

# From Quanta to Qualia: How a Paradigm Shift Turns Into Science

Deepak Chopra

Menas C. Kafatos

University of California San Diego

Chapman University

Ever since the development of quantum mechanics in the first part of the 20th century, a new world view has emerged. Today, the physicalist objective assumption that objects exist independently of acts of observation has been challenged. The repercussions of this radical challenge to our common-sense perception of the world are far-reaching, although not yet generally realized. Here we argue that there is a complementary view to the way science which is being practiced, and that consciousness itself is primary and qualia form the foundation of experience. We outline the arguments of why the new science of qualia will tie objects that are being perceived to the subjective experience, through the units of subjective experience called qualia. If there is a reality that exists outside of perceptions in consciousness, it is indeed inconceivable. The reason is that once one subtracts everything that one can sense, imagine, feel, or think about, there's nothing left. Since qualia are subjective, they challenge the dominant world view of science as practiced today, which is reductionist, objective, and mathematical. Our view is a natural continuation of the quantum world view. We outline what the steps will have to be in order to fully develop the science of qualia.

*Keywords:* consciousness, quanta, qualia, Quantum Theory, complementarity, recursion

## 1. Introduction

The reliable world of the Newtonian paradigm, based on the five senses and everyday experience, is undercut by the quantum worldview. The repercussions of this radical challenge to common-sense perception have been far-reaching, and yet there is more to come. In particular, quantum physics opens the door to consciousness in physical theories by introducing a participatory view of the cosmos<sup>1</sup>—in quantum calculations, the observer, the measuring device, and the quantum system under study, form an undivided process. The randomness of quantum phenomena, when coupled to the observer's ability to make choices affecting events in space time, roughly forms the foundation of the concept of free will. Quantum field theory is today the most successful and accurate predictive model in physics and it has given us a profoundly different view of the cosmos.<sup>2</sup>

Physicists drive cars to work, like everybody else, while knowing that the “stuff” which goes into a car or any other solid—tangible object is radically uncertain and yet most definitely not solid and tangible. To quote

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Deepak Chopra, M.D., FACP, assistant clinical professor, Department of Family and Preventive Medicine, University of California, USA; main research fields: Endocrinology Metabolism Integrative and Mind Body Medicine Philosophy. Email: carolyn@chopra.com.

Menas C. Kafatos, Ph.D., Fletcher Jones endowed professor, director, Center of Excellence, Chapman University, USA; main research fields: Quantum Theory, Consciousness, Cosmology, and Computational Physics. Email: mkafatos@gmail.com.

Werner Heisenberg, “The atoms or elementary particles themselves are not real; they form a world of potentialities or possibilities rather than one of things or facts” (Heisenberg 1958).

However, the quantum revolution is only the first stage in directly addressing the role of consciousness. It has provided no answer to the actual experience of phenomena. For the purposes of quantitative measurements—the basic occupation of workaday physicists, one can plausibly ignore the sights, sounds, textures, tastes, and smells of the world. For countless scientists, this exclusion is so crucial that it defines the process of doing science. But it is undeniable that we experience the world as qualia,<sup>3</sup> the teeming subjective qualities of sensation, images, feelings, and thoughts. Qualia are inescapable. If there is a reality that exists outside what we perceive, it is inconceivable. Once you subtract everything you can sense, imagine, feel, or think about, there’s nothing left. Because qualia are subjective, they sharply challenge the dominant world view of modern science, which is reductionist, objective, and mathematical. The most rigorous data-collecting is at the same time a personal experience, which gives pause about the validity of shunning subjectivity once quantum theory enters into the mysterious interactions between the observer and observed.

To describe the nature of reality, our contention is that qualia, not quanta, are the building blocks of nature. Without qualia, quantum physics finds itself trapped in a paradox, since it radically undercuts the notion of solid physical objects while at the same time retaining the physical universe as a given (an unprovable assumption since non-experiential reality is not susceptible to experimentation by humans, who must rely solely on experience). This situation presents truly fundamental challenges. In the first place, it leads to an unacceptable kind of fence-sitting about what is really real—understandably, since tough issues are involved. But the issues need to be addressed head on. Quantum physics is obliged to follow through with its own first principles.

“Qualia science,” as we envision it, resolves the paradox by showing how the universe operates as the domain of consciousness (Kafatos 2011). An external physical universe as a given is untenable in the post-quantum era; it now requires radical revision as our frame of reference for what is really real and what is not, replaced by the participatory universe that all of us experience through qualia. The process of undercutting the five senses is valid, but we would urge that what makes any experience viable—consciousness—cannot be undercut. This distinction rescues objectivity and subjectivity at the same time, as we hope to demonstrate.

As reliable as the periodic table of the elements have been, qualia are the reliable elements of experience. The objection that qualia are only how the world “seems to us” is superficial. Two people looking at an aqua-colored vase may disagree over whether it is green or blue, but they won’t disagree on what “color” means. They may taste an escarole salad and argue over whether it is too bitter, but they must agree that “taste” is involved—even the existence of scrambled senses (synesthesia), where people declare that they can taste colors or feel the texture of sounds, still affirms that sensation is one of the elements of experience, irreducible in human perception. The skeptical argument that would dismiss subjective experience as an epiphenomenon—the byproduct of basic physical processes in the brain, cannot get around two objections. First, the various personal experiences that everyone has, such as pain, pleasure, dreaming, memory, etc., are the very things that lead researchers to investigate the brain in the first place. Without them, brain activity as measured by EEGs and fMRIs is meaningless. In other words, the experience obviously comes first, and if a person says, “I’m not in pain,” “I’m not depressed,” or “I’m not in love with you,” such reports are the last word—no brain scan can prove them wrong (Try to imagine a brain scan that can prove that water isn’t tasteless or that sugar isn’t sweet).

