is subjective, not objective.” (2002).

Effectively, in experience, the linear dynamics is enacted. In experience, time

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<sup>2</sup> As the consciousness is nonlocal, all instances of a specific world hologram are simultaneously experienced, thus the physical reality is necessarily the world superposition.

passes. The appearance of collapse is also explained. As each observation is made the quantum-mechanical frame of reference is redefined. The experience of the change of the world hologram is the experience of the transition from one quantum-mechanical frame of reference to the next; and the events observed become the single and specific determinate outcome. This is what it is like to experience the change of the physical reality defined by the state vector. Events happen.

## 11 Universe Consciousness

The contextual nature of consciousness is a conclusion also arrived at in the philosophy of consciousness. As proposed by Chalmers, the experiencing phenomenon can only be: "... a fundamental feature of the world, alongside mass, charge, and space-time." (1995, p. 216). Here it is proposed that the empirical evidence is striking. To falsify it one would have to be certain that the frame of reference in which observations are made is not passing through time. Otherwise we have direct evidence for a phenomenon that nothing in the static physical domain can possibly engage in. A third-logical-type phenomenon is required, and consciousness is clearly in this position as is immediately and directly evident.

The effect is like the passage of the landscape outside the moving frame of reference of a train window: there is the experience of the passage of the landscape. Just like the countryside outside the window, the block universe does not move or change, but in the moving frame of reference it seems as if time is flowing past. The Now is the inside view of this frame of reference, the gaze of consciousness. It is this to which Weyl is referring. On the outside view his statement does not make sense, but he is simply describing the inside view of the operational system which is a quite different type of phenomenon. This is how the world works. It is logically identical to the operation of a movie but for the highly significant detail that all observations are made from inside it.

## 12 Causation

As Davies states the passage of time is subjective, not objective, and as Everett demonstrates there is solely the appearance of the collapse of the wave function. There is no collapse. In both cases the great puzzle has been what it can possibly mean that these are purely subjective phenomena. The answer is that these are features of the transtemporal reality of the conscious individual, the protagonist as experienced by consciousness. As Bitbol describes this is "... the pure knowing subject" (1990, p. 7).

The resolution is that the term subjective in this context does not mean a property

of an observer as a physical object, simply an emergent property of the quasi-classical world. This is not like a mental filter or a psychological bias of an observer. It means a property of the frame of reference of the conscious individual on the inside view, which is an emergent property of the whole. This is the physical reality of a constantly changing class of worlds superposed, a second-logical-type phenomenon, experienced by the third-logical-type phenomenon of the universe.

In the case of both dynamics the consciousness is essentially causal, which is deeply counter-intuitive. It seems obvious that consciousness is a purely passive phenomenon. This is the experience *of* that which has already happened, subsequently processed in the neural system, producing experience. It seems obvious that the phenomenon must be purely consequent. This is exactly true of the process of perception, consciousness as sapience. Sentience, however, is a completely different type of phenomenon. This is the subjective attribute of the moving frame of reference. It is essentially causal. It is because of the movement of this frame of reference that reality as generally conceptualised, i.e. as transtemporal, exists and operates. The subjective in this sense is both definitive and causal.

Nonetheless, like the movie projector, the moving frame of reference of consciousness is just the iterator. The wave function defines the rails along which the path of consciousness must follow, constantly branching into every possible variation as Everett described. The physical defines both the state of the system and the probabilistic time evolution. The moving frame of reference passes along the rails of reality, fissioning as each observation is made. In terms of what path is followed in the evolution of time, the moving frame of reference is entirely passive, like the coaches on a moving train. Nonetheless, with regard to the exercise of the time evolution of reality, the moving frame of reference is entirely causal, like the engine of the train. Naturally, all this is the case only on the inside view.

## 13 Free Will

The conscious individual, the protagonist of the dynamics, is here defined as the world hologram, the product of sapience, 'psychological consciousness', experienced by the sentience, 'phenomenal consciousness'. This entity is naturally transtemporal. The experience of the linear dynamics and the collapse dynamics is the experience of the passage of time and events happening.

If the universe is static it is therefore predetermined, so it would seem free will must be an illusion. Certainly Newtonian mechanics would logically rule it out. Quantum theory means the future is not fixed, but this does not necessarily mean that the individual making choice is a meaningful concept. The future is probabilistic but it is still predetermined: every possible life-line is preprogrammed. And all are somehow taken. Intuitively, it seems that mental states are what causes a person to act, but if

everything is predetermined these mental states are every bit as preprogrammed as everything else. So the apparent free will in sapience is still an illusion. The individual observer is therefore simply part of the mechanics of the physical environment, albeit a conscious part. All logical sequences of events are defined, already 'there' in space-time like railway lines along which consciousness must pass. The layout of the lines is a constantly branching structure, but each line is a fixed and static part of the structure. Nothing in one of these lines can have free will. The worldline of the observer is one of the lines.

