Why Consciousness is a Big Deal for Science

Akhaṇḍadhī Dāsa
Founder of the Science and Philosophy Initiative

This paper is derived from a talk I presented at the Consciousness in Science Conference in Gainesville, Florida (January 2019).

Philosophers and scientists don't always have a comfortable relationship. I have heard scientists say, "At best, you can go to philosophers for questions, but don't ever rely on them for answers." Perhaps that is disingenuous, as scientists usually don't like the questions philosophers raise. And philosophers become frustrated that scientists prefer to answer questions other than the ones philosophers pose. There is an old joke that much scientific research can be likened to a drunk man who stumbles up the path to his front door, drops his keys there, but then goes back out to the street to search for them under a streetlamp, where the light is better. My role as a philosopher is to raise uncomfortable questions and ask scientists to search for the answers *not* in places they are habituated to — where they feel comfortable looking — but rather where they have a better chance of finding answers. Nowhere is this more vital than in the study of consciousness.

What is consciousness? At a seminar in 2016, Anil Seth, a British neuroscientist, referred to it as a mystery in our face at every moment. He said that consciousness is "at once the most familiar and the most mysterious feature of our existence."[1] However, there is still no broadly accepted definition of what we mean by consciousness. Mostly, Seth said, we have only "folk intuitions." In that spirit, one of my favorite definitions is: "Consciousness — that annoying period between naps."[2] Yes, it is that weird phenomenon that bothers us from morning to night.

But what, more precisely, do we count as consciousness? Is it simply the content of our inner world: thoughts, ideas, emotions, feelings? Or is it the processing of neural activity that produces such mental content? Is consciousness the felt experiences of mental content? Or is it the property that enables that awareness? Perhaps consciousness is that which possesses the property of subjective awareness and the ability to experience.

The empirical study of consciousness tends to focus on aspects that are, so to speak, at arm's length from the seat of our actual conscious awareness. These aspects — particularly processing mental content correlated with neuroscientific studies of the brain — are hugely important but only part of the picture, since the empirical approach ignores both the subject and the experience of the subject of experience.

Here is a profound question: Do you exist? We do believe we exist, even if we postulate that we may not exist in the ultimate issue. Therefore, we have to confront our current status as persons conjecturing on existence. What leads us to believe that we exist? We intuitively accept ourselves to be entities experiencing life, with the conviction that we are the subjects of our personal experiences, and not just now, but that we have been the same witnesses experiencing life since the earliest event lodged in our memories. What, then, is that entity who is the subject of all our experiences?

Descartes, in his second Meditation, tries to address the question, What can I know for certain? His conclusion is: The only thing I can be utterly certain of is that I am the entity contemplating that question. I am a thinking thing. The thoughts I think may be full

of error, illusion, and foolishness, but the fact that I am the person experiencing them is my only certainty. I don't have much regard for Descartes's further development of this insight, but the proposition that each "I" infers itself to be a coherent self, experiencing the mind's vagaries, has remained the challenge of subjective consciousness for philosophers and scientists since the historic Eastern contemplative traditions down to this day. For instance, Patañjali's *Yoga-sūtra* describes the self as the observer of the mind's relentless machinations. A recent online comment I read expressed a similar idea: "My mind is like my internet browser: Seventeen tabs are open, three of them are frozen, and I have no idea where the music is coming from."

After decades of behaviorism and cognitive neuropsychology, the study of subjective consciousness started its real comeback around 1990. We have Stuart Hameroff to thank for encouraging its re-emergence, by organizing the first Science of Consciousness conference, in 1994. At that event, up stepped the young, long-haired David Chalmers, who challenged the consciousness community with the call that the experience of qualia must be central to any theory of consciousness. Moreover, he introduced the phrase that continues to haunt neuroscientists and philosophers: the hard problem of consciousness.[3] Chalmers says: "The hard problem of consciousness is subjective experience. . . . How does a bunch of 86 billion neurons, interacting inside the brain, . . . produce the subjective experience of a mind and of the world?"[4]

Or as John Searle posed it: The essential trait of consciousness that we need to explain is "unified qualitative subjectivity."[5] Any explanation of consciousness, however attempted, must provide due regard for the conscious self as the unified, singular, coherent subject of its experience. (I stress the distinction between the conscious self and the types of bodily, psychological, social, and other selfhoods that I, as that conscious self, may adopt and identify with.) Such an explanation must also address the qualitative nature of our experiences, which leads us to a concept at the heart of the discussion on consciousness: qualia.

