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Focus Issue

Time & Consciousness
Two Faces of One Mystery?

Guest Editor

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Advisory Board

PAUSE OF THE CLOCK

I sat down
in a space of time.
It was a backwater
of silence,
a white silence,
a formidable ring
wherein the stars
collided with the twelve floating
black numerals.

Federico Garcia Lorca

Lorca, Federico Garciá (2005). “The pause of clock” (S. Read, trans.). *The Selected Poems of Federico Garciá Lorca* (p. 33). New York: New Directions. Originally published 1955.

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Guest Editorial

Time & Experience: Twins of the Eternal Now?

Gregory M. Nixon*

Abstract

In what follows, I suggest that, against most theories of time, there really is an actual present, a *now*, but that such an eternal moment cannot be found before or after time. It may even be semantically incoherent to say that such an eternal present *exists* since "it" is changeless and formless (presumably a dynamic chaos without location or duration) yet with creative potential. Such a field of near-infinite potential energy could have had no beginning and will have no end, yet within it stirs the desire to experience that brings forth singularities, like the one that exploded into the Big Bang (experiencing itself through relative and relational spacetime). From the perspective of the eternal now of near-infinite possibilities (if such a sentence can be semantically parsed at all), there is *only* the timeless creative present, so the Big Bang did not happen some 13 billion years ago. Inasmuch as there is neither time past nor time future nor any time at all at the null point of forever, we must understand the Big Bang (and all other events) as *taking place* right here and now. In terms of the eternal now, the beginning is happening now and we just appeared (and are *always just appearing*) to witness it. The rest is all conscious construction; time and experience are so entangled, they need each other to exist.

Keywords: eternal present, simultaneity, eternal return, quantum vacuum, Akashic Field, dynamic chaos, Big Bang, time's arrow, singularity, construction, creation.

"The sun is new each day."
(Heracleitus, frag. 6, ca. 500 BCE, in Freeman, 1948)

We dare not question the reality of time, or, to be more specific, the seemingly inescapable reality of time's arrow — since our very conscious experience is built upon chronological sequence and a narrative of "think and do". *I think this then I do that.* I am the cause of such and such particular events (unless something bad happens and I want to blame someone else). All events, it appears, have discernible causes, and cause-and-effect is essentially our lives in linear time. Time *passes*. Our stories all have beginnings, middles, and endings (if they're worth listening to); that is, they incarnate time. Our self-knowledge is built upon the stories we tell ourselves, so our self-conceptions, too, incarnate time. In fact it may be that there are no selves but selves-in-time. Strange that we so fervently embrace that which will ultimately do us in, for time's linear course means we must ultimately meet the morbid *three Ds* — decline, death, and decay — as

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our time grinds to a halt. We were created, somehow, in time (so our story begins), we live our lives through time (remembering some of the accumulating past as it recedes into the distance), and we face the sudden, inevitable halt of time (and so our story ends). Time and causation seem to precede our brief existence and will continue once that existence flickers out. Is this not the way it is?

Our lived reality (i.e., our daily experience) gives no credence to the Einsteinian block universe in which time is just another mathematical dimension without past or future, or to the Nietzschean proposal of *eternal return* that suggests all time's arrows are but short flights that return to their timeless source once their course is spent. For Einstein and Nietzsche (strange pairing as they are) there is nothing new under the sun; it follows that in time's illusion or time's cycle there is no actual present in which the creative or the new may breakthrough and change the *course of time*. Is there an actual present in the path of time's arrow, in the cycle of eternal return, or in block spacetime?

Amidst our busy mental chatter — the regrets and reminiscences of the past along with the worries and hopes of the future — we may sometimes feel a disquieting sense that something is missing in this *motion picture* in which we act. We see life flying by as though watching it from the window of a speeding train, and sometimes we may pause to wonder, "How does time flow by when I am here in the present? When did the flow of time begin? Where is it leading?" And these frivolous questions may lead us to other more dangerous (because utterly *pointless*) questions, such as, "When did the present begin and when will it end? Is there a timeless present?" Timelessness is something conscious experience abhors in the same way the universe abhors a vacuum. (Have you ever tried silent meditation?) To experience is to experience time. Perhaps experience and time are quantum entangled (or just two faces of the same mystery). Without time, change, or motion, there is nothing to experience, and I'd like to suggest that without experience, perception, or consciousness, there is no time (change or motion).

Our lived experience just takes time as a given, and we believe time is the reality within which experience takes place. Could it be our particular form of internalized symbolic culture (self-consciousness) holds us prisoners — prisoners of time — so we dwell in the past while planning the future? We lay stretched across the abyss of the actual present, fearing its unknown depths, like some victim of the Inquisition. But in this case, the inquisitors are us (despite the many traditions that promise an ecstatic or heavenly end to time). In frustration at time's inexorable progress toward seeming personal oblivion, we may find ourselves crying out like Aldous Huxley (1944), "Time must have a stop!" But to speak of timelessness after time ends or before time began is a logical error, since *before* and *after* are terms that derive meaning by *being part of time*. Timelessness cannot be found before or after time, even in the case of the Big Bang. If there is eternity, it must forever be in a postulated actual present. The same applies to a human life — my life and your life — in reality, *a timeless moment* within which consciousness constructs and remembers a past, measures motion and calls it time, and watches for the future and its inevitable corollary, the end.

What we call the present has been definitively shown by physics, biology, and phenomenology to be little more than the pendulum swinging from the past into a future we expect to be as much like the past as possible. Instead of being awake and creatively attuned, we are merely caught in time, dragging our conditioning with us as we shamble into the unknown future to reduce it to the known. Heracleitus (frag. 27, in Freeman) again: "The proverb bears witness to them: 'Present yet absent'." We experience our lived reality in an instant-playback review; *we always already live in the past but confuse it with the present.*

A distinction is often made between psychological time and physical or *real* time (and some of the essays in this issue focus on it). Phenomenology, now backed by significant research in cognitive psychology, has revealed that our conscious sense of the present is an illusion or, better, a construction. Our "present" really consists of memories (the past) being projected forward to predict and thus control the present as it gives form and sequence to an unknown future. This disjuncture between our experienced present and the possibly *real* present has been noted at least as far back as Kant, who noted we are unable to go beyond our own experience and know *the things in themselves*. William James with his specious present and others have noted this delusion brought about by *timely processing necessary for human conscious experience*, that is, self-consciousness. Only rarely can we escape the context of self through which our life experience is filtered, and it must be noted that remembering and (self) consciousness may be the same thing. It may be possible to somewhat escape the self-constructed prison of time-past through creative inspiration or spontaneous action in a crisis situation, but more on this later. At this point, I'd like to note that our various psychological *now*s need not be in sync; that is to say, there may be no simultaneity among our senses of the present (and this is also true from the perspectives of biology and physics). Though we pass each other on the street, we may be experiencing two different psychological present moments because the point where memory leads into action in "the present" will vary with individuals. Still, we would not recognize ourselves or each other without this "present" contextualized by the past. Can it be said that, psychologically speaking, the present as we experience it is nothing but reenactments on the stage of memory?

How is this possible? It seems we symbol-dependent humans have a need to re-cognize things, to identify events and objects according to the schemata of memory before we can *consciously perceive* them. It takes time for this recognition to take place, and the same processes of recognition apply to bringing to consciousness our own unconscious or semi-conscious thoughts and feelings. It does not seem likely that other animals, unencumbered by formal language, would have the same need to go through symbolic recognition to function in the world, and, so, without the baggage of symbolic memory, they may be conscious — or, more precisely, experiencing — in a different, more direct manner.

Are nonhuman animals, then, living in the present, free as they are from the human necessity of symbolically re-cognizing the events and entities we encounter before we enter the field of action? It has been suggested by many that our difference from the

other animals is that they dwell in a stimulus-response present without the need or ability to call upon memories at will or to mentally rehearse various alternatives before taking action. Oh, they may experience a kind of neural Darwinism when their instinctual responses compete for primacy, but the choice finally made is said to be determined by the wisdom inherent to their species or, possibly, learned behavioural adaptations made in response to past experience — but conscious (symbolically abstract) choice is not involved. They do not need to engage the past or imagine into the future, so they remain either switched on or switched off in the present.

However, this won't do either. Basic biology added to what we have learned from physics tells us that perceiving a stimulus and determining a response (even via instinctual competition) also takes time. Even if we assume the existence of an objective, or material mind-independent reality *out there* that is at least a close parallel to the way we perceive it (which, by the way, we have no reason to do), perceiving that world would still take time. Perceptions are still limited by such things as the speed of light or sound received by the appropriate organs or the time it takes for impulses to travel along nerves, not to mention the necessary brain processing of received data before perception is achieved. Even microscopic prehension through cellular membranes takes time. What is finally perceived, even among microbes, is already from the past.

But there is more to perception than reception of data from an external world. In the visual cycle, for example: If the retina of the eye sends its "visual data" to the thalamus (that has been likened to a relay station for sensory data), which then sends this signal to the primary visual cortex for the first stages in the experiencing of visual information, why should the primary visual cortex send a nerve pathway directly back to the same area of the thalamus from which it has just received the data? The backprojection is not insignificant: Neuroscientific findings indicate in the case of vision that there are *ten times* as many nerve fibers in the "backwards" direction as in the direction in which information is supposed to flow (Rose, 1992). This indicates the possibility that *the world seen or experienced is as much a product of whole brain projecting as it is from purely outside-in receiving*. The body itself is seen here as the primary context of experience and — through the body — the world we are "thrown into" (and create) becomes the secondary context, a construction of the culturally-framed sensorium, if you will.

As indicated above, the place of time in recent physics is tenuous indeed. Not only do Einstein's STR and GTR argue against its reality, but there is no such thing as universal simultaneity either. The present is itself relational and experienced differently by different perceivers in different locations or travelling at different velocities. There is no arrow of time and there is no present in Einstein's widely accepted relativistic physics.[1] There is a host of books out recently that discuss the true nature of physical time — including a recent article in *Scientific American* called "Is Time an Illusion?" (Callender, 2010). These books and articles based in quantum physics, string theory, multiverse speculations, etc. almost universally fail to bring in variations in perspective, that is, the

[1] See Stephen Robbins, "Special Relativity and Perception", in this issue for an opposing viewpoint.

affect on time of the perceiver and the even bigger question whether time has any reality beyond its being perceived. The point has been made often enough that we can know nothing about a presumed reality that is not experienced (i.e., that is mind-independent). As I wrote in an earlier paper, "All objective researches must deal with the epistemological problem that they are themselves products of conscious experience. To objectify a mind independent reality, then to look for mind in that mind-independent reality, is a bizarre sort of logic to say the least" (Nixon, 1997, pp. 17-18).

Today, repeated experiments at the subtle level of the quantum have shown that perception (measurement, experience, consciousness, will, or *what have you*) is a necessary player in the construction of the reality we know that consists of energy-bound particles and objects, as well as events within the arrow of time. As back-up, I will only quote one of the more conservative founders of quantum theory, Max Planck (1931): "I regard consciousness as fundamental. I regard matter as derivative from consciousness. We cannot get behind consciousness. Everything that we talk about, everything that we regard as existing, postulates consciousness." Planck refers to reality, both as we know it and at the cosmic and quantum levels. Is there consciousness in the postulated timeless present? Needless to say, an eternal present whose physical existence is in question will not be detectable by the empirical methods of science (even at the quantum level), yet it is there — or, rather here (and now).

I'm no expert in quantum physics (few really are), but it's my understanding that observation, or measurement (which must itself be observed to have any meaning), is said to collapse the (pilot) wave of all possibilities, i.e., the quantum wave superposition, into a specific time and form, so momentum and position can be simultaneously measured. What exists before this collapse of the superposition (and continues to exist, unseen, after it)? I suggest it is the eternal present, which can be said to *actually exist* only as potential. The actual or eternal present is formless and timeless. Like the quantum wave superposition or the quantum field state vector, the dynamic present is a chaos of possibilities, none of which will be *realized* (literally) until experience (observation, measurement, perception, expectation, conjuration!) draws the field of near infinite possibilities into a form (space) and motion (time) that we can live with.

What is this *now* field of chaotic potential energy like? Well, it makes no more sense to ask that than to ask *where is it?* or *when is it?* Any such description defeats language, for language is a construction that depends on time, even creates time. All we can use are spatial metaphors, which are, by their very nature, misleading. This field may not exist in any usual sense since, as noted, it has none of the qualities of existence, including location, duration, or experience (which in the strict sense is always relational). It is everywhere and everywhen and, most of all, active right here and now (and right here and now is forever). I have suggested it is awareness-in-itself, that is, awareness without any sort of object of awareness and without any sort of *other* to reflect its awareness back upon itself. Irvin Laszlo (2004) has called this actual present the Akashic Field (or A-Field), but he prefers to see it as an information field that contains the memory of everything that has ever happened and thus strongly influences all that will happen.

However, he sees his A-Field as emerging from the quantum vacuum — as close to nothing as we can get in this universe. Yet it may well be that *there is no nothing*, or not exactly, since this quantum vacuum is precisely what I am calling the eternal or actual present that pre-exists any and all Big Bangs and continues to be the secret background within every moment of time. Language contorts, but how can this absolute vacuum be the creative source of all that we know as something or even as everything?

Negative conceptions provide a way to indicate potential existence by pointing to what is not. In created spacetime (and likely well "before" it), where indeed can the true void — absolute nothingness or vacuum — be found? Peat (2000) reveals that our conceptual "nothing" is not quite what it linguistically implies, explaining recently discovered dark or *vacuum energy*: "The vacuum state is the void. It is pure silence. But it is also a bubbling sea in which elementary particles are constantly dancing in and out of existence" (p. 94). Even more unsettling, the potential energy in this void is as unlimited as creativity itself: "It turns out that the energy within one cubic centimeter of the vacuum state would vastly exceed the energy content of our entire universe. … So this void, this nothingness, this cosmic silence, is pure potential" (p. 96). Could it be the ultimate "source" of the creative principle within everything is *nothing* — that is, the infinite potential energy of the void?

Beyond the limitations of science, we may turn to philosophy and literature for metaphoric conceptions of the unknowable eternal now. Nature at its core is, as physics teaches us, ceaseless dynamism, even if it takes an experiencer to give this dynamism form and process. I'm with Heracleitus that such timeless/formless dynamism is the first and fundamental principle of all that is: "The ordered universe (*kosmos*), which is the same for all, was not created by any one of the gods or of mankind, but was ever and is and shall be ever-living Fire, kindled in measure and quenched in measure" (Frag. 30, in Freeman, p. 26). This living fire was sometimes called by Heracleitus "change" and at other times "strife," but as that which brings the new, it is always creative. Even Parmenides, the contemporary of Heracleitus whose ideas are often put in opposition to his philosophy of change, may be interpreted as referring to the eternal present as Being (even though I suggest it is only potential being):

> Being has no coming-into-being and no destruction. … And it never Was, nor Will BE, because it Is now, a Whole all together, One continuous. … Nor shall I allow you to speak or think of it as springing from Not-Being; for it is neither expressible nor thinkable what What-Is-Not Is." (in Freeman, p. 43)

I think it's likely that we have an irrational intuition of an actual present that we can never quite reach. It is this intuition of dynamic stillness that may be sought by dedicated meditators, but methinks we come closest to it in moments when we are seized by the "divine frenzy" of creative inspiration or perhaps when we act before becoming conscious of our acting during intense moments of crisis. It may be that the divine fire of dynamic creativity is the very nature of the actual present, and the creative decisions we

make as individuals or as cultures or as global participants bring us close to the divine fire and determine what reality will be, at least *for the time being*.

T. S. Eliot captured both the stillness and the dynamism within it in these famous lines:

> *At the still point of the turning world. Neither flesh nor fleshless;*
> *Neither from nor towards; at the still point, there the dance is,*
> *But neither arrest nor movement. And do not call it fixity,*
> *Where past and future are gathered. Neither movement from nor towards,*
> *Neither ascent nor decline. Except for the point, the still point,*
> *There would be no dance, and there is only the dance.*
> (1944, pp. 15-16)

And who could say it better?

The only question left for this little editorial excursus is how could time, space, and experience emerge from the seeming nothingness of the everpresent quantum vacuum? I do not have the hubris to presume to know the answer, but I can suggest that, in the same way the quantum superposition is observed (or experienced) causing the "wave collapse" into classical space, time, and motion, it may be that the eternal field of the creative actual present had to be observed or experienced for its energies to focus into form, motion, and time (which, again, it is doing right this second). I'm not going to suggest some sort of deity acting as an outside observer, but I might go so far as to compare the beginnings of language and selfhood with this primal emergence.

Human language structures (or indeed nonhuman signaling) would serve no purpose if only one creature invented and employed them. Language and communicative signaling are group phenomena that can only be active when members of a group comprehend the signals. Within that group, at some point in time, at least two of its members needed to work out meanings of words and phrases in a way that could be understood by both, yet different identities had to be recognized for interlocution to take place. The same applies to self-identity. We somehow objectify our own embodied experience in the context of cultural intersubjectivity and subsequently conceive of ourselves as inner entities we each call "I" (like other selves). It seems the creative chaos of the eternal present needed to conceive a being — perhaps a form, perhaps a motion — from within itself that could then relationally reflect its own quasi-existence back upon itself.

In the case of the eternal awareness-without-experience of the absolute present giving birth to form, time, and experience — that is, the universe as we know it (perhaps new each second) — I might suggest that some sort of desire or yearning to become aware of itself arose in the dynamic eternal present. Don't ask me why or how. Systems have been demonstrated to be creatively autopoietic (e.g., Maturana & Varela, 1987), and, though the creative chaos of the quantum vacuum may not be a system, systems have been shown to emerge from chaos (cf. Prigogine & Stengers, 1984). Like in many myths of creation (see Long, 1963), the primal unity calls forth an *other* who, though forged

from its own uncertain dynamics, could perceive and relate to its source, even as the eternally present source could also become aware of itself through the perspective of its *other*. With this, One has become two. The two relate and experience in its most rudimentary form begins, and since "begins" is only possible in time, we can see that time enters reality the very moment that relational experience does — so, in a sense, they are two faces of one mystery, and that mystery is creation.

All the articles and essays in this issue delve into many of these same issues. Does time flow or is it sliced into disconnected moments? Is time real or is it a phenomenological fabrication in a timeless universe? Instead of me outlining the contents of each, I suggest you read the abstracts of the articles to choose which ones you would most like to read. The style and content of each epaper vary significantly, but I can promise that each one is worth *making time for*. I invite readers to email in their comments on anything they've read to the editor-in-chief of JCER, Huping Hu, at editor@jcer.com.

Gregory M. Nixon, Guest Editor

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Research Essay

Why Time Flies When You're Having Fun

William A. Adams*

Abstract

This paper distinguishes scientific and psychological time, and suggests how cycles of mentality define units of psychological time. This explanation explains the elasticity of psychological time and gives a broad account of the relationship between consciousness (mental activity) and time.

Key Words: time, consciousness, psychological time, la durée, Social Self, creativity, intentionality, subjectivity.

To the title question of this issue of JCER: "Time and Consciousness: Two Faces of One Mystery?" the short answer is, "No." Time is mysterious. Consciousness is mysterious. But that is not a sufficient basis to link them. However, there seems to be a deep connection between time and consciousness, even though they are clearly discriminable entities.

Why is it so difficult for a person to know what time it is? Why do we have clocks in every room of the office and the house, and just to be sure, wear a wristwatch? The computer, the cell phone, and the television constantly display the time. Radio stations report the time as a "public service." Even my coffee pot tells me the time. We have no trouble knowing where we are located in space, but for time, we need a lot of help.

This difficulty arises because psychological time, as experienced, is virtually unrelated to scientific time, the unrelenting arrow of Newton's clockwork universe that all our household clocks and calendars track. Exact, uniformly divisible scientific time is not a good fit to the continuous elasticity of psychological time, yet scientific clock time is what we use to coordinate our social lives. Scientific time is like the rigid plaster cast a doctor puts on a broken arm to constrain the movements of living tissue. We force ourselves to conform to scientific-social time, but like wearing the plaster cast, it is never going to be comfortable.

My main point in this essay is to distinguish psychological and scientific time then try to explain how psychological time arises from mentality. However, I will briefly stick my neck out to suggest that scientific time may not be a fundamental fact of the universe anyway, and can safely be ignored in considering psychological time.

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Scientific Time

The idea that the universe (at least the heavenly universe) might be a giant machine stems from the days of Kepler, who in the early 1600s, formulated exact laws of planetary motion. The heavens became autonomous, deterministic and predictable. Newton's *Principia* in 1687 and its theory of gravity congealed the idea of a clockwork universe. Although Newton never used that term, it became obvious to others that the new celestial mechanics was so well defined and exact, it was as if God had wound up a big clock at creation then stepped back to let the machine run its course. Oddly, Newton's equations are entirely reversible, making equal mathematical sense running forward or backward in time, so the metaphor of the clockwork universe does not quite work despite its grip on the philosophical imagination. However, Newton did assume, and his equations required, a master clock that made absolute time a fundamental fact of the universe. That is what allowed him to define simultaneity for events occurring anywhere in space.

Absolute time endured as a basic assumption of science until Einstein's theory of relativity proposed that time was not absolute. The rate at which a clock ticks depends on whether it or its observer is moving and how fast. That idea was used in making Einstein's prediction of the gravitational distortion of light, which was confirmed in observations of a solar eclipse. Newton's master cosmological clock was thus debunked.

The theory of general relativity does not use a universal clock. Frames of reference can be compared to each other without an absolute standard. Callender (2005) makes an analogy to money. Money is a convention that makes comparative valuation easier, but money is not a fundamental fact of nature. One could price a new car in units of hamburgers, as *The Economist* magazine sometimes demonstrates with exchange-rate theory (www.economist.com/markets/bigmac/). How many hamburgers would a dealer accept as payment for a new car? Ten thousand? Enough to feed a city for a month? The ratio of cars to hamburgers establishes the value of each, without reference to artificial money. In the same way, the units of time are social conventions that make comparisons of change easier, but that does not mean time is a fact of nature (see Sorli, 2010, for a technical version of this argument). Scientists do not agree whether time is fundamentally real or not. Time has been largely spatialized into the fourth dimension, space-time, in general relativity, but quantum theory seems to still need something like Newton's absolute time. Nevertheless, I wanted to cast some doubt on the idea, accepted by nearly everyone, except relativity theorists, that scientifically described time is a fact of nature. It may not be. It may be just a made-up convention of science.

Psychological Time

Whether scientific time is a natural fact or not, it has little to do with psychological time, which is a subjective estimate of experiential duration. Psychological time is highly elastic, depending

on the circumstances of experience. Time goes by very quickly when you are enjoying your activity. Who has not been surprised to see the clock after enjoying a party, a sports event, or watching a good TV show? It is widely known that interacting with a computer can consume hours of clock time when experientially, it might seem like only a few minutes. You can "lose track of time" altogether while reading an engrossing novel. Your mind is in a world of imagination where the time scale might be years or centuries, yet scientific clock time ticks along as before while you read. When you put the book down, the difference can be shocking.

Some experiences stretch psychological time beyond scientific clock time. Boredom makes psychological time move slowly, often excruciatingly so. A day at work is always longer than a day of recreation. I would guess that prison time is longer than time spent free. Music can slow down psychological time or increase it. Psychoactive drugs also can slow psychological time, although some increase its pace. Psychological time seems to run faster as we get older, and yet, in memory, individual episodes may seem like they went on forever. Dream time is a species of psychological time that seems to have no fixed relation to scientific time.

Time disappears altogether during dreamless sleep, anaesthesia, and certain meditative states. When you recover from such states, you may not know how long you have "been out" until you consult a clock or otherwise deduce the passage of clock time from waking context. We can all think of examples of how psychological time, as a subjective measure of the pace of lived experience, is highly elastic and not easily aligned with scientific time.

There is more to time than its pace. Scientific time also has qualities of continuity, duration, simultaneity, flow, and direction. It defines order, causality, repeatability, prediction, persistence, memory, infinity, history, and much else. Does psychological time have the same, or similar qualities and carry the same explanatory burden?

Psychological time has many of the qualities of scientific time, but they differ importantly from their scientific counterparts. For example, experiences can repeat in psychological time. We have no problem recognizing an experience we have had before. So repeatability is a quality defined by psychological as well as scientific time. Yet no experience ever repeats exactly. The memory of what happened before is not identical to what actually did happen, and in any case you, the person having the repeated experience, are different now than you were before, so the experience cannot be a replica.

This problem also occurs in science because the world is always changing. It was the basis of Heraclitus' maxim that you can't step into the same river twice. Scientists overcome variability with abstraction – often mathematical abstraction – as Newton did. However we do not have precise methods and language for abstracting (or even identifying) the essential features of experience. So, while repeatability is a roughly comparable feature of psychological and scientific time, the differences are significant.

Likewise, we can see that psychological time does have qualities of continuity, duration, simultaneity, flow, and direction, with important differences from scientific time. It is a project beyond the scope of this paper to detail all the characteristics of psychological time. This discussion is only meant to establish that there are similarities and important differences between scientific and psychological time and to propose that psychological time is generated by consciousness.

Bergson and Psychological Time

The French philosopher, Henri Bergson, was the first in the modern era to give a thorough analysis of psychological time. He was more than skeptical of scientific time; he rejected it altogether, saying it is merely a derivative of psychological time. He argued that the construct of scientific time is built from enumeration of simultaneous observations that occur in psychological time. While psychological time is elastic, the count of simultaneities is not (Bergson, 1889/2001), so he turned his attention to analysis of psychological time.

While Bergson's analysis of psychological time is rich and complex, I will focus on just three of his major points: the self-existent nature of psychological time, its inherent indivisibility, and the relationship between time and self. The first two of these I disagree with and in explaining why I hope to present better alternatives. On the third point, the relationship between time and self, I find an important point of agreement that will also, I hope, illuminate my own approach. First I will briefly describe these three points of contact.

Self-Existent Psychological Time?

Bergson called psychological time *la durée*, usually translated as duration, but since that also has scientific meaning, I prefer the unambiguous term, psychological time. For Bergson, psychological time is a fundamental, inherent quality of consciousness that provides continuity and sequence to mental events, enabling memory. And, since memory *is* consciousness for him, psychological time enabled consciousness.

Bergson's axiom of psychological time as a self-existent quality of mind goes back to Newton's absolute metaphysical clock, only now the clock was in the head. (Bergson wrote his dissertation on psychological time pre-Einstein). I will argue against the idea of a Newtonian clock in the head, but I do accept the fundamental status of psychological time. My objection is to supposing that the psychological clock is self-existent. Instead of supposing that mental activity conforms to the pace of an arbitrary psychological clock, I will propose that mental activity itself generates the clock.

Indivisibility of Psychological Time

Bergson emphasized that psychological time is indivisible. Whereas scientists can divide time into indefinitely smaller units, limited only by available measurement technology, psychological time, he said, is continuous and indivisible because moments of experience blend smoothly into each other. Perhaps Bergson was taking his cue from William James's (1890) stream of consciousness metaphor. While discrete episodes of psychological experience are discriminable, it is a mistake, Bergson said, to think of them laid out in a pre-existing homogeneous spatial medium, because experiences are not physical, not extended in space, and never wholly outside each other. Nor do experiences overlap, which is another inappropriate spatial metaphor. Instead, they interpenetrate and are thus indivisible. This explains why the past continuously flows into the present without any seams, gaps, joints or discontinuities.

I will argue instead that experience and therefore psychological time are in fact marked by sharp discontinuities. The obvious example of such a discontinuity is dreamless sleep, where psychological time does not even operate. Upon awakening one can deduce or estimate that time has passed, and how much, but during dreamless sleep itself there is not sufficient cognitive capacity to make such a judgment, so we say that no psychological time exists during that period. At the subpersonal level where psychological time begins, experience is also interrupted by discontinuities of unconceptualized experience, what Merleau-Ponty called "hollows of experience" (Merleau-Ponty, 1968, cited by Nixon, 2010, p. 37), or alternatively, periods in which there is a complete absence of all experience, what I have called "the black hole of non-experience" (Adams, 2010). As a consequence of these phenomena, psychological time is gappy rather than continuous.

Psychological Time and the Two Selves

Near the end of *Time and Free Will*, Bergson (2001) proposed that there are two different selves, which he called a fundamental self and a social self. The fundamental self is intuitively understood as one's sense of being alive, sentient, and psychologically developing. That description maps to what Damasio (1999) and Zahavi (2006) call the "core" self and what I have called the "sensorimotor self" (Adams, 2009). According to Bergson, it is the fundamental self in which indivisible psychological time flows continuously.

Bergson also identifies a social self, a conceptual, linguistic ego oriented toward the world. Numerous writers, including James (1890), Mead (1934) and others, have defined a similar social self. Bergson lamented that we live most of our socialized lives outside our fundamental self, "the Social Self hardly perceiving anything of ourselves but our own ghost—a colourless shadow..." (Bergson, 2001, cited by Gunn, 1920, Ch. VI). Since the Social Self is oriented toward the world, most of our life seems to unfold in space rather than in time, he noted.

This discrimination of two selves is critical to my discussion of how psychological time is generated by the nonintellectual, nonlinguistic, largely unconceptualized sensorimotor self (Bergson's fundamental self) and how it is then interpreted by the social, intellectual social self.

How Consciousness Generates Time

It is helpful to imagine a structural model of mental activity analogous to a storage battery (Adams, 2010). Two poles, or electrodes, are separated by a directional flux that completes a cycle. The poles of mental activity are subjectivity and objectivity. That is a dualism, but not a Cartesian dualism. This dualism says nothing about mind and matter. It is only about the internal structure of mental activity.

The Structure of Mental Activity

In any mental activity, the subjective pole initiates each cycle. In perceptual observation, for example, it is the observer that does the observing. The observed object is passive. It doesn't "do" anything. That is true even if the targeted object is a memory or a feeling. This principle is consistent with James's (1912) description of mentality, in which mental events had to pass through memory to become static, passive, mnemonic objects before they could float down the stream of consciousness and be apprehended by the introspecting ego.

The subjective pole of mentality is active because it is inherently self-relating (Adams, 2005). Subjectivity knows that it exists, and it exists is in a state of self-knowing. This intuition is what motivated the Cartesian cogito: I think, therefore (I cannot doubt that) I am. Subjectivity's knowledge is *proto-knowledge*, where *proto-* means the earliest, most primitive form of something that can be hypothesized or inferred. Proto-knowledge is not knowledge in the ordinary sense, but the condition needed for ordinary knowledge. Proto-knowledge of its own existence is what defines subjectivity's self-relatedness.

Subjectivity exercises its self-relatedness by directing intentionality toward its alterity, objectivity. Intentionality is the most basic form of attention, a proto-attention. For example, it is the minimum mental relationship between an observer and observed. Intentionality is directional (always from subject to object) and effortful, which is why we talk about "paying" attention.

Intentionality must be satisfied to complete a mental cycle. A technical term for that satisfaction is accommodation (Adams, 2005). When it occurs there is a moment of subjective self-recognition that closes the loop of the mental act by satisfying its intentionality. In ordinary terms we might think, "Yes, that is what I was looking for, " or, "I recognize this situation," or, "I created this thing." Without accommodation, intentionality remains unsatisfied and the mental act incomplete.

Accommodation differs from ordinary recognition in that it involves *self*-recognition alongside recognition of the object. It is a simultaneous recognition of two entities, not just one. Bergson (2001) hinted at a similar phenomenon: "*La durée* is the continuous progress of the past which gnaws into the future and which swells as it advances, leaving on all things its bite, or the mark of its tooth" (cited by Gunn, 1920, Ch. VI). I usually think of a patina of objectified subjectivity covering recognized objects, but I like Bergson's metaphor of subjectivity recognizing its tooth marks on things. In ordinary experience, the self-recognition of accommodation constitutes the subjective feel of the experience, or as philosophers say, "what it is like" to have that experience.

Stopping and Starting Time

At the moment of accommodation, the intentional act is satisfied, complete, essentially canceled. At that moment, the cycle of mental activity is finished. Subjectivity is no longer in relationship with objectivity, and, without that bipolar structure, there is no mental activity. If there is no mental activity, there is no experience. If there is no experience, there is no psychological time. Time stands still each time we complete a mental cycle.

We can identify that moment of stillness when it occurs just before the "aha!" phenomenon. I propose that it is also the stillness of zazen and other meditation. It is also the stillness of death. It is also the stillness of what I have described as the "black hole" of non-experience that defines nirvana, samadhi or "enlightenment" (Adams, 2010).

Moments of absolute stillness occur all day every day, each time we understand or recognize something; each time we complete a mental act. But we don't notice these moments of timeless emptiness because they are not experiences. They are the opposite of experience, the complete absence of experience. They are black holes, or discontinuities in experience. So we skip over them in our understanding of experience.

Once experience has stopped, how does it ever get started again? Subjectivity starts up the next mental cycle with a spontaneous, creative act. It projects an objectification of itself into the landscape of objectivity. That creative move is an inherent capacity of subjectivity, an eruption of the internal tension between knowing and being that constitutes its self-relatedness. That move is the foundation of all human creativity (Adams, 2005). I have called the process of creative self-objectification *psychological projection*, and elsewhere described how it works (Adams, 2005).

With subjectivity once again linked to objectivity, the bipolar structure of consciousness is restored and experience can resume with the subjective issuance of a normal intentional act targeting some aspect of objectivity. Another mental cycle then occurs, and the process of mentality continues, in tiny loops of activity, as the apparent flow of experience progresses, seemingly continuously, but actually via these discrete quanta of mentality.

This is the basis on which I disagree with Bergson's hypothesis that psychological time is indivisible. Experience is analyzable into these quanta of cyclic mental acts. In principle, where there is experience, it has duration, and when there is no experience, just after the moment of accommodation, there is no duration. Therefore, psychological time is not continuous, but lumpy, down to an ultimate granularity defined by the smallest single cycle of mental activity. However, in the ordinary experience of the Social Self, it *seems like* experience is continuous.

The Ticking of Psychological Time

Psychological time seems continuous in ordinary experience because we have been taught that it is. The Social Self is socialized. We understand experience to be a continuous stream just as we understand vision to reveal a coherent scene. But as research has shown (e.g., Noe, 2004), only very fragmentary visual information is available at the retina and visual cortex at any one moment, so our impression of seeing a smooth, full scene is entirely illusory, just a mental (or neurological) construction, not the fact we believe it is. Conversely, our perception of a scene may include large, obvious, and even bizarre elements that we do not notice because they don't fit with the scene being constructed to meet expectations (Simons & Chabris, 2010). The inexorable conclusion is that the convincing impression we have of the visual world as a continuous, coherent plenum, is merely a construction understood by the Social Self, not a fact directly perceived.

The situation is analogous with psychological time. We construct, tacitly in the Social Self, the understanding and then the intuition, of continuous experience, as Bergson described. However in my interpretation of that thesis, psychological time is discontinuous because experience is. Furthermore, since mental cycles can have different durations, the ticks of the psychological clock are variable.

The duration of a mental cycle is a judgment we social selves make retrospectively, applying the construct of scientific time to mental experience. A mental cycle itself simply takes as long as it takes. There is no aspect of duration embedded in its operation as experienced. But considered from the social self perspective, we realize that the intentionality it takes to glance up at the clock on the wall is satisfied with the flick of an eye, and the more encompassing intention to determine "what time it is" runs only a second or two longer before it too is satisfied. Going to the store to buy milk takes considerably more clock-time to satisfy the most encompassing intentionality of that plan. Intending to earn a Bachelor's degree from a university takes even more clock time to satisfy. So, while it is difficult to use scientific time to precisely measure the duration of individual mental cycles, it is clear that there are differences among them, and that the duration of a mental cycle of intentionality and accommodation is variable with respect to clock time.

Rather than force the construct of scientific time onto mental activity, it makes more sense to say that the cycles of mental activity themselves define the units of the psychological clock. That would account for the apparent elasticity of psychological time, which should be seen, not

as anomalous with respect to scientific time, but as completely consistent with the pace of experience that drives it.

Psychological time is thus manifest in proportion to what you are doing, whether behaving purposefully, perceiving, talking, or thinking. If you are not doing anything, you are not exercising intentionality, not churning through those mental cycles. If mental activity is at a low level, psychological time is drawn out, compared to scientific time, because mental activity defines the units of the psychological clock. We can see therefore that psychological time does not inexorably "pass" as does the time of Newton's cosmological clock, but is created at a rate proportional to mental activity. In intense mental activity, psychological time runs faster (as later adjudged by the Social Self). At low levels of mental activity, psychological time runs slower (compared to scientific time). At zero level of mental conscious activity (dreamless sleep, for example), psychological time is undefined.

The Mainspring of Psychological Time

The pulsing of psychological time arises, as described, from cycles of mental activity. But what drives those? Ultimately, mental activity is driven by the nature of self-relating subjectivity. Subjectivity is not a static complementarity of knowing and being, but is animated in such a way that the epistemological function strives to subsume its own existence. In other words, knowing strives to overcome its alienation from being. Sartre (1947) used analogous concepts to propose that the project of the *pour-soi* is to eliminate the *en-soi* by becoming all-encompassing (even though that is impossible). Hegel (1807/1967) said that the mission of subjectivity is to "sublate," or actually destroy, objectivity. The point is that subjectivity's self-relatedness entails a directional dynamic intended to eliminate its alterity, to overcome objectivity by somehow converting it all into subjectivity. As far as we know that is a feat not possible to achieve, but, nevertheless, that dynamic is the driver of intentionality. The energy of that dynamic is conceptualized in ordinary (social self) experience as psychological motivation. Thus at the bottom of the explanatory stack for psychological time is this motivational principle: knowing strives to consume being.

Conclusion: Time and Consciousness

Can we imagine time without consciousness (mentality)? Scientists who believe in the view from nowhere can imagine autonomous, self-existent time. Isaac Newton certainly did. Modern physicists are less sure. But my proposal is that for psychological time at least, time without mentality is unimaginable.

Conversely, can we imagine consciousness without time? Here, scientists have nothing to say, because consciousness is not scientifically observable or measurable. From introspective observation, we can describe certain experiences as virtually, or seemingly timeless, but that is only metaphorical talk. As I have described the relationship between psychological time and

mentality, time is a consequence of mental activity when experience is retrospectively conceptualized by the Social Self. If experience is not so conceptualized, it is as if it didn't happen because it remains unknown to consciousness, and from that perspective, has no duration, no time.

Finally, if experience is interrupted, psychological time is stopped, because psychological time is generated by units of mental activity. Because of these interdependencies between time and consciousness, we can conclude that the two phenomena are distinct but deeply related.

In the interest of brevity I draw this discussion to a close at this point. I have distinguished scientific and psychological time, and suggested how the cycles of mentality define the units of psychological time. This explanation accounts for the elasticity of psychological time and explains the relationship between consciousness (mental activity) and time.

What I have omitted is discussion of memory, and related phenomena that arise from it, such as one's sense of continuous self-identity over the span of psychological development. That remains a project for another time, so to speak.

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Research Essay

Liberation and its Constraints
A Philosophical Analysis of Key Issues in Psychiatry

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Abstract
There can be no question that we are living in a post-Husserlian and post-Freudian world. Their modernist dream, consistent with Enlightenment ideals, was to create a perfectible science of consciousness that would ultimately have the power to liberate people from their confused and conflicted selves. But we can't seem to get past the distortions that surround us. We are incessantly exposed to all sorts of images containing signifiers that we are unable to ignore. If in consequence we tend to internalize and become consumed by an increasingly large number of signified impressions that are uncontrollable and insatiable, then the limits of any science of consciousness become increasingly clear, and the insights made possible by hermeneutical interpretation must be included in our ongoing efforts to liberate ourselves from them.

Keywords: liberation, constraint, psychiatry, Husserlian, Freudian.

Introduction
Classical realism is based on the beliefs that the world "out there" exists and that it is separate from us. Freud and Husserl have taught us, though, that what we see is connected to what we've been taught to see. Our perceptions of reality have been affected by preconceptions that are built into the language we use. We'd like to think that once these assumptions have been acknowledged and removed, a profound clarity would be left behind. This, however, is an illusion.

This paper breaks down into two parts. The first is a comparison of Husserl's and Freud's theories on the structure of consciousness, which demonstrates that whether the mechanism of consciousness is understood as intention or desire, its access to reality is mediated by the perceptual process. The second part focuses on the implications of this insight to the ongoing struggle for personal liberation in the face of social order constraints. The formation of personal identity will be examined in terms of the ongoing interplay between consciousness and time.

Ricoeur
We begin with Ricoeur's investigation of psychoanalysis from the point of view of phenomenology. His investigation was initiated in part to provide a response to

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the many critics within the scientific community who had accused psychoanalysis of being unscientific (a charge also made against phenomenology and hermeneutics). His response was that "psychoanalysis is not a science of observation; it is an interpretation, more comparable to history than to psychology" (Ricoeur, 1970, 345).

It may be useful to note here that both Freud and Husserl initially thought of themselves as pure scientists, using methods that were intended to reveal objective truths about psychological states. During the latter part of their careers, though, they found themselves increasingly skeptical about the possibility of achieving this certainty. Husserl recognized the impossibility of completing the correlating of the passive and active modes of intentional consciousness while Freud realized that an observer can never completely overcome the interpretative aspect of perception (which may make him more of a literary figure than a scientific one). For phenomenologists this problem became known as the hermeneutic circle, the idea that all modes of judgment and interpretation are unable to completely transcend their historical context because, whenever anyone applies linguistic tools to describe a particular reality, they are limited by the historicity of these tools. This does not mean that the circle is a closed one, however, since there is always the possibility of someone finding the creative will to transcend the programming. Similarly for psychiatry, attempts to define consciousness in purely physicalist or neurobiological terms are confounded by the realization that these as well as other measurable states are never final but unavoidably and constantly affected by subjective experience.

Ricoeur (1970) explained that what turns psychoanalysis and phenomenology toward one another is the philosophic act with which phenomenology begins, namely the "phenomenological reduction." By an act of bracketing or withholding of judgment we reduce our natural attitude, which presupposes a literal reality that we normally take for granted, to the realization that our relation to the world around us is intentional, not to be separated from the meaning we attach to it. Furthermore, this meaning is neither transparent nor fixed. "Thus," he wrote, "phenomenology begins by a humiliation or wounding of the knowledge belonging to immediate consciousness" (Ricoeur, 377). Since both Freud and Husserl were students of Franz Brentano, it's useful to note Brentano's claim that every mental phenomenon is characterized by what the medieval scholastics called the intentional or mental inexistence of an object, what might be called its immanent objectivity. This means that every mental phenomenon — real or imagined — includes something in it as an object. But since this object as such can never actually be reached by perceptual consciousness, we can't know anything about it with absolute certainty. To clarify this situation Husserl divided the intentional structure of perceptual consciousness into two aspects, which he divided between the *noema*, the object itself as it is perceived through its different adumbrations over time, and the *noesis*, the various acts of perception directed at the object, and he called the process of resolving their relation to one another the *noesis/noema correlation*.

Ricoeur (1970) explained this in the following way: "One describes by disengaging the (noetic) intention and its (noematic) correlate — the *something* intended, the implicit object in ritual, myth, and belief" (28-29). While we direct our attention towards the object in different ways, in turn it gradually shows itself to us one side at a time. As we continue to engage with the object, its meaning for us gradually changes.

Ricouer (1970) later drew a connection from Husserl's phenomenology to Freud's idea of the unconscious when he wrote that "Intentionality concerns our meditation on the unconscious inasmuch as consciousness is first of all an intending of the other, and not self-presence or self-possession. Engrossed in the other, it does not at first know itself intending" (378). This means that the "lifeworld" (from which the unconscious draws its energy) appears to consciousness unreflectively, even before consciousness appears to itself. It becomes necessary to separate the actual lived relation to the object of consciousness (the noesis) from its refraction in representation (the noema). This in turn leads to the idea that a phenomenological confrontation with the Freudian exegesis of symptoms is possible, once they are understood as noematic refractions that can be traced back (at least in theory) to their noetic origins in actual lived experiences. Not surprisingly, though, both Husserl and Freud showed a marked regressive tendency with regards to their search for a constitutive genesis (see Ricoeur, 381). This is because the movement from symptom to cause in psychoanalysis is like the movement in intentionality from a single perception of a thing to the perceived thing itself, and because in both cases there is simply no clear end to the process.

What Ricoeur proposed instead was a form of hermeneutical inquiry, a meditation on symbols that starts with the fullness of language and of meaning already in place. "Is not such an explication of a meaningful contingency," he argued, "what psychoanalysis proceeds to carry out? Is it not sufficient to extend to desire and its objects this explication of layers of meaning, this investigation of an 'original founding'?" (381). Ricoeur's hermeneutic meditations on symbolic language that are the central focus of his life's work are an engagement with those limit situations (like death, suffering, and evil) that are ultimately not reducible to transparent or logically consistent explanations.