Second, in order to deny the reality of experience, turning it into a trick pulled by the brain in some complex physical way, one must have an experience to begin with. That “I don’t believe in experiences” depends irreducibly on having an experience. There is no non-experencer standing in the wings to act as an impartial judge on the matter, in the way King Solomon is called upon as judge over two women who are claimed to be the mothers of the same baby. We’re all in the game; no one stands apart from experience. Denying the very thing that enables you to think and talk is fallacious in the face of it. This is very discomfiting when a physicist tries to say that subatomic particles are “objectively” real outside our experience of them. What properties would they have? And exactly, are those non-experiential? Anything that might be proposed would be untestable and by definition inconceivable (High-level concepts used in particle physics, such as “charm” and “spin,” are qualia, too, including mathematical concepts). Abstract thought doesn’t have a privileged position as a non-experience. How could it?

Qualia take us on a journey to the place where mind, operating “in here,” produces the sight, sound, texture, taste, and smell of the world “out there.” To date, the duality between “in here” and “out there” has forced science to choose data and theory over experience. In essence, consciousness becomes the elephant in the room, a participant in every human activity including mathematical calculation that is never acknowledged. Qualia science will resolve the core problem in duality, the vexed relationship between mind and body. Instead of pursuing the fruitless goal of discovering how atoms and molecules learn to think, qualia science takes consciousness as primary in the universe, not a secondary product of brain processes. The so-called “hard problem”<sup>4</sup> becomes easy once this step is taken, because it is much easier to show how mind creates matter than the reverse—one only has to account for the qualities of matter (solidity, weight, mass, and momentum), which are adduced entirely from experience of these qualities. Understandably, there is considerable resistance placing consciousness first, after so many decades of considering it a barely respectable subject for science. There will be birth pains and intellectual crises. But it has become increasingly evident in theoretical physics that far from closing in on the nature of reality, our present understanding of space, time, matter, energy, and gravity—not to mention the all but unknowable domains of “dark” matter and energy—has become shaky and may in the end prove untenable.

Getting from quanta to qualia involves a major paradigm shift, but we aim to show that it is a necessary one. The principles that govern the new paradigm allow science as it is presently practiced to survive and thrive. The fact that science involves subjective experience doesn’t negate the existence of facts, calculations, measurement, and data. These are redefined, however, as phenomena based on the orderly nature of consciousness, which has its own natural laws and reliable properties, including self-organization, similarity across different levels, complementarity, non-locality, least action, etc., as established in quantum theory. Without our customary blind spots, we can see that there is never any reason to view consciousness as unreliable, disordered, chaotic, or somehow unreal. Quite the opposite, the mistake of duality is to turn reality into an either, or choice between subjectivity and objectivity, when in reality consciousness is the common element that unites “in here” and “out there.”

In order to succeed, qualia science must meet the demands of rigor, verifiability, experimentation, and falsifiability. In a sense, the terms, “qualia science” and “science of consciousness” are synonymous with the former emphasizing the nature of experience and the latter being a more all-inclusive term. Here we provide a blueprint for the evolution of current object-based science into the future observer-based science. We show that unless and until this evolution unfolds, the dream of a theory of everything will remain just that.

## 2. The Place Reality Leading us to

Wherever reality leads, science follows. The two are inseparably linked, as they must be when science is our way of knowing reality. Reality shifts in ways that are unpredictable and strange, however. Time and space took very strange turns a century ago, for example, while cause-and-effect turned into a game of probabilities, and the solid physical universe dissolved into invisible energy clouds. Quantum theory has arrived, keeping pace with where reality led it. What Einstein calls the “spookiness” of activity at the quantum level has only become spookier ever since.

Now it appears that reality is about to lead us into new, unexpected paths once more. A hint of the future was provided decades ago by one of the most brilliant quantum pioneers, Wolfgang Pauli, when he used a word that science shunned—psychic: “It is my personal opinion that in the science of the future, reality will neither be ‘psychic’ nor ‘physical’ but somehow both and somehow neither” (Pauli 1954). Pauli was pointing to a kind of ultimate mystery. What if the vast physical mechanism we call the universe behaves more like a mind than a machine? To thousands of working physicists, the riddle of mind and matter doesn’t apply to their research. But the founder of quantum physics, Max Planck, has no doubt that mind will eventually become inescapable—an issue too massive and obvious to ignore: “I regard consciousness as fundamental. I regard matter as derivative from consciousness. We cannot get behind consciousness. Everything that we talk about, and we regard as existing, postulates consciousness” (Planck 1931).

The reason why mixing mind with matter disturbs many scientists isn’t a secret. Mind rules the subjective world, while matter is the basis of the physical world, and science is dedicated to gathering objective data from there. Subjectivity is notoriously fickle, individual, shifting, and preying to all kinds of bias, if not outright delusion. Consciousness therefore has been systematically excluded from scientific consideration—it’s simply a given that all of us are conscious, and a given doesn’t need to be factored into the equation. Or so it is claimed.

Planck and Pauli were not alone in suspecting that consciousness was more than a given. Mind holds some kind of key to the nature of reality. But neither Planck nor Pauli followed up on the mystery they had uncovered. There was no need, not for a long time. Quantum physics blossomed into the most accurate and mathematically sophisticated model in the history of science. It achieved such precise results that its predictive powers were nothing less than stunning. As the eminent British physicist Sir Roger Penrose affirmed, Newton’s gravitational theory as applied to the movement of the solar system was precise to one part in 10 million. Einstein’s theory of relativity was improved upon Newton by another factor of 10 million.

