Quantum Misuse in Psychic Literature: A Rejoinder

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ABSTRACT: We provide a rejoinder to the responses of Chopra, Goswami, Kas-trup, Radin, and van Lommel to our article “Quantum Misuse in Psychic Lit-erature” that opens this journal issue. Our comments may be summarized in two main themes: These authors failed to recognize (a) how and why the von Neumann concept that only consciousness can collapse the quantum wavefunc-tion has been largely rejected by physicists today and that quantum collapse is now understood to be able to occur without a conscious human observer, and (b) that their efforts to justify a universal consciousness on the basis of presently understood quantum nonlocality are flawed. Also, in our view, from a quantum physics perspective the universe may be much less entangled and holistic than psi authors often assume. In conclusion, we contend that quantum misuse by psi authors remains a serious problem, undermining the credibility of psi research. We provide suggestions to help psi authors avoid this problem in the future.

KEY WORDS: quantum misuse, quantum collapse, entanglement, psi, consciousness

We appreciate the serious and substantial Responses that Deepak Chopra (2019), Amit Goswami (2019), Bernardo Kastrup (2019), Dean

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Radin (2019), and Pim van Lommel (2019) wrote in response to our article “Quantum Misuse in Psychic Literature” (Mroczkowski & Malozemoff, 2019) that opens this journal issue. In addition to their many substantive comments, which we address below, it is nevertheless frustrating that most of these authors seem, almost reflexively, to lump us in with many others who (a) deny the validity of psychic phenomena, and (b) deny the right of authors recounting psi experiences to propose novel explanations of these phenomena. *We do neither!*

Instead, our concern is focused *specifically* on authors who have used quantum physics to buttress their speculative explanations of psi phenomena and who do so in ways that violate prevailing quantum physics principles. These authors usually have failed to make clear the line where established quantum physics ends and where novel speculation begins. In our view, this muddying of the waters exacerbates the widespread skepticism in scientific circles of psi authors’ explanations, and, by extension, even of psi phenomena themselves. Unfortunately, we found that this problem also applied to many aspects of the authors’ Responses.

In short, our purpose is not to shoot down either psi phenomena or psi speculation. Rather, we are trying to help! So we urge psi authors, and our responding authors in particular, to rein in their reflexive reactions and take a more careful read of our article and this response.

Admittedly, determining a clear-cut line between established quantum physics and speculation is not easy, especially for psi authors lacking expertise in quantum physics, and even for many quantum physicists. As Kastrup (2019) pointed out, “there is no consensus regarding *any* position when it comes to interpretations of QM [Quantum Mechanics]” (p. 180). Indeed, numerous new speculative theories and interpretations are published each year, including those of psi authors. Kastrup seemed to imply that one should not criticize psi authors, no matter what theory they choose to base their arguments on.

But lack of consensus does not mean that anything goes! In fact, if one leaves aside the many speculative interpretations, (almost) every quantum physicist agrees on three well-established principles which we presented in our original article and which we summarize again here:

- (a) Electrons, photons and all the other entities (“quanta”) in the universe are described by a mathematical wavefunction ψ , which can consist of a single or multiple linearly superposed—sometimes called coherent—quantum states. The wavefunction evolves predictably and smoothly in time according to the Schrödinger

equation and its relativistic and quantum field theory extensions until it is interrupted by wavefunction collapse (see [b]).

- (b) Wavefunction collapse, precipitated for example by a measurement, causes the wavefunction to jump instantaneously into one of its constituent quantum states. It does so with a probability set by the Born rule, which says that, for example, the probability of finding a delocalized electron in a particular spot after collapse is given by the square of the wavefunction's amplitude $|\psi|^2$ at that spot. Although many researchers seek more fundamental interpretations of collapse, as in pilot wave or many world theories, experiments to date follow, for all practical purposes, the collapse principle and Born rule.
- (c) When multiple quanta interact—become “entangled”—and then separate, they still act as a single entity, showing instantaneous nonlocal correlations when measured; this is called quantum non-locality. However, according to the No Communication (or Signaling) Theorem, superluminal—that is, faster than the speed of light—communication, and in fact *any* communication, of *useful* information by these non-local quantum correlations is not possible.

A simple explanation of this theorem comes from considering, for example, two electrons, each with a spin that can be up or down. If the electrons interact by bumping into each other, then even if they later fly far apart, they remain entangled. Entanglement implies correlation; that is, if an observer now measures one of the electrons to have spin up, the second observer, far away, will measure the other one to have spin down. But, by the Born rule, the measured spin is random from experiment to experiment: In a first experiment the two spins may come out up and down, and in the second they may come out down and up, and so forth. Because of this randomness, the spins cannot be controlled, and so the correlation between the two spins cannot be used to transmit useful information between two observers.

We evaluate psi authors' quantum physics speculations on the basis of these accepted principles.