Derrida

We discover an even more radical engagement with the work of Husserl and Freud in the work of Derrida, who uncovered what he called a "logocentric" bias at the heart of Western metaphysics. From this perspective, all notions of meaning are forced to conform to a rationalist logic based on principles of identity and non-contradiction. This is a system in which it is assumed that language provides a transparent window on reality, or that a sign adequately represents its signified meaning. He also associated this system of assumptions with speech. In its place he introduced a strategy of disruptive readings of canonical texts which he called "deconstruction." This involves both the process of tracking the

unraveling of meaning that is going on in the world at large, and the process of discovering how each and every speech act contains the seeds of its own negation, owing to the impossibility of any meaning staying true to itself. Derrida believed that Western metaphysics mistakenly privileged speech over writing and clarity over ambiguity.

Derrida's deconstruction of Husserl's fundamental concept of the transcendental ego can be seen in this light. While Husserl's dream for phenomenology was to reach the things themselves, Derrida demonstrated how impossible this goal actually was by examining Husserl's analysis of the experience of an interior voice that hears and understands while one speaks. Derrida pointed out that this experience was the source of the metaphysical illusion of the idea of personal identity. We might think that this pure identity of the self is real – and reachable -- but the temporality of consciousness indicates that such an idea has its basis in a series of differences between past and future traces of things no longer or not yet present. "Self-identity is thus undermined by alterity," he explained (as cited in Kearney, 128).

Derrida took this prioritization of difference over identity even further, not only with his preference for writing over speech but also when he elaborated on his equating of metaphysics with worn-out metaphors. With his exploration into how concepts arise after metaphors fade away we can see his deconstruction as a process of unmasking concepts in order to lay bare the hidden play of meanings that lies beneath the surface of a text. The metaphysical activity of transporting meaning or carrying it beyond its original place (inherent in the Greek etymology of the term metaphor as meta-phorein) is evident in the movement between the various polarities that can be found within the interpretative process that itself masquerades as "objective" conceptualization. While the traditional quest for meaning will try to keep the poles separate, Derrida's strategy was to point out their contamination of each other, to open up a text in order to show up the ambiguities that persist at its limits (see Kearney, 131).

Derrida's (1978) analysis of Freud's notes on the child's toy known as the "mystic writing pad" or "Wunderblock" exemplifies his critical approach to metaphorical reasoning. Freud intended that the structure of the psychical apparatus could be represented by a writing machine. Derrida framed the discussion in terms of Freud's attempt to bring together two separate psychic systems: memory and perception. Derrida associated memory with writing and dreaming, and he associated perception with speech and with immediate consciousness of the present moment. Earlier in his career (from his Project text of 1895) Freud had attempted to explain memory in the manner of the natural sciences, as "quantitatively determined states of specifiable material particles" represented by the "differences in the facilitations of the psyche-neurons," according to Derrida (1978, 200-201), but by 1925 (when he wrote these notes) he was thinking about memory in terms of writing and dreaming. In both cases though Freud knew he

needed to retain two main features for memory, the permanence of the memory-trace and the infinite renewability of the receiving substance.

With his discovery of the mystic writing pad Freud believed that he had found the perfect analogy to describe these necessary features of the memory system and explain their relationship to one another. The writing pad consists of three layers: a transparent sheet of celluloid, a much thinner grey translucent sheet of waxed paper, and a slab of dark brown wax attached to a paper foundation. One writes with a wooden or plastic stylus upon the first layer but the imprint is actuated only on the next layer. This material in turn leaves a faint but perceptible trace on the waxen surface below, a trace that can be seen if one were to lift up the sheet of plastic and examine the wax surface. This whole process was Freud's attempt to provide an analogy for the way the psychic system receives sense impressions from the outside world and remains unmarked by these impressions even as they pass through it to the unconscious. Freud was also trying to show that "the appearance and disappearance of the writing" is similar to "the flickering-up and passing-away of consciousness in the process of perception" (Freud, 1961, 230).

The pad, for Freud, was exactly analogous to the perceptual apparatus of the memory system. Most importantly, he insisted on the protective nature of the celluloid sheet which protects the waxed paper below just as the mind possesses an external layer to protect itself by "diminishing the strength of the excitations coming in" (Freud, 230). Secondly, when we lift the entire covering sheets off the wax slab, the writing vanishes, and this for Freud was precisely how the perceptual system operates — because the layer which receives the stimuli forms no permanent traces. Finally the wax slab itself represents the unconscious, including, as Derrida (1978) emphasized, its temporal nature, since Freud pointed out the impossibility of reducing the multiplicity of sensitive layers of the pad to a single act at a given moment. In other words, it takes time for the memory to erase its past traces in order to preserve the illusion of the "virginity" of the present moment. "Writing," explained Derrida, "is unthinkable without repression" (226). Freud thus insisted that at least two hands are needed to work the entire apparatus, one hand writing on the surface of the pad, and the other periodically raising the covering sheet from the wax slab (Freud XIX, 232), demonstrating how the functioning of memory was neither automatic nor undistorted.

None of us, said Derrida with regards to Freud's example, apprehends the world directly, but only retrospectively, since our sense of that which is beyond ourselves is the product of previous memories, previous writings. "Writing," he added, "supplements perception before perception even appears to itself" (224). Freud's analogy of the mystic writing pad, then, was for Derrida a model of the primacy of writing over the immediacy and presencing of speech. This was noteworthy because for him we can never experience the world in any other way than as after the fact, through the traces of previous experiences and through the signifiers that are in effect the condition of our being. "The subject of writing, he

wrote, "is a *system* of relations between strata: the Mystic Pad, the psyche, society, the world" (227).

Derrida turned to Freud's analogy to make the point that although we might act as if each of our memories is a direct recollection of experience, in fact each is polluted by the traces of previous experiences that are either well entrenched in the unconscious or persist in the preconscious as residuals of cultural programming. While for Freud there is always the possibility of constructing a new personality once the old causes of neurosis are exposed to analysis, for Derrida these traces can never disappear completely. For him, it's simply not possible to determine completely and with final authority who is thinking, writing, or speaking; the psyche might produce a stream of various identities but they are neither consciously nor intentionally produced.

Foucault

When we turn to Foucault we find in his work a sustained investigation into the dominating discourses of a variety of human sciences, including psycho-pathology, medicine, criminology, and sexuality. With his "archaeologies" of knowledge, Foucault initiated a "science of science" — an exploration into the theoretical conditions for the possibility of science — in which he attempted to reveal what he called the "positive unconscious" of knowledge (see Kearney 284). Behind the apparent rational discourses of linguistics, biology, and economics, he developed the idea that "man" itself was the product of a specific epistemic epic, namely modernism. Far from being the creator of scientific codes of discourse, "man" was revealed as a category created by these codes. And there was nothing behind these codes but more codes. If modern science once served to objectively legitimate the idea of an autonomous individual consciousness (replacing God and nature with Kant's transcendental ego), Foucault's postmodern science dismantled this construction, exposing the unconscious structural laws that ultimately predetermine what we had previously deemed to be the free activities of the human consciousness.

For Foucault knowledge was neither innocent nor neutral. Behind the assumption of disinterested scientists, Foucault identified some of the various ways whereby repressive institutions monopolize the truth. These institutions define what is normal, and the kinds of behavior that transgress these limits they categorize as being "deviant." Asylums define various sorts of insanity, clinics differentiate between the sick, prisons classify different sorts of criminals, while legal institutions have the final say concerning whose sexual behavior is deviant or perverted and whose isn't. Foucault ultimately characterized these covert epistemological codes as a hidden history of power, serving the need for social control through discipline (see Kearney, 291).

Foucault recognized his central concern as a search for "a new economy of power relations" (Dreyfus, 1982, 210). He saw his central task as the analysis of specific rationalities of power. His method was to investigate the antagonisms of

strategies that he saw operating in the fields of madness, illness, crime, and sexuality. He later added death to this list. Thus to find out what our society means by sanity he thought we should investigate what is happening in the field of insanity, etc. More generally, in order to understand what power relations are all about, we should investigate the forms of resistance, such as for example in recent years the opposition to the power of men over women, of parents over children, of psychiatry over the mentally ill, and of medicine over the population. Not only are these struggles anti-authoritarian, they are also not so much struggles against a particular group as they are struggles against a series of techniques that belong to that form of power that categorizes individuals as "subjects" — in Foucault's sense of the term, that is. Foucault identified two senses of this term "subject": subject to someone else's control, and tied to one's own identity by conscience or by self-knowledge — and both meanings suggested for him a form of power that subjugates the individual. Foucault further identified three types of struggle: against ethnic, social, and religious domination; against exploitation; and against that which ties the individual to him or herself and submits him or her to others in this way

It should be noted that Foucault too found the idea of confronting Freud with Husserl to be of interest. In his introduction to Binswanger's *Dream and Existence* (Foucault & Binswanger, 1994) he noted the contemporaneousness of Husserl's *Logical Investigations* (1899) with Freud's *Interpretation of Dreams* (1900). He discovered how psychoanalysis had taken the dream symbol as immediately valid, confounding the achievement of meaning with the induction of indices – while not taking into consideration the distinction between them. Even if indices like tone of voice, volume of words, use of silence, even verbal slips can guide us when the words themselves elude us, they are not the same as words, since by itself an index has no signification (Foucault, 1993). Husserl in contrast was able to separate the strict meaning of what a person says from the way the person expresses it. Foucault believed that while "Freudian analysis could see only an artificial connection between meaning and expression in the hallucinatory nature of the satisfaction of desire, phenomenology … enables one to recapture meaning in the context of the expressive act which founds it" (Foucault, 1993). But then Foucault went on to say that "Phenomenology has succeeded in making images speak; but it has given no one the possibility of understanding their language" (42). This is not only a criticism of phenomenological psychology; it is a recognition that fundamental difficulties in meaning apprehension lie at the limits of language.

Deleuze and Guattari

We conclude with the postmodern anti-psychiatry of Deleuze and Guattari. They identified their philosophy of schizoanalysis as a strategy of disruption to be directed against the stability and productive forces of modern capitalism, a point of view at odds with the modernist belief that schizophrenia is a correctible form of mental illness. Deleuze and Guattari discovered in what they called their "nomad thought" a kind of work space within which the possibilities of living and

thinking outside the common lines of power can be worked out once these lines of power are disrupted. In the first volume of their work *Capitalism and Schizophrenia*, entitled "Anti-Oedipus," (1972), they attempted to explode that part of Freudian dogma that they said reduces to the unity of the "Oedipus Complex" the multiplicity of social relations that constitute an individual. What is left is a "body without organs," a term they appropriated from the surrealist writer Artaud in order to signify the residual effect of a schizoidal process whereby the individual person has been replaced by a system that creates what they called "desiring machines" that exist to consume its products. Difference without identity is a goal of nomad thought, since "molar" identities are controllable, while "molecular" desiring machines are not. Desiring machines though can't escape the double-bind experience, an idea that captures the self-defeating character of the politics of desire. For an example, imagine parents who say to their child, "always tell us the truth," and then the child tells them about something bad he or she did and gets punished for it. The child would perceive this as a no-win or double-bind situation, unless the meta-message of the parents was understood: "don't get into trouble in the first place."

Even if the body without organs, disconnected from the system, is able to record on the surface of its own hyped-up awareness the ordinarily hidden activities of capitalist production, this doesn't mean that it has any answers to its dilemma. Critically aware of their own revolutionary status and of the need for many of their readers to discover a new system of ready-mades for their entertainment, Deleuze and Guattari knew that the force of their thought could have little end in sight other than to promote an awareness of the kinds of power existing in our societies and in our minds. Their strategy was not to look for new answers — which would necessarily be employed to develop new systems of power — but to exemplify ways of thinking and of living that are constantly vigilant against the abuses of power.

Conclusion

In conclusion, we can recognize how all these theorists conceive of the real world as something of a single piece that is imposed on the individual by the social order, which, when it goes to work on the self, creates constraints, repressions, and renunciations – sources of neurosis, perhaps, but also the stuff from which a new personality might be made.

But if there is a residual self left over from the conditioning imposed by the social forces that control our very thoughts and desires, how can we find the words to talk about it since the words we use belong to the same system that defines us? Perhaps we need to look for a part of language that is non-rational and non-categorical, neither asocial nor a negation of order. Following the anti-psychiatry movement we might find this language in the speech of schizophrenics. Or, breaking with the scientific habit of using words as instruments, we might turn to Roland Barthes's declaration that words may be seen as dynamic literary texts, with the capacity to explode, vibrate, or transform intended meanings.

Foucault once claimed his purpose was "to reveal a positivist unconsciousness of knowledge: a level that eludes the consciousness of the scientist yet is part of scientific discourse, instead of disputing its validity and seeking to diminish its scientific nature" (Foucault, 1970, xi). From this point of view, we are in danger of becoming little more than potential consumers of new and better versions of ourselves. We don't produce science so much as it produces us.

In consequence, could there be something about the "medical gaze" that is inextricably tied up with a determinist framework? There is a current trend to identify varying yet still legitimate forms of behavior as being medically treatable. Recognizing whether a given situation is a medical problem in the first place has become an important issue. The borderline behaviors that have come under the purview of psychiatry and pharmacology in recent years include grief, madness, depression, gambling, stuttering, and homosexuality.

Is this tendency to create problems merely an example of market forces at work? Or does this phenomenon reflect a natural tendency for other forces in society to assume their own avenues for the assumption of power? Most recently the media have introduced the very complex issue regarding the involvement of psychologists as military advisors on the interrogation of prisoners at Guantánamo Bay and at other unnamed locations. Which forces do these psychologists represent?

There can be no question that we are living in a post-Husserlian and post-Freudian world. Their modernist dream, consistent with Enlightenment ideals, was to create a perfectible science of consciousness that would ultimately have the power to liberate people from their confused and conflicted selves. But we can't seem to get past the distortions that surround us. We are incessantly exposed to all sorts of images containing signifiers that we are unable to ignore. If in consequence we tend to internalize and become consumed by an increasingly large number of signified impressions that are uncontrollable and insatiable, then the limits of any science of consciousness become increasingly clear, and the insights made possible by hermeneutical interpretation must be included in our ongoing efforts to liberate ourselves from them.

If disillusionment and disenchantment permeate recent Continental philosophy, strategies for enabling the processes of liberation and freedom that are resistant to these strains are also present. They are directed at the various societal forces which if not checked will increase the sickness which already permeates our language, values, desires, and economics. These philosophers are no longer content to describe the world; they are providing us with the tools to change it. If we are ever to resolve the dangerous and manipulative double-bind scenarios created by the social and cultural environments in which we live, we will need to learn to think about our world with or without their help in radically different ways.

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Research Essay

Now

Gordon Globus*

Abstract

The Now is not of time but of Being, dis-closure. Time is continually stretched (Heidegger's temporal ekstases) whereas Now is a match "between-two." The now is unfolded anew in the dual mode match of each segmented Moment. There is no universal creative Now, as Nixon (2010) suggests, but unique fragmented Nows, monadological Nows, discreet dis-closures of Being within scattered monads of sufficient complexity.

Keywords: Now, time, being, moment, consciousness.

Introduction

"Now," "Time," "Consciousness," "Being" … these crucial terms are replete with philosophical confusions. Assimilating "Now" into "Time" is the greatest detriment, for Now is properly *presence*, Being, the palpable fullness of being-here-now. The Now is *disclosure*—Heidegger's (1962) dis-closure, or, positively phrased, a lighting-up of a clearing (*die Lichtung*). The Now is actually segmented presencings. Hiley (2001) calls the segments "Moments" while Freeman and Vitiello (2006) liken them to a roll of individual "frames" in a movie film, which when run fast enough lose any hint of segmentation. Stapp (2009) attributes the seeming continuity of what is an actually segmented Now to a "quantum Zeno effect" in which rapidly repeated measurements sustain continuity of the quantum preparation measured. The Now is "where" we always already find ourselves, amidst phenomena of some kind or other, whether percepts, feelings or thoughts. The Now, as disclosure, is the key to understanding Consciousness and Time. The idea will be developed below that the Now is actually not of time but a Moment "between-two," between dual quantum thermofield modes of a dissipative system.

Heidegger developed the fruitful idea that time is not a container, as in Einstein's block space-time universe, but is dynamical, stretched anew at every moment. That is, Now is spontaneously created at every Moment (bringing together Heidegger and Hiley). The past moment, the past day, the past year, the past century – the past is differently stretched at different moments, and the same for the segmented stretching of future too. Heideggerian time is a fluctuating horizon whose time metric is continually dimensionalized. The stretching of the time dimension, along

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with other types of stretching (e.g., space), leads to a dynamical situatedness that is Dasein's own doing. Dasein's intentional actions stretch and thereby situate. Time is Dasein's creation. For the present discussion the Now is the state of thrownness, an eruptive being amidst a world of pragmatic presencings or mental contents. A life is disclosed in the Now for each of us.

Heidegger's conception of *now* fails to make a crucial distinction, however, which ends up confusing. Heidegger considered the Now stretched too (now as you read this, now in the 21st century), just as past and future are stretched. But when Now extends past the Moment, presence is lost. In the context of "now this year" the distinction is lost between that part of the now-this-year that presences ("right now") and the previous part of the year and the part of the year yet to come which do not presence. In the strict sense the Now cannot be stretched.

Consciousness and the Now

Consciousness is to my mind the greatest bone in the throat of contemporary philosophical thought, and scientific thought too. Despite a monumental amount of discussion, there is absolutely no agreement on what the term actually means (Nunn 2009). Some are even moved to cry with respect to Consciousness: *Ignoramus et Ignoramibus* (e.g., McGinn 1991). We are ignorant regarding Consciousness and shall remain so. Etymologically con-sciousness is to "know-together," a cognition that is social. There is nothing perceptual in the original meaning of Consciousness; the infiltration of the perceptual into Consciousness is a poisoning by metaphysics (which lives in language, philosophy and science to this day).

In Hiley's (2001) view, *time becomes nonlocal* in the Moment, so there is no particular momentous now. The movement of explication in which Being unfolds is outside of Time, holds Time not in abeyance but nihilates Time. There is no *ontological* before and after within the Moment; Moments are sequences of creatings. Heidegger calls the attunement of such creatings "pro-jects" (*Entwerfen*). In the Moment there is explication of Presence, Being as such.

Without memory there would be no past as such. Indeed, intention toward memory dimensionalizes time: now, past and future. This intention is a self-tuning. Without memory there would be no future. Expectation is a function of self-tuned trace. Intentional self-tuning towards traces stretches future too. Shortly the dis-closure of a Now which is not of Time will be considered.

To summarize, we have put Consciousness aside, as having to do with cognition. Time as past and future is stretched by self-tuning pro-jective intentional acts and is dependent on trace. Now is orthogonal to Time. Now is disclosure, dis-closure, lighting-up, revelation (re-velation, which reverses veiling). To think Now within Time is to continue metaphysics, which is what the present discussion urges against.

Between-two

It is widely accepted that, as Neisser (1976) succinctly put it, "Perception is where cognition and reality meet." Cutting-edge thinkings in cognitive and brain science today gussy-up Neisser's dictum in the guise of Baysean theory. A leading proponent of the Baysean view is Friston (2010), who has developed a highly regarded "least energy" brain dynamics. This "energy," which is mathematically formulated in elegant fashion, is interpreted as "surprise." *Self-organizing brain states spontaneously evolve so as to minimize surprise*, according to Friston, where zero surprise is the perfected matching of cognitive expectation and sensory input. The organism responds to surprise in two ways: by changing its behavior in search of less surprising input and by tuning its expectations to better match the input actually available. The match in effect amounts to hypothesis confirmation. (This conception is the dynamical successor to Helmholtz's 19th century idea of "unconscious inference.")

Least energy brain dynamics is a thoroughly cognitive theory. Expectations are confirmed by the match. Perception is a matter of hypothesis confirmation, which makes perception cognitive rather than disclosive. The Now for the least energy proposal is a succession of hypothesis confirmations in the stream of time. The relation of the cognitive now of least energy theory to time is along the lines of traditional representation theory where the brain builds a temporal succession of models of the world from sensory input, memory and intention. Whether hypothesis confirmation or representation, the Now remains within time in traditional fashion.

The theory of the between-two (Globus 2009) has the Now orthogonal to past and future time. Here there are two quantum modes, one relating to sensory and self-tuning inputs and the other to traces of sensory and self-tuning inputs. The match between these two modes (which takes place in the quantum ground or "vacuum" state) is no longer like the match of a lock and a key but like the match of complex conjugates, a+bi matching to a-bi, with the result real. *Dual imaginary modes disclose phenomena in the ground state between-two in virtue of their match.* Presence/Being is created/explicated/unfolded in the belonging-together of dual modes—which is fundamentally different from both hypothesis confirmation and construction of re-presentations. *Now is between-two in the match of complementary complex conjugates.* Sensory and self-tuning inputs together with traces are participants. To revise Neisser's dictum, perception (world-thrownness) is where cognition and reality are complementary, hence dis-closive.

The view developed here is rather Bohmian in spirit (Bohm 1980). The fundamental dynamic or "holomovement" is pre-space and pre-time. Space-time Now is repetitively explicated each Moment, unfolded from the holomovement simultaneously with a reenfoldment of the previous Moment back into the plenum that is the holomovement. Of course, as Pylkkänen (2007) discusses, consciousness figures prominently in Bohmian theory. Bohm's philosophy was Spinozan, consistent with Whitehead, and also influenced by J. Krishnamurti; there was no existential turn. However Bohm and Whitehead have been recently assimilated to Heidegger

(Globus 2009). Along such lines the existential state of world-thrownness is continually unfolded such that the Now is the match of the between-two.

The fragmented *nows* of monads

Nixon (this issue) conceives time as moving through a recurrent and reiterating now. There is a universal conscious now which hosts the passage of time. It is an uncreated creative source of past and future on Nixon's view (with its Aristotelian overtones). The present claim in contrast is that the Now is also created in the same Moment as past and future, rather than being their metaphysical receptacle. The Now is furthermore fragmented into monadic Nows in parallel (here somewhat reminiscent of Leibniz). These fragmented Nows in parallel are disclosures between-two. No metaphysical subject is permitted to stand outside all of them. The Now consists in Moments of becoming.

Leibniz was not to be trapped in the notion that God is responsible for good and evil. After all, God operates an optimization principle that would result in the greatest good for the greatest number, but God is not responsible for individual monadic actions that meet his emanations. There is choice within monads, or, in the present context, self-tuning that constrains the between-two. Self-tuning can bring selfish evil against the Leibnitzean God's loving intention to optimize the Good. Each monad is responsible for its Now, which lets God off the hook.

An hierarchical fragmentation of the Now operates also. There is a halt in the descent into the Now beloved of panpsychists, who find the Now in every particle. To the contrary, Now does not go all the way down into fundamental matter (Globus 2009a). A large quantity of quanta, on the order of Avogadro's number, must be available before cooperative quantum dynamics (coherence) might take place. A gas does not have cooperative dynamics in its between-two. A crystal does—but its between-two is static. It is the dissipative brain's achievement to sustain a between-two whose fluctuating dual mode matchings are disclosive of particular Nows. So the disclosive Now is scattered among rich enough Monads; the rest of them are stuck each in its same Now or having no Now at all.

Conclusion

The Now is freshly conceived in the context of dissipative quantum thermofield brain dynamics. The Now to our surprise does not sort with time but with Being, dis-closure. Thinking Now with time is a continuation of the metaphysics that postmodernism attempts to overthrow. Now is not a unity (not even a relativized unity), but is deeply broken, indeed multiplexly monadological, disclosive, existential Moments in parallel. Now thus understood no longer grounds quotidian life in a reassuring unity right now but is terrifying in the fragmentation of each to their own Now.

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Research Essay

'Landscapes' of Mentality, Consciousness and Time

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Abstract

This paper describes 'mentality' in terms of the contents of dynamic state spaces, then goes on to explore how consciousness-associated features of these contents, termed 'ruling attractors', could 'map' onto neural states. A fractal mapping, its links with memory mediated by the protein CaMKII, is pictured; it's a view that, with minor differences of emphasis, turns out to have a lot in common with Stuart Hameroff's 'conscious pilot' as far as the neural (though not quantum computational) picture is concerned. Finally, it is proposed that consciousness itself may be a local field, supervenient on fractally mapped 'ruling attractors'and due to time-related symmetry breaking. Lines of evidence that may prove relevant to these ideas are indicated. I thus argue that consciousness can be ***described as*** *a succession of 'ruling attractors' in the brain; it is* ***based on*** *fractal patterns of calcium waves, interacting with EEG fields and recorded by changes in protein (CaMKII) activation, while it may turn out to* ***be*** *a modulated 'temporal field'.*

Key Words: landscape, mentality, consciousness, time, neural state, ruling attractor, fractal pattern, EEG, temporal field, symmetry.

Introduction

This account offers an outline sketch of what is essentially a rather traditional picture of consciousness. I'll try to be as concise as possible, albeit at the expense of omitting much fascinating detail. Like many others, I see consciousness as analogous to the beam of a searchlight, illuminating features of a vast landscape. Although I shall stick with the word 'landscape' in some of what follows, it's actually a bit misleading since it refers to something more like clouds in a storm, billowing, heaving and constantly changing shape. The 'landscape' of mentality is not only in constant, dynamic turmoil, but is also far more extensive than those parts of it that are 'lit up' by consciousness if only because it encompasses unconscious, as well as conscious, brain activity. Indeed I shall follow the currently popular 'extended mind' approach and envisage 'mentality' as extending beyond the brain into aspects of its physical and social environments.

Given this overall picture, the paper falls naturally into three main sections:

- A description of the 'landscapes' of mentality.
- An account of how the 'landscapes' may map onto neural activity.

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- A speculation about the nature and origins of the 'searchlight beam' of consciousness.

Mental 'landscapes'

'Mentality' and 'mind' are words that appear to refer to things; objects out there that you could maybe pick up and weigh if you wished. But of course they're not things, they are processes. The closest thing-like analogies for them would be candle flames or the braided patterns you can see in falling water. Try to pick up either of those and they are liable to vanish or change form. Mentality is thus all about dynamics, and the first question to ask is: 'the dynamics of what?'

The answer most people would offer nowadays is of course 'neural activity' at all levels from individual synapses and cells, through small local networks and larger 'modules' and circuits, up to the brain as a whole. The bulk of this activity can be regarded as self-organizing and 'emergent'. Its larger-scale features can probably be considered to bear much the same relationship to local networks as do local networks to individual cells, for relevant aspects of brains (and minds) are often organized fractally or quasi-fractally, both spatially and temporally (e.g., MacCormac & Stamenov, 1996). But neural activity is far from autonomous. Longer lasting features often depend upon gene activations leading to protein synthesis, etc., so genetic dynamics are also relevant, while inputs originating from the dynamics of the physical and social environments constantly mould neural behaviour. And it's not only information that is received via these inputs. Mirror neuron systems of unknown extent serve to add personal *meanings* to information from the social environment[1]. In brief 'mentality' relates to hugely complex dynamics, ranging from genes to societies with brains sandwiched in the middle.

A standard way of describing any dynamic is in terms of Poincare dynamic state spaces. In these, a single point represents the dynamics of a *whole* system at any given moment, while a line trajectory through the space describes the evolution of the system over time. The practical problem with this approach is that the appropriate space requires six dimensions for *each* separately identifiable entity contributing to the dynamics of the system described by the space. A complete state space description of the dynamics of mentality would thus necessitate envisaging a space with astronomical numbers of dimensions – dimensions, moreover, that could never be precisely identified or specified in practice. This conceptual monstrosity is often felt to be distinctly unhelpful when it comes to picturing mind – as a cure for the complexities involved, it can seem worse than the disease! Nevertheless the approach does have two advantages that, in my view, make it uniquely valuable. These are:

[1] I use 'information' to refer to Shannon information (i.e. a 'bit' being the answer to a single yes-or-no question when the prior probability of either answer is 0.5, and regardless of the meaning of the answer), or to Bateson information (i.e. 'a difference that makes a difference'), which is a more useful concept in some contexts but is also meaning-free. Conflating meaning with information, as often happens, can be a source of confusion.
[2] Velmans himself (personal communication, 2009) sees no conflict between the type of 'monism' that he describes and the one offered here.

(a) The state space description of any brain/environment dynamic will constantly be fluctuating in dimensionality as different aspects of environmental dynamics come into play. Nevertheless it remains a *single* state space at any given time. This means that it offers a useful way of picturing the basis of the 'monism' in Velmans' (2009) 'reflexive monism', albeit a picture dependent on rather different concepts from the ones that he himself uses[2]. As Velmans has written so extensively about his ideas, since first describing them in 1990, I won't say more about his theory here other than to record my belief that it offers the best available description of, and approach to understanding, perceptual experience. In addition, the 'state space' picture allows a natural extension of Velmans' views on perceptual experience to encompass an understanding of group mentality also.

(b) The state spaces will harbour attractors (periodic, quasi-periodic and strange)[3], which can be pictured as forming 'landscapes' in the spaces. Attractors and their landscapes have all sorts of interesting general properties, which are independent of the precise dimensionality of the spaces in which they 'exist'.

The 'interesting general properties' of attractors and their associated landscapes referred to above would require several hundred pages for a proper description, so I'm simply going to list those that I think most relevant and make assertions about them. But it's first worth noting that their conceptual usefulness in developmental biology was discussed 50 years ago by Conrad Waddington (he called them 'epigenetic landscapes') and more recently by many others, for example Stuart Kauffman (1995). Moreover many individual attractors, especially those in the brain, are equivalent to memories, as Walter Freeman (1999), for instance, stressed in connection with rabbits' experience of smells – so they often link directly into psychology and our experience in general.

- Attractors share many of the characteristics of non-universal 'natural laws' such as laws of hydraulics (Nunn, 2005, 2007). Strange attractors in particular appear to have more in common with Aristotle's 'formal causes' than with his 'efficient causes'. Whether this appearance is misleading or not involves unresolved questions to do with the status of 'emergence' and its possible associations with true novelty (e.g., Clayton & Davies, 2006).

- Attractor landscapes in general are prone to 'rut formation', i.e., stereotyped usage tends to reduce the complexity of the landscape and/or 'strengthens' some attractors at the expense of others. This circumstance can be used to account for a wide range of phenomena, from our need for sleep to the tendency of bureaucracies to rigidify as time passes.

[3] Point attractors, the simplest type, can't occur in open dynamic systems like those involving brains.

- The multidimensionality of attractor landscapes entails 'small world' properties that can be envisaged as the existence of invisible tunnels joining 'seemingly' unconnected landscape features (see Wagner, 2005, for an account of how this works in relation to RNA configuration spaces). In conjunction with the 'mapping' of attractors onto neural states (see following section) this may provide a basis for understanding some of the 'flexibility' of mentality in general and memory in particular.

- Attractor landscapes within the brain will be in a constant state of flux as inputs vary and internal dynamics dictate. At any given time, however, overall brain activity is likely to be dominated by one or a relatively small number of 'ruling attractors'. Some of the information associated with the activity of any given ruling attractor will be widely distributed throughout the brain. The succession of 'ruling attractors' can thus be envisaged as equivalent to the content of Baars' 'global workspace', or indeed to Dennett's notion of 'fame in the brain'.

The equivalence of a succession of ruling attractors to Baars' and Dennett's notions of what constitutes the stream of consciousness strongly suggests that this succession provides the 'landscape feature' that gets 'lit up' by consciousness. My next step, therefore, is to look at how these ruling attractors could map to the neurology of the brain. This is of course the reverse of the more familiar procedure, which involves looking at the neurological circuits, the coherent neuron activities or whatever, and then thinking about how they could relate to mentality. I've got a model of mentality and want to see how it could be instantiated in neurology. If I can succeed in this, I will have described a candidate NCC.

But first there is an essential fact about consciousness that I need to emphasize, or at least the fact concerns the only sort of consciousness that we can meaningfully discuss[4], namely that it has to be introspectible in principle if not necessarily always in practice. If it lacked this property, we could know nothing about its existence (for an account of many of the issues involved here, please see 'Defining Consciousness' *Journal of Consciousness Studies*. Special issue, May, 2009). And it follows from this, of course, that recognizably human-like consciousness has to be closely tied to early stages of memory processes, to what Robbins (2004) has called 'primary memory', which is more than the simple 'integration over time' capacity possessed by individual neurons. Benjamin Libet's well known findings, that consciousness of perceptual inputs takes ~ 200 msecs to 'develop' while conscious awareness of neural antecedents of a decision to comply with an instruction lags ~ 350 msecs behind these antecedents, give empirical support to this inference. Consciousness, in these circumstances at least, has to be associated with the content of some type of very short-term memory. Many other lines of evidence (e.g., Wegner, 2002) point to much the same conclusion. Perhaps I should add that the conclusion is already implicit in the attractor dynamics picture since attractors in the brain *are* (mostly re-activated, but occasionally new) memories of one sort or another.

[4] We can't say anything useful, at least from a scientific point of view, about any supposed 'consciousness' that we have not ourselves either experienced or received credible reports of from others.

Mapping attractors into neurology

Ruling attractors, the candidate substrates for the stream of consciousness, 'exist' in state spaces with vast numbers of dimensions, but their representations in the brain are 3 dimensional (or practically 2 dimensional when it comes to the cerebral cortex). The only form of mapping with the complexity needed[5] to represent them is fractal or quasi-fractal (i.e. the representation might not need to possess the *same* fractal dimension at every scale). So our candidate NCC, according to these ideas is going to possess a fractal structure. There are lots of brain features with the right structure, but we can narrow the field down a bit more. As noted at the end of the previous section, any such candidate has to have close links with early stages of the memory process; moreover, it has to work on the right sort of time-scale – a scale of the order of 10 Hertz, which seems to correspond with a minimal conscious 'moment'. Any processes very much faster than this (e.g., individual action potentials), or very much slower (e.g., protein synthesis) are unlikely to be directly related to consciousness.

Given these three requirements, many would follow what has hitherto proved a popular option and point to the diffuse electromagnetic fields of the brain (EEG), which certainly work on the right sort of time scale and are often structured quasi-fractally. However, links between EEG fields and memory are not direct, but are mediated through a range of chemical processes, so they fail on that criterion. I shall therefore follow Pereira and Furlan (2009), for instance, and propose a different candidate (though I won't be using the quantum theoretical considerations that these authors invoke in connection with their candidate). It's a candidate linked with EEG fields in what can be regarded as a 're-entrant' (to steal Edelman and Tononi's term) relationship; namely changing calcium ion concentrations, pictured as calcium 'waves', which appear to meet all three criteria.

Please note that calcium waves may not be the *only* candidates in the brain to fit the criteria. The account that follows merely illustrates aspects of what I take to be the general *type* of NCC that is likely to be found when we have the right tools to help the search[6] – I'd need a lot of luck to hit on precisely the correct mechanism with this sort of *a priori* argument. However, the overall picture offered here is remarkably similar to the 'conscious pilot' described by Hameroff (2009). My model places more weight on the fractal structure of the proposed neural correlates of consciousness than his, and does not invoke the possibility of *quantum* computation in microtubules; microtubules in my model subserve 'calcium wave' scales intermediate between dendrites and whole neurons and undertake *classical* computations, but otherwise the two models could be twins. The fact that we independently arrived at similar models by very different routes can perhaps be taken to suggest that they may be on the right lines.

[5] To get a feel for the required complexity, it's worth looking at Wikipedia on tesseracts (4-D cubes). They are only two dimensions up from a sheet of paper and very simple in shape, but their representation in 2-D is quite complex – then try to imagine the 2-D representation of a strange attractor existing in a billion-D space!

[6] i.e., tools combining the spatial resolution of fMRI with the temporal resolution of EEG, capable of use with conscious subjects and able to 'see' whatever the NCC turns out to be. Calcium waves can be imaged with the right resolutions at present, but not *in vivo*.

Calcium waves occur on a wide range of scales, from that of dendritic spines, through individual neurons (when they are often referred to as calcium currents, but the principle is the same), to much larger scales involving astrocytes. Inter-astrocytic calcium waves are known to follow a power law (i.e., are fractal) spatially and temporally (Jung et al., 1998). Reciprocal relationships between larger scale calcium waves and EEG activity may partly be mediated by the dynamic behaviour of gap junctions which, in Hameroff's model, enables the formation of a mobile syncytium that comprises the 'conscious pilot' and can be regarded as the instantiation of my 'ruling attractors'. Nevertheless a range of other mechanisms are also probably involved in forming larger scale calcium wave patterns, such as variations of sodium entry into neurons (Harris-White, 1998), which affect calcium ion concentration.

Calcium waves make a particularly attractive NCC candidate because of the properties of the protein CaMKII (e.g. Lisman et al., 2002), which is activated by increased calcium ion concentration and, when active, plays essential roles in a range of memory-related and other functions including the development of long term potentiation (LTP) in NMDA synapses. Remarkably enough, it has also been found to affect the opening of gap junctions (Alev et al., 2008). In brief, the protein has exactly the right properties to mediate a relationship between calcium waves and early stages of memory processes, while at the same time feeding back to affect the waves themselves over a wide range of scales.

In addition CaMKII activation states must inevitably provide holographic records of calcium waves because all holography depends on recording interference fringes between waves. Since calcium concentrations are higher where separate waves reinforce one another and lower where they don't, while CaMKII responds to higher concentrations, interference fringes will be recorded by matching distributions of activated and inactive protein. Activated protein, in turn, initiates other, often more permanent, memory processes (CaMKII itself may remain permanently activated, but only if calcium ion concentrations exceed a threshold). What this implies, if the model is correct, is that some forms of memory must be holographic – a view that Karl Pribram has been affirming for 40 years or more!

So far, we've arrived at a picture that puts a different slant on global workspace theory (i.e., the concept of a succession of 'ruling attractors'), allowing us to construct what appears to be a workable model of links with memory processes and the structure of (some types of) memory. The picture also allows us to sidestep many questions about links between attention and consciousness, for the succession of ruling attractors *comprise* conscious attention on this view, while lesser attractors can be considered to entail specific unconscious attentions.

However, just as global workspace theory cannot tell us why the contents of the workspace should be conscious, neither are we in a position to say why 'ruling attractors' should be conscious particularly as lots of lesser attractors are active at any given moment, which don't manifest in conscious experience unless they take a turn as 'rulers' or contributors to some 'ruler'. Simply being an attractor is clearly not sufficient for consciousness; something

more is needed. What puts the fire into the neurology to produce the 'searchlight beam' of consciousness? Many, faced with this question, have turned to quantum theory for tentative explanations, Hameroff's 'OrchOR' being the present front-runner here. I shall take a different approach; one that has often been hinted at but has not, so far as I am aware, been clearly articulated. It depends on ideas about the nature of the material world that are arguably deeper and more general than those deployed in quantum theory alone. I shall outline these considerations first, before getting on to the question of what they might conceivably have to do with consciousness.

Symmetry rules

Our worlds, with the apparent exception of our consciousness, consist of particles and fields, enabled and constrained by rules often dubbed 'natural laws'. So far as we know, the majority of our deepest natural laws are based on considerations of symmetry. The conservation laws that most immediately affect us (energy, momentum and angular momentum, electric charge) are consequences of Noether's theorem: *"any differentiable symmetry of the action of a physical system has a corresponding conservation law".* Both special and general relativity depend on similar symmetries; the first, with all its apparent paradoxes, is due to physics having to look the same to all observers regardless of their relative motion, while the second depends on the equivalence of physics carried out in a gravitational field to that carried out in an accelerating reference frame. Not all of the fundamental rules so obviously depend on symmetry, and a few may not be based on symmetry at all (e.g., the rule that action always has to manifest in multiples of Planck's constant). Most, however, are so based.

More remarkable still is the role played by symmetry in the so-called 'gauge fields', the most familiar of which is the electro-magnetic field (e.g., Huang, 2007). There is a quantum property called 'phase' that has no observable consequences for the real world whatsoever[7] – provided it is globally invariant (i.e. symmetrical everywhere). However consequences of special relativity threaten global phase symmetry. Back in the 1950s, Yang and Mills were playing with equations that would 'cancel out' this threat. They duly came up with the famous Yang-Mills equations, the fame of one version of which is down to the fact that the term needed for cancellation *described the electromagnetic field*. It looks very much as though something as fundamental to our existence as electromagnetism is a consequence of a threat to the symmetry of a hypothetical property which is otherwise completely unobservable. Breaking, or threatening to break, a symmetry can be a very big deal in physics, it appears! The Yang-Mills approach subsequently allowed physicists not only to picture the weak and strong forces as involving symmetries, but also led them to predict the existence of a range of previously unknown particles. Quite a lot of the physical basis of reality – maybe, some have suggested, the universe as a whole – depends on consequences of symmetry.

[7] This is because 'phase' refers to angle of rotation in the complex plane. The angle doesn't affect the probability amplitude and it's that amplitude (when squared) that 'determines' what is likely to be 'observed'.

Consciousness

To the best of our knowledge, time possesses symmetry. Newtonian time is like a perfect wave steadily and universally advancing to turn future into past, the 'present' being the interface between the two, which is of infinitesimal duration. Nowadays of course, the Minkowski space-time of special relativity is thought to offer a truer picture, but this too has a symmetry (from the perspective of any given individual) between past and future light cones. If the 'block universe' view of time is correct, there is still symmetry in that there is no difference between future, present and past (despite the apparent differences arising from our perspectives on the universe).

A number of authors have hinted that consciousness might have some quite fundamental special relationship with time. They include:

- Harth (1995) expressed the idea beautifully when he wrote: "Consciousness has the capacity to break the causal chains, the infinitesimal moment that is the present, the sliding point in time that separates past from future . . . it is like a wedge driven between the *whence* and the *hence*, a timeless region where intentionality, volition and creativity are spawned."
- Humphrey (2006) speculated that the existence of consciousness has something to do with what he called its 'temporal thickness'.
- Gray (2006), discussing the coloured moving dot illusion[8], commented: "The first, temporal, inference[9] is that, on a sufficiently fine-grained temporal scale, it is impossible to allocate a precise time to a conscious experience."

Basically, what these authors have identified is that 'consciousness', referring presumably to the neurology (or at least to some aspect of the neurology) associated with consciousness, does what one might loosely refer to as 'messing with time'. Over 'objective' time scales of the order of 200msecs, consciousness appears to possess an inherent subjective 'fuzziness', quite unlike the strict ordering of events in either Newtonian or (local) relativistic time.

Could some time-related, broken symmetry have any consequence as profound as those that appear to relate to other symmetries? A 'yes' answer doesn't appear totally unreasonable. In that case, maybe consciousness could be regarded as *being* a local field consequent on a broken symmetry. The dynamic generating any such field would depend upon some aspect of the memory-related processes associated with 'ruling attractors', according to the picture offered earlier. One need not suppose that any such field should

[8] If a red dot is shown at one point on a screen followed, ~200msecs later by a green dot at another point, one perceives a spot of light moving from the first to the second point. However it is perceived to change colour from red to green about half way between the two points – i.e. apparently 100 msecs *before* the actual colour green appears on the screen. This is less spooky than one might suppose because it's probably a manifestation of Libet's 'backward referral' of conscious experience. Nevertheless, Gray's comment remains relevant.

[9] Gray's second inference was to do with the impossibility of allocating a spatial location to consciousness – something that necessarily follows from its fractal/holographic structure, according to the model offered here.

manifest in new, 'objective', physical forces or particles since temporal symmetry is not a quantum theoretical gauge symmetry. It is possible to suppose that the consciousness of a 'consciousness field' might be a property that occurs as a 'brute fact', just as the electromagnetic field is what it is. There might, in other words, be no possibility of explaining *why* consciousness is like what it is like, any more than one can explain why something, rather than nothing, exists. The best one could ever do, on this view, is to explain *how* consciousness fields come into existence.

One particularly interesting explanatory possibility builds on an idea due to Tal Hendel (2009), which uses concepts at the foundation of quantum theory and makes no speculative addition to standard theory. He points out that, whenever an energy eigenstate manifests, the associated Hamiltonian (energy function) can be written either as an operator acting in time or as an operator acting in space. He suggests that the spatial equation represents the objective energy that we perceive, while the temporal equation represents a *subjective* experience – a sort of quantum of subjectivity that he dubs a 'qualion'. Since we know that equations of quantum theory, which are apparently meaningless at first sight, may later turn out to describe a reality of some sort (e.g., Dirac's equation of the electron, the alternative solution of which described the positron, an entity that no-one knew about when he wrote the equation) the fact that the Hamiltonian can be described in two ways has to be taken seriously – especially as this can be regarded as a 'broken symmetry' of the basic Schrodinger equation. The proposal can be regarded as a 'panprotopsychist' one, in which all energy manifestations have a 'subjective' aspect. But how can one get from that to human-like consciousness?