"Qualia" (singular "quale") is a term derived from Latin. A quale is defined as "the internal and subjective component of sense perceptions, arising from stimulation of the senses by phenomena."[6]

Unfortunately, dictionary definitions don't do the concept justice. After Charles Sanders Peirce coined the term "qualia" in the mid-nineteenth century, Clarence Lewis developed its usage in the 1920s, but despite the concept's significance, it was largely ignored during the trends of the twentieth century. However, Michael Tye, compiler of the *Stanford Encyclopedia of Philosophy* entry on qualia, comments: "The status of qualia is hotly debated in philosophy, largely because it is central to a proper understanding of the nature of consciousness."[7]

Analysis of qualia

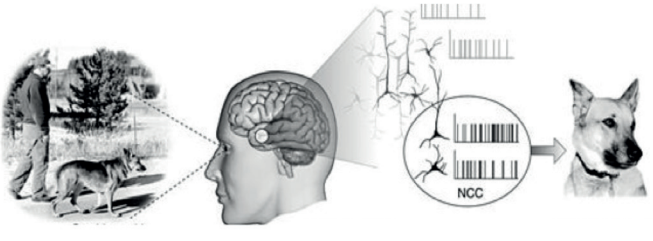
Qualia are most commonly related to sensory stimuli. Scientists describe them as the qualities of our internal experiences, arising from the input of data from our senses to our brain. Consider our visual experience and the archetypical example of qualia: the redness of red. Experiencing redness is different from experiencing blueness. Here scientists are not talking about possible emotional responses to color, which may be a subsequent secondary psychological reaction. Rather, the quale of redness is actual experience of redness — not as an external physical property, but as the internal conscious experience of redness — that is, what it is like for me to undergo the color of red as redness.

Invoking physics, let us follow a path from object to brain to experience. For instance, light bouncing off a red ball is mostly of a certain wavelength, about 700 nanometers. That light enters our eyes, which act like video or phone cameras. The lenses focus the light onto light-sensitive plates called retinas. This particular wavelength activates certain receptor cone cells. They fire. (Other cones, e.g., receptive to stimulation by light around 470 and 530 nanometers, relate to blue and green, respectively.) Signals from cones and rods gather as a bundle at the top of the optic nerve, sending a binary signal down the nerve to the brain's visual-processing cortices. The brain has a complex pattern of digitalized electrical data.

The question arises, Why is our conscious experience of that neural data now in the format of a picture possessing the qualia properties of redness and roundness? To affirm this by suggesting

"I see a picture because the outside world is picturesque; there is the red ball, and I see its image" would be naive. After the image of the external scene is focused within the eye on the retina, it is transformed into electricity and sent down the optic nerve. The question, therefore, is, Where in the brain is that picture in the format of an image that my consciousness is experiencing? The brain certainly has digital data related to both the object and how the eye obtained light from it, but it does not contain that data as a picture, much less a picture that is a beautiful color, providing you with the phenomenal experience of redness.

The issue is that the brain contains much information but not in the format of our experiences, that is, as a picture of form and color. The aspects of color and imagery are the qualities of our experience — qualia. But how have the qualities we experience been generated from the brain's neural processes? This is the big problem for neuroscience and no generating mechanism has been identified, nor even satisfactorily theorized. This conundrum is well known. Here is an illustration produced by Christof Koch, which shows the same process.[8]



This diagram follows the path of rays of light as they enter the eyes and become focused on the retinas. Then it shows how the stimulation of cones and rods sets up biochemical electrical signals that travel to the brain. And, within the brain, those signals are presented as a network of electrical connections amongst an array of neurons. The stimulation of the eyes and the electrical signals arising from them are effectively a set of digitized data. This is standard and noncontroversial, so far.

