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Characteristics of Consciousness in Collapse-Type Quantum Mind Theories

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The purpose of this paper is to look at some of the apparent characteristics of consciousness in theories in which consciousness is said to play a role in the collapse of the state vector. In particular, these reflections are based primarily on the work of three theorists: Amit Goswami, Henry Stapp, and Evan Harris Walker. Upon looking at such theories, three characteristics of consciousness become apparent. The first is a volitional aspect of the mind that needs to be distinguished from awareness or observation. The second is the stratification of consciousness such that the experiential stream that goes on privately for a given person can be distinguished from a universal deep consciousness, akin to David Bohm's implicate order, that might underlie ordinary consciousness. Having done so, a question arises regarding the manner in which deliberately intentional acts that occur within one's experiential stream can apparently have their intended effects. An indirect mechanism consistent with the M^5 model of Robert Jahn and Brenda Dunne is proposed. Third, in transferring the notion of the collapse of the state vector from the context of observation in experimental physics to manifestation of everyday life, the temporal discontinuity of collapses implies that the experiential stream of ordinary waking consciousness is also discontinuous. Furthermore, in some collapse-type quantum mind theories, the subject–object distinction is thought to emerge with the collapse, so that the physical universe itself, including its spatial features, could be arising from a pre-physical substrate at the rate of once per Planck time. This idea can be modelled using Jack Ng's notion of a spacetime lattice with Planck time timelike separations and Planck length spacelike separations. Furthermore, such modelling can be partially cast in category-theoretic form by adapting a previous application of Grothendieck topoi to Edmund Husserl's conceptualization of conscious mental acts. Thus, a volitional aspect of mind, the stratification of consciousness, and discontinuity of the ordinary waking state are some of the characteristics of consciousness implicit in some collapse-type quantum mind theories.

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Usually, in discussions of quantum mind theories, the emphasis has been on the physics side, so that, by the time someone has finished churning out the technical details of her version of quantum theory and the manner in which consciousness could fit into it, there appears to have been little energy left for looking at what consciousness must be like for that theory to be true. My purpose in this paper is to try to redress that imbalance by placing the emphasis on consciousness rather than on quantum theory, and to say a bit about the characteristics of consciousness that are implied by such theories. Furthermore, I am going to confine myself to what I have come to call "collapse-type quantum mind theories" in which nonmaterial aspects of consciousness play an efficacious role (Barušs, 2006). The theorists whose work I am primarily considering are Amit Goswami (1997/2003; Goswami, Reed, and Goswami, 1993), Henry Stapp (1993/2004, 2007; Schwartz, Stapp, and Beauregard, 2005), and Evan Harris Walker (1970, 1977, 2000, 2001).

Three controversial contentions arise at the outset. The first is the contention that consciousness could have nonmaterial aspects. However, materialists for whom that could be a concern comprise only a fraction of academics interested in consciousness, as seen from empirical studies of beliefs about consciousness and reality (Barušs, 1990, 1992, 2000, 2003; Barušs and Moore, 1989, 1992, 1997, 1998; Jewkes and Barušs, 2000; Lukey and Barušs, 2005) so that it is not always necessary to conform to their views. Also, there are numerous problems with materialist beliefs (Barušs, 1993, 1996, 2003, 2007) so that it is not imprudent to entertain alternatives whereby consciousness could have nonmaterial aspects.

The second is the contention that collapse is necessary at all and that sufficient reduction of a state of superposition is not possible through decoherence or a consistent histories approach. There are strong opinions about this in the literature (e.g., Adler, 2003; Griffiths, 2002) and I am not going to argue one way or the other except to make the third contention, namely that consciousness can have causal effects on physical reality.