It is well known that there is a 'Heisenberg uncertainty' relationship between energy and time. The more precisely you measure one, the less you can know about the other. However, explaining what 'temporal uncertainty' might mean has generated much uncertainty albeit of a different type! Applying Hendel's idea allows one to interpret it as a *subjective* uncertainty. Following the Heisenberg implications, it can be said that any very precisely defined energy eigenstate will be accompanied by a 'qualion' with, on average, a huge 'subjective' duration; loosely defined energy eigenstates, on the other hand, will be accompanied by 'qualions' of infinitesimal 'subjective' duration. Some energy eigenstates can be expected to be associated with 'qualions' possessing a 'subjective' uncertainty of the order of 100 msecs.

If some 'wavy', approximately 10Hz, energetic process in the brain happened to be associated with a temporal uncertainty of roughly the same order, the outcome would be a modulated 'qualion field'; one that would in effect translate the spatio-temporal dynamics of the brain into a tempero-spatial, 'subjective' form. Candidate processes might include neurotransmitter bindings to receptors or calcium binding to CaMKII, and many other possibilities besides. In principle, the 'temporal uncertainties' could be calculated from observation of the energy eigenstates, allowing exclusion of candidate processes not associated with the 'right' temporal uncertainty.

According to this picture, all energetic processes in the brain (and elsewhere) are in a sense 'conscious', but only those associated with 'ruling attractors' possess our sort of

introspectible, contentful consciousness. This could be either because other energetic processes are not memory-associated in the right way, or because they are not the right sort of energetic processes (i.e., ones accompanied by temporal uncertainties of ~100msecs), or of course both of these possibilities may apply if some memory-associated energetic process peculiar to ruling attractors happens to be the only one with the right degree of temporal uncertainty.

Looking for the evidence

Although the model that I have described is fairly run-of-the-mill in many respects, it does make two unusual claims:

(a) Attractors and their landscapes can be considered to possess a sort of quasi-autonomy, rather analogous to the apparent independence of specific 'natural laws' (such as laws of hydraulics) from the 'efficient causes' to which they are often supposed to be reducible.

(b) Consciousness may originate in a broken time-related symmetry, in which case it is likely to be sometimes associated with temporal anomalies.

Where should one look for any anomalies associated with these unusual features? Going back to electromagnetism again, Michael Faraday arrived at the field concept by looking for extraordinary phenomena, and found what he needed in his iron filings patterns. By analogy, evidence for any 'consciousness field' is likely to be found in unusual subjective, and maybe even objective, experiences relating to time.

There isn't space here to look at likely sources of evidence in any detail – that would require book length treatment, so I shall risk annoying readers by simply suggesting some areas of research (many of them described at length in, for example. Kelley et al., 2007) which may provide appropriate support:

- Some of the puzzling features of psychedelic drug experiences and of near death experiences are less difficult to understand if it is assumed that attractors can take charge of the neurology associated with (remembered) experience. Attractors can appear to be more than just products of, or ways of describing, brain and associated dynamics, and maybe they actually do have some sort of independent 'reality'. It isn't easy to explain on entirely reductionist, neurological grounds, for instance, how traumatised brains can produce the clear, complex and above all *memorable* experience of some NDEs. Reported experiences of that sort give the impression having been 'orchestrated' by hierarchies of memories (attractors) acting almost independently of the sometimes confused brains in which they have their home. My personal estimate is that there is quite strong, albeit still only suggestive, evidence from these sources that attractors can take the role of 'formal causes' in relation to experience.

- There's lots of evidence, from reports of 'mystical' and related experience, that 'subjective' anomalies of temporal experience (e.g., experience of 'timelessness', or of a time completely separate from that of the mundane world) can and do occur, though their interpretation is of course open to debate. There's also evidence from a variety of sources (e.g. 'psi' work, especially that on the so-called 'pre-sponse'[10], reports of 'precognitive' dreams, some reports of death bed experiences) that 'objective' anomalies, inexplicable in terms of the time of special relativity theory, also occur. Intriguing though much of this evidence is, I don't myself think that we have anything (yet) equivalent to an 'iron filings pattern' for 'consciousness fields'.

Concluding remarks

There are two final questions that I'd like to raise before closing, though with little hope that the first will find answers anytime soon. The second may prove a little more tractable.

(a) Could the apparent autonomy of attractors be connected somehow to the suggested origins of consciousness in broken time-related symmetry?

(b) If consciousness is related to broken time-related symmetry, could there, via Noether's theorem, be some conserved quantity associated with it?

The first question raises all sorts of profound philosophical issues to do with the reality or otherwise of a timeless, Platonic realm. Since we have pictured attractors as being in some ways like natural laws, perhaps they can form a bridge to the realm of laws and mathematical objects, if indeed this has independent 'existence'. A Platonist could perhaps speculate that the origins of consciousness are such that it *enables* a bridging between mundane and Platonic realms.

With regard to the second question, Noether's theorem itself applies only to systems describable by Lagrangians[11]. However, according to the view offered in this paper, 'consciousness' is closely tied to energy, which *is* conserved. On the other hand, energy conservation is dependent on the indifference of physics to position in time, while 'qualions' in a sense *are* (subjective) time, so it's far from clear that they can be viewed as conserved along with energy. All the same it is perhaps conceivable that an extension of Noether's theorem might apply to 'qualions'. In that case the 'conserved quantity' in question would probably turn out to be consciousness itself, rather as electric charge is the conserved quantity in electromagnetism. Since conserved quantities are 'substances' from a

[10] The 'pre-sponse' is a physiological reaction (e.g., GSR), apparently associated with being shown an emotionally upsetting picture, for example, that occurs *before* the picture is shown. The effect appears to be replicable; indeed, almost robust as findings of this sort go (see, e.g., Radin, 2006, for a popular but accurate account). The time elapsing between 'pre-sponse' and 'stimulus' can be of the order of 2 or 3 seconds – i.e., much too long for the 'pre-sponse' to have any direct connection to Libet's 'backward referral'. However, the role if any of *consciousness* in the genesis of this phenomenon isn't known.

[11] Lagrangians are energy functions similar to the more familiar Hamiltonians; indeed Hamiltonians and Lagrangians are interchangeable for many purposes. According to Baez (2002) an extension of Noether's theorem can apply to systems describable by Hamiltonians.

philosophical point of view, this raises the interesting possibility that *both* monism *and* a form of substance dualism are true!

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Research Essay

Special Relativity and Perception
The Singular Time of Psychology and Physics

Stephen E. Robbins*

Abstract[1]

The Special Theory of Relativity (STR) holds sway as a theory of time due to its apparently successful predictive structure regarding time-related phenomena such as the increased life spans of mesons or retarded clocks on jets circling the globe, and due to the relativization of simultaneity intrinsic to this theoretical structure. Yet the very structure of the theory demands that such very real physical effects be construed as non-ontological. The scope and depth of this contradiction is explored and, if these time-changes are indeed viewed as ontological effects within STR, an additional problem for the theory is introduced in the context of perception. The origins of this confused situation arise as a result of the fact that STR is an expression of a classical, spatial metaphysic – a framework that equally underpins current discussions of the hard problem. This metaphysic holds an inadequate concept of time and a failure to acknowledge the reality of simultaneous causal flows. These problems are developed against the background of an alternative, namely, the temporal metaphysic of Bergson – a framework that provides a profoundly different base for viewing both relativity and consciousness.

Key Words: special theory of relativity, perception, singular time, psychology, classical, spatial, temporal, Bergson.

1.0 Introduction

> Physicists mislead us when they say there is no simultaneity. When the camera pans to the heroine tied to the rails and then to the hero rushing to the rescue on his horse – these events are simultaneous.
>
> (James J. Gibson[2])

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[1] This paper is the essence of a talk entitled, "Special relativity and perception: Bergson's debate with Einstein," presented at *Thinking in time*: *Henri Bergson (an interdisciplinary conference).* UCLA-Berkeley, April, 2005.

[2] Gibson, the highly respected theorist of perception, made this statement in a talk at the University of Minnesota in 1975. He had read a paper by the author the previous day which at the time accepted Capek's (1966) view that relativity adequately preserves the "becoming" of the universe, and which attempted to fold in psychological time as part of the relativistic structure of time. Gibson, however, appeared to have none of this. He is in effect alluding to the concept of the *simultaneity of flows* of time, a subject discussed at length by Bergson in *Duration and Simultaneity* (1922/1965) in his analysis of relativity.

In 1922, Henri Bergson engaged with Einstein in a spontaneous discussion under the auspices of the Société de Philosophie (Gunter, 1969, pp. 123-135). Acquiescing to an invitation to make an impromptu comment, Bergson noted, in the course of about 15 minutes of remarks, that the concept of universal time arises from our own "proper" or experienced time in our immediate environment. He drew attention to the concept of the *simultaneity of flows*. Our experience of simultaneity, he observed, arises from our experience of multiple flows within a single flow, whether it be multiple race cars racing side by side down the track, multiple melody lines within a single flow of a symphony, multiple musicians playing on the symphony stage, multiple women cooking in the kitchen, multiple family members eating at the table, a boat floating down a river with geese flying overhead, or Gibson's hero coming to the rescue of a struggling heroine (using my own examples). This experience of multiple simultaneous flows within a single experienced flow is generalized to other perceivers, ultimately, he argued, to our concept of a *universal* flow of time. Further, this intuitive notion of simultaneity supports the very concept of relating an event to a specific time instant on a clock (as for example where an observer must relate a lightning bolt and a clock hand at 3PM as occurring simultaneously). Now, he noted, a microbe observer could say to our observer that these two events (clock hand at 3PM, lightning bolt) are not "neighboring" events at all, but are vastly distant and would not be simultaneous to a moving microbe observer. Nevertheless, to paraphrase his conclusion, he felt that this intuitive simultaneity must underlie the possibility of any time measurement at all in relativity, and was in fact the basis for reconciling the two notions.

Einstein's reply is worthy of complete quote:

> The question is therefore posed as follows: is the time of the philosopher the same as that of the physicist? The time of the philosopher is both physical and psychological at once; now, physical time can be derived from consciousness. Originally individuals have the notion of simultaneity of perception; they can hence understand each other and agree about certain things they perceive; this is a first step towards objective reality. But there are objective events independent of individuals, and from the simultaneity of perceptions one passes to that of events themselves. In fact, that simultaneity led for a long time to no contradiction [is] due to the high propagational velocity of light. The concept of simultaneity therefore passed from perceptions to objects. To deduce a temporal order in events from this is but a short step, and instinct accomplished it. But nothing in our minds permits us to conclude to the simultaneity of events, for the latter are only mental constructions, logical beings. Hence there is no philosophers time; there is only a psychological time different from that of the physicist. (Gunter, 1969, p. 133)

This was the totality of the interchange. And so it rests. Bergson's position is, to say the least, a minority opinion. Einstein's "time of the physicist" has been the accepted criterion of reality. The simultaneity of perception is considered, at best, suspect, and in practice, invalid.

Stein (1991) essentially reprised and expanded Einstein's argument, attempting to explain ongoing misconceptions of relativity, as he saw them, in terms of our continued naïve belief in the perception of simultaneous events – an illusion based on the high velocity of light. Thus, he argued in essence, the naïve or intuitive simultaneity that perception provides is founded upon the "fleeting motions" of "masses of elements" in the brain, all subject to the limitation of communication via the velocity of light, and

implying therefore that at a small enough scale of time, perceptive simultaneity would break down.

This is, in fact, a curious state of affairs. Let us allow that Stein expresses Einstein's view in somewhat extended form. Then this exposition of relativity and its inherent, relativized simultaneity of events entails, or at least places a fundamental constraint upon a theory of perception (cf. Hagan & Hirafuji, 2001). Stein is assuming a model, admittedly sketchy, of the processes in the brain underlying perception. Perception, however, is simply part and parcel of what Chalmers (1995) dubbed the "hard problem," i.e., the explanation of conscious experience, the “world-out-there” in depth, in volume, in quality. As the problem fundamentally involves our consciousness, the problem surely cannot be divorced from our model of time. It is a problem become ever more acute, far more so than realized in Einstein’s time and even just becoming so in Stein’s time. Neither Stein nor Einstein could claim to have a solution. We can ask an interesting question: what if the solution to the hard problem intrinsically relies on the simultaneity of events?

Bergson had such a solution. As I have discussed it extensively elsewhere (Robbins, 2000, 2001, 2002, 2004a, 2004b, 2006a, 2006b, 2007, 2009, in press a), I will only be giving a sketch here. Sufficient it is to say that this theory contains a prediction in the sphere of perception/action that contradicts the Special Theory, though it is a contradiction if and only if physics holds that the relativization of simultaneity is a real property of time, i.e., a real, ontological property of the matter-field and its temporal evolution. But this is the problem.

1.1 The Problematic Status of Relativistic Effects

Let me begin with an overview of the status of physical effects assigned to STR. It is a difficult topic, one which faces every student of the subject. Relativity, it is well known, contains a feature which sees space units contracting and time units expanding depending on the motion of an observer. The most famous example is the twin paradox. In this case, twin Y leaves the earth at high speed in a rocket while his brother, twin X, stays on the earth. X is considered the stationary twin; he is at rest relative to Y. In motion at high velocity, Y’s units of time, according to relativity, expand. Simultaneously, his space units contract. Because his time units are so much larger, he uses fewer of them, and when he returns to earth, he has aged less than his brother X. In this paradox, then, the expansion of time units and contraction of space units is considered very real. If the earth-based twin has a long beard, grey hair, and occupies a wheel chair, and the rocket-riding twin returns looking like Brad Pitt at twenty, well, we have a very real, a very physical, effect. These expansions and contractions, then, have *ontological status*. If this is the case, Einstein’s “relativization of simultaneity” must be very real too.

What is the relativization of simultaneity? It relates to fundamental problems of measurement. Suppose, Einstein had argued, two lightning bolts strike on either side of you, fortunately a safe one thousand meters away. You happen to have two very accurate stop watches in either hand. Both are perfectly synchronized to the millisecond. You click to stop each of them when you see the light from each bolt out of the corner of your eye. You are a very fast and accurate “clicker.” Behold, both watches show the same time. Further, you measure the distance from where you stood to the point where each bolt hit the ground. The distances are exactly equal. Assuming the light from each bolt traveled at the same velocity to your eyes, then the two bolts must have hit simultaneously. They traveled the same distance at the same speed, so they must have hit at the same time in order for you to have stopped both your watches at the

same time. Therefore you judge these two lightning bolt events to be simultaneous. So far so good. But suppose another observer, we'll call him Observer Two, is moving on a large flying disc (his reference system) at some velocity right past where you stand. Observer Two is moving on an exact line towards the bolt on your left and away from the bolt on your right. He too has two synchronized stop watches. Note, however, that for this moving observer, the light from the bolt on the left must strike him a little sooner since he is traveling towards it, while the light from the bolt on the right gets to him a little later since he is moving away from it. He stops his two watches at different times. He declares the two-lightening bolt events *not* simultaneous.

Surely, we ask, he must know that he is moving! This explains the difference easily. But, said Einstein, perhaps he does not know that he is moving. Perhaps he thinks he is at rest. Perhaps he really is at rest. Perhaps it is you who are moving. How do we know? This became the essence of the first of two major postulates proposed by Einstein and which underpin his theory. The postulate is stated as, "the laws of physics are the same (invariant) in all inertial (reference) frames." It can equally be called the "reciprocity of reference systems." It implies that any observer has the right to declare himself at rest and all others in motion with respect to him. There is no way to tell who is right. The second postulate is the invariance of the velocity of light in all inertial frames.

Where do the expanded time units and contracted space units come from? Well, since Observer Two doesn't realize he is in motion (according to you), his clocks are not actually in sync. The method by which he must synchronize his clocks, Einstein showed, would be affected by his motion. One of his clocks will lag behind the other. Because of this, his measurements of distance and time within his own system will be affected. Einstein derived equations to allow us, as Observer One, to coordinate Observer Two's measurements of distances and times to our measures, in fact to specify what his measurements will look like in his system in terms of distance and time values. Central to the equations is a constant for both systems – the velocity of light. Applying these equations to Observer Two and his reference system, we would assign him expanded time units relative to ours. We would also assign him contracted distance units. At this point, one can intuitively understand why these distance and time change phenomena might be called "measurement differences." They are seeming squabbles over clock settings due to motion, but the problem of just who is in motion is very real. Observer Two, invoking reciprocity and declaring himself to be the system "at rest," can of course use the same equations for our system and for our distance and time values, claiming we are in motion and our clocks are out of sync.

Note what this implies for the simultaneity of events. The strikes of the two lightning bolts are relativized. They happen at the same time for one observer, at different times for another. Events that seem simultaneous to us may not be for another person. This means that what are simultaneous events for one observer may be successive events for another. This is to say, drilling down, that two simultaneous events for one observer, may, for another, be one event in his future, the other in his past. But what does this mean for the flow of time?

What is the classical conception of time? The advance of time traditionally involved the vision of the "time-growth" of the universe along some universally defined plane we call the "universal present." Were we to build a "space-time solid" in three-dimensions, letting the third dimension represent time, we could build one with (very thin) bread slices. Each slice represents all of 3-D space taken at an instant in time. We proceed, adding slice by slice to the "front end," gradually building a time-solid "loaf." The universal present is reduced rather mundanely to a slice of bread in this exercise. The

flat surface of each slice is the universal "plane" of the present. In the classical conception, everyone's "present" is on this plane. All simultaneous events live on this plane. To us, the two lightning bolt strikes were on this plane. Any event not on this plane is either in the past, or the future – for all beings.

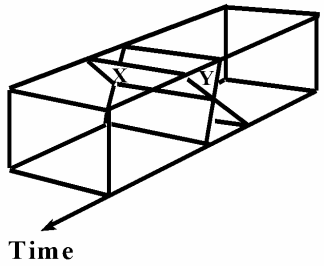

Figure 1. Planes of simultaneity in the space-time solid.

But now we have the relativistic fact that what are simultaneous events for one observer might be successive events for another. This implies different planes of simultaneity. It can be visualized as slices at different angles through our time-loaf. For observer X, with a plane sliced at a certain angle (Figure 1), certain events which he is experiencing as simultaneous events comprising his "present" can yet lie in the future for observer Y, while others lie in Y's past.

This vision of different futures and pasts for observers moving relative to one another makes it extremely difficult to conceive of a "universal becoming" with its vision of the growth of the universe in time along the plane of the "universal present." The conversion of simultaneities to successions, and successive events to simultaneous events, presents a troublesome difficulty for this classical conception, for the "plane of the universal present" seems to have disappeared – a single vertical slice cannot properly represent the "present."

There is, however, a natural route out of this dilemma, and it is simply to deny that there is any universal becoming, any motion of time, and to move instead to a conception of a static universe. Einstein's great collaborator, the mathematician Herman Minkowski, made statements that were the most famously conducive to this view. "Henceforth space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality." This conception is commonly called the "block universe." In it, there is no motion of time. All is given, past, present, future, in one giant block. This is a very common interpretation of relativistic space-time.

But let us remember, the *ontological* reality of this static block model entirely depends on the relativity of simultaneity being a fact. All depends on this relativization being a real property of the time-evolution (which we can no longer coherently visualize) of the matter-field. On this in turn depends the reality of the expanded time intervals and contracted space intervals of the rocket-riding twin Y. On this, in its turn, depends the differential aging of the twins X and Y, or the retarded aging of twin Y, as a real, physical property of matter, and the grey beards and real wrinkles.

1.2 Space Changes as Non-Ontological

When one begins to study the special theory, this is the first question that arises: are the changes in time and space real? It is extremely perplexing, for there is much to say that they are not real, and much to say they are. Here is a comment by the prolific physicist and physics writer, Paul Davies:

> How could the same thing [aging] happen at different rates?' I asked myself. I formed the impression that speed somehow distorts clock rates, so that the time dilation was some sort of illusion – an *apparent* rather than a *real* effect. I kept wanting to ask which twin experienced real time and which was deluded. ... I had to admit I could not visualize time running at two different rates and I took this to mean that I did not understand the theory. … It was then that I realized why I had been confused. So long as I could imagine the time dilation and other effects actually happening and *could work out the quantities involved, that was all that was needed.* (Davies & Gribbons, 1992, pp. 100-101)

It is not comforting to see the mechanical resolution he finally accepts, simply "doing the equations." But the contradictions are deep. Consider the initial and critical experiment to which the theory was applied, the famous 1895 experiment of Michelson and Morley. Michelson and Morley were trying to ascertain the speed of the earth through the ether. The ether was considered the all pervading, universal, fluid-like substance or medium through which energy is transmitted. Energy was considered to be propagated in waves. A wave requires some medium to ripple, in fact a wave is simply a ripple propagating through the medium. Without something like the ether, there could be no waves of energy. The earth was conceived as though it were a huge boat plowing through the ether, creating a bow wave or current. The Michelson-Morley experimental apparatus (Figure 2) sent out two light waves at right angles to each other. One went against the current, one went crosswise to the current.

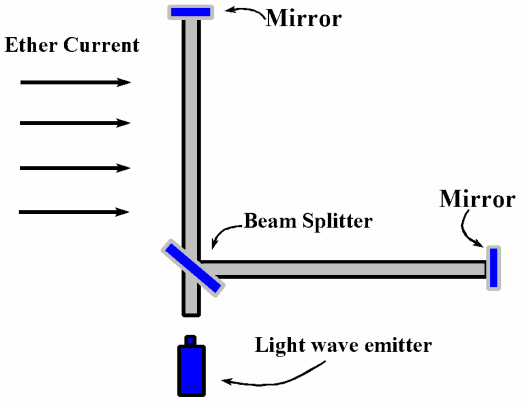

Figure 2. The Michelson-Morley apparatus (1895). The earth was conceived as a boat plowing thru the ether, creating an ether current or flow. The pipes/arms of the apparatus are equal in length, and an emitted light wave is split in both directions. The light wave traveling through the pipe in the direction of the current and back should have taken longer, creating an interference pattern or fringe between the two waves. However, no interference was observed; each wave takes the same time, creating a problem for the existence of the ether.

When they ran their experiment, they obtained a strange result. The light ray running in the direction of the ether current and back should have taken longer than the light ray running crosswise. It did not; both rays took equal times. The result could be explained if the arm of the apparatus, in the direction of motion, in line with the ether flow, shrunk slightly, just enough to compensate for the theoretically larger time of travel of the light ray going though it. The light ray cheats by having a shorter course. Is such a contraction of the arm of the Michelson-Morley apparatus real, a physical fact?

Let us remember that Hendrik Lorentz, a highly respected physicist of the time, some years before Einstein's publication, originally proposed that it was indeed real. He advanced ether-based, electro-dynamical arguments in support of equations he developed for the foreshortening of the apparatus-arm in the direction of motion as a function of velocity. His equations expressed the degree of contraction and accounted for the same travel-times. The equations looked exactly like Einstein's. But the contraction was unappealing to physics; it was rejected, or at least never accepted. Why was Einstein's "contraction," using precisely the same equations, accepted? Because the length became a space-time invariant.

How does the length become such an invariant? By being subject to the reciprocal transformations of two observers in two different reference systems, either of which can consider himself at rest and the other in motion. Einstein's perceived advance was to embed the Lorentz transformations within this symmetric, reciprocal framework, together with postulating the invariance of the velocity of light. Indeed, Einstein wished that his theory had been named "Invariantentheorie," rather than relativity (cf. Horton, 2000). In special relativity, the Lorentz transformations have no meaning with respect to just one observer. There is no invariance with just one observer. *Some form of transformation is required for an invariant*. This symmetric system is required, and within it, either observer can declare himself at rest, and then attribute the length contraction to the other (in motion), adjusting the other's space and time units to preserve the invariance of the velocity of light. Therefore as A. P. French (1968) states in his textbook on relativity, the length contraction is not a real property of matter, *it is a measurement effect*, "something inherent in the measurement process" (p. 114).

In the textbooks I studied in the 1970s, the explanations of length contraction routinely told this story. The length contraction is not real. It is an effect of measurement only. The length is a space-time invariant, but no single observer has a claim on knowing the "true length." The student is warned not to fall into "the length contraction is real" trap. In truth, we must remember, there is little choice. To say that it is a real effect is to say that the Michelson-Morley apparatus arm is actually contracting somehow. This is to revert back to Lorentz and his hypothesized contraction, an explanation in fact with a real, physical model at its base – the very thing physics refused previously to accept.

1.3 Time Changes as Ontological

But as soon as the textbook turned to expanded time units or time dilation, the story was different. The problem was that there were real, physical phenomena for which time dilation appeared to be physics' only available explanation. Mesons, for example, are particles that have a certain lifespan. At rest, they exist for a certain measurable period before they decay away. When moving at high velocity, they exist for a longer period. When Lorentz's original equations are applied in this case, the increased time is perfectly predicted. Therefore time dilation is considered a quite real effect.

If there is a doubt that this is considered a very real effect, we can propose a test. We could set up a tiny electric switch a distance from the start of the meson's motion. The distance is just long enough that if the electron is not living any longer beyond it normal rest life, it won't set off the switch, but if it is living longer, it makes it to the switch and sets off an alarm clock. The ringing clock is a very real effect. Physics would quite surely accept that the meson will ring the clock.

The slow-aging Y twin with the grey and bearded X twin is simply another case of the time-dilation being considered a real effect. There is just one problem with all this. It ignores the reciprocity of reference systems. A tiny physicist on the meson should be able to say, "I'm not in motion, you are. I will never make the clock ring." The rocket-riding Y twin has perfect right to declare himself at rest, and the X twin in motion. The fact that he is on the rocket is of no account. The rocket engines could be considered to be holding the rocket's place in space as the earth moves away from the rocket, but in truth, the mathematics of relativity is abstract and these physical considerations are irrelevant. Only the abstract reciprocity of reference systems is important. So now it is the X twin who ages less. So for whom is the aging less? X or Y? Has *time* really changed? Or should we just be saying that aging period too is a space-time invariant, just as the length contraction?[3]

But fast forward. An experiment was ultimately performed in which a clock was put on a jet and flown at great speed. When the jet landed, the clock was compared to a previously synchronized counterpart left on the ground. The jet-carried clock lagged behind. The Lorentz equation for the expanded time-interval accounted for the difference – another triumph for relativity. When the experimenters stepped off the jet with their retarded clock, no one on the ground stepped forward and argued that in actuality the plane was at rest and the earth moving at extreme speed relative to the jet, thus it is the earth-based observers' clocks that should be retarded. Why not? Because obviously it is absurd. These are very real effects. They cannot be made to go away by invoking reciprocity. If the longer-living meson rings the alarm clock, the ringing is very real, it cannot be said that clock isn't ringing by suddenly remembering reciprocity. The bearded twin, should it happen, would be very real, and the beard would not go away by remembering reciprocity. The symmetry implied by reciprocity clearly has been broken.

1.4 Space Changes as Non-Ontological – Again

As far as I can ascertain, in the 1980s (perhaps earlier) another paradox began appearing in the textbooks called the "pole-barn" paradox. The "paradox" notion was now being applied to the length contraction. In this paradox, we have a longish, say, telephone pole. In its resting state, it is too long to fit into a certain barn. However, when the pole is launched into motion at a velocity near the speed of light and flies through the barn, there is a period where the pole, due its length contraction, actually fits into the barn. But *this* paradox is used as a parable for illustrating that we should *not* consider these real effects. It is unhesitatingly pointed out that the *barn* could be conceived to be in motion, and therefore the barn will contract. Now the pole does *not* fit. So the length contractions are not real, or in philosophical terms, they have no ontological status. This nicely holds the line with the interpretation of the Michelson-Morley experiment.

[3] It was Langevin's 1911 announcement of the twin-paradox that alarmed Bergson. He viewed this as an inappropriate interpretation and application of STR, voiding its invariance apsects. This precipitated his 1922 analysis (*Duration and Simultaneity*).

One could ask something however. Just like the jet-carried clock experiment, why not perform a pole-barn experiment? We could rig a mini barn-like apparatus with front-end and back-end doors that open and shut at great speed, or some analogy. The device would capture a mini-pole moving at high velocity precisely when it fits inside due to its length contraction. If we can so unhesitatingly predict that the jet-carried clock will slow down, why would we not predict that the mini-pole would contract and be trapped in the barn? But this would be admitting that the length contraction too is a very real effect. It would signal the end of any pretense of usage of the reciprocity of reference systems aspect of the special theory. At present, physics deploys the reciprocity feature for length contractions, and unhesitatingly dumps the feature for time-expansion. It therefore rejects the relativization of simultaneity as real and simultaneously (or not simultaneously?) accepts the relativization of simultaneity as real along with its block universe implication.

Those knowledgeable in this area may say, "But the twin paradox must be assigned to the General Theory (GTR)." This is due, it is thought (by some), to the accelerations involved with the rocket. Einstein's General Theory, developed after STR, deals with gravity and acceleration. This is obviously questionable on face value. If it is the twin's beard, i.e., the real, physical, obviously non-symmetric effect displayed in the aging that we are worried about, then the jet-carried clock and the meson's increased life spans must be sent to the GTR as well. These are just as real and just as non-symmetric. But I will deal with this later. Suffice it to say for now that this gambit only adds to the confusion. One quickly discovers that there is an "explanatory pea" shuffling between the General Theory and the Special Theory.

1.5 The Question for the Problem of Consciousness

Already a theory of consciousness has appeared (Smythies, 2003a) that assumes the standard vision of the implications of special relativity for time, namely that of the space-time block. Weyl, a physicist contemporary of Einstein, expresses the implications of space-time unambiguously:

> The scene of action of reality is not a three-dimensional Euclidean space, but rather a *four-dimensional world, in which space and time are linked together indissolubly*. However deep the chasm may be that separates the intuitive nature of space from that of time in our experience, nothing of this qualitative difference enters into the objective world which physics attempts to crystallize out of direct experience. … *Only the consciousness that passes on in one portion of this world experiences the detached piece which comes to meet it and passes behind it*, as *history*… (Weyl, 1922, p. 217, emphasis added)

Weyl's statement, implying that the experienced passage of time has no objective counterpart, would have had revolutionary implications had it truly been taken to heart. But relativists themselves do not seem to have been entirely clear on the implications of the concept of space-time, and the meaning of these statements had perhaps more radical ramifications than anyone cared to make clear to anyone. We will briefly examine these.

The 'Psychical' Observer

The extensions of time-extended objects are usually called "world-lines" in relativity theory, or sometimes "tracks." "An individual," says Eddington, "is a four-dimensional object of greatly elongated form. In ordinary language, we say that he has considerable extension in time and insignificant extension in space. Practically, he is represented by

a line – his track through the world" (Eddington, 1966, p. 57). The last five words – "his track through the world" – as Dunne (1927) pointed out, make his statement appear like hedging, for we must ask how the line can be both the observer and the observer's path. But Eddington makes clear within the same page that the track is indeed coincident with the observer, i.e., is the observer himself. "A natural body," he says, "extends in time as well as space, and is therefore four-dimensional" (p. 57).

Now the first problem that presents itself is the experience of the passage of time that humanity universally shares. If everything is given, if the universe simply exists as a four-dimensional, static block of space-time, then motion has become non-existent. "Changes then correspond to individuals moving along world-lines" – this is the acknowledgment of our experience of time's motion. But just what are these individuals? To any observer viewing such a system of fixed tracks or world-lines, the appearance of motion in the dimensions representing space could be produced by the movement of a three-dimensional field of observation along a track or fourth dimension orthogonal to the other three. Thus the field would simply "come across" events (as does the 1-D field of Figure 3). This time-traveling field of observation we can provisionally term a "psychical" observer, for the physical observer is defined as the track traveled over. This is exactly the move Smythies (2003a) accepted and utilized, envisioning "consciousness modules" moving along these tracks.

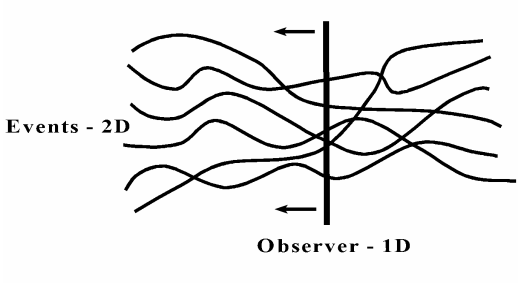

Figure 3. One-dimensional field traversing events in a 2-D universe

The relativists had a complex case to present, and the burden of a psychical observer, had it explicitly been acknowledged, would probably have been too much to bear. Not wanting to ignore the motion of time, however, expositors of this particular notion of space-time leave us with the non-committal statement indicating that the observer moves along his track, from which the reader may infer what he pleases. The reader usually proceeds to infer that the observer is nothing more than an organic, physical apparatus, and that this physical apparatus moves over its nebulous track in the fourth dimension. Obviously, however, a track that possessed reality to such an extent as to account for the physical characteristics of an imagined 3-D object moving along it would be, in every one of its cross-sections, physically indistinguishable from the object. Physically the track is the object extended four-dimensionally. Anything which we would consider moving along the track must differ from the track itself. Speaking of a body such as a clock or light ray moving over its track is conducive only to confusion, for the clock is physically a bundle of tracks and cannot move over itself.

Some philosophers, such as J.J.C. Smart (1967), have noted this inconsistency. Yet, respecting the static, "all is given" nature of the four-dimensional manifold, have voted solidly in favor of the concept that "there is no time." They see the passage of time as a pure illusion. Unfortunately, while they scoff at the absurdity of a psychical

observer or of "consciousness running along world-lines," they offer little to put in its place. *You must at least offer a "theory of the illusion.*" Even while Smart is writing his essays on time, his hand fatiguing, the ideas flowing by, he is experiencing the "illusion" in all its trickery. Whence then does the experience of the "passage" of time arise? At least the admittedly mysterious psychical observer tried to answer the question.

A Scale-less Manifold

But there is yet another thing, for we have no right to assign any particular time-scale to this manifold. We cannot envision it as it would appear to normal perception, for this perception already entails a summation over a vast history of events. If the event/world-lines the psychical observer is crossing comprise a "buzzing" fly, the choice of scales is infinite. The fly can be merely a phase in a field of vibrating strings, an ensemble of electrons/protons with no precise boundary, a fly slowly flapping his wings, or the buzzing fly of our normal perception. We would then have to account for the means whereby the time-traveling field determines scales.

Smythies would envision his traveling consciousness module as projecting a camera-like mechanism into the brain, observing the brain-tracks (Smythies, 2003b). Again, what scale is the "camera" observing – quarks, molecular activity, chemical flows? And how are any of these – quarks or whatever – unfolded into the world of golf balls and putting greens? This is simply what I have termed elsewhere (Robbins, 2002, 2007) the coding problem. How is the external world of golf balls and greens unfolded from this chemical/neural/atomic code? The contents of the tracks are supposedly projected on the consciousness module's "screen." Welcome to the homunculus, observing the screen. Nor are we clear why we seem to have a whole set of observation fields moving along in parallel and constituting humanity. Why are some of us not now fighting the Peloponnesian Wars – or are we?

In any case, we could exhaust ourselves on the metaphysical, epistemological, and psychological facets of the static block reading of the implications of STR. Had psychology considered it seriously, an immediate question might have been: why are we storing memory in the brain? Clearly all events are preserved in the 4-D manifold, and the brain itself is vastly four-dimensional. If our psychic observer can go forwards, why not backwards too? Or is storage merely an illusion in the first place as we are merely coming across things that resemble past sections of the track, sections corresponding to remembering events? These and other questions might have occurred.

One might wonder how STR can pose any dilemma for a theory of consciousness when relativistic effects such as time dilation only occur at any appreciable magnitude at extremely high velocities. The normal motion velocities of organisms seem such as to make STR's effects irrelevant. However, the strange implications being noted here – the inability to account for the experienced motion of consciousness, the spectre of "psychical" observers as a questionable solution to this, the curious questions about memory – are all simply functions of taking a static, four-dimensional block model of space-time seriously. This model in turn only has a possible reality if we take the relativity of simultaneity seriously (as did Smythies), i.e., as having ontological status. Proposed STR-effects such as the twin-effect, even though occurring at extremely high velocities, cement in the ontological status of these effects, and therefore the reality of the relativity of simultaneity. It is not the "extremes," for in the theory, the breakdown of simultaneity begins at the most minute of velocities. Further, as we shall see when reviewing the analysis of Hagan and Hirfjui (2001), whether or not the changes are taken as ontological, if STR is indeed valid, it places difficult constraints upon any theory of consciousness. Finally, in any case and regardless of discrepant orders of velocity, the Bergson model of perception, which I will briefly describe, generates a testable

prediction relative to action that contradicts an implication of STR, again, only if STR's effects are taken as ontological.

Let me state this emphatically: I am not denying the reality of increased life-spans of mesons, or retarded jet-carried clocks. These phenomena are very real. The crucial question is: *how they are explained*? If changes of space and time, *as currently explained by the mathematics of relativity,* are ontological, then the relativization of simultaneity must be real. We are forced to the static block universe. A theory of consciousness is then held by this constraint, despite the difficulties into which it would inevitably place psychological theory. Given all these immensely problematic and incomprehensible implications of the static block universe for a theory of consciousness, it is time to move to a different framework of thought on the subject. We shall now briefly view Bergson's solution to the problem of conscious perception, a solution that goes to the source of STR's problem.

2.0 Bergson and Time

Let us begin with the heart of the difference between Bergson and Einstein. The "microbes" in Bergson's comments are an index, in essence an index to the process of thought leading to the "objective" that Einstein must take to its logical conclusion. Bergson, in introducing them, had asked just what is the concept of "proximity" or "neighboring events" used in relativity to relate clocks to events? A microbe consciousness questions whether the clock and lightning bolt of the system of some observer are "neighboring." A micro-microbe questions the microbe's judgment of what is "neighboring"; a micro-micro-microbe does the same to the micro-microbe, and so on. Logically, we are forced to take this to its conclusion. There can be no accepted judgment of neighboring (and therefore of simultaneity) as we descend scales until we end at the mathematical point. The mathematical point is the essence of complete abstraction. The question is, is time found at all at this abstract point-event?

At the foundation of Bergson's theory (1896/1912) was already a critique of the *abstract* space and time implied in Einstein's theory-to-be. Abstract space, Bergson argued, is derived from the world of separate "objects" gradually identified by our perception. It is an elementary process, for perception must partition the continuous field that surrounds the body into objects upon which the body can act – to throw a "rock," to hoist a "bottle of beer." This fundamental perceptual partition into "objects" and "motions" is reified and extended in thought. The separate "objects" in the field are refined to the notion of the continuum of points or positions. As an object moves across this continuum, as for example, my hand moving across the desk from point A to point B, it is conceived to describe a trajectory – a line – consisting of the points or positions it traverses. Each point momentarily occupied is conceived to correspond to an "instant" of time. Thus arises the notion of abstract time – the series of instants – itself simply another dimension of the abstract space. This space, argued Bergson, is in essence a "principle of infinite divisibility." Having convinced ourselves that this motion is adequately described by the line/trajectory the object traversed, we can break up the line (space) into as many points as we please. But the concept of motion this implies is inherently an infinite regress. To account for the motion, we must, between each pair of points supposedly successively occupied by the object, re-introduce the motion, hence a new (smaller) trajectory of static points – ad infinitum. It is the core of Zeno and his paradoxes.

Zeno, Bergson held, was forcing recognition of the logical implications of this infinitely divisible, abstract space and time. With each step, Achilles halves the distance between himself and the hare, but he never catches the hare; there is always a distance,

no matter how minute, between pursuer and pursued. In the paradox of the arrow, the flying arrow occupies, at each instant, a static point in space, therefore, "it never moves." In all four of the paradoxes, it is the infinitely divisible space traversed that is the focus. Motion, Bergson argued, must be treated as *indivisible*. We view the indivisible steps of Achilles through the lens of the abstract space traversed and then propose that each such distance can be successively halved – infinitely divided. Achilles, never reaches the hare. But Achilles moves in an indivisible motion; he indeed catches the hare.[4]

But the abstraction is further rarified. The motions are now treated as relative, for we can move the object across the continuum or the continuum beneath the object. Motion now becomes immobility dependent purely on perspective. All real, concrete motion of the universal field is now lost. *But there must be real motion*. Trees grow. People age. Stars grow cold. Galaxies collapse. Bergson would insist:

> Though we are free to attribute rest or motion to any material point taken by itself, it is nonetheless true that the aspect of the material universe changes, that the internal configuration of every real system varies, and that here we have no longer the choice between mobility and rest. Movement, whatever its inner nature, becomes an indisputable reality. We may not be able to say what parts of the whole are in motion, motion there is in the whole nonetheless. (1896/1912, p. 255)

He would go on to note:

> Of what object, externally perceived, can it be said that it moves, of what other that it remains motionless? To put such a question is to admit the discontinuity established by common sense between objects independent of each other, having each its individuality, comparable to kinds of persons, is a valid distinction. For on the contrary hypothesis, the question would no longer be how are produced in given parts of matter changes of position, but how is effected in the whole a change of aspect." (1896/1912, p. 259)

Within the global motion of this whole, the "motions" of "objects" now become *changes or transferences of state.* The motion of this whole, this "kaleidoscope" as Bergson called it, cannot be treated as a series of discrete states. Rather, Bergson would argue, this motion is better treated in terms of a melody, the "notes" of which permeate and interpenetrate each other, the current "note" being a reflection of the previous notes of the series, all forming an organic continuity, a "succession without distinction," a motion which is indivisible. In such a global motion, there is clearly simultaneity.

The process of "objectification" which Einstein, in his response to Bergson, describes and accepts as leading us to the "real," to objective events, and which leads Stein to his "fleeting motions" of masses of "elements," is exactly the process warned of by Bergson. The "objects" of perception – purely practical partitions carved by the body's perception in the flowing universal field at a particular scale of time – are reified into the concept of

[4] There is a mythology that these paradoxes have been resolved by Russell (1903) and/or modern mathematics. While Bergson showed that all four paradoxes have exactly the same root cause in an abstract space, Russell, having missed the point, actually accepted the fourth paradox as a physical reality. The mathematical "resolutions" are inherently limited to a spatial treatment and, in "taking a limit," simultaneously invoke hand waving over infinity in the operation (cf. Bergson, 1907/1944, pp. 335-340).

abstract, independent "objects" and their "motions," and this is further rarified to "objective" space and time, with its objective, separable "events." And following this path, Einstein is consistent. These "objective," separate events are only mental constructs. They and their simultaneity are fully subject to the relativity logically inherent in their birth.

2.1 Physics on the Abstraction

Hence, to Bergson, Einstein's "time of the physicist" is an artificial time. It can be argued, however, that this (artificial) path is exactly the opposite of what physics has found itself to be following. The concept of abstract space and time – this "projection frame" for thought originating in perception's need for practical action – has been the obscuring layer that is slowly being peeled away. As Bergson argued, "...a theory of matter is an attempt to find the reality hidden beneath ... customary images which are entirely relative to our needs ..." (1896/1912, p. 254). The customary images are dissolving. The *trajectory* of a particle no longer exists in quantum mechanics. If attempting to determine through a series of measurements a series of instantaneous positions, simultaneously we renounce all grasp of the object's state of motion. In essence, as de Broglie (1947/1969) would note, the measurement is attempting to project the motion to a point in our abstract continuum, but in doing so, we have lost the motion. Motion cannot be treated as a series of "points," i.e., *immobilities.* Thus Bergson noted, over forty years before Heisenberg, "In space, there are only parts of space and at whatever point one considers the moving object, one will obtain only a position" (Bergson 1889, p. 111).

Lynds (2003), echoing Bergson, now argues that there is no precise, static instant in time underlying a dynamical physical process. If there were such, motion and variation in all physical magnitudes would not be possible, as they (and the universe itself) would be frozen static at that precise instant and remain that way. Consequently, at no time is the position of a body (or edge, vertex, feature, etc.) or a physical magnitude precisely determined in an interval, no matter how small, as at no time is it not constantly changing and undetermined. The inherent *uncertainty* introduced by this unceasing flow of time is the inescapable tradeoff required for the universe to change. It is only the human observer (enmeshed in the abstract space), Lynds notes, who imposes a precise instant in time upon a physical process. Indeed, Nottale (1996), noting Feynman and Hibb's (1965) proof that the typical paths of quantum particles are continuous but non-differentiable, now questions the fundamental assumption that space-time is differentiable, laying out a fractal approach to space-time, i.e., indivisible extents. The essence of differentiation – for a motion from A to B or the slope of a triangle – is division into ever smaller parts.

