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Monistic Idealism May Provide Better Ontology for Cognitive Science: A Reply to Dyer

Amit Goswami

University of Oregon, Eugene

This is a response to Michael Dyer's (1994) *Commentary on Goswami's Quantum-Based Theory of Consciousness and Free Will*, a theory that I will call idealist science — a science based on the primacy of consciousness rather than matter. First, I review Dyer's main points: (1) there is no need for idealist science since cognitive science can explain whatever human phenomena idealist science purports to explain; and (2) idealist science offers nothing new, such as, new methodology or experimental prediction. I then review some of the inadequacies of the cognitive science model of consciousness stemming in part from its impoverished ontology of physical realism. It is shown that cognitive science follows from the new idealist science (as classical physics follows from quantum physics) in the limit of a correspondence principle. In this way, idealist science is seen to support cognitive science (rather than replace it) while generalizing the scope of science itself to include the subjective aspects of reality. Next, I point out what idealist science gains for us: (1) treatment within science of the subjective aspects of creativity, ethics, free will, and spirituality (without the need to explain these away as epiphenomena); and (2) integration of all the forces of psychology, and also of physics and biology. Finally, I discuss possible experiments to distinguish between realist and idealist models of reality.

Michael Dyer (1994), a highly knowledgeable computer scientist, has done us all a favor by initiating a discussion concerning two ways of doing science. The first, traditional way may be called realist science; it is based on the philosophy of physical or material realism that is grounded in the primacy of objectivity and matter; cognitive science and most modern paradigms of science are examples. The second is a recent development of quantum physics (Blood, 1993; Goswami, 1989, 1990, 1993; Herbert, 1993), which I will call idealist science; it is based on the philosophy of monistic

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idealism that posits the primacy of consciousness, in which subjects and objects are equally treated.

The challenging perspectives of the rapidly developing quantum-based idealist science are well served and advanced when able scientists like Dyer seriously consider and thoughtfully comment on them. Unfortunately for all concerned, Dyer seems to view the issue in either/or terms, failing to realize that the new science and the new ontology (idealist science) is inclusive of the old science and the old ontology (realist science).

Dyer's main points are as follows: (1) idealist science is not needed because cognitive science is already developing computer programs which can emulate human creativity, ethics, and free will; and (2) idealist science does not buy us anything scientific because "Goswami does not offer one single experiment, algorithm, system, model or knowledge/reasoning construct that can be tested or employed to make predictions or synthesize any kind of cognitive behavior" (Dyer, 1994, p. 286). These are the issues I will mainly address in this paper.

Dyer (p. 270) comes to his opinions "as a result of over a decade directing research in the areas of computer modeling of symbolic AI systems and artificial neural systems. Over the years my [Dyer's] students and I [Dyer] have designed and programmed symbolic AI systems that model language comprehension, argumentation and belief, learning, and creativity." He also mentions programs with capability for the acquirement of language and knowledge from examples, the disambiguation of words and the integration of aspects of learning with vision. In addition he states (p. 278) that "my [Dyer's] own opinion is that AI (computer) systems will exhibit 'free will' once they have been designed with [certain] capacities."

Based primarily on this experience and his firm belief that matter is the ground of all being, Dyer (p. 266) asserts that "life itself is a consequence of how nonliving matter interacts"; and that "my [Dyer's] thoughts arise from the dynamics of my neurons (and their neurotransmitters etc.) which are inexorably conforming to the laws of physics" (p. 269). Finally, Dyer asserts that "consciousness is a physical process, following the laws of physics" (p. 269).

Dyer is so fixed in his materialist dogma that he tends to misinterpret idealism (p. 266): "the paradigm of Idealism postulates that consciousness, rather than being an extremely high-level, emergent phenomenon, is rather *the* lowest level, fundamental building block of reality — from which the rest of the physical universe is constructed." No idealist would ever think of consciousness as a building block; consciousness is the ground of being but it is also the whole, it cannot be reduced. In fact, the main point of idealist science is that causal efficacy not only travels upwards (upward causation), as according to the material laws of physics, but there is also causal efficacy that travels downward from consciousness through quantum measurements (downward causation). It is this downward causation of consciousness that expresses itself as free will and creativity with which consciousness creates the material world (Goswami, 1994b). Dyer's inability to accept free will and creativity as attributes of consciousness rather than of neurons belies his own creativity, his own considerable accomplishments.