Now, it is also true, as Chopra (2019) and others pointed out, that just because a majority holds a given opinion does not mean it is correct. Science, after all, is not a democracy, and new paradigms often emerge from individuals rather than from a majority.

On the other hand, consensus-defying ideas are not always, or even often, correct either! Our main point is that it is incumbent on psi authors to at least *clarify when they choose to speculate beyond, or even violate, generally accepted quantum physics.*

We are pleased that in general the Response authors supported

our message of using quantum physics correctly; van Lommel (2019) and Radin (2019) in particular emphasized using quantum physics as analogy for psi explanations rather than as proof of psi phenomena. Nevertheless, we believe all the authors strayed into misinterpretations, and considering the substantial volume of their Responses, we believe these misinterpretations require our substantial Rejoinder.

In the next section, we address two fundamental issues that are common to the Responses and central to psi authors' invocations of quantum physics. These two subsections are most likely of the greatest interest to the general reader, in that we provide a more complete treatment of these issues than we did in our original article. In the first subsection, we discuss the idea of quantum-collapsing consciousness, that is, of consciousness as the *only* agent to precipitate quantum wavefunction collapse. This idea originally emerged from the principle described in (b) above, but quantum-collapsing consciousness is now largely rejected in the physics community. In the second subsection, we treat the idea of universal consciousness, often promoted as arising from the principle described in (c) above but actually violating it.

In the subsequent, second section, we provide more detailed corrections and rebuttals, addressing first the particularly detailed technical points in Kastrup's Response and then the Responses of van Lommel, Chopra, and Goswami. Finally, in the third and last section, we summarize. In all sections, we address general readers and also, where we deem important, include commentary for experts in quantum physics; the latter paragraphs begin with "For the expert."

Fundamental Issues in Quantum Physics

Quantum Collapse Without Consciousness

A central issue in the Responses, and in quantum-physics-based psi speculation generally, concerns the role of consciousness in quantum collapse—principle (b) above. This apparently abstruse issue is in fact of great importance because it has been frequently used in quantum physics explanations of mind-over-body healing, psychokinesis, and other psi phenomena.

John von Neumann (1932) first introduced the idea that *only* a conscious observer can collapse the wavefunction of a superposed system, because any isolated non-conscious measurement apparatus simply entangles with the superposed system, leaving the system-apparatus combination still in coherent superposition. van Lommel (2019), Chopra (2019), and Goswami (2019) all listed distinguished physicists

who, over the years, have supported this idea; Henry Stapp (2017) has been the most recent major champion.

That perspective, however, has changed dramatically during the last few decades. Per Sean Carroll (2016, p. 166), “almost no modern physicist thinks that ‘consciousness’ has anything whatsoever to do with quantum physics”—although some psi authors still do.

Rejections of quantum-collapsing consciousness are abundant (Carroll, 2016; Ghirardi, Rimini, & Weber, 1986; Goldstein, 1998; Hobson, 2017) and include some of the same articles Kastrup (2019) cited to defend the concept. For example, Proietti et al. (2019) wrote,

We define as observer any physical system that can extract information from another system by means of some interaction and store that information in physical memory . . . Our definition covers human observers as well as more commonly used non-conscious observers such as (classical or quantum) computers . . . as long as they satisfy the above requirements. (p. 2)

Similarly, Žurek (1994) wrote, “To be ‘conscious’ must then mean that the information processing unit has accessed the available data, that it has performed logical operations including copying of certain selected records” (p. 29). In short, these and many other authors have affirmed that a conscious human observer is *not* required for quantum collapse.

Nobelist Eugene Wigner has often been cited by psi authors and their proponents because of his early support of quantum-collapsing consciousness. But later Wigner famously changed his mind (Esfeld, 1999), a fact unacknowledged in the Responses. In explaining his position, Wigner referred to the decoherence theory of Dieter Zeh (1970), based on the fact that “macroscopic objects can never be considered as isolated systems” (Esfeld, 1999, p. 149). Decoherence theorists showed that interaction of a coherent quantum “system”—for example, an electron or a qubit in a quantum computer—with the huge number of degrees of freedom in a macroscopic measurement apparatus destroys the system’s quantum superposition and precipitates collapse. No consciousness is necessary! (See below the section “Rebuttal of Kastrup’s Specific Criticisms” for our discussion of Kastrup’s claim that this argument is a fallacy.)

Decoherence is an overwhelming experimental fact: A quantum system must be completely isolated from its environment to preserve its coherence and prevent collapse. In their experiments on coherent photons stored in a cavity at high vacuum and ultralow temperature,

Haroche's group in Paris (1998) directly measured the time dependence of decoherence and collapse—and got results in remarkable agreement with the theory.