Reality, which cannot be denied, has led science along a very productive path. Leaving consciousness out of the equation is like leaving metaphysics out of cookbooks. You don’t need metaphysics to measure the flour and butter of a cake. But its commitment to follow reality wherever it leads can make science very uncomfortable, especially when it’s time to overturn some cherished assumptions. That time inevitably arises, however, for one simple reason: Reality is always more complicated than the models we use to explain it. Reality, as we investigate it more deeply, conforms to Planck and Pauli’s intuition that consciousness will turn out to be the thing you cannot get behind. We think their intuition is right. We don’t say this because we happen to be fans of the mind or have a personal stake in boosting it. Science has come to a turning point by following its own findings.

### 3. Quantum Reality and the Next Horizon

It's in the nature of theories to be right about what they include and wrong about what they exclude. Today's science as it is practiced assumes an external reality "out there," existing independently of any observers (and not limited just to human observers). Therefore, the universe is independent of the human mind, even though it is our minds that conceive the theoretical constructs that drive scientific investigations. An objective universe sounds like common sense. People may be baffled by the riddle: "Does a tree falling in the woods make a sound if no one is around to hear it?" But they have no problem with: "Did the Big Bang occur if no one was around to see it?" Yes, of course.

Although at first this seems obvious and reasonable, a fixed, solid, and reliable universe is inconsistent with quantum mechanics. In everyday life, we experience a world "out there," while our own feelings, thoughts, sensations, etc., seem to be "in here." Quantum physics presents us with a radically different viewpoint: The subatomic quanta whose properties are studied in the laboratory are inexorably tied to the act of measurement. The observer is involved in what he observes. Quantum properties exist only in potential form (being invisible and unlocatable in time and space) until a measurement is actually carried out (Bohr 1934/1958; Heisenberg, 1958; Von Neumann 1955/1932).

Before that moment, no specific values can be assigned. Once a measurement takes place, hidden potentialities reduce to specific values. This is called the "collapse of the wave function." Quantum theory calculates with great accuracy probabilities of occurrence, but it cannot say for certain what will happen when a measurement takes place—only how probable it is to get a particular value. Nor can it say—and this is the crucial point—how the act of observation actually affects what is going on "out there." Common sense tells us that looking at a sunset doesn't change the sunset. But common sense is confounded in quantum reality. In some mysterious way, looking isn't a passive act.<sup>5</sup>

Most quantum physicists, including the ones who put the theory together almost a century ago, accept the probabilistic nature of events (not everyone, however—Einstein never stomached the quantum world, even though he did much to launch the quantum revolution). At the same time, however, most scientists go about their profession as if the classical world is an accepted reality. They sleep in bed at night, not in clouds of probability waves. They do science at a level far grosser than the quantum domain, on the assumption that quantum behavior is confined to the microscopic world. But the confirmation of a reliable and fixed physical world is at bottom invalid.

Everything we see, touch, taste, and smell is founded on a more fundamental level, and when you get down to the building blocks of nature, you find a shadowy dance of quanta that don't have any "hard" material presence. Hardness is a quality that dissolves as we go into smaller dimensions. Imagine that two powerful magnets approach each other with their positive poles facing each other. Similar poles are repelled, and so at a certain point, the two powerful magnets would stop dead in their tracks, because repulsion forces them to go no further. If magnets could speak, they'd say that they ran into an invisible hard wall. But they'd be wrong: When viewed at a finer level, hardness dissolves into the activity of an invisible force field. So do all the familiar qualities delivered by the five senses.

One of the oldest ideas about reality, which can be found in every culture, holds that nature is a mirror. We relate to it by seeing ourselves, but not passively. Messages are constantly going back and forth about birth and death, about constant change and the bond between our life and nature itself. To the ancients, a natural

disaster—fire, flood, or earthquake—shows that nature is angry. If Nature is appeased, the harvest will be good and the sun shines. As long as Nature is a mirror, a living bond with humanity goes unquestioned.

In a word, the universe means something. It's astonishing that how quickly a timeless worldview is utterly brought down by science. In modern post-classical physics, the universe is utterly devoid of meaning; it operates through random chance, perfectly meshed with evolution operating through random genetic mutations. The mirror has shattered. We no longer see ourselves because there's nothing meaningful to see, no purpose, no creator, and no end point that will reveal who we are and why we are here. Even more absurd in the view of science is the notion that nature is sending us messages—it would be delusional to think so.

It seems totally impossible that the gap between two worldviews can ever be closed. Yet it can't remain open, either. Human life and evolution led to its present form, is meaningful. It is filled with purpose, intelligence, creativity, and values like love and compassion. If you start at the purely physicalist level, you can't get there from here. No one has explained how matter and energy acquires purpose, meaning, and all the rest; we are left stranded with a species with no foundation. We can only relate to the mindless cosmos with a shrug of the shoulders. Electrons and hydrogen atoms floating in the bleakness of outer space bear no resemblance to the electrons and hydrogen atoms in your brain, which serve meaning and purpose in every millisecond. Are they the same particles? If yes, it will imply that all particles possess some form of sentience. If the answer is no, then physicalism has no way to explain why sugar molecules sit lifelessly in a sugar bowl but participate vibrantly in every aspect of life once they cross the blood-brain barrier.

Let's say we want to take this mystery personally instead of leaving it to professional scientists. Reality is an interesting topic to spin theories about, but it becomes a compulsory topic when it's our personal reality at stake. If we know where our own intelligence comes from, why we are alive, where we are going, and what the next leap in our evolution will be, everything will change for us. In their pursuit of a theory of everything—the holy grail of modern physics, theorists have neglected a simple fact: "Everything" includes you and me, and why we matter. That, in a nutshell, is what's at stake.

#### **4. Qualia—the Place to Start**

What would it take to make the universe a living entity? What would it take to make it human once again—a secure home for us instead of a cold and meaningless place? These questions are on the minds of current thinkers, some of whom would also like to throw themselves in God and the possibility that he (or she or it) lurks behind the veil of the physical world. The deeper one looks, the more it appears that all three issues—a living universe, a human universe, and a universe that holds a place for God—start to merge. If they actually do merge, nothing will ever be the same again. Not just science but everyday existence will be completely overturned.