Dyer (p. 270) says, ". . . all cognitive scientists need is theoretical support from quantum physicists that quantum level can bring about neurons (or other information processing devices)." But anyone who has studied the meaning of quantum mechanics knows that its implications are not limited to the submicroscopic world. In quantum mechanics, subjects enter physics via the measurement process. Thus, quantum physics offers us an unprecedented window of opportunity for understanding consciousness.

The issues at stake — subjectivity, the mind–brain problem, creativity, ethics, free will and spirituality, the existence or nonexistence of paranormal capacity in humans, and so forth — have been debated for millennia but within philosophy and with little gain. Instead, let me propose a dialog, a dialog in the mode of science. Let us agree that we have two competing scientific paradigms of reality. Scientific models should be judged on the basis of creativity and logical consistency in the development of the appropriate ontology and epistemology, scope, usefulness, and experimental verification. Let us use these criteria to evaluate the fundamental validity of idealist science as a competing paradigm for realist science. When we do that, Dyer and many cognitive scientists will discover that the new science is not antagonistic to the old; rather it is inclusive of it. The new science does not say that the old science is wrong, only that it is incomplete and gives a limited description of the human condition. The new science extends the scope of all science by including those (subjective) aspects that the old science leaves out.

I do not believe that Dyer is totally antagonistic to idealist science. Not only does he grudgingly acknowledge (Dyer, 1994, p. 286) that I have "come up with a response to each immediate problem facing Monistic idealism," but he also states (p. 288) "I [Dyer] sympathize with Goswami's goals and wish also that we were all wiser and more ethical and loving." I believe that integrating cognitive science within a broader idealist science as shown here will help achieve these goals.

I will begin with a discussion of certain limited and unnecessary premises on which today's cognitive science is based. I will then move on to a discussion of how idealist science gives an alternative basis for pursuing cognitive science, how its methodologies allow traditional science to extend its scope. Finally, I will discuss some experimental means of discerning between the two paradigms.

Is Cognitive Science Based on Limited Premises?

What is it like to be a bat? What is it like to experience eating a banana? The answer to this kind of question leads us to the concept of subjectivity or the quale (felt quality) of an experience that varies from person to person or species to species. But cognitive science based on material realism is objective. Can an explicitly objective science ever explain the essential subjectivity of what it is like to be conscious or what it is like to experience something? A negative answer seems logical and hence cognitive science itself is suspect as a science of the mind. This argument has been developed by many philosophers of science, John Searle (1994) in particular. To this argument, cognitive scientists respond by denying the validity of the quale of a subjective experience and subjectivity altogether. Dennett's (1991) work that Dyer cites is a good example of this denial. One is apt to remember that consciousness itself was denied its status until recently.

Another one of Searle's (1987) criticisms of cognitive science is the contrast of syntax, which a computer can process, and semantics, which it cannot. A universal Turing machine is a rule-bound symbol processing machine. But our cognitive experiences are most often about something external to us, there is an essential intentionality of the experience that reaches out to an object outside of us. How can a computer, bound only to interpreting internal syntax, reach out and interpret the meaning of the world outside of it? It cannot, and therefore it is impossible to model our consciousness after computing machines.

One cognitive science answer to this criticism is the philosophy of objectivism according to which the world itself is organized in the same way as the computer representations in our brains, and hence the brain can make representations of external objects that have meaning for us. But the biologist Gerald Edelman (1992) has (correctly, in my opinion) argued that this leaves us with a static world that does not fit the facts, such as the fact of evolution.

Searle (1994) declares flatly that cognitive science is wrong and that we need to develop the science of the mind on the basis of a new philosophy in which the concept of *material* itself is modified to include subjectivity. Edelman (1992) also rejects cognitive science in favor of a biological, evolution-based theory of consciousness.