There are other arguments against consciousness as a requirement for quantum collapse. Wigner (Esfeld, 1999) considered it to imply something he could not accept: solipsism, the idealist philosophical notion that only a person's consciousness and sense impressions are real; all else is illusion. Quantum-collapsing consciousness also spawns paradoxes about who or what possesses quantum-collapsing consciousness—whether those entities might include not only awake adult humans, but also babies, ants, amoebas, or even viruses. The concept also raises the question of whether quantum collapse was impossible before the appearance of conscious life in the universe. Such questions have driven physicists like Henry Stapp, who has supported quantum-collapsing consciousness, to invoke a “universal mind” present at all times and everywhere in the universe (2017, p. 73). However, universal mind appears more like a *deus ex machina* invoked to explain the unexplainable than a testable scientific proposal grounded in quantum physics. We will discuss this idea further in the next section.

For the expert: We should also mention the information-theoretic interpretation of quantum physics, or, in Wheeler's (1989) famous phrase, “it from bit” (p. 354). One such approach is the Quantum Bayesian view (C. Fuchs, in Schlosshauer 2012, pp. 45–46) in which probabilities, conventionally given by the absolute square of the wavefunction, are now considered “personal . . . degrees of belief” (p. 46), and measurement is simply updating one's knowledge. The subjectivity inherent in this approach suggests a conscious human being. But as stated in Żurek's (1994) quote earlier, a “conscious” observer can also be considered any entity processing and storing information, like a computer. Although significant theorems have emerged from quantum information theory, “the approach is currently regarded . . . as an unfinished project” (Hardy, in Schlosshauer 2012, p. 78), because, per Sheldon Goldstein (in Schlosshauer, 2012), “I'm aware of no precise version of quantum mechanics that has been genuinely suggested by quantum information theory” (p. 187). Psi authors sometimes refer to such information-theoretic ideas, but there is minimal support in such ideas for quantum-collapsing consciousness.

Universal Consciousness Not Based on Quantum Nonlocality

Another concept addressed by the Response authors and widely used in psi literature is universal consciousness, or what Goswami (2019) called “the oneness of consciousness” (p. 165), van Lommel (2019) called “nonlocal entanglement of consciousness” (p. 182), or others such as Henry Stapp (2017) called “universal mind” (p. 73). This important concept underlies psi explanations of near-death experiences, telepathy, clairvoyance, and meditative experience itself.

To the extent that psi phenomena appear to break the bounds of space and time, it is fair to speculate about such ideas. But as we pointed out in our original article, all too often psi authors invoke quantum nonlocality or the Aspect, Grangier, and Roger (1982) entanglement experiments to justify the instantaneous information transfer underlying universal consciousness. However, such information transfer is forbidden by the No Communication Theorem. The experiments confirmed entanglement and instantaneous *correlations* but *not* instantaneous information transfer. Unfortunately psi authors often neglect the difference between the two.

For the expert: Although the possibilities of entanglement pertaining to *both* space and time, and of nonlocality in time, have been proposed (Adlam, 2017), the overwhelming majority of physicists consider quantum entanglement as pertaining only to space. Thus, in a statement like van Lommel’s—“In quantum theory this timeless and placeless dimension interconnectedness [in NDEs] is called nonlocality” (p. 224)—the “timeless” part is inconsistent with accepted quantum physics, and “placeless” is not appropriate either because the correlations of quantum entanglement occur across space.

Many psi authors take the notion of universal consciousness a step further. As Kastrup (2019) wrote, “in the altered state of consciousness near-death experiencers find themselves in, they are ostensibly one with all existence, and so the information is, *ex hypothesi*, already ‘everywhere’” (p. 197), and then he added that “the allusion to entanglement is meant to underpin the possibility that the entire cosmos is fundamentally a unitary whole, not necessarily an appeal to information *transfer* through entanglement” (p. 197).

The giveaway here is the Latin phrase, *ex hypothesi*—that is, by hypothesis, by assumption. In other words, Kastrup (2019) *assumed* what he wanted to explain. This is not an explanation based on quantum physics. Bringing in entanglement makes it sound like an expla-

nation, and the universe may be a quantum-entangled whole (but see below); however, this is *not* the same as Kastrup's "unitary whole" where "information is . . . already 'everywhere'" (p. 197). After all, if entanglement and quantum nonlocality are supposed to be relevant, how did the information get "everywhere" in the first place, when such information transfer is forbidden?

Similarly, Goswami (2019) wrote,

If two quantum objects—waves of possibility—come close and interact, they become correlated or entangled. What this means is that they develop . . . instant communication that remains intact . . . even when they move far away, even galaxies apart, from each other." (p. 165)

We find his wording to be either imprecise or incorrect, because "communication" generally refers to information transfer rather than to quantum correlation, and such communication is forbidden. He continued, "correlation or entanglement made them into one. One does not need a signal to communicate with itself . . . Consciousness maintains its oneness even at a distance" (p. 165). This is the kind of speculative leap or muddying of the waters that we object to: Goswami leapt from the information-less correlations of an entangled wavefunction to a consciousness that implicitly entails consciousness of information. By avoiding the word "information," he hid the *non-sequitur* in his logic.