A new paradigm begins with a single word. The term quantum is plucked from the Latin dictionary—its literal meaning is "quantity, amount, a specific portion"—to give the strange new world of subatomic physics a tag. In the same way, qualia, which is Latin for "qualities," is a tag for a world that is as far-reaching as quantum physics pointing in the opposite direction. Quanta are "packets" of energy, an innocuous term that wound up having explosive effects. Qualia are the everyday qualities of experience—light, sound, color, shape, or texture—whose explosive effects are barely hinted at. Since the only way we know reality is through experience, qualia, not quanta, are the building blocks of nature.

You experience the world as qualia. It's the glue that holds your personal reality together. The scent of a

rose is a qualia (we'll use singular and plural as the same word), so is a rose's velvety texture and its shimmering color. Looking at everyday experience through the perspective of the brain, psychiatrist and neural theorist Daniel Siegel<sup>6</sup> reduced reality "in here" to SIFT: sensation, image, feeling, and thought. No matter what's happening to you right this minute, your brain is registering either a sensation (I'm hot, this room is stuffy, or the bed sheets are soft), an image (the sunset is brilliant, I see my grandmother's face in my mind's eye, my keys are on the dining room table), a feeling (I'm pretty happy, losing my job makes me worried, or I love my kids), or a thought (I'm planning a vacation, I just read an interesting article, or I wonder what's for dinner).

Qualia are self-evident, arising from beyond the physical but interfacing with the physical. Nothing can happen without them. The physical universe needs to be tossed out as a frame of reference, replaced by the active participatory role of consciousness, because the world "out there" is nothing if not participatory. The participatory nature of reality is also what makes nature a mirror. As the late British physicist David Bohm declared, "In some sense, man is a microcosm of the universe; therefore what man is, is a clue to the universe" (Bohm 1986). If we really are a microcosm, then the macrocosm must be seen in terms of what makes us most human: consciousness.

The simplest and most elegant explanation for why human beings can think, feel, and experience the world is that the universe consists of consciousness at the most fundamental level. Any explanation that leaves consciousness out creates a host of problems in a struggle to divide objectivity and subjectivity in any strict sense. Taking a qualia perspective ends the struggle. Experience is experience, without the need to erect a barrier between "in here" and "out there." There is no difference, as far as the visual cortex is concerned, between seeing a red rose and imagining it. The qualia of red is present in both.

At first this may seem too obvious to matter. The rose is red, and I see it as red. A camera does the same thing, mechanically transferring a specific wavelength of light on to a chemically reactive film or digitized screen. This implies that perception is a passive process, which is far from the case. Perception is a conscious act. Perception creates reality. A specific wavelength of light isn't actually red—it takes a mind for redness to exist. Indeed, it takes a mind for light to be bright in the first place. Photons are invisible without an eye to see. In the words of Sir John Eccles, the famous British neurologist, "I want you to realize that there exists no color in the natural world, and no sound—nothing of this kind, no textures, no patterns, no beauty, no scent" (Eccles 1995).

This reversal makes perception the whole key to reality. Rocks are not hard; water is not wet; light is not bright. These are all qualia created in your consciousness, using the brain as a processing facility. Although it appears to be a huge leap from traditional quantum theory, this is actually the next natural step in an evolving science. We are going exactly where quantum theory points and where Heisenberg, Bohr, Schrödinger, Pauli, Born, Bohm, Wigner, and others struggles to go in their understanding of quantum phenomena.

Qualia theory can be built up around consciousness because the same principles that govern the world "out there" also apply to the world "in here." This must be true, because reality is reality, an undivided wholeness which physics itself implicitly assumes. The universality of the laws of physics points to a universality of reality. Since reality is an experience in consciousness, we are led by reason to the universality of consciousness. The quantum pioneers are ahead of us here, too. Schrödinger says: "To divide or multiply consciousness is something meaningless" (Schrödinger 1983). Why do we feel that consciousness is not everywhere, as universal as gravity? Because we perceive the world through individual minds, not one great

mind. Reality comes to us sliced like sandwich bread into separate moments of experience. There are not two realities—one for the outer world and one for the inner world. But we act as if we live in a divided world. There seems to be a big difference between the romantic passion of Romeo and Juliet measuring their body temperature when their bodies are touched. Now we can measure the brain activity when Romeo is in love with Juliet. This is more sophisticated data than measuring body temperature. Even so, without a bridge that connects data to experience, reality is incomplete. Qualia science is the bridge. It restores you, the perceiver, to a creative role—you are the conscious agent who shapes reality as you experience it.

## 5. Building the Principles of Qualia Science

We are realists. The argument for qualia science will meet with stubborn, perhaps hostile resistance, beginning with the most basic objection: Subjectivity has no place in “real” science. Other objections will follow along familiar grooves:

“Science is practical. You are talking about metaphysics.”

“The physical universe is a given, no matter what anyone says.”

“Science is based on mathematics. Shut up and calculate.”

“Research is about the scientific method. What you’re looking at is outside science.”

Even if all of these objections can be answered—as we think they can, there’s the enormous mental shift that’s involved whenever a new paradigm arises. The reversal that qualia science entails, turning consciousness into the agent of creation, is too mind-blowing for the vast majority of working scientists. If we say that the new paradigm does not require current science to abandon its conventional pursuits, there is always the retort: “Then who needs it?” The answer is that anyone needs it who wants to answer questions that conventional and object-based science continues to struggle with. We can place these questions into a few broad categories.

1. Questions about mind: How does mind arise? What is its relation to the physical world? How are mind and body connected?