A matter-field in a global motion, wherein the motions of objects are changes or transferences of state, implies a simultaneity of causal flows. It also implies a framework for the problem of perception.

2.2 The Classical, Spatial Metaphysic and the Hard Problem

Abstract space and abstract time form what can be termed the "classical metaphysic." STR dwells solidly within this metaphysic; it is only a refinement of the metaphysic's implications. It is this metaphysic that resides behind the entire discussion of qualia and the hard problem (Robbins, in press a). As noted, the end result of this "principle of infinite division," even could we legitimately conceive of an end of such an operation, ignoring the mathematical hand waving of taking a "limit," would be at best a mathematical point. At such a point, there could exist no motion, no evolution in time of

the field. Further, as every spatially extended "object" is subject to this infinite decomposition throughout the continuum, then we end with a completely *homogeneous* field of mathematical points. The continuum of mathematical points then, both spatially and temporally, can have no qualities – qualities at the least imply heterogeneity.

That this is indeed the framework that the debate participants have tended to work within is attested to by a very common starting point, namely that the matter-field contains no qualities – objects have no color, there are no sounds, etc. This framework is also betrayed by the fact that the vast preponderance of examples of qualia are static – the "redness" of red, the taste of cauliflower, the feel of velvet, the smell of fresh cut grass. Seldom are qualities of *motions* ever discussed, e.g., the "twisting" of leaves, the "gyrations" of a wobbling, rotating cube, the "buzzing" of a fly. This glaring lack is coordinate with the fact that an abstract "time" that is simply another dimension of the infinitely divisible space is equally completely homogeneous. Any "motion" in this space, logically, has no duration greater than a mathematical point, then another point, then another. In fact, then, the debaters universally fail to realize that the perceived time-extents of these motions – the rotating cube, the buzzing fly, the whirling of the coffee surface with circling spoon – are equally *qualities* that arise, just as problematically as the "static" colors of objects, in the homogenous time dimension of infinitely divisible instants in this continuum (cf. Robbins, 2004a, 2007).

Galileo, in initiating this metaphysic, equated the *real* with the quantitative (cf. Manzotti, 2008). Qualities, he felt, were contributions of the "living organism." From this arose the distinction of primary and secondary properties of matter. Shape (form) is considered part of the quantitative realm and thus considered part of the "real," not a quality therefore and not part of the hard problem. But the concept of a static instant is a fiction. This is why Galileo was even wrong when he assigned shape or form to his "quantitative" continuum, while thinking he was excluding qualities (contributions of the mind) therefrom. There is nothing static in the ever-transforming material field. The "edges," "vertices" or "surfaces" of a rotating cube do not exist in an instant. Nor its color. There are no "instants." The brain, simply a part of the ever transforming flux, cannot use in its computations what for it does not exist. Even form can only be derived by imposing constraints (invariance laws) over ever flowing fields (Figure 4). For a "Gibsonian" cube, the "edges" and "vertices" are but sharp discontinuities in these flows. Thus, Weiss, Simoncelli and Adelson (2002) argued, in developing a Bayesian model of form based on velocity flows, that form is always an *optimal* percept, based on the best available, but inherently uncertain, information. In essence, even the most veridical of forms is simultaneously an "illusion," but yet the best partition of the transforming field the brain can offer.

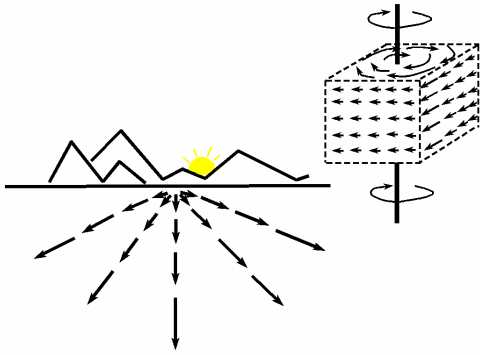

Figure 4. Optical flow field. A gradient of velocity vectors is created as an observer moves towards the

> mountains. The flow field "expands" as the observer moves. At right, the flow fields over the side of a rotating cube – expanding as the side rotates towards the observer, contracting as it rotates away, with the top a radial flow field. (Robbins, 2004a).

"Form is only a snapshot of a transition," said Bergson (1907/1944, p. 328). The eyes are continually in motion. Objects eventually disappear when, in experiments, the position of the object is fixed relative to retinal motion. The brain is at a loss in a static world. The brain is, and is embedded in, an ever flowing material field; it is tuned to this fundamental aspect of reality, and form is obtained by the application of constraints across these flow fields – information inherently uncertain due to the non-fixity.

The misconception of "static" form, derived from the classic metaphysic and Galileo's misassignment of form to the "quantitative," underlies the qualia debate participants' failure to grasp that the issue being addressed is the problem of the origin of the *image* of the external field. All seem to think that the origin of the image of the *forms* of the external world is no problem – these are easily "computable" and hence the image itself is no problem, only its "qualities." They fail to grasp that the origin of the image of the forms in the field and of the objects in the field is just as much a problem as the (other) "qualities" of the field – the "rednesses," the "velvets," etc., etc. *None* of these is simply "computable." *It is the origin of our image of this field, any image, that is the problem*.

The brain is integrally a part of the abstract continuum of the classic metaphysic. Therefore, when light rays strike objects termed eyes in brain, the abstract, homogeneous motions of the external matter-field, all reducible in time-extent to mathematical points, simply continue in the portion of the field called the "brain." Nowhere in the brain, taken as part of the abstract continuum, can there be anything but more homogeneous points/instants. There can be no actual time-extent of motions through the nerves, no "continuity of time-extended neural processes" – the logical time extent of any neural process is never more than a mathematical point, then another, then another. However one views these motions within the brain, e.g., as maintaining some structural correspondence or isomorphism relative to the always past trans-formations in the external field or as the processing of invariants in this structure of field motions relative to the body's action systems, it changes nothing. Within the brain, taken as a part of this abstract, homogenous continuum, we can never derive qualities, whether qualities of objects (colors, smells) or of time-extended motions (ignoring that the "object" *is* a motion). We cannot explain how we see a cube "rotating" let alone a "blue" cube. Therefore, all qualia are logically forced, within this metaphysic, into the non-physical, or the mental, or somewhere, anywhere but the abstract continuum. But the step by which this generation of events unto and into another realm can occur, *within the confines of the metaphysic*, remains a dilemma. The structure of the metaphysic makes the step impossible, while leaving the nature of realms outside the structure – e.g., the "mental" – forever incapable of definition or of use to the science that currently operates precisely (though reluctantly less so) within this metaphysic.

2.3 Bergson on Perception

Bergson's "temporal metaphysic" is equally important to both physics and psychology. For psychology, it provides a very different framework for approaching the hard problem. In this temporal metaphysic, the indivisible or non-differentiable motion of the material field forms an elementary property of *memory* in the field's motion – each (now past) "instant" does not cease to exist as the next (the present) instant appears. It

is this "primary memory" – an attribute of the time-evolution of the material field – that supports our perception of "stirring" spoons, "twisting" leaves, "rotating" cubes. Quality is now inherent in this motion of the material field. At the null scale of time, the field is near the homogeneity envisioned by the classic metaphysic, but at ever larger scales of time where the oscillations of the field (e.g., the 400 billion/sec oscillations of the field as a "red" light wave) are "compressed" in the experience or glance of a moment, we obtain ever differentiating quality.

Bergson realized in 1896 that this field is holographic – the state of each "point" in the field is the reflection of, carries information for, the whole. Noting that there is no "photograph" of the external field developed in the brain, he stated, "But is it not obvious that the photograph, if photograph there be, is already taken, already developed in the very heart of things and at all points in space. No metaphysics, no physics can escape this conclusion" (1896/1912, p. 31). But, as opposed to Pribram (1971), the brain is not simply a "hologram." Rather, to place Bergson's view in modern terms (Robbins, 2000, 2002, 2006a, 2006b, 2009, in press a), the brain is the modulated *reconstructive wave* "passing thru" the external, holographic matter-field. This brain-embodied reconstructive wave is specifying, always, an image of the *past* motion of the material field – a buzzing fly, a rotating cube. The fly's wing-beats being specified have long gone into the "past," but the indivisible motion of the field supports this past-specification. The image is right where it says it is – in the field. It *is* the field – the past of the field – at a specific scale of time. The brain dynamics supporting the specification determines this scale of time. The chemical velocities underlying these dynamics are responsible for this. Begin increasing these velocities (equivalently, the energy state) significantly – the fly transitions, from a buzzing fly, to a fly barely flapping his wings like a heron, to a motionless being, to a vibrating, crystalline structure, and on. Again, scale implies quality. We have specification of a qualitative field at a scale of time. This wave, specifying a portion of the field, need not cease during saccades.

The continuous modulation of the brain (as a wave) is driven by the invariance structure of the external events (Robbins, 2008, in press b), e.g., the velocity flows defined over the sides of the cube as it is rotating conjoined with its recurring symmetry period. Due to the continuous motion of the field, this information is always inherently uncertain – we have always an optimal specification of the past motion of the field. In holography, a reconstructive wave, passing through a hologram and successively modulated to different frequencies, successively *selects* information from the multiple, superimposed wave fronts originally recorded on the hologram, and successively specifies each – a toy ball, a cup, a truck. If modulated to a non-coherent (non-unique or composite) frequency, it specifies a fuzzed superposition of the three. There is no "veridical" selection. So too, the brain, as a reconstructive wave, is selecting information from the transforming matter-field, where the principle of selection is based on information (invariance) relatable to the body's action systems – hence the intimate feedback to and from its motor areas. In Bergson's succinct phrase, *perception is virtual action*. The heron-like fly slowly flapping his wings is also a specification of the action possible to the body at this new scale of time, in this case, modulating the hand to leisurely catch the fly by the wing.

Given the holographic properties of the field, where the state of each "point/event" reflects the mass of influences from the whole, simultaneously therefore a state of very elemental "awareness" of the whole, and given the field's indivisible motion defining a primary memory, there is implied, at the null scale of time, an elementary form of awareness defined throughout the field. This is a field property. It is not elementary "constituents" with ad hoc intrinsic and extrinsic properties that must be "composed."

This is the old metaphysic, spawned from perception's derivation of "objects" and "motions," still speaking. The specification, then, is simultaneously to a time-scale specific form of this vast, taut "web" of awareness at the null scale. This form of specification holds for frogs, for chipmunks and for humans. At the null scale, there is no difference between subject and object. Run the scaling transformation in reverse. The fly transitions – initially waves in the field undifferentiated from the perceiving subject, it becomes a crystalline, vibrating being, then becomes the motionless fly, then the heron-like fly slowly flapping his wings, then the buzzing fly of normal scale. Subject is differentiating from object. This is the meaning of Bergson's statement: "*Questions relating to subject and object, to their distinction and their union, must be put in terms of time rather than of space*" (1896/1912, p. 77, original emphasis).

The body/brain as a modulated reconstructive wave passing through a holographic universal field, specifying a virtual image of the past motion of the field's non-differentiable motion, and reflective of possible action at a particular scale of time – this is the elegant solution of the universe to the problem of specifying an image of the external world for its living organisms. Nearly fifty years before Gabor, this was Bergson's insight.

3.0 Special Relativity and Perception

For Bergson, the perceived world is the reflection of the possibilities of bodily action. Again, succinctly, perception is *virtual action*. As noted, the fly buzzing by, his wings ablur, is an index of the possibility of the body's action. Were the fly flapping his wings slowly, like a heron, this would be an index of a yet different possibility, in this case, reaching out slowly and grasping the fly by the wing tip. Note that in each case, this index is simultaneously reflective of a *scale of time*, also a feature of our perception.

That perception is indeed virtual action is indicated by our modern understanding of the processing areas of the brain with their reentrant connections. For example (simplifying greatly), visual area V1, which initially receives the retinal signals, projects to V4 (simple form processing) and V5 (motion processing). Simultaneously V4 and V5 project diffusely back to V1, modulating V1's processing. While the visual areas project to the motor areas, simultaneously the motor areas feedback to the visual areas, modulating visual processing. In fact, counterintuitively, if we simply sever the connective tracts between the visual areas and the motor areas, the subject goes blind (cf. Weiskrantz, 1997).

But supporting this resonating feedback in the neural architecture, there are underlying chemical velocities. It is the base rate of these chemical velocities that determines our normal scale of time, e.g., the world of normally "buzzing" flies. Chemical velocities are subject to modification by catalysts. Were a catalyst (or catalysts) of sufficient strength introduced into the systems underlying the computation and preparation of action, increasing the velocity of chemical processes, then we could expect that the time scale of perception would change. In principle, catalysts of sufficient strength would now allow the system to specify a heron-like fly, barely flapping his wings. By the principle of virtual action, this view of the fly is precisely a specification of how the body can act.

The change of scale and form for the fly is not merely "subjective," or a "subjective modification" of experience. This is an objective effect. Virtual action, straightforwardly, makes a prediction on action relative to the increase or decrease of the velocity of underlying processes. In principle, this is a testable consequence albeit difficult today. The question is, does Special Relativity also make a prediction, and if so, what?

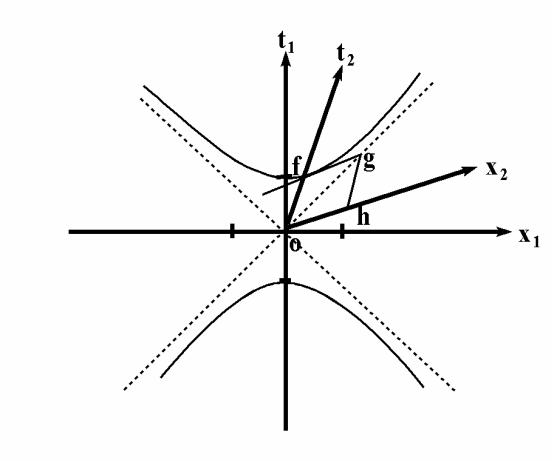

Figure 5. The Minkowski diagram.

Let us consider the case of two observers, X and Y. We take the X system to be stationary, and Y moving relative to X at high uniform velocity. Assume there is a fly in X's system. X, at his normal velocity of processes, i.e., at his time-scale, perceives the fly as a blur. The fly, which X is observing, travels one of X's distance units using sixty wing-beats. It does this in one of X's time units, say a second. Y, moving at great velocity, has much expanded time units (and contracted space units), the time units increasing as he moves nearer to the speed of light. However, this is as X computes these units relative to his stationary system. The complimentary case is Y's (in motion) view of the space-time of X. The Minkowski diagram (Figure 5) shows this situation. The rhombus OFGH is gradually collapsing like a scissors as the velocity of Y increases. The tangent to the hyperbola, GF, drops lower and lower below X's time unit, displaying that the time units of X, as Y sees them, are contracting steadily. Eddington (1966) had us imagine that at O, X lights up a cigar that lies along x_1 and has a very longish length of one space unit. The cigar burns one of X's units of time, being represented by the line t_1 and extending to its first unit. Y would now see the cigar as burning longer for X, in fact, as the tangent drops as v increases, it would last many units of X as assigned by Y. This could equally be X himself, aging (a form of "burning") many more time units than Y. Simultaneously, the space units of X, as Y sees them, are increasing. Thus note that GH would fall outside the space unit of X – the cigar is longer.

Now it might be said that the fly, flying the length of the cigar lying along x_1, is flying a longer distance as far as Y is concerned since he determines X's space units have expanded. But the distance that the fly traverses in sixty wing-beats – however great or small the distance is *measured* to be – this distance holds a fundamental "causal flow" or invariant that relativity and its measurement procedures cannot alter. If we mark this distance by two markers, A and B, the fly will buzz from A to B in sixty wing-beats, no matter what the reference system from which he happens to be viewed. It is the "sixty wing-beat distance invariant." We start from this. The fly flies this distance every day, from the cereal bowl to the sticky spoon on X's table, in sixty wing beats. Relativity, simply because Y goes into motion, contains no inherent justification for altering this.

Assume that the rocket is moving at 80% the speed of light. Given Y's view of X as having contracted time units, the same sixty wing beats require 1.66 seconds as assigned to X by Y. So, now we partition this sixty wing beats (an invariant causal flow) across the 1.66 seconds. In X's normal system, at sixty wing beats/second, there are six wing beats in each $1/10^{th}$ second, and X can normally perceive or discriminate one wing-

beat per 1/10th second. Thus at six beats per each 1/10th second, he sees a blur. In the new partition assigned by Y, with sixty beats partitioned over the 1.66 seconds, X sees only 3.6 wing beats in each 1/10th second. It is less a blur. The fly appears to be buzzing more slowly. X's time (his perception of the rate of events) is slower, despite the fact that his velocity of processes has not changed. This is clearly absurd, yet this is exactly what is required of the world of X if we ignore reciprocity, and if these transformations are ontological enough to support Y's eventual return as more youthful than X.

On the other hand, there is the effect on Y, whose time units are expanded and space units contracted. In Y's moving system, a fly is buzzing across the table in the rocket cabin, again using sixty wing beats from A to B. It requires only .6 of the expanded Y-second for the distance to be covered. The invariant sixty wing beats are partitioned across this amount, therefore becoming ten beats per each 1/10th second, and thus the fly is now more of a blur, despite the unchanged velocity of processes. It can be argued, just as Eddington notes, that due to the rocket's velocity, Y's processes are retarded. But in fact everything in Y's reference system is retarded, to include the fly and its buzzing from A to B. In effect, we have simply subtracted a constant across all motion values of the system, and the problematic modification of perception just noted still holds. In essence, psychology contradicts physics.

In this analysis, I have stayed consistently within the implications displayed in the Minkowski diagram, that is to say, within the case where Y is consistently the one in motion, X stationary. If we want to set X in motion, we need another diagram, and the situation simply reverses.

3.1 The Role of Reciprocity

What is wrong here? There is the strange picture of Y's view of X's altered perception of events in X's own system. But let us ignore this. One aspect of the problem is more elementary. As noted, when we represent the situation of X and Y in the Minkowski diagram, we have fixed on one observer, X, and set all other systems in motion relative to him. The Minkowski schema represents the adjustments in time and space units necessary to preserve light-velocity invariance for all other systems. But it cannot represent reciprocity. We could equally have fixed on Y and set all other systems in motion with respect to *him*. This, again, requires another diagram, and so on for each observer upon whom we fix.

Given this, we must ask the fundamental question: is the effect on either X or Y a real effect? Y, we know, could equally declare his system to be at rest, and X in motion relative to him. Clearly, the effects cannot be real from this perspective. The different "times" and "distances" represent only the observer's method of keeping his measurements consistent with light-velocity invariance. STR, from this perspective, fails to justify, either for X or for Y, a different perception of the fly based on the observer's motion. If we respect the inherent reciprocity of reference systems in STR, there is no contradiction with the relativity of perception. STR is at worst neutral with respect to a causal flow in time (the fly) invariant to both X and Y. Only if we insist that STR implies a real effect is there a contradiction.

It must be clearly understood here that I am not denying the empirical facts, e.g., increase of life spans in mesons, or the retarded clock carried by the jet, or increases in mass. The empirical evidence is not in dispute. These are real effects. What is in dispute is the use of STR to explain the empirical evidence; it is used inappropriately in attempting to do so. The structure of reciprocity intrinsic to STR is being ignored.

3.2 Half-Relativity

"Half-relativity" is what Bergson (1922/1965) termed the asymmetric use of STR. The Lorentz equations are applied to the meson; the life span increase falls out via t'. End of explanation. As noted already, A. P. French (1968), in a textbook that attempts to maintain clarity, in a section entitled "Relativity is Truly Relative," flatly states that the time dilation (just as the length contraction of the Michelson-Morley apparatus) as observed for a meson is not a property of matter but something inherent in the measurement process. He goes to the rare extent of actually showing *two* Minkowski diagrams, one for each observer (as though there were a small observer on the meson), to show the symmetry of the changes in *each* system. Just as Bergson (1922/1965) argued earlier, French notes that were an observer to compute t' as the meson falls to the earth, the tiny observer on the meson is equally allowed to say that he is stationary and the earth moving towards the meson. This is to say we have here, in French's terms, a "measurement effect." Thus, when French treats the twin paradox, he invokes the *asymmetry* introduced when the twin on the rocket turns around to return, therefore introducing a new inertial frame (pp. 155-156). STR is used to compute the different (shorter) "time" of the traveling twin for each leg of the trip, thus ascribing the magnitude of the difference to v (the rocket's velocity). But he assumes, in conjunction with this, that it is the asymmetry introduced by the turn-around that is required to support the real (aging) effect, i.e., as *a real property of matter*. Clearly, if one twin is now gray and has a long beard, we have a change that is a real property of matter. Thus he argues that STR, factoring in this asymmetry associated with the turn-around and its acceleration, and due to the fact that a time difference value can be derived due to v, can indeed handle the twin paradox. Yet he has earlier painstakingly built the case, to the point of doubled Minkowski diagrams, that the structure of STR demands symmetry (reciprocity), and given this symmetry, it does *not* explain any changes as real properties of matter.[5] In essence, the entire explanatory burden for aging as a real effect now falls on the asymmetry introduced by the change in inertial frame. But where is this theory, i.e., *where is the theoretical framework supporting how and to what magnitude introducing an asymmetry affects the physiological processes underlying aging*? Or why the asymmetry can be introduced into STR? More precisely, where is the theory that explains how introducing an asymmetry now allows the use of the Lorentz equations independent of, or outside of, the symmetric, reciprocal structure provided in STR?

In the comparison between X and Y above, we only asked Y to be in uniform relative motion at velocity v, just as in the meson case, just as in the Michelson-Morley case. This comparison could care less about Y's return or differential accelerations. We don't need a rocket. While X sits by the kitchen table watching the fly, Y could travel by on his tricycle, and the same relativistic laws hold.[5] Nevertheless, there are those that would simply classify this case as the twin-paradox, invoke the existence of accelerations, and move the problem and the effects involved into the General Theory. All of the effect can then be assigned to acceleration(s). This reaction is extremely problematic. If we seize upon any accelerating component of a motion (which one can always find, even for the startup of the tricycle) to allow us to get to the safety of the

[5] I have been posed one objection or "solution" to this problem stated as follows: "The twin leaving and returning on the rocket ages less because his worldline between departure and return is shorter. And the length of the worldlines is observer invariant." This is a strange misconception and misstatement. The "observer invariance" is only defined within the structure of symmetric (reciprocal) transformations created by both observers. There is no "invariance" with but one observer. But then it is this very symmetry that makes it impossible to use relativity to explain changes as real properties of matter.

GTR, then what if anything is the province of STR? The physics would be in danger of becoming a shell game, shuffling an explanatory pea between STR and GTR. If we are doing this to avoid reciprocity, then the argument that STR, with its inherent reciprocity, fails to explain any of these effects is effectively conceded, and this lynchpin in its being a theory of time – its ability to explain these effects – is removed.[6] Note again, it is not the aging effect, it is *all* asymmetric effects – jet carried clocks or long living mesons – that would have to be so moved into GTR for consistency. One dismisses the above comparison of X and Y into the GTR then only with difficult consequences.[7]

Thus others (as well as French) have argued, as Eddington (1966) appeared to believe, that the twin-effect is perfectly consonant with STR. But to stay fully within the context of the Special Theory without bringing in gravitational field changes, Salmon (1976) envisaged a rocket ship (A) departing earth and passing another (B) coming in the opposite direction at the same velocity. At the point of meeting, the two exchanged signals to coordinate their clocks. B continued on to earth where clocks were compared, and of course, in a triumph for the theory, an earthbound observer's clock showed a greater passage of time than B's. This appears to be ironclad, yet there is a problem. Reciprocity has not been avoided. The observer in A takes with him his own reference system. Since no reference system is privileged, he has equal right to declare himself at rest and everything else in motion relative to him, including the earth, the earthbound observer, and the earthbound observer's clock. When B passes A and signals are exchanged, will they then reflect a decrease in the rate of A's time? Hardly, given A is at rest. Only the author of the argument happens to believe A is in motion, but he forgot to ask A.[8]

[6] Brillouin (1970) would argue that a reference system must be very massive to reduce all action-reaction effects. The tricycle, let alone an abstract "coordinate system," would not qualify in his opinion. The same point however can be made with a more massive system going by the table. But I do not believe that Einstein was concerned at all with this distinction, the geometry being the overriding consideration.

[7] The comfort of assigning this to the GTR arises from the tenet that acceleration breaks the symmetry or reciprocity of systems. I am aware that this is a fundamental tenet of GTR, but it is yet possible that the original analysis by which this tenet was derived is subject to question. Bergson argued simply that acceleration cannot be distinguished from velocity in the sense relativity claims – velocity is a rate of change in position over time, acceleration simply the rate of change of the rate of change of position. Wang (2003) refines this argument, deriving the generalized Lorentz equation for t' in the context of acceleration. If we cannot integrate over infinitesimal velocities, he argues, as did Bergson also, we have undercut all of physics. Wang's equation completely undercuts any appeal to the GTR due to acceleration in the twin paradox; in fact it implies a question to the foundation of GTR.

[8] Davies (1977) resolves the twin paradox by flatly assigning the aging differential to the turn around at the target star and the homeward acceleration of the rocket (pp. 43-44). Yet, like French, he applies the Lorentz equations, claiming that he has also preserved the symmetry, a fact his table of durations (p. 44) obviously belies, for only the rocket clock shows a consistent, time-expanded 4.8 light years for each leg – the rocket is clearly the only object moving to Davies. Davies (1995) drops the clear emphasis on acceleration as the root cause of the aging. He does declare there is no paradox because the symmetry is broken due to accelerations in the necessary stop and return of the rocket, but never mentions this again. Ignoring the consequent inapplicability of STR, he again proceeds to apply the Lorentz transformations (with what justification?). In essence, he notes that that at 80% of the speed of light, earthbound twin Ann would see the clock of the rocket-twin (Betty) as running .6 of earth-Ann's. Symmetrically, rocket-Betty, viewing herself as stationary, sees earth-Ann's clock as running .6 of Betty's. This

The twin-paradox is disturbing precisely because it epitomizes, very concretely, the inconsistency relative to standard use of STR. It highlights a very real effect, e.g., a youthful man versus a hoary old one, that cannot simply be assigned to a measurement process. Interestingly, Einstein himself, in a (little known) 1918 article, attempted to preserve reciprocity and the asymmetrical effects together by arguing that indeed the rocket ship could be considered stationary, its motors only neutralizing the pull of the earth as the earth recedes.[9] But he then argued that it would require such tremendous field changes to move the earth and bring it back that the earth twin would undergo rapid aging. The reciprocity and the paradox denying the reciprocity appear resolved (just as French argued). But now, ignoring the ad hoc, physically unrealizable fields, it is not clear of what use relativity is here at all. Its mathematics, with its intrinsic reciprocity, now does not accurately describe the phenomenon – we can clearly distinguish the two systems via gravitational effects – and it would seem logically prior to have a theory relating gravitational changes to a model of the physiological processes driving aging – this in itself being sufficient to account for the phenomenon without appealing to changes of "time" itself. The one-way application of the Lorentz transformations would then appear in retrospect to be but a convenient empirical description of these events, but a deeper theory would provide a model of the processes involved (as Lorentz himself attempted).

3.3 The Half-Relativity of 1905

Einstein, for all practical purposes, began assigning real effects due simply to v, ignoring reciprocity, in 1905. In the paper, he quickly invokes the reciprocity implied in the first postulate, having us envisage a rigid sphere of radius R, at rest in the moving system (1905/1923, section 4, p. 48). At rest relative to the *moving* system, he notes, it is a sphere. Viewed from the "stationary" observer, the equation of the sphere's surface gives it the form of an ellipsoid, with the X dimension shortened by the ratio $1:(1 - v^2/c^2)^{1/2}$. He notes (the reciprocity) then immediately: "It is clear that the same results hold good of bodies at rest in the 'stationary' system, viewed from a system in uniform motion" (1905/1923, p. 49). Two paragraphs from this point he notes the "peculiar consequence" that were there two synchronous, separated clocks A and B in the stationary system, and if A is moved to B with velocity v in time t, it will lag behind B by $\frac{1}{2}\, tv^2/c^2$ (section 4, p. 49). The structure of reciprocity is already being voided here – we are dealing only with an effect in the stationary system, not relating the two systems. The observer in the stationary system can simply move the clock from A to B to fulfill Einstein's condition, and the effect is simply ascribed to v. This conclusion is quickly reinforced. Within another paragraph, Einstein, extending this to "curvilinear motion," states flatly that this result implies that a clock at the equator must go more slowly, by a small amount, than one situated at the poles (p. 50), i.e., again two clocks in the same system. Physicists accept this equatorial clock retardation naturally as a real effect. The effect had to be factored in to Hafele and Keating's jet-carried clock experiment. Yet

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symmetry holds for each leg – the outward and the homeward bound. In Davies's scenario, it is rocket-Betty who returns having aged less, not earth-Ann, and he claims that he has resolved Dingle's (1972) critique that in this case, "each clock runs slower relative to the other," in other words, a critique which says precisely that there can be no ontological status here. Given the symmetry he took great pains to describe, Davies conveniently never tells us why earth-Ann does not also have the distinction of aging less.

[9] A translation of this paper is discussed in Dingle (1972, pp. 191-200).

reciprocity demands that the clock on the equator be stationary, the observer at the pole spinning around. Now it is not a real effect. This is likely not very tasteful. Yet this conclusion regarding v as already producing real effects in 1905 is doubly reinforced when it is considered that the equator-clock is an exact analogue to Einstein's future thought experiment (introducing GTR) of the rotating disk. Now the observer leaves the center of the disk, moving along a radius to the rim and back, while carrying a clock. Upon his return the clock is retarded. The thought experiment used this result as a very real effect. Yet why? The observer takes with him, at every point he occupies, his own proper time. He should return with the clock unchanged.

Why is the problem of "real effects" significant? There are three reasons. Firstly, if STR is being used inappropriately as an explanatory device where the one-way use of the mathematics just happens to work, then physics should be searching for the true explanation. It could be extremely instructive, if only for the apparent return of the ether, which formerly housed some of these effects (again, in Lorentz's mind for example), in more sophisticated form as the quantum vacuum.[10] Secondly, there is now the contradiction with the psychology of perception just discussed and which I hope would merit at least some review. Thirdly, if we cling to the idea that STR can explain real, asymmetric effects, then we are equally clinging to the reality of the relativization of simultaneity, i.e., to the *real* breakup of simultaneity into successive moments in time, and vice versa. It is this implication that I wish to further question.

4.0 The Relativity of Simultaneity

In Figure 6 we picture three points, A', B', and C' in Y's moving system placed along the direction of this motion. Each will be a distance L from each other. We will assume Y is at point B', and the system is moving with velocity v. From the viewpoint of the stationary X, these three events are not simultaneous. The clock at A' registers a time slightly behind that of B', while the clock at C' is somewhat ahead. The greater the value of v, the greater this lag and lead time respectively. Both times are given by Lv/c^2 seconds. As v approaches the speed of light c, the maximum difference becomes L/c seconds.

[10] There are probably any number of ways, for example, to account for the life-span increases of mesons without resort to the mystical "changes of time" required by STR. Thomson's model of the electron, as just one possible example of an approach, saw the electron as a special case of an electric current. In motion, a current naturally generates a counter-EMF – a resistance to its own motion, a resistance increasing with velocity, unto a singularity at light velocity. So too would a single electron. Now if the meson is a group of electrons and positrons, where the positrons radiate away the group's energy as a function of a certain synchrony, this being "decay," then putting the group in motion will retard this radiation, the decay rate ever decreasing with speed, and increasing its lifespan. (Cf. for example, Aspden, 1969, 1972; Kessler, 1962).

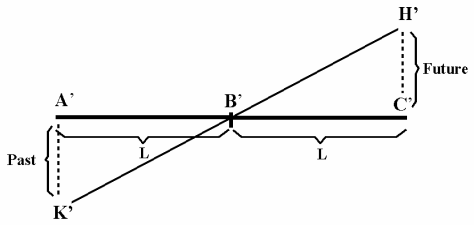

Figure 6. Planes of simultaneity (cf. Bergson, 1922/1965).

If we drop a perpendicular from A' to K', this line will symbolize all the past events at A'. Since we see that the clock is slow at A', and Y then supposedly looking at past events, this line displays the maximum reach into this past. Likewise the line upwards from C' to H' shows the maximum of the future. Now we can draw yet another line of simultaneity, this one running to (hypothetical) points D' (between C' and H') and E' (between A' and K'). Its divergence from the original line A'B'C' is a function of the speed v. Further, were the difference in v between the X and Y systems infinitesimally small, there would be a line barely divergent from A'B'C' representing the fact that at even the most infinitesimal velocities, we see the breakup of simultaneity begin, radiating from the most minute point or distance from B', increasing in degree towards A' and C'. There are any number of such lines.

What is the reality here? Imagine that Y is moving at an infinitesimally small velocity relative to X. For practical purposes, X's line ABC and Y's line A'B'C' are virtually coincident. But yet, even at the most minute velocity, simultaneity has begun to break up at the most infinitesimal point or distance from B, increasing in degree as we approach A' or C'. Now Y moves at a much higher velocity. X now notes the difference in Y's clocks. He is forced to assign events at A' deeper and deeper into Y's past as v increases, and to assign events at C' farther into the future. He does this by the very fact that he needs to keep the velocity of light invariant as per the Lorentz transformations. But Y can equally say he is at rest. He continues to note the simultaneity of events at A', B', and C'. He now notes the same breakup of simultaneity for X. Again the question becomes, is the conversion of simultaneity to succession real? Is it more than a notational convention required for the consistency of measurements between the two systems? Can this possibly be true of the flow of time?

4.1 The Simultaneity of Flows

The intuition of a universal flow is partially preserved in relativity in the conservation of a "causal order." On analysis, we will find multiple causal orders or flows within this flow as Bergson noted or even, as Gibson insisted in the opening quote, where hero rushes to save the endangered heroine. The simultaneity of flows is integrally bound to causal order and to a global transformation wherein the motions of "objects" are transferences of state. Consider two football players running down each sideline of the field at precisely equal velocity. A physicist (O_1) at the fifty yard line notes the time against two synchronized clocks on each sideline as the players run by and ascertains that they have passed the same point simultaneously (Figure 3, e_1 and e_2). Of course a

second physicist (O_2), thinking the first in motion and noting this observation says the first is in error, the events were not simultaneous. Yet the two football players continue on, converging on a football equidistant from both that they both kick simultaneously (e_3), kicking the ball twice as far as just one would have achieved. From the perspective of an instantaneous measurement, i.e., abstract time, their simultaneity is relativized. From the perspective of the two causal flows, the simultaneity of the flows is absolutely real. The second physicist cannot deny the effect of the simultaneous kick. One cannot simply relativize multiple causal flows.

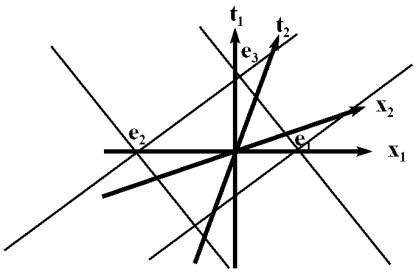

Figure 7. Two football players (e_1, e_2) converge on the ball (e_3).

It can be argued that e_1 and e_2 are not truly simultaneous just as O_2 states, that simultaneity is achieved only at the point-instant of the kick. But we could replace the football players equally well with a huge cue stick sweeping down the field towards a billiard ball. Positioned at each yard line are O_1's measurement clocks. If the cue's outside edges truly fail to pass the measurement clocks/points simultaneously, it will hit the ball at a slant sending it off at an angle. In sliding the x_1 , x_2 and t_2 axes upwards towards e_3, it can be seen that there will come a point as our very wide cue nears the ball at e_3, that e_3 will fall in the causal elsewhere of the light cones of each of the edges (e_1, e_2). This implies that the two outer edges could not possibly be squared in time for a flush contact of the entire cue surface with the ball if they are as non-simultaneous as claimed by O_2. The global causal flow led by the cue's frontal surface is fragmenting under STR's treatment. Yet the cue strikes the ball precisely perpendicularly. Only one strand in this flow, one local flow, the causal order in STR invariant to both observers, is ultimately preserved. This is the chain of causal relations, <, the relation determining time-like and space-like events, defined upon a sequence of infinitely minute point-instants extending through the time line t_1 to e_3. Were we considering the fly, no matter how infinite the "points" we place on this line, or the in fact multiple lines comprising the fly, this will remain sixty wing beats – an indivisible movement or flow. A global flow, whether fly or cue stick or hero and heroine, cannot be an invariant to all observers in STR.[11]

[11] A comment on concepts expressed in Myrvold (2003) is appropriate here. Myrvold considers the relation eRe' (where R = "realized with respect to") in the context of *extended* objects. This requires taking a spacelike slice – in effect an instantaneous stage along some foliation of the object's history. Failure to do this results, he notes, in paradoxes like the "pole and barn," where, with the barn at rest and the pole in high velocity motion through the barn, there is a period where the pole just fits inside the barn, and conversely, with the pole at rest, and the barn

We must ask what is the causal validity or efficacy of this one local point-instant flow? The breakup of simultaneity, as we have earlier seen, drives downwards in space-time to the most infinitesimal of point-instants. At this mathematical point, as earlier noted, there is neither time nor events. As such, without the possibility of even an event, it is impossible to say that there is anything causal whatsoever with respect to this point, or with respect to a "causal" chain of such points. The abstract space and abstract time that support the classical concept of causality offers again an infinite regress. If this chain is infinitely divisible – an infinite set of "point-events" – then between each point we must introduce a "causal relation," which is in effect to say a motion ad infinitum. Causality too will require indivisible extents. The fly, as a coherent biological system doing his sixty wing-beat trip, is precisely a global, indivisible flow. Were he taking his sixty wing beat trip to e_3, the tips of his wings will stop precisely simultaneously, O_2's measurements to the contrary notwithstanding. When it was insisted earlier that this sixty wing beat flow be treated as invariant to both X and Y, this weakness inherent in STR's treatment emerged.

In the above, I have not attempted a formal definition of a causal flow. I am leaving this at the intuitive level where, for example, a fly, as a complex system in motion, is comprised of multiple processes acting in concert, be this multiple muscle systems, neurons firing, or chemical flows. Such a system could be as large, and larger, as a weather system such as a hurricane, or an evolving galaxy, or a collection of individuals all working together to play a symphony. The two football players with which we began were two seemingly isolable local flows. They could, however, have been two sailboats moving in unison before a vast pressure front. Or this could have been a vast magnetic flux sweeping the earth. The point is that we must ask if any such local flows, any more so than "objects" and their "motions," are truly isolable from the global flow of the universal field. Are they more than transferences of state within the global motion? This global transformation is the classical "flow of time" invariant to all observers.

4.2 STR and Consciousness

Hagan and Hirafuji (2001) analyzed the concept of the "emergence" of consciousness in the context of relativity. Emergence envisions consciousness arising (or being generated from) from the physical processes in the brain, analogous, it can be

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in motion, there is no such "pole-inside" state. This conflict is resolved, he argues, "by remembering that the states of the extended system of which one account speaks are states along spacelike slices of the system different from those of which the other account speaks" (p. 478).

This is a not a justifiable modification of STR. The reference system of Figure 6 would be treated as a set of points, α. Another set, β, would be definite or realized with respect to α if in α's causal past. Though seemingly applying to the cue stick example, we could not extend the system indefinitely, or it would extend across the entire universe, providing a plane of simultaneity. But, given Myrvold, what prevents this move? My earlier analysis relative to Figure 6 shows that the simultaneity of α begins to break up at the most minute interval relative to an observer in motion. But, there is a simpler reason why Myrvold is not a resolution. If the length contraction of the pole is being taken as a real effect in this paradox, the (very testable) implication is that we could actually trap the pole inside the barn, different spacelike slices or not. Such a real result (captured pole) is as much a contradiction as the twin paradox. If it is not considered a real (possible) effect, this is due to giving the reciprocity of reference systems its appropriate status, which is to say there is no ontological status to the relativistic contraction, and no "paradox" in the first place. Myrvold dismisses the paradox, considering it an example of misunderstanding, yet it is no more a misunderstanding than the twin-paradox where the "time-change" should have equally as little ontological status.

said, to the glow arising from the filament of a light bulb. Their analysis deals a critical blow to the emergence concept, but a deeper reading indicates that doubt is cast on STR's ability to support any theory of consciousness.[12]

Starting with what they term the *extrinsic* definitional problem, they argue that any emergent property or state of consciousness must be frame invariant to satisfy the requirement that the conscious state be invariant to another observer in motion. Hagan and Hirafuji aver that keeping the emergent property frame invariant might be achieved, but choose not to explore the difficulty, moving on to yet another (what they term "boundary") extrinsic problem. In fact, it cannot be achieved. Our experience, we have seen, is marked by the characteristic of simultaneity of flows – the multiple melody lines within a single flow of a symphony, multiple musicians playing on the symphony stage, multiple women cooking in the kitchen, etc.

From the standard view of relativity, from which Hagan and Hirafuji write, the simultaneity of any of the above systems (read *experiences* as well) should indeed breakup, simultaneity becoming succession, and succession becoming simultaneity. Recall the three points, A', B', and C' of Figure 6, and the break up of simultaneity at the most infinitesimal interval. We asked if this can possibly be true of the flow of time? In the more obvious causal context of causal flows, e.g., our two football players, we saw that this cannot be true. One cannot simply relativize multiple causal flows.

Yet this is precisely what relativity would do. Each of the experiences mentioned earlier, with their simultaneous flows, would begin to breakup relative to the motion, for example, of observer Y. This is why the "emergent" consciousness or emergent "property," as Hagan and Hirafuji mention, would have such difficulty remaining frame invariant. More correctly, this is why the invariance is impossible. The experience would inevitably be distorted relative to the frame. But as I asked earlier, can we seriously believe this "breakup" of succession and simultaneity is possible, i.e., that it has any ontological status? Do we believe the symphony would become jumbled, the musicians playing out of time, the conversations at the table scrambled, the cooking women putting ingredients in the cake one after the other rather than together, etc.?

One could question the relevance of the frame invariance requirement. So what, if from Y's point of view, my consciousness is distorted? It is my consciousness and it is perfectly OK, the symphony is fine, the ladies' conversation is fine. But this is the problem: if the theory (STR) is taken to indicate that this distortion would indeed be so from Y's perspective, i.e., it has ontological status, despite the intuitive oddity of the claim, we must ask what good is the theory? Hagen and Hirafuji are not only demonstrating the difficulties with a theory of "emergence" in the context of current physical theory, but also the difficulties for relativity of supporting any model of consciousness.

Let us move to the *intrinsic* definitional problem. Hagan and Hirafuji show that an intrinsic definition, while not requiring simultaneity, will always be incompatible with locality constraints. The difficulty here stems from the transmission speeds of the brain or, simply the very need or constraint for finite transmission. Under these constraints, the brain could not support a global state underlying an emergent property. The global state cannot inform the local dynamics of the boundary necessary to establish the physical extent of the emergent unit. But in essence here, I note, we have come back to the need for simultaneity, for this is an essential feature of any emergent property of consciousness or perception of which we can conceive.

[12] Van Gulick (2001) maps in detail the many variants of emergence theories. It is not necessary to distinguish them all here. They all, in any case, fail to consider the problem of time.

Stein (1991, pp. 158-162), as we noted, attempted to explain ongoing misconceptions of relativity, as he saw them, in terms of our continued naïve belief in the perception of simultaneous events – an illusion based on the high velocity of light. Thus, he argued in essence, the naïve or intuitive simultaneity that perception provides is founded upon the "fleeting motions" of "masses of elements" in the brain, all subject to the limitation of communication via the velocity of light and implying, therefore, that at a small enough scale of time, perceptive simultaneity would break down. Stein is assuming a model of the processes in the brain underlying perception. But it is precisely this "fleeting motion" of masses of "elements" that Hagan and Hirafuji demonstrate is subject to locality constraints and, in being so subject, cannot support the simultaneity inherent in conscious states or perception, at least not from an "emergence" standpoint. If, however, we only require a classical dynamics within the brain, under the locality constraint, to support a specifying reconstructive wave as per Bergson's model, we escape the emergence difficulty, but this framework, with its non-differentiable time and simultaneity of flows, leaves relativity and its metaphysic behind.

