What are the Laws of Nature Anyway? Part I: Toward a Holistic Model

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ABSTRACT

Like many terms in modern science, 'laws of nature' are used as if the meaning is clear. After hundreds of years of objective research, however, whether the laws exist on their own or are just ideas such as equations, and whether they are universal and guide change or are just empirically identified patterns, seem to be not yet known. Also, there is little certainty about their whereabouts if they really do exist. Scientific progress from concrete matter to energy to abstract information, and to the interdependence of objective and subjective, brought these issues to prominence again. In Part I, perspectives of a selection of well-known theorists including Paul Davies, Roger Penrose, Henry Stapp, Max Tegmark, David Bohm, and Albert Einstein are reviewed. In Part II, the ancient holistic Vedic account as re-clarified by Maharishi Mahesh Yogi is then shown to offer a more comprehensive meaning of 'laws of nature.'

Key Words: laws of nature, emergence, ontology, levels of reality, unified field, Vedic 3-in-1 account

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Introduction

Modern science is relentless in its pursuit of the total laws of nature. But it still functions mainly within the physicalist belief that things we commonly hear, touch, see, taste, and smell with our ordinary senses exist as *real* in nature on their own, independent of us. However, conceptions and descriptions of *reality* are dramatically changing as we investigate much less tangible, finer-grained layers of nature not directly observable with our ordinary senses—historically, a scientific criticism of religion.

We have identified cellular and molecular layers, glimpsed atomic layers, and proposed intangible particle-forces and 'imaginary mathematical' quantum fields, which according to standard quantum theory interpretations are not independent of us as observers. Increasingly abstract theories of nature now extend to a real quantum information field said to generate conventional physical spacetime, toward ultimate unification in emerging unified field theories. Long-held views of local causality, physical matter as primary, and object-subject independence are now recognized to be inadequate. Summarized in the questions below, this has been leading to renewed and deeper consideration of what the laws of nature are:

Are the laws of nature invented or discovered?

Are the laws independent of or dependent on us as observers?

Do the laws precede phenomena governed by them, or are they emergent with them?

Are the laws eternal, or do they change according to contexts?

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How does the order implied by the laws reconcile with *fundamental* quantum randomness?

Do the laws or anything else including us have any power to choose what happens?

If laws of nature really exist, where are they?

Leading scientists are again pondering these issues, especially with the revolutionary leap beyond physical matter due in part to empirical validation of nonlocal quantum entanglement. Ultimate unification—including of objective and subjective, a core theme in the ancient Vedic account—will be shown to be the direction modern science is inexorably progressing.

Paul Davies' three-level scheme

Let's start with views of physicist Paul Davies because his paper "What are the laws of nature?" (1991) naturally brings up key issues. Davies points out that he takes a "somewhat positivist approach…that ultimately, we have to work entirely with the (common) facts of experience… (p.65)." Later it is suggested, however, that this is the main issue restricting scientific progress. Regarding the laws of nature, Davies (1991) states:

> "On the one hand I am convinced that there are *some* transcendent eternal truths that constrain the nature of the physical world, and I believe that the coming into being of the universe was a lawful event and not the genesis of law" (p. 67).

According to this statement, there are laws of nature that shape what happens in the physical world, and that are transcendent and eternal. Thus the laws are neither just empirically identified patterns nor just equations in the minds of scientists or mathematicians. The transcendent laws are beyond the physical and beyond individual observers; and as eternal, they did not emerge in the process of the universe coming into being, but preceded it and guided its coming into being. With respect to the first four questions then, Davies seems to believe that the laws of nature are 1) discovered; 2) independent of us observers; 3) prior to and govern phenomena in nature; and 4) eternal. Exemplifying support for these beliefs, Davies (1991, p. 52-53) quotes revered astrophysicist/philosopher Sir Arthur Eddington and physicist Richard Feynman:

> "If there are any genuine laws of control of the physical world, they must be sought in…the transcendental laws…. [We] are no longer engaged in recovering from Nature what we ourselves put into Nature, but we are at last confronted with its own system of government" (Eddington, 1930, pp. 244-245).

> "When you discover these things, you get the feeling they were true before you found them. So you get the idea that they existed somewhere, but there's nowhere for such things…. I get the feeling that I'm discovering laws that are *out there*, analogous to the feeling that a mathematician gets when he discovers laws that are *out there"* (Feynman, 1988, p. 120).

But in trying to account for higher-order complexity from a reductive view of lower-order basic structures, Davies (1991, pp. 67-69) suspects that not all laws are transcendent and eternal:

> "However, I am suspicious that what are conventionally regarded as "fundamental laws" (for instance, the Lagrangian of some collection of fields or particles or strings) are altogether too narrow to encompass the full richness of physical phenomena, especially the organizational properties of complex systems…. I believe that new laws come into play as the universe evolves to ever more complex states….
>
> Thus the eternal laws endow the universe with a *predisposition* to develop along certain evolutionary pathways…but they do not fix in detail everything that will come to pass…. So an element of spontaneity is retained within a generally causal-deterministic framework. There exists in the eternal laws (including maybe a law of initial conditions) something like a Platonic Idea, or blueprint, for a universe of growing complexity. As states of ever-greater complexity emerge spontaneously, new higher-level organizing laws and principles emerge with them. So it is that the physical world has given rise to conscious beings who observe the world about them and ask: What are the laws of physics?"

In these statements, Davies expresses belief that higher-order laws emerge in addition to the fundamental transcendent eternal laws as the universe evolves more complex systems. The

eternal laws 'endow the universe with a *predisposition* to develop along '*evolutionary pathways*,' allowing spontaneity and unpredictability in a 'generally causal-deterministic framework' that includes other emergent laws. The phrase 'generally causal-deterministic framework' is an interesting one that relates to question 5 about *fundamental* order or randomness in nature, as well as question 6 whether humans have free will—recurring themes in this paper. Regarding question 7, it appears that Davies believes that laws of nature are real but where they exist is unclear, echoing Feynman's quote that 'there is nowhere for such things.' That is, there is nowhere within the reductive physicalist worldview that implicitly requires, but does not explicitly recognize, ontologically real levels of nature beyond the physical.

Importantly, a predisposition for 'evolutionary pathways' of higher-order organizing principles implies a preference, direction, or *value* to change in nature. For this, Davies gives the example of natural selection. This view needs to be reconciled with the long-held claim that science is *value-less*. The notion of a predisposition is in the direction of inherent values (and even has somewhat of a ring of 'intelligent design'). The issue is: How can the non-random directional 'value' of survival that is core to natural selection enter the *closed* causal chain of a *value-less* universe that began long before living organisms evolved? And where does the 'value' of survival, which suggests intelligence, order, and even purpose, come from in the first place?

Further, how does this predisposition in the 'blueprint of nature' reconcile with randomness? *Spontaneous* could not mean unpredictable due to *fundamental* randomness without any precedents if, according to Davies, predisposition is built into the transcendent eternal laws existing prior to and directing natural events. This directional 'value' to the eternal laws suggests that nature is not *fundamentally* random, and that higher-order systems do not arise *completely* spontaneously and randomly but with some degree of predisposed order/guidance in what Davis (1991) has described as 'evolutionary pathways.'

Fundamental randomness would mean no *memory* across events, no way to maintain continuity with the next event if a real orderly event happened to occur even once, and no choice about it by anyone. It is not clear how orderly systems and events, including a predisposition toward anything, could ever occur given *fundamental* randomness as the bottom line of nature.

And still further, what would be random if there are not yet any processes or events expressed in nature? Physicists David Bohm and F. David Peat (1987) made the useful point that randomness depends on the context—which requires the existence of a *context*.

Randomness typically means that the probability of an event is independent of the next event. In the context of time and space, we can have a sequence of identifiable events testable for orderly or random patterns; but already the orderly context of space and time as well as continuity in nature of successive events in order to compare them have been assumed. The concept of randomness doesn't seem applicable 'before' then, and also meaningless if we have only one real event (a one-trial sample)—namely our entire universe.

As mathematician/cosmologist Sir Roger Penrose (2012, p. 36) notes in a related context, we would be in the "…curious situation of making statistical arguments based on only one data point (the conditions in our universe)." This suggests that at least in the unique case of the origin of the universe, randomness is misapplied as an alternative to order. Theologian/philosopher Keith Ward (2010, p. 293) takes it further:

> "Something has gone wrong here with the use of the idea of probability…. [N]o single possible state is either more or less likely to exist than any other possible state. Probability does not really work when considering the likelihood of anything at all existing. Considerations of probability alone cannot tell us what is likely to exist, out of the complete array of all possible states of affairs."

One way to reconcile this issue in the context of Davies' views is that it might mean laws of nature deterministically include processes that appear random at certain stages. The *spontaneous* aspect may be determinate but incalculable. This is consistent with Einstein's view of determinism, and one basis for his opposition to interpretations of quantum theory that posit nature to be irreducibly probabilistic

and indeterminate. It also is consistent with the ancient Vedic principle of *Karma*, which refers to action and reaction, cause and effect, as determinate but so subtle and interdependent as to be unfathomable and virtually impossible to predict with utmost precision. (Later discussions will bring out that we not only cannot get order from *fundamental* randomness, but we cannot get randomness without at least a few orderly principles—namely at least three.)