I think that there is sufficient empirical evidence to take this third contention seriously (irrespective of whether or not such causality permits free will). Given that it could always be argued that any effects within the scope of one's physical body result from the activity of cybernetic systems of the brain, the relevant data are those that come from intentional efforts to affect events outside the scope of one's behavioral influence. Such effects were demonstrated during the experimental program by Jahn and Dunne at the Princeton Engineering Anomalies Research laboratory at Princeton University in which various anomalous deviations from chance expectation were found when operators intended to affect mechanical devices without physically interacting with them (Jahn and Dunne, 2005). There are also some well-considered summaries of research concerning remote influence

(McTaggart, 2007; Radin, 1997), although they are not academic publications. So, either these types of events can be accommodated within quantum theory, with or without collapse, or quantum theory needs to be replaced by a more comprehensive theory in which they can be explained.

Three characteristics of consciousness become apparent upon examining collapse-type quantum mind theories in which mind is considered to be efficacious: (1) the separability of volitional and perceptual aspects of consciousness; (2) the stratification of consciousness; and (3) the flickering nature of consciousness. I address each of these in turn.

Volition vs. Awareness

One of the problems in quantum mechanics is to reconcile a superposition of states of a system with the singularity of its physical manifestation upon measurement. According to von Neumann, as soon as we measure, we entangle the measurement apparatus with the event being measured, so that we end up with a "von Neumann chain" in which even the brain of the observer becomes part of the system being measured (Esfeld, 1999). One way out of this has been to suggest that it is consciousness that terminates the von Neumann chain and collapses the state vector, as suggested, perhaps most famously, by Wigner: ". . . the 'reduction of the wave packet' . . . takes place whenever the result of an observation enters the consciousness of the observer . . ." (1972, p. 137). Subsequently, Wigner himself rejected this view (Esfeld, 1999) although it is still held by others.

If we are to make a statement such as that made by Wigner, then we are no longer talking about observation solely as a perceptual process, but activity in which consciousness is doing something, namely, eliminating all but one of the possibilities for physical manifestation. Such an understanding of consciousness is actually consistent with the use of the word "consciousness." In a 1986 survey of 334 academics and professionals who had written or could potentially write about consciousness in the academic literature, only 62% agreed that "Awareness is a term equivalent to consciousness" (Barušs, 1990, p. 173). From a study of its usage, the concept of consciousness usually entails not only awareness but also volition (Barušs, 1987). These two qualities can be thought of as "input" and "output" aspects of consciousness, in the sense of awareness as a perceptual mode of consciousness and intention as its volitional dual. Furthermore, not only are these two qualities conceptually distinguishable, but they are phenomenologically and behaviorally differentiable aspects of the psyche (e.g., Assagioli, 1973; Ferrucci, 1982).

Thus, in some quantum mind theories, the volitional aspect of consciousness acts to select the particular state of the physical system that will occur as a result of measurement. For example, according to Walker, the synapses of

the brain are in a state of superposition and, when "observation" occurs, it is the will that determines which of the synapses actually fires, thereby determining what the brain and hence the body, end up doing (2000, p. 260). What we have, in other words, is not a single process of "observation" but dual processes of volition and perception (Barušs, 1986).

If will and awareness can be discriminated psychologically, there is no reason to suppose that they need to coincide temporally. For Stapp, intention reduces the possibilities for events by selecting which of them are to be possible outcomes of a measurement. It is only subsequently that all but one of the possibilities collapse (Schwartz, Stapp, and Beauregard, 2005; Stapp, 2007). The first of these is a volitional act whereas the second is a perceptual one. In this case, our intentions precede our perceptions. And the distinction between volition and perception becomes an apparent characteristic of consciousness.

Stratification of Consciousness

In discussions about the role of mind in quantum theory, consciousness is often treated as a homogeneous phenomenon with its variegations only sometimes acknowledged. Thus, as we have already seen, consciousness has both volitional and perceptual aspects. But it is also stratified. The first such distinction that needs to be made is that between implicit consciousness and explicit consciousness. Explicit consciousness, as I am using the term here, is that which entails the explicit presence of our experiential stream. I have previously referred to this as "subjective consciousness$_2$." Consciousness$_1$ is implicit consciousness in that it is the discrimination of environmental stimuli, processing the resultant information, and acting on it in a goal-directed manner without necessarily having any explicit awareness of those activities (Barušs, 1987). There is little agreement and some confusion in quantum mind theories as to whether consciousness$_1$ will suffice. Stapp (2007) has attributed the necessary volitional capability to "every healthy and alert infant" (p. 23), to which only consciousness$_1$ can be ascribed, whereas for Goswami "the collapse of the wave function takes place in the . . . case [of consciousness with awareness] but not in the [case of consciousness without awareness]" (Goswami, Reed, and Goswami, 1993, p. 98) so that it is consciousness$_2$ that is deemed to be necessary.