Radin's (2019) Response to our article was more cautious, which we applaud. Nevertheless he referred the reader to his book *Entangled Minds* (2006) where, in spite of his clear recognition of the No Communication Theorem, he, like many other authors, then brought up universal consciousness in the context of *quantum* entanglement: (a) "In an entangled medium minds and intention are not just located here—minds are everywhere and every-when" (p. 270), and (b) "within a holistic medium we are always connected. No information transfer need take place because there are no separate parts" (p. 266). But how did the information get there in the first place, we would ask? And (c) "On extraordinary occasions, you might obtain a veridical sense of what is happening somewhere else . . . It would appear to be a form of information transfer, but in fact it would be a pure correlation" (pp. 65–266). We would argue that his "veridical sense of what is happening somewhere else" sure sounds like information being transferred, which, once again, is in conflict with the No Communication Theorem of quantum physics.

The notion of a holistic universe, often adopted in psi literature, refers to a kind of universal quantum nonlocality arising from the wave-

function's unitary evolution predicted by Schroedinger's equation and from the entanglement it entails. However, what people often forget is that quantum collapse interrupts that evolution and entanglement. As Roger Penrose (2004) wrote, "Why do these ubiquitous effects of entanglement not confront us at every turn . . . It is *measurements* that slash through these entanglements" (pp. 591–592). And as discussed in the previous section, quantum collapse is not limited only to conscious observation and measurement; it occurs *whenever* a superposed (coherent) quantum system interacts with a macroscopic entity, precipitating decoherence, to use Radin's (2006) phrase, "everywhere and every-when" (p. 270).

So which phenomenon wins: spreading entanglement or collapse? In our view, the universe surely contains microscopic—and even mesoscopic—islands of quantum entanglement and nonlocality, at least for brief durations, as for example in the carefully isolated experiments of Aspect et al. (1982) or in the qubits of a quantum computer. But decoherence assures that the vast majority of the universe behaves classically, that is, fully collapsed—as is observed. The prevalence of quantum decoherence and collapse implies that the universe is not as entangled and holistic as has been supposed in some psi explanations of universal consciousness based on quantum entanglement.

In short, the usual psi arguments for universal consciousness, based on (a) instantaneous information transfer by entanglement and (b) persistence of coherence and entanglement in macroscopic bodies, are *not* supported by quantum physics today.

Commentary on the Responses

Rebuttal of Kastrup's Specific Criticisms

In Kastrup's extensive and well-informed Response, he raised nine specific technical points that we believe deserve a detailed rejoinder.

1. The physical world as illusion—yes and no. Kastrup (2019) wrote, "the authors suggested that the characterization of the physical world as illusory is not justified by QM [Quantum Mechanics]" (p. 187). That we suggested this idea is simply false; we stated clearly that quantum physics is mute on the question of reality, and we took no position on this issue. Either yes or no could reasonably be claimed. We also agree with Kastrup's (2019) points about "contextuality"—observer dependence—in quantum physics, though we would point out that contextuality does not necessarily imply the world is illusion;

after all, no physicist would draw such a conclusion from the observer dependence in special relativity.

The real issue here of course lies in the definitions of illusion and reality. Solipsistic idealism, defining consciousness and personal experience as the only reality and all else as illusion, is always an option, but it was highly unintuitive to Samuel Johnson (2019), who famously kicked a stone and asserted “I refute it thus!” and it is also highly unintuitive to most people. The quantum wavefunction, on the other hand, may be a strange beast—contextual, probabilistic, nonlocal—but if it describes a world that can be usefully probed and shows an overall consistency over time, it could indeed be defined as real.

For the expert: Adlam (2017) wrote that according to the Pusey-Barrett-Rudolph theorem (1912), “either the quantum state is ontological [i. e. real], or some quantum measurement results must depend in a temporally nonlocal way on events at other times” (p. 3). As mentioned above, few physicists today accept temporal nonlocality, which would then imply the quantum state is real.

2. Personal physical realities: the physical world not a response of a human observer. Kastrop (2019) restated Chopra’s assertion that “the physical world . . . is a response of the observer” (Chopra, 1993, p. 5) and that “these assumptions . . . are grounded in the discoveries of quantum physics” (Chopra, 1993, p. 7; Kastrop, 2019, p. 189) We criticized this idea on the basis that Chopra (2019) appeared to refer to the discredited idea of quantum-collapsing consciousness and also that, even before any human observation, macroscopic systems they observe are already collapsed by environmental decoherence.