In physical causal determinism as generally understood, every event is linked to past events in a closed causal chain; and there are no breaks in the chain to add to and alter the sequence. This means we as higher-order complex biological systems are just links in the *unbroken* determinate causal chain that began long before us, with no room for real intentional choice or free will to do anything about anything.

On the other hand, *fundamental* randomness also disallows free will—it is not intentional choice. Neither classical determinism nor irreducible indeterminism allow for free will. In these views, we are links in the *closed* determinate causal chain that began long before we existed, or nature is *fundamentally* random. In both cases, we don't really get to *choose* what happens.

It is important to appreciate that if we don't have free will, then to be consistent we cannot *intentionally* improve our lives through applying scientific laws (Boyer, 2013). If we do have free will to change the course of nature by *intentionally choosing to apply* specific scientific laws, logically there needs to be real processes through which subjective intentions and choices in our minds are transduced into causally efficacious changes in the real chain of physical events. But modern science has yet to establish the required links. The ancient Vedic account reconciles determinism and free will in a way not yet appreciated in modern science (Boyer, 2014).

Whether nature is *fundamentally* random or non-random but incalculably complex, the belief among modern scientists that events in nature are only probabilistically predictable is said to be reasonably well established (Kruger *et al.,* 1990). This epistemic recognition of knowledge as probabilistic is related to a recent fundamental recasting of quantum theory based on Bayesian principles of probability, called *QBism* (e.g., Caves *et al.,* 2002).

In this interpretation, the quantum wavefunction represents subjective degrees of belief about the state of nature, the probabilities of which are updated with new knowledge through observation. The quantum wave function is not necessarily attributed to be a real 'quantum object' that exists separate from observers (necessary in 'objective reduction' interpretations of quantum theory); rather, it represents the observer's knowledge state.

Although reflecting deeper recognition of the subjective and probabilistic nature of knowledge, this interpretation addresses neither the reality of a 'state of knowledge' nor even of a knower/observer's mind needed for a state of knowledge. Probabilistic knowledge in an observer's mind is a core feature, but the interpretation doesn't address where mind might exist—and is agnostic about whether it actually does exist, even though essential to the theory.

Information field interpretation of quantum theory

Another new information-based interpretation is further toward a real place where minds could exist in nature. Returning to Davies' views, in more recent writings he has likened the 'blueprint of nature' to 'Platonic Ideas or Forms,' believed by Plato to exist in an objective, very abstract but real level in addition to our familiar physical universe. In Davies' (2010) paper "Universe from bit," his general support for this view is evident. This view has direct relevance to question 7 on the list that concerns the ontological status and whereabouts of the laws of nature.

This information field interpretation of quantum theory carries forward Wheeler's (1990) 'it from bit' concept that abstract *bits* of information underpin the concrete *its* of tangible matter (qubits, quantum bits). Quoting Davies and theologian/philosopher Niels Henrik Gregersen (2010, p. 3) in their book Information and the Nature of Reality: From Physics to Metaphysics:

> "Davies asks what happens if we do not assume that the mathematical relations of the so-called laws of nature are the most basic level of description, but rather if *information* is regarded as the foundation on which physical reality is constructed. Davies suggests that instead of taking mathematics

> to be primary, followed by physics and then information, the picture should be inverted in our explanatory scheme, so that we find the conceptual hierarchy: information → laws of nature → matter."

This is in the direction of a real quantum information field underlying the physical. It has some affinity with loop quantum gravity theory, which posits classical space as created from topological relationships in a dynamically evolving network of intersecting loops called a *spin network*, akin to Penrose's *twistor theory* (Smolin, 2001). Spin networks are described as a '*pure geometry*' that is more fundamental than and *generates* classical physical space (Smolin, 2001). It links the concepts of *bits* of abstract information and *it's* of physical spacetime in a formal mathematical relationship—*Bekenstein's bound*. It borders on taking the leap beyond physical space and time, but doesn't quite make it because it remains within the physical metrics of the Planck scale.

Davies' three-level hierarchical scheme (information→ laws of nature→ matter) needs to be reconciled with his earlier stated belief in the laws of nature as transcendent and eternal. How is it that the laws of nature are less fundamental than 'information' in this newer scheme? Laws of nature he earlier identified as transcendent and eternal would not be physical. Are the transcendent eternal laws somehow in a real quantum information space beyond the physical?

If so, what orderly structures are they, and how is this consistent with quantum randomness? On the other hand, if the laws are physical but beyond matter, then what physical structures they are needs to be identified.

We need to account for how information and laws of nature relate to each other, as well as where information and both transcendent eternal and emergent laws exist if they are real. Although the theory of information field space as the basis of ordinary matter and energy can be viewed as closer to a real mind-like information field, there is still a long way to go. One major reason is that in this theory the concept of information is *objectified* and without subjective semantic meaning, like the concepts of classical matter and energy.

In Davies' view, information does connote semantic meaning, intentions, recognition of significance, and meaningful answers to questions about relationships in nature. But objectified quantum information field theory is not yet a model that includes information as having semantic meaning. Therefore, it cannot be a model of real mind with subjective intentions that can causally affect the world (like we all at least regularly function in our daily lives as if we have). Davies and Gregersen (2010, p. 4) note:

> "When the foundation for information theory was laid down by Shannon, he purposely left out of the account any reference to what the information means, and dwelt solely on the transmission aspects. His theory cannot, on its own, explain the semantics and communication of higher-order entities."

This *objectification* of information is typical of the reductive physicalist view of the physical as the only ontological reality. Mind and consciousness are merely *epiphenomena,* somehow associated with higher-order biological systems that emerged spontaneously from lower-order inert, fundamentally random processes. The lower-order physical layers are believed to be non-sentient, with no ability to experience anything and no ability to *choose* what happens in nature. Lower-order physical processes are presumed to be activated by the inherent dynamism of the random fluctuations of quantum fields that don't include intentions and predispositions at all.

It is not clear in this view when, where, and how the order via a predisposition could possibly provide 'evolutionary pathways' in nature. The mechanistic, meaningless view of an information field is not sufficient to address how meaning, direction, and value get into the universe that includes humans associated with semantically meaningful information, values, and 'evolutionary pathways' based on transcendent eternal laws that shape our orderly world.

Indeed, in contrast to a meaningless objectified quantum information field, Davies and Gregersen (2010) go so far as to assert it is "immediately obvious" information makes a difference in our daily lives and has "an undeniable causal role" (p. 7). This also is implied in their quote relating the issue to evolutionary biology:

> "No evolutionary theory can have explanatory function without attending to the instructional role of DNA sequences… neither can a bridge or skyscraper be constructed

> successfully without paying due attention to the phenomenon of resonance, and so it seems that just as *informational events* are quintessential at the lowest level of quantum reality, so are *informational structures* quintessential as driving forces for the historical unfolding of physical reality" (p. 7).

Again, Davies' three-part scheme of information→laws of nature→matter places the laws of nature *in-between* information and matter, which suggests that information is more fundamental than the laws. However, in the earlier quotes above, the fundamental laws are transcendent and eternal. It is not clear how quantum information field space could be more fundamental than transcendent orderly (non-random) laws that provide an inherent direction to nature. Either there is *fundamental* randomness, meaninglessness, and high entropy at the basis of nature, or orderly transcendent eternal laws with information that meaningfully *informs* and shapes simple and complex processes.

Davies' views seem *almost* to go beyond the physical, while still maintaining a reductive perspective. Later we will discuss how the reductive view, in which lower-order meaningless quantum and information fields are non-sentient and conscious mind is epiphenomenal, contrasts with holistic views consistent with emerging unified field theories.

To summarize the above points, starting from the historical reductive view that the bottom-line of nature is inert matter, progress has taken us to more abstract notions of energy fields as the essence of matter, and now to a much more abstract notion of a subtler information field as the essence of matter and energy. In Davies' view, we now have three aspects or levels, one more fundamental and more abstract than the previous one: matter, energy, and information. But how to bring into the picture the notion of order for *meaningful* information—as well as 'evolutionary pathways,' orderly laws of nature, and free will—is not yet clear.

Deeper into information and order

Objective modern science has a long history of difficulty addressing how order comes about in nature—such as the origin of natural laws—though it is built entirely on at least implicit assumptions that there is an orderly universe that includes real orderly minds that can know it. Information and order relate to the concept of intelligence, and a value or 'purpose' in evolution (even more difficult concepts to address in modern science).

Other articles in Davies and Gregersen's (2010) book *Information and the Nature of Reality: From Physics to Metaphysics* attempt to deal further with information and order. In the paper, "The quantum universe," for example, physicist Seth Lloyd (2010) notes that the failure of order to emerge from randomness is sometimes exemplified by the extremely small chance of even a million monkeys randomly hitting keys on typewriters to produce Shakespeare's *Hamlet*. But if the monkeys were to type random strings on a computer which *interprets* them as a set of program instructions, from random programs will emerge all the patterns generated by the laws of nature. Lloyd asserts that the entire universe functions as a computer, and likens the random key punches to quantum mechanics providing random bits via decoherence (chaotic environmental interactions). He concludes it is a mathematical fact that there is a good chance of producing the order and complexity seen throughout the universe. Lloyd (2010) states that

> "…the universe, technically, is a giant quantum computer…. Quantum mechanics possesses intrinsic sources of randomness (God plays dice) that program this computer…. [T]he injection of a few random bits, as in the case of genetic mutation or recombination, can give rise to a radically new paradigm of information processing (p. 102)…. Because of its computational nature, the universe processes and *interprets* those bits, naturally giving rise to all sorts of complex order and structure..." (p. 102).