5.0 Conclusion

There have been other examinations of STR, of both its explanatory status in physics and as a theory of time. Bergson was perhaps the earliest. His argument in *Revue Philosophique* with physicist Andre Metz circa 1924 centered on the use of STR in explaining asymmetric effects (cf. Gunter, 1969, pp. 135-190). Metz could neither accept that STR is an inappropriate explanatory vehicle, nor could he conceive of the possibility that the increased life spans of mesons could be explained without resorting to STR. Deleuze (1966/1991) would reprise Bergson's (1922/1965) general argument on time with respect to relativity. Dingle (1967, 1972) would make interesting critiques, particularly on the invariance of light. Brillouin (1970, pp. 77-85) would give a non-relativistic explanation of the retardation of atomic clocks (and of the red shift). Earman (1989) would note that there has yet to be a relational, let alone a relativistic explanation of Newton's humble bucket. Nordenson (1969) would argue that Einstein's rejection of the classical flow of time, whether beyond "proximity" or anywhere even beyond the mathematical point, must surely undermine any meaning to his new procedure for clock synchronization. Rakić (1997), in proving certain logical inadequacies of the Minkowski metric, is reduced to declaring Special Relativity to be not an ontological theory, but concedes it a status as a "temporal" theory. Whatever meaning this concession might have, a theory with no ontological status is of little use; it is certainly not relevant to a science of perception or a theory of consciousness.

STR, with its confused interpretation, its reflection of the classic, spatial metaphysic and its view of "time," is an impediment to both physics and psychology. Physics has struggled to both reconcile STR/GTR with quantum theory (aggravated by the awareness of quantum theory's non-locality) and simultaneously to understand and perhaps incorporate the role of consciousness in quantum theory. The theory of time is precisely the ground where psychology, the theory of consciousness and physics meet. In truth, with Bergson's vision of time – with its non-differentiable flow, with its irreversibility derived from the fact that each "instant" reflects the entire preceding series, with its primary memory or true continuity wherein there are no mutually external "instants," where the motions of "objects" are transferences of state within a global time-evolution of the material field implying therefore an inherent non-locality – one sees that Einstein's two times, "a psychological time different from that of the physicist," are in reality one.

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Research Essay

Phenomenal Time and its Biological Correlates

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Abstract

Our goal is to investigate the biological correlates of the first-person experience of time or phenomenal time. 'Time' differs in various domains, such as (i) physical time (e.g., clock time), (ii) biological time, such as the suprachiasmatic nucleus, and (iii) the perceptual rate of time. One psychophysical-measure of the perceptual rate is the critical flicker frequency (CFF), in which a flashing light is perceived as unchanging. Focusing on the inability to detect change, as in CFF, may give us insight into phenomenal time. CFF varies from 24 Hz for dim light and 60 Hz in bright light and is lower for colored lights. We propose that problem of the phenomenal time can be addressed using two contrasting but complementary approaches (inability to detect changes vs. ability to detect changes): (1) The soliton-catalytic model that entails invariant quantum coherent state for temporal frequencies (TFs) >= CFF, where flickering light is perceived as unchanging, similar to a Bose-Einstein condensate (BEC). (2) Temporal frequency tuned mechanisms model, which starts with ability to detect changes for TFs < CFF and then their sensitivities decreases to zero at CFF. For a subject who has CFF of 60 Hz, the duration of one cycle or time-period of the flickering light is approximately 16.7 ms. Phenomenal time may be quantized into 'subjective occasions of experience' (SE), which arise out of the interaction of the individual with situation (environment). Pioneering work examining the complex interaction of neurons suggests the possibility that macroscopic quantum states similar to a BEC may also occur in the brain (Davia, 2006; Freeman & Vitiello, 2006; Georgiev, 2004; Vimal & Davia, 2008) .

Key Words: Phenomenal time, quantum coherence, soliton, Bose-Einstein condensate, critical flicker frequency (CFF), color fusion frequency, temporal integration, luminance and color channels; subjective passage of time, linear and cyclic nature of time.

1. Introduction

Bergson argued that time could only be understood from the contemplation of the moment of consciousness, i.e., time is "grasped by, and belongs only to, inner consciousness" (Bergson, 1889/1960). According to (James, 1890/1981), in the context of phenomenal time, (i) Clay's[1] the obvious past, the specious present, the real present, and the future play important role in the stream of consciousness, (ii) the 'sensible present' and 'specious present' have duration (a few seconds to a minute), which is in recent past, i.e., working memory, whereas the 'the real present' implies a durationless instant, the latter boundary of 'specious present', (iii) the perception of space and that of time interacts, i.e., "Date in time corresponds to position in space", and (iv) a succession of thoughts is not a thought of successions. According to (Vimal,

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[1] Adapted from http://en.wikipedia.org/wiki/Specious_present.

2009k), phenomenal time can be defined as the subjective, personal, or first person experience of time.

2. Problem Formulation

Phenomenal time is a long standing problem for cognitive science and the philosophy of mind. St Augustine argued that the experience of change must involve a connection between future events, present events, and past events. However, if each moment comprised an infinitely thin slice of time, then such a connection seemed impossible. One might argue that the experience of change emerges simply as a consequence of the causal relationships that effect transitions; however, "Change in our experience is not the same thing as experience of change" (Le Poidevin, 2004). In physics, there is no absolute rate of time, i.e., although we may claim (within limits determined by relativity) that event A precedes event B, there is no criteria that determines how quickly or how slowly consecutive events should be experienced. The concept of an absolute and fixed rate of time is wholly absent from our physical description of the universe. The temporal passage has been considered a subjective illusion (McCall, 1994), yet it is certainly phenomenologically real. We shall argue that the problem of phenomenal time cannot be solved within the context of a classical physics. An approach rooted in quantum coherence, such as a solitonic (traveling wave) coherent state similar to a Bose-Einstein condensate (BEC) or an approach based on temporal frequency tuned mechanisms, may resolve the problem. We will point to a specific physical quantity as the principle factor, which determines the apparent rate that we experience time. We will discuss the physiological correlates of cyclic and linear nature of time underlying temporal consciousness. The fundamental problem is formulated as follows: what are various aspects of time, what is phenomenal time, and what are its neural correlates?

3. Problem Solution

3.1. Aspects or forms of time and phenomenal time

The various forms of time are as follows (Vimal & Davia, 2008): **(A) Physical time**: This is physical clock time. The Planck time is the unit of time in the system of natural units known as Planck units, which is the time it would take a photon traveling at the speed of light in a vacuum to cross a distance equal to the Planck length; it is about 5.39×10^{-16} seconds; however, it has not been measured yet. Images of electrons leaving atoms were produced by short pulses of laser light and recorded within 100 attoseconds (10^{-16} seconds); this is the shortest time measured so far. **(B) Biological time**: Although all brain areas can be considered as biological clocks, the suprachiasmatic nucleus is the master molecular clock (Vimal, Pandey-Vimal, Vimal, Stopa, Renshaw, Vimal, & Harper, 2009); it is measured in msec. **(C) Perceptual rate of time**: This is psychophysically measured in cycles per second (Hz) using luminance critical flicker frequency (CFF). It varies from 24 Hz in dim light and 60 Hz in bright light for normal humans to 80 Hz for Buddhist monks during meditation to 300 Hz for the honeybee. Color fusion frequencies are lower than CFF. Time can be integrated up to 160 msec for luminance stimuli, whereas integration time is longer for color stimuli. When we view a sinusoidally flickering light with temporal frequency (TF) above CFF, the associated experience is invariant in a sense that we do not perceive any flicker and light appears like steady light. In other words, if we start from TF = 0 Hz to CFF, (i) we perceive first steady light at 0 Hz, (ii) then flicker-perception increases with increase of TF to maximum value at peak-TF and (iii) then flicker-perception decrease as we increase TF and (iv) eventually reaches flicker-perception of zero at CFF. However, CFF depends on internal and external context, i.e., it would be possible to alter the predictions of the values of peak-TF and CFF, but the above 4 steps will occur. It would be interesting to perform

experiments related to the estimations of time at the above 4 crucial points. Our prediction is that phenomenal time (defined below) will be different (perhaps faster) at peak-TF than that at TF > CFF. Note that we perceive maximum flicker at peak-TF and no flicker at CFF. **(D) Relative positions in time**: These can be distinguished in two ways: (i) Each position is either Past, Present, or Future. This distinction varies continuously. (ii) Each position can be *earlier* or *later* than other positions. This distinction is permanent. **(E) Cyclic and linear nature of time**: Time can be cyclic (day ↔ night) or linear (future → present → past). **(F) Subjective passage of time** can be shorter or longer than physical time depending on the state of mind. Phenomenal time is defined as the subjective experience of time.[2] It seems to speed up as we grow older, slow down in crisis, and slowing towards stopping, in some cases, such as at death, in near-death experience, meditation, and psychedelic drug use (Vimal & Davia, 2008). Furthermore, rather than focusing on the ability to detect change, insight into phenomenal time may come by focusing on the inability to detect change such as in CFF. Every phenomenal time may be an 'occasion of experience' or SE, for example, a Buddhist Monk who has CFF of 80 Hz may have SE every 12.5 msec, whereas a subject who has CFF of 60 Hz may have SE every 16.7 msec.

3.2. Models and experiments related to time

We would like to discuss a few models that may address phenomenal time. **(i)** In the **dissipative quantum model** of the brain, "Water and other biochemical molecules entering brain activity are, indeed, all characterized by a specific electric dipole which strongly constrains their chemical and physical behavior" (Pessa & Vitiello, 2003). The electric dipole field can be considered as the fundamental units of the brain rather than neurons (Stuart, Takahashi, & Umezawa, 1978). In this model (Vitiello, 2001), the brain is constantly entangled with its environment in a way that maintains the unified whole in time. This entanglement causes our perceptions to be imprinted upon memory, which are then processed into the cognitive map of our environment. This map appears to be in relative motion ('relating the presence of consciousness to the contents consciousness is conscious of') during the SE of passage of time (Franck, 2004; Husserl, 1996). **(ii)** The **soliton-catalytic model**. Davia (2006) argues that non-linear interactions in the brain give rise to solitons, which mediate energy dissipation as a macroscopic process of catalysis. It does not contradict the quantum-dissipative model (Pessa & Vitiello, 2003), rather they are equivalent to each other; they try to connect discrete neural activities to classical field to the quantum field (Vimal & Davia, 2008). Within the catalytic model (Davia, 2006), it is noted, that solitons are a classical analogue of quantum particles suggesting the possibility that solitons may 'induce' macroscopic quantum states. Although solitons are often defined as non-dissipative, this is not true for similar phenomena that occur within dissipative media. Within the soliton-catalytic model the brain is considered to be an excitable media and therefore a dissipative media. In the soliton-catalytic model (Davia, 2006), energy is dissipated via structure (fixed points that do not change under transformation). **(iii)** According to Vimal (2009k), the wriggles in Humphrey's framework (Humphrey, 2000) of sensation from the internalization of action during evolution can be considered equivalent to the traveling wave in soliton-catalytic model (Davia, 2006). **(iv)** One could argue that the apparent

[2] Subjective experiences (SEs) are the experiential aspect of consciousness (Vimal, 2009e, 2010d). In the dual-aspect dual-mode proto-experience (PE)-SE framework (Vimal, 2008b, 2010c) with hypothesis H_1, SEs are *superposed* in the mental aspect of every entity. In hypothesis H_2, SEs are derived from a PE and 3 *gunas* (Vimal, 2009a). Further research on the dual-aspect view is detailed in (Bruzzo & Vimal, 2007; MacGregor & Vimal, 2008; Vimal, 2008a, 2009b, 2009c, 2009d, 2009f; Vimal, 2009h; Vimal, 2009i, 2009j, 2010a, 2010b; Vimal, 2010e; Vimal, 2010f, 2010g).

rate at which time is experienced (phenomenal time) depends on the spatio-temporal characteristics of visual mechanisms. For example, human visual system has one luminance and two color (Red-Green and Yellow-Blue) psychophysical channels, and each has spatial, temporal, and spectral frequency tuned mechanisms. There are six bandpass spatial frequency tuned luminance mechanisms and six spatial frequency tuned Red-Green color mechanisms (one lowpass and five bandpass) (Vimal, 1998, 2002). There are four temporal frequency tuned luminance mechanisms: one low-pass with a corner frequency of 8 Hz, and three bandpass with bandwidth of 2-2.5 octaves peaking between 4-8 Hz (Lehky, 1985). There are two temporal frequency tuned color mechanisms: one low-pass and other bandpass (Metha & Mullen, 1996). The above are threshold mechanisms, which have flattening effect and show color-contrast constancy at suprathreshold level (Vimal, 2000; Vimal, Pandey, & McCagg, 1995). The luminance channel showed no temporal integration beyond 160 msec, whereas color channels had longer integration time (Smith, Bowen, & Pokorny, 1984). Our goal is to investigate a general unifying principle underlying these tuned mechanisms and to relate them to phenomenal time. **(v)** In **chaos theory**, the balance between linear and nonlinear time involves (a) the changing demands as one approaches and departs bifurcation points, and (b) time dilation and contraction as a control parameter. For example, meditators **self-organize** time perception differently compared to non-meditators: critical flicker fusion frequency progressively increases by 11-15% following yoga training (Vani, Nagarathna, Nagendra, & Telles, 1997). Buddhist monks show highly coherent, high amplitude gamma synchrony EEG about 80 Hz (Lepine, 2007). To sum up, there are two major approaches to address CFF based phenomenal time: (I) An approach based on inability to detect changes, such as for TFs >= CFF. Here, the soliton-catalytic model can be used, which entails invariant quantum coherent state with respect to change in TF, similar to a Bose-Einstein condensate (BEC). (II) An approach based on temporal frequency tune mechanisms, which starts with ability to detect changes for TFs < CFF and then their sensitivities decreases to zero at CFF. These two contrasting approaches (inability to detect changes vs. ability to detect changes) may indeed be complementary.

3.3 Continuous experiences and invariance related to time

One could hypothesize that the apparent rate at which time is experienced is dependant upon the lower limit of a subject's sensitivity to change. This hypothesis is based upon our own *subjective* experience of what it is like to 'just about be able to see something move' and relies upon our inability to conceive of what it might be like if our experience of change was not characterized by a continuum of experiential states – i.e., from almost stationary to moving as fast *as we experience them*. But, our inability to conceive of what it might be like to experience change in a radically different way is not sufficient evidence that a very different relationship between changing stimuli and corresponding phenomenological states is not possible. Up until now we have been examining the problem of phenomenal time within the context of changing temporally structured experiences. However, there is a class of experiences that are completely invariant with respect to time. When we listen to a sine wave above the critical frequency, the associated experience is completely invariant. Can progress be made by considering the problem within the context of temporally invariant experiences? Having argued that change is not essential for an experience to involve phenomenal temporal flow, we may simplify the problem we are addressing by eliminating the need to consider change or 'phenomenal change' as a first order aspect of the problem. We suggest that *phenomenal temporal flow may exist without phenomenal change but phenomenal change cannot exist without phenomenal flow*. Invariant experience with respect to phenomenal time is related to perceiving steady light for all stimulus-flicker rates that

are greater than critical flicker fusion frequency. Thus, for a particular temporally structured stimulus there may be only one possible phenomenal state.

3.4 Quantum coherence and solitons in visual area for phenomenal time

The inability to detect change beyond critical flicker fusion (CFF) frequency may be because our visual system is not sensitive to frequencies greater than CFF. In other words, visual system needs time to integrate information, which we have defined as *phenomenal time* and is about 16.7 msec for CFF = 60 Hz.

Alternatively, one can argue that rather than focus on the ability to detect change, insight into phenomenal time may come by focusing on the inability to detect change. One operationalization of the inability to detect change is the CFF rate. CFF may be correlated with a neural Bose-Einstein condensate (BEC) soliton, the properties of which include temporal uncertainty. According to Hameroff (2003), quantum states are implicated in the phenomenon of consciousness. Dynamic systems may give rise macroscopic states that resemble a phenomenon termed a Bose-Einstein condensate (a field that may exhibit invariance in time). A Bose-Einstein condensate is a condensed phase of matter in which the individual identity of the comprising atoms is lost and forms a coherent unity – a single wave function. This phase change is extremely difficult to bring about and usually requires temperatures very close to absolute zero. However, there is a growing body of research that suggest that similar states may be brought about as a consequence of the behavior of nonlinear dynamic systems.

Studies into the behavior of complex networks like the World Wide Web, suggest that, under certain conditions, a change in the overall dynamic behavior of the network may occur that is a classical analogue of a BEC and is mathematically modeled in the same way (Bianconi & Barabasi, 2001; for discussion see Barabasi, 2002, pp. 99-107.[3])

Pioneering work examining the complex interaction of neurons suggests the possibility that Macroscopic quantum states similar to a BEC may also occur in the brain (Davia, 2006; Freeman & Vitiello, 2006; Georgiev, 2004; Vimal & Davia, 2008). If such macroscopic states do indeed form the neural correlate of consciousness then these states may be in the form of solitons (Davia, 2006) . A soliton is an extremely robust non-linear dynamic that preserves its structure as a consequence of a fine balance between linear dissipative and nonlinear compressive forces.

Solitons (or robust traveling waves) were observed in visual area V1 and are essential for the organization of retina to lateral geniculate nuclei connectivity prior to birth. For example, Xu, Huang, Takagaki, and Wu (2007) observed traveling waves in the brain; they reported that (i) visually evoked primary wave originated in V1 and was 'compressed' (via GABA inhibition) when propagating to V2, which then reflected and propagated backward into V1, (ii) the compression/reflection pattern appears to be organized by an internal mechanism associated with visual processing. There is an empirical evidence that solitons can be generated in a BEC (Denschlag et al., 2000). Furthermore, Kole, Letzkus, and Stuart (2007) reported observing digital to analog transformations in living systems: action potentials are the primary binary (digital) signal used by neurons for communication within the central nervous system. They

[3] According to Bianconi and Barabasi (2001), "The evolution of many complex systems, including the World Wide Web, business, and citation networks, is encoded in the dynamic web describing the interactions between the system's constituents. Despite their irreversible and nonequilibrium nature these networks follow Bose statistics and can undergo Bose-Einstein condensation. Addressing the dynamical properties of these nonequilibrium systems within the framework of equilibrium quantum gases predicts that the 'first-mover-advantage,' 'fit-get-rich,' and 'winner-takes-all' phenomena observed in competitive systems are thermodynamically distinct phases of the underlying evolving networks."

showed that the site of action potential initiation in neurons, the axon initial segment, serves as a critical locus where these binary signals can be modified in a graded (analog) manner. In the retina, spontaneous activity takes the form of traveling waves, which are essential for the organization of retina to lateral geniculate nuclei pre-birth connectivity (Penn, Riquelme, Feller, & Shatz, 1998).

Moreover, solitons require structure in the boundary conditions of their environments for the possibility of their emergence. Furthermore, Davia (2006) argues that, as per fractal catalytic model, the brain (which is considered to be an excitable medium) is structured in real time by the body and the environment (both immediately via the senses and historically via past experience), and that any spatiotemporal symmetries (invariance) implicit in the body, the senses and dynamics of interaction between body/senses and the environment may support soliton formation in the brain. Within the context of this theory, consciousness is correlated with the spatio/temporal evolution of a coherent soliton. If an invariant conscious state is to be correlated with a soliton in the form of a BEC, then, just as it is possible for a simple electromagnetic field to exhibit non-trivial invariance, so it is possible for non-trivial states to occur such that no matter at what rate we present the flickering stimulus the physical correlate of consciousness (the BEC soliton) may always appear exactly the same, as long as the flicker rate is greater than CFF frequency.

A BEC soliton is an interesting phenomenon when considered in the light of the problem we are addressing. Unlike a classical soliton (e.g., a tsunami), a coherent soliton in the form of BEC exhibits properties quite different from a classical soliton. Although complex – a BEC soliton is a probability wave function, and, as such, it embodies characteristics of any quantum probability wave function. In addition to the uncertainty between position and momentum, the wave function also describes the uncertainty between energy and time. So, a soliton in the form of a BEC is a four dimensional phenomena with extension in time as well as space. This extension is based on the uncertainty principle (usually considered as the principle of indeterminism).

Correlating consciousness with a coherent BEC soliton does not immediately solve our problems. Although, the uncertainty in time of the wave function may be significant with respect to the problem we are addressing, within the context of the potentially infinite number and variety of cognitive and behavioral states and the potentially infinite number of associated wave functions, it is difficult to see why our experience of temporal flow should exhibit such consistency.

However, progress may be made by considering research that provides evidence that there may be an underlying ‘carrier wave’ that supports other neurological processes – a carrier wave for consciousness. The basis of this hypothesis is as follows: The frequency of stimulus fusion in the tactile, auditory, and visual modality equals 18 Hz (Lalanne, 1876). If film is shown at a frame-rate less than 16 Hz then ‘flicker’ becomes more pronounced. Color flicker-fusion frequency is lower than luminance flicker-fusion frequency (Kaiser, Ayama, & Vimal, 1986; Kaiser, Vimal, Cowan, & Hibino, 1989). Thus, there is sufficient evidence pointing to a critical threshold that demarcates the boundary between continuous and discontinuous experience across sensory modes. The flicker-fusion threshold demarcates the boundary between temporally modulated stimuli that can and cannot be sensed; it marks the limit above which change cannot be experienced. These findings support the hypothesis that there may be an important cycle rate or minimum unit of consciousness. For the argument that follows we shall assume that these findings point to an underlying coherent carrier wave for consciousness.

3.5 Catalytic-soliton and temporal frequency tuned mechanisms models for phenomenal time

As discussed above, the fractal catalytic model of consciousness correlates mental states with the spatio-temporal evolution of a coherent soliton. The underlying coherent soliton associated with consciousness may be continually adapting and changing its organization as a consequence of variations in the boundary conditions imposed upon it by the body and the senses. If the temporal structure of the stimulus exhibits modulations that are greater than the uncertainty of the probability wave function of the BEC soliton then a varying experience will be the result. But, what of stimuli that exhibit temporal variations (ΔT_s) that are smaller than the uncertainty of the wave function (ΔT)? Stimuli with temporal intervals smaller than the temporal uncertainty of the carrier wave function (i.e., when $\Delta T_s < \Delta T$) may nevertheless give rise to unique and *unvarying* solitonic solutions. Given the possibility that the neural correlate of temporal consciousness is a BEC soliton, and given the possibility that there may be unique solitonic solutions determined by temporal structures which fall below the uncertainty in time associated with its wave function (i.e., when $\Delta T_s < \Delta T$), then those solutions cannot embody information that could be used to distinguish individual temporal components of the stimulus within the BEC's soliton's temporal uncertainty. In our views, this hypothesis accords well with the phenomenology of experience. Although we may be able to experience a high frequency stimulus, we are unable to distinguish its small scale structure. Given that the flicker fusion frequency or CFF is a crucial quantity that represents the limit above which we cannot experience change (i.e., when stimulus flicker frequency FF_s > CFF), then it would seem reasonable to conclude that the primary factor that determines the apparent 'rate' at which we experience time is the uncertainty in time associated with the carrier wave function of the BEC soliton. The flicker-fusion frequency may be giving us very precise information about the way in which we (and other species) experience time. It must be pointed out that a threat to this hypothesis exists as a consequence of a large body of research that seems to show that the flicker-fusion frequency depends upon factors such as intensity and wavelength of stimuli, adaptation condition, background condition and so on (Kaiser et al., 1986; Kaiser et al., 1989). However, we could argue that uncertainty in time associated with the carrier wave function of the BEC soliton also similarly depends on the above factors. Any attempt to interact with a coherent state that resulted in information being obtained that fell below the temporal uncertainty of the wave function (i.e., when $\Delta T_s < \Delta T$) must cause it to collapse. We suggest that the temporal uncertainty of the wave function demarks the boundary below which discriminations in time cannot be made. We suggest that for this reason, time as it forms part of the wave function cannot be considered as a 'duration' as is normally conceived.

Alternatively, one could also argue that some of the temporal frequency tuned mechanisms that were sensitive at high suprathreshold luminance becomes less sensitive to the extent that they are non-functional at lower luminance. This is in analogy to the number of luminance spatial frequency (SF) tuned mechanisms dropped down from 6 at photopic to 4 at mesopic level to 2 at scotopic level, where higher SF tuned mechanisms were first to drop (Vimal & Wilson, 1986, 1987). It would be interesting to extract temporal frequency tuned mechanisms at mesopic and scotopic luminance levels. One could further argue that if a subject's CFF = 60 Hz, then the subject has Whitehead's *occasion of experience* at every 16.7 msec. The critical flicker fusion frequency (CFF) is the frequency at which a flickering light is indistinguishable from a steady, non-flickering light. CFF depends on species, luminance level, color, and other conditions. Frank (2000) reported that diurnal insects likely to have higher CFFs (and hence higher temporal resolution) than nocturnal insects, and CFFs tend to decrease as habitat depth increases. Some of

luminance CFFs are as follows (Vimal & Davia, 2008): (i) 60 Hz in bright light and 24 Hz in dim light for humans, (ii) 58 Hz for cat, (iii) 70 Hz for octopus in bright light, and (iv) 180-300 Hz for honeybee, dragon fly and blowfly flies. These data can also be explained by their temporal frequency tuned mechanisms, which needs further investigation.

3.6 Biological correlates of phenomenal time

The brain itself can be considered as a clock or 'organ of time sense' (Dawson, 2004). The biological circadian clock has an intrinsic period of about 24 hours, which synchronizes to the daily day-night (light–dark) cycle (Herzog, 2007). According to Herzog (2007), "[C]ircadian clocks may be crucial for widespread changes in brain activity and plasticity. These daily changes can modify the amount or activity of available genes, transcripts, proteins, ions and other biologically active molecules, ultimately determining cellular properties such as excitability and connectivity" (p. 790). For example, suprachiasmatic nucleus (SCN) tracks the cyclic form of time such as sleep-wake rhythms and regulates the biological need for sleep, food, and reproduction. Activation of SCN and primary visual cortex depends upon time of day (Vimal et al., 2009).

Furthermore, hippocampus and frontal cortex tag a linear cause-and-effect form of temporal information about the memories of the past and the expectancies for the future, respectively, and regulate neural nets that together form memories, consciousness, and the perception of past, present and future (Dawson, 2004). In addition, both forms of biological time or clocks are critical in temporal consciousness; when one is turned on, other is turned off. When these clocks are out of synchrony, both physical and mental disorder can occur. Temporal disorganization of the brain is a characteristic of the aging process, such as a disruption of the sleep–wake cycle, 'an increase in the subjective rate of time passage', and a decline in future expectancies (Dawson, 2004).

Time seems to speed up as we grow older and time appears to slow down in crisis (Vimal & Davia, 2008), for example, time seems 36% longer in free fall.[4] Phenomenal time (subjective experience of time) slows down towards stopping, in some cases, such as at death, in near-death experience, meditation, and psychedelic drug use (Osis & Haraldsson, 1997; Smith & Tart, 1998). A player who has higher rate of conscious moments may win the game (Hameroff, 2003). The temporal disorganization observed in schizophrenia, autism, and bipolar disorders may be partially due to genetic mutations in the human clock gene. The brain is temporally organized via 'temporal tagging' and 're-entry', which bind the wide range of spatiotemporal stimulus-features to a unified subjective experience that is held in synchrony with the external world (Dawson, 2004; Vimal, 2009g).

Time and its neuroendocrine correlate melatonin are involved in binding the spatiotemporal stimulus features for subjective experience (Dawson, 2004; Vimal, 2009g). Melatonin decreases the desynchronization between internal circadian rhythms and the external environment, which occur in jet-lag, shift-work, blindness, and delayed sleep phase insomnia (Vimal et al., 2009). From the fMRI data for the phenomenological concepts of temporality i.e., phenomenal time, (Northoff & Heinzel, 2006) noted that "Lloyd (2002) observed that the multivariate distance and changes between brain images is approximately linearly related to their temporal distance. The more closer acquired in time the more similar the images. Thus, the changes between the different images occur gradually over time. Lloyd argues that these results are consistent with Husserl's description of time consciousness in that they reflect the inexorable temporal flux of

[4] Adapted from "Does time slow in crisis?": http://www.physorg.com/news116655680.html

the conscious state. Analogous to the way that each moment of our phenomenological experience of time builds on foundation of the previous moment, the series of fMRI images appears to form a continuously evolving temporal pattern of global activity."

4. Conclusion

We summarize our proposal as follows:

(1) Rather than focus on the ability to detect change, insight into phenomenal time may come by focusing on the inability to detect change. This is consistent with the *psychological present* (the term used by Stroud, 1967): "[R]egardless of multi-stability or ambiguity, there is always an experienced duration in which experience does not change" (van Leeuwen, 2007).

(2) One operationalization of the inability to detect change is the critical flicker fusion (CFF) rate.

(3) CFF may be correlated with a neural Bose-Einstein condensation (BEC) soliton (traveling wave), the properties of which include temporal uncertainty.

(4) A single CFF (16-18 Hz) would be associated with an *underlying coherent carrier wave* for consciousness; however, CFF may depend on many factors.

(5) The subjective experience of time is *phenomenal time*; in terms of measurable physical time it is 1/CFF; it can be addressed by temporal frequency tuned mechanisms.

(6) Every *phenomenal time* (or subjective experience of time) may be an *occasion of experience* (Whitehead, 1978). For example, a Buddhist Monk who has CFF of 80 Hz may have SE every 12.5 msec whereas a subject who has CFF of 60 Hz may have SE every 16.7 msec.

(7) Thus, the CFF based *phenomenal time* can be explained by two models: (i) soliton-BEC model based on the time-interval in which a subject is unable to detect change of stimulus or flicker and (ii) temporal frequency tuned mechanisms model based on the limit to detect change (when mechanism's sensitivity to flicker is zero). The latter is popular in psychophysics. Further investigation is needed to find out which model is better or if they are complementary to each other.

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Exploration

Time and its Relationship to Consciousness An Overview

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Abstract

Time is one of the most fascinating and fundamental concepts in human life. Yet the physical meaning of time is far from understood. Subjective experience of time is equally intriguing and mysterious. Time may be considered an illusion according to modern physics, but its psychological impact cannot be denied. This current paper explores the conception of time in many diverse contemporary fields such as physics, psychology, psychoanalysis, phenomenology, and anthropology. Disorders of time perception and neurophysiology of time is discussed. The idea of time as the creation of conscious mind is considered.

Keywords: Time, relationship, consciousness, illusion, mystery, creation.

Introduction

The Oxford English dictionary defines time as: 'the successive states of the universe regarded as a whole in which every state is either before or after every other duration, indefinitely continued existence, the progress of which this is viewed as affecting persons and things' (*Oxford Combined Dictionary*, 1982). As expected this definition sheds little light on the nature of time, but inadvertently makes things more confusing by introducing other concepts such as duration. The human mind has always been fascinated by the mystery of time. Humans have reflected on the nature, origin, and flow of time from antiquity and continue to refine their understanding of time. They have used religion, mythology, philosophy, mathematics, and science to unravel the mysteries of time.

Almost every culture has a myth about the creation and time. In Greek mythology, Chronos is the keeper of time. He comes from nothingness called Chaos, before which time did not exist. He helps avenge his mother Gaia (Earth) from his father Uranus (the Sky) for having her bear too many children. Chronos makes a sickle and cuts off the genitalia of his father when he comes to visit Gaia. This may reflect the pain and suffering human beings have always associated with time. Even though we may feel that we can influence what happens in time, we cannot influence the way that time itself progresses on. As the twelfth century Persian mathematician and poet Omar Khayyam wrote: "The Moving Finger writes: and, having writ, Moves on: nor all thy Piety nor Wit, Shall lure it back to cancel half a Line, Nor all thy Tears washout a Word of it."

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Yet, despite the centrality of time in our life, time may not be a fundamental element of the universe. It appears that time is a way we have learned to organize the universe. As Ernest Mach (1960), the famous Austrian physicist and philosopher put it, "Time is an abstraction at which we arrive by means of the changes of things."

This conception of time may appear surprising and counter-intuitive to everyday life; however, a number of developments in many diverse fields tend to support this conclusion. This paper presents an overview of our changing understanding of time and its implications for mental health and related fields.

Notion of Time in Physics

In his Principia, Newton defined time as "absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external, and by another name is called duration." He further noted "relative, apparent, and common time, is some sensible and external measure of duration by the means of motion, which is commonly used instead of true time; such as an hour, a day, a month, a year". (Poincare, 1898). Thus, even in classical mechanics, we can only measure the relative time and that only through some measure of change and motion. In fact, it is mathematically possible to derive Newton's laws of motion in a time independent fashion. However, at least theoretically it is possible to have a cosmic time and simultaneity in the universe in the framework of classical physics. In contrast, there is no notion of absolute time in general relativity. In fact, there is no absolute notion. All physical predictions have to be formulated as relations between physical quantities. Herman Minkowsi (1908) famously predicted the destruction of idea of time: "Henceforth, space by itself, and time by itself, is doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality".

This task was taken up by Einstein who abolished any sense of universal time through his theory of general relativity. When his lifelong friend Besso died, Einstein wrote a letter to Besso's family, saying that although Besso had preceded him in death, it was of no consequence,"for men who have knowledge of physics know that the separation between past, present, and future is only an illusion, although a convincing one."

This points towards his idea of time as a "mere illusion" adopted by modern physics. Time becomes even more counter-intuitive in quantum mechanics, where time may simply be indeterminate in the quantum superposition phase events and there is even a possibility that quantum information may be sent "backwards in time", as exemplified by Aharonov's "dual vector" theory (Aharonov & Bohm, 1958). This effect that has been experimentally verified in the the most common case, called Aharonov-Bohm solenoid, that knowledge of the classical electromagnetic field acting *locally* on a particle is not sufficient to predict the quantum-mechanical behavior.

More interestingly, all laws of fundamental physics (i.e., the Dirac equation, Schrödinger's equation, Maxwell's equations, Einstein's field equations of gravity, Feynman diagrams) are time reversible (Barbour, 1999). This is to say that at the most fundamental level, there is no preference for one direction in time (future) over the other

direction (past). Physics provides no objective reason to believe that our present is in any way special, or more real than any other instant of time.

However, at the macro level, the laws of physics, chemistry, and biology are irreversible. This is most clearly exemplified in the second law of thermodynamics that states the levels of entropy (disorder) increase in the universe as a whole. Thus, the arrow of time flows from the direction of less order to more disorder. However, even the second law of thermodynamic does not always guarantee a progression from the past to future. If we look closely, it is the entropy of any closed system (and the whole universe can be considered a closed system) that increases in the direction of disorder *on average*. For a single system, the entropy can either increase or decrease, thus the orientation of time is not absolute and for small systems (such as neuro-chemical processes) it may become nebulous and difficult to resolve.

In quantum mechanics, if we take the universe as a whole then the progression of its wave function (containing all information about the geometry and matter content of the universe) can be represented by Wheeler-de Witt equation. It is quite perplexing to note that Wheeler-de Witt equation is necessarily time independent (de Witt, 1967). This has led prominent physicists (such as Julian Barbour and Carlo Rovelli) to conclude that time is an illusion and only emerges as a convenient tool of organization at a secondary level. Surprisingly this conclusion harkens back to similar insights gained from a number of other fields.

Notion of Time in Psychoanalysis

Freud emphasized the timelessness of unconscious processes. He showed how unconscious ignores time and temporal progression. For example, in dreams and fantasy where past, present, and future are united in one representation, he showed that certain aspects of psychopathology are also essentially atemporal. In a note added in 1907 to *The Psychopathology of Everyday Life* (1901), concerning the indestructibility of memory traces, Freud wrote that "the unconscious is completely atemporal." In his essay on the metapsychology of the unconscious, he further noted that the processes of the unconscious system are “timeless, i.e. they are not ordered temporally, are not altered by the passage of time; they have no reference to time at all.”

Yet Freud struggled to reconcile his notion of unconscious time with his Kantian and Newtonian view of the psyche. He wrote, "If the philosophers maintain that the concepts of time and space are the necessary forms of our thinking, forethought tells us that the individual masters the world by means of two systems, one of which functions only in terms of time and the other only in terms of space." He believed that temporal dimension is accessible to us only as a function of acts of consciousness. Since these acts in turn depend on rapid, periodic, and discontinuous impulses from the unconscious-preconscious system, Freud believed that perception of time itself is discontinuous. He wrote, “I further had a suspicion that this discontinuous method of functioning of the system lies at the bottom of the origin of the concept of time” (Freud, 1925).

Time in Anthropology

Time is considered relative in anthropology in the tradition of Durkheim. Durkheim attempted a sociological explanation of all fundamental categories of human thought, especially the central concepts of time and space. He claimed that these concepts are social creations not merely transmitted by society. He pointed out that the social organization of the primitive community is the model for the primitive's spatial organization of his surrounding world. Similarly, temporal divisions into days, weeks, months, and years correspond to periodical recurrences of rites, feasts, and ceremonies. He wrote (1915): "A calendar expresses the rhythm of the collective activities, while at the same time its function is to assure their regularities."

Perception of time differs across cultures. In the Judeo-Christian culture time is perceived as having a 'linear' form (i.e., past–present–future). We believe that the past is 'behind us', the future is 'in front us', and the present time is 'where we are now'. This concept of time is based on the notion that time is linear and unidirectional. As Geertz (1973) pointed out, our awareness of ourselves and others as growing, developing and ageing beings across the life span is a major source of our perception of time as linear in nature.

Other cultures do not perceive time as a linear and uniform phenomenon and their time calendars consist of multiple and simultaneously existing time categories. These categories may include 'practical time', 'social time', 'religious time', etc. Many indigenous cultures do not perceive time as linear and describe it as having a 'circular' or 'cyclic' form. Time is perceived as 'static' and the individual person is believed to be 'in the centre of time' (i.e., surrounded by concentric 'time circles'). Life events are placed in time along and across the 'time circles' according to their relative importance to the individual and his or her respective community. For example, more important events are placed closer to the individual and are perceived as being closer in time; unimportant or irrelevant are placed in peripheral time circles, although they may have happened more recently according to linear concept time.

In a study of concept of time in aboriginal Australians, Janca and Bullen (2003) showed that the Aboriginal view of time differs from the Judeo-Christian linear approach in a number of ways. For Aboriginal people, time is multidimensional and can be described "as a pond you can swim through – up, down, around." In the aboriginal concept of time, it could not be viewed as purely functional groups of seconds, minutes and hours. Aboriginal people saw time as "being around you at every moment. You can't pull time apart or separate it". This conception of time is decidedly at odds with the psychological arrow of time that is considered to be a universal human perception.

Phenomenology of Time

In 1927, Heidegger published his critically important *Being and Time*, in which he attempted to use the phenomenological method to interpret the meaning of human existence (Clark, 2001). Of special interest was his emphasis on the way that past, present, and future aspects coexist and interpenetrate. This theory offered an alternative to the scientific conception of time as a serial order of three phases of past, present, and future, each of which can be isolated from another, and all of which are merely arbitrary

linguistic notations for qualitatively similar segments of a continuous series of measurable bits.

Husserl refined this notion of phenomenological time further. Using his phenomenological methods, Husserl analyzed time in his *Lectures on the Phenomenology of Internal Time Consciousness* (1928/1964). Husserl distinguishes between objective time in the world, inner time of experience, and a deeper consciousness of inner time. He argued that the deep time consciousness permits experience to have a temporal character, and provides the ultimate context for the identity of the ego as a temporally extended being. He used the perception of music as an example in his investigation. Though there are multiple disjointed notes in a piece of music, our mind perceives them as a smooth progression. If we were to become aware of all the notes at once, it would be a cacophony and not a symphony. Similarly, we organize separable units of experiential entities in the continuous modalities of past, present, and future.

Merleau-Ponty (in Matthews, 2002) sets aside the conception of a 'chronometric' time. He traces time to memory or rather forgetting of the memory. Using the Heraclitus metaphor that one cannot step in the same river twice, he envisioned time as a river but this river is not coming from the past, passing through the present, and going to the future. Instead the river is static but we are moving in it. He explains that his apparent flow of time is a product of our "surreptitiously putting into the river a witness of its course". It is only by considering ourselves as separate and distinct from the rest of the universe, that we perceive time as changing. In other words, we forget to place ourselves and our connections into the picture. Thus, objective time itself may be explained by the subjective experience of time.

Neurophysiology of Time Perception

Unlike for senses of sight, sound, touch and smell, there are no sensory organs to perceive duration. How then are intervals, durations, and sequences coded in the brain? Despite its importance to behavioral sciences, the neural bases of time perception remain a mystery.

Much of what we know about time perception in the brain emerges from psychophysical experiments. One class of studies involves ways in which time perception distorts: for example, during brief, dangerous events, such as car accidents and robberies, many people report that events pass in slow motion as if time slowed down. Other studies have been able to quantify distorted time judgments during rapid eye movements (Eagleman, 2005; Morrone et al., 2005) or after adaptation to flickering or moving stimulation (Kanai & Verstraten, 2005).

Several empirical studies have related disorders of temporal experience to abnormal psychological functioning in schizophrenia, depression and anxiety. Unspecified breakdown in the 'biological clock' has been proposed as a mechanism for disordered time perception (Prabhu et al., 1969).

In a series of experiments done since 1950s, Libet (e.g., 1979) was able to demonstrate a "backward causation" in the brain. Libet found that the awareness of the decision of a motor action in his study subjects came about 200 ms before the motor action had started as evidenced by EEG readings. Thus it appears that in the brain there may be a mechanism to transfer the information "backwards in time," so that we act first but later on may retroactively "decide on the action."

Conclusions: Consciousness and Time

Consciousness like time is difficult to define. What St. Augustine remarked about time can be equally true of consciousness, that when no one asked him, he knew what time was; however when someone asked him, he did not (in Smart, 1972). One of the key features of consciousness is what seems to be temporal synchrony — in contrast to the idea that our conscious perceptions are non-synchronized (Dennett, 1991). In fact at any given time nervous system is bombarded by a wide variety of visual, auditory and tactile input. What we perceive as the external reality is in fact the organization and interpretation of this sensory data and is one of the fundamental aspects of consciousness. As Julian Barbour has argued time may be a collage of haphazardly arranged moments whose continuity is an illusion of memory. Thus, it seems that time is a creation of consciousness.

Henri Bergson attributed time to the innermost dimension of consciousness. Andrei Linde used the insight by Kluza and Klein about the possibility of large extra dimensions to develop a theory of consciousness, according to this view consciousness has a special extra dimension or "brane" in the super-string theory, thus the ordinary space time becomes a part of the "hyperspace" organized by consciousness (Smythies, 2003).

Similar ideas are expounded by Penrose and Hameroff. In their Orchestrated Objective Reduction (Orch-OR) model, Hameroff (1996) conceptualizes consciousness as successsive quantum superposition of the tubulin protein conformations in the brain. He proposes that with each conscious moment, "a new organization of Planck scale geometry is selected irreversibly". This leads to apparent illusion of time. Thus without consciousness, there would be no time.

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Exploration

Time, Consciousness and the Foundations of Science

Stephen Deiss*

Abstract

For the reasons discussed herein, it makes sense to treat consciousness as a process pervasive in nature, at all levels of complexity. It can be seen as having a type of self-similarity. Recall that time supervenes on change, change requires contrast, and the contrast has to be detected. Whatever systems are changing are sensing and recording their reaction to the contrast in their behavior and in their state change.

Key Words: time, change, energy, consciousness, science.

What could be more different and unrelated than elementary physics and consciousness? The prevailing view is that consciousness is something that emerges in complex physical systems. Yet, with all we know from cognitive neuroscience today, there seems to be no biophysical process that should of necessity produce sensations, experience, or self-awareness (3 different things) as a byproduct. Although our mammalian experience seems to clearly supervene on embodied brain processes, mammals are only a subset of the range of living and non-living systems in nature. A complementary view is that there is some kind of sensation or experience in any physical process. This is one way to characterize panpsychism (Skrbina, 2007, 2009). Resolution of these two conflicting views goes beyond scientific analysis.

The view taken here is that the answer to the larger question of why there is conscious experience anywhere in nature, the hard problem, is largely a problem of philosophical perspective and how one defines consciousness (Deiss, 2009). Reflecting on our own experiences and what we have learned from cognitive neuroscience, we know we sense contrasts between light and dark, loud and soft, warm and cold, and other sensations. We then, in the blink of an eye, habitually (unconsciously) interpret those sensations as evidence of or proxies for objects around us and of our own bodies. The interpretations are what we perceive. These interpretations are driven by recognition of repeated patterns in sensory contrasts that have some constancy or tendency to repeat within bounds of family resemblance. But note that it is not possible to recognize such patterns over time without *re-cognizing*, i.e., using our memory of past exposures to patterns. Furthermore, if we are not attending to what we are sensing and interpreting enough to remember the interpretation we produce at least for some nominal time span, then we will likely be operating in a reflex automaton mode (like zombies, see

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Kirk, 2006) without any later recollection of lived details because we were attending elsewhere or otherwise unconscious. Examples are driving while talking on a cell phone, or watching TV while riding a stationary bicycle. For all these reasons I define *consciousness as a process of using our memory to interpret patterns of contrast among our sensations (as the stuff of the world) and using these interpretations in behavior while committing the interpretation to memory for a nominal time*. This provides the means of bootstrapping a worldview by induction.