Kastrop (2019) objected and referred again to observer dependence: “The implication is that each person, as an individual observer, ‘inhabits’ one’s own physical world, as defined by the context of one’s own observations” (p. 189). But we would point out that inhabiting one’s own physical world is not the same as *creating* it through a process of quantum-collapsing consciousness.

Kastrop (2019) also quoted Rovelli (1997): “A quantum mechanical description of a certain system (state and/or values of physical quantities) cannot be taken as an ‘absolute’” (p. 7). But he failed to mention that Rovelli (1997) also wrote: “By using the word ‘observer’ I do not make any reference to conscious, animate or computing, or in any other manner special, system,” and “the observer can be a table lamp” (p. 3). This assertion is yet another confirmation that the quantum

physics community has by and large rejected the notion of the “observer” as only a conscious person.

Of course, quantum physics does not *rule out* the possibility of a conscious observer. But if almost everything—even a lamp—can be an observer, and if quantum coherent systems decohere quickly in macroscopic environments, there is little “personal physical reality” for a person to “create,” because the macroscopic world is not filled with quantum coherent states waiting for the conscious observer to collapse!

3. Choice and randomness—no violation of the Born rule.

Kastrup (2019) cast doubt on our argument concerning the randomness that quantum physicists assign via the Born rule to the results of quantum collapse. This matter bears on the question of whether humans could actually control something via quantum-collapsing consciousness; a random result would leave no room for control.

We found Kastrup’s (2019) discussion of randomness to be puzzling in two respects. First, he argued that a random process can in principle produce *any* result. Consider a coin toss, or a measurement of electron spin up or down, giving a million heads, or ups, in a row. Of course, the probability “isn’t zero,” but *for all practical purposes* it is; in this case the odds are $(1/2)^{1,000,000}$ to 1: That’s pretty small!

Kastrup’s (2019) next idea was that there could be “natural agencies or organizing principles that current science still fails to recognize” (p. 190). Of course, but any claim that such an idea is grounded in *today’s* quantum physics is certainly wrong. The more completely the Born rule is tested, the less likely could non-random results, influenced for example by someone’s intention, be lurking in the noise, and so far the Born rule stands unchallenged in quantum physics experiments.

Or does it? Radin and collaborators (2016) recently reported a measurable—with high statistical probability—influence of a test person’s thoughts on results of a quantum double slit experiment. To the extent such amazing results stand the test of time, they call for some kind of evolution of quantum physics. But until such evolution occurs, claims of non-random quantum collapse contradict presently accepted quantum physics.

For completeness, we also mention Henry Stapp’s (2017) clever mechanism for intentional consciousness to influence reality. He showed that in special cases, a high frequency of repeated observations could bias quantum collapse outcomes via the Quantum Zeno Effect. The

main problem with Stapp's idea is what we argued above, namely the implausibility of quantum-collapsing consciousness to start with.

4. Jung's synchronicity should not violate standard probability, according to Pauli. Kastrup (2019) criticized our denial, in relation to Gary Schwartz's (2017) *Super Synchronicity*, "that something about quantum theory may explain the serial coincidences that underlie synchronicity" (Mroczkowski & Malozemoff, 2019, p. 150; Kastrup, 2019, p. 191). Kastrup (2019) suggested that the non-deterministic nature of quantum theory "*leaves space open* for synchronicities" (p. 191). We found this to be a strange argument because, as we discussed in the previous section, randomness can of course produce sequences that are apparently meaningful but that arise only by chance and in most cases with incredibly low probability.

In support of his argument, Kastrup (2019) referred to correspondence between the eminent psychiatrist Carl Gustav Jung, who first introduced the synchronicity concept, and quantum physicist and Nobelist Wolfgang Pauli. In one letter Pauli called Jung's essay on synchronicity "unassailable" (Jung & Pauli, 2001, p. 71). But exactly what about it was "unassailable?" The correspondence makes clear that both authors were drawing *parallels* or *analogies* between connections of psychic and physical events. And whereas Jung spoke of a "psychic ordering factor" or "global archetypal pattern," Pauli made clear that whatever this factor or pattern might be, it should not violate standard probability—which is inherent in the Born rule. Indeed, Pauli wrote, "the archetypal element in quantum physics is to be found in the (mathematical) concept of probability" (Jung & Pauli, 2001, p. 64). So as long as Born's rule stands, so stands our argument that today's quantum physics does not violate standard probability and so does not support claimed non-probabilistic explanations of synchronicities.

5. Space in atoms: filled or empty? On this particular issue, we admit Kastrup (2019) had a point. We were not quite fair in criticizing some authors who stated that the space in atoms is more than 99% empty.

As Kastrup (2019) noted, the quantum physics community is divided into two camps. The "epistemic" camp denies reality to the wavefunction *between* measurements and considers the only reality to arise at the moment of measurement; for them, the hydrogen atom is largely empty because measurement is expected to find the electron localized in a tiny spot. The other "ontic" camp ascribes reality to the wavefunction; for them the atom is full because the wavefunction fills space.

