

Multisolipsism

The Physical Ontology of the Many-Minds Concept

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Abstract: The missing piece of the great quantum puzzle is a fundamental dualism. This is the meaning of the measurement problem: the two dynamics operate at different levels of logical type.

As Everett specifically defines, while the observer is the physical entity, the measuring instrument, 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'.

The world hologram is the 'inside view' described by Tegmark. It is multiply instantiated, existing in a great number of versions of a quasi-classical world. Since they are all superposed in the many-worlds universe, this is the inside view of all of them. Thus the world of this inside view is their superposition, a second-logical-type phenomenon. This is by definition indeterminate where unobserved, thus collapse operates on observation. This provides the ontology of epistemic interpretations such as the many-minds interpretations and QBism.

This explains the incomprehensible effects in quantum mechanics because it is *this* domain on which physics experiments are carried out, a class-of-worlds-as-a-world. Observation produces the change of the effective quantum state *solely* on the inside view because this alters the inside-view frame of reference: a second-logical-type phenomenon idiosyncratic to the individual protagonist. Hence the apparent problem in measurement.

As stated by Everett, solipsism fits the facts; but it seems philosophically untenable because of the exclusivity. 'Multisolipsism' solves both problems. At the second-logical-type level the universe is a system of non-exclusive solipsisms: personal, physical, parallel realities, with remarkable properties. More detailed analysis and further implications are presented in *The Quantum-Mechanical Frame of Reference* (2017).

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 in this context. The problem is that no explanation of this appearance in the physical environment of the observer can be found, as Barrett (1999) describes in detail. 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. Observations are made by formulating sensory data that are then recorded in the memory. As he demonstrates, however, 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. As he states, it is: "Judged by the state of the memory" (p. 462) that the linear wave mechanics 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).

This seems nonsensical because the physical environment in which this dynamics operates, taken to be the decoherent quasi-classical world of the current scientific worldview, 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, 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 world in which it exists. This is the nature of the world of the individual protagonist in the world: on which, therefore, all experiments are actually performed. It is 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 his formulation is the physics of *this* domain: the physical reality of the protagonist, the relative state. This is inside-view physics.

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, 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 *is* 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 all observations made, 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, 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, hence the protagonist of the dynamics. As he states, it is: "Judged by the state of the memory" (p. 462) that the collapse dynamics operates. This is the central point of his formulation.

At first sight this hardly seems adequate for a full description of the self-aware substructure, but this is the functional identity. 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)

Once this is understood as the self-aware substructure, the individual on the inside view, the paradoxes of quantum theory automatically dissolve.

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:¹ 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 it is in.

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 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 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. Naturally, therefore, the net result is the Bayesian probability of Quantum Bayesianism (Fuchs et al., 2013). This holds that there is no reality to the world except where experienced, as in the Copenhagen interpretation, but *personally*.

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

5 Evidence

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 goes for all classical physics experiments. The world superposition operates exactly like a specific quasi-classical world *because* all the superposed worlds are 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, half of them with 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).

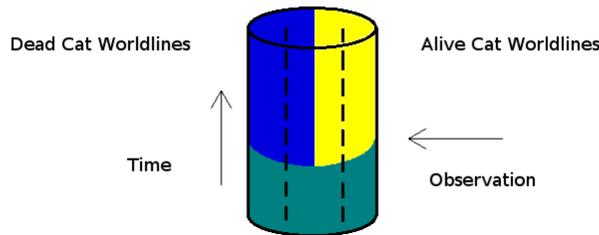


Figure 1: Parallel worlds in the Schrödinger's cat experiment, on observation.

There are two sets of physical worldlines, live-cat and dead-cat. Each worldline is in a specific decoherent quasi-classical world. In the lower section, before the crucial 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 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 many-worlds reality retrodicts the reality of the Schrödinger's cat

paradox. This is just how a world superposition works. The result is the dynamics of Everett's relative state.