In the case of humans with their large associative memory and language-based socialization that begins in infancy, we learn one very special repeating pattern as children. We learn that there is a *self* associated with our body and our actions, a unique private thread of memory no one else can have. We are taught a narrative about whom we are, and we participate in the making up of this narrative as we grow up. We are storytellers extraordinaire. The end result is that early on in development we not only experience the world around us, but we also experience ourselves in the background ever present as an accompaniment. This makes us self-conscious. No one would claim that a prelinguistic infant is unconscious. Yet, it does take some years for them to develop in-depth self-awareness with the help of language. For this reason, I would claim that higher order thought (e.g., Rosenthal, 2009) notions of consciousness are misleading. One can have experiences without attaching them to their person. Adding a self to the narrative merely personalizes the experience. It does not create nor legitimize it in some way. Lower life forms with insufficient social structure or less or no associative memory can be conscious of the world without elaborate self-consciousness. The argument extends to the nonliving as seen below.

As science matures we have learned that the so-called *laws* that govern nature are not operating on nature from anywhere outside, much less from 'on high.' What nature does consistently simply *are* the laws of nature. As nature evolves and self-organizes, consistent patterns begin to be seen in the scheme of things observed. These laws may not be as immutable as once thought. They include constants that are no longer thought to be so constant. They involve quantum interactions that have probabilistic outcomes. Nature seems to be a work in progress, making up its story as it goes, just as we do. But if nature is not governed from the outside, how do things happen as they do? To answer this I find it helpful to think of the difference between how rules are learned in an artificial neural network, embedded implicitly in the synaptic weights and connectivity, versus how rules are programmed into an old-fashioned AI system for which someone had to define the rules up front. In the neural network vernacular this is called constraint satisfaction. What if most or all nature works that way? If so, then everything that happens involves a kind of decision making, whether it be the way the wave function collapses on a particular trial, or the way a brain weighs alternatives to choose behaviors and narrative updates.

With that background and definition for consciousness, we can begin to explore what physics, time and consciousness have to do with each other (cf. Deiss, 2006). Whenever an event is detected, something must have changed. Events are changes that occur on a contrasting background of non-change or a differing background rate of change. If we look at the differential equations used commonly in physics, they often involve a change with respect to time. But time is just a place holder for another differential equation that defines the movements of a clockwork with respect to some other regular repeating process of change in nature. Time is defined by change.

A universe that was totally static might as well not exist. No events would be detectable, and the universe would be irrelevant. The opposite of being is not nothingness. Nothingness is unimaginable. The opposite of being is lack of interaction and change. Even a rock reflects light on interaction with photons, and the rock and photons undergo subtle changes. An object that never interacts with anything is undetectable and would not ever be part of the empirical world except as theory or fantasy. Change is the basis of interaction. Any change must occur along one or more dimensions (color, spatial location, pitch, etc.). These are some of the possible dimensions of contrast.

Detection of change requires concurrent sensitivity to the world configuration along that dimension of contrast, so that there is a detectable difference, or else it requires concurrent activation of a memory representation of the contrasting side, a model. In order for there to be *a difference that makes a difference* there has to be two or more things that can be differentiated and compared by the system that would respond to the difference. A detector is a system that reacts to the differences presented by the changes it is sensitive to. Systematic or non-random change itself requires memory to occur in the first place. The seed of the next state or behavior must be present in the current state and behavior even if there is a dynamical nonlinearity. In its most simple abstract form such memory is a form of resistance to random change. It is basically the foundation of *inertia* in the general sense of that term. Therefore, in order for there to be any detectable change, there also has to be contrasting inertia. Without any change, there would be no such thing as time because change is the basis for building clocks.

All this leads to rather interesting conclusions. Nothing detectably endures and exists with inertia unless something else is detectably changing by contrast. The change implies some kind of dimensionality. Nothing is changing unless something else, relatively speaking, is static and enduring. Inertia, dimensionality, time and change define each other, always accompany each other, and are relative to each other. None of these are ever conceivable in isolation without all the rest. Contrasts are fundamental. Until detected somewhere, contrasts are irrelevant and do not make any difference or produce any change.

Detection of change requires sensitivity to the contrast in question. People can sense red-green contrast. Complex cortical V1 cells respond to small oriented patches of luminance contrast. Retinal cones respond to photon wavelengths differentially. For all these there is a difference that can make a difference. There is a qualitative aspect when people sense red-green contrast. The almost universal bias is to deny any such sensation to the complex cell or the retinal cone cell, much less to something like a thermostat. This is the mechanistic bias of science that blinds us. As long as we believe nature is governed from somewhere else, we can deny any need for sensation in the simpler systems so often referred to in science as "simple physical mechanisms."

That unjustified bias leaves us with the hard problem of where and how sensation and experience arise in nature. One proposed way out is the eliminativists' position that denies there is anything other than material mechanisms. However, this position is inconsistent and incomprehensible. The only evidence eliminativists have for materialism comes from their own ability to observe and interpret sensed qualitative contrasts. If they deny any knowledge of them, they eliminate any empirical basis for eliminative materialism. On the other hand, the less radical bias of most science is to use Occam's Razor to deny sensation or conscious experience anywhere but in brains. However, if we instead use Occam's Razor to cut away the supernatural transcendental view of laws of nature, then there is little reason to assume that the universe is divided into sentient versus only mechanical systems. It is more consistent to assume that *any* system that can detect and respond to a contrast has sensation of it as it does so, just as those of us blessed with brains do. If the contrast cannot in principle be sensed by some kind of matched detector system, then it is irrelevant since nothing could ever happen as a result. The universe runs off "differences that make a difference" (Bateson, 1980), which is information for some detector observer. All detectors are observers, however simple they may be.

It is natural to ask if such primitive detector systems' sensations are conscious the same way our own are, involving our multi-sensory brain and body and reflection on a narrative self. I would not make the claim that they are anything like the qualities of our human or any mammal's experience. That requires very large associative memory that can learn new things and integrate much information from many sensory channels. Human memory associates the adult narrative with other things we are aware of thereby creating a reflective awareness. Nevertheless, these primitive detectors are formally analogous. Take an old fashioned thermostat as an example. It has a spring and a small glass container with mercury in it. This spring acts as a memory with hysteresis. As it interacts with its environment the spring is deformed one way or the other to trip a switch that can turn on heating or air conditioning. That interaction with the environment as well as the tautness of the spring itself should have elements of sensation. The action on the switch is the thermostat's behavior. The state of the switch, the spring, and the flowing current is the (inertial) memory state of the system so that its behavior is not random, and it changes and adapts to its microenvironment. The thermostat refers to that inertial

self in every state update it makes via feedback. However, without associative memory (allowing massive feedback of a different order that includes personal episodic history and anticipation) the thermostat need not have any higher order thought about what it is doing. It experiences its limited realm of sensitivity without experiencing any human-like self. This is more than an analogy. With some work I suspect it can be formalized into a general theory of conscious systems that integrates the cognitive sciences with the social, biological, and physical sciences going well beyond modern mathematical system sciences or the grand schemes of the general systems theories of the past century (cf. von Bertalanffy, 1968). However, the end result will still be a theory, another interpretation of an enormous number of observations of patterns in our experience. Science itself is just such process with the added adaptations of publication and consensus. This is a conscious process at a social group level.

For all these reasons, it makes sense to treat consciousness as a process pervasive in nature, at all levels of complexity. It can be seen as having a type of self-similarity. Recall that time supervenes on change, change requires contrast, and the contrast has to be detected. Whatever systems are changing are sensing and recording their reaction to the contrast in their behavior and in their state change. The concept of energy in physics falls into this intuitive metaphysics as well. In physics, energy is the ability to do work. Work involves changing something. Therefore energy is the impetus for change. Since time is the flip side of change, energy is bound together with time making it possible. Since contrast has to be detected for change to be realized, consciousness, as defined here, is a key part of fundamental processes, in fact, *the* fundamental process of nature as it self-organizes. The end result is that time and consciousness define each other along with energy, information, qualitative contrasts, inertia and detectable dimensions of differentiation. These are the conceptual foundations of any viable physics.

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Exploration

Contextual Division and the Analysis of Linear Time

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Abstract

I employ a contextually divided analysis to reconsider the relevance of linear time in biological concerns and its irrelevance in a realm defined by quantum and cosmological properties. Linear time is explored as a necessary byproduct of biological world-modeling; a cognitive construct crafted and utilized by sentient organisms to manage successful narratives of nutrition, procreation and self-protection. Order and disorder are proposed as the fundamental conceptual components of a cognitively constructed linear experience of duration.

Key Words: contextual division, linear time, cognitive, sentient organism, nutrition, procreation, self-protection, order, disorder.

Introduction

The subject of *time* is truly troublesome to those that think on it. The more we attempt to know its secrets the less familiar it becomes. The trouble with *time* is very much akin to our trouble with *matter* which on close inspection also dissolves into thin air – objects reveal themselves to be as much about empty space as the supposedly empty space around them, a difference only distinguished by patterns of energy. We perceive and engage objects in a specific conceptual way (solid, extended, immutable, impermeable, consistent over time, etc.) that disallows for an understanding of the actual properties and dynamics that make an object possible. In similar fashion, we perceive and engage time as a one-way arrow from the past through the present and into the future. Much like our assumption of matter as solid and immutable, this regulable, linear conception of time is so fundamentally interwoven into our experience of the world that questioning it at all seems a misguided and highly irrational endeavor.

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Yet, with the rationality of physics as our guide, we are hard pressed to find any actual proof of time as a regulable one-way arrow and quite a lot to indicate that whatever it is, it is definitely neither fixed nor regulable and cannot be confined to a single unified direction. When called on to justify our assumptions about linear time physicists refer to the principle of entropy in thermodynamics. In short it is the principle that ordered thermonuclear systems dissipate into disordered thermonuclear systems and the direction of this dissipation is an irreversible one-way arrow. As the sole scientific example of proof for time's one-way arrow it is specious for many reasons. Physicists agree that a reverse in the dissipation direction, going from disorder to order, is not impossible, merely 'unlikely' (a far cry from the level of 'certainty' we expect in scientific proofs). And the 'likely' direction of dissipation does not apply to the biological realm wherein the creation of order from disorder is commonplace (the entropic concept is therefore clearly limited in its scope of applicability – lacking in the 'universality' that we also expect in our scientific proofs). The terms 'order' and 'disorder' at the center of the entropic claim are ill-defined and ill-understood (something I will touch on later in this essay). And, most embarrassingly, the assumption of linear time is already built into the principle of entropy from the start. (We cannot compare the ordered and disordered states of the self-same system without embedding them in a preconceived notion of linear time.)

Contrary to our intent to illustrate a fundamental dynamic, the entropic principle sadly reveals the qualitative weakness in our thinking about time. The cosmological sciences afford us ample proof that our conventional notion of time bends and warps, stops and reverses, in a highly malleable interwoven relationship with space, mass, gravity and energy. More damningly, the quantum realm discredits our assumption that measurements of any kind are passive, objective acts of observation – including the measurement of time. The act of measurement collapses the potential of a quantum state into qualitatively different properties – waves or particles. And the particles cannot be measured for both position and momentum. To measure either eliminates the possibility of assessing the other; and yet we need both to indicate the common notion of movement through space over time. Our commonplace intuitive assumption that the world is a collection of discrete physical objects subject to causal actions unfolding in linear time does not apply to reality as described by the cosmological and quantum realms, and it cannot be illustrated by thermodynamics or any other scientific example of fundamental principles.

"Well, so be it," we collectively say, "life goes on," and so it does. But unfortunately, we are not able to conveniently quarantine time's peculiar inconsistencies solely within the obscure realm of non-classical physics and thermodynamic principles. Our common interactions with the shared world (supposedly objective by virtue of being inter-

subjective) provide us with an equally inconsistent and unreliable standard for the experience of time. Everyone experiences and accepts as normal the strange speeding up or slowing down of perceived time that accompanies a changing degree of individual busyness or languor. But this translates into an unreliable communal standard of experience because the inter-subjective realm of cultural expectations is nothing more than a bell-curve average of individual distortions and preferences that arise in a specific cultural setting. A change of cultural and geographical circumstances can result in a noticeably disorienting experience of time's elasticity, as can happen when one travels from a busy urban center to a relaxed island in the West Indies (or visa-versa). A day in an unaccustomed cultural context of time can seem three times as long or disturbingly brief regardless of the regularity of clocks across the globe. In fact, an awareness of the regularity of clocks is what makes the variations of time in our private and communal experiences especially obvious to us. We do not experience time as standard and regulable and clocks remind us of this. But then, of course, if clock time were fixed in our individual or communal experience, we wouldn't need the clocks. A global synchronized system of clocks is ostensibly designed to coordinate travel and commerce, but it also inadvertently functions to call us back to a standard beyond our individual and communal distortions.

Furthermore, even within the shared range of distortions in our communal perception of time, different subcultures and age groups experience time in vastly different ways. School children experience the months of summer as an endless ocean of time while the elderly claim experiencing an entire decade as having passed by in a heartbeat. Clearly, the warps of human memory apply additional unavoidable distortions to our personal and communal perception of time. Memory is hugely unreliable for simple facts, figures and circumstances yet we rely on short and long term cognitive mechanisms of memory to provide us a reliable sense of time passing. Time itself can reasonably be asserted to be nothing more than the imperfect byproduct of an unreliable system of memory that provides a useful order and structure to what would otherwise be distinct and disjointed present moments, just random isolated impressions and events. Given the lack of hard-science support for the concept of linear time, an exploration of the mind's role in creating and coordinating the impression of time as linear and one-way is a reasonable endeavor.

A study of the mind and cognitive processes provide even more cause to repeal our unfounded assertions about time than do physics and thermodynamics. For example, we are somehow given the very real-seeming conscious impression of deliberately choosing to perform an action in advance of performing that action when all the while the order is inexplicably reversed. We are neuro-chemically/neuro-electrically activated to perform body movements in advance of our consciously deciding to make those

movements (according to the work of Benjamin Libet and others). The assumption of top-down conscious command *and* the trusted arrow of time are both brought into serious question here. Both may be manufactured impressions arising in consciousness for the sake of advantageous behaviors rather than accurately representing intrinsic properties of selfhood or absolute truths regarding the fundamental properties of the world.

But even the most thorough exposure of our time concept's embarrassing unreliability does nothing to undermine or dislodge the robust quality of our working assumption that it is linear and one-way. Despite the copious evidence available to discredit its veracity, our strongly guarded intuition is to accept time as linear and regulable and to assert it as fundamental. We defer to clock time and happily assume it to be a fixed quality of the universe, an unquestioned foundational property of reality. We hold our faith. An inquiring mind might not only question our assumptions about time, but also inquire into what it is that so strongly and so strangely adheres us to this very questionable assumption. Why is such a flimsy concept so resilient and so useful? Rather than proactively ignoring the evidence that speaks so loudly against it (as the culture agrees en masse to do), I suspect it is more interesting and fruitful to probe the question of time in new ways in order to see where such questions might lead.

Yet how does one go about questioning a supposedly fundamental phenomenal property that is so inextricably interwoven into our experience of reality – the very same reality we use as the empirical standard to judge and compare all phenomena? Funny you should ask! *Contextual Division* is a very handy analytical contrivance with many uses and this is just one of them. Hark! – a necessarily wordy explanation approaches just ahead. I will do my best to make plain the concept of contextual division and then I will illustrate its application in a reassessment of the concept of linear time.

Contextual Division

Contextual division is a reconceptualization of analytical parameters in order to discern new information, new relationships and new meanings. It is not a theory of the testable sort. It is simply a new angle of assessment, a new perspective on old problems. Unlike theories, it comes with no assertion of absolute truths about the nature of reality. It is a mere contrivance, an analytical tool to be disposed of as soon as the kind of analysis it produces is no longer relevant or warranted. It is a particularly useful and relevant tool as it can reveal much about our conscious condition.

Contextual division is a tool for knowing certain kinds of things and is modeled on more common and familiar ontological processes. Our baseline method-of-knowing anything is to divide and classify phenomenal properties into dichotomous pairs of opposites:

soft/hard, large/small, beneficial/harmful, order/disorder, and so on. By dividing an otherwise indistinguishable spectrum of object properties and dynamics into convenient pairs of opposites we provide ourselves a context in which to assess phenomenal aspects of our environment as they occur in direct relation to our own unique needs and uses. Acts of awareness are used in this way to create a useable, creature-specific world-model. It is only in comparison with its opposite that the quality being expressed in our world-model is fully defined for us and can then be applied and utilized in our orientational calculations. We tend not to think of it that way but there you are: without a concept of softness, there is no concept of hardness; without a concept of light there is no concept of dark, etc. And most importantly to all world-modeling equations, without a sentient entity signifying this difference for a particular reason, there is no concept of anything.

Without a signifying entity (a sentient being to perform the conceptualizing, modeling and distinguishing acts) there are no world-models, because world-modeling is a *process* requiring a world-modeler. Without a signifying entity there are no *concepts*, because the signifier provides the *conceptual criteria*; there are no distinguishing features of an environment without a signifying agent's criteria for distinguishing relevance. The project of formulating pairs of opposites and thinking of them as distinctly separate phenomenal characteristics (independent of each other and separate from ourselves as signifying entities) is hugely beneficial, but there are many reasons why we cannot depend on this process to describe the world in an accurate way. The most significant and damning of these reasons is that the process of world-modeling precludes acknowledging to what extent the self/world dichotomy at the heart of it is also a conceptual contrivance. The process of distinguishing opposites from the perspective of a biological 'self' set in a 'non-self' world is an inescapably subjective exercise performed by organic entities, with unique and limited perceptual capabilities, for very specific reasons. It is inherently NOT objective because it is a purposeful conceptualization, a cognitive construct, a manipulation of information, a mistaking of concept for fact, a projection of preference and need, rather than a passive objective observation of a world. Though it should not be construed as constituting an objective reading of either the world around us or our actual condition, it is a very useful artifice for by this process creatures like us flesh out a configuration space in which to maneuver and manipulate, self-sustain and procreate, adapt and evolve, etc. Later in this essay I explore the importance of signifiers (and their criteria for relevance) in relationship to the concept of linear time. But for the sake of explaining contextual division it is sufficient to understand that signifiers, with specific purposes for signifying anything, are inescapably bound up in whatever conceptualizations are produced in the process.

Contextual division can help us to circumnavigate the conundrum of being inescapably bound up in self-made world-modeling conceptualizations. Contextual division is an analytical tool designed with an awareness of the role of signifiers and an awareness of the basic dichotomous method of fleshing out our world. And contextual division is informed by the assumption that sentience is at the service of creating a functional world-model in precisely this way. By taking our very ingrained habit of distinguishing a world via dichotomies and projecting it onto an even larger scale represented by two distinct realms of logical relevance (rather than property types), we extend the realm of our analytical grasp and incorporate into our world-model all the properties and phenomenal features that our biological necessities would otherwise compel us to disregard. Our commonly-shared orientational world-modeling equations compel us to ignore certain aspects of reality like quantum and cosmological features (non-linearity, non-causality, dark matter and dark chemistry, etc.) and we ignore the backstage world-modeling aspects of cognition itself (the meaning-generative dynamics of concepts and beings). We typically ignore these features or treat them as puzzles or anomalies because they are bio-functionally irrelevant. Bio-function supplies the signifying purpose of our world-modeling equations and whatever falls outside that purpose is generally considered less real. Contextual division is a way of rectifying this so that our world-modeling can expand to include all phenomenal qualities.

In short, *contextual division* is an intentional separation of conceptual and phenomenal properties into two distinct dichotomous categories distinguished not by physical/phenomenal characteristics but by the signifying criteria that informs their use – the logical relevance or irrelevance of property concepts in relation to bio-functional needs. This particular dichotomizing action results in a *biospecific* category unique to biological world-model manifestations and an *extracontextual* category for everything else. The important point is that the categories are not defined by the properties themselves but by the logic or illogic of their use in their direct relation to biofunctional purposes. Please note this dichotomy is an analytical device, not an assertion about the true nature of reality. Its use is pragmatic and its value is only to the extent that it can produce more fruitful analysis. I use it in this essay to formulate an analysis of time from a significantly different conceptual perspective, one that contradicts and exceeds the limitations of empiricism. I will briefly explain the separate contexts and the logical criteria that define their difference. Then I will apply the analytical perspective it generates in a reconsideration of linear time.

The Biocontext

The *biospecific* context envelops all the conceptual/phenomenal properties and characteristics relevant to our needs and uses as biological entities, such as: causal-material property concepts (time, space and matter concepts expressed in classical

physics and biochemistry); self/world boundary concepts and the complex concepts involved in owning specific volitional capabilities; the concept of free will to utilize our unique volitional capabilities to solve specific kinds of problems; and the especially vital concept of a positive valuation of living that inspires all successful organisms (including us) toward *advantageous* volitional engagement (rather than random ineffectual or inadvertently destructive activities). The *biospecific* contextual category envelops the entirety of the biologically relevant world-model, includes all its conceptual components, and is informed by an awareness of the necessity of world-modeling processes to create and engage this world-model (ergo, it is informed by an awareness of its artificial and contingent nature in relation to the world in-and-of itself).

The Extracontextual

The extracontextual context is a catchall for everything else, for everything external and irrelevant to fundamental biological world-modeling concerns. It is best represented by that which so obviously contrasts with biocontextual features like: non-linear, non-causal quantum phenomenal characteristics; non-linear, non-causal, non-material cosmological properties and dynamics; and the non-linear, non-causal features of our own perception and cognition – like the vibrant, dynamical procreative interrelation of meanings, concepts and beings that social anthropology and cognitive neuroscience bring now to our attention. These features are every bit as real and legitimate and aught now to be incorporated into our understanding of reality. Contextual division is one way of doing this. A unified theory of everything would be another method of incorporation but that is proving mysteriously elusive. Contextual division clarifies the unification mystery by illustrating the illogic of the unification quest (or even less politely, the extent to which unification is simply an overweening biocentric desire for a simple explanation of quantum properties in biorelevant terms). Instead of the property types (classical and quantum) that are used to define the unification problem, contextual division utilizes the *logic, meaning and purposefulness* behind the signification of property types – a biological agent's signifying criteria for relevance.

Contexts of Logic

The logic, meaning and purpose of living systems provide a category of phenomenal dynamics, properties and assumptions that are distinct, specific and pragmatic. This biocentric logic is most apparent when we regard the interrelation and interdependence of world-modeling concepts that so clearly rely on one another in order to manifest as real and useful. Biocentric logic is therefore best illustrated by observing the disappearance of this logic as soon as we remove any one of the interdependent concepts that support it. For example, without a concept of physicality (extension in three dimensions) there is no concept of boundaries, without a concept of boundaries there is no concept of causation, without a concept of causation there is no concept of volition,

without a concept of volition there is no concept of freewill, and so on. None of the supposedly fundamental features (including the concept of linear time) make sense or have purpose outside the uses that biocentric logic animates within the world-modeled configuration space of their *combined* use. The logic of these concepts is bound up in the purposefulness of their combined use in biological necessities. We, as biological creatures ourselves, are so caught up in the logic, purposefulness and conceptual usefulness of these supposedly fundamental features that we are typically unable to see to what extent they are contrived and limited assumptions. We are so caught up in them that in the face of very damning evidence given to us in our own best rational terms of analysis we persist in a staunch refusal to see their gross inaccuracy. Biocentric logic is so compelling and so necessary that we don't typically enjoy the luxury of seeing it at a distance, of understanding it as a closed system of contrived assumptions, of knowing it as merely one example of many possible logical matrices. Our deep biological investment in this logic compels us to mistake its conceptual components for the truth about the world – the true nature of reality. For the sake of a more interesting analysis the biocontext is considered here a unique context of logic that only applies to living systems and therefore cannot be used to analyze all the properties and dynamics that fall beyond the borders of bio-relevance.

For the purpose of contextual division, everything beyond the parameters of the realm defined by organic logical purposes represents the dichotomous opposite – the realm of the *extracontextual* that awaits a more clear-headed application of non-biocentric logic to incorporate and activate the usefulness or relevance of its features. Dividing otherwise indistinguishable phenomena into dichotomous pairs is standard ontology. In the case of contextual division however, the common division of opposites is represented by these separate categories of logic that are specific to the logic and purposefulness of phenomenal functional properties. Biological life supplies its own unique purposefulness and so the characteristic phenomenal components of the biological world-model are logically bound up in that purposefulness. We model a world based on biorelevant exigencies. Quantum and cosmological characteristics are not bound by life-logic and cannot be properly understood by applying the same logic and characteristics that inform the success of life-systems. In short, for the sake of a new form of analysis, contextual division divides the world into a category of biophysical functional logic and a category for everything else that we now know about reality but which contradict (or are anomalous to) our bio-physical causal-mechanical assumptions.

Just like the more common dichotomizing of phenomenal pairs, contextual division does wonderful things for us. It fleshes out a more objective and useful world-model in which to maneuver and manipulate, and it provides a broader, more insightful

perspective onto our situation as sentient creatures in a world of wildly diverse phenomenal characteristics. What's more, by artificially tethering the logic of the causal-material world of properties (which includes the concept of linear time) to the logic of their direct functional uses in biological organisms, we can begin to see with greater clarity the self-creative world-modeling processes that are by necessity the primary task of conscious processes in sentient beings. By aligning acts of awareness to biological purposes and aligning biological purposes to the construction of bio-relevant world-models we are provided a more useful conceptual approach to the study of consciousness; we can begin to discern the purposeful evolution of awareness from the world-modeling processes of simple organisms into the spectacular cognitive bells and whistles in the vibrant cognitive-perceptual self-model mode of human conscious experience.

Contextual division affords us a unique intellectual distance from the assumptions we are typically caught up in as biological entities. From this new perspective we can begin to see certain phenomenal properties (like linear time) in their direct relation to bio-physical needs rather than as inherent properties of the world itself. By proactively choosing to separate reality into these two distinct categories we can more accurately assess the realm of biologically driven concerns as a separate and self-contained construct – a distinct conceptual environment, an entity unto itself, *the biocontextual configuration space*. By simply choosing to categorize phenomenal characteristics in relation to the logic of their use and relevance (biological and non-biological), we can begin to see how the specific and limited grouping of phenomenological properties that are tied to the purposes of biological functional success would (and do) distort our objectivity when assessing the properties and dynamics of a reality that includes the quantum, the cosmological, and the cognitively dynamical realms. Biological habits of thought induce us to apply biophysical/biocontextual logic to a realm of properties that by their own intrinsic nature elude such logic. The artificial categorizations of contextual division allow us to intellectually disassociate ourselves from all the assumptions and instincts that go hand in hand with being a biological organism, in order to see the source and accuracy of those assumptions more objectively and to circumnavigate them more efficiently.

Just as we (in our role as biological organisms) can see little point for non-causal, immeasurable quantum properties within the ordinary world of daily concerns, neither can a purpose (or any evidence) be discerned for our biologically relevant causal-dynamic properties in a world as defined by quantum and cosmological characteristics. Both the biorelevant and the extracontextual are legitimate realms but neither context is particularly relevant to the other. The biospecific realm is informed by a context of logic reflecting the purposes of organic entities and the extracontextual realm is wide open, of

vastly different characteristics, and awaits a context-appropriate matrix of logic with which to animate its use. To force a unified theory of everything onto these disparate and unrelated realms is to do nothing more than force the concepts relevant to the biocontext onto a realm in which the logic does not apply. And the reverse is also true; to claim that elusive quantum properties are the mysterious basis of consciousness (for one example) is an equal distortion of the biocontext, a context in which the logic of living systems *(not* the properties of physics, classical or otherwise) most accurately defines the configuration space. Contextual division allows us to explore the drastic qualitative differences of these two distinct logical/phenomenal realms and allows us to use this difference to understand ourselves and the world in an unusual new way. It is an openly and admittedly artificial creation of dichotomies in order to reassess the configuration space we call 'reality', and in this particular example, to more accurately reassess the *time* aspect of this shared conception of 'reality'.

New Questions

Armed with a contextually divided realm of analysis, we can begin to ask questions regarding the bio-relevance of any concept. What does linear time mean to us as organic entities, what might its advantages and uses be to biological systems, how would biological entities formulate such a concept; and in what way might our biologically relevant explanatory conceptualizations be distorting our understanding of the properties and dynamics that we now know legitimately exist as *extracontextual* realities? We are in the habit of assuming our limited *biocontextual* phenomenal parameters are the proper parameters by which to judge all things. We are mistaken in this and it will take some getting used to the prospect of thinking differently about it. Our intuition tends to lead us back toward a biophysical-causal assumption of the world which then must be augmented by mysterious metaphysical concepts in order to psychologically subdue the vast uncertainties and wild vagaries that are the natural byproducts of so inaccurate and incomplete a world-model. *Contextual division* provides clarity here by allowing us to set up camp (so to speak) in a purpose-neutral, meaning-neutral, non-biocentric, non-anthropocentric *extracontextual* territory of analysis and to observe all biorelevant properties and dynamics with an eye toward their unique phenomenology and uses rather than solely in terms of our previously unquestioned biocentric causal-physical concerns. From this perspective it becomes abundantly clear that bio-contextual expectations, and the urgent biological needs that inform them, induce us to overinvest in biocontextual analytical criteria, mistaking them as absolute truths about the nature of reality. By just knowing this, we can begin to see our world, our world-modeling, and ourselves for that matter, in a new and more objective way.

In the light of the analysis that contextual division affords, it is apparent that we have mistakenly been granting explanatory sovereignty to properties and dynamics that are only relevant to our own functional uses. Our standard approach to explaining phenomena is biocentric in that it is typically with an eye toward advantage or control in some aspect of biological, personal, social, medical, environmental, economic, or political function. Typically, the object or property of concern must ultimately *do* something for *us* if it is to be counted as worthy of concern and so traditionally its relevance must be measurable via the matrix of properties that define a realm in which 'doing things for us' is actually possible. While there is nothing inherently misguided about such pragmatism, the expectation of human (ergo biological) utility puts false limitations on the larger quest for knowledge of the universe in-and-of itself. We cannot assume we possess full knowledge by only assessing the few phenomenal characteristics that are specifically useful to creatures like us. Much (perhaps most) of the universe may never prove useful in the causal-physical or bio-functional sense but knowledge of these non-bio-relevant features can infinitely extend our cognitive grasp of our condition as sentient beings in a universe of wildly divergent properties that extend far beyond the realm of biocontextual relevance.

We happen to already possess extensive knowledge of extracontextual phenomenal properties (quantum, cosmological and cognitive qualities), but our biocentric habits of thought prevent us allowing these new properties to fully inform our conception and experience of reality. We have thus far confined our communal notion of reality to the small subset of properties directly engaged in our basic bio-functional concerns. And we have not bothered to discern in what way our functional concerns distort all objectivity when we apply these same properties (physicality, causality, linear time) as standard measurement assumptions in our approach to a broader version of reality. Contextual division allows us to observe, analyze and adjust for these biocentric distortions in our assumptions about the world.

By applying the logic of contextual division it becomes apparent to what extent an inquiry into alternative conceptualizations of *time* falls outside the parameters of biocentric relevance and necessity. Such an inquiry may never prove causally-functionally *useful,* yet such an inquiry can profoundly alter our conception of what it is we are up to in terms of accuracy or inaccuracy regarding our overall world-model. If linear time is a conceptual contrivance then what is the true nature of the world? What can and will be altered by such an inquiry is the very context in which we judge anything 'useful' in the first place. A contextually divided inquiry exposes us to a vastly expanded realm for our knowledge of the world, and, by this exposure, simultaneously expands our self-knowledge. Our identity is defined by a boundary-response to a specific sort of world. Engaging a vastly altered conception of the world evokes a vastly altered sense of

identity. An exploration of the non-linear, non-regulable concept of time will not *do* anything for us in the ordinary causal-mechanical biocontextual sense, but it promises to change the very nature of *doing* and *being* by changing how we understand *doing* and *being*. An expanded understanding of the context in which we function will inevitably transform how we understand ourselves as functioning entities.

Time

We feel intuitively and instinctually certain that time is regulable and linear and configured in a one-way arrow, pointing from the past through the present into the future. It is worth employing contextual division to look at this linear-time concept with a fresh extracontextual, non-biocentric eye, so we can determine in what way it might solely be derived from (and solely relevant to) biocentric imperatives. Quantum physics, cosmological properties, and various aspects of cognitive dynamics, by running awry of the causal/mechanical empirical logic that is so central to bio-physical function, allow us to question the concept of linear time as an absolute truth. By lending full legitimacy to this very different set of phenomenal properties and dynamics we are allowed to discern the relevance of linear time in two distinct realms – the biocontextual and the extracontextual. By conceptualizing two distinct realms we are better able to determine whether the explanatory conceptualizations we inherit by virtue of being biological systems (like linear time) are fit conceptualizations for objective analysis of a universe chiefly expressed and governed by non-biologically relevant properties.

Setting up a dichotomy of logical realms quickly reveals to what extent we have evolved within a limited context of bio-functional imperatives and reveals to what extent we are intuitively bounded within the limited parameters of properties necessary for achieving bio-functional goals. By simply seeing and accepting the limitations of biocontextual parameters, very different assertions about our condition emerge. Primarily and most obviously, we cannot assume we are as rationally or as objectively oriented as we had thought. We have evolved morphologically, perceptually and cognitively to recognize and resolve only those exigencies that fall within a very narrow, self-tailored slice of phenomenal reality. Living organisms are only compelled to engage a small, distorted subset of all available phenomenal properties. We have only been developmentally enabled, via pragmatic evolutionary upgrades, to engage the small portion of properties and dynamics involved in biophysical function (object boundaries, causal properties, linear time, self-models, etc.). As biological organisms we are highly attuned not only to bio-relevant causal-physical properties but to the logic of their interplay in bio-functional narratives of nutrition, procreation and self-protection. The concept of one-way linear time is especially useful in a bio-functional context. Bio-functional narratives are only meaningful, purposeful and efficacious when the correct causal-physical actions can be played out in a specific linear order – in an extended, one-directional, linear

concept of time. To be a living thing is to be inescapably situated within this time-line concept. To be a living thing is to be an active co-participant in constantly creating and engaging the functional configuration space in which the concept of linear time plays an integral role.

Obviously it is very useful to be as adept and articulate in our interrelationship with all the concepts and properties that enable successful organic life narratives, and linear time is one of these properties. Our mistake is to assume that because bio-functional properties are so vitally necessary to us as organisms that they are also the appropriate properties by which we should be judging, measuring and determining the properties and characteristics of the universe itself. We tell ourselves stories about the universe as a series of astronomically scaled causal-physical events played out in linear time, from the big bang through the current expansion of the universe toward an eventual re-condensing of the universe and a final inevitable implosion. We are used to understanding our world as the product of a causal-physical linear-timed narrative of events, a story with a beginning a middle and an end, when linear time may be the most irrelevant feature of description for understanding a universe that is almost entirely devoid of such biological concerns. We are living things. We indeed have a beginning, middle, and an unfortunate end. We are in the natural but misguided habit of telling our own stories and projecting these same conceptual narrative patterns onto the universe. We cannot know the universe in that way. It is not an objective or neutral approach to the universe's own unique non-linear, non-causal, non-material, non-biocontextual characteristics.

By utilizing a contextually divided analytical perspective the concept of one-way linear time can be conceived of as the result of a biological imperative to construct a proper narrative order of actions for achieving nutrition, procreation and self-protection; scenarios entirely irrelevant to inorganic worlds (that is, the rest of the universe, as far as we know it). When viewed in this way, linear time can, for the sake of analysis, be regarded and studied as a necessary concept built into the biological world-model for the purpose of organic self-actualization and success. Linear time can be viewed as an organically self-generated and self-sustaining concept. To understand time in a biological world-model context we can look at the concepts and imperatives that would logically inform the uses and purposes of linear time in biological systems. We can ask and begin to answer *how* and *why* an organism might come to conceive and perceive time in this linear one-way format.

Order and Disorder

One feasible method of conceiving linear time in a context of sentient biological systems is by applying our baseline method-of-knowing mentioned earlier: dichotomy building.

With a useful creation and comparison of dichotomous properties, organisms flesh out the configuration space of fundamental organic concerns. In the case of linear time we can look to the dichotomous property pair of *order* in relation to *disorder*. *Order* and *disorder* represent a phenomenal pair of opposites that have a direct and obvious relationship to survival in biological systems. The recognition of order and disorder in biological systems could arise via recognition of important repetitious events and rhythms (sun rises, tides, seasons, respiration, etc.) in a dichotomized contrast with an equally useful recognition of random events (predator interactions, environmental upheavals, disease, weather changes, etc). An awareness of the random quality of certain events is defined by their stark contrast with an awareness of repetitious, predictable events. Each is useful in its own right, but these concepts can then be utilized in recombination to construct a map of duration. The awareness of unfamiliar random events is overlaid onto the field condition of familiar repetitious events to create a constructed sense of duration. Duration would be recognizable and discernable precisely because of the interruptions to rhythm (order) that random events (disorder) provide. This stark and useful comparison of a dichotomized property pair results in a conceptual matrix in which a sense of time 'passing' can be proactively constructed as linear and one way. A cognitively constructed recognition of time's passing provides an organism a priceless advantage. Suddenly an organism (or system of organisms) can self-organize volitional activity into repeatable successful actions and into a series of actions that add up to more elaborate nutritional, procreative and self-protective behaviors. Suddenly organisms *have* behavior. Without a constructed sense of time 'passing', without proactively perceiving an order of events as linear and one-way, there is no structure for the possibility of behavioral experimentation or development of the sort that allows for complex adaptations in the face of adversity (the very essence of evolution and biodiversity). With the application of contextual division we can begin to rationalize the possibility that linear time may be a creature-subjective, cognitive construction for specific purposes. From this we can begin to formulate very different assumptions about the world, and most importantly to a science of consciousness, we can begin to see the vital and central importance of world-modeling processes to all living things.

Order and disorder concepts at the root of our conceptualization of time have not been well understood because they have not been defined as cognitive constructs, acts of signifying which, because they are signified for specific purposes, cannot stand alone as independent objective description. Nothing other than our own preference indicates that repeatable events are any more 'ordered' than non-repeatable ones. A more natural 'order', particularly in the realm of life-systems, is for no individual biological event to repeat itself in precisely the same way, ever. The regular affairs of biological life systems are in a constant state of flux that a forward arrow of time comes closest to conveying.

Organisms can re-approach the same dilemma in the same way but the context of the problem and the context of the solution are in constant flux; here are no do-overs of already manifested instances in life-systems. In the biological realm all is in essence unrepeatable so, ironically, the biologically 'real' order of things is *change* not *stability* or *repeatability*; but we show a distinct (and distorted) preference for order of the stable, repeatable, predictable, *unchanging* kind.

The concept of 'order' in reference to biological systems is just as readily used to describe this constant unrepeatable flux of events (order as in 'a direction of non-repeatable events' rather than order as 'repetitious predictable events in the environment'). The same word in fact represents three very different aspects of bio-relevant phenomenal description. 'Order' can signify the inevitable unrepeatable forward-flux, linear orderliness of biological events; it can signify the dependable orderliness of something familiar, repetitious and predictable in nature; and it can indicate the dynamic of control or command ('order' as in 'I will it to be so'). All three versions are employed simultaneously. The linear concept of time is the means by which an organism willfully controls the constant forward-flux version of order by proactively associating it with the psychologically comforting qualities borrowed from the familiarity of things predictable. The 'onward' sense of order is willfully overlaid with the pipe dream hope of the 'stable, repeatable' idealized version of order. If we accept that we create a direction of time to reflect the conceptual necessities of biological survival then what suddenly becomes equally evident is how vital and meaningful a concept 'order' of any kind is to life-systems. It is built of deep-seated, creature-specific meaningfulness.

The obvious preference for order shows up as a clear value judgment (order is good; disorder is bad). From the biological perspective, the positive dynamics of *order* need to be recognized and emulated while the negative dynamics of *disorder* need to be avoided or responded to in creative and calorically expensive ways – disorder shows up as something requiring attention, usually an emergency, often deadly. We find examples of order in our environment and use them as the stable orientational foundation from which to assess and overcome the inescapable qualities of disorder that beset all living things. The not-so-obvious upside of disorder is that it is therefore the vital dynamic that challenges and extends our creative, cognitive and morphogenetic abilities. The disorder dynamic can be seen to inspire exigency-specific, species-creative, evolutionary adaptations that ultimately inform the entirety of the biosphere's great diversity. Disorder inspires creative-adaptive solutions and those solutions are often genetically encoded as a base model of operations for future generations – providing an upgraded morphological manifestation of order.

We are creatures caught up in biorelevant logic and meaningfulness. The meaningfulness of order and disorder play a useful role in the construction of a time concept, a vital aspect of the bio-functional configuration space. Our habit is to think of time as something distinct from our acts of signifying. We speak of the 'nature of time' and in so doing we inadvertently assume that time can actually have recognizable inherent qualities unrelated to our agenda for signifying it in the first place. We project the concept outwardly and disassociate ourselves from its construction and meaning. Whether or not our conceptualization of time represents anything actual about the world itself is irrelevant. We *must* signify one-way linear time because one way linear time is critical to our biological format. It is a necessary mode of organic logic, a context-appropriate parameter of biological narratives. Contextual division awakens our attention to the otherwise hidden agenda informing the biocontextual world-model and thereby clarifies the purposefulness of modeling a world in one way rather than in another. By acknowledging deep-seated organic purposes and meanings in all our signifying acts we can then see the extent to which we project a need for *particular* qualities onto the configuration space that are indeed significant to creatures like us. We over-invest in these features with a conviction that allows us to mistake them as inherent truths about reality. Without this new analysis we will continue mistaking our signifying acts as passive, objective assessments of a 'real' world, naively believing we are registering the world's 'inherent' qualities.

This functional naïveté causes us to overlook the procreative projective aspect of all signifying acts and concepts and in so doing we are also caused to overlook the entire qualitative spectrum of conscious processes in nature. When we fully face the subjective quality of our signifying processes it becomes increasingly obvious that consciousness emerges for no other reason than to coordinate and orient life systems within a life-appropriate configuration space. Consciousness shows up as nothing more than signifying acts and these signifying acts are for a purpose, and biological survival has provided that purpose all along. Reality and the true nature of things are completely irrelevant in this biocentric signification process. Yet, the more our configuration space can *seem* like the full extent of reality, the more we can invest in it as an absolute truth, the more we invest the more efficacious it becomes as a world-model, and then the more adept we become at manipulating the few features that fall within the phenomenal parameters of this supremely useful (and beautiful) fiction.

We prefer to think that as humans we are separate from the riff-raff of nature and all its primitive mechanical world-modeling engagements. Surely we must, for all our sophistication, be significantly different in our understanding of reality. And yet, though it may seem that this conceptualization of time in nature (the overlay of random *disordered* events onto a field of regulable *ordered* events) is a primitive, exotic,

unfamiliar conception; it is precisely the way we organize our own calendars. We form a grid representing regular solar and lunar events and overlay it with the random events that we mark onto these calendars as reminders. Our sense of time passing, and our functional engagement with this sense, is no different than it has ever been in our biological and cognitive evolution. We have merely supplied self-reference, precision, signs and symbols, and the invention of mechanisms of regularity. We simply offloaded the biologically common function of linear time concepts onto shareable media like calendars and clocks. We can pat ourselves on the back for this if we like but we are not in fact *significantly* different from (nor more accurate than) other living things in our general conception of a world-model.