The purpose of this paper is not to evaluate Searle's or Edelman's proposed solutions, but to ask if there is any value to cognitive science, given that it fails to describe ourselves fully, that is, it omits our subjectivity and intentionality. Is there any sense in making a theory of cognition on the basis of mental representations when such a theory treats the world in a blatantly incomplete fashion?

I would like to propose that cognitive science is not wrong but limited in its premises. The appearance of wrongness comes from the use of an inadequate philosophy, material realism. Quantum physics researchers have shown beyond a reasonable doubt that material realism — an ontology of independent, separate objects — cannot be supported (see Blood, 1993; Bohm, 1981; Goswami, 1989, 1993; Herbert, 1993; Penrose, 1989; Stapp, 1993; Wolf, 1984).

I (Goswami, 1993) have already indicated that the idealist alternative, a more complete theory of the brain–mind using ideas of quantum measurement theory within an idealist ontology, revives cognitive science in the limit of a correspondence principle. Cognitive science does not treat those aspects of us that are subjective, that involve real freedom or purposiveness, or that involve nonlocality or other quantum processing. These aspects are explicitly idealist and quantum and are suppressed in the correspondence limit in which the validity of cognitive science is reestablished.

In idealist science, consciousness is *not* an aspect of the mind, it is the ground of all being including the brain–mind; accordingly, brain–mind identity is defined without connotations of subjectivity or consciousness. In contrast, cognitive science assumes consciousness to be an epiphenomenal aspect of the mind. Then when it asserts brain–mind identity, it is forced to treat consciousness without causal efficacy, without even subjectivity: thus the appearance of incompleteness, even wrongness. For example, many authors think that subjectivity is included only as a subtle dualism (psycho-physical parallelism; see, for example, Herbert, 1993) in most cognitive approaches. Those who claim to include consciousness in cognitive science without psycho-physical parallelism (for example, Dennett, 1991) do so only by redefining consciousness as a mental property without subjectivity. That seems to me like sophistry.

Idealist Science and Its Correspondence Limit

It will be useful at this juncture to review the basic features of idealist science's treatment of the brain–mind and the subject–object split of the world. According to quantum physics, all things exist in possibility until a measurement is made, at which point an actual event appears in space–time. According to the idealist interpretation (Goswami, 1989, 1990, 1993), a quantum measurement occurs when transcendent consciousness collapses the possibility structure, choosing one facet which becomes actuality. The collapse is self-referential, involving a tangled hierarchical mechanism posited for the brain–mind. Before collapse there is only one undivided consciousness and its possibilities in potentia (the unconscious); collapse brings about the physical object, awareness of the corresponding mental object, and the universal subject/self that experiences the mental objects. The experience and awareness in which the universal subject (called the quantum self) arises are called primary.

However, repeated quantum measurements condition the self-referential quantum system of the brain–mind (demonstrated by Mitchell and Goswami [1992] via the use of nonlinear Schrödinger equation suitable for self-referential systems). This produces enhanced probability weighting for conditioned responses to stimuli in individual brain–minds which gradually acquire a personal history, a learned repertoire of responses. In the limit of infinite conditioning, the probability of conditioned events approaches one-hundred percent. In this limit, the creative uncertainty of choice available in the quantum self-experience is removed. Instead, what is experienced is a personal ego acting according to past habits and preferences. This is the correspondence limit. It is in this limit that cognitive science begins to make sense. As an example, let us consider perception.

When sensory stimuli from an external object arrive, the quantum brain–mind processes it unconsciously (without awareness), expanding as a quantum superposition of possibilities. Consciousness collapses the possibility structure, giving rise to the primary awareness event. If there is conditioning, the learned memory is played back as secondary stimuli; the secondary collapse events of the brain–mind's possibility structure in response to these stimuli are probability-biased; that is, conditioned responses have a greater probability of appearing.