So yes, it is fair for psi authors to join the epistemic camp if they so choose. However, it is disingenuous of them to claim the epistemic view as a quantum physics fact (Chopra, 2019; Dispenza, 2014; van Lommel, 2019) when this debate is far from settled.

In high energy physics, all so-called “fundamental particles,” including electrons, are actually considered to be matter fields rather than particles (Hobson, 2013). This field picture is also indispensable in theories of solids, diffraction, and matter-energy exchange according to $E=mc^2$. In short, it is far easier to consider all particles as matter fields with particle-like properties rather than as particles with field or wave properties. In this view, which we support, atoms *are* filled with wavefunctions and electron fields.

6. Consciousness is not the agency of collapse. Kastrup (2019) laid out the standard von Neumann argument for quantum collapsing consciousness, but most quantum physicists have now passed this idea by, as we explained in the previous section.

7. Decoherence is relevant to collapse. Kastrup (2019) said decoherence collapsing the wavefunction (see the previous section “Quantum Collapse Without Consciousness”) is “a well-known fallacy” (p. 195), and he quoted Żurek (1994), one of the leading decoherence theorists, as seeking a model of “consciousness.” Here we put the word *consciousness* in Żurek’s quotation marks intentionally, because, as we argued earlier, Żurek (1994) defined consciousness as including *non-living* things such as computers.

Kastrup’s (2019) “fallacy” argument is based on the idealistic perspective that when one looks from the “outside,” such as from the perspective of God, the entire universe indeed must preserve quantum coherence—somewhere. But as Żurek (1994) wrote, “no systems—no problems” (p. 3) In other words, only when one breaks up the universe into subsystems and looks from the “inside” does decoherence, *for all practical purposes* (FAPP), lead to wavefunction collapse. This argument is what Penrose (2004) called the “FAPP philosophy of environmental decoherence” (p. 802). No consciousness necessary!

8. A boundary between microscopic and macroscopic exists in practice. We certainly agree with Kastrup (2019) that the entire universe, both its microscopic and its macroscopic aspects, should in principle be consistent with quantum physics. There is no boundary *in principle* between microscopic and macroscopic.

But *in practice*, as is widely acknowledged, the decoherence phenomenon is omnipresent in quantum physics experiments and sets a *practical* boundary between microscopic and macroscopic, as we dis-

cussed in the above section “Quantum Collapse Without Consciousness” (see also Haroche, 1998). Of course, the boundary can be pushed by increasing the isolation of a coherent quantum system, and there is no theoretical limit, but the more macroscopic—that is, larger—the system is, the harder this isolation is to achieve. Every new success in maintaining quantum coherence in larger objects, like the diamond experiment described in our original article or multiple qubits in quantum computers, illustrates the increasing challenge in pushing the flexible boundary that actually exists.

9. Superluminal information transfer is not allowed. An all too common error, committed here by Kastrup (2019) as well as by all the other Response authors, is to posit a nonlocal consciousness in which “*there is no need for information transfer to begin with*” (Kastrup, 2019, p. 197) and then to invoke quantum entanglement and nonlocality to “underpin the possibility that the entire cosmos is fundamentally a unitary whole” (p. 197). As we described in detail in the above section “Universal Consciousness Not Based on Quantum Nonlocality,” the unitary whole of quantum physics is defined on the axes of a real, or at least mathematically defined, space, whereas a nonlocal consciousness not requiring any information transfer doesn’t even exist in such a space; so invoking quantum concepts to explain this kind of nonlocal consciousness is inappropriate.

Discussion of the van Lommel, Chopra, and Goswami Responses

Response by van Lommel. The first section of van Lommel’s (2019) Response was devoted to an impressive list of scientists supporting quantum-collapsing consciousness. However, in the above section “Quantum Collapse Without Consciousness,” we showed why this list is largely out of date and why the concept has been mostly abandoned today, except for some authors in the psi community.

Next, van Lommel (2019) objected to our remark that “psychic phenomena are mostly subjective and anecdotal” (p. 177). Other psi researchers have similar concerns, such as Radin (1997) who wrote, “Because almost all the evidence for these phenomena (NDE, OBE . . .) comes from uncontrolled spontaneous cases—and thus was necessarily collected as after-the-fact anecdotes rather than as controlled laboratory results, scientific confidence that such effects are what they appear to be is very poor” (p. 280).

Countering this point, van Lommel (2019) referred to his own research in which he has sought to establish a higher level of scientific confidence. Unfortunately, it remains challenging to acquire the funding to achieve adequate scientific controls for such research, as Sam Parnia (2014) recognized in the AWARE project.