6 The Personal World

The major conceptual shift is that the physical reality of the world is relative to the individual. World superposition provides the ontology for epistemological interpretations.

Schrödinger and his cat are in different versions of the world. Since the world superposition is determinate solely where defined by the observations made by this individual, and different individuals have made different observations, their worlds are different. As described in Quantum Bayesianism:

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)

These are the many worlds of Everett's formulation in the many-minds sense. 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 this kind of interpretation. 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 Schrödinger's cat paradox simply means that the experimenter and the cat live in different versions of the world, different world superpositions, in the same place at the same time. As described in Wigner's friend (1961) the two individuals have different decoherent histories, thus different Bayesian probabilistic definitions of the future. In other words they have different pathways through the quantum concept of time.

7 The Quantum Concept of Time

As Deutsch (1997) explains, every possible physical state of the world exists in the quantum universe, each one a 'snapshot' of one version of the physical world. This is the quantum concept of time. Thus, as he states, the essence is that “... other times are

just special cases of other universes” (p. 278), where 'universes' are snapshots: complete quasi-classical worlds.² As he makes clear, however, all possible snapshots exist 'already'; and there is nothing that changes; and there is no possibility of movement from one snapshot to another.

Everett's formulation establishes the basis of how the dynamics of the quantum concept of time is actually enacted. As he describes, each new observation made establishes a new correlation with the physical environment. This means that the inside-view frame of reference becomes correlated with a different snapshot. Thus the making of each observation changes the effective physical frame of reference of the individual, the quantum-mechanical frame of reference. On the inside view, there is the transition from one snapshot to the next.

That is the quantum jump. It is an inside-view-only phenomenon. It is idiosyncratic to the individual. On the inside view each snapshot defined by a superposition of quasi-classical worlds, here the quantum mechanical frame of reference.

8 The Protagonist

The nature of the protagonist of the dynamics is the missing explanatory principle. This is not the observer as is automatically assumed. The observer is of course a key component in the process. This is the measurement *instrument*, i.e. that which *makes* an observation. Naturally, it is a physical entity. The protagonist of the collapse dynamics, however, is the state of the memory, the record of observations: the *product* of the observer mechanism, as Everett specifically states. This is the self-aware substructure in Tegmark's description, here the world hologram.

This is the cause of the inevitable conceptual error about the nature of the world encountered. The world of the observer is the objective, physical, quasi-classical world, the world of the outside view. The world of the individual protagonist is the world of the world hologram, the class-of-worlds-as-a-world, the many-worlds reality. Schrödinger's cat is simply how the world of each protagonist actually works. This is the physical reality encountered by each conscious individual, a second-logical-type phenomenon. This is what not only resolves but explains the measurement problem.

9 The Measurement Problem

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

² “This understanding first emerged from early research on quantum gravity in the 1960s, in particular from the work of Bryce DeWitt, but to the best of my knowledge it was not stated in general terms until 1983, by Don Page and William Wothers.” (p. 278).

... 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 linear dynamics, Process 2, operates within the context of a specific snapshot, defined by a specific quantum-mechanical state vector. This is the *enactment* of the state vector, as 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.

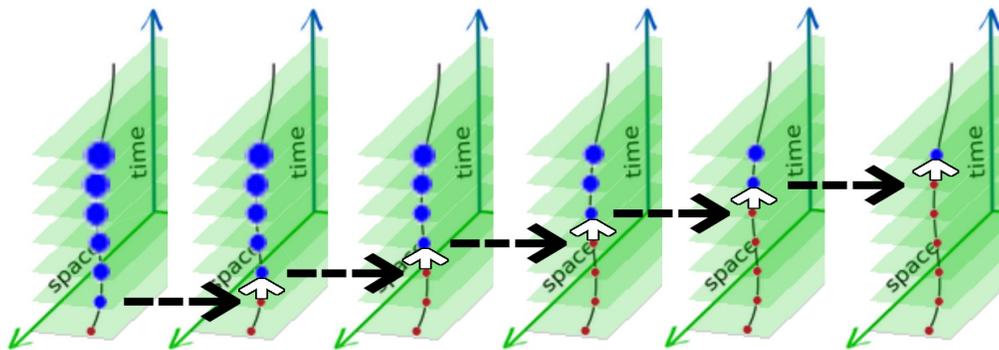


Figure 2: A sequence of snapshots in the quantum concept of time.