For a stimulus that is conditioned to a certain degree, the felt quality of experience (the quale) is an amalgam of both universal (arising from the primary event) and personal (arising from the secondary events) subjectivity (Goswami, 1994b). However, in the event that all stimuli can be considered infinitely conditioned, the quale is the same for all people and the concept of an objective mental representation of the external event makes sense. When the stimulus is new, consciousness is free to name the experience of the event and to make a physical memory in the brain–mind. Each subsequent experience of the stimulus leads to a reconstruction of the memory of the event, a dynamic memory that evolves to reflect the dynamism of the world. But in the limit of infinite conditioning, no further reconstruction of the memory need be assumed to take place. In this limit, the world itself takes on a static character and the philosophy of objectivism also makes sense.

In this way, all the objections to cognitive science that Searle (1994) and Edelman (1992) and others have raised are answered within the idealist science framework. Professor Dyer, behold! We have succeeded in finding an ontological foundation for cognitive science. Cognitive science survives the demise of material realism in physics.

Dyer makes a big point of how conventional cognitive science is already compatible with quantum physics because quantum physics governs the behavior of all things at the submicroscopic level. This assertion, of course, ignores the nonalgorithmic nature of quantum measurement which is fundamentally incompatible with algorithmic cognitive science. By positing quantum measurement dynamics at the macrolevel of the brain–mind and demonstrating a correspondence limit of conditioning, idealist science provides cognitive science with compatibility with a quantum universe and more, with an ontological foundation.

Dyer (p. 286) complains that the idealist approach does not "offer one single experiment, algorithm, system, model or knowledge/reasoning construct that can be tested or employed to make predictions or synthesize any kind of cognitive behavior." The question of experiments will be taken up later, but it should be clear now why the new approach does not give us new algorithms for predictions or synthesis of cognitive behavior. The new science involves the discontinuous collapse of the possibility wave, which is fundamentally nonalgorithmic; it is exclusively algorithmic only in the correspondence limit in which cognitive science is sufficient to obtain its predictions.

However, here is a futuristic challenge to Dyer and all cognitive scientists. If a quantum computer is built whose time-development algorithm is quantum mechanical (see also, Penrose, 1989, 1994), then the methodology of idealist science would directly come into play. Can such a quantum computer be built? And will consciousness collapse its wave functions? In view of the fact that computers currently are approaching the quantum domain quite rapidly, we may not have to wait long for the answer to such questions.

So what have we gained by bringing consciousness into the arena of science? Not only does the new theory give us the correspondence limit of conditioning, for which cognitive science holds, but also in the opposite limit of the primary experience it gives us the complete freedom of choice of the quantum self. And for a finite amount of conditioning, a more usual case, the experience is potentially an admixture of the freedom of the primary event and the bondage of the secondary events. That is, although most often we respond according to past conditioning, the freedom of choice is potentially available. Below we will consider how creativity, free will, and morality in the full idealist model are qualitatively different from what the ingenious computer programs of Dyer and other cognitivists have produced.

But the most important gain of the new science should already be clear. For the first time, it is becoming possible to treat, within science, both subjects and objects on the same footing. In idealist science, there is subjectivity from the beginning. But even more importantly, the subject of the primary event has causal efficacy (as it must have in order to resolve the problem of quantum measurement). The causal dynamics of quantum mechanics in this model are two-fold (von Neumann, 1955). First, there is the time development of the possibility structure according to quantum mathematics; the causal efficacy here pertains to the laws of quantum mechanics and is continuous and deterministic and material (upward causation). But, second, there is also a discontinuous choice of the possibility structures; the causal efficacy here belongs to consciousness (downward causation), and it is free and creative. It is this inclusion of the creativity of downward causation (in addition to the conditioned behavior of upward causation) that is the real gain of the new science (for example, the explanation of punctuated equilibrium in biological evolution; Goswami, 1994b), and it is this for which there is already much evidence (for example, directed mutation; see Goswami and Todd, 1994), and it is this that can be tested in new experiments (McCarthy and Goswami, 1993). But we have to consider tests beyond the conditioned correspondence limit.

