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THE RIDDLE OF CONSCIOUSNESS AND THE CHANGING SCIENTIFIC WORLDVIEW*

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SUMMARY

Centuries-old determinist traditions of scientific materialism are currently being challenged in an unprecedented outburst during the past two decades of emerging new paradigms, new worldview "visions", new approaches to consciousness and reality, along with other transformative trends including an all-time high in favor of holism over reductionism. These revisionary developments are traced to sources in the preceding cognitive revolution and its changed concepts of consciousness and causation. A new reciprocal "two-way" mode of causal determinism, required to shift mental states into an ineliminable causal role, is the common underlying factor. The bidirectional model, upheld to be a more adequate and complete paradigm for causal explanation, opens the way to a science-consistent approach to ultimate value with a new set of answers to some of today's deepest issues.

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INTRODUCTION

I once suggested that the 1980s might well be called "the decade of emerging new paradigms". This semi-serious assessment refers to the explosive outburst during this period of new worldviews, new "visions of reality", "new sciences" (of mind, of life, of qualities, wholeness, ...), new epistemologies, ontologies and what not. Beyond a growing sense that we are in a period of fundamental change, we yet lack any consensus regarding the precise nature of this change, its exact cause, what it means, or where it may be leading. It is in the context of this unprecedented upsurge in novel world outlooks with its many uncertainties, and the associated flux in shifting and emerging paradigms that I try to support a case for holding firm to a scientific view of reality that we already have -- specifically, the view spawned some 20 years ago in the widely documented, so-called cognitive, consciousness or mentalist revolution of the 1970s (Baars, 1986; Dember, 1974; Gardner, 1985; Matson, 1971; Palermo, 1971; Sperry, 1987).

Following an era of some two centuries or more of "scientific materialism", this turnabout in the treatment of mind and consciousness has transformed today's scientific descriptions of ourselves and the world. A changed way of thinking, explaining, and understanding is instilled. New principles of cognitive and emergent causation supersede the older atomism, mechanism, and value-empty determinism. Countering prior physicalist views, the new principles of causality affirm that subjective human values are today the most strategically powerful driving force governing the course of events in the civilized world -- the key to our global predicament and its solution.

Described as "a virtual Copernican Revolution" (Manicas & Secord, 1983), the new outlook in science most assuredly calls now for a global mind change, a thoroughgoing shift to a new value-belief system with new transcendent guidelines, life goals, and new ways of thinking and living. Upholding a changed scientific interpretation of the creative forces that made and move the universe, it brings a new set of answers for some of humankind's deepest questions. Intrinsic evolutionary directives emerge that provide an ultimate moral basis for environmentalism and wilderness values, population balance, the rights and welfare of future generations, and for other measures which would serve to help insure a high-quality, sustainable world with an ever-evolving future. If implemented worldwide as a basis for world law and justice (through the United Nations, for example), the called-for type of global mind change would serve to turn around today's self-destruct trends in directions that would sustain and enhance the evolving quality of life and the biosphere.

Even so, examination of the underlying conceptual developments behind this sweeping paradigm turnaround does not, I believe, encourage hope for a

continuing further shift within science in wished-for directions that might, for example, provide some sort of supernatural transcendence or after-life for the conscious self. In other words, I think today's new trends toward "wholeness", "subjectivity", "qualities", and so on, do not presage any additional further loosening or shift in these directions -- nor imply either that science ought hereon to be viewed as "enculturated" after some two centuries of commonsense understanding that if there is any enterprise in the human venture that stands out as being relatively free of cultural, ethnic, political and other bias, it is science.

At least that is the position I try to support and recently expressed as follows:

> "...our new acceptance in science of consciousness and subjectivity, the mental and cognitive, or spiritual does ***not*** -- as frequently inferred -- open the doors of science to the supernatural, the mystical, the paranormal, the occult, the otherworldly -- nor, in short, to any form of unembodied mind or spirit. The strength and promise of the new macromental outlook is in just the opposite, that is, in taking our ultimate guideline beliefs, and resultant social values out of the realm of the supernatural and otherworldly uncertainties and grounding them in a more realistic realm of knowledge and truth, consistent with science and empiric verification." (Sperry, 1991a, p. 255)

This being an area, however, where final answers still lie far beyond us, my aim in what follows is simply to explain a possible analytic interpretation of the recent outburst of revisionary new outlooks, along with supporting considerations -- not with the idea that this leads to any final conclusion, but merely in hope that these factors and the related arguments may hereon be better perceived and taken into account in further appraisals of the many pros and cons.

INTRODUCTORY RÉSUMÉ

In brief overview, the principal reason I think the current upsurge in transformative new outlooks is not apt to continue further into a more extreme brand of metaphysical reality is because most of these recent trends seem best viewed as outcomes of the consciousness revolution that immediately preceded. If so, they are then dependent upon an interactionist model of mind and brain, the mental and the physical, a model which seemingly rules out the existence or transmission of conscious experience in a disembodied state.