But Koch's diagram contains a sleight of hand, for it claims that, somehow or other, the brain's digital data converts into the phenomenal experience of the image with its associated qualia. This is a jump that cannot be left unchallenged. There is no explanation offered for how, why, or where this process takes place. It simply is the presumption of physicalist or reductionist ideology that the brain must have generated conscious experience. This is a prime example of a theory of consciousness that seeks to avoid the actual "hard problem."

To give credit, though, Crick and Koch do state, "The most difficult aspect of consciousness is the so-called 'hard problem' of qualia — the redness of red, the painfulness of pain, and so on. No one has produced any plausible explanation as to how the experience of the redness of red could arise from the actions of the brain. It appears fruitless to approach this problem head-on."[9] Nonetheless, they and other scientists hope that further study of neuroscience may yield some progress.

More than two decades after Chalmers introduced "the hard problem of consciousness," two things are clear: There is still no plausible explanation for qualia, and if anything, there is less confidence that a neuroscience-based theory will explicate consciousness and the problem of qualia. My position, in company with Searle's "unified qualitative subjectivity," is that if you cannot explain the subjective experience of qualia, you do not have a theory of consciousness.

Qualia are real

So significant are qualia that many scientists have attempted to deny that qualia exist. It would take much space to address each of their arguments, so I will refer to Michael Tye's conclusion. He explains that our own experience of them, at this and at every moment, should be enough to establish their actuality. "In this sense," he says, "it is difficult to deny that there are qualia."[10]

Typically, it is accepted that qualia are certainly present within experiences arising from sensory stimuli and internal sensations (hunger, thirst, pain, and so on); tentatively in emotional states (happiness, sadness, fear, etc.); but perhaps less certainly within memory, ideas, thoughts, and desires. I contend that for any aspect of mental content, specific what-it-is-like qualia can be established. My definition of qualia is that they constitute the qualitative nature of the experience of all forms of mental content.

Qualia are apprehended

There are no such things as subconscious qualia, since they are what is actually experienced — regardless of how inattentive we are to them or how unappreciative we are of the phenomenon. However, mindful introspection and attention are valuable in helping us ascertain the actuality of qualia as we regularly experience them in our everyday life.

Qualia are subjective, private, ineffable

It is impossible to communicate the actual subjective nature of our experiences of qualia to another person. Imagine how you might explain to a person with monochrome color-deficiency vision what it is like to experience the redness of red. Comparatives would be useless in that context — as they are even when communicating the experience to a person with chromatic vision. Similarly, how would you convey the experience of music to someone with the total inability to hear sounds?

Qualia possess inexplicable qualities

After all their incredible progress, neuroscientists cannot currently explain the nature of qualia with reference to the brain's known functions, properties, and attributes.

Reductionist theorists suggest that qualia — seemingly endowed with unique qualities — are really qualities somehow contained in the properties of the objects that stimulate them. This is the idea of supervenience, by which the properties of a higher-level, for example, qualia, might be somehow determined by the properties of a lower-level such as, in this case, the properties of light. Suppose, for instance, that we experience colors because color is a property of light. This proposition can be challenged with a simple experiment: Close your eyes tightly, completely cover them with your hands, shutting out any light from your eyes, and then apply gentle but firm pressure to your eyeballs. The result is that you will experience colors even though no light energy was involved. Instead, the pressure stimulated the cones to fire, then the brain received the stimuli as neural electrical data, after which color qualia were experienced within your mind. Hence, qualia related to color are features of inner experience, not external properties. There may be correlations between the properties of sensory stimuli and what we experience, but we can be certain only that the qualia we experience exist internally. We have no way of confirming their presence in this form elsewhere, and we seem led to accept that there is an intractable difference between the digital data contained in the brain and the subjective experience of the qualia related to that neural state.

The Hard Problem remains

Returning to Crick and Koch's diagram (above), it seems that the process of exploring the physics, biology, and neuroscience of light traveling from an object to our eyes, instigating biochemical signals to the brain, and establishing a network of neural correlates represents the *easy* problems defined by Chalmers.[11] But the hard problem of how we perceive digital data as an image-form of qualia remains. According to Michael Tye, many scholars thus see qualia as de facto evidence of consciousness being non-neural. Indeed, if

qualia are irreducible to any known physical properties or processes, what does this say about the conscious self, who experiences itself as the observer of qualia? Does it not follow that this also must be irreducible to physical properties?