The sentience, on the other hand, is in precisely the correct logical position to make executive choice. It is contextual to physical reality, 'outside' of the lines. It is thus in the correct logical position to be able to switch the frame of reference one way or the other; but it has no criteria. It has no point of view about what would be good or bad, or right or wrong, just as the movie projector has no favourite movie, and no point of view about possible endings. As Bitbol describes:

Mind is by itself point-of-view-less, just as it is placeless and timeless.  
(1990, p. 8)

In other words, although Mind has the capability to make choices it has no canon.

This, however, is exactly what is acquired in identification with the world hologram of an individual. This gives rise to an emergent phenomenon of different order, the conscious individual, the *me* experienced by the *I*. This entity has both a set of criteria, and the capability to make choice, and thus alter which version of the future is likely to be experienced. This entity has free will.<sup>3</sup>

Thus free will is a property of the emergent entity that arises from the identification of universe consciousness with the world hologram. The first is free, having the capability of choice. The second has will. The resulting, emergent entity has free will. It is an emergent property of the combined system involving all three levels of logical type.

## 14 Alternative 1

As Fuchs states, reality differs from one agent to another. For a the conscious individual on the inside view this makes perfect sense. For the individual that is experiencing the passage of time and events taking place, the phenomenal

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<sup>3</sup> The other great challenge to free will is that all possibilities exist, so choice is meaningless let alone free will. Precisely true on the outside view, but on the inside view the experience of reality is the experience of the *transition* from snapshot to snapshot. This experience is singular: just *this* version of things happens, in this frame of reference. Inevitably in the quantum universe, some other specific choice is also made, by a different version of the individual.

consciousness is universe consciousness, the functional identity is the world hologram, and the physical reality is a class-of-worlds-as-a-world, indeterminate except where personally observed. The striking implication is that all other individuals are determinate solely to the extent they have been observed. Thus the only person real and fully defined in this frame of reference is this individual. This is closely akin to solipsism, but at the same time it is true for all individuals: multi-solipsism.

Solipsism certainly fits the facts of quantum mechanics as Everett states in his summary of the textbook formulation of quantum mechanics:

It is now clear that the interpretation of quantum mechanics with which we began is untenable if we are to consider a universe containing more than one observer. We must therefore seek a suitable modification of this scheme, or an entirely different system of interpretation.

Alternative 1: To postulate the existence of only one observer in the universe. This is the solipsist position, in which each of us must hold the view that he alone is the only valid observer, with the rest of the universe and its inhabitants obeying at all times Process 2 except when under his observation.

This view is quite consistent, but one must feel uneasy when, for example, writing textbooks on quantum mechanics, describing Process 1, for the consumption of other persons to whom it does not apply. (1973, p. 6)

The interpretation to which he is referring is the standard von Neumann-Dirac formulation, the operation of the two quantum mechanical dynamics in an alternating cycle as described in Section 7.

As Everett is saying here, if the quantum state is taken to be defined solely by the record of observations, the two dynamics are operating in a cycle just as the standard textbook formulation describes. Solipsism is a precise fit with the facts of quantum mechanics.

## 15 Alternative 5

Everett's Alternative 5 is his chosen solution. There is only the linear dynamics. There is no collapse; but there is the *appearance* of collapse. In other words, on the outside view there is no collapse but on the inside view there is. Thus Alternative 5 is actually the outside view *of* Alternative 1, the inside view. Alternative 5 is the world of the current paradigm, outside-view physics. Alternative 1 is the world of the inside view, a second-logical-type phenomenon. This is inside-view physics.

At the first, primitive level of logical type, the world is the ordinary, decoherent,

quasi-classical world. This is the domain of the linear dynamics. At this level the universe is the existence of all possible physical worlds of this nature. There is no collapse. That is the many-worlds theory at the physical level, as for instance described by DeWitt (ibid) and more recently Wallace (ibid). The outside view is the physical reality of the unitary wavefunction. These are the many worlds in the physical sense. As Tegmark states:

The abstract quantum world described by this evolving wavefunction contains within it a vast number of parallel classical storylines ... continuously splitting and merging (2003, p. 10)

At the second level of logical type the Alternative 5 universe is all possible world superpositions, each one a class-of-worlds-as-a-world. This is multisolipsism: the universe of the effective physical environments of specific inside views. This provides the ontology of the many-minds type of universe: e.g. Zeh (1970) Albert & Loewer (1988), Lockwood (1989) and Donald (1998). This is the universe of Alternative 1: idiosyncratic domains unique to the individual on the inside view. The dynamics cycle as described in textbook quantum mechanics.