Creativity

Dyer has made an issue of how his and others' programs can produce creative acts from computers, and the idealist science model is not needed to explain creativity. What Dyer does not mention, however, is the fact that there is a great amount of controversy over the nature and definition of creativity among creativity theorists. The so-called mechanistic theorists (Dyer is one) define creativity as continuous and algorithmic, although the algorithm may be well-hidden and novel (Boden, 1990). But there are also organismic (such as Howard Gruber; see Gruber, 1981) and idealist (such as Abraham Maslow; see Maslow, 1968) theorists who define creativity as nonalgorithmic and discontinuous.

This is not the place to go into a detailed discussion of all the different creativity theories (interested readers may consult Goswami, 1988, 1994a, in press). Suffice it to say that the behavioral psychologist Shawn Boles and I (Boles and Goswami, 1991) have proposed an inclusive taxonomy of all the different types of creative acts in order to integrate the different theories and to better treat all the data.

In the new taxonomy, we acknowledge that there are two kinds of creative acts. The first, called *situational creativity*, is mainly algorithmic and consists of inventive permutations and combinations of existing contexts to bring about something novel. This is the creativity that humans most often pursue and that computers can handle, at least in principle. But there is also *fundamental creativity* which is a discovery of something new *in a new context*. This is the creativity that we ascribe to creative people such as Einstein and Mozart, Tagore and Darwin. This kind of creativity involves the primary awareness of the quantum self-experience. It is potential in all of us but is relatively rare because it requires a major leap of discontinuity, transcendence, and freedom. This nobody can reason out and no computer can do.

In truth, computers cannot be expected to see even the new meaning that situational creativity demands. Computers process only symbols, not meaning. If we reserve some symbols to denote meaning, we will need other symbols to denote the meaning of these latter symbols, ad infinitum. This is a problem of Goedellian proportion as the computer scientist Ranan Banerji (1994) has pointed out. Penrose (1989, 1994) has made a similar point in regard to achieving mathematical understanding.

If the distinction between the two kinds of creativity is still vague, perhaps a set theoretic classification in terms of logical type will help. A set is of a higher logical type than its members and fixes the contexts for the latter. Similarly, fundamental creativity is of a higher logical type than situational creativity for which it sets the contexts. Every new discovery of fundamental creativity, whether relativity theory or Mozart's *Requiem*, sets the context of myriad new acts of situational creativity, but never the other way around.

Elsewhere (Goswami, 1994a), I have analyzed in some detail the computer program *Bacon* (Langley et al., 1987) that purports to discover a law of the seventeenth century genius, physicist Johannes Kepler. Kepler had to discover a new context for looking at the data; that is why his was an act of fundamental creativity. It is easy to see that *Bacon* succeeds only because its programmer gives *Bacon* Kepler's new context for his discovery through the selection of relevant data as determined by the context. (The creativity researcher Howard Gardner [1993] agrees with me.) Within the given context, the computer is able to use some clever algorithms to figure out Kepler's law, a good example of situational creativity.

The data on acts of fundamental creativity clearly indicate discontinuity, purposiveness, transcendence, and freedom. In the new science, discontinuity comes from quantum leaps in the brain–mind, a break from its conditioned ways. Transcendence is modeled after quantum nonlocality, quantum processing in a domain that is nonlocal — outside of space and time, as demonstrated in Aspect et al.'s (1982) experiment. Freedom comes from the downwardly causal efficacy of consciousness inherent in the new model.

Richard Feynman (1981) showed that nonlocality can never be simulated by a classical computer whose functioning is based on algorithms. Dyer refers to the controversial phenomenon of phase lock in neural networks. Are they simulations of nonlocality? Feynman would not think so, and neither do I. There is no causal meaning that can be attributed to the phase lock phenomenon.

Similarly, the discontinuity which occurs in quantum phenomena is fundamental, it signifies a jump involving the transcendent. In contrast, classical movement is always continuous. Any simulated discontinuity (such as a threshold effect) lacks causal meaning.

In the next section, I will consider an example to see the difference between causally potent meaningful phenomena and their emulated prototypes. We will consider freedom — freedom of choice and free will. In idealist science, freedom comes from consciousness, but Dyer makes the good point that it is not easy to distinguish between the emulated apparent freedom of a computer versus human freedom.