Perception and the brain

Qualia, the self, and subjectivity are not the only issues facing a model of perception that entirely relies on brain functions. The following are two more examples.

(*1*) *Sparseness*

Sparseness is a feature of all sensory reception, but here I will consider only visual sparseness. When our eyes regard a scene, the number of bits of information passing through the pupils and hitting the retinas is about six billion. After reception by the cones and rods, and collection, the total amount of data ready to be transmitted down the optic nerve has been significantly reduced. By the time that data is received at the visual processing area of the brain, the data volume is a small fraction of the original. This suggests that there should be a significant disparity between the paucity of data that the brain contains and the richness of our perception.[12]

Many neuroscientists, therefore, conclude that the brain makes its best guess at what is going on, based on sensory input. Andy Clark suggests that we are "nature's own guessing machines, forever trying to stay one step ahead by surfing the incoming waves of sensory perception." [13] However, does this really explain the detail and accuracy of veridical perception — the direct perception of stimuli as they exist?

No doubt, a function along the lines of predictive processing — by which our mental model of the environment is generated and updated to *best accord with actual sensory input* — may be a real feature of our experience. But is it certain that it is a purely neural process? We already demonstrated that brain activity cannot account for qualia, and, similarly, we cannot explain in neural terms the image-enhancement of qualia that we factually experience. A

guessing brain could not assure us that the picture of reality we observe is accurate, especially considering a second issue: the time lag between the processing of different sensory inputs.

What you see.

What the brain has available for you to see.

(2) *Time lag*

Consider the example of witnessing a handclap close by. The light and the vibration from the clapping reach our eyes and ears at roughly the same instant, and in your mind, you hear the clap and see the hands meeting as a unified synchronous event. But this is a mystery in neuroscience, because it takes the brain longer — up to a half-second longer[14] — to process data from our eyes than from our ears. This has profound philosophical implications. If there is a significant delay between when the brain has dealt with the input from our ears and when it completes the processing of input from our eyes, then how is it that our consciousness experiences them simultaneously? Two options have been suggested to address this issue. One is that the brain holds back awareness of the sound until it has completed processing the image to go with it. The other is that on the basis of the sound it processed, the brain then tries to predict and generate an image to go with it, in advance of actually having the definite data. Neither option is satisfactory. Either our

conscious experience of the world is a fraction of a second after the fact, or our visual impressions are guesswork. This fact of the brain's inability to handle perception led Anil Seth, the UK's most prominent consciousness scientist, to say, "If hallucination is a kind of uncontrolled perception, then perception right here and right now is also a kind of hallucination, but a controlled hallucination in which the brain's predictions are being reined in by sensory information from the world." [15]

Brain model

The proposition that neural functions alone account for all aspects of consciousness ends up as a view of perception, experience, and our sense of self that's unrecognizable to our everyday understanding. The physicalists, therefore, appeal to our tendency to be deluded by the brain. Somehow, they claim, the brain casts up higher-order echoes that create an illusion of the self, qualia, experience, and free will. Yet howsoever we may be fooled by our thoughts and self-conceptions, it requires a real self to be the subject who experiences erroneous thoughts or illusions.

This brain-model perspective, which denies the self and its subjective experience, arises not from any positive evidence to substantiate how consciousness can be attributed to physical and neural processes. Rather, it is an abductive speculation that fails to show how the brain alone can be responsible for (a) the existence of a self, (b) the conscious awareness of qualia or even everyday perception, and (c) treasured human values or metaphysical aspirations. Taking into account all the evidence regarding both our experience and what we know of neuroscience, I suggest that the brain model fails as an account of consciousness. We need a bigger and better model.