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 state vector. This is the effective change of the state vector, as illustrated by the black arrows in Figure 2. This is the collapse dynamics, Process 1.

Here the state vector defines the quantum-mechanical frame of reference. Each of the green space-time snapshots is a class-of-worlds-as-a-world.

Just as Everett describes, the addition of a new correlation with the world equates to the effective collapse of the wave function: the appearance of collapse. This is a completely different type of phenomenon to the linear dynamics. It is operating at a 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).³

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: of higher logical type to the processes of a specific snapshot, a specific quasi-classical world.

10 Logical Types in Ontology

Analysis in terms of logical type resolves the intractable paradoxes of the new physics. There is a fundamental dualism of physical reality, as directly evidenced by the total incompatibility of the two fundamental dynamics of quantum mechanics. The measurement problem is resolved because the incompatible dynamics operate at different levels of logical type. This is the meaning of the quantum theory. 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.

A third level of logical type resolves the paradoxes of special relativity. The moving frame of reference is to the events in space-time as the projector is to the frames of the movie film: a meta-set phenomenon. This explains the appearance of the passage of time in the static, four-dimensional, space-time, block universe of relativity, and the Now, the present moment. This also provides a full definition of the conscious transtemporal perceiving subject: the world hologram, the product of sapience – the capacity for information processing and thus knowing – experienced by sentience, the universal consciousness.

3 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 states: "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).

11 The Third Logical Type

As shown in Figure 2 both the two quantum-mechanical dynamics involve moving the frame of reference. Process 2 moves the inertial frame of reference through space-time. Process 1 moves the quantum mechanical frame of reference from snapshot to snapshot. In both cases a moving frame of reference is a fundamental requirement. In other words this is required in order to explain the observations made. But the universe is static, as stated by Barbour: “The quantum universe just is. It is static.” (1999, p. 256). This is the same paradox as found in the static four-dimensional block universe of relativity. Here both pillars of the new physics are in full agreement: the universe is static. Nonetheless the dynamics of physics are somehow enacted, as observed in universal operation.

In relativity the issue is starkly clear. There can be no passage of time, and there is no Now, meaning the present moment, as greatly troubled Einstein. Relativity is an incomplete model. But it *is* a complete model of the objective physical reality. As stated by Weyl the solution is self-evident:

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)

In other words, the frame of reference of consciousness crawls upward along the four-dimensional space-time worldline, and the enactment of the movie of life is the ongoing result. As Tegmark states: “So life is like a movie, and space-time is like the DVD” (Kuhn, 2015). In the moving frame of reference it operates exactly like the DVD in action, thus producing the effect of the movie. The fleeting image in space is the effective time-evolution of the world hologram as the moving frame of reference passes from moment to moment along the worldline of the body. Effectively time passes, in experience. The gaze is the Now.

This also explains how the quantum concept of time effectively operates. As each observation is made, the frame of reference moves from one snapshot to the next. The quantum-mechanical frame of reference of the inside view changes.

In both cases, in order for the dynamics to be enacted a further level of logical type is required. The logical types of the components of a movie system is the ideal example. The frames 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. Similarly, the snapshots are first-logical-type phenomena, the sequence is like the movie film, second-logical-type. The moving frame of reference is third-logical-type. The problem is that such a phenomenon cannot exist in the physics as currently defined. Once again, however, that is the whole point.