But there is another layer of consciousness that comes into play in these theories, particularly given that consciousness is viewed as being outside the ordinary physical domain, namely, "deep consciousness." It can be introduced by considering David Bohm's notion of an implicate order (Bohm, 1980/1983; Bohm and Hiley, 1993). Although his is not a collapse-type theory, the idea here is that underlying both the physically manifest world and our experiential streams is a pre-physical level of reality, the implicate order, from which

both arise. Thus, from the physical side of reality, for example, for Goswami, ". . . the wave aspect of a quantum object belongs in potentia, it exists in another domain of reality transcending the space-time reality of manifest appearance" (Goswami, 1997/2003, p. 534).

In order to get a grip on this from the psychological side of the picture, it can be noted that ordinary waking consciousness, from the time of Brentano in the late nineteenth century, has been thought to be characterized by intentionality. Intentionality, not in the sense of intending something, but in the philosophical sense that that which is mental is characterized by a subject–object structure whereby, for a subject, there is a directedness upon an object, producing the contents of our experiential stream (Barušs, 1989, 2003). However, what happens, is that in some altered states of consciousness and, in particular, transcendent states of consciousness, the subject–object distinction disappears. For example, for Merrell-Wolff (1994), during the occurrence of transcendent states of consciousness:

> The Self is no longer a pole or focal point, but it sweeps outward, everywhere, in a sort of unpolarized consciousness, which is at once self-identity and the objective content of consciousness. It is an unequivocal transcendence of the subject–object relationship. (p. 265)

The relationship of such "deep consciousness" to the explicit and implicit strata, and to the volitional versus perceptual dimensions of consciousness, is illustrated in Table 1.

And now we put the two together. Pribram (1982), among others, has suggested that anomalous experiences, such as those of mystics, could be explorations of the implicate order. Thus the prephysical substrate could be intimately linked or identical with deep consciousness.

I think that causal effects, or perhaps more properly speaking, synchronous effects, would arise not from the ordinary levels of consciousness, but from this deep consciousness. As Goswami has said: ". . . nonlocal consciousness . . . collapses the brain–mind from outside space-time, thus terminating the von Neumann chain" and "Consciousness collapses the total quantum state . . . resulting in the primary separation of subject and object" (Goswami, Reed,

Table 1
Stratification of Consciousness

Consciousness	Volitional	Perceptual
Deep	prephysical causation	direct apperception
Explicit (consciousness$_2$)	deliberate intention	sensory awareness
Implicit (consciousness$_1$)	goal-directed behavior	discrimination

and Goswami, 1993, p. 186). The implication of some of these quantum mind theories is that the subject–object structure of mind allowing for the presence of physical objects arises along with those objects at the time of collapse.

If it is deep consciousness that has causal properties, what then are we to make of Schwartz's notion of self-directed neuroplasticity, whereby intentional effort appears to cause brain changes, as in the case of the treatment of obsessive compulsive disorder using cognitive-behavioral therapy in which mindfulness meditation plays a crucial role? These brain changes are attributed to mind–brain interaction mechanisms proposed by Stapp (Schwartz, 2005; Schwartz and Begley, 2002). That is to say, deliberate intention, at the level of consciousness$_2$, shapes physical events.

I think that there is reason to think that such deliberate intention could act indirectly in that, for instance, a playful attitude appears to be more conducive to success than grim determination. Schneider, for example, found playfulness to be a significant variable in participants' ability to affect their own immune systems through visualization of the desired effects in studies that he carried out (Schneider, Smith, Minning, Whitcher, and Hermanson, 1990).