2. Questions about origins: Where does the universe come from? What precedes time and space? What is the nature of the quantum vacuum?

3. Questions about life: How does life arise from lifeless matter? How is biology related to physics? Is there a systematic basis for biology as there is for quantum mechanics?

4. Questions about the laws of nature: Are they permanent or changeable? Are they in fact universal and applicable to “dark” matter and energy, for example? Why are they so fine-tuned, beginning almost at the instant of the Big Bang?

5. Questions about evolution: Is evolution universal or germane only to life forms? How does self-regulation arise? Is self-organization fundamental at all levels of creation? Where is evolution going next?

If anyone wants to comprehend why a new paradigm is needed, these unanswered questions should suffice. They all depend upon the expansion of conventional science, and if it’s too troubling to contemplate a reversal of object-based thinking, we are comfortable proposing an expansion instead. Reality, as currently conceived, involves a three-part structure: observer, observed, and process of observation. By focusing on the observer, the new paradigm is expanding beyond a narrow focusing on the observed. But that does not mean that the observed—i.e., everything that provides data, measurements, and information—is rendered invalid. Rather, its validity is placed in a wider context—human experience as a whole.

We’ve affirmed that qualia science will have to be built on a set of principles—its own set of axioms. They

are not mathematical but experiential axioms. To begin with, such axioms will necessarily be quite broad because experience itself is all-inclusive. Object-based science proceeds by isolating a phenomenon, reducing it to its basic components, and measuring those components as precisely as possible. Observer-based science is not reductionist. It investigates the largest possible phenomenon and consciousness. Imagine four people standing in front of a sunset: The first is basking in the view; the second is photographing it; the third is making an oil painting of it; the fourth is looking at it through a high-powered telescope. These activities may seem entirely different, but they have a commonality, too, which exists at the level of consciousness: All of these activities require a mind, and mind is embedded in the three-part structure of observer, observed, and process of observation.

Qualia science engages the commonality just as described, which connects every level of reality from quantum to cosmos. In addition, the new paradigm involves subtle, underlying issues of what it means to exist (ontology) and how knowledge is gained (epistemology). In other words, our position is that every given in conventional science and every assumption that has gone unchallenged, must be rethought.

As a start, we can provide a set of axioms of experience that bridge the old and new paradigms, carrying us from quanta to qualia:

(1) The physical universe described by quantum physics exists exclusively as one that our nervous system allows us to perceive in the form of qualia—defined as all sensations, images, feeling, and thoughts experienced in a conscious mind.

(2) Quantum phenomena are not manifested until registered by an act of observation. Far from being completely detached, observers participate in the phenomena they observe. The quantum world is a world of events, not “hard” physical entities, and the role of consciousness in it is fundamental.

(3) If we look deep enough, different phenomena that are applied in the quantum world are just as applicable to how consciousness operates. In brief, it includes the most basic discoveries of the quantum era: quantization or individualization; coherence, superposition and entanglement; complementarity; contextuality; primacy of process; non-locality; sentience; and sufficient reason (i.e., whatever happens must be for a reason). All can be expanded to describe the fundamental workings of consciousness. The phenomena that are applied to the quantum world all are aspects of three fundamental principles that unite the inner and outer worlds: Complementarity, recursion, and sentience. We view these principles as applying at all levels of reality, and as such, they manifest in the mental processes of everyday life and life in general (Kafatos and Nadeau 1990/2000; Nadeau and Kafatos 1999; Roy and Kafatos 1999a; Kafatos and Roy 2004; Theise and Kafatos, 2013a/2013b). Therefore, they provide the necessary links between current quantum science and qualia science.

(4) All experience, whether of the body or the outside world, consists of qualia. Our world only exists because we perceive it and act as conscious agents. Thus, all interactions with the universe are experiential and subjective. What we call “objective” in science is that which we can measure within patterns of qualia dictated by mathematical laws. Quantum mechanics is a mathematical model for measuring Qualia Mechanics. It’s the map, not the territory.

(5) Consciousness is fundamental and indivisible. As such, consciousness can only interact with itself. In life as in science, all experiences and measurements involve consciousness interacting with itself. All reality originate from the potential inherent in consciousness, which is a field of all possibilities, those that manifest in spacetime and those that do not. Each possibility emerges as qualia. However, the field of pure consciousness exists prior to qualia. Even our nervous system is a product of a possibility in consciousness, which has evolved

as a mode for interpreting consciousness from a human perspective. It does this by creating qualia (including sight, sound, touch, taste, and smell) as consciousness interacts with itself.

(6) Qualia exist on the boundary between the perceived and the actual (pure consciousness). Qualia science aims at crossing that boundary. The perceptual world is what our nervous system (or the nervous systems of other species) experiences. The actual world is pure consciousness, which has no qualities, being the pre-created state. However, since this is also the ground state of existence, human awareness can explore it through an experience of the mind's silent source.

(7) Pure consciousness differentiates itself as the process of creation. Within the perceived universe, species-specific reality (e.g., that of humans) is a continuous and dynamic flow of consciousness from the unmanifest field of all possibilities into matter, energy, worlds, and beings. Qualia science entails capturing this dynamic unfolding, as opposed to taking snapshots to measure it in small and frozen slices. True reality is acausal and non-local. Causality arises as the result of limited focus within specific nervous systems. For example, the fact that thoughts are linear in the human brain creates the need to view the world "out there" as linear, with events entrained in a procession of single causes leading to definite effects.