The most relevant point here is the tacit assumption of *inherent order* that makes the universe a 'computational system by its very nature.' (In other words, 'God' has the ability to play dice if useful for nature). Order is implicitly shifted to the orderly computational system; but the orderly computation cannot just pop into nature with no precedents.

Consistent with Davies, Lloyd's view clearly implies orderly laws that guide quantum mechanical processes and interpret them to produce orderly computation and complexity. While explicitly recognizing that the universe did

not originate "completely at random!" (Lloyd, 2010, p. 100), Lloyd does not explain from whence order necessary for computation arises, or where principles of order/laws of nature exist. Given their role, it is reasonable to suggest that they are more fundamental than the 'most microscopic levels' he asserts are computational by their 'intrinsic' nature. Indeed, implying fundamental *order,* Lloyd suggests we "use the physics of the computing universe as a basis for its metaphysics" (p. 103). Lloyd's view exemplifies another step in physics toward an underlying level of nature beyond the physical, including a real information field that, importantly 'by its very nature,' has the ability for orderly computation.

This information field would not be just random without meaning because it at least involves orderly principles/laws through which the universe, according to Lloyd, is a 'giant quantum computer' and, according to Davies, is guided along 'evolutionary pathways.' This is clearly in line with fundamental order rather than *fundamental* random disorder at the deep underlying levels.

Davies and Gregersen's (2010) book includes articles that further the discussion of information, by identifying three types. The first type is attributed to the seminal work of Shannon (1948; Shannon and Weaver, 1949). It is said to be a *physical* application of information: a quantitative, objectified concept (no subjective semantic meaning) as in countable bits of information (0's and 1's). It is reductive, associated with inert, lower-order, mainly linear bottom-up physical processes.

A second type is exemplified in 'shaping information,' referring to how biophysical structures and functions are guided, by DNA for example. This *biological* type incorporates more *holistic* top-down information codes to guide formation of unitary biological organisms with survival intentions (biological flow of instruction codes). This type might be said to be *intentional* and *self-referential* in the sense of survival, but not *semantic* in the sense of subjective meaning for the whole organism. Gregersen (2010, p. 329) elaborates:

> "Despite all claims of causal reduction, physics (not only classical, but also modern) has failed to explain basic features of biological evolution…. [T]here exists no law for the sequences of DNA macromolecules….[I]f DNA sequences are casually efficient instructors by virtue of their informational structure, information can no longer be left out of a comprehensive picture of what drives nature. For again, what is causally effective, is real. As a matter of fact, information co-determines how organisms make use of their available energy budgets."

This biological 'shaping' type of information may sound like it is beyond reductivism via a more holistic, systemic view of the whole as greater than the sum of the parts and as having top-down influence on the parts. But as theologian/philosopher Keith Ward (2010, p. 283) points out:

> "Few biologists, however, think that… DNA is actually designed, in the sense of being intentionally set up…. DNA, it is widely thought, has evolved by processes of random mutation and natural selection to be an efficient replicating machine by entirely blind and randomly evolved means…. This is epistemological emergence with a concomitant ontology…but it is easier if we speak of functions and codes that can be "read"…. We could reduce this language to that of chemistry, but it is too cumbersome to bother…. A rather different view is that… [e]ven though no new physical entities are involved, the way the basic physical entities interrelate and organize means that integrated and complex entities act in accordance with new principles."

In the 'concomitant ontology' then, only 'new principles' are involved, not new real entities or levels of nature. The 'new principles' remain in the closed physical causal nexus, which means they do not constitute new 'top-down' processes directing biophysics ('mind over matter'), discussed more soon. Information as *semantic* and *meaningful* calls for real mind outside of the closed physical chain for a logically consistent model of causally efficacious mental intentions.

The third type of information—its meaning in ordinary parlance—includes purpose and intention in terms of the exchange of *semantic meaning* between conscious senders and receivers, as in language. It is associated with higher-order unitary biological organisms with self-referential conscious selves that are goal-directed (in humans even perhaps

goals/purposes/values beyond the survival instinct). This third *psychological* type of information has embedded in it the other two lower-order physical and biological meanings. Biochemist/theologian Arthur Peacocke (2010, p. 256) refers to these three types of information:

> "J.C. Puddlefoot has carefully clarified the relation between the different uses of 'information' (Puddlefoot, 1991; pp. 7-25). First, physicists, communication engineers, and neuroscientists use it in referring to the probability of one outcome among many possible outcomes of a situation; second, there is the meaning of 'to give shape or form to' (stemming from the Latin *informare*); finally, the ordinary sense of information as knowledge, so broadly, 'meaning')".

These types of information will be shown (in Part II) to be related to theories of emergence. These theories require going beyond the notion that higher-order complexity creates 'new principles' with top-down causal power while remaining in the closed physical causal chain that has no gaps to insert new causal influences. In this direction, there are parallels between the three types of information and Davies' trinity of matter (physical information), laws of nature (forming orderly structures), and information (meaningful communication) toward ontologies consistent with top-down causal power from outside the closed physical causal chain.

In his paper "Information and communication in living matter," theoretical biologist Bernd-Olaf Kuppers (2010) emphasizes progress from concrete matter to abstract informational structures in the 'structural sciences.' This increasing abstraction can be viewed as emphasizing epistemology over ontology, similar to the rise of 'structural realism' in the philosophy of science. But it can also be viewed as a more abstract ontology beyond the physical that is no longer appropriately characterized as having concrete properties of 'ponderable matter' (Boyer, 2012).

As a step in this direction, biologist Jesper Hoffmeyer's (2010) paper "Semiotic freedom: an emerging force" emphasizes the need for a logically consistent model of downward causation (top-down, whole influencing parts). He proposes *semiotic causation* (related to the second type of information) as a link toward incorporating into science "how purposive processes can emerge in the absence of antecedent intelligence, carefully selected prior conditions, or intrinsically teleological components "(Deacon and Sherman, 2008):

> "Downward causation operates through indexical sign relations; that is, the values of system parameters are interpreted by lower-level agents as indexical signs. But this state of affairs in itself presupposes the formation in the first place of a large-scale pattern with a behavior that stabilizes the semiotic interaction between parts" (Hoffmeyer, 2010, pp. 185-204).

Downward causation requires instruction codes or 'signs' that shape lower-order processes into complex, integrated wholes such as biological selves that perform unitary behavior for biological survival. But the important point is again that these causal influences would need to add 'top-down' guidance from outside of the bottom-up closed physical chain of cause and effect, which in the physicalist view is an unbroken chain that began long before biological organisms existed. Some kind of globally-functioning guidance system needs to *precede* and give *holistic* direction for lower-order processes into higher-order integrated biological units; such functions are thought not to exist in the lower-order, inert processes and closed physical causal chain.

In the paper "God as the ultimate informational principle," Ward (2010, p. 287) expands the meaning of information (a further step toward the ancient Vedic account discussed in Part II):

> "If we posit consciousness as a distinctive kind of existent, we move to the third use of the term "information" – the semantic use, when some physical item (a written mark or sound) provides information about something other than itself to some consciousness that understands it. There are three main components here: the physical item, the person who takes it to refer or to indicate that some operation is to be carried out, and what it is about, or (in logic and mathematics, for example) the operation it instructs one to perform."

The three components outlined in this quote can be associated with the three types of information: 1) physical (Shannon) information, 2) the codes or operations to be carried out

('shaping' information'), and 3) 'semantic' information (involving the conscious experiencer or knower that brings meaning to the information). They further can be related directly to the trinity of known, process of knowing, and knower (observed, process of observing/measuring, and observer). The physical meaning of information can be associated with the known, the 'shaping code' or biological meaning to the process of knowing, and semantic information to the knower/observer. Objective modern science has focused on the object (the observed or known). Now it has to consider the process of observing (as in quantum and biological theories), and also the conscious observer/knower. This is useful progress, and it is bringing into view limitations of an 'objectified' science that did not acknowledge its basis in the subjective 'knower.'

To apply this progress in more practical terms to scientific epistemology, the objective indirect third-person *experimental* approach in modern science is becoming recognized as inadequate. The value of a developmentally significant direct first-person *experiential* approach—the primary means to gain knowledge in Vedic science that includes 'knower' and 'process of knowing' along with 'known'—is starting to be appreciated. (How direct subjective means can be reliable is considered with respect to the Vedic system of Yoga in Part II.)

Particularly relevant here is that in the quote above Ward attributes real existence to consciousness. In the Vedic account, the dynamics of nature at all phenomenal levels are expressions of the self-interacting, self-referral dynamics of the unified field of universal Being that is held to be consciousness itself. Complexity involves embodiment of the simple, basic trinity of knower, process of knowing, and known as the nature of consciousness itself.

While a more integrated holistic view is that consciousness is the most basic, most fundamental and *primary* aspect of nature, reductive views attribute consciousness to be the highest complexity in nature. But the unified field as a field of consciousness is ultimately unified, singular, and is held to be the simplest possible state of nature. On the other hand, it is a field of all possibilities, not random or arbitrary—a field of least entropy and highest order, beyond the most simple and the most complex. Ultimately, this is the coherent reconciliation of simplicity/complexity, unity/diversity, and holism/reductivism.