More specifically, our new treatment in science of the contents of subjective experience, established by the 1970's cognitive revolution, has its basis in the idea that conscious mental states are emergent properties of brain processes. As such, any separate existence apart from the living functioning brain, of which they are dynamic properties, would seem to be a logical impossibility -- as would also their manifestation, expression, or

transmission in phenomena such as telepathy, reincarnation, channeling, clairvoyance, psychokinesis, and such like.

Despite this shortcoming, if it be taken as such, science already in the present view, has improved itself through a major shift in its conceptual foundations. The result, as I see it, places scientific theory today in an even more complete, coherent and stable state than was the case with its preceding reductive physicalism, which itself achieved a long and highly spectacular sucess record as a working paradigm, and remained seemingly irrefutable for more than two centuries. The odds against further change in today's additionally strengthened paradigm appear correspondingly even more unlikely.

DEPENDENCE ON A SPECIAL INTERPRETATION

My case for holding to, and working with the newly defined cognitive, mentalist, or "macromental" paradigm of science is based on a particular analysis and interpretation of both the 1970's cognitive revolution and also of the subsequent 1980's boom in "wholism" and "emerging new paradigms". This interpretation is one that definitely remains open to correction, with some half dozen or more competing alternative accounts of these same worldview developments. My explanation in the following, therefore, becomes in large part an attempt to support and justify this particular interpretation in contrast to the various contested alternatives. In order to judge the relative credibility, it is essential obviously that one start from an accurate understanding, which in the past has not always been easy (Globus, 1976; Natsoulas, 1987; Ripley, 1984; Trevarthen, 1991). The following account, spelled out in greater detail than elsewhere and expressed largely in nonspecialist terminology, may well appear to some readers to be overly simple and often redundant. The key concepts, however, though quite straightforward and obvious once they have been grasped, nevertheless, do not fit into the traditional philosophic dichotomies with which we are familiar and have a long history of misinterpretation (see Natsoulas, 1987; Ripley, 1984; Sperry, 1992a).

In a time when it has become common to observe that there are almost as many different theories of consciousness proposed as people writing on the subject, it is important to note, firstly, that the interpretation defended here is not just another individual opinion. Rather it represents the current scientific mainstream view of the mind-brain relation, the actual working conceptual framework over the past twenty years for the whole discipline of science that specializes in mind and behavior. What we deal with largely, is thus not merely philosophic opinion, but with the factual recorded history of a paradigm shift in science. The leading concern is not so much whether

mentalism or materialism may ultimately be correct, or reductionism or holism, and so on, though these and related questions are directly involved. Primarily, however, the question becomes one of analyzing the factual historical record to find the answer to what happened in psychology to cause its 1970's shift from behaviorism to today's new mentalism or cognitivism.

The answer we arrive at will attribute this shift, along with related present-day trends in science toward irreducibility, "wholeness", and subjectivity, to conceptual developments within the mind-brain and behavioral sciences -- not to the "new physics", Bell's theorem or "nonlocality" (see Klotz, 1988), or to ecologic interconnectedness, Whiteheadian "process" philosophy, or various other things to which these same trends have also been ascribed. The list includes information theory, general systems theory, philosophic realism, structuralism, computer science, and nonlinear dynamics -- to mention just some of the contested alternatives. Many of these alternatives undoubtedly helped contribute to today's outlook in various secondary, supportive, reinforcing, and/or sociologic roles. In my analysis, however, the critical key factor was the overthrow of the deeply ingrained deterministic logic of traditional reductive physicalism with its centuries-old reasoning which previously had succeeded in ruling out any functional, causal, or interactive role for mind or consciousness.

I assume throughout that it is now an agreed fact of history that behavioral science in the 1970s underwent a major paradigm shift in which long-dominant Behaviorist tenets denouncing mentalistic explanations gave way to a new cognitivism that now reverses the explanatory status of conscious mental constructs. Conscious awareness, including all contents and qualities of subjective experience, previously had been banned from the explanations of science not only because of formidable methodologic difficulties, but also on the grounds that objective materialist theory already offered a complete, closed, and coherent system. In principle, this strictly physical system had no place for conscious or mental forces. Their inclusion would seemingly have to violate the conservation of energy and other established laws. "Mental states cannot interact with physical states", or "Mind does not move matter" was the long-accepted verdict, and "No physical action waits on anything but another physical action."

Nevertheless, in the early 1970s following a half century of strict Behaviorist renunciation, conscious subjective states quite suddenly, "almost explosively"(Pylyshyn, 1973), gained acceptance in mainstream behavioral science as causally interactive agents, legitimate for scientific explanation of conscious behavior and its evolution (Baars, 1986; Dember, 1974; Gardner, 1985; Matson, 1971; Palermo, 1971; Sperry, 1987). In my interpretation the achievement of this startling, long-delayed, and still little explained

breakthrough was finally effected only through recourse to a different conceptual framework for causal determinism, in other words, only by making a change in the basic ground rules for scientific explanation.