To rebut our criticism of his book *Consciousness Beyond Life* (2010), van Lommel (2019) provided a series of quotes from the book that stressed his use of *comparison*, *similarity*, and *analogy* of NDE to quantum physics. We applaud this approach. However, all too often he strayed beyond comparison and analogy, as for example: “The mind seems to contain everything at once in a timeless and placeless dimension. In quantum theory this timeless and placeless interconnect-edness is called nonlocality” (p. 224). As we have explained above, “timeless and placeless interconnectedness” of the mind is simply not the same as presently understood quantum nonlocality, which refers to brief correlations in physical space and does not include temporal nonlocality.

van Lommel (2019) seemed to dodge our criticism of his very confusing term “nonlocal space,” instead repeating statements from his book, such as, “I support the interpretation of . . . von Neumann, Wigner, Josephson, Wheeler and Stapp that this nonlocal space is more than a mathematical description; it is also a metaphysical space in which consciousness can exert influence because it has phenomenal properties” (van Lommel, 2012, p. 241). So we again feel compelled to highlight the problems he created when he jumped from the *physical space* of quantum nonlocality—given by the “mathematical description”—to some other nonlocal *metaphysical space* in which “everything is one” (2012, p. 224). The two spaces and the two types of nonlocality are completely different. This error is again evident as he repeated, “basic principles from quantum theory, such as . . . instantaneous information exchange in a timeless and placeless dimension” (2012, p. 255). Quantum theory predicts instantaneous nonlocal—that is, in two different physical locations—*correlation*, but that correlation does not support any real *information* exchange per the No Communication Theorem.

And finally, van Lommel (2012) wrote in his book, “but since the advent of quantum physics we know that everything is interconnected, that everything operates like a holistic system and not in isolation” (p. 241). The implication here is again of interconnection due to quantum nonlocality. But as we have pointed out previously, whereas some systems may be interconnected by quantum nonlocality, it is far from

clear that *everything* is. This outcome comes from the fact that quantum collapse breaks up this interconnectedness, resulting in a largely classical universe, as we explained earlier.

van Lommel (2019) seemed to jab us with his conclusion that “scholars should always be open to new concepts in science . . . before they assert these new concepts to be outside the domain of science” (p. 183). But we consider his statement to be just another example of a reflexive reaction to suspected psi-deniers, which we are not. Rather, to the extent psi phenomena are real, we in fact share van Lommel’s interest in a possible “paradigm shift in science toward a post-materialist approach” (p. 183)—though *not* on the basis of misinterpreted quantum physics!

Response by Chopra. Much of Chopra’s (2019) Response seemed to us to be misguided for the reasons summarized in our introduction above: Our original article’s focus was not on psi *per se* or on mind-over-body healing but specifically on psi authors’ misuse of quantum physics.

Chopra (2019) claimed we “brush[ed] aside some striking ideas from very prominent thinkers—John von Neumann, Henry Stapp, and Roger Penrose” (p. 156). In fact, we addressed their ideas about consciousness and quantum physics in our article, though admittedly briefly, and have added more detail in this article. Our argument against quantum-collapsing consciousness forms a central point in this rejoinder: Our admonition stands that psi authors should avoid relying on the von Neumann-Stapp idea of quantum-collapsing consciousness or at least recognize and explicitly acknowledge that this is very much a minority perspective.

As far as Penrose is concerned, we by no means brushed aside his ideas; in fact, we consider them some of the most interesting in the field of consciousness and quantum physics today, especially his idea that quantum collapse might be quantum-gravity-induced, not consciousness-induced. Penrose (2004) wrote, “my *own* position fundamentally differs from those . . . which assert that it is consciousness that reduces [collapses] the [quantum] state. (In this regard, my view has sometimes been misrepresented by other commentators)” (p. 814).

Chopra (2019) warned that “fruitful speculation that ventures beyond provable facts is often dismissed as ‘metaphysics’ rather than ‘real’ physics” (p. 157). We tried to avoid this pitfall by writing that “there is nothing wrong with using ideas from quantum theory as

hypotheses or suggestions for new concepts” (Mroczkowski & Malozemoff, 2019, p. 141).

Chopra (2019) seemed a bit shell-shocked from all the “knuckle-wrapping,” “finger wagging,” and “snickering” criticism he has received over the years from others who treat him as an “unqualified duffer” (p. 156). We have tried to avoid such disrespect by focusing carefully on specific issues rather than making sweeping judgments. By no means do we reject the growing interest in psychic phenomena and speculations about their origin. In fact, we agree with Chopra on the ample evidence for psi phenomena and the importance of investigating the nature and role of consciousness.

Chopra (2019) wrote, “the most basic assertion that Mroczkowski and Malozemoff made is that the microscopic activity in the quantum domain has no bearing on macroscopic activity in the physical world” (p. 158). We contend this is hardly the case. Back in 1935, Schrodinger recognized the absurdity of considering his cat simultaneously alive and dead; we believe that he was right and that Chopra needs to come on board with that insight. The entire universe, not just microscopic entities, is the domain of quantum physics, but an effective, “for all practical purposes” boundary does exist between microscopic and macroscopic, as defined by the rate of decoherence observed in every quantum physics experiment (see our discussions above).