In the Vedic account, consciousness itself, universal consciousness, is the holistic basis of nature, the least excited ground state, the field of all possibilities; and all phenomena reflect various degrees of expression of it. In the contrasting reductive view, consciousness is at best an epiphenomenon of complex physical interactions in higher-order biological organisms based on non-sentient random processes and ultimately perhaps nothing at all—which strains logical consistency that is generally held to be the core of science.

Further in the direction of a holistic view, with respect to Davies' proposal of two different types of laws of nature, *transcendent eternal* and *emergent*, Ward (2010, pp. 285-287) points out how this can be reconciled with the principle of random disorder:

> "Instead of a wholly arbitrary set of ultimate laws and states that proceeds by wholly random processes to an unanticipated outcome, we might have a complete set of all possibilities, from which one set of consistent laws might be actualized. This set might include this space-time as one of many actualized states, or it might be the only consistently actualizable universe that contains intelligent agents like us. Mathematical physicists have proposed both possibilities.
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> …[T]he most comprehensive state would include the specification of all possible states, and a selection of actual states in terms of value…. Then the laws of nature would not be wholly arbitrary principles of interaction. They would be principles necessary to the fruition of a coherent, complex, organized, and integrated universe of unique…value.
>
> The set of all mathematically possible states (a set that would exist necessarily, and could not come into being or pass away) plus a selective principle of evaluation (a rule for ordering these states) would provide the informational code for constructing an actual universe…. That sense of information would be importantly different from the sense in which, for instance, DNA is a code for building bodies. It would precede, and not be the result of,

> any and all physical processes, evolutionary or otherwise. And it would not be part of the physical system for which it was a container and transmitter of information…. [T]he historical example…is Plato's 'World of Forms"…in which the phenomena of the physical cosmos participate partially and imperfectly…. It was Augustine, in the Christian tradition, who formed the elegant postulate that the forms were actually in the mind of God…."

Although described in theological terms, these same points and issues are central to the progress from the standard orthodox to many-worlds, consistent histories, and neorealist interpretations of quantum theory. The interpretations are attempts at a coherent explanation of how to get from possibilities to probabilities and then actual experienced definite outcomes. A key point here is the association of the 'blueprint of nature' and 'complete set of all possibilities' with transcendent eternal laws as the 'transmitter of information' into an imperfect cosmos inside the more fundamental field (that is, 'in the mind of God'). Ward further states:

> "With the introduction of the idea of mind or consciousness as the carrier of possibilities, there is some motivation to move beyond the view that higher-level laws are just shorthand substitutes for boringly laborious lists of lower-level laws, and beyond the view that they are new principles of interaction between complex systems…" (2010, p. 287).

Ward gives logic to the view that the transcendent eternal laws include what is needed to express complexity, which is a more integrative view. Relating these points to the completely holistic Vedic account, the distinction of basic transcendent eternal laws versus emergent laws of complexity, and the reductive dilemma of complexity as not accountable for by the basic laws, can be resolved.

The transcendent eternal laws are contained within the 'set of all possibilities,' and are applied to shape the phenomenal structure and overall direction of nature. The transcendent eternal laws are both simple (ultimately unified Singularity) and the highest complexity as the 'set of all possibilities' at the same time.

The transcendent eternal laws include everything necessary for the building of complex systems. What emerges are not new laws but new instantiations guided by them. (However, we can think of emergent 'principles' as limited 'local laws' dealing with specific contextual applications of transcendent eternal universal laws which govern them, considered in Part II.)

Ward associates 'the carrier of possibilities' with consciousness. In the Vedic account, the integration of apparently opposing qualities is the nature of consciousness itself. To link to Ward's theological terms, the shaping of phenomenal nature relates to the 'mind of God,' and the 'set of all possibilities' relates to the nature of the consciousness that 'God' has, or is.

Davies concludes his 1984 book *Superforce: The search for a grand unified theory of nature* consistent with his belief in transcendent eternal laws guiding 'evolutionary pathways:'

> "The new physics and the new cosmology hold out a tantalizing prospect: that we might be able to explain how all the physical structures in the universe come to exist, automatically, as a result of natural processes. We should then no longer have need for a Creator in the traditional sense. Nevertheless, though science may explain the world, we still have to explain science. The laws which enable the universe to come into being spontaneously seem themselves to be the product of exceedingly ingenious design. If physics is the product of design, the universe must have a purpose, and the evidence of modern physics suggests to me that the purpose includes us." (p. 243).

In this anthropic view a holistic 'design' of the universe is implied, with 'evolutionary pathways' or purpose for the universe. But it is thought to be spontaneously implemented without requiring a 'Creator' in the traditional meaning—similar to the impersonal concept of 'Godhead.'

Although Davies' views have taken us quite a long way, we have to go further for links with the completely holistic Vedic account. We will now go deeper into how semantic information and consciousness fit into the picture.

A key issue is the mainstream reductive view of emergent individual *consciousnesses* embodied in brains/nervous systems versus underlying non-physical universal consciousness, which is directly related to the contrasts of complexity/simplicity and reductivism/holism. In this pursuit, Ward (2010) goes further to

describe consciousness as both real and not just physical:

> "Consciousness, as a distinctive sort of real existent, not composed of purely physical elements, has been a major problem for classical materialism…. When quantum physics speaks of the collapse of a wave function when an observation is made, some quantum physicists hold that consciousness is involved in the actualization of possibilities in a constitutive way…involved in the very existence of physical nature as its appears to us…. Thus a hypothesis consonant with many interpretations of quantum physics is to see the actual world as rooted in a consciousness that conceives all possible states, and actualizes some of them for a reason connected with the evaluation of such states by that consciousness…. If there is a holistic explanation for the universe, it will explain its simplest laws and elements as preconditions of the realization of its fullest and most complex states…. As a matter of logic, the laws in accordance with which physical entities relate cannot be generated by the relations between such entities. At least some basic set of laws must be seen as primordial and constitutive of reality rather than emergent from it…" (pp. 289-292).

Moreover, these 'primordial' laws need to be guided holistically by a

> "…primary causal factor in the generation and nature of those simple laws… a cosmic intelligence…. [W]hat this paradoxical suggestion really points to is a trans-temporal consciousness that can originate the universe as a condition of the existence of the sorts of consciousness the universe generates through and in time…. [W]e can imagine, and even to some extent experience, consciousness of non-physical objects such as mathematical realities and unactualized possibilities. The cosmic consciousness being envisaged here would have the set of all possible universes as its object, and so it could not be part of any such universe (…it would also have to transcend any such form). In that respect, cosmic consciousness is quite unlike any embodied consciousness. It is a primary ontological reality, in fact the one and only primary ontological reality, from which all universes are generated…. This is the supreme informational principle for constructing universes (Ward, 2010, pp. 291-292)…. Whether or not one calls such a primordial consciousness "God" is partly a matter of taste. For some, the idea of God is too anthropomorphic, too primitive and sentimental, to be of use" (p. 289).
>
> "Precisely because our views of reality must be informed by scientific knowledge, theologians must engage with science in formulating metaphysical theories that, however tentative, show religious commitment to be reasonable and intellectually appealing…. So my conclusion is that the ultimate ontological reality is indeed information, but that information is held in the mind of God, and such a hypothesis expresses one of the most coherent and plausible accounts of the nature of ultimate reality that is available to us in the modern scientific age" (pp. 298-299).

Ward's point about language demonstrates a pragmatic and less emotion-laden approach to historically divisive views on these issues, through which increasingly abstract concepts bridge gaps between science and religion. In the past, technical language hid underlying consistencies—as if untranslatable, or even antithetical. Fortunately now, however, scientific views are developing of fundamental levels of nature and ultimate unification that are becoming recognized as meshing with religious views (e.g., Plantinga, 2011).

Although Davies' scheme of 'information→ laws of nature→ matter' can be viewed as generally consistent with Ward's points, it doesn't explicitly associate meaningful information with real consciousness, either individual consciousness or the concept of a 'cosmic' or universal level of consciousness.

Davies' scheme also can be compared to models from other theorists about where 'laws of nature' exist, the meaning of information, and conscious mind, discussed next. Some of these models are more explicit about the role of subjectivity and consciousness, converging further on the Vedic account. The Vedic account integrates objective and subjective levels in a hierarchy of phenomenally real levels, addressing long baffling dilemmas in reductive physicalism. But we first consider these other models in pursuit of a coherent view of 'laws of nature,' where they exist, and how they relate to mind.

Roger Penrose's three-realm model

Penrose's (2004) book *The Road to Reality*: *A Complete Guide to the Laws of the Universe* addresses laws as 'objective mathematical truths.' Penrose begins the book by asking: "What laws govern our universe? How shall we know them? How may this knowledge help us to comprehend the world and hence guide its actions to our advantage?" (p. 7).