12 Consciousness

As Weyl (1934, p. 1) states, this consciousness is not of this world. It is a property of the universe. No doubt this is why his simple dictum is not accepted. As Block (1995) and Chalmers (1995) state, however, the word consciousness is used indiscriminately for two very different types of phenomenon, sapience and sentience. The first is well understood. The sapience, information processing, responsible for the production of the world hologram from sensory data, is a property of the physical brain as is obvious. The sentience 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, as Weyl's delineation makes clear. As Chalmers proposes, the experiencing itself can only be:

... a fundamental feature of the world, alongside mass, charge, and space-time. (1995, p. 216)

The evidence is the movement of the frame of reference constantly encountered by every conscious individual. Nothing physical can possibly engage in such a process. A third-logical-type phenomenon is required and consciousness is clearly in this position.

The effect is like the passage of the landscape outside the moving frame of reference of a train window. The result is the experience of the passage of time, and events happening. 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. This is what Weyl is describing.

On the outside view, Weyl's statement does not make sense, but he is simply describing the inside view of the operational system, which is quite different. This is how the world works, operating in the same way as a movie, but for the highly significant detail that all observations are made from inside it.

It makes no sense in the outside-view ontology *because* it operates only on the inside view. The resolution is that the definition of the world is all physical, quasi-classical and real, just as conventionally understood, four-dimensional and static; but the inside view operates the logic of a movie by virtue of the moving frame of reference. This is what is experienced as the time evolution of the physical world in the cycling operation of the two quantum dynamics: the passage of time and the happening of events.

13 The Origin

It seems obvious that the sentience is 'in here', i.e. in the brain. This, however, is simply the location of the origin of the perspective to which the world hologram is formulated. This is a key feature of the virtual-reality representation of the world, the world hologram, the product of sapience; it tells us nothing about the sentience, the experiencing consciousness.

The world hologram is formulated with respect to a specific point of view. 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, in no way means 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.

Incidentally, as the sentience is nonlocal, all instances of a specific world hologram are simultaneously experienced, from the origin, and thus the effective physical environment of the individual is necessarily the world superposition.

14 The Moving Frame of Reference

The passage of time has no explanation in the new physics. The moving frame of reference explains it perfectly, but then there would seem to be no explanation of this phenomenon either. If the term subjective is taken literally, there is an explanation to be found in the roots of quantum mechanics. Since the state vector defines the time-evolution of the world, the experience *of* the state vector must be the experience *of* the time-evolution of the system defined by the state vector.

In other words, to use 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 change, so for consciousness to experience the reality it defines is to experience the changing of that reality. The functioning of the wave function is experienced. This is a purely subjective explanation, but this is precisely the conclusion forced on the science given the static nature of the universe of Einstein's relativity. As Davies states: "... it appears that the flow of time is subjective, not objective." (2002).

This explains how the static block universe of the new physics actually comes to life, in experience, on the inside view. Effectively, in experience, the linear dynamics is enacted. In experience time passes. The appearance of collapse is also explained. As each observation is made, the frame of reference of experience passes to the next snapshot in the quantum concept of time; 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.

15 Causation

In both cases, the passage of time and the collapse of the wave function, the great puzzle has been what it can possibly mean that these are purely subjective phenomena. The resolution is that the term subjective in this context means not a property of an observer, like a mental filter or a psychological bias, but an attribute of the experiencing consciousness, the third-logical-type phenomenon of the unitary system.

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.

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 which version of the evolution of time in the world is encountered, the moving frame of reference is entirely passive, like the coaches on a moving train; but 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.

16 The Transtemporal World

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. Naturally, the cycle of the standard formulation cannot be encountered by the observer, the physical entity because this follows only the linear dynamics, existing in a superposition of states as Everett describes. On first acquaintance the enormity of this concept is deeply jarring. As DeWitt states:

The idea of 10^{100+} slightly imperfect copies of oneself all constantly splitting into further copies, which ultimately become unrecognizable, is

not easy to reconcile with common sense. Here is schizophrenia with a vengeance. (1970, p. 33)

All the physical copies exist, determinate but in superposition, more correctly a mixture. Only on the inside view is there a specific outcome to observations, as Everett makes clear: only the world hologram engages in the collapse dynamics.