Dyer criticizes the idealist theory for not giving a knowledge/reasoning construct that can explain any kind of cognitive behavior. Well, here is a clear case of how the quantum theory explains one of the details of the process in fundamental creativity. In the famous double-slit experiment, when an electron is allowed to go through two slits in a two-slitted screen simultaneously, it becomes a superposition of two possibilities in transcendent potentia. This possibility structure enables the electron to interfere with itself and enhances the probability of its landing at many places denied to a Newtonian particle. In the creative process, an equivalent thing happens in what creativity theorists call unconscious processing (Wallas, 1926). Exposure to ambiguity produces coherent superpositions of possibilities in the mind that multiply when other ambiguities are present. The result is a proliferation of possibilities from which consciousness chooses a new event when it recognizes a new gestalt. In the ensuing collapse, an insight is born (Goswami, 1994a, 1994b, in press).

The Question of Free Will

Dyer argues that a learning machine cannot be distinguished from a human being in its acts, except that in the machine's case we *know* that computer programs and circuitry are guiding its actions whereas in the human case our knowledge of neurophysiology is still incomplete. A learning machine learns from its actions, including its rewards, mistakes, and punishments. But, says Dyer (1994, p. 282), it is free to be itself just by "thinking the thoughts one is going to think anyway." It does not resort to some abstract notion of free will. Maybe humans can also dispense with the idea of free will, argues Dyer.

Dyer also argues that a robot is determined, but can have the appearance of free will, if its circuitry is based on chaos dynamics. Chaotic systems are determined, but they are extremely sensitive to initial conditions; since these initial conditions cannot be determined very accurately, the errors multiply and make it impossible to predict the behavior of chaotic systems over long periods of time (Gleick, 1987). Thus being determined is not the same thing as being predictable. If the behavior is not predictable, it could easily be assumed to have free will. But that would be unnecessary ontological baggage.

Do we humans present an unnecessary ontological criteria in the hypothesis of freedom of choice? Bateson (1980) distinguished between two classes of learning, level I and level II (see also, Piaget, 1977). In level I learning, the learning occurs within given contexts. Recognize robot learning? But level II learning is learning to discover new contexts; it is learning of a higher logical type and requires fundamental creativity. It is this level II learning that allows humans to have real freedom — freedom to move beyond previously learned contexts.

The stubborn cognitivist may ask, Can chaos dynamics give the robot access to fundamental creativity and level II learning? It is a fact that chaotic systems stuck in a given pattern (technically called an attractor) can bifurcate to a different attractor if some system parameters are changed. Could this dynamical change of attractors not simulate fundamental creativity?

No again. Chaos-machine computers, if they are to be of any use, must operate within the contexts that the programmer gives them. Computer systems learn as trial-and-error systems using existing contexts, quite appropriate for situational creativity but not fundamental creativity (Goswami, (1994b), not for the purposeful discovery of a new context. The programmer alone, consciousness, has the purposiveness and the freedom to bring about new contexts.

Once we have learned a certain number of contexts in developing an adult repertoire of behavior, it is true that we develop a character and a persona as aspects of our ego. In this correspondence limit, we do become robot-like. This is why Dyer's comments make sense to us. But, according to idealist science, we never lose our creative ability; we retain the possibility of moving our identity beyond ego, and our personal experiences bear this out.

This journey beyond ego I have termed *inner creativity* (Goswami, 1993). By looking at the behavior of people in the journey of inner creativity, we gather hints that there exists real freedom beyond our robotic conditioning.

Have you ever wondered where the moral fortitude of Gandhi or Mother Theresa comes from? Or the love of Saint Theresa of Avila or Anandamayi Ma of India? Or the wisdom of Lao Tsu or Thomas Jefferson? These are all people of the path of inner creativity and their behavior does not come from learned reward–punishment contexts. The origin of their behavior is the real freedom of the quantum self toward which their identities have shifted. True morality, true love, and true wisdom all require real freedom.