An alternative approach

My prior analysis was intended to establish the inordinate, perhaps intractable, difficulties of the physicalist enterprise to explain how 1.4 kilograms of biological matter can produce the conscious

experience we know to be our actuality. While no one can unequivocally rule out the possibility that scientists might someday find the key to consciousness within physics and neuroscience, none can claim that such success is guaranteed. Hence, an intellectual society should remain open-minded and encourage the exploration of a range of options to explain consciousness. I am not suggesting that all researchers should abandon their quest for a neural basis of consciousness but just that the physicalist presumption is too limited to explore consciousness and should not, therefore, be our sole approach to it.

The dilemma Carl Hempel identifies in *The Theoretician's Dilemma* is whether the notion that physics can explain all phenomena refers to our current or future physics. Clearly, physics as currently understood is incapable of handling — or to be kind, too incomplete to handle — all issues, including consciousness. But physicalism is not rescued by claiming that it will be a future physics that explains consciousness. Indeed, what sort of physics might that be? Should physics not extend the scope of reality to include other fundamental phenomena like consciousness?

With this in mind, I present an alternative approach: What if consciousness is irreducible to currently known physical properties? What if it is a distinct, fundamental aspect or property of reality? And what if we took that idea seriously? By this I mean that we do not examine or judge consciousness from the standpoint of our assumptions about physical matter. For when we regard consciousness as a fundamental feature, a function, or a property in its own right, it becomes inevitable that we raise questions about how we observe and frame our description and modelling of the physical world. This is important because the suggestion that consciousness is irreducible and fundamental often invokes mind-matter dualism and interactionism — the very issues that for centuries have plagued consciousness research.

Muddied waters

Although it should be clear from our analysis that physical properties are distinct from the qualia properties of our mental experience

and that both are distinct from the conscious perception of functions and properties of matter, still we tend to forego the analysis of these functions and properties and muddy the waters by asking about substance: What is consciousness made of?

But this question is epistemologically unfair. Physics cannot answer this question even for matter, so why demand an answer for consciousness? The deeper physics delves into the constitution of matter, the more amorphous and insubstantial it seems to be. We end up with subatomic particles whose nature and existence are modelled and defined by the properties we need them to have in order to explain the behavior we observe. Physicists then gleefully inform us that even these so-called particles aren't absolute but are transitory products emerging from a sea of probabilities. Science is the study of our experience of the world, but all we know of matter is what it appears to be like and what it appears to do — not what it is.

Our study of physical matter examines its distinct properties and functions — without defining its ontological substance. I argue that we should adopt the same approach with consciousness. Our inability to ascertain the actual substance of matter, mind, and consciousness does not render them unreal; it simply highlights what the scientific method allows us to explore. Perhaps, once we better understand the functions and relationships of these various phenomena, we may unravel the substance issues.

Eastern insights

This is, of course, not the first time these issues have been pondered on. For millennia, Eastern contemplative traditions engaged in radical study and arduous subjective experimentation to isolate the function of conscious awareness from the various states and properties of thoughts, sensations, and experiences stirred up by the mind. Such insights are still available to us within the corpus of Vedic philosophies, particularly Vedānta, Sāṅkhya, and Yoga. There is a range of interpretations applied to these schools of thought, many tending toward idealist or immaterialist notions associated with monism. But perhaps the best fit to the evidence of modern science is the interpretative perspective of *bhedābheda* theory.

This ontology posits that the forms and properties of the world are real, along with the reality of the consciousness that observes those forms and properties. *Bhedābheda* refers to a recognition of the simultaneous oneness (*abheda*) and difference (*bheda*) present in an ontological relationship of two facets of reality. Some might consider this inherently contradictory or a heinous violation of philosophical logic. However, it is the routine way in which we regard the world around us and a founding principle of science and mathematics.

For instance, mathematics is built on our ability to count and manipulate quantities. Counting requires us to distinguish one item from another, so they may be individually enumerated. But unless we determine criteria for also assigning commonality to a group of objects or a set of members, our counting would never stop or be meaningful. In this way, mathematics recognizes both the individuality and the distinctiveness of each of the members of a set (i.e., their difference or *bheda*) and the commonality that relates them to the set (their oneness or *abheda*). Equations and formulae follow the same principle: in $E = mc^2$ both sides are simultaneously different and equivalent.