Our use of entropy in thermodynamics as proof of linear time is of the same common cognitive construction. We attempt to indicate the passing of time using the self-same concepts of order and disorder, but in entropic theories we replace the orderliness of planetary and lunar movement with the orderliness of thermonuclear structures, and we replace the disorder of random biorelevant events with the disordered dissipation of thermonuclear structures. It needs to be pointed out that our base-description concept-ualizations of order and disorder are purely biocentric, entirely bio-subjective affairs that cannot be applied willy-nilly in this way. Order and disorder define one another by a negation of opposites and cannot be conceived or understood independently, that is, without each other and without an organism acting as a dichotomizing signifier for a specific purpose. The concept of order does not show up without a concept of disorder to oppose it to (and vice versa) and the qualities they represent would lack the animating relevance without the purposefulness of a signifier's imperative for distinguishing them. From the perspective of the universe an ideal state of order might be the fully dissipated disordered state of thermonuclear systems – an indistinguishable but uniform soup of dissipated energies as an ideal of order. Since our concepts of order and disorder are not independent of biological pragmatism, they are not objective assessments of the world. They are artificial and contingent conceptual constructions manifesting biological creature-specific preferences. This does not disqualify the use of the concepts. It clearly behooves an organism to formulate such a dichotomy, to recognize the difference between regulable and random events and to emphasize the stability of regulable events in a manner that gives advantage in our managerial disposition toward the numerous irregulable aspects of biological existence. Order and disorder concepts are pragmatic and useful, but contingent on an organism's need for a specific kind of configuration space, a contingency that ultimately renders the concepts inappropriately subjective in their role as standards of measurement and assessment.

Our biocentric, cognitively constructed, subjective concept of linear time is employed as a standard of assessment in a multitude of ways: in our basic bio-physical functional

narratives of nutrition, procreation and self-protection; in our conception of personal and inter-personal experiences; in our communal histories of culture and bio-physical evolution; and in our cosmology, our explanations of the universe itself and in the explanations of our situation within it. In the light of the dichotomy that contextual division affords us, our conceptualization of the universe as embedded in one-way linear time is a fundamentally flawed conceptualization – a gross category error. Entertaining a notion of linear time as a purely biospecific conceptualization allows us to analyze this linear conceptualization in relation to specific bio-functional necessities and simultaneously allows us to better understand the logic of its *irrelevance* in non-biologically-oriented phenomena occurring in the quantum and cosmological realms.

There is nothing at all to indicate that linear time should be applied in our descriptions of the universe or in objective explanations of our own condition as sentient beings set in a universe of wildly diverse phenomenal characteristics. We are mistakenly assuming a particular *type* of world throughout. We need to determine whether any or all of our basic explanatory concepts (time, causation, three-dimensionality, self-models, object boundaries, etc) hold up as universal description or whether they should be unequivocally circumscribed (because of their inherent explanatory limitations) to a subset realm of *biospecific* conceptual necessity. We currently tell a certain kind of life story, a one-way, time-line narrative about the cosmos from the big bang through its current expansion to a final implosion. We mistakenly project a human story with a birth, a midlife, and a death when these time-lined life metaphors and in-built narrative assumptions misconstrue the actual properties and characteristics of a mostly inorganic, non-living cosmos. Similarly, we should no longer assume we can comprehend the quantum realm using the logic of linear time or the causal properties that the assumption of linear time contributes to in our thinking. We can understand quantum properties in their own unique terms rather than in terms we apply by force of biological habit or out of desire for the simplicity of a unified theory. In short, we should no longer assume that a linear concept of time can be used as a basis for understanding the cosmos, the quantum realm, or ourselves. We could be far more objective in our approach to all aspects of reality by understanding the degree to which certain biologically appropriate world-modeling concepts (like linear time, causation, object boundaries, and order) are cognitive constructs for the purpose of successful biorelevant survival narratives rather than inherent properties of the world itself.

It is admittedly discomforting to pick apart these seemingly innocent, fundamental assumptions about reality, because, despite their failure as absolute truths, we are obliged to continue utilizing them. We strongly prefer the notion of absolute truths and it is deeply discomforting to see how the critique of a single element like time brings every other element of our beloved reality concept crashing down into the psycho-

logically unsettling realm of artificially constructed relative assumptions. Our supposedly foundational basics (like linear time, causal ordering, three dimensions, self/world boundaries, freely willed volition, a positive valuation of life, etc.) only make sense fully combined with one another, each concept inspires and requires the other concepts and their combination is what renders the bio-functional configuration space so logical and so useful. Thus, this *one-assumption-at-a-time* nit-picking brings the entire world-model down in one disconcertingly swift blow. Ultimately, despite our discomfort, we will need to question all our conceptualizations and assumptions in this way – be it linear time, free-will, self-models, three dimensions, causal/mechanical physics, and so on – to determine whether they represent anything accurate about the world in some truly objective sense or whether these concepts are merely biologically contrived subjective descriptions that can only accurately represent and refer to the limited aspects of organic pragmatism in which they are primarily used.

Implications

The analysis of time that contextual division produces comes with significant implications for the empirical project, for consciousness studies, and for the reformulation of communal values. There is a strong indication that an inherent biological *meaningfulness* resides in our *order* and *disorder* concepts embedded in our concept of time. The juxtaposition of the positive and negative *meanings* attached to order and disorder informs a conceptualization of time as configured in a one-way arrow. We align with the 'goodness' of order to attend to the 'badness' of disorder. In so doing, we create a biologically useful conceptualization of duration formulated expressly for the purpose of navigating through biological exigencies. If our concept of time is in fact dependent on biologically subjective *meanings* and biologically relevant *narrative necessities* then such a conceptualization is not capable of informing a truly objective view of the phenomenal properties of the universe itself. If the one-way arrow of narrative time is only relevant to organic processes, and if we truly want to understand the universe and our condition in it, we ought not to rely on interpretations of the universe (or anything else) that depend on such a bio-specific, bio-centric, subjectively meaning-laden concept.

Empiricism is founded on the notion that when we funnel our individual sense perceptions through the intersubjective filter of repeatable experiments we will arrive at an objective truth about the world. However, if the concepts that inform the construction and interpretation of perception are prepackaged with biocentric meanings shared by all living things then our intersubjective agreements about reality are as subjectively invalid as the independent individual subjective experience we are so used to rationally denouncing with empirical glee. Both individual *and* communal levels of analysis would miss to what extent inherent biocentric meanings distort our level of

objectivity. It hardly matters whether the empirical project intentionally or inadvertently disregards the inherent values and meanings that the pre-given criteria of signifying creatures infuse into all acts of signifying. Either way, this meaningfulness-oversight renders the causal-mechanical, meaning-stripped criteria of the empirical project invalid by its own standards of objectivity; it is particularly invalid in its attempts to engage the logic of living systems and the conscious condition that animates this realm. We ought now to be reviewing all our supposedly objective empirical concepts to determine whether or not deeply embedded biocentric value judgments are invisibly distorting the explanatory efficacy of our supposedly impeccable analysis. It is quite safe and logical to assume that no concept or dichotomous pair of conceptual opposites can or would arise in the conscious awareness of biological organisms unless there is a point or purpose to make such distinctions. Concepts arise precisely *because* they *mean* something to a signifying entity or group of entities. To pretend for the sake of empirical study that the concept(s) of *order* and *disorder* are meaning-stripped, value-neutral aspects of physics and nature is to delude ourselves. To apply the order and disorder concepts (which are employed in every aspect of science but especially in astrophysics, quantum physics, thermodynamics, and chemistry) without recognizing their inherently loaded biological value lends a false sense of objectivity to those scientific endeavors. Our mistake is in pretending any property concepts (like order and disorder) are inherently value-neutral and that we can use them to determine something objective about the universe or about ourselves.

Empirical science has proven to be very effective for analysis and control of proactively meaning-stripped causal/mechanical properties, but the danger is in confusing this limited range of causal-mechanical effectiveness with an accurate description of our actual condition. And even if we are just talking about the world-model as it is currently and commonly perceived (as three-dimensioned, linear timed, with self-world boundaries, causal properties, volitional capabilities, free-will, etc.) the clues to a truly objective analysis of this condition would best be found in a clearer analysis of the biospecific meanings, preferences and imperatives that lead us to such a distinct, and specific world-model – a model that remains resilient even when strong contradictory evidence in physics, neuroscience, theoretical mathematics and philosophy have long been inducing us to think and believe otherwise about our actual condition and the ultimate nature of reality. In short, the empirical world-model does wonderful things for us (it allows us to exert control over causal-physical aspects of the world), but it fails to inform us about our 'actual' or even our 'perceived' condition in a meaningful way. It cannot elucidate our context. It does not and cannot reflect the inherent meaningfulness that life-systems co-create and self-organize around.

The study of consciousness exposes classical physics, causal function and linear time as unreliable base descriptions of cognitive dynamics. Cognitive neuroscience's investigations into perception and cognition reveal the hitherto hidden process involved when sentient beings model a world for functional use and this process exposes a very different matrix of functional elements. Creating and sustaining a functional cognitive model of the world has as much to do (or more) with the interplay of *concepts, meanings, identities, signs, perspectives* and *purposes* than it has to do with causal-material description. To over-emphasize causal-material description in the realm of consciousness studies is to obscure the very essence of a conscious condition. It is certainly true that successful biologically-relevant world-modeling depends upon organisms being able to formulate and adhere to a sense of the world as physical and causal (and therefore linear-timed) in order to perform the biological basics of nutrition, procreation, self-protection, and so on. However, in doing so, we (being biological creatures ourselves) mistakenly grant explanatory sovereignty to certain features of biological experience (like linear time, three dimensional space, matter as solid and immutable, self-models and self-world boundaries, free will, etc.) that are more appropriately considered bio-centrically distorted *byproducts* of having cognitively modeled a configuration space for successful biological function, rather than having modeled an objective description of the external world's inherent features. Advances in cognitive neuroscience begin now to show us the errors in our assumptions, that is, they indicate to what extent the unique properties, characteristics and dynamics of experience are the *proactive creative product* of perception and cognition rather than *passive objective* observations of a world and its intrinsic properties.

Equipped with highly evolved cognitive mechanisms we actively create and sustain a causal-material, bio-functional world-model while simultaneously performing many other complex and vital orientational calculations as well. In addition to a causal-physical configuration space we must also maneuver within an equally important social, moral, linguistic, emotional, spiritual, economic, political, life-affirming, self-affirming dynamical map of the world. Asserting the primacy of the causal-material aspects of our world model (the foundational assertion of the empirical project) over and above these other vital aspects of living experience misguides us in our research by radically limiting our view of reality, but even more detrimentally, it limits us in our values - leading us to believe that value itself is pre-decided by causal-material properties (by the relative rarity or usefulness of objects and substances), and that the boundaries and brute forces of causal-mechanical description should naturally translate into legitimate worldly power. Our communal beliefs about reality manifest as specific sorts of political and economic institutions and assumptions. Asserting the primacy of causal-material properties is a choice with specific consequences, consequences that we now see can unfold in disastrous ways for the economy, the environment, and the nature of

individual experience. Empiricism has morphed into a belief system that has had many wondrous benefits but it is proving unstable, unjust, unsustainable and deadly. The values that causal-material beliefs manifest in us are ultimately anti-life for failing to acknowledge (much less cherish) the vital intrinsic properties of living systems (like consciousness for example).

A radical reassessment of the empirical project is necessary for the advancement of consciousness studies, to expand the legitimacy of life-system dynamics in science, and to rectify the destructive communal behaviors that our causal-material beliefs about the world (now instituted globally) are reaping on the life systems of our planet. Best we not lay waste to life itself solely for the sake of a hubristic, causal-material sense of mastery and dominance. Thinking green is of course a terrific development but as yet it is nothing more than a thoughtless expedience, an upgraded causal-material pragmatism in response to climate change and dwindling resources. We are merely becoming more efficient causal-materialists when it may be more expedient to radically rethink our fundamental concepts about the reality of living things.

Moving Forward

As an alternative to the intentionally meaning-stripped, supposedly neutral, supposedly objective empirical analysis, we can proactively choose to understand ourselves as embedded in a world of biological meanings. We can proactively choose to see how, by logic and necessity, inbuilt biocentric meanings inform, create, and decide the format of our world-model – *including* the very basis of our empirical analysis. (Biocentric meanings inform, create, and decide the concepts of time, causation, physicality, etc.) Let us see where such a renewed analysis can lead in terms of an explanation of our condition. Instead of describing consciousness as nothing more than a chain of meaning-stripped biophysical reactions in the human brain, we can intentionally define consciousness via the meanings and concepts employed in world-modeling processes observed throughout nature. Understanding biological systems as primarily a complex interrelation of signifying entities allows room for all the dynamics of meaning that inform the construction of creature-specific world-models. Such an approach is far more explanatory and is far more compelling in scope as it includes all living things and their necessary interrelation rather than limiting our concerns and interests to our anthropocentric obsession with the human brain and the causal-mechanical aspects of human cognitive function.

This *meaning-asserted* rather than meaning-stripped approach need not replace the empirical project, but it promises to be the more interesting and fruitful road toward an understanding of conscious processes as it allows for a new engagement with a universe of vastly different conceptual possibilities that by their intrinsic nature lie beyond the

grasp of empirical criteria. Throughout the empirical project we agreed to pretend that the world could actually *be* stripped of meaning and purpose. This was indeed the most efficient way of disentangling our communal concept of reality from the terrific muddle of transcendental interpretations that preceded the age of reason. The incredible advantages of focusing on and subduing causal-mechanical properties are easy to glean from our outstanding success at causal-mechanical dominance as a species. However, the unfortunate byproduct of over-investing in causal-mechanical meaning-stripped features is that the interconnectivity, rarity and inherent meaningfulness of self-creative organic systems are grossly undervalued and too easily destroyed. By purposely ignoring the unique interconnected, qualitative aspects of living things we blindly sanction the destruction of that which makes our own existence possible. With the rapid rise of a global culture that unapologetically embraces materialism, we are suddenly and urgently behooved to reconsider our world-model conception in order to correct the self-destructive/world-destructive communal behaviors that they inspire, before we are all subsumed by the effects.

Contextual division can assist us in this urgent task of world-model revision. The analysis it provides facilitates a conceptual approach that will lead to a better understanding of our actual condition as conscious creatures within the exponentially expanded phenomenal realm that includes 20th century physics and 21st century neuroscience. This is the point and purpose of contextual division, to expand our world-model to include all that we already know and to grant new ideological space for subject-appropriate and context-appropriate methods of inquiry and understanding.

The concept of linear time is as finely interwoven into the fabric of our daily lives as it is deeply embedded in the criteria for analysis in the empirical project; so disproving linear time via the empirical method is neither possible nor anywhere on the agenda. Contextual division is just one possible reconceptualization. Adherents of empiricism might claim that the reconceptualization of time that contextual division affords us here is nothing but an empty cognitive exercise and has nothing to do with the empirical project of causal-material reduction for the purpose of pinning down absolute truths about the nature of reality. By the terms of their own limited causal-mechanical/-physical criteria they would be right. However, causal-mechanical/physical empirical criteria (and the sorts of questions that suit empirically defined answers) are not what we can use to pin down a conscious condition, the properties that define such a condition, and world-modeling dynamical processes that are the purpose of such a condition. Yes, contextual division may be a purely cognitive project, but it is cognition and consciousness that we now hope to understand. Understanding consciousness on its own terms is the most logical approach. Ultimately, this new, admittedly non-empirical project with new subject-appropriate criteria can redirect not only our

cognition, but can re-inform the full extent of human endeavor toward a new, non-empirical, non-causal, non-mechanical redirection of values as well. We are cognitively and morally altered as beings by learning to expand and re-conceptualize our condition in more objective and advanced ways.

When contextual division is applied to the question of time we are given a new view on our old methods of analysis. As for the absolute truths of empiricism, it turns out, when properly viewed, we have been making those up as we go along. In a realm defined by sentience and signifiers there are no absolutes, just a combination of imperatives (thus far informed by biocentric concerns) and the various pragmatic, contingent, conceptual tools we have formulated to meet those imperatives. The empirical project and its attendant habits of thought are clearly pragmatic in a certain realm of endeavor, but we must learn to see the contingency of the criteria and the undeniable limitations of their effective application. My hope is that this alternative assessment of time provides an indication of the inroads we must make toward a necessary revision of our analysis. Causal-mechanical/physical purposes and criteria were instrumental in our rise as a species, but a naïve over-investment in them as absolute truths is holding us back from an exciting new avenue of cognitive and experiential expansion.

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Exploration

How Unconditioned Consciousness, Infinite Information, Potential Energy, and Time Created Our Universe

Leon H. Maurer*

Abstract

Since the cause and nature of consciousness and its derivation from the universe have never been satisfactorily explained by conventional reductive science, I offer here a rationally imaginative basis for a new scientific paradigm. This new view not only explains the origin of the physical universe, but also that potential consciousness, time, mass/energy and infinite holographic information are rooted in original spin momentum of unconditioned pre-cosmic (empty) space (see appendix) – the absolute source of all relative phenomenal existence.

Keywords: consciousness, information, potential energy, spin momentum, time, cosmogenesis.

One of the major problems in physics is that the origin and nature of time and consciousness, along with the experience of consciousness, cannot be satisfactorily explained in physical/material terms without running into explanatory gaps and "hard problems" (Chalmers, 1995). How does the brain produce the experience of qualia? What is the nature of a color seen in the mind? Of what does the mind consist? How does the mind bind to the brain? Why and how is the experience of consciousness localized, e.g., feeling pain in a finger, taste on the tongue, smell in the nose, etc.? By what means of calculation does the brain and mind (or our thinking mechanisms) enable us to know (relative to our individual point of view) the exact coordinate position of any point or part of our body relative to any other point on the body, as well as relative to any point in the outer world view (so as to catch a ball, scratch an itch, draw a circle, aim and shoot a gun, drive a car, etc.)? What is the nature of the process that enables us to subjectively perceive (through the mind, brain and visual sense organs) the outer world in perfect 3D depth, and in the same perspective as if it were photographed or 3D modeled in a computer?

Since consciousness is the necessary basis for the understanding of mathematics and is the essential observer of scientific experiments, science simply takes its existence for granted without explanation or assumes it to be an epiphenomenon of neural processes. It is only recently (within the last 20 years) that consciousness has become a serious scientific study. Unfortunately, few of the above questions appear to have been answered satisfactorily by conventional physics or mathematics.
Time, being the necessary measure of change in physical processes, is an essential part of all scientific calculations. As part of the relativity equations, it has different

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values in different frames of reference, and is treated as a metric vector dimension in the theoretical relativity equations pertaining to mass/energy and space-time. Apparently, physics has never been able to explain time in connection with consciousness. However, in my view, they are fundamental interconnected aspects of total reality, along with potential mass/energy and information or intelligence.

Since the universe could not have come into existence without a pre-cosmic source of potential energy (in accordance with the fundamental law of conservation) and since energy and mass are equivalent with reference to the speed of light – which is based on distance travelled during a measured period of time (such as miles per second or light years on the physical/ material plane) – it is essential to realize that both *potential* mass/energy and *potential* metric time are fundamental aspects of unconditioned absolute space. This "empty" pre-cosmic space is the origin of total multidimensional spacetime, including all the fractal harmonics of radiant electromagnetic fields and their particle/standing waves (Wolff, 1998). Such waveforms would also have to include the compressive gravitational force field that pushes all forms of mass together and causes the apparent curvature of space around them – just as the spherical standing wave front of all radiant fields and their particle-waveforms curve around their centers. (See cross section view of spiraling oncoming photon standing wave, which analogously corresponds to the initial fields of cosmogonists in **Fig.1** below)

In addition, since such unconditioned pre-cosmic space at absolute zero° Kelvin must act like a BEC or a superfluid/superconductor, it would have no friction. Therefore, the only possible source of such expansive and contractive energy fields within the total manifested cosmic space-time would have to be the infinite angular spin momentum of the ubiquitous absolute zero-point or infinite ZPE (Casimir Force) located everywhere in the Planck volume of total metric physical space-time (see Lang, 2003)

Since all radiant fields have fractal harmonics based on the initial cyclic spin of their ZPE source and the triple cycle loop of its emanation/radiation, all such fields would originate from the same zero-point. Each such field would be woven out of individual rays of ZP force following a triple loop, double helix Mobius Klein path (see **Fig. 1**). As all zero-points of absolute space are essentially one thing, all spherical fields (originating from any zero–point spin momentum or singularity in spacetime) would also be interconnected. Therefore, all particle-standing waves originating from the same zero-point would be entangled with each other (see Aspect, 2004).

The initial field of cosmogonists at near infinite frequency (depending on the total mass/energy of the entire cosmos) would transform down through a series of fractal harmonic involutions at successively lower frequency phase orders, like bubbles within bubbles within bubbles, until our physical universe appears on the fourth lowest frequency phase order. This is the supposed "big bang" of the standard model of physics. Its initial field, at its highest frequency phase order would (after initial inflation) similarly in-volve fractally down to the 4^{th} lowest material phase level. It would then continue its involution until the most dense sub-quantum particle/standing waves are reached in the quantum vacuum (See **Fig. 1**).

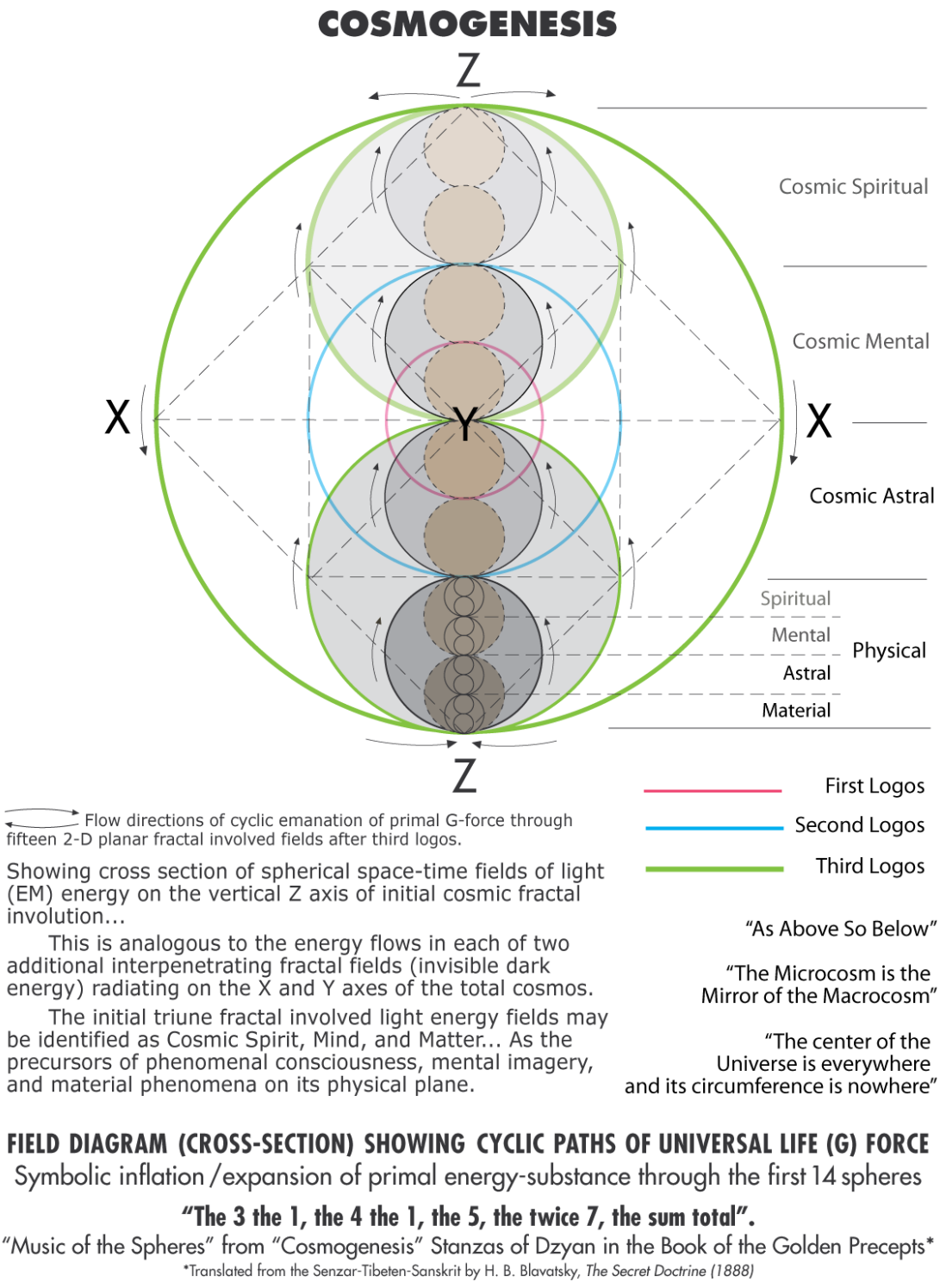

Figure 1–Cyclic origin, inflation, involution of cosmos down to physical universe

Note: To enlarge: http://leonmaurer.info/ABCimages/Cyclic-paths-cosmogenesis.jpg*. This diagram is only symbolic and should not be taken literally. The initial highest frequency phase order radiant fields, along with their harmonics, which are generated from any relative ZPE source on any level or plane of existence in the total cosmos, extend infinitely throughout*

total relative spacetime. Since all such fields of consciousness are coadunate but not consubstantial, they holonomically interpenetrate each other everywhere within their own spherical reference frame (e.g., photons in physical space).

These super dense micro particles and their combined overall field would extend as far outward in physical spacetime as the highest order spiritual field on the physical plane of the cosmos – if not the total cosmos itself – like the overall physical/material photon field extends to the furthest limits of the visible universe. The micro particle-waves below the quark level, along with the sub-quantum gluons, quarks, etc., and all the quantum particles they support, begin their lives at the third fractal involution of the cosmos, after the fourth lowest frequency phase order of the physical universe appears, inflates, and subsequently breaks its symmetry.

According to my model of cosmogenesis (see the theory of Astro Biohological Coenergetics), the physical universe always was, is and ever will be. It periodically manifests, involves, evolves and dissolves back into its ubiquitous ZPE singularities, in accord with the fundamental cyclic law inherent in its original spin momentum. These relative ZPE sources are located everywhere in total 3D spacetime. Therefore, initial energy fields that radiate from any such ZP "singularity" fractally involve harmonically as a consecutive series of standing waves, which are analogous and corresponding to the initial highest order field of cosmogenesis and its fractal involutions.

As for modern physics, it can only see as far in as the ZPE fields on the cosmic physical/material plane, and as far out as the farthest visible star field. Within this limited framework, however, quantum and classical physics are generally valid theories of material reality. After initial symmetry breaking, all-subsequent composite physical forms are surrounded by their total gravitational and electromagnetic fields. These fields are also analogous and corresponding to the initial fields of cosmogenesis and its fractal harmonics. Most of the higher f/E phase order harmonics above the physical/material level, however, are beyond the reach of conventional scientific observation.

All such radiant fields, starting with the simplest particle on any frequency phase level, are, in effect, spherical standing waves that follow a double helix spiral vortex Mobius Klein path. It seems obvious to me that the incoming wave is the compressive gravity aspect, and the outgoing wave is the expanding electromagnetic aspect. Such field structural geometry, consisting of opposite traveling rays of force that vibrate both inward and outward, is the apparent root of the unified gravitational, strong, weak, and electric forces. Einstein, possibly limited by the renormalized mathematics of conventional, reductive physics, could never resolve this unification. Incidentally, the opposite flow of energy rays (or strings) on the surface of all spherical wave fronts also seems to correspond analogously to the spiral vortex ladder of the DNA molecule. This seems to conform with the ancient adages that "the microcosm is the mirror of the macrocosm" and "as above so below." These analogies are also in accord with the absolute laws of conservation and symmetry (see **Appendix**). In addition, the fields surrounding the human body, and centered on its initial zero-point of individual consciousness (possibly located in

the naval plexus or chakra center) are also analogous to the fractal harmonic involution of both the physical and the prior cosmic space-time fields. (See **Fig 2**)

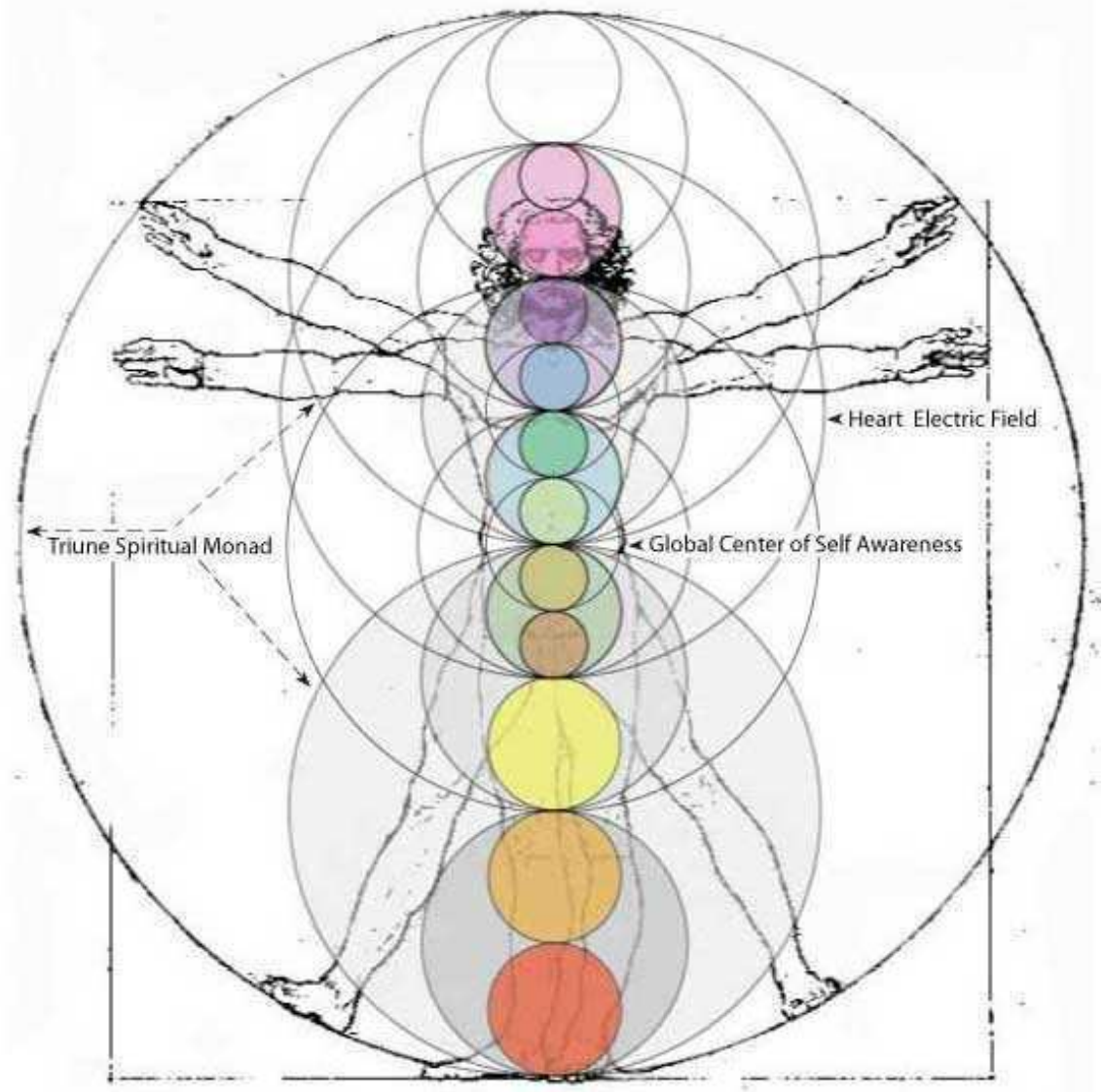

Figure 2 – Overall electromagnetic energy field harmonics body

(To enlarge: http://leonmaurer.info/ABCimages/Chakrafielddiag-fig.col.jpg*) Note that every cell in the body is similarly permeated with and surrounded by an analogous and corresponding series of fractally harmonic resonant electromagnetic fields. These fields also would necessarily interpenetrate each other and be entangled with our individual global or self-consciousness at their zero-points of origin. Obviously, cells communicate, both internally and externally, by means of these resonant fields, which are also linked to and apparently control their chemistries. (click on image to enlarge)*

All these radiant energy fields and their harmonics, originating from each zero-point-instant ZPE in physical space-time, interpenetrate each other and can carry holographic information as wave interference patterned holograms on their surfaces. Since all such fields are linked together by phase conjugate adaptive resonance, down to their smallest ZPE field next to their zero-points of consciousness, no information can ever be lost – although it may fade in time from our lower frequency

phase order mind-memory harmonic fields (in hyperspace) that are closest to the brain-body's detectable EM fields.

Therefore, since all such information is time dependent, relative to the frequency of the field carrying it, the laws of conservation apply – not only to mass/energy, but also to time and information as well. Apparently all such information is linked resonantly to the infinite spin momentum force inherent in absolute zero-point space. Thus, all information carried by harmonic fields (at their zero-point of consciousness) radiating from the same ZPE source is entangled with the information carried by every other field in the microcosm or macrocosm of which they are all a part. On the human level, this allows our mind and memory fields to be inked together, through the brain field, for instant access (both perceptively and responsively) by our global consciousness to every conscious cell and organ in the body. That's how we can feel a hot stove touched by a finger, signal the muscles to pull it back, and remember the circumstances, unconsciously and consciously.

Based on the above structure of spatial reality, the ZP center of awareness must be absolutely stationary relative to the Audio/Visual information in the mind-memory field surrounding our zero-point of view. This enables it to detect, discern and discriminate between the finest modulations of the holographic information. This information is reconstructed and detected by autonomic projection and reflection of coherent radiation from the ZPE surrounding the point of A/V consciousness. This point in the center of the brain is entangled with our individual self-awareness located at the center of our spiritual monad or soul (see **Fig 2**).

Consequently, unconditioned consciousness (potential awareness and will) is both the perceiver of qualia and the thinker/responder. It is also a fundamental aspect of unconditioned (motionless, formless, timeless) absolute zero-point-instant space. This space, while empty of form, also contains the infinite spin momentum (potential mass-energy) that stores the total structural and experiential information acquired from all previous cycles of cosmic manifestation and evolution. Thus, our individual awareness, as a single ray of cosmic consciousness, when properly concentrated and focused through the stilled mind in deep meditation, can access all that information. This is the state of infinite knowledge said to be attained by the Buddha.

Accordingly, in our ordinary states of wakeful consciousness, the brain – as the processor of audio/visual sensory information and serving also as the transponder/channel switcher between conscious will and the neuromuscular system – acts as the transformer to recreate such images as holograms in its overall LH and RH EM field. (Apparently, the crossover networks of the optic nerves facilitate this process). Such information, after neural processing and assemblage as a hologram in the brain's overall EM field, is resonantly transformed into the higher order (hyperspace) fields of mind and memory. These hyperspace fields are directly accessible (as thought images) to both our global consciousness and its entangled zero-point center of visual and audio perception located in the center of our brain (in the pineal area).

Similar points of conscious perception are also located at the zero-point centers of the cellular fields that surround each remote sense perceiving organ (such as taste on the tongue, touch on the skin, smell in the nose). All such points of localized consciousness are also entangled with our individual global consciousness or higher self-awareness, which is located at the naval chakra's zero-point center of the highest order invisible triune spiritual fields (our soul, the so called "aura" of the mystics, or the body's monad suggested by Leibniz. See **Fig. 2** above).

Incidentally, since our spiritual monadic field is of a much higher frequency/energy phase order than the electromagnetic fields of the brain-body, there is no reason why our monad (along with its center of consciousness) should not remain intact after the body dies. The human monad, then, could last as long as the analogous and corresponding initial triune spiritual field of the cosmos. This could account for most religious beliefs in an eternal soul, as well as some philosophical beliefs in reincarnation. According to my fractal field model of cosmogenesis, which links absolute zero-point consciousness with cosmic information and potential energy as eternally conserved absolutes, life as rebirth after death – which would also depend on primal spin momentum (as the root of the immutable law of karma or action=reaction) – may be a fundamental reality.

In addition to its stationary role in perception, necessary to subjectively differentiate and discriminate between the finest frequency modulations on the highest order mind-memory fields, our center of visual and audio consciousness (located in the middle of our head) also serves as a fixed reference point relative to the entire body image (along with the individual nerve endings at all external appendages). This enables us to coordinate our exact bodily positions and movements in 3D space, in conjunction with the 3D body image field (generated by the kinesthetic cortex of the brain). Since this brain field image is also resonant with the holographic image of the outer world (carried as a hologram in the visual fields of both mind and memory), this spherical spatial location system must be based on analog computation. This computation works by phase conjugate resonance coupling, which facilitates instantaneous triangulation between corresponding points on each of the spherical field circumferences relative to our conscious viewpoint. This, coupled with our binocular rangefinder system, is similar to but much simpler than the way satellite based GPS works.

Thus, we are able to instantaneously calculate the ballistics and trajectories of moving objects relative to our moving body, drive our cars safely at high speeds, catch a fly ball on the run and jump, hit a moving target with a firearm or a bow and arrow, play a piano concerto without thought, etc. Such a system also enables a fine artist, such as Da Vinci, to place the point of his brush on the exact spot on the canvas corresponding to the same spot on the model seen in his mind or memory. Such analog computational processes also allow motional energy and consciousness related feats of instantaneously responsive thoughts and body movements that would be impossible to accomplish using linear time based, sequential parallel, or digital computational processes. (Although modern technologies, using wireless communication along with 3D computer processing and virtual reality simulation systems, can come very close.)

One mind experimental method to test the actuality that consciousness and time are fundamental qualities of the zero-point of absolute space located everywhere in 3D holographic space-time would be to mentally observe that the light from every star seen from any point of view on Earth converges in every zero-point between our point of view and the entire star field. This allows us to realize that each point of view, no matter where located in 3D spacetime, is at the exact center of the universe observed from that point – and that the total image at the point of observation is a hologram. David Bohm (1980) said if we take away an eye lens, all we could see is a hologram. Karl Pribram (1971) demonstrated that placing a tiny lens in the beam of a projected slide image would produce a smaller image on a sheet of paper identical to the larger image on the screen. From this we can conclude that the fundamental structure of total spacetime includes all non-local zero-point fields radiated from the ZPE at the Planck level. And that such ZPE must generate and empower all the black hole centers of every galaxy, star, planet, sentient being, organism, organ, cell, virus, etc. – down to each fundamental quantum and sub-quantum particle-standing-wave, as well as all the higher order hyperspace fields in our physical spacetime realm.

Thus, it becomes apparent that each individual global consciousness (awareness, will, qualia, detection, perception, discernment, discrimination, intention, decision, etc.) is located at the ubiquitous source of each ZPE field within and surrounding every sentient being. All information of consciousness (both efferent and afferent, or willful and perceptible) is carried, transformed and transmitted as holographic wave interference patterns on the surfaces of higher order hyperspace fields, which are resonant with the intermediate EM field of the brain. The entire universe, including all the visible and invisible structures within it, is essentially a hologram. According to the fundamental laws of electrodynamics, such information can be transmitted from one fractal-involved field to the other by phase conjugate adaptive resonance. (Note the analogy and correspondence of such octaval harmonic fields, located everywhere in total metaphysical and physical space-time, to the harmonic musical sound spectrum on the physical/material level.)

How consciousness works holistically in each human

All such holistic information is also reflected in the EM fields of the brain whose malleable neural network serves as the material-physical-chemical links between the senses, the neuromuscular system, and the willful intent of individual consciousness. The brain also is the CPU and controller of all the autonomic life support systems within the corporeal body. As such, it acts autonomically in conjunction with the cellular memory fields distributed throughout the body. In itself, the brain, as an organism, is entirely unconscious – except, perhaps, for the subliminal cellular awareness each neuron has of their individual conditions.

All such information of consciousness (either as neurologically transformed sensory images, or as stored memory field images) can be holographically reconstructed, detected and perceived as qualia by the zero-point of awareness (at the mind and memory field's center of origin). Perception occurs by reflection of appropriate higher order coherent radiation projected willfully from the ZPE spin-momentum ("spinergy") surrounding each point of sensory perception. This willful projection

also is linked to the subliminal control of attention, which (in the case of vision) automatically willfully directs the saccades, binocular convergence and focus of the eyes. These processes are holonomically linked everywhere throughout the body, in conjunction with the neural processing of willed energy, coupled with the learned control of all intricate and subtle muscle movements at the level of "cell memory". In addition, the malleable neurology, through repetitive training, reinforces the will directed neuromuscular energy channels. Thus, such cellular memory, neural channelling and control explain how a musician can play a practiced musical piece without any conscious thought or perceptive attention to the body or the instrument. Note that our appreciation of music and our emotional and physical responses to it are also based on cellular memory that may even go as deep as our DNA molecular memory. This is evidenced by our body's pleasurable responses to music (harmonic resonances, tones, tempos, and rhythms) – which, as massage, acupuncture, acupressure, tapping, massage, etc., can also be used as a medium of healing.

Thus, we see and hear from a point in the center of our head, feel pain at the point of trauma on the skin or in an internal organ, experience taste on the tongue, smell in the nose, touch on the skin, etc. – with all such zero-points of awareness entangled with the central zero-point of our individual self or "I AM" consciousness, apparently located in the primal neural plexus at the navel chakra center of the overall, highest frequency phase order (spiritual) field. This triune field permeates and surrounds all inner organ and cellular physical fields, along with their harmonic hyperspace fields. (See **Figure 2** above)

Therefore, we can conclude that potential consciousness, time and information are fundamental aspects of unconditioned absolute space. Furthermore, it seems obvious that, since all zero-point-originated radiant fields interpenetrate each other everywhere, the universe, along with everything within it, is essentially a hologram (see Talbot, 1991). Also interesting to note is that, in such a hologram, the only reason objects appear solid to us is that we are made of the same kind of stuff, i.e., we both vibrate in the same frequency phase order (photonic EM) spectrum and have similar repellent field boundaries. Naturally, the higher frequency phase order fields of mind and memory would be undetectable and invisible to us, yet we can perceive the holographic sensory information they carry. However, when in deep meditation or dreaming and all wakeful sensory information (noise) is blocked, our ZP consciousness is sensitive to all frequencies up to those of the highest order spiritual fields.

Thus, our conscious time perception is different on each higher or lower phase order field. This explains why, during an NDE and OBE that I experienced some 40 years ago during a coronary occlusion that lasted about 5 minutes, I watched (from near the ceiling) the people around my supposedly dead body moving and talking in ultra slow motion. I also experienced a finely detailed life review, which seemed to rush by, minute by minute, day by day, and year by year, in the few minutes I was in the OBE state.

Many thousands of similar experiences have been reported from all over the world going back many ages, as well as thoroughly researched in modern times (see, e.g.,

Tart, 1989). Also, some dream researchers report that dreams that seem to take place during long periods of time actually occur in minutes if not seconds during REM sleep. It has also been experimentally shown that people who experience OBE during NDE or when sleeping are not in the normal dream state of REM sleep (Bernstein, 2010).

To sum up, the holographic fractal field model of cosmogenesis indicates that there are at least four fundamental absolutes (or potential characteristics/aspects) of the void or emptiness underlying all manifest multidimensional cosmic reality. These are, unconditioned consciousness, infinite potential time, infinite spin momentum or potential energy, and infinite holographically stored information, covering all possible conditions of the structural evolution of infinite universes. This includes an infinite number of possible sentient beings – wherever conditions are favorable to the evolution and survival of self-generative life forms with only a small part of such evolution being fulfilled in each cyclic manifest period of any possible universe, macrocosm, or microcosm.

If there were to be a mathematics that can describe this total manifest reality, it would have to start with the fundamental equation, zero equals infinity ($0 = \infty$), have a hyperspherical fractal geometry, and obey all the laws of physics inherent in absolute spin momentum. These laws would be based on the fundamental principles of eternal absolute space, immutable cyclic law, and eternal involution and evolution – leading to the three possible states or conditions (Sanscrit: *gunas*) in any manifest reality or dimension of spacetime, i.e., inertia, action, harmony (Sanscrit: *tamas, Rajas, sattva*).

Thus, everything in the universe is interconnected with everything else. All individual consciousness (including the cosmos and all microcosms within it) is a ray or spark of universal unconditioned and eternal absolute consciousness. Plus all information is holographically accessible to all zero-points of individual phenomenal consciousness of all sentient beings by means of phase conjugate adaptive resonance between coenergetic, fractal involved, interpenetrating (coadunate but not consubstantial) harmonic electromagnetic fields.

Infinite parallel universes on the macrocosmic scale (and microcosmic scales) are possible – due to the infinite sets of triple spherical axes (each at different angles) of fundamental spin momentum of the primal absolute ZP space. Each such universe would be totally invisible and undetectable to each other but would have to obey the same laws of physics, rooted in fundamental spin, as every other universe. However, their individual evolutionary development would necessarily be entirely different because of the unpredictability of individual zero-points of conscious intention, along with the indeterminate motion and momentum of individual particle-standing waves on any fractal harmonic field level. As Milo Wolff (1998) pointed out, such attractions and repulsions would be caused by opposite or parallel rotations of approaching spherical particles. Incidentally, this could account for the loss of energy and associated frequency lengthening of starlight photons traveling through vast distances of spacetime, which may be mistaken by cosmologists for Doppler effects due to a supposed expansion of space.