## 16 Solipsisms

Were it to be taken seriously, the original concept of solipsism would be a philosophy of despair, a world devoid of companionship or even genuine interaction. Multisolipsism is very different. It does not mean that other people do not exist, or that the real world does not exist. Other individuals encountered in the world are all perfectly real, but they live in parallel realities, idiosyncratic physical domains. The world of each individual is ultra-real, a class-of-worlds-as-a-world.

The solipsisms are coexistent, and they share common ground. Naturally, these realities can often be the same with regard to the current location. With respect to two individuals standing next to each other and making essentially the same observations, their physical realities are of course the same – with regard to this environment, at the present moment. Nonetheless, the Bayesian definition of each of their realities is different. This is where the practical implications are deeply at odds with the current paradigm. This peculiar logic is produced by the overlapping *sets* of quasi-classical worlds. The Bayesian future of each personal, physical, parallel reality is idiosyncratic to that class-of-worlds-as-a-world. This is inside-view physics.

Each has a different quantum-mechanical frame of reference, thus the trajectory of the quantum concept of time is different for each individual. Bayesian probability operates on an idiosyncratic basis, defined by the quantum-mechanical frame of reference of each individual. This is the dynamics of inside-view physics.

## 17 Conclusion

The incompatible linear and collapse dynamics operate at different levels of logical type in the unitary system. This is the meaning of the measurement problem. The invisible source of the problem is an essential category error. As described by Everett, the protagonist of the observation dynamics, the self-aware substructure on the inside view, is not the observer, the physical entity that makes the observations, but the state of the memory, defined as the record of observations. In humans this takes the form of a three-dimensional virtual reality representation of the world, mentally projected onto the real world to align precisely: here the world hologram. The self-concept avatar figure at the centre defines the complete functional identity of this individual. The perceiving subject, the real person in the body-mind, conscious and unconscious, is the world hologram experienced as a whole by consciousness.

The apparently paradoxical phenomena are simply attributes of the physical reality of this protagonist: the superposed sum of all the worlds in which it is instantiated, a world superposition. The net result is a class-of-worlds-as-a-world: a second-logical-type phenomenon. In this physical frame of reference the determinacy is defined solely by the record of observations: by definition all else is indeterminate. In this type of physical reality the collapse of the wave function occurs, effectively, as each observation is made because the definition of the class-of-worlds-as-a-world changes.

There are two types of ontological fundamental, both psi-ontic, at different levels of logical type. The physical reality of the quasi-classical world is defined by the quantum state. The class-of-worlds-as-a-world encountered by each protagonist is defined by the superposed quantum states of all the quasi-classical worlds in which it exists, a quantum state.

This resolves the measurement problem. The incompatible dynamics operate at different levels of logical type. The linear dynamics operates the time evolution of the quasi-classical world: the passage of time in space-time. The collapse dynamics operates the time-evolution of the class-of-worlds-as-a-world: the progression of the quantum concept of time. This is the meaning of quantum theory: a fundamental dualism. As described in Section 8 both types of frame of reference are unilaterally ontic.

As described in Everett's Alternative 1, solipsism fits the facts of quantum mechanics: in this frame of reference the cycle of the standard formulation operates naturally. His Alternative 5, no collapse, is simply the outside view of Alternative 1. The physical ontology that synthesises both views is the world superposition, a class-of-worlds-as-a-world, idiosyncratic and unique to each individual. Multisolipsism fits the facts. Unexpectedly, the subjective perspective makes perfect sense of quantum physics, the science of the fundamental attributes of objective physical reality: the rogue dynamics operates only on the inside view.

The implications are bizarre but this is the nature of scientific revolution. As stated by Pagels:

We live in the wake of a physics revolution comparable to the Copernican demolition of the anthropocentric world (1982)

For a century the meaning of quantum theory has remained unresolved. By grasping the nettle of the subjective we discover a previously invisible domain, the class-of-worlds-as-a-world, a second-logical-type phenomenon. Quantum theory defines a dualism of domains in which the linear and collapse dynamics operate exclusively. The dualism means that as well as the quasi-classical world of the modern paradigm, there is another type of physical world, and it is this other type that is directly encountered, and on which all experiments are performed. Conscious individuals, the self-aware substructures, live in personal, idiosyncratic physical realities. At this level of logical type the universe is a multisolipsism.

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