In all idealist traditions, there is the concept of total freedom, liberation from bondage of any kind. Dyer's problem is that he (1994, p. 288) thinks (like most scientists today) that this is imagination, an ideal of "how we ought to be." But the people cited above and many others from all cultures and all times stand witness that freedom is not a mere ideal. All humans can arrive at freedom provided they travel the path of transformation, provided they do not adopt incomplete systems of thought such as cognitive science. It seems that in order to understand the subtle aspects of consciousness, such as freedom and transformation, scientists need to adopt a new epistemology that allows their own transformation as they investigate consciousness (Harman and De Quincey, 1994).

The Integration of the Sciences

But Dyer can point out that, although idealist science incorporates science within the ontology of consciousness, its methodology does not add much to spiritual traditions which are already quite rich. This is not quite true (see Goswami [1993] for many occasions where the new methodology is helpful to sort out spiritual techniques), but it is legitimate to ask whether idealist science has any new knowledge/reasoning structure to contribute to the sciences. And the answer is yes, it does.

Idealist science, partly via its distinction of mind and consciousness, consciousness and unconscious, ego and quantum self, and partly via the use of quantum measurement theory, is able to integrate all the forces of psychology — behavioral/cognitive, psychoanalytic/Jungian, and humanistic/transpersonal (Goswami, 1993). Subsequent studies have shown that an integrated approach can be taken for physics and biology as well, using the idealist methodology (Goswami, 1994b; Goswami and Todd, 1994). Let me briefly elaborate on this last item.

Dyer (1994, p. 266) states, "For a physical realist, Life itself is a consequence of how nonliving matter interacts, much in the way that a fountain is the result of how numerous water molecules interact." But this is all unfounded epiphenomenalism (to avoid confusion, let me state that I am using the word epiphenomenon in the sense of a secondary attribute without downwardly causal efficacy). The truth is, as the biologist Lynn Margulis says bluntly, biologists do not know how to define life (see Barlow, 1993). Biologists do not know how to define life because they consider their science to be an offshoot of physics and chemistry, because they ignore the causal efficacy of life, leaving them no rationale to distinguish the nonliving and the living.

With idealist science, we can make the big step of defining life. A living cell is a self-referential quantum system (like the brain–mind). Consciousness is needed to choose actuality from the quantum system's possibility structure. It is this self-referential choice that leads to the distinction of life and its environment (food, etc.). Life is the identity that consciousness assumes with a living cell (and conglomerates of cells) and as such it has causal efficacy. In this identity, consciousness limits itself; like the brain–mind in its relation to cognitive science, cellular function in its conditioned correspondence limit is then adequately described by molecular biology and neo-Darwinian evolution theory. And as in the brain–mind, the conscious freedom of life is expressed through creativity, through quantum evolution, as proposed in the theory of punctuated equilibrium (Eldredge and Gould, 1972: see Goswami, 1994b; Goswami and Todd, 1994, for further details).

The idealist paradigm of biology enables us truly to integrate biology and physics since it is recognized that they both need consciousness: physics needs consciousness to choose actual events from quantum possibilities; biology studies self-referential systems with which consciousness identifies. In the process both physics and biology become part of an extended paradigm of science — idealist science.

One fall-out of the integration of biology in the idealist paradigm is that the door is opened for a true understanding of so-called mind–body medicine — the many instances of the effect of "mind over body" in healing (Chopra, 1990). A case is building for a truly wondrous application of idealist science (for details, see Goswami, 1994b).

Can We Experimentally Discern Between Idealist and Realist Sciences?

Now to the important question: Can one experimentally discern between realist and idealist science? And the answer is a resounding and reassuring yes.

There are three possible types of experiment that can be used to test the particular idealist science that is developing.

a. tests for quantum discontinuous leaps; already, considerable evidence exists in the data for creativity (Goswami, 1988, 1994a, in press), and healing (Chopra, 1990; Dossey, 1990);

b. tests for quantum coherent superpositions at the macro level and quantum wave interference; there is some cognitive and biological data already (Marcel, 1980), and further cognitive experiments have been suggested (McCarthy and Goswami, 1993, see below);

c. tests for quantum nonlocality; parapsychological data abound and experimentation is more sophisticated and more objective, such as the recent work by Grinberg–Zylberbaum et al. (1994, see below).