This view of indirect action is consistent with Jahn and Dunne's (2001) M^5 model,whereby anomalous human–machine effects can be attributed to the indirect activity of intentional acts. In this model there are four modules as shown in Figure 1. Thus, deliberately intentional acts, originating in the "conscious mind" module could affect the "unconscious mind," or, more specifically, deep consciousness, which, in turn, could affect the "intangible physical," that which I have called the pre-physical substrate, and from there, manifest as the "tangible physical." That is one possibility for such an effect.

Flicker Universe

To get at the third characteristic of consciousness, we can note that the discrete nature of measurement in quantum physics gets implicitly carried over

Conscious Mind	Tangible Physical
Unconscious Mind	Intangible Physical

Figure 1: M^5 theory. Figure adapted from Jahn and Dunne (2001, p. 310).

to everyday living in collapse-type quantum mind theories. The idea is that each of us is acting in the manner that scientists do when they perform a measurement, thereby collapsing the state vector upon observation of whatever is going on. As we have established, such observation can have both volitional and perceptual aspects, and any causal effects could be originating from a deep consciousness of which we are not ordinarily explicitly aware. The point here is that this is not a once-in-a-while event, but an ongoing occurrence.

This measurement process of everyday living is an ongoing occurrence but is it a continuous one? In quantum theory, observation is not usually regarded as being continuous. There is a theorem in quantum mechanics called "a watched pot never boils" in which it is stated that a system does not change if it is being continuously observed (Sudbery, 1986, p. 192). While there are ways around this situation, they are not unproblematic. Thus, in general, measurements are regarded as being temporally discrete events. But if that is the case, and if it is collapse that allows for states of superposition to be pared down to a single state that can manifest as physical reality, then what is happening between these collapses?

From what we have said already about Goswami's theory, it would appear that between collapses all that can exist is the pre-physical domain from which collapse will allow a particular manifestation of physical reality to occur. It is not clear that any more substantial reality can be assigned to such a mathematically-described state of superposition. But then, what about our experiential stream, the subjective aspect of consciousness$_2$? And what about the physical world? One implication of these quantum mind theories is that there is nothing there at all between collapses. In other words, there are gaps in our experiential stream and gaps in the presence of physical reality.

Of course, the celebrated Schrödinger wave equation describes the manner in which a system changes with time. Thus, for example, for a particle moving in a potential, the wave equation would take the form

$$i\hbar\frac{\partial}{\partial t}\Psi(r,t)=\left[-\frac{\hbar^2}{2m}\nabla^2+V(r,t)\right]\Psi(r,t)$$

(Bransden and Joachain, 1989/2000, p. 84). This is a description of what is happening when we can not see what is happening. But the time evolution of nature is not usually considered to be continuous (e.g., Bransden and Joachain, 1989/2000) for all that the wave function has conveniently been chosen to be continuous and differentiable. So we can propose the notion that the experiential stream is not a stream at all but more like the box cars on a train that get blurred together when the train moves sufficiently quickly. And, if the subject–object split arises with ordinary consciousness, then the physical world, as such, also flickers on and off.

This is not a new idea. For example, Matthews (2000) has speculated that ". . . perhaps what is contained in the universe flickers on and off at each instant; its flickering on involves the creation of an instant-universe, and then its flickering off the destruction of one" (p. 284). This notion is consistent with the altered states experiences of Wren–Lewis (1988): ". . . what I perceive with my eyes and other senses is a whole world that seems to be coming fresh-minted into existence *moment by moment*" (p. 116). There is a similar idea in the Yoga Vāsiṣṭha, a medieval Hindu–Buddhist text:

> When the infinite vibrates, the worlds appear to emerge. When it does not vibrate, the worlds appear to submerge, even as when a firebrand is whirled fast a fiery circle appears. And when it is held steady, the circle vanishes. (Venkatesananda, 1984, p. 45)

Of course, these citations have no evidential value, but they do provide some context for the notion of a flicker universe.