According to this approach, a single ontological reality manifests as diverse yet interrelated fundamental functions. Hence, we may reframe matter as a particular form of reality that possesses energy and information and manifests specific physical properties and consciousness as that form of reality with the property to observe the information inherent within physical properties. Although the properties and functions of matter and consciousness are distinctly different, there is also a natural interactive relationship between them based on the sharing of information.

Ātmā

Like many physical fields that exhibit particle properties, most Vedic philosophical schools also suggested that there is a fundamental unit of the field of consciousness, called *ātmā* in Sanskrit. I have adopted this helpful term because of its precise meaning and definition: the smallest individual entity possessing consciousness

and constituted of the property of consciousness. The *ātmā* is the subject of our personal experiences; it is the I, the "who I am," the unitary conscious self that has the fundamental experience of personal existence, identity, and conscious selfhood.

The Vedic traditions explore how the *ātmā* may extend its conception of itself by identifying with an extraneous persona. Personae are forms of selfhood derived in terms of the physical body, mental constructs, social relationships, and so on. There is a clear distinction between the *ātmā* as the conscious self, that is, the entity capable of subjective consciousness, and the various aspects of psychological content and conceptions, including notions of our self-image.

Sāṅkhya and the mind as interface

For this model to be credible, it must help explain the mechanisms by which consciousness observes the properties of matter. In the Sāṅkhya analysis, the interaction of the conscious self with the physical world's properties is facilitated by a set of non-neural cognitive functions acting as a form of interface. In simple terms, this concept equates to the traditional function referred to rather generally as "mind." The Sāṅkhya concept of the mind as an interface is considered a non-neural psychic organ with the non-sentient cognitive function of decoding the information of physical systems and representing it in qualia formats available for consciousness to apprehend. Modern philosophy of mind tends to lump consciousness, cognition, emotion, awareness, and all our mental baggage into one vague concept called the mind and then confuses the issue still further by conflating all of them with brain processes.

In essence, the Sāṅkhya system clarifies the particular roles of the conscious self, the mind, and the brain. This threefold model is a brilliant insight of timeless wisdom. It offers definite utility for clinical psychology, however you regard the ontology. And it has parallels with modern technology. Consider the four functions involved in computer processing: sensors, CPU, screen, and operator. Sensors gather information for processing within the CPU. Such data in a digital format is sufficient for the computer's analysis and response

output. So, what is the point of the screen? It is not for the CPU's benefit. Rather, it is the device by which the computer's internal workings become comprehensible to the observer, which is something other than itself. The screen acts as an interface by allowing communication and the sharing of information between two very different things: a silicon chip and a human being.

Similarly, the non-neural nature of qualia and mental content is evidence that the brain requires some form of interface between its data and an independent observer. Computing's four functions correlate with the senses, the brain, the interface of the mind, and the *ātmā* observer. This matches our intuitive understanding. Although the detail is beyond the scope of this article, it is possible to use the principle of a non-neural interfacing mind to account for the two examples of visual sparseness and the processing time-lag without resorting to claiming that all our perception is an illusory hallucination or happens after the fact.

Volition

To appreciate the implications of this approach, we could ask a further question: Is this conscious entity, the *ātmā*, merely an observer, or does it also possess volition? The Sāṅkhya system provides a detailed analysis of the mind as a set of cognitive subfunctions, intricately modelling their interactions as they process the information flow and its transformation from physical properties exhibited by our surrounding world to internal subjective experiences of qualia. Sāṅkhya describes perception as decoding the properties of physical objects and neural data to mental content. In parallel with physics, the proposition is that the properties of matter are a manifestation of inherent information. And the interactions of physical matter with mind, and mind with consciousness, entail not only the exchange but also the transmutation of the format of that information.

If the process of perception facilitates the flow of information from the external world to that of our inner mental experience, then volition is the reverse process. The traditions of Vedānta, Vaiṣṇava Sāṅkhya, and the *Yoga-sūtra* assert that consciousness is causal

in that it is a source of original information that affects change in physical systems. Volition, or free will, may be defined as the *ātmā's* wish to vary its experience.