I have stated before that in conditioned situations ordinary cognitive science prevails and quantum effects are suppressed, but there may be some exceptions. I analyzed some cognitive data regarding word-sense disambiguation (Marcel, 1980) in both conscious and unconscious perception that suggest that the brain–mind does process quantum coherent superpositions (Goswami, 1990, 1993). In a subsequent paper, McCarthy and Goswami (1993) have shown how word-sense disambiguation can be used to demonstrate quantum interference, as in the double-slit experiment. What Dyer needs to do is make predictions for the suggested experiments on the basis of his threshold model, which I am quite certain will be different from those of the quantum model. When the experiments are carried out, they have a very good chance of weeding out the incorrect model.

Some comments on the paranormal. Dyer has chided me for not referring to *The Skeptical Inquirer*, but this journal reflects the biases of avowed "debunkers." Admittedly, some of the parapsychology journals also publish bunk, but I have kept them out of my references as well.

If one is honestly to hold bias in abeyance, one has to admit that there is something really intriguing, something that seems nonlocal about consciousness, clearly suggested in paranormal phenomena, for example, in some of the distant viewing data (Jahn, 1982; for an extensive review see Mishlove, 1993). A recent experiment by the Mexican neurophysiologist Jacobo Grinberg–Zylberbaum and his collaborators (1994) is even more telling. In their work, the researchers used subjects "correlated" (after the fashion of quantum nonlocal correlation posited by Einstein–Podolsky–Rosen [1935] and verified by Alain Aspect [Aspect et al., 1982]) by meditating together for twenty minutes. Subsequently, a stimulus producing an evoked potential in one subject's EEG was found to provoke a similar transferred potential in the non-stimulated and now electromagnetically isolated partner's EEG. A succinct explanation is that nonlocal consciousness collapses the possibility structure of both brain–minds at a distance, producing the same primary event (see also Goswami, 1994b). And here is something else that is interesting. If nonlocal consciousness is mediating the process then no longer do the restrictions of Eberhard's theorem about information transfer in quantum nonlocal collapse hold, and real information transfer can take place, something that the parapsychologists have been telling us for some time.

Summary and Conclusions

At the recent Arizona meeting on consciousness (for a review see the July, 1994 issue of *Scientific American*), researcher David Chalmers argued that no strictly physical theory can explain consciousness or can answer the question of why there are subjective experiences. He challenged philosophy to bridge the gap. In a recent review of my research (Goswami, 1994b) and in this paper, I have argued that an idealist science that is based on the ontological primacy of consciousness and uses quantum measurement theory is able to meet the challenge of including both subjectivity and objectivity as equal copartners in our scientific worldview. Physical realism is outdated, anyway, in view of quantum mechanics, as we have known since the 1920's; the Bell–Aspect work on quantum nonlocality (Aspect et al., 1982; Bell, 1965) is just the final nail in the coffin. I have shown, convincingly to Dyer and to the readers, I hope, that cognitive science finds a better ontological foundation in idealist science as the correspondence limit of the latter.

I have shown that contrary to Dyer's belief, the developing new science has both explanatory and predictive powers; however, one has to move beyond the conditioned domains of the human experience in order to see it in cognitive phenomena. Examples are given from the phenomena of creativity, free will, unconscious perception, and the paranormal. Each of these examples is a challenge to Dyer and other cognitivists: Can cognitive science explain (rather than explain away) fundamental creativity, nonlocality, unconscious processing, and inner creativity in the human experience?

A special feature of idealist science is its integrative promise. It not only integrates science and spirit but also the different forces of psychology, and physics and biology. Idealist science is being proposed as a true scientific alternative to realist science, and I hope it will be given a fair and impartial trial. I hope fair-minded researchers such as Michael Dyer will continue this dialogue, and I am happy to have participated in it.

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