(8) As consciousness interacts with itself, the resulting qualia self-organize (i.e., evolve). Self-organization is based on continuous feedback loops. Every qualia that manifests from existing qualia (e.g., a new insight, discovery, or work of art) in turn serves to regulate the qualia from which it manifested. A prime instance would be the interconnected processes in the body, where any new activity (running down the street, going to sleep, or getting pregnant) requires the self-regulation of every process as it is operating before the new activity begins. In other words, qualia emerge in layers of manifestation that make up a self-regulating program based on multifold feedback loops. This program can be a feeling, a human, the planet Earth, or the universe itself. Birth is the beginning of a particular qualia program (e.g., a particular human being). An individual qualia entity emerges into the world with a potential in qualia that unfold as life. For humans, the most important qualia are intelligence, creativity, love, aspiration, and free will—the essentials that define us as human. From birth, our reality is created via the resonance of shared qualia with others in our species (and related species of plants and animals). As such, the perceived universe is, in essence, an agreement about qualia as experienced in the human mind. Against the background of this broad, inclusive agreement, there is the infinite play of personal qualia. Death is the termination of a particular qualia program. The qualia return to a state of potentiality within consciousness, where they reshuffle and recycle as new living entities.

(9) The process of consciousness interacting with itself is most obvious in humans as self-awareness imparting the sense of choice, purpose, and meaning. Self-awareness is the starting point for the next leap in our creative evolution as a species. Qualia science is made possible by the presence of self-awareness, which lies at the source of a universe that can be comprehended in the first place. Without self-awareness, the universe would be devoid of meaning and therefore incomprehensible.

(10) The future of qualia science will lead to the emergence of new, dynamic, and self-organizing networks of qualia that will reshape the universe as we know it. In the process, quantum mechanics and classical science will remain necessary in their role of producing new technologies, measuring objects of observation, and interpreting mathematical laws. However, this activity will be subsumed under the reality of consciousness unfolding as qualia. The perceived is always subsumed under the actual, even though everyday life is preoccupied with the perceived. Exploring the actual (the "real" reality of consciousness) qualia science will take us in a new direction, breaking down the barrier between a non-local field of all possibilities and the

perceptions produced by our nervous system. The result will be a more connected and enlightened "human universe."

The last two words are the most important. A "human universe" is as alive, intelligent, and conscious as we are. After centuries of looking out into the cold void of space and feeling isolated (if not terrified) to be an accidental creation, humanity will look outward and see the universe as our home, because consciousness is the very definition of home.

## 6. The Third Element

An agreed upon theory of a living universe hasn't been formulated yet. That's what we've started to do in the present work. Matter and energy aren't enough to explain the universe, which is why we've proposed that a third element—consciousness—must be added before anything approaching a unified description of reality will ever be possible. A living universe does not need to evolve to produce life on earth. Rather, all the elements characteristic of life are already present in the underlying field of consciousness that is the pre-created state. Only they do not become apparent until human beings develop self-awareness, which has the capacity to explore its own source. Taking a qualia perspective runs counter to current assumptions about evolution, which holds that the constituents of life do not exist until sometime in the history of our planet, where special or even unique, physical developments arbitrarily give birth to life.

If the constituents of life are inherent in the cosmos, however, human existence is no longer privileged, much less unique. We are a specific qualia program, surrounded by the cosmic qualia program. In everyday life, we engage with reality in its three-part structure of observer, observed, and process of observation. No quantum physicist would be ignorant of that fact. The next horizon is to grasp that all three parts are conscious. For a scientist working in the scheme of physicalism, which holds that all phenomena can be explained through the interactions of matter and energy, accepting a conscious universe may be a bridge too far. However, in our view, all efforts to devise a theory of everything will come up woefully short if the third part of the trinity is left out. Physicalism has no explanation for the emergence of mind. It accepts without proof the transformation of atoms and molecules into mental events—feelings, sensations, wishes, dreams, and scientific theories—as if no other explanation is even possible. But as we've shown, mental events can be unified as qualia, a rubric for all subjective perception. Science itself is a subjective experience, despite of the attempt to isolate and reduce objective facts and expel subjectivity in the bargain.

Setting aside any other argument, the most basic reason for qualia science is that it liberates us from arbitrary boundaries. The most arbitrary is the dividing line between inner and outer reality.

Three-in-one state exists as a seamless unity in everyone's experience. Hard as it is for physicalists to accept, there is no sunset, cloud, mountain, electron, or galaxy independent of a unified state that must include an observer and the process of observation. Science is not superior to common experience in that regard. It does not describe reality; it describes phenomena that fit various theories.

As Roger Penrose puts it, "I do not believe that we have yet found the true 'road to reality,' despite of the extraordinary progress that has been made over two and half millennia, particularly in the last few centuries. Some fundamentally new insights are certainly needed" (Penrose 2007). To find the road to reality, one must give up the whole scheme of dualism. Reality is one and only, an undivided wholeness. What humans experience in everyday life constitutes our reality, since by definition whatever we can't experience is inconceivable. As Peter Wilberg, one of the most astute and gifted qualia theorists, has explained, we don't see

because we have eyes. Eyes are physical organs evolved to serve the mind's desire to see. Mind comes first. It reaches out to experience reality through qualia, which embrace the five senses along with sensations, images, feelings, and thoughts in the mind.

For anyone who can loosen their loyalties to the current scientific paradigm, the three-in-one structure of nature is not opposed to current science; it's more expanded and inclusive. Therefore, we consider it natural in next step.

When qualia become fully integrated into a new science of consciousness, reality will be understood, through verifiable procedures, to be three-in-one. With the following components: quarks (the particles of matter), quanta (the mediators of quantum interactions), and qualia (the units of experience), a Q3 sequence arises. Three-in-one reality reflects the history of science. Discoveries in physics have unfolded in a line from the more inert and physical to the more subjective. Here we argue that a better understanding results from reversing the Q3 sequence, making it qualia-quanta-quarks. This reversal recognizes the undeniable fusion of observer-observed-process of observation. It maps the natural way in which the universe becomes manifest in our awareness. Without awareness, there is no experience; without experience, there is no physics.