It is reasonable to suppose that these questions are predicated on Penrose's beliefs. The questions reflect beliefs that laws of nature are: 1) discovered; 2) objective, independent of us observers; 3) prior to and govern phenomena expressed in nature; 4) eternal (expressed in other points he makes about Platonic Forms); 5) fundamentally orderly; and 6) sort of compatible with the power of humans to change the world (free will). So far, this is consistent with Davies. The aspect of Penrose's views focused on here concerns question 7, where the laws of nature exist. Penrose (2004) also associates the laws with "Plato's ideal mathematical world of forms," (p. 12) which Plato held to be an objective, non-changing, non-physical realm apart from individual observers. Penrose (2004, pp. 17-19) identifies three realms, and seems to attribute real existence to each;

> "The mathematical forms of Plato's world clearly do not have the same kind of existence as do ordinary physical objects such as tables and chairs. They do not have spatial locations; nor do they exist in time. Objective mathematical notions must be thought of as timeless entities and are not to be regarded as being conjured into existence at the moment that they are first humanly conceived…. Thus, mathematical existence is different not only from physical existence but also from an existence that is assigned by our mental perceptions. Yet there is a deep and mysterious connection with…the physical, the mental, and the Platonic mathematical…as entities belonging to three separate 'worlds …. [T]he entire physical world is…governed according to mathematical laws…. If this is right, then even our own physical actions would be entirely subject to such ultimate mathematical control, where 'control' might still allow for some random behavior governed by strict probabilistic principles."

Penrose suggests that unchanging mathematical laws, existing separately from individual minds, control physical actions, but also might still allow statistically random behavior. This was addressed by Davies in terms of new laws or 'principles' *emerging* with complexity that allow spontaneity. This implicitly suggests that the physical causal chain is not closed, and that nature is not *fundamentally* random.

But relationships between the three realms are unresolved. Penrose (2004, p. 14) expresses belief that all physical processes are governed by mathematical laws and all mental processes are based in the physical; but then he describes "…the entire Platonic world to be within the compass of mentality. This is intended to indicate that—at least in principle—there are no mathematical truths that are beyond the scope of reason."

If the laws govern mental and physical realms, wouldn't they need to be a more fundamental and encompassing reality? Also, Penrose seems undecided whether the three realms have a hierarchical relationship, such as they are in Davies' scheme of 'information→ laws of nature→ matter.'

However, in expressing his opinion of and preference for the relationship between the three realms or worlds as stated in the quote above, Penrose (2004, P. 20) also points out the *possibility* of "…physical action beyond the scope of mathematical control…mentality not rooted in physical structures…the existence of true mathematical assertions whose truth is in principle inaccessible to reason and insight." Penrose (2004, pp. 22-23) takes it another step by stating that;

> "There may be a sense in which the three worlds are not separate at all, but merely reflect, individually, aspects of a deeper truth about the world as a whole of which we have little conception at the present time. We have a long way to go before such matters can be properly illuminated."

However, Penrose (2004) envisages the phenomenon of consciousness "…to be a *real physical* process, arising 'out there' in the physical world…" (p. 1032). This is suggestive that consciousness exists both in individual bodies and in nature apart from them. Although the conscious mind seems to be considered real here, again a reductive physicalist view is put forth, in

which higher-order conscious mind comes from lower-order physical brain processes. In this view, 'Platonic Forms' would seem to be in the physical brain, while curiously also having their objective reality 'out there' separate from individual subjectivity. Again, both are needed. In his 1994 book, Penrose asserts strongly that Platonic Forms are primary, and that "…the world of conscious perceptions and the world of physical reality are its shadows (p.417)," but it is not so strongly stated in this more recent book, or in the 2014 version of the 'Orch OR' theory of consciousness he has been developing with anesthesiologist Stuart Hameroff.

To summarize, Penrose might seem to be on the side of free will with respect to question 6, but a logically consistent model that allows real free will is not yet provided. Concerning question 7, where the laws of nature exist is, once again, not provided. In explaining the ambiguities about how the three worlds may be related, Penrose (2004) states:

> "I believe that major revolutions are required in our physical understanding. Until these revolutions have come to pass, it is, in my view, greatly optimistic to expect that much real progress can be made in understanding the actual nature of mental processes" (p, 21).

It is useful to point out here that there is no recognition of the Vedic account of nature that long ago addressed the issues he awaits revolutions in physical understanding to address. This is attributable to another implication in Penrose's 2004 book—and objectified modern science generally—that the means to traverse the 'long way to go' for 'real progress' in understanding 'the actual nature of mental processes' is through reason and insight. Unfortunately, it is the long way to go. There is no recognition of systematic means to go beyond or transcend ordinary sensory experience, reason, and insight for 'direct experience' of the unity of the 'three worlds.' This is the essential contribution of Vedic Yoga (discussed in Part II), unfortunately missing in the indirect third-person experimental approach. The ancient Vedic experiential approach provides means to validate levels beyond the physical, and also direct validation of ultimate unity (Maharishi Mahesh Yogi, 1967; Boyer, 2008). As Indian sage Nisargadatta Maharaj stated:

> "To prove a theory you carry out an experiment according to the operational instructions, left by those who have made the experiment before you. In spiritual search the chain of experiments one has to make is called Yoga" (1973, p. 367).

Henry Stapp's three-aspect model

Physicist Henry Stapp goes further beyond a meaningless information field in addressing the *interdependence* of objective matter and subjective mind in free will, which he considers essential to a rational model of nature. He further holds that these essential features are addressed in orthodox quantum theory which all along, he asserts, was about subjective experience:

> "To…cling to the false precepts of classical mechanics that leave mind and consciousness completely out of the causal loop, seems to be totally irrational. What fascination with the weird and the incredible impels philosophers to adhere, on the one hand, to a known-to-be-false physical theory that implies that *all* of our experiences of our thoughts influencing our actions are *illusions*, and to reject, on the other hand, the offerings of its successor [quantum theory], which naturally produces an image of ourselves that is fully concordant with our normal intuitions, and can explain how bodily behavior can be influenced by *felt evaluations* that is not adequately conceptualized in terms of the mechanistic notion of bouncing billiard balls (p. 108)…. Any conception of reality that cannot explain how our conscious efforts influence our bodily actions is problematic" (Stapp, 2010, p. 112).

Bringing these ideas to the context of daily life, Stapp (2011, p.18-19) further states:

> "Each of us rejects in actual practice the classical-physics claim that our conscious thoughts and efforts can have no effects on our physical actions. We build our lives, and our political, judicial, economic, social, and religious institutions, upon the…belief that, under normal wakeful conditions, a person's intentional mental effort can influence his physical actions…. [T]o brand as illusion… the idea that our conscious efforts can influence our physical actions… is a travesty against reason…"

Stapp's model attempts to address relationships between three fundamental aspects of nature that he believes must include mind and consciousness with causal power. He states that consciousness is needed in quantum wave function collapse because:

> "...the local-reductionistic laws of physics, regarded as a causal description of nature, are incomplete.... The physical part of reality represents merely the possibilities for an actual experience, not the actually experienced reality itself…. [F]rom the purely physical standpoint the [wave function] collapse seems to come from nowhere, as an unpredictable and undetermined 'bolt from the blue.' Something is needed to... bring 'classicality' into the dynamics, and it needs a 'cause' for the collapse, and it needs a reality to complement the 'potentia'... It must be something that exists, and the only thing that we know exists, besides the physical part of reality... is the experiential part..." (Stapp, 2000, p. 213).

In Stapp's model, there is physical *reality*, experiential *reality*, and Hilbert space as an infinite dimensional space of all possibilities. However, physical reality and experiential reality seem unspecified with respect to their relationship to each other. The view seems to be a sort of parallelism—or *complementarity* as in the seminal work of quantum physicist Niels Bohr. It is not the older form of classical parallelism, however, because physical and experiential must interact causally in his model.

On the other hand, what experiential reality is and where it exists in nature seems not specified. But at least both are in Hilbert space, a major step in the direction of a holistic view. Hilbert space as an all-possibilities field has affinity with Ward's (2010) description of consciousness as the 'carrier of all possibilities,' quoted earlier.

Stapp (2010) asserts that the classical model of nature is inadequate, and it is irrational to continue believing in it, especially because it left out the commonsense intuition of the causal role of our subjective minds. He feels that quantum theory reconceives *reality* as not made of just *matterstuff*, and as necessarily involving subjective experience. He further states that

> "…the quantum state of a system specifies the 'objective tendency' for a quantum event to happen, where a *quantum event* is the occurrence of some particular outcomes of some particular action performed upon the system…. Once the action to be performed upon the system is selected, the objective tendencies are expressed as probabilities assigned to the various alternative possible outcomes of that chosen action" (p. 106).

> "According to this picture, your physically described brain is an evolving cloud of essentially classically conceivable potentialities. Owing to the uncertainty principle smearing, this cloud of potentialities can quickly expand to include the neural correlates of many mutually exclusive possible experiences. Each human experience is an aspect of a psycho-physical event whose psychologically described aspect is that experience itself, and whose physically described aspect is the reduction of the cloud of potentialities to those that contain the neural correlate of that experience…. These psycho-physical actions/events are of two kinds. An action of the first kind is a choice of how the observed system is to be probed. Each such action decomposes the continuous cloud of potentialities into a set of mutually exclusive but collectively exhaustive separate components. An action of the second kind is a choice 'on the part of nature' of which of these alternative possible potentialities will be 'actualized.' The actions of the second kind are predicted to conform to certain quantum probability rules. An action of the first kind is called by Bohr 'a free choice on the part of the experimenter.' It is controlled by no known law or rule, statistical or otherwise" (p. 109).