The *Yoga-sūtra* clearly describes the sequence. Volition expressed by the *ātmā* generates some particular mental content in the form of intent, desire, strategy, and so on. The contents of such intention or purpose (*arthavattva*) are encoded in a set of data in terms of specific combinations of the three *guṇas* (modes or qualities). This *guṇa* data forms the *avyaya*, or constitutional information content, which then specifies the subliminal sensory qualities, the *tan-mātras* (subtle sound, touch, form, taste, and smell). And when the *tan-mātras* with those *guṇa* specifications inhere on the fields of the five elements, or *mahā-bhūtas* (earth, water, fire, air, and ether), the particular observable properties of the *mahā-bhūtas* are manifest and can be observed by our senses.

This is the phenomenon that Robert Jahn and Brenda Dunne so diligently explored within the Princeton Engineering Anomalous Research (PEAR) experiments carried out between 1979 and 2007.[16] This program was set up to study the interaction of human consciousness with sensitive physical devices. The authors concluded: "The enormous databases produced by PEAR provide clear evidence that human thought and emotion can produce measurable influences on physical reality." The Vedic model is consistent with these findings, and thus a number of researchers are exploring ways to examine the volition of non-neural consciousness and its interaction with various physical and biological systems.

Source of novel information

What does this mean for the rest of science? My view is that all scientific study relates to the information content that defines the properties and interactions of systems — whether they be physical, chemical, or biological. However, there are numerous situations wherein research encounters anomalous changes in entropy and information content. The standard recourse is to attribute such effects to vague stochastic or random processes. But why rely on chance and randomness with such certitude? After all,

these conceptual ideas do not qualify as scientific theory, for they explain nothing, cannot be tested, and, rather, discourage further investigation.

Perhaps a certain openness to a known source of novel information is called for, a consideration that information generated from conscious intention may be responsible for the increased, specified, or integrated information content that we may observe in systems? For those who suspect that consciousness cannot be reduced to neural complexity, such an approach seems imperative, not a mere fancy. PEAR's findings and other studies have demonstrated the impact of conscious intent arising from individual and coherent group consciousness. It may well be time to conduct far greater research into the link between conscious volition, psychological intent, and the change or manipulation of information content in physical, biological, neural, and quantum systems. For instance, I believe that the work of Stuart Hamerof (though I know he holds a different interpretation) regarding Orchestrated Objective Reduction[17] indicates a potential route by which non-neural consciousness could affect quantum states within microtubules and produce non-deterministic neural firing.

What if the effect of intention, whether from localized, conjoint, or pervasive sources of consciousness can be shown to play a vital role in the formation of higher-informational structures and processes in physics and biology? Where should we see this effect? Perhaps in situations in which a high-information state or a precisely specified system has appeared from low-information sources and processes. Or wherever there is specificity emerging from a state of the equivalent of white noise — for instance in biology, physics, cosmology, etc. Or where an initial state possesses inexplicable low entropy or fine-tuning of its parameters. Or where there are nonlinear interactions among components of a system producing emergent complexity.

The PEAR results indicated that the effect of intention was enhanced when subjects identified with the system they were trying to influence or when a group of subjects shared coherent intention; also, that such effects could be achieved regardless of distance from the equipment and even if the intention was applied before or after the measurement. There were also preliminary studies of

the influence on random-event equipment from the psychological intent of other species.

To summarize, there is a clear rationale for proposing that consciousness is an irreducible property. Compared with purely physicalist approaches, the perspective of non-neural consciousness as a fundamental feature of reality far more comprehensively accounts for perception, psychological factors, and subjective experience. Such a perspective also offers a way to integrate our sciences and humanities with the personal convictions and intuitions most of us have about the nature of our own existence and may open up immense possibilities for research and discovery. Indeed, it may well lead us to developing new technologies, new applications, and new advances and could unlock many conundrums plaguing current theories on the origin of life, speciation, cosmic fine-tuning, universal structure, quantum phenomena, and so on. All in all, science gains from embracing consciousness rather than ignoring it. Consciousness is not just a missing piece of the scientific puzzle — it is the missing foundation.