The result is the time evolution of the inside view, the four-dimensional space-time, matter-and-energy movie of life. This transtemporal reality exists only on the inside view. There is no such thing on the outside view. If you are experiencing the passage of time and events taking place, your phenomenal consciousness is universe consciousness, your functional identity is the world hologram, and your physical reality is a class-of-worlds-as-a-world, indeterminate except where observed by you.

17 Alternative 1

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

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 of quantum mechanics, the operation of the two quantum mechanical dynamics in an alternating cycle as described in Section 9.

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 fits the facts. The same is thus naturally true of multisolipsism: for each individual the dynamics cycle exactly as described by the standard formulation, as has been shown.

18 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, on the inside view there is. Alternative 5 is the outside view of Alternative 1, the inside view. Since the outside view encompasses all possible inside views, this is the outside view *of multisolipsism*. Each appearance of collapse is a process of observation unique to that inside view, a specific sequence of appearances in that world hologram, in that class-of-worlds-as-a-world.

Alternative 5 is traditional outside-view physics. Alternative 1 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). 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 universe is all the world superpositions, each one literally a many-worlds reality, a class-of-worlds-as-a-world. This is multisolipsism, and it provides the ontology of the many-minds type of universe: Zeh (1970) Albert & Loewer (1988), Lockwood (1989) and Donald (1998). This is the universe of inside views, fields of information experienced by consciousness.

19 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. The world is ultra-real a class-of-worlds-as-a-world. Other individuals encountered in the world are all perfectly real, but they live in personal, physical, parallel realities, also here and now.

The solipsisms are coexistent, and they are in communication. 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, each with a different quantum-mechanical frame of reference. Thus the trajectory of the quantum concept of time is different for each individual. This is inside-view physics. Bayesian probability operates on an idiosyncratic basis in the quantum-mechanical frame of reference of each individual. This is the dynamics of inside-view physics.

20 The Missing Subject

The protagonist is the missing piece of the puzzle that produces the great paradoxes of the new physics. As Mermin (2014) describes, our worldview does not fit the facts *because* the conscious individual, the perceiving subject, has been rigorously excluded from the science. Naturally it is a fundamental tenet of physics that the subjective should be ruled out, but this produces a physics with a precisely world-hologram-shaped 'hole' in the science. As Wilczek describes, what is missing is an entity with:

... conscious awareness [that interacts] with the physical world, following the equations of quantum theory [and] accords with our experience (2006, p. 142)

The world hologram is literally the definition of the terms he defines. As has been described, it is the *definition* of conscious awareness, the perceptual reality itself. Furthermore, there is no question that the interactions of this entity with the environment follow the equations of quantum theory precisely: that is the whole point of Everett's formulation. As he states:

... we shall deduce the probabilistic assertions of [the collapse dynamics] as subjective appearances to such observers, thus placing the theory in correspondence with experience. (1973, p. 9)

In other words, the world hologram is the "observer" and the protagonist of life.

The observer is taken as the protagonist in all of physics by default, but as Everett defines, the physical observer is simply a machine:

... possessing sensory apparatus and coupled to recording devices capable of registering past sensory data and machine configurations. (1957, p. 457)

This *produces* the world hologram. As Everett states, it is the record of observations that is the functional identity, the world hologram; but the world hologram seems inadequate to fully define the self-aware substructure in the world. The key is the self-concept.

The self-concept is a holographic representation of the body-mind. Naturally, therefore, this is the central feature of the world hologram. On the inside view, the body-mind is determinate only where defined by observations; and the self-concept avatar figure is the integrated synthesis of self-observations. Thus the self-concept avatar figure defines the determinacy of the body-mind, just as the rest of the world hologram defines the determinacy of the rest of the world. Taken all together that is the protagonist of the observation dynamics. It is with respect to this "observer" that the dynamics actually operate. That is the real person, the individual.