Every experience is qualia, including the experience of blue-green algae. One-celled organisms respond to the world by breathing, eating, dividing, heading for the light, and so on. Those responses are the first links in the feedback loop that eventually gives rise to human perception—an unbroken chain of qualia. Thus we have a commonality that can unify all phenomena which the mind can conceive of. Qualia medicine could one day explain spontaneous remission of cancer, for example. Cancer is marked by numerous changes at the genetic level, including complex activity in the “junk DNA” (formally known as “non-coding DNA”) that comprises over 96% of the human genome. Genes are not divorced from qualia—they respond to the environment around them, which includes all the incoming information that passes from the bloodstream through the cell membrane. That information is controlled by the brain, and the brain is the processing center for all thoughts, feelings, sensations, and images—so the unbroken chain of qualia exists at every level in the body.

Medical science has taken thirty years to accept the validity of the mind-body connection. Once it takes the next step into qualia, the difference between disease and wellness will include personal experience. Present mind-body phenomena that cannot be denied, like the placebo effect or the increased risk of illness caused by depression, will expand, because qualia tears down the barrier between mind and body altogether. Instead of being peripheral to “real” medicine (i.e., drugs and surgery), the mind-body connection will be central to prevention and wellness.

Since qualia are the “units” of experience, qualia science will provide the working tools for a new way of dealing with reality. Object-based science has provided great discoveries. It's time now to realize that observer-based science can do the same by uncovering the underlying structure of reality, not simply a provisional model. Schrödinger is right to say that there is only one consciousness, then human awareness can unlock any secret hidden in the infinite field of consciousness.

## Notes

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<sup>1</sup>. John A. Wheeler in particular has emphasized the participatory nature of the universe as revealed in quantum theory, e.g. *Quantum Theory and Measurement* (1983).

<sup>2</sup>. The most successful and accepted field theories are quantum electrodynamics (QED) and quantum chromodynamics

(QCD). See for example Richard Feynman's *QED* (1986). They form what is known as the Standard Model of particle physics, where the Higgs boson plays a fundamental role.

<sup>3</sup>. Daniel Dennett writes that qualia is "an unfamiliar term for something that could not be more familiar to each of us: the ways things seem to us."

<sup>4</sup>. For a description of the "hard problem," see David J. Chalmers (1996).

<sup>5</sup>. See Notes at the end for detailed references to the world view of standard quantum theory as developed in the Copenhagen Interpretation by Bohr, Heisenberg, Pauli, Born, Dirac, etc. and revised by John von Neumann (1955); also Stapp (1979, 2004, 2007); Kafatos and Nadeau (2000), and other works; as well as important alternative views, such as by Penrose and Hameroff (2011).

<sup>6</sup>. Dr. Siegel is clinical professor of psychiatry at the UCLA School of Medicine and on the faculty at the Center for Culture, Brain, and Development. He also co-directs the Mindful Awareness Research Center.

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## Appendix

Deepak Chopra, MD, is the author of more than 80 books translated into over 35 languages with over twenty New York Times bestsellers. Chopra serves as Founder of The Chopra Foundation.

Menas C. Kafatos, Ph.D., Fletcher Jones Endowed Professor of Computational Physics, is the author of more than 280 refereed articles, author or editor of 12 books and co-author with Deepak Chopra of the forthcoming book, *Who Made God and Other Cosmic Riddles* (Harmony).

The reader may be interested to read a series of popular articles that we published (Chopra, Doraiswamy, Tanzi, Theise, and Kafatos) in the San Francisco Chronicle, under the general link: <http://www.sfgate.com/search/?action=search&channel=columnists%2Fchopra&search=1&firstRequest=1&query=opinion%2Fchopra&x=0&y=0&searchindex=property>

For the so-called “hard problem,” see Chalmers, D. J. (1996): *The Conscious Mind: In Search of a Fundamental Theory*, Oxford University Press, Oxford.

The Copenhagen Interpretation has been developed in a large body of published works, primarily by Bohr, Heisenberg, Pauli, Born, etc., such as: Bohr, N. (1934), *Atomic Theory and the Description of Nature*, Cambridge, Cambridge University Press; Bohr, N. (1958), *Atomic Physics and Human Knowledge*, Wiley, New York; and Heisenberg, W. (1958), *Physics and Philosophy*, Harper, New York, etc.

The so-called orthodox, modern quantum theory, that followed and extended the Copenhagen Interpretation was developed by the mathematician John Von Neumann in his book (1955/1932), *Mathematical Foundations of Quantum Mechanics*, Princeton University Press, Princeton.

Excellent works on the orthodox quantum mechanics and some of the paradoxes have been described by: Stapp, H. P. (1979), “Whiteheadian Approach to Quantum Theory and the Generalized Bell’s Theorem,” *Found of Physics* 9, 1-25; Stapp, H. P. (2004), *Mind, Matter, and Quantum Mechanics* (2nd edition), Springer-Verlag, Heidelberg; and Stapp, H. P. (2007), *The Mindful Universe: Quantum Mechanics and the Participating Observer*, Springer-Verlag, Heidelberg.

Central to the Copenhagen Interpretation is the double slit experiment, revealing a wave aspect or a particle aspect, which are tied to experimental choices. This dual situation is the core of complementarity, which forms the central pillar of the Copenhagen Interpretation: The quantum can be either a particle or a wave but never both in a given situation. What it is (or better what it is measured to be) depends on the observational choice that an observer made. The nature of the quantum is inexorably tied to choices of observers!