Stapp links experiential reality and physical reality in 'psycho-physical actions/events.' This is another way to identify the relationship of observed and process of observing, matter and mind, which quantum theory recognized as crucial to the measurement process. In the context of orthodox quantum theory, Stapp (2011, pp. 19- 20) even identifies the quantum state as

> "…*physical*, in the defined sense that we can describe it by assigning mathematical properties to space-time points. But this physical aspect…does not have the ontological character of a *material substance,* in the sense in which the physical world…is made of material substance: it does not always evolve in a continuous manner, but is

> subject to abrupt "quantum jumps," sometimes called "collapses of the wave function…. The *physical aspects* of quantum mechanics are…more like *mental* things than like material things."

Physical reality includes 'objective tendencies,' classical *possibilities* or *potentia*, that get narrowed down to experienced actualities through mind-brain interactions. In this view, Stapp relates physical reality to the mathematical concept in classical physics of a dimensionless point particle. Within this abstract mathematical conception, he brings out two aspects of the physical. One is the ordinary notion of ontologically real objects of material substance that have definite measurable physical attributes. The other, however, is a more abstract conception that includes as physical the notion of quantum objects that do not have 'material substance' and definite attributes in the same way. These differences reflect changing meanings of physical in physics, discussed again later.

Stapp further indicates that the more abstract physical objects that don't have material substance make a transition from abstract probabilistic attributes to definite material attributes in the interaction of subjective experiential reality and objective physical reality. This transition is the 'collapse' of the quantum wave function. Stapp attempts to connect these processes in the physical brain.

Von Neumann named two processes in the 'collapse,' but Stapp divides it into three. Von Neumann's process 1 is a '*choice in the probing action*' by an observer. However, Stapp seems to go beyond the orthodox quantum theory interpretation by placing this choice in subjective experiential reality; that is, in the experiential reality or mind of the observer. It is associated with the physical brain of the observer, but it is an ontologically real experiential reality rather than physical reality. However, it does lead to physical changes in the brain that guide the brain to direct physical actions taken to observe or measure physical reality. Process 2 is an event in some form of abstract physical reality (the quantum wave function) that "…specifies nature's response to the probing action…." (Stapp, 2011, p. 23). Von Neumann's process 2 relates more to the unitary evolution of the quantum wave function through time in the more abstract probabilistic physical reality, before any collapse occurs due to the process of observing by a subjective observer outside the wave function in experiential reality.

> "Von Neumann uses the name "process 2" to denote the physical evolution that occurs between the mind-brain (collapse) interactions. I therefore use the name "process 3" to denote the reduction/collapse process associated with nature's response to the process 1 probing action" (2011, p. 23).

The cloud of potentialities of the quantum wave function is an abstract physical object that includes the brain in a quantum state of potentialities, not yet definite neural actions (process 2). When the subjective observer makes a choice as to how to measure, what to experience in order to gain new knowledge of the state of the world (process 1), the abstract probabilistic aspects of the physical quantum wave function (process 2) reduce to a physical brain state that is logically consistent with the prior context of knowledge in the subjective observer's mind. This results in reduction of the cloud of potentialities (process 3) into specific neural correlates in the observer's brain that is consistent with the definite actual subjective experience in the observer's mind.

For Stapp (2010), *reality* is not just given to us by nature independent of us, as classically conceived, but is created in part by free choice about what to measure. Objective tendencies and possibilities are then further narrowed down via decoherent interaction following from the choices freely made, resulting in the neural correlate of the 'actualized,' experienced event.

Importantly, Stapp (2010) states that "…free choice on the part of the experimenter…is controlled by no known law or rule, statistical or otherwise (p. 109)." Explaining further, he states that "…the physically described world is not a world of material substances, as normally [classically] conceived, but is rather a world of potentialities for future experiences (p. 110)." This suggests that the classical world of material substances is in a sense *less real* than either quantum physical reality or the mental world of experiential reality. Moreover, Stapp (2010) associates experiential reality with an information field, as well as with logically consistent empirical knowledge of the world which is causally linked to the physical world. The mental intention of the observer to choose a certain measurement bridges the causal gap:

> "The neural correlate of an intent to act in a certain way would naturally be a pattern of neural activity that tends to cause the intended action to occur. Holding this pattern in place for an extended period ought strongly to tend to make that action occur. Thus a prominent and deeply appreciated gap in the dynamical completeness of orthodox quantum mechanics can be filled in a natural way that renders our conscious efforts causally efficacious. By virtue of this filling of the causal gap, the most important demand…that one's conscious efforts have the capacity to affect one's own bodily actions…is beautifully met by the quantum ontology. And in this age of computers, and information, and flashing pixels there is nothing counterintuitive about the ontological idea that nature is built…out of events, and out of informational waves and signals that create tendencies for these events to occur" (p. 115).

> Given this new playing field, we may commence dialogues pertaining to the remaining, and vitally key, issue: namely the origin and significance of the felt evaluations that seem to guide our actions. These evaluations appear to come from an experiential or spiritual realm, and are certainly allowed by quantum theory to have the effects that they seem to have…. [T]he quantum mechanical conception of nature, is in line with intuition. It is rather classical physics that is non-intuitive. It is only the viewing of the quantum understanding of nature from the classical perspective, generated by three centuries of indoctrination that makes the quantum conception appear non-intuitive (p. 111)…. The deepest human intuition is not the immediate grasping of the classical-physics-type character of the external world. It is rather that one's own conscious subjective efforts can influence the experiences that follow (p. 112).

Thus Stapp emphasizes an underlying field that involves meaningful information and actual choices. He views this as in line with our intuitions that we do have free choice. This view can be said in a rational manner to place personal responsibility within the context of what was historically an objectified and 'value-less' science. This version identifies an abstract information field as experiential reality, with 'waves and signals' that influence 'actualized' classical reality. Such an information field as causally efficacious, 'experiential,' even 'spiritual' and moral, is far beyond meaning-less objectivity in science (and also seems to be several steps beyond the initial orthodox interpretation of quantum theory).

Combining these perspectives with Stapp's three-aspect model, within Hilbert space is an information field of experiential reality that is crucial in shaping the 'actualized,' perceived classical world. This seems further toward a hierarchical model of the three real aspects of nature: Hilbert space (mathematical reality), within which is an information field associated with causally efficacious subjectivity related to experiential reality, and physical reality that has both abstract probabilistic quantum objects and 'actualized' classical physical reality and matter.

It is appropriate also to consider how Stapp (2010) addresses quantum randomness, because his three-aspect model seems inconsistent with *fundamental* randomness in some versions of standard or orthodox interpretations of quantum theory. In the following quote, probabilism and indeterminacy relate to Heisenberg's uncertainty principle:

> "The interaction of the various parts of the brain with their environment has the effect of reducing an extremely complex conceptualization of the state of the brain to something everybody can readily understand. The quantum state of the brain is reduced by these interactions to a collection of *parallel potentialities*, each of which is essentially a classically conceivable possible state of the brain. The word 'essentially' highlights the fact that each of the classical possibilities must be slightly smeared out to bring it into accord with Heisenberg's uncertainty principle: the potential location and velocity of the centre of each particle is smeared out over a small region. This conception of the quantum brain is intuitively accessible, and it is made possible by (environment-induced) decoherence. This picture of the brain captures very well the essence of the underlying mathematical structure, and it can be used with confidence" (pp. 108-109).

This seems consistent with the view that probabilism and indeterminacy stem from measurement limitations related to the

uncertainty principle, not *fundamental* randomness. It also seems consistent with most of the views quoted earlier. It could mean that an orderly universe utilizes random processes due to determinant fluctuations too 'fine-grained' to measure. Much further toward a holistic view, in this next quote Stapp (2010) relates quantum theory to a 'global informational structure' deeper than classical physics:

> "Perhaps the main basis for the claim that quantum mechanics is *weird* is the existence of what Einstein called 'spooky action at a distance'….[I]f the conception of the physical world is changed from one made out of tiny rock-like entities to a holistic global informational structure that represents tendencies to real events to occur, and in which the choice of which potentiality will be actualized in various places is in the hands of human agents, there is no spookiness about the occurring transfers of information. The postulated global informational structure called the quantum state of the universe is the 'spook' that does the job. But it does so in a completely specified and understandable way, and this renders it basically non-spooky" (pp. 115-116).

Again however, while the emphasis is on 'objective tendencies' in the quantum model, the crucial issue here is how humans *effect* causally efficacious choices. This requires a real mental force of some kind, which would extend determinism and order beyond classical cause and effect and quantum randomness. As to where this causal force of *subjective intention* exists, Stapp (2010, p. 117) seems to go no farther than information qubits in the 'quantum smear;' that is

> "…the quantum smear of possibilities that constitute the universe at some instant (on some space-like surface in the relativistic quantum field theory description) into a set of discrete yes-no possibilities with assigned probabilities. The actualized bits specify the tendencies for future creations of bits. The partitionings specified by the process 1 actions thus lie at the base of the computational notion of information…. These processes of choosing are in some ways analogous to the process of choosing the initial boundary conditions and laws of the universe. That is, the free choices made by the human players can be seen as miniature versions of the choices that appear to be needed at the creation of the universe. Quantum theory opens the door to, and indeed demands, the making of these later free choices."