There is something else that is related to this. For Stapp, the time scale at which the effects of intention occur is of the order of tens of milliseconds. But, more importantly perhaps, the rate at which collapse occurs can be increased in that "applying mental effort increases the rapidity of the sequence of essentially identical intentional acts" (Stapp, 2007, p. 36) associated with collapse. If that is the case, then we have a grand binding problem on our hands, in that the rates at which collapse occurs would differ between individuals. This suggests to me that there could be a lowest common rate of collapse on which the ordinary spacetime structure of reality could supervene. That would be the flicker rate.

There is a natural candidate for such a shortest time period, namely Planck time, which is given as

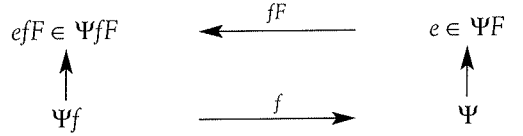
$$t_p = \sqrt{\frac{\hbar G}{c^5}} \approx 5.39 \times 10^{-44} \text{ sec}$$

And so, in effect, time would be quantized with $\Delta t = nt_p$ where $n \in Z$. And, as Ng (2003) has done, we can go on to create a spacetime lattice where the spacelike separation is just the Planck length.

In our case, assuming a synchronized flicker rate, the boxes of the lattice would be, in effect, empty. Or, to think of it another way, physical reality arises and disappears within each temporal stratum. This is not dissimilar to some contemporary ideas of emergence in quantum theory: "Space is no longer the all-embracing theatre of reality, but a structure that has emerged together with the macroscopic material entities that have emerged from the microworld" (Aerts and Aerts, 2005, p. 153).

For those familiar with category theory, these ideas can also be partially modelled using Grothendieck topoi in a manner similar to previous modeling of Husserl's conception of conscious mental acts (Barušs, 1989). The objects

of a category could be considered to be the states of a system at different times with temporal quantization as already described. Then different morphisms whose codomains are particular states could represent the manner in which possible future states could be reached; i.e., future states are represented by the tails of arrows. A contravariant functor from the base space into the category of Hilbert spaces could represent the action of a complete set of compatible observables giving rise to stalks of eigenvalues for the operators associated with those observables. The germs in the stalks, as the eigenvalues, could represent actual experiences in the manifest world of the stalk space. Thus, in diagrammatic form, an experience e for an individual could be seen to be carried through a single temporal increment of t_p into the future as



where Ψ is a state of the system at some time; f is a morphism whose codomain Ψf represents a possible future state of the system; F is a contravariant functor representing a complete set of compatible observables; e is a germ in the stalk ΨF representing an eigenvalue that is identified as a particular experience; and where all compositions are written using forward notation. In this way, the prephysical substrate is modeled by the base space, i.e., by the constructions on the lower line, and the world as it is experienced is modeled by the stalk space, i.e., by the constructions on the upper line. The transitions fF are such that the world disappears between manifestations. Something that needs to be kept in mind with this modeling is that switching between functors is associated with bringing about the stalk spaces since, due to contextuality, actual values of measurements cannot exist until the choice of which observables to measure has been made.

Conclusion

We have considered three implications of collapse-type quantum mind theories which can be summarized as follows:

1. Consciousness has both volitional and perceptual components. The problem is how to order them temporally around the time of collapse. In particular, volitional acts could direct reality and perceptual ones could register its occurrence.

2. Consciousness is stratified so that our experiential stream is only one of many levels at which consciousness could operate. If the experiential stream is thought to arise with the collapse, then there could be a deep consciousness from which the directing agency of the collapse originates.

3. If the process of observation in physics is carried over to everyday living, we end up with a discrete sequence of collapses. If experiential consciousness

eventuates with the occurrence of the collapses, then consciousness is discontinuous. And, indeed, there would be no universe to observe between collapses, so that the universe itself flickers on and off.

Some of these characteristics of consciousness are well-established whereas others are highly speculative. The point is that in developing quantum mind theories, it is important to pay attention to what consciousness must be like for those theories to be true and what that says about the nature of reality. That would facilitate the necessary task of finding ways of empirically testing these theories to determine which, if any, are true.

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