The strange but real world of the quantum, including non-locality, and the Copenhagen Interpretation and the great successes of quantum mechanics are described in the *Conscious Universe*: Kafatos, M. and Nadeau, R. (1990; 2000). *The Conscious Universe: Parts and Wholes in Physical Reality*, Springer-Verlag, New York. And in: Nadeau, R., and Kafatos, M. (1999), *The Non-local Universe: The New Physics and Maters of the Mind*, Oxford University Press, Oxford.

The connection of the quantum to cosmology is discussed in: Kafatos, M. (2009), “Cosmos and Quantum: Frontiers for the Future,” *Journal of Cosmology* 3, 511-28.

The role of universal Consciousness, hinted in the *Conscious Universe*, is developed in the recent work of Kafatos, M., Tanzi, R., and Chopra D. (2011), “How Consciousness Becomes the Physical Universe,” *The Journal of Cosmology* 14, pp.3-14.

Stuart Hameroff and Roger Penrose in a series of several works have developed the Orchestrated Objective Reduction model of how conscious awareness arises, which utilizes space-time geometry at the fundamental Planck level; see for example Roger Penrose & Stuart Hameroff (2011). “Consciousness in the Universe: Neuroscience, Quantum Space-Time Geometry and Orch OR Theory,” *Journal of Cosmology* 14. Orch OR makes specific and interesting predictions on quantum coherence at microtubular levels which are being explored by experimentalists.

Related to what universal consciousness might be is the concept of sentience as assigned to all objects and systems in the universe. Sentience is discussed in: Theise, N. D., Kafatos, M. C. (2013), “Sentience Everywhere: Complexity Theory, Panpsychism & the Role of Sentience in Self-Organization of the Universe,” *Journal of Consciousness Exploration & Research*, 4(4), pp. 378-90. In their view, even single cell organisms possess rudimentary awareness of their environment, which serves to define the essential, underlying field of primary consciousness, namely sentience, leading to “sense making.” An example they examine in detail is how a paramecium swims. In fact, even “inanimate” objects such as elementary particles possess some elementary sentience as they interact with their environment in complex ways (e.g., electrons in DNA molecules).

Whereas universal Consciousness includes everything, namely conscious self-awareness, object awareness, sensing of the environment (“sentience”), subconscious processes, etc., sentience is more primitive and only refers to sensing of (and interacting) with the environment.

Efforts to unify biology with physics can be found in recent works by Grandpierre, A. and Kafatos, M. (2012) “Biological Autonomy”, *Philosophy Study*, Volume 2(9), pp. 631-49. See also Grandpierre, A. and Kafatos, M. (2013) “Genuine Biological Autonomy: How can the Spooky Finger of Mind Play on the Physical Keyboard of the Brain?” Chapter 9, *An Anthology of Philosophical Studies*, Vol. 7, P. Hanna (edit.), Athens Institute for Education and Research 2013, pp. 83-98. In these works, the fundamental role of the quantum vacuum is assigned to both physics and biology. Biological autonomy is tied to the vacuum.

The possible role of complementarity in brain dynamics has been developed by e.g., Roy S. and Kafatos, M., (1999a), “Complementarity Principle and Cognition Process,” *Physics Essays*, 12, 662-8; also, Roy, S. and Kafatos, M., (1999b), “Bell-type Correlations and Large Scale Structure of the Universe,” in: *Instantaneous Action at a Distance in Modern Physics: Pro*

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and Contra, A. E. Chubykalo, V. Pope & R. Smirnov-Rueda (eds.), Nova Science Publishers, New York; and Roy, S. and Kafatos, M. (2004), "Quantum processes and functional geometry: new perspectives in brain dynamics." *FORMA*, 19, 69.

It is worth repeating here arguments from Kafatos (2014) book chapter in: *Brain, Mind, and Cosmos: The Nature of Our Existence and the Universe*, ed. Deepak Chopra, eBook (May, 2014).

Building on what has been developed, let's examine the amazing, emerging view of the ultimate unity of everything in the Universe. Namely that everything in the universe is unified through the underlying, ever-existing, universal Consciousness. This underlying, universal consciousness operates at every level of reality. It is founded on the fundamental "I-ness." The basic nature of consciousness is also basic to each and every one of us: It is the perfect I-consciousness or the I-awareness. This I-consciousness is not the identity of the ego, which assigns specific properties to itself and has a finite lifetime. It is, instead, the I-ness behind all relative experiences, a transcendent background of fundamental existence.

Through a series of fundamental principles, which apply at all levels, in all fields of human activity, all life, and everything that exists in the universe, consciousness creates, sustains, and re-absorbs onto itself all in the universe. The fundamental principles consist of a fundamental complementarity between object and subject, a projection from Consciousness into consciousness. Secondly, consciousness recursively holds objects to form similar relationships, appearances, and properties across vastly different scales. Thirdly, it provides awareness and meaning to everything, sensing of the environment through contextual and sufficient reason. A manifestation of sufficient reason is the process of choices made in quantum observations.

Through these principles, consciousness unifies everything in undivided wholeness. All quantum phenomena spring out of the fundamental principles. At the same time, these principles in a sense limit (or focus) universal consciousness, which otherwise would be unmanifest and unknowable. The universe is participatory as consciousness is in partnership, or participation with everything in it. This participation manifests as sentience at all levels in all objects.

The participatory universe implies that experience is fundamental. Without experience, the three principles would be rendered meaningless. It is the experience of universal consciousness that manifests in countless beings.

Finally, at the individual level, experience becomes subjective. Qualia give rise to all levels of subjective experience.

As such, Qualia will be shown in the new Science of consciousness to be the fundamental building blocks of the conscious universe. The new science of consciousness will usher a new revolution in human awareness and evolution unprecedented to this day. In its development, the connection to ancient monistic wisdom systems will become natural.

The ultimate view of an integrated reality will be found in the forthcoming book by Menas Kafatos and Deepak Chopra, *Who Made God and Other Cosmic Riddles*, Harmony, New York.