Each fractal field phase level of our cosmos could have not only its own specific types of different sentient beings, but also its own experience of time that differs from our normal physical/material level of existence. In any event, since Mankind, God, and the Cosmos appear to be synonymous, perhaps we might call this "New Scientific Paradigm" (as a grand unified theory of everything [GUFTOE]) either *Astro Biological Coenergetics* or *Astro Biohological Cosmology* — both abbreviated as the **ABC Theory**.

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Appendix

Summarizing the rational basis of the universal laws of conservation, symmetry, cycles, harmony, gravity, electrodynamics, thermodynamics, holography, etc., which underlies the new scientific paradigm.

1. The fundamental root of all phenomenal coenergetic existence of everything in 3D space-time could only be the infinite angular spin momentum or potential energy of the absolute zero-point of eternal unconditioned space – a beginningless and endless plenum, empty of all fields and forms – that is beyond all possible finite comprehension or thought. (This is the first principle underlying the Astro Biohological Coenergetic theory of cosmogenesis, consciousness and mind)

2. This abstract motion of the angular spin momentum force of absolute ZP space must necessarily cyclically rotate, both clockwise and counter clockwise, at infinite velocities on infinite axes of every potentially spherical absolute zero-point. (This basis of the immutable laws of cycles is the second principle of the ABC theory)

3. To maintain its cycles of continuous motion, any parallel spin of such opposite rotation must follow an endless and beginningless spiral vortex double helix Mobius Klein path in both angular directions (see **Fig. 3)**. (This fractal geometry and topology, based on cyclic spin momentum, is the fundamental basis of the initial condition and ultimate involution of manifest multidimensional spacetime.)

Figure 3

(To enlarge: http://leonmaurer.info/ABCimages/CW-CCWspincycles.pn*) Note that the twin rays would actually spiral around each other – due to their ZP spin perpendicular to their direction of motion – much like the analogous and corresponding spiraling of the DNA ladder, or the spiraling of an oncoming photon standing wave front (see **Fig. 4**).*

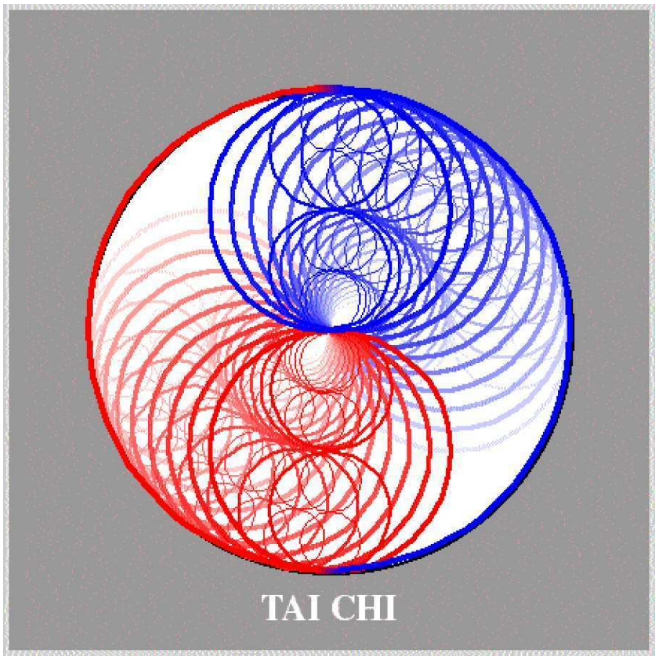

Figure 4 – *Cross section diagram of an oncoming photon standing wave. To enlarge:* http://leonmaurer.info/ABCimages/PhotonField.gif

4. All such opposite spin rotations simultaneously emanate outward (as 1D rays of force) on their ZP axis of spin. These lines of parallel force instantly maximally inflate to form a 2D circle – which, due to lateral rotation on its vertical polar axes, eventually spins into a 3D sphere. The initial ZP rays must follow the same continuously repeating spiral vortex double helix path, like a figure eight within a surrounding circle, which ultimately form twin bubbles within a surrounding bubble (See **Fig. 5**).

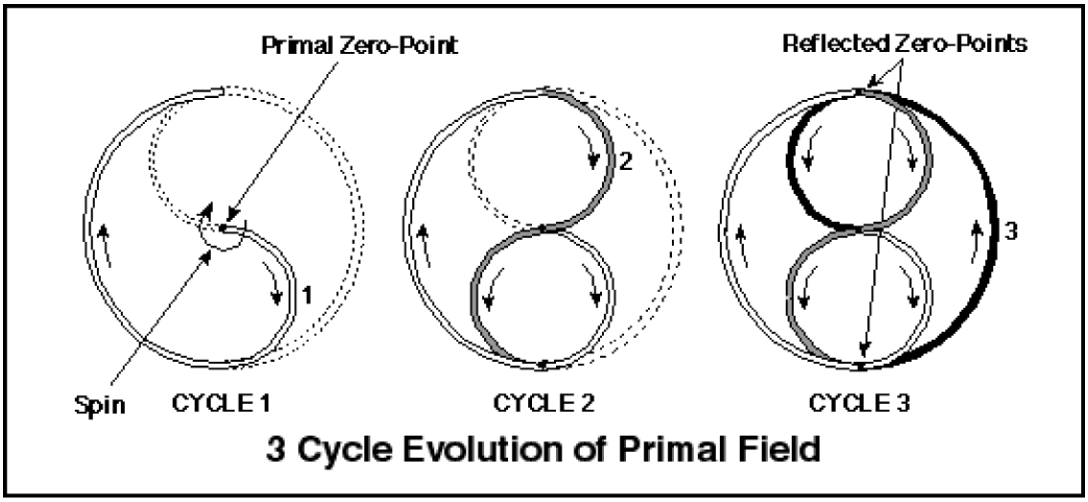

Figure 5 –*Note that only one direction of spin is shown.*
(To enlarge: http://leonmaurer.info/ABCimages/3cyclefield.gif*)*

5. The total hyperspherical field (and each harmonic) would also expand and contract periodically, inward and outward from its zero-point of origin, at a fundamental frequency relative to the initial cyclic velocity of the emanated ray of spin momentum force.

6. This initial triune field surrounding any zero-point of origin, and all subsequent fractal harmonic involutions of its inner fields, *ad infinitum*, would always be balanced in total energy during each frequency cycle of expansion and contraction – as all ingoing and outgoing rays of force passing though the zero-point center of field origin would additively and subtractively complement each other on each triple cycle pass-through the spin momentum source.

7. Since the cosmos exists eternally centered on its singularity and manifests periodically in accord with cyclic law, all zero-points of radiant fields, particles and forms remain forever dormant within its spin momentum – to reappear at each subsequent manifestation since no information is ever lost. Information is encoded in the modulated interference patterned frequency modulations of spin, whether actively radiated as standing wave energy fields or latent in absolute space or the Aether (Einstein, 1920) on the physical plane. ("Aether" in this New Paradigm, refers to both the radiant EM energy fields of physical spacetime that carry the light matter particle-standing waves on their surfaces, as well as their spin momentum origins in absolute ZPE space.) Obviously, the mass of each such ZPE source, up to the cosmos itself, is finite relative to each other, and to the infinite potential mass of unconditioned Absolute Space and its eternal consciousness.

8. As each perpendicular axis of any singularity or ZPE source radiates an identical series of fractal involved harmonic energy fields of equivalent mass energy – our visible physical universe exists only on one of the three spherical axes of total cosmic spacetime. Therefore, the fields that form on the other two axes, which together with the light matter contribute to the total gravitational force of the cosmos, would account (on our physical plane) for at about 63% of its total mass (as invisible dark matter/energy fields and forms) – in addition to the invisible ZPE fields in the Planck false vacuum, which could account for about ±33% (See **Fig. 6**)

9. All instants or ultimate divisions of time on each fractal harmonic field phase of the total cosmos, is relative to the frequency of the harmonic field and its holographic forms whose changes it measures. Thus, while time itself is absolute at such harmonic field's common ZP origin, its metric on each level of normal or hyperspace at any harmonic frequency/energy phase order, is relative. Thus, the total cosmos is both absolute and relative, simultaneously – whether manifested or unmanifested.

10. The duration of the manifest cycle of existence of the universe or any subordinate objectively metric or positive state of physical existence, is equal to the duration of its negative state or non physical existence… Just as the positive phase of any field frequency is equal (in both time and charge) to its negative phase. In Eastern scientific philosophies, the period of cosmic or universal manifestation is called a Manvantara, and its unmanifest state is called a Pralaya.

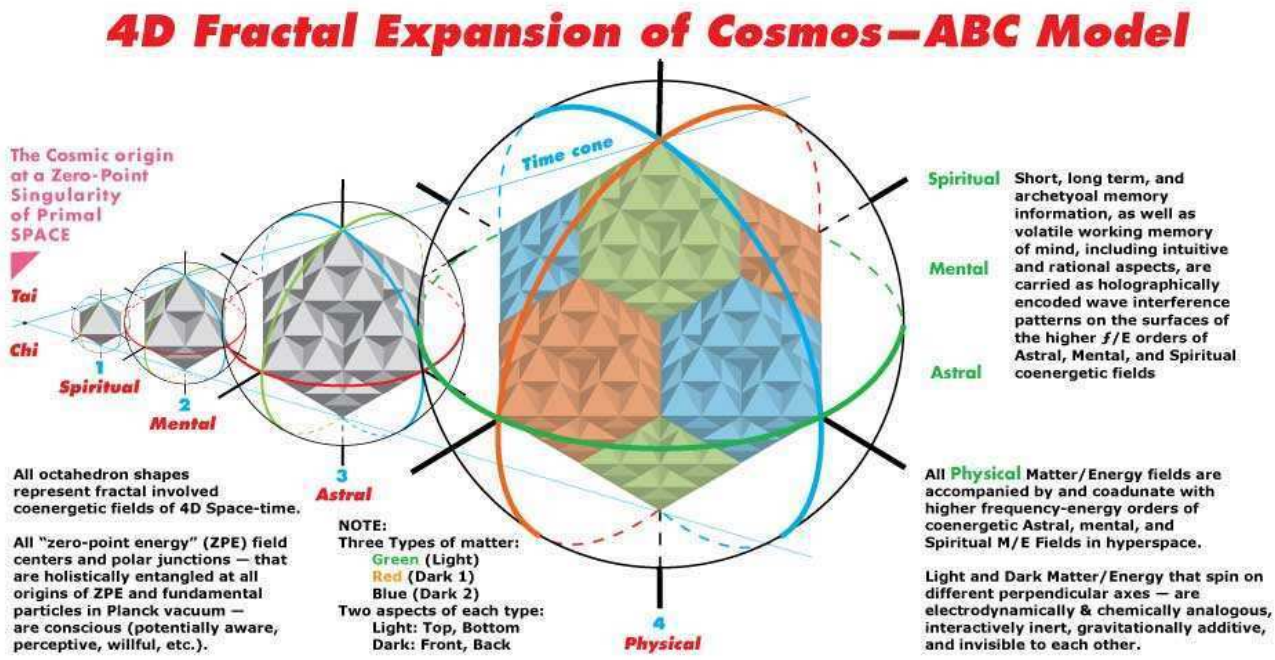

Figure 6 – *To enlarge:* http://leonmaurer.info/ABCimages/Fract-Exp-Lt-Dk-matter-text.jpg

Exploration

Whitehead & the Elusive Present
Process Philosophy's Creative Core

Gregory M. Nixon*

Abstract

Time's arrow is necessary for progress from a past that has already happened to a future that is only potential until creatively determined in the present. But time's arrow is unnecessary in Einstein's so-called block universe, so there is no creative unfolding in an actual present. How can there be an actual present when there is no universal moment of simultaneity? Events in various places will have different presents according to the position, velocity, and nature of the perceiver. Standing against this view is traditional common sense since we normally experience time's arrow as reality and the present as our place in the stream of consciousness, but we err to imagine we are living in the actual present. The present of our daily experience is actually a *specious present*, according to E. Robert Kelly (later popularized by William James), or *duration*, according to Henri Bergson, an *habitus*, as elucidated by Kerby (1991), or, simply, the psychological present (Adams, 2010) – all terms indicating that our experienced present so consists of the past overlapping into the future that any potential for acting from the creative moment is crowded out. Yet, for philosophers of process from Herakleitos onward, it is the philosophies of change or process that treat time's arrow and the creative fire of the actual present as realities. In this essay, I examine the most well known but possibly least understood process cosmology of Alfred North Whitehead to seek out this elusive but actual present. In doing so, I will also ask if process philosophy is itself an example of the creative imagination and if this relates to doing science.

Keywords: Whitehead, process philosophy, elusive present, creative, time's arrow.

§1. Bergson. "*Time is invention or it is nothing at all*" (Bergson, 1983, p. 341).

"But, as regards the psychical life unfolding beneath the symbols which conceal it, we readily perceive that time is just the stuff it is made of" (Bergson, 1983, p. 4).

Though the focus of this little study is Whitehead, Bergson provided a context for the minute specificities of Whitehead's insightful speculations, and probably opened intellectual and intuitive doors that encouraged Whitehead's process cosmology possible. In various works, Bergson has shown us that the human experience of time is mostly an illusion, and this is especially true of our sense of living in the present. For Bergson, the contents of consciousness itself are naught but memories. Memory performs the almost

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mystic function of uniting our inner experience with the outer experience of the world. He claimed that "*memory ... is just the intersection of mind and matter*" (1912, p. xii). We project our experience from a remembered past into an anticipated future, all the while believing we are in a present in which time flows by, as though we were carried along in a swift river, hardly able to affect to its course. Without an actual present, how can time do anything but repeat itself? "Of the future, only that is foreseen which is like the past or can be made up again with elements like those of the past" (Bergson, 1983, p. 28). Without an actual present, there are no fires of creation.

However, Bergson's duration (*la durée*) is more than just the habitual *habitus* of our illusory present. When reflected upon in great depth, *la durée* is found to have a creative core that intuition (not intellect) reveals as universal and not just personal. He expressed this most strongly in *Creative Evolution* (1983), the title of which reveals his insight and makes his case against Newton's cosmic clockwork and Einstein's so-called block universe in which time loses its universal status. Bergson believed that the future was not determined in advance but that a creative power underlay the processes of the world, which includes both matter and memory (thus mind), and may have its expression in language. As two later process philosophers put it:

> Bergsonian intuition is a concentrated attention, an increasingly difficult attempt to penetrate deeper into the singularity of things. Of course, to communicate, intuition must have recourse to language. … This it does with infinite patience and circumspection, at the same time accumulating images and comparisons in order to "embrace reality," thus suggesting in an increasingly precise way what cannot be communicated by means of general terms and abstract ideas. (Prigogine & Stengers, 1984, p. 91)

Attempting to deny both idealism and realism, Bergson reasoned that matter is an "aggregate of 'images.' And by 'image' we mean a certain existence which is more than that which the idealist calls a *representation,* but less than that which the realist calls a *thing"* (1912, p. *vii*). Each traditional position, then, depends upon the perspective taken. If memory remains only perceptual memory, he writes in *Matter and Memory* (1912), then we may be helped to make evolution creative:

> But this is not all. By allowing us to grasp in a single intuition multiple moments of duration, it frees us from the movement of the flow of things, that is to say, from the rhythm of necessity. The more of these moments memory can contract into one, the firmer is the hold which it gives to us on matter: so that the memory of a living being appears indeed to measure, above all, its powers of action upon things, and to be only the intellectual reverberation of this power. (p. 303)

Bergson is suggesting that by contracting the moments of memory into one, one may become nearer to the creative present, whence the nature of matter unfolds. It appears that if we can participate in the creative present, we can affect the nature of matter. Such pure memory has access to what he calls different planes of consciousness, or, sometimes, pure spirit. Pure memory, he indicates is a pure potential for action to create the next

creative field of order science can then convince itself it has discovered. The world, that is to say, does not come to exist with its objects, i.e., objectively, until the "intelligence" perceives it as such. Simultaneously, the intelligence gives itself mental form through the conceptualization of its actions: "Thus the same movement by which the mind is brought to form itself into intellect, that is to say, into distinct concepts, brings matter to break itself up into objects excluding one another. *The more consciousness is intellectualized, the more matter is spatialized*" (1983, p. 189).

Bergson never develops a complete system or cosmology or states imperatives, but he does indicate that if we wish to find the real, to participate in the ongoing emergence of creation, we must cease projecting a future from a "present" which seems to exist only because we are always in the process of remembering it:

> We should no longer be asking where a moving body will be, what shape a system will take, through what state a change will pass at a given moment: the moments of time, which are only arrests of our attention, would no longer exist; it is the flow of time, it is the very flux of the real that we should be trying to follow. (1983, p. 342)

La durée refers to time as the *becoming* of a reality that is never become, though the intellect perceives it so. The rational intellect is an important survival mechanism that evolution has made manifest, Bergson says, but it seems only able to carry us along into a future we have determined shall be as identical as possible with the past. If there is no *real* present, an interesting implication is that we have created our sense of the present with the immediate memories of the past, *but the only creative position is always the slightly extended futurity of becoming.* The "present" may be created from the duration already moving into the future — with the materials of the past — from which "present" we project the "future," and so on.

We cannot perceive beyond our senses that are limited by our intellect's "use" of memory to perceive. And we cannot creatively *act* with intellect alone, which works only within the flow of time:

> For, as soon as we are confronted with true duration, we see that it means creation, and that if that which is being unmade endures, it can only be because it is inseparably bound to what is making itself. Thus will appear the necessity of a continual growth of the universe, I should say of a life of the real. And thus will be seen in a new light the life which we find on the surface of our planet, a life directed the same way as that of the universe, and inverse of materiality. To intellect, in short, there will be added intuition. (p. 343)

It is intuition, according to Bergson, that guides us into "true duration," a union with the power of creativity found there (the immediacy of *élan vital*). Bergson's position seems to be that an intuitional memory can seek the symbols beyond the perceived circle of self — the habitus — in the creative imagination that emerges from the timeless.

In what fashion can we imagine time unfolding or our infolding into time? Lifting my head, I hear my fan circulate the summer heat. I look beyond my iMac and see Rasputin, our Siberian husky, asleep on the cool linoleum, and I feel the solidity of this body relentlessly tapping away at these keys (apologies to Descartes!). How can creative duration be conceived as happening amidst these realistic events? Whitehead is often considered to have taken Bergson's suggestions about time and memory and to have completed them in a systematic fashion. I ask myself: Is there a place for creative imagination or an actual present in Whitehead's intricate cosmology?

§2. Becoming as Process: A. N. Whitehead.

[W]e experience the universe, and we analyze in our consciousness a minute selection of its details. (Whitehead, 1968, p. 121)

My initial response to the latter question would be to simply reply in the affirmative. Since any human construction of a cosmology cannot ultimately be verified experimentally and since, by definition, any human is *within* its own ideas of a cosmos, a cosmology is a work of speculative philosophy, which Whitehead has extensively defined. Speculative philosophy in our rationalizing world is related to the creative imagination. A cosmology is, itself, a work of imagination that endeavours to divest itself of the cosmetics of imagery, drama, and allusion to specific culture-heroes or divinities (Whitehead, 1978).

This is insufficient, however, so I will proceed to dissect the terms of the question. Following this, I will attempt a brief outline of Whitehead's cosmology, as "ultimate" then as "immediate," especially as portrayed in *Process and Reality: An Essay in Cosmology* (1978) realizing that this statement and my limitations could not possibly do Whitehead's *magnum opus* its deserved justice. I shall then speculate whether or not Whitehead intended the creative present to have a background or central place in his cosmic scheme, or if such *place* can be found.

§3. Whitehead's Ultimates. Influenced by Einstein's theory of relativity, Whitehead developed his theory based on spacetime, rather than understanding space and time as separate dimensions of the same unfolding reality. We perceive extension in space-time and understand reality to be present and solid:

> We must first consider the perceptive mode in which there is clear, distinct consciousness of the "extensive" relations of the world. These relations include the "extensiveness" of space and the "extensiveness" of time. Undoubtedly, this clarity, at least in regard to space, is obtained only in ordinary perception through the senses. This mode of perception is here termed "presentational immediacy." In this "mode" the contemporary world is consciously prehended as a continuum of extensive relations. (Whitehead, 1978, p. 61)

The senses, however, are later developments upon a deeper, less conscious mode of awareness called *prehension.* This accepted, experience need not be restricted to entities with sensory organs:

> On this basis, it is not absurd to attribute a vague kind of emotional-purposive perceptivity to those lower organisms that are devoid of sensory organs. … To say that all individual events *prehend* the things in their environments is to say that they take influences from them into themselves and have some sort of emotional-appetitive response to them. (Griffin, 1988, p. 153)

In this statement, David Ray Griffin, prominent Whitehead interpreter and promoter[1], does not pursue the matter beyond "lower organisms" to its smaller and more momentary limit: the actual *entity* (for the space oriented), or the actual *event* (for the time oriented), or, simply, the *occasion,* defined by Whitehead as "a momentary experiential event which occupies (or constitutes) a region that is spatial as well as temporal" (in Griffin, p. 151).

So instead of semi-permanent "things" changing through a continuous flow of time, we have experiencing occasions which appear, prehend their environments, perhaps adapt to some "extent," and disappear as *experiencing* occasions to become completed objective occasions. These occasions include events at the subatomic level and those of macrocosmic stature. The occasion is the act of *becoming,* like Bergson's duration, the process of which is going on "all the time." These are the existential realities, according to Whitehead — experiential occasions becoming, achieving satisfaction, and perishing. Their prehension guides them to satisfaction and alters them through the environmental influence of other, past occasions. In their "perishing" they become fixed as objective occasions which will now influence the becoming of subjects of new actual events. As Griffin (1988) explains:

> [A]n object is an event that had been, in itself, a subject. Accordingly, it *has the kind of stuff a subject can receive, i.e., feelings,* whether conscious or unconscious — feelings of derivation, feelings of desire, feelings of attraction and repulsion. … By conceiving of each event as *having been* a subject of feeling prior to being a felt object, we can understand how an object can influence a subject. (p. 155)

Thus the world according to Whitehead. But we must look deeper into Whitehead's speculations to discover the alpha point of his cosmology.

In the beginning — metaphorically speaking since "non-temporal" does not constitute linearity — was pure *creativity* and *God* in his primordial nature. Unlike Bergson and others, Whitehead does not identify God pantheistically with the primal impetus of creativity but as a non-temporal actual entity on his own. Creighton Peden (1981) concludes that Whitehead's creativity "is without character or individuality of its own. It

is the active, creative force of the universe, being conditioned by the objective immortality of the actual world and by God" (p. 35). Bergson would likely accept condition one.

Studying Whitehead seems often a matter of learning a new terminology, but, as in all self-referential language systems, each term has meaning only in reference to other terms and the assumed meta-meaning of the entire language. Some terms never emerge, it seems, as actual entities — just as in Whitehead's system actual entities are really processes. Here at the beginning of Whitehead's cosmogony, it seems important to understand the difference between the conceptions of "creativity" and "God," since specifically human creativity will be the subject of the next section.

Creativity as a first principle allows Whitehead to avoid the mechanistic view of straightforward cause and effect determination and to account for the *dendritic* nature of evolution. Further, his conjectures about eternal objects, aims, and even God's primordial nature, which — combined with the also primordial creativity — allow him to explain the unpredictable outcome of each "concrescence" of occasions that results in "novelty" in the universe. As Whitehead (1978) explains in more detail:

> "Creativity" is the universal of universals characterizing ultimate matter of fact. It is that ultimate principle by which the many, which are the universe disjunctively, become the one actual occasion, which is the universe conjunctively.
>
> "Creativity" is the principle of *novelty*. An actual occasion is a novel entity diverse from any entity in the "many" which it unifies. Thus "creativity" introduces novelty into the content of the many, which are the universe disjunctively. The "creative advance" is the application of this ultimate principle of creativity to each novel situation which it originates.
>
> … The ultimate metaphysical principle is the advance from disjunction to conjunction, creating a novel entity other than the entity. … The novel entity is at once the togetherness of the "many" which it finds, and also it is one among the disjunctive "many" which it leaves; it is a novel entity, disjunctively among the many entities which it synthesizes. The many become one and are increased by one. (p. 26)

Creativity is both the ultimate reality and the active principle in the concrescence of the many to produce a novel actual occasion, as in Whitehead's expressive phrase: "The many become one and are increased by one." The novel actual occasion then embodies its novel creativity as one of the many to be used in the concrescence of the next actual occasion, an increase of one. In this way, creativity may be understood as *inhering* as self-creativity in each event. As Peden (1981) interprets:

> Because of creativity, every actual entity, temporal or non-temporal, is to some degree self-creative. Every actual entity, being to some degree self-creative, is a novel being. On the basis of novelty … an actual entity is a new form in the universe. The doctrine of creativity points to the fact that constantly new forms are being created and are perishing in the universe. (p. 35)

If reality were understood as purely creative, however, then literally anything could happen. Reality would be a chaos of novelty in which even dendritic patterns could turn back upon themselves in disarray. To explain the seeming form of the onflow of reality, Whitehead *invokes* an ultimate actuality to guide his ultimate reality. Griffin (1989) theologizes:

> God, who is the source of all physical, aesthetic, and ethical principles, is the *ultimate actuality.* … The ultimate reality and the ultimate actuality are equally primordial. God does not create creativity, but neither does creativity generate God. Each equally presupposes the other. Creativity that is uninfluenced by God's persuasion toward ordered beauty therefore never occurs. (p. 31)

God is present "at the beginning" as a hidden persuader, so to speak. This is what Whitehead calls *God's primordial nature*. In this idea, God is understood as an actual entity like all other actual entities (which are also occasions), except that God "is non-temporal. This means that God does not perish and become objectively immortal as temporal actual entities" (Peden, p. 34).

This suggests all sorts of difficulties in Whitehead's previous definition of actual entities as becoming from a previous many, but this is not the place to consider them. Suffice to say that God, in his primordial nature, influences the process of occasions by sustaining within him "eternal objects" that contain the *potential subjective aims* for the becoming of temporal actual entities. Eternal objects are conceptions which have no reference to any definite entity in the temporal world, but, as Whitehead (1978) declares:

> An eternal object is always a potentiality for actual entities; but in itself, as conceptually felt, it is neutral as to the fact of its physical ingression in any particular actual entity of the temporal world. "Potentiality" is the correlative of "givenness." The meaning of "givenness" is that what *is* "given" might not have been "given"; and what *is not* "given" *might have been* "given."[2] (p. 44)

As indicated, it is the eternal objects that provide the subjective aim in the concrescence of the many into an actual occasion of experience. There will be more on this event later, but for now it should be noted that in Whitehead's view the eternal objects are *present* as potentials "in the beginning" sustained by God's primordial nature, and they are also *present* "at the end" as future possibilities toward which the creativity of each actual event aims. These everpresent potentialities for experience, that approach randomness in their sense of being "given" or "not given," are the reason for *beginning* and *end* being understood as metaphors (disguising circularity?).

God is also understood as having a "consequent nature." This is the physical prehension by God of the actual events/entities of the evolving universe. Whitehead indicates this is how temporal entities achieve "objective immortality" after attaining satisfaction of their

subjective aims and perishing as an actual experience. These objective entities are no longer capable of change or experience, but they never cease to exist, apparently, in the mind of God. In this way, all objective entities have a potential influence upon the present experience of an actual event (Whitehead, 1978).

Finally, God has a "superjective nature." It is in this manner that God influences the creativity of each actual event toward noble or harmonious ends, but does not determine those ends. An important question arising here is the creation of dissonance or evil. In the self-creation of each actual entity, is it possible to create destruction, that is, to coalesce into an experiencing event without the superjective influence of God? Whitehead's theologian interpreter, Griffin, indicates above that such things may occur. As I have shown, Whitehead understands all possible aims — the eternal objects — to be sustained by God in his primordial nature. Griffin (1989) interprets Whitehead as implying that higher order self-creations — human beings — are capable of evil aims:

> From the point of view of a theology of universal creativity, the existence of chaos and evil is no surprise. They are to be expected, given a multiplicity of centers of creative power. The surprise is the existence of order and goodness. They beg for explanation in terms of an all-inclusive creative influence. (p. 43)

Chaotic, evil, or mischievous creations can only be explained by having aims not within God. But what else was there "in the beginning"? Only a non-differentiated creativity, according to Whitehead. Anything non-differentiated is usually conceived as being in the primordial state known to many mythologies as chaos[3]. Perhaps creativity, especially human creativity that has such expanded memory capacity, partakes simultaneously of chaotic and divine essences. Divinely "underinfluenced" creativity may not be creative but destructive, according to Whitehead. Yet it must be understood as creative if it is a novel concrescence of the many into a one to increase the many by one. Every novel concrescence is the result of both "past" occasions and an aim toward eternal objects, even those novel occasions conjured by human minds. It is at least conceivable that Whitehead left room for eternal objects not sustained by his harmonious, ordered, and morally correct God. If so, such eternal objects need not be understood as evil/chaotic/satanic. Where would one place the potential of an eternal object that inspires a mischievous but innocuous aim for an actual event?

God, even his three natures, should not be understood as being omnipotent. His superjective nature potentially affects the creativity of events only through the multiplicity of eternal objects. Whitehead (1978):

> This doctrine applies also to the primordial nature of God, which is his complete envisagement of eternal objects; he is not thereby directly related to the given course of history. The given course of history presupposes his primordial nature, but his primordial nature does not presuppose it. (p. 44)

God and his natures are possibly unnecessary abstractions for seeking archetypal memory or creative imagination. However, Whitehead's cosmology is built within such abstractions and it seems necessary to touch upon them. Hartshorne (1981) has commented how Whitehead's three-natured God and the seemingly infinite potentials for concrescence found in the eternal objects seem to be a multiplying of abstractions that have no need of, or logical relationship to, each other.

For my purposes, it seems worth observing that Whitehead's metaphysics implies a process of becoming within a divine order that ultimately is without beginning or end. This may even apply to microcosmic elaborations, since the three natures of God are closely mirrored in the subjectivity of becoming and perishing during each actual occasion. One major difference is that each occasion looks to past occasions for some of its aims in concrescence, but God, at least in his primordial nature, has no past.

The question of Whitehead's strict ethical dualism within the non-temporal God-influenced cosmic process cannot be resolved here. The related question of the freedom and purpose of the human imagination within such a cosmology must be addressed by examining the unfolding occasion, itself, for evidence of a moment — the actual present — of spontaneous (progressive or regressive) vision.

§4. Process: The Elusive Present. The quest for a purely spontaneous present in Whitehead's system may well be in vain. Every actual event occurs through a concrescence of past or objective actual events. The creativity, the novelty, the aim of each occurring actual event is always unique to itself, but it is brought about by *the creative potential still contained within those past actual events*.

The influence of the multitude of past actual events, i.e., objective occasions, upon the many becoming a novel one is called by Whitehead efficient causation. The influence of the eternal objects, the aim of the concrescence, is called final causation. We usually imagine the latter as lying in the future or as teleological causation. This may be metaphorically valid, but Whitehead also emphasizes the creative potential-as-memory that inheres within each objective occasion but is no longer a potential for experience for that occasion. The creative potential within each objective occasion is a potential only for the unfolding of a present occasion of experience. It is in the combining, i.e., the concrescence, of past potentials that the creative potential of the present event is realized. The aim, itself, *can only exist as potential within the influence of an eternal object*, which may be understood teleologically (category of explanation vii). The realization of such an aim, however, can only come through the utilization of objective occasions of the past: The many become one and are increased by one.

Though God is present at all stages in the process of becoming and though the eternal objects are potentials for experience that may be understood in the past in terms of their inherence in all objective occasions and their paradigms for relating objective occasions into *nexus* (pl.) and though these same eternal objects seem to be potentials without form or substance on their own that lie in the future as aims, it is our experience of temporal process in the imagined present which gives us clues to all other cosmic events. We

experience the passage of time from past into future with all the attendant changes in space-time and have a difficult time, as Whitehead has indicated through his central thesis, trying to locate this present.

As narrowly as we can define *the moment*, upon examination we find that moment to be in reality a process in which past and future are always implicated. Even our sensory perceptions only allow experience of the "presented locus" (Whitehead, 1978, p. 168) of actual events that are themselves in process. The prehensions supporting these sensory perceptions are what bring them into "presentational immediacy" (pp. 61-65), but the prehensions are of the causal efficacy behind the sense response. The prehensions are "a direct perception of those antecedent actual occasions which are causally efficacious both for the percipient and for the relevant events in the presented locus" (p. 169).

An event at the quark level may be an actual entity (or actual occasion or actual event) and so, apparently, may God. Most things that we perceive, it seems, are objective actual entities in some combination. Something such as a rock is not an actual entity; it has no experience and is not in process. Its constituent parts (molecules, atoms, or whatever), however, may be actual entities in the nexus of rockness and they do have experience. Their process is temporally unhurried (relatively speaking) and their memories and aims are limited to the most basic prehensions and appetitive responses.

Our animal body has extended prehension through the sense organs and our mind has enlarged memory capacity and, it would seem, a wider range of potential responses to efficient and final causality. Despite this, we are not actual entities, either, but compounds of various subjective experiences. Wallack (1980) puts it this way:

> Similarly for other cases of sense-perception: a viewer is subject of a sight; a sniffer is subject of a smell; a taster is subject of a flavor; a sentient body is subject of a texture or an ache; and as such all are actual entities. The experiences of sense-perceptions, seeing, hearing, touching, tasting, and smelling, are naturally very important actual entities for people. … In fact, Whitehead allows that an animal body is constructed so as to provide percipient experience of this sort for the animal. (p. 19)

Memory, itself, is "a human percipient experience, although in different mode, just as are the sense perceptions" (Wallack, p. 19)[4]. Whitehead, as noted, has also referred to this as the prehension of efficient causality. The point of this for my purpose is that even in the mode of so-called "presentational immediacy" it is *not* the immediate present that we are perceiving, according to Whitehead, but the perceptions are separate subjective entities which our minds perceive (i.e., prehend) in their causal efficacy, their effect, and unify into the experience we call consciousness. To perceive anything, we must perceive through the *immediate* past.

Another way of conceiving it is to simply recall that all actual entities are diverse until creatively brought together into a concrescence of experience. It is only when the aim of the experience is subjectively satisfied that a novel entity ceases to experience and becomes objectified as a past occasion which can now be remembered (prehended or memorially perceived) to influence the next becoming event. Complicated as this may sound, it seems clear Whitehead means that nothing can be perceived until it is a perceivable object — and nothing is an object until it has ceased to exist as an experiencing subject in process (i.e., an occasion of experience) and has become an objective entity. *All that we perceive are objects that have already entered the past.*

It must be remembered that, for Whitehead, all matter is itself creative. These objective entities are not inert but continue to actively influence experiencing subjects. "The past does not remain past; anything past is presently effecting a present subject, and anything present is in process" (Wallack, p. 142).

Prehension also provides for us an intuition of possibilities that inhere in the past creative possibilities of causal efficacy and in the pure potential of the eternal objects. Being eternal, such potentials lie neither in the past nor in the future but as pure potential they can only be envisioned as being *before* or *around* the process of becoming. They are already *within* the process by being contained in each objective entity and its relationships but then they are no longer imperceptibly pure; as pure potential they are intuitively apprehended only as final causes towards which we in the elusive present can aim our becoming. To prehend a pure potency in and of itself without the causal efficacy of objective occasions is inconceivable. But perhaps it is such non-conceptual prehension of pure potency that brings some artists their creative inspiration or leads some mystics to withdraw into silence.

Where or when in Whitehead's system is actual creative present? It would seem that as causal efficacy meets final causation there must be an instant when the aim is chosen — a *flashpoint* of inspiration or decision to move the process of becoming toward a particular type of concrescence and subsequent satisfaction. There must be moment of balance when negative causation is excluded, positive causation included, and teleological (final) causation accepted as purpose. This could be the moment when imaginative spontaneity actually becomes an ultimate necessity of process — and the only real experience of the actual present we can possibly have.

Griffin (1988) implies that there is such a moment when the decision is made or when the aim is chosen: "The momentary subject then makes a self-determining response to these causal influences; this is the moment of final causation, as the event aims at achieving a synthesis for itself and for influencing the future" (p. 24). It sounds like the *moment* has been found, until Griffin goes on to explain that final causation is but a response to efficient causation in Whitehead's system:

> This final causation is in no way unrelated to efficient causation; it is a purposive response to the efficient causes on the event. When this moment of subjective final causation is over, the event becomes an object which exerts efficient

> causation on future events. Exactly what efficient causation it exerts is a function both of the efficient causes upon it *and* of its own final causation. Hence, the efficient causes of the world do not run along as if there were no mentality with its final causation. An event does not simply transmit to others what it received; it may do this, but it also may deflect and transform the energy it receives to some degree or another, before passing it on. (p. 24)

This indicates that the "final causation" inspired by the eternal objects does not just imply teleological or primordial potential, but also implies that such archetypal potential *inheres* in each actual occasion. It does so through the causal efficacy of the objective occasions that had their own ingression of final causation during their concrescence. Though objective occasions are no longer in process, the ingressed final causation — or eternal potential — continues to be active through them. Past, present, and future are simultaneously implicated in process. *Teleological inspiration may be activated through remembering*.

Perhaps some of Whitehead's own "Categories of Explanation" (1978) may summarize what I have been trying to elucidate:

> (i) That the actual world is a process, and that the process is the becoming of actual entities. Thus actual entities are creatures; they are also termed 'actual occasions.'
>
> (ii) That in the becoming of an actual entity, the *potential* unity of many entities in disjunctive diversity — actual and non-actual — acquires the *real* unity of the one actual entity; so that the actual entity is the real concrescence of many potentials.
>
> (iii) That in the becoming of an actual entity, novel prehensions, nexus, subjective forms, propositions, multiplicities, and contrasts, also become; but there are no novel eternal objects.
>
> (vii) That an eternal object can be described only in terms of its potentiality for "ingression" into the becoming of actual entities; and that its analysis only discloses other eternal objects. It is a pure potential.
>
> (x) That the first analysis of an actual entity, into its most concrete elements, discloses it to be a concrescence of prehensions, which have originated in its process of becoming.
>
> (xix) That the fundamental types of entities are actual entities, and eternal objects; and that the other types of entities only express how all entities of the two fundamental types are in community with each other, in the actual world.
>
> (xxiv) The functioning of one actual entity in the self-creation of another actual entity is the "objectification" of the former for the latter actual entity. The

> functioning of an eternal object in the self-creation of an actual entity is the "ingression" of the eternal object in the actual entity.
>
> (xxv) The final phase in the process of concrescence, constituting an actual entity, is one complex, fully determinate feeling. This final phase is ... the "satisfaction." (pp. 23-25)

From this, I feel I can safely conclude that there is no "given" present moment for the human subject or for any experiencing entity whatsoever in Whitehead's cosmology, unless it is the non-sensory instant (Bergson's intuitional duration) of *ap*prehension of an aim toward an eternal object. As one actual entity is objectified in influencing another, the ingression of an eternal object is taking place. All actual entities in the process of becoming are made of a great array of other actual entities and their concrescence and influence by final causes is happening at different rates in different regions. The satisfaction that occurs upon the attainment of "one complex fully determinate feeling" (Griffin, 1988, p. 154) is a *temporal movement* from outer to inner. As compound entities, we have feeling and consciousness, but according to Whitehead the image of consciousness as an ongoing stream of actual durations may be appropriate after all.

§5. Spacetime of the Creative Source. Does an ongoing stream of consciousness negate any chance for the creative imagination? If the creative imagination can only exist in a spontaneous present then it must. But a spontaneous present could have no substance, no consciousness as we know it, if all perceivable entities have already become temporally objective. A spontaneous present could only be absolute awareness of potentials for concrescence, the pure potentials of the eternal objects. That is to say, *substantially* conscious of nothing, or of everything (same thing) so its conscious content could only be null and void.

This is what Whitehead implies about the primordially natured God, creativity, and the eternal objects: that nothing can be said about them in themselves. He does use the adjectives "non-temporal" and "eternal," however, and, as Wittgenstein pointed out, eternity is found neither at the beginning nor at the end of time: "Proposition 6.4311: If we take eternity to mean not infinite temporal duration but timelessness, then eternal life belongs to those who live in the present" (in Campbell, 1968, p. 676).

In this way, the present must contain all extra-temporal potentiality and all timelessness, including the silent eternal objects. Similarly, silence is the only "response" to such being-in-itself. Silence, however, is not creativity. Could it be that our sensory *and self*-perceptions take place an "instant" into the past, just as matter appears to ultimately consist of energy "particles" travelling slower than the speed of light? If so, then the objective referents of memory and speech can refer only to themselves in a (vicious?) circle of repetition.

Most language forms are built as a response to other language forms whose referents may be actual entities. The realistic, *actual* language Whitehead employs is just such a self-referential theoretic code. Even though he constructs a new terminology, his words all

refer to actual entities within his system. Every term refers to actual entities in their objective form: as efficient causation, as past occasions, as objectively immortal in the mind of God.

Poetry, however, is sometimes perceived as turning away from the possibilities of causal efficacy and attempting to allow language to speak. Bachelard (1987) sees the poet as attaining a non-objective awareness, similar to that of the mystic, but the poet, instead of remaining silent, becomes herself the "objective" occasion for the speaking of such silence: "Poetry then is truly the first manifestation of silence. It lets the attentive silence, beneath the images, remain alive" (p. 25).

This sounds extreme, perhaps, but I am trying to map the source of creative inspiration in an assumed actual present; many writers, visionaries, and mythmakers seem to feel this inspiration is an important part of their art. Many also admit to a feeling of dismay at the impossibility of attaining the full depth of vision hinted at by the first possession of inspiration. The actual occasion may achieve satisfaction but the eternal object, or the archetype, or the Muse cannot because its pure potential becomes "impure" when ingressed into actual occasions. It is similar to the inevitable fall from the sacred time of creation into the profane time of history (or the shrinking of personal awareness within the habitus of the specious present).

This does not seem strange when it is considered that, from our point of view, eternal objects must use as tools for the expression of their dynamism only individual human actual occasions that can act only from the causal efficacy of past (objective) occasions. Objective occasions are nearly infinite; at least they have achieved immortality in the mind of God. An electron may have a memory for the efficient causation of objective occasions that had achieved satisfaction and become objective only microseconds ago. A human being, as a compound actual occasion capable of both physical and mental prehension, may *memorially delve well beyond its own lifetime*. Because of the extent of awareness of the becoming actual occasion of experience (i.e., the present as process) we humans possess a relatively vast capacity for memory. This leads to the seeming contradiction that creative inspiration, though derived from an unattainable present, expresses itself only through the depths of imaginative memory. It seems free flights of imagination can be found through memory.

Such memory increases human freedom and that, apparently, worried Whitehead in his ethical dualism. It seems this enlarged capacity for reception and present self-determination in terms of desired ends makes the human creature more valuable in Whitehead's scheme of things. This value must be because of the human ability to imagine unique possibilities. Since possibilities are unimaginable without eternal objects, the human being must be able to imagine possibilities by prehending/remembering the primordial influence of creativity, in itself, without the mollifying influence of God in his primordial nature or by apprehending, as "aim," toward the teleological draw of creative inspiration (since eternal objects are "eternal," they must be in the eternal *now*, which we can only imagine as *alpha* or *omega*). To an ethical dualist, such "present self-determination" can be understood as dangerous:

> A world with more valuable creatures is therefore *necessarily* a more dangerous world, both because higher creatures can more radically deviate from the divine persuasion for them and because this deviation can create more havoc than the deviations of lesser creatures. (Griffin, 1989, p. 43)

To a poet, storyteller, or mythmaker, however, this is the place/time of human creation: By employing memorial antecedents as far, as deep, as wide as the human mind can conceive, we are bringing to the present unfolding actuality qualities not found within any language system in itself. The creative imagination may make images, music, poems, or narratives without necessary reference to concrete objective actual referents.

As pointed out at the beginning of this survey, a cosmology is, itself, an aesthetic rendering of universal reality. Whitehead even indicates that process begins with imagination "like the flight of an aeroplane," and that any metaphysical system requires "a leap of the imagination to understand its meaning" (Whitehead, p. 4). Though thoughts and perception — our usual selves — can never exist in the elusive present, imagination, inspiration, and archetypal memory, by Whitehead's own suggestions, just may. And it is from these dynamic potentials that time, our world and ourselves emerge.

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