This is the perceiving subject that has been carefully excluded from the science. Individuals are fields of information, transtemporal expressions of the dynamics, and each solipsistic world is defined by the observations made, which is also the full identity.

These world holograms are the 'minds' in the many-minds theories. As has been shown the distinction between the worlds encountered by each individual is necessarily made at the level of the record of observations, the world hologram because the definition of the determinacy of the world encountered is defined by the world hologram.

21 Conclusion

In the light of logical types as ontologically fundamental, it is clear why the omission of the protagonist is the source of the great paradoxes of the new physics. It is the protagonist that embodies the two vital logical types missing from the current ontology of physics.

The crucial point is that the protagonist is not the physical entity, as universally assumed, but something completely different: the record of observations as defined in Everett. The paradoxes of quantum theory are resolved because the physical reality of the protagonist is a world superposition, a second-logical-type phenomenon. In this physical frame of reference only what is observed is determinate, by definition. The paradoxes of relativity are resolved because the experiencing consciousness is the subjective attribute of the third-logical-type moving frame of reference, as implicit in Weyl's (ibid) dictum. Thus the time-evolution of the real world is encountered. The real protagonist is the world hologram experienced by the consciousness. This is the real person that encounters the effectively transtemporal physical reality.

The nature of the protagonist explains the surreal results of quantum physics experiments, and the reality of Schrödinger's cat. The world of the conventional wisdom is a specific quasi-classical world, but the world encountered by the perceiving subject is a class-of-worlds-as-a-world. For the experimenter, the cat really is both alive and dead because his class-of-worlds-as-a-world subsumes both versions of the objective physical reality, different versions of the quasi-classical world.

Schrödinger's cat is simply an illustration of how the physical reality of a solipsism works. Before the crucial observation is made, the class-of-worlds-as-a-world of the experimenter includes both states of the cat. On the making of the observation, effectively, the world of experimenter is redefined. The making of the observation does not of course affect the state of the cat, but simply redefines the quantum-mechanical frame of reference of the experimenter. Before, he exists in the class of all the worlds in which the outcome is unknown. On observation this becomes the class of only those worlds in which he has made that specific observation. In his class-of-worlds-as-a-world there is the *appearance* of collapse of the wave function. This is inside-view physics.

The explanation is that there is are two types of ontological fundamental, both psi-ontic. The physical reality of the quasi-classical world is defined by the quantum state. The class-of-worlds-as-a-world of each protagonist is defined by the superposed quantum states of all the quasi-classical worlds in which it exists, a quantum state. The linear and collapse dynamics are the operation of the two different aspects of this fundamental dualism. This is the meaning of quantum theory.

The linear dynamics is the dynamics of the wave function. This is the dynamics of the outside view, defined by the equations of physics, encompassing all possibilities. The collapse dynamics is the dynamics of the inside view, operating as each observation is made. Thus *effectively* the quantum state of the world is changed: the quantum-mechanical frame of reference is updated. Each inside view is a personal, physical, parallel reality, each one a class-of-worlds-as-a-world. These are the solipsisms.

Each one is idiosyncratic and unique, thus at this level of logical type, at the level of the experience of sensory fields of information, the universe is a multisolipsism. Unexpectedly, this makes perfect sense of quantum physics, the science of the fundamental attributes of objective physical reality.

As stated by Pagels:

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

This process, however, is not complete. As Myrvold states:

Despite its status as a core part of contemporary physics, there is no consensus among physicists or philosophers of physics on the question of what, if anything, the empirical success of quantum theory is telling us about the physical world. (2016)

The human race stands on the brink of a revolutionary change to the understanding of reality itself. It is a multisolipsism, and the experiencing consciousness is universe consciousness. Individuals live in personal, physical, parallel realities.

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