REFERENCES

Bryant, E. F. 2009. The Yoga-Sutras of Patañjali: A New Edition, Translation, and Commentary. New York: North Point Press.

Descartes, R. 1641. Meditations on First Philosophy.

Hempel, C. 1958. The Theoretician's Dilemma. Minneapolis: University of Minnesota Press.

NOTES

1 Seth, A. July, 2016. Lecture at the New Scientist event "Instant Expert: Consciousness." London.

2 Crane, Brian. "Pickles" comic strip. Dec. 30, 2002.

3 Chalmers, D. J. 1994. "Facing Up to the Problem of Consciousness." Journal of Consciousness Studies. (blutner.de/philom/consc/chalmers_facing.pdf)

4 Chalmers, D. J. Interview, February 20, 2015. TED Radio Hour.

20 (news.wypr.org/post/how-can-we-explain-mystery-consciousness#stream/0)

5 Searle, J. 2014. "Theory of Mind and Darwin's Legacy." In the Light of Evolution: Volume VII: The Human Mental Machinery. National Academy of Sciences; Cela-Conde C. J., Lombardo, R.G., Avise, J. C., et al., editors. Washington (DC): National Academies Press. Available at: ncbi.nlm.nih.gov/books/NBK231634/

6 Qualia. In Oxford English Dictionary.

7 Qualia. In Stanford Encyclopedia of Philosophy. (plato.stanford.edu/entries/qualia/)

8 Koch, C. 2004. The Quest for Consciousness. Englewood, Colorado: Roberts and Company Publishers.

9 Crick, F. and Koch, C. 2003. "A Framework for Consciousness." (cogsci.msu.edu/DSS/2007-2008/Koch/Crick-Koch-03.pdf)

10 Qualia. In Stanford Encyclopedia of Philosophy. (plato.stanford.edu/entries/qualia/)

11 Chalmers, D. J. 1994. "Facing Up to the Problem of Consciousness." Journal of Consciousness Studies. (blutner.de/philom/consc/chalmers_facing.pdf)

12 Cohen, M. A., Dennett, D. C., Kanwisher, N. 2016. "What is the bandwidth of perceptual experience?" (sciencedirect.com/science/article/abs/pii/S1364661316000668)

13 Clark, A. 2016. Surfing Uncertainty. Oxford: Oxford University Press. The quotation is from a book review in New Scientist, by Anil Ananthaswamy, April 6, 2016. (newscientist.com/article/mg23030681-300-do-our-dynamic-brains-predict-the-world/)

14 Hameroff, S. 2012. "How quantum brain biology can rescue conscious free will." (frontiersin.org/articles/10.3389/fnint.2012.00093/full)

15 Seth, A. 2017. "Your brain hallucinates your conscious reality." (ted.com/talks/anil_seth_your_brain_hallucinates_your_conscious_reality#t-1217)

16 Dunn, B. J., and Jahn, R. G. 1993. "Experiments in Remote Human/Machine Interactions." Journal for Scientific Exploration 6, no. 4: 311–32.

17 Hameroff, S. and Penrose, R. 2014. "Reply to criticism of the 'Orch OR qubit' – 'Orchestrated objective reduction' is scientifically justified." (quantumconsciousness.org/sites/default/files/Hameroff%2C%20Penrose%20-%20Reply%20to%20criticism%20of%20the%20Orch%20OR%20qubit.pdf)

AKHANDADHI DASA, a disciple of Srila A. C. Bhaktivedanta Swami, is based in the UK. He was the president of the Bhaktivedanta Manor from 1982–95. His interest is in the discourse of Vedanta, Sankhya, and Yoga with topics of modern philosophy, science, and sociology. He is a director of both the Science and Philosophy Initiative and the Bhaktivedanta Institute for Higher Studies. Both seek to facilitate a growing international network of scientists and philosophers exploring the integration of Vedic ideas into issues of consciousness, physics, and biology. He was a founder member of the Interfaith Network in the UK, served on the Central Religious Advisory Committee for the BBC, and since 1989 has presented over four hundred pieces for broadcast on BBC radio. He is currently involved in two UK consultation groups: Faith and the Ethics of Artificial Intelligence and Faith and the Environment.