Stapp (2010) recognizes that these human choices are fundamental and crucial. But it is important to note that computations on information are attributed to a level of nature that involves knowledge and experience in a real observer in a real non-physical level of experiential reality. And much further, such choices and information processing is attributed not just too individual human observers but to the universal level of nature itself, in the form of the quantum wave function of the universe. Stapp even asserts that it allows a 'religious interpretation' that is 'concordant' with the idea of 'God' as the Creator of the universe and the laws of nature:

> "This situation is concordant with the idea of a powerful God that creates the universe and its laws to get things started, but then bequeaths part of this power to beings created in his own image, at least with regard to their power to make physically efficacious decisions on the basis of reasons and evaluations (p. 117)…but that, by contrast, is quite incompatible with the percepts of mechanistic deterministic classical physics" (p. 118).

The link here to religious views of 'God' seems to be the concept of the nonlocal 'quantum wave of the universe' as a 'global information structure.' This is in the direction of Ward's 'supreme informational principle for constructing universes' (Ward, 2010, pp. 291-292) and a 'primordial consciousness' that is the 'set of all possibilities.' If it relates to a *causally efficacious* observer, whether human or 'God,' it needs to be real to have real effects. In other words, von Neumann's process 1 and process 2 interact on some level of the real world. This would mean that mental intentions, the 'waves and signals' of information, exist as real, and also as not just local. Stapp does not seem to make an explicit statement of the ontological reality of mental intentions, mental force, or *nonlocal mind*, even though he hints at them as the basis of meaningful computational information in the 'quantum smear,' and also an experiential reality.

Historically, mental forces were not recognized in modern science, but rather were

attributed to metaphysics, religion, or spirituality. However, using a sharper 'Occam's Razor' we would have recognized long ago the necessity of conscious mind as real, before assuming anything else outside as real (Boyer, 2014).

Fortunately we are progressing deeper into more causally interactive subjectivity (mind over matter). As we will soon consider, it bears directly on theories of the emergence of higher-order information processes with subjective meaning that actually do have causally efficacious top-down effects on lower-order non-sentient physics. To summarize, for Stapp the laws of nature can be said to be 1) discovered 2) unspecified whether independent of/dependent on us as observers, 3) unspecified whether preceding or emerging with phenomena, 4) unspecified whether eternal or changing, 5) associated with order rather than *fundamental* randomness, 6) have causal power both in terms of individual subjectivity and a 'quantum wave of the universe,' and 7) real, at least in some meaning in which mathematical Hilbert space can be said to be real.

Tegmark's multiverse levels

Physicist Max Tegmark (2014, p. 120) describes physical reality as "Everything that exists," which would seem to be a one-level ontology of physical realism or emergent materialistic monism. But he summarizes contemporary speculations about inflationary big bang theory with its logically deduced prediction of infinity of universes in terms of four levels that extend beyond what *physical* has historically meant in physical science. Importantly, he describes this model as a nested four-level hierarchy. It seems to be an attempt to address a more abstract view of nature than our ordinary understanding of the physical world, while for some reason still attributing it to be physical. It severely conflates physical and mental, objective and subjective.

Level I. Tegmark (2014) states that "The Level I parallel universes are simply universe-sized parts of our space that are so far away that light from them hasn't yet had time to reach us" (p. 129). This level has infinity of galaxies including ours—and, it would seem, infinity of copies of each of us and our universe, and infinity of universes of infinite gradations of like-to-unlike copies of us and our universe with infinity of copies of each. Level I parallel universes share the same laws of nature, but are said to differ in some details because of starting out slightly different due to being generated from random quantum fluctuations. As Tegmark (2014) notes, "[S]tudents in Level I parallel universes would learn the same thing in physics class but different things in history class" (p.122). However, the parallel universes overlap, with no special boundaries distinguishing them other than the current range of light cones of observers in them.

But Tegmark also asserts that of the infinity of 'look-alikes' of you in the infinity of universes, "there's only one who speaks English, lives on a planet identical to Earth, and has experienced a life completely indistinguishable from yours in all ways." He further notes that this undermines determinism because "there's no way for you to determine which of these copies is 'you" (p. 13). Why there is only one copy (not an infinity) seems unclear. But he asserts that if there are copies of 'you,' then

> "[T]here's no guarantee that you'd even find an exactly identical one…there's only a finite number of universe possibilities that our collective human civilization can ever distinguish between in practice, since our brains and computers can store only a finite amount of information. Moreover, we can only measure things with finite accuracy" (p. 130).

Level II. Tegmark (2014) notes that eternal inflation predicts "an infinite set of distinct ones [parallel universes], some perhaps with apparently different laws of physics" (p. 132). What defines Level II is that eternal inflation creates space between universes more rapidly than can be traveled within them even at light-speed, so the universes are forever isolated from each other, with no possibility of crossing from one to another within the limitation of light-speed and classical local causality.

In some areas of space the inflation ends, forming a Level I region with infinity of universes in it that eventually creates clusters of atoms, then stars, then galaxies and then us in our universe. But the specific laws of physics characterizing these isolated or 'pocket' universes may be somewhat different due to their varying histories. Tegmark (2014) asserts that

> "Many of the regularities that we used to view as *fundamental laws,* which by definition hold anywhere and anytime, have turned out to be

> merely *effective laws*, local bylaws that can vary from place to place, corresponding to different knob settings defining space in different phases (p. 138).... Many physical laws and constants that are unchanged across a Level I multiverse may vary across the Level II multiverse, so students in Level I parallel universes learn the same thing in physics class but different things in history class, while students in Level II parallel universes could learn different things in physics class as well" (p. 153).

Tegmark explains that 'effective laws' refer to the "Particular solution to the mathematical equations that describe physics; [which] can be mistaken for fundamental laws if the same solution is implemented throughout the universe" (p. 139). In this view, dark matter is said to be an attractive force pulling things together, and dark energy is repulsive. Avoiding too much of either is needed to arrive at the fine-tuned balance necessary for our universe to be hospitable for us. All the dynamics of nature in the infinities of Level I seem to be subject to the ordinary limitations of relativistic spacetime and gravity including light-speed—with the apparent unique exception of the repulsive force in the inflationary phase, which brings about Level II.

At the Planck scale, our ordinary notions of space (distance) and time (duration) break down. But it further needs to be pointed out that a breakdown of classical notions of space, time, and local causality in quantum field theory doesn't invalidate all notions of them, discussed later.

Level III. Tegmark (2014, p. 151) states that "[A]ll possible Level I multiverses are realized within each of these Level II multiverses." So why the more levels, and where could they be?

Tegmark (2014) posits Level III based on ideas originating from the many-worlds interpretation of quantum theory (Everett, 1957), sometimes described as a 'many mind-worlds' interpretation. In this interpretation, each observation/measurement results in a parallel mind-world or conceptual universe. This irreparably fragmenting view seems to undermine empirical physics that requires continuity across time, places, and events.

Tegmark (2104) describes an abstract infinite mathematical space, Hilbert space, in which 'exist' purely mathematical objects. He asserts that the 'quantum wavefunctions' (Schrödinger equation) comprising Level III are purely mathematical 'objects' that may constitute the most fundamental physical reality. As described in the Introduction, these purely mathematical 'quantum objects' are no longer characterized as tangible, substantive 'ponderable matter' but rather superposed probabilities in mathematical space of appearing in a particular place and time in three-dimensional spacetime when measured.

How come they are still attributed to be *physical* is curious. It seems to reflect a trend in *physics* to redefine *physical* to include levels of nature historically *non-physical,* or *meta-physical.*

Level III clearly shifts away from ontologically real physics to a more abstract mathematical multiverse that exists as a conceptual reality, but also is said to be more fundamental. This reflects the revolutionary quantum leap now underway into *quantum reality*, bigger than any transition in the history of physics. It can be viewed as progress toward a level beyond classical space and our familiar physical universe, without being *meta-physical*.

A real level of nature more fundamental than Levels I and II is implied, but its ontological reality and where it could possibly exist seems not yet clear. Nonetheless, the Level III multiverse of mathematical wavefunctions in Hilbert space is said to be real, and also physical.

Level IV. Tegmark's (2014) proposal for Level IV seems to add no new observable or potentially observable phenomena beyond the three levels. It rather seems to be an attempt to describe a transcendent aspect to the abstract mathematical conception of nature, in the form of the 'Mathematical Universe Hypothesis (MUH) that attributes all universes in the ultimate multiverse to be a more fundamental abstract mathematical 'reality'—but again curiously, still physical:

> "The Mathematical Universe Hypothesis implies that mathematical existence equals physical existence....This means that all structures that exist mathematically exist physically as well, forming the Level IV multiverse. The parallel universes we've explored form a nested four-level hierarchy of increasing diversity, Level I (unobservably distant regions of space), Level II (other post-inflationary regions), Level III (elsewhere in quantum Hilbert space) and Level IV (other mathematical structures).... Exploring the Level IV multiverse doesn't require rockets or

> telescopes, merely computers and ideas…. Mathematical structures, formal systems and computations are closely related, suggesting that they're all aspects of the same transcendent structure whose nature we still haven't fully understood" (2014, p. 357).

In these statements, Tegmark outlines a hierarchy identified as most fundamentally within a transcendent mathematical field that is infinite all-possibilities Hilbert space. In this transcendent space are abstract mathematical objects, quantum objects (Level III) which are the basis of ordinary phenomenally real physical/material objects (Levels I and II).