Response by Goswami. We regret to say that Goswami’s (2019) Response was largely a restatement of his earlier work that we already critiqued in our original article, and so he continued to perpetrate the kind of quantum misuse we warned about in our article. Much of the Response, like his accusation of us holding scientific materialism as a central dogma, represents the kind of reflexive reaction we described in the introduction to this rejoinder: Scientific materialism is *not* our dogma.

Goswami (2019) wrote, “the tunnel vision of scientific materialists . . . comes from their lack of meditative experience of expanded consciousness. No amount of theorizing can substitute for direct experience” (p. 163). We have nothing against Goswami’s meditative experience, but that experience is irrelevant to our focus on how established quantum physics is applied to explanations of psi. So we urge him to consider the following points—as well as those in our original article, at least in his less meditative and more analytical frame of mind.

The idealistic interpretation of quantum physics that he promoted in his Response, or “monistic idealism” as described in his *Physics*

Essays paper (1989), is founded on von Neumann's (1932) concept of quantum-collapsing consciousness. Unfortunately, as we discussed above, this concept is largely rejected by today's quantum physicists for good reasons that Goswami should at least address.

A second key principle is what Goswami (1989) called "unitive subject consciousness" (p. 390) or equivalently a nonlocal consciousness, and as we already discussed in the section "Universal Consciousness Not Based on Quantum Nonlocality," he strayed into the usual justification by quantum locality, in violation of the No Communication Theorem. Goswami (2019) accused us of not understanding that the Eberhard-Ross (1989) No Communication Theorem applies only to "material" interactions; conscious choice, he said, obviates the theorem (p. 163). We wondered on what basis he permitted himself such an ad hoc exception! Arguing that consciousness obviates the No Communication Theorem amounts to saying that consciousness obviates accepted quantum physics; so it makes no sense to us for Goswami to bring up quantum nonlocality in the first place.

Goswami (2019) went on to bring up new subjects never discussed in our original article, such as vital life forces and morphogenetic fields. He referred to Rupert Sheldrake, a pioneer in this field. But Sheldrake has remained properly cautious; even in his latest books after 30 years of research, he still labels these fields as *hypothetical* and never attempts a "quantum" explanation, either in his initial book *A New Science of Life* (1989) or in his more recent book *Science Set Free* (2012). By contrast, Goswami (2019) wrote, "*it is the vital component of a living organ that is quantum; the physical is quantum by association—what in quantum physics is called correlation or entanglement*" (p. 164). But quantum entanglement of a vital component, whatever he might mean by this, with its macroscopic physical counterpart, is a long putt, considering the rapid decoherence inherent in any macroscopic body.

We do not deny Goswami the right to speculate about an "unitive and transcendent" world of consciousness. However, in our view, his mixing in quantum physics simply undermines and confuses his argument.

Summary and Conclusions

Judging by the Responses from the authors whom we cited for quantum misuse, we need to reiterate three things.

- First, our article focuses on *misappropriation of the quantum label* and not on psi itself.
- Nevertheless and secondly, to the extent psi phenomena are real and challenge the predictions of quantum physics, significant evolution of quantum physics may be required. We encourage new and speculative theories as long as they remain consistent, in the appropriate limit, with well-established aspects of existing quantum physics.
- Thirdly, we have *not* argued explicitly against any kind of nonlocal mind or universal consciousness, only that its understanding should not rest on inappropriate interpretations of quantum non-locality.

We also agree that it is not misuse to explore new paradigms for psychic phenomena which may involve quantum physics. However, we cannot emphasize strongly enough that authors who explore such possible connections need either to really know the physics or to have some physics experts review what they have written.

The Responses, especially the detailed response from Kastrup (2019), who was not a subject of our article, have given us the opportunity to provide further clarity on several points, including: (a) why today a majority of physicists consider that quantum collapse can occur without consciousness—that consciousness is not necessary to cause quantum collapse, and (b) why claims for universal consciousness based on quantum nonlocality violate the No Communication Theorem and why quantum nonlocality may not, after all, imply a holistic universe.

Serious efforts to understand consciousness in the context of quantum physics, like those of Roger Penrose and Stuart Hameroff (Penrose, 2004), are much needed. But the quantum label is excessively flouted in much of psi literature as if to add credence to whatever is being discussed; this practice is unfortunate because it ultimately undermines psi authors' credibility. In short, we believe that sweeping away much of the confusing, distracting, and ultimately counterproductive efforts to apply established quantum physics to psi will actually give the field of psi research a new lease on life and win it more attention and respect in the wider scientific community.

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