Perhaps the most significant point of this model is that it is transitioning from reductivism to holism, via the notion of a nested hierarchy of levels of that are all within an all-encompassing mathematical Hilbert space. Three fundamental levels of nature seem to be emerging in the model: the concrete local physical relativistic space or medium of Levels I and II, the abstract nonlocal quantum reality of Level III, and the most abstract *transcendent* level of space identified in terms of the mathematical Hilbert space of Level IV that includes the other levels. In a general way with respect to aspects or levels, this model can be understood as in the same direction as the other three-level models.

Another significant point is that in conceiving of the levels as nested within infinite Hilbert space, it also can be understood as starting to bridge the conceptual gaps between matter, mind, and the integrated totality. However, it does not address the relationship between mathematical, information field, and physical space; and it also largely avoids the concepts of mind and consciousness.

Tegmark (2014, p.357) attributes important features to the Level IV multiverse, beyond orthodox interpretations of quantum theory, and that further relate to the many-worlds interpretation associated with Level III. In the following quote, these attributions are described by his phrases the 'Computable Universe Hypothesis' and the 'Finite Universe Hypothesis:

> "The Computable Universe (CUH)… mathematical structure that is our external physical reality is defined by computable functions….The Finite Universe Hypothesis (FUH) that our external physical reality is a finite mathematical structure implies the CUH and eliminates all concerns about reality being undefined…. The MUH implies that there are no undefined initial conditions: initial conditions tell us nothing about physical reality, merely about our address in the multiverse [where we happen to exist in the Level I and II parallel universes, which relates to the specific conditions that formed our habitable part]…. The MUH implies that there's no fundamental randomness: randomness is simply the way cloning feels subjectively [that is, the inability to experience processes that created our particular habitable universe with us in it]….The MUH implies that most of the complexity we observe is an illusion about our address in the multiverse…. Our multiverse is simpler than our Universe, in the sense that it can be described with less information, and the Level IV multiverse is simplest of all, requiring essentially no information to describe."

These points reflect additional steps in the direction of the holistic Vedic account. They are also consistent with the unified field as the source of order in nature, rather than *fundamental* randomness as quantum field theory is frequently interpreted to imply. However, how computational ability enters into the Computable Universe seems not to be addressed.

To summarize the various views so far, for Davies either the transcendent eternal laws or an information field is the most fundamental. But if the information field has no meaningful information in it, it is not clear how it relates to the order of a predisposition in nature toward more complexity, or how it relates to belief in free will which Davies clearly supports.

For Penrose, the laws of nature in terms of 'Platonic Forms' would seem to be the most fundamental, but are not placed hierarchically with respect to the mental and physical. On the other hand, the mathematical laws are 'compassed' by the mental, which is 'compassed by the physical. This appears to be an attempt to accept the reality of mind and the reality of mathematical laws of nature ('Platonic Forms'), but not quite yet explicit about accepting them as ontologically real levels beyond the physical.

For Stapp, the most fundamental level seems to be the concept of abstract Hilbert space, within which is a meaningful information field with

causally efficacious mental intentions (experiential reality). Apparently this level is more fundamental than the 'actualized,' perceived physical reality associated with classical matter. Stapp seems to feel strongly that causally efficacious subjectivity is real, and asserts that orthodox quantum theory addresses it quite well. On the other hand, Stapp seems not to go farther than the 'quantum smear' in locating 'waves and signals' of meaningful information including causally efficacious 'felt evaluations.' These processes seem to be inadequately characterized in terms of 'classical potentia' as a more abstract probabilistic level of physical reality and experiential reality with real free will.

But if in the 'quantum smear' is the *nonlocal* 'quantum wave of the universe' associated somehow with causally efficacious 'waves and signals,' then we certainly are not talking about just a mathematical Hilbert space with no ontological reality. We also would be including a field of mental intentions/mind in a very abstract space that is determinate, ontologically real, and outside of ordinary matter and the closed physical causal chain, a real 'space-like' physical field of mathematical possibilities and 'objective tendencies,' plus a separate experiential reality.

For Tegmark, the universe and all that exists in it is a mathematical reality, which also is said to be physical. This reflects tacit attempts to recast the concept of physical reality from its traditional meaning associated with ordinary time and distance scales and particle-interaction causality of the ontologically real physical world. Tegmark's model of nature is hierarchical (nested) and holistic in the sense of infinite and eternal. But it does not explain how mind and consciousness fit into the mathematical universe, even though it is said to be inherently computational by nature. Although Tegmark might be open to the possibility of real minds and consciousness, in his model subjective mind and consciousness seem to remain products of the material brain and are not identified at the level of the computational, mathematical universe.

We now consider a three-level model that explicitly posits real mind and a real place for it to exist. It is a major step toward causally efficacious mind, real free will, a meaningful information field, real 'Platonic Forms', and laws of nature that are transcendent and eternal.

Bohm and Hiley's three-level hierarchy

The model discussed now posits *quantum reality* in addition to physical reality. Taking and applying nonlocality as ontologically real, it posits a real nonlocal field that underlies and causally affects physical matter. Associated with mathematician/physicist David Bohm (1980) and physicist Basil J. Hiley (Bohm and Hiley, 1993), it is sometimes called *neorealism* because it recovers both the fundamental principles of objectivity independent of the observer and of nature as determinate that historically were basic to realism. In contrast to orthodox quantum theory, elementary particles are real whether measured or not (in other words, a tree falling in the woods creates a sound whether or not anyone is there to hear it). Their dynamic attributes of motion are guided by a nonlocal guiding wave, sometimes called the *psi wave*.

To match the behavior of objects according to quantum probability predictions, the psi wave must be connected to every particle in the universe, classically invisible, and common in nature (Bohm. 1980). The psi wave carries 'active information' that reflects the totality of the experimental arrangement (Bohm, 1980). The path of a particle is influenced by the physical forces in their environmental contexts, and also by the 'active' influence of the nonlocal psi wave subtler and permeating physical matter that must be involved in implementing fundamental laws of nature to influence action on the physical level.

The observer's mind is brought back into the picture via the psi wave as an intentional influence in the underlying nonlocal field. This nonlocal field including nonlocal mind is in the brain in the sense of permeating and causally influencing it. But it is both smaller than (permeating) and bigger than (encompassing) the entire physical universe. In other words, gross real *matterstuff* is embedded in some kind of subtler real nonlocal *mindstuff*. For the first time in modern science, this view allows at least a logically consistent model of how your brain and arm, for example, actually could be guided by your mind.

In this interpretation, the gross classical physical level is the *explicate* order. The subtler *implicate* order is a highly interconnected, entangled, enfolded nonlocal field of much more abstract wave impulses that have meaning and 'signal' value. (Bohm, 1980; Bohm & Hiley, 1993). Mental intentions of individual minds in this

subtler field can cause motion in physical spacetime. Further, both the finite gross level (*explicate* order) and the finite subtle level (*implicate* order) exist in the infinite universal plenum (*super-implicate* order) in a three-level hierarchy.

To summarize, the major contributions of this interpretation include an expanded ontological model with three explicit levels of nature, actually applying nonlocality in terms of a causally efficacious nonlocal mind, and unifying the levels into a single wholeness. Referring back to the seven questions in the Introduction, for Bohm the laws of nature can be said to be 1) discovered, 2) unspecified as to whether they exist independent or dependent on us as observers, 3) prior to and govern phenomena in nature; 4) unspecified whether eternal or changing according to context, but likely eternal 5) associated with order, not *fundamental* randomness, 6) causally efficacious and allowing real free will, and 7) existing in the super-implicate order.

This model represents progress toward an all-encompassing unified field theory (super-implicate order), on which Einstein spent much of his later life. Near the end of his life, Einstein spent time with Bohm, and most likely helped Bohm clarify his thinking that led to the more holistic view of nature which both were pursuing. Einstein's work at unification was not successful, for one reason because it didn't get past relativistic physical spacetime. Consistent with reductive physicalism, Einstein (1949) also seemed to hold the view that humans don't have free will: "In human freedom in the philosophical sense I am definitely a disbeliever. Everybody acts not only under external compulsion but also inner necessity."

Einstein's views might be summarized as follows: laws of nature are 1) discovered, 2) existent independent of observers, 3) the specifiers of phenomena in nature, 4) eternal and unchanging, 5) associated with order rather than *fundamental* randomness, 6) determinate and not allowing free will, and 7) apparently existent but paradoxical with respect to not easily accountable within physical existence.

While it is not surprising that Einstein believed in physicalism and thus not in free will, his admonitions for daily life emphasized personal responsibility consistent with free will. This inconsistency reflects the challenge of reconciling a deep intuitive sense of values beyond relativism and meaninglessness with strong commitment to the limitations of deterministic physical science—noted earlier.

Part II of this paper begins with the inadequacy of the two prevailing theories within physicalism of *epistemological* and so-called *ontological* emergence to account for higher-order conscious minds. Both of these approaches are not consistent with free will, even though our legal and social systems as well as our entire daily lives are predicated on the belief that we actually do have free will and personal responsibility for our own actions.

The holistic Vedic account is introduced as a logically consistent view of levels of nature that allow real free will and deterministic laws of nature. The Vedic account can be said to reconcile emerging scientific views of the unified field as 'the source of everything' and religious views of 'God.' Quite importantly, it links practical 'moral laws' with scientific laws of the structure and function of nature in the concept of the "Constitution of the Universe.'

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