A MODIFIED FORM OF CAUSAL DETERMINISM

In the traditional atomistic or "microdeterministic" view of science, everything is determined from below upward following the course of evolution. In this view, brain states determine mental states, but not vice-versa. In the new view, however, things are determined reciprocally, not only from lower levels upward, but also from above downward. In the reciprocal, "two-way", or bidirectional model, a molecule, for example, rather than being governed solely by its atomic make-up, becomes also the "master of its inner atoms and electrons". In chemical interactions the space-time course of its atomic components is determined by the overall configurational properties of the molecule as a whole, as well as the other way around (Sperry, 1964). This is illustrated, for example, in the often very different chemical properties of mirror image forms of the same molecule. In reference to brain function...

> "...the simpler electric, atomic, molecular, and cellular forces and laws, though still present and operating, have been superseded by the configurational forces of higher-level mechanisms....these include the powers of perception, cognition, reason, judgment, and the like, the operational, causal effects and forces of which are equally or more potent in brain dynamics than are the outclassed inner chemical forces." (Sperry, 1964, p. 20)

In effect, the traditional one-way "bottom-up" view, based in a heretofore supposedly closed, complete scheme for describing the entire natural order including brains, was perceived in the new outlook to be inadequate or flawed, in that its one-way logic omitted the downward control. This shortcoming was perceived to leave an opening in which conscious subjective experience might be included in a causal interactive role (Popper, 1972; Sperry, 1965).

By combining the old "bottom-up" atomistic determinism with an added concept of "top-down emergent determinism", a way was found at long last by which subjective causality might be included within the classic objective account of science. Especially noteworthy, the new bidirectional approach made this possible without any loss in the many proven analytic-technologic benefits of the conventional one-way approach. What is challenged and changed is the former theoretic assumption that materialist determinism had been a logically airtight complete system.

In the reformed scheme the microdeterminist chains of causation already covered in the brain-behavioral and other sciences need not be disrupted, intervened or disposed of. Mostly these are maintained in their existing form and simply surrounded, enveloped, or "supervened" by higher level cerebral

systems. The resultant downward causal effects are evidenced, not in a reordering of events within lower local details of the given brain process, primarily, but in the way the lower-level components are ordered relative to things outside this cerebral process. With respect to a particular given cortical neuron, whether it fires or not, and its firing schedule for the day, is determined by the types of thoughts, feelings, memories and other higher-level cognitive phenomena that happen to pass through the brain (Sperry, 1965). Unlike proposals that would utilize and amplify any indeterminant quantal influences (Eccles, 1992; Lahav and Shanks, 1992; Stapp, 1992), the type of downward control that is posited actually works in the opposite direction: That is, it tends to protect brain function and its dynamic organization against any chaotic, injurious, or other such interference in favor of control through (overriding) higher-level processes of cognition that are much less easily disrupted (Sperry, 1970).

The bidirectional, emergent interaction model places emergent properties in a stronger role. Their irreducibility is demonstrated, as is their downward control over lower-level components. Their evolution as novel causal entities, not just as a different assembly of old entities, is held to introduce into the cosmos (and to science) new control phenomena and forces in their own form and in their own right. Inclusion of both the bottom-up plus the top-down type of inter-level determinism is claimed to be necessary in order to obtain a complete picture of (causal) reality.

This double-way, reciprocal form of causal determinism applies, not only within the brain but throughout nature to emergent properties in general. It follows accordingly that traditional "scientific materialism" as applied throughout the sciences has been in error all along. For, in its exclusive atomistic, reductive physicalist approach, it has logically excluded, not only mental but also, in principle, all autonomous macro emergent or holistic causation. Instead, it has made these all reducible to the elemental forces of physics and eventually, in principle, to an even more elemental 'theory of everything'.

For neuroscience, acceptance of mental causation in the above form does not imply any alterations within the already-described chains of neuronal causation -- as did, for example, early attempts to account for conscious influences through "quantum jump" effects at synaptic junctions between brain cells, attempted unsuccessfully in the past by Arthur Compton, John Eccles (1953) and many others. Instead, consciousness is located in higher (cognitive) domains of brain processing, which as yet are neither described nor understood (Sperry, 1965). Mental states, as they successively emerge in a train of thought, for example, are conceived to interact functionally as emergent wholes at their own cognitive level in a progression governed by its

own special ***mental or cognitive*** dynamics. The dynamics of the mental progression are determined presumably by emergent cognitive properties functioning as irreducible wholes, and ***as subjectively experienced.*** The dynamics and laws for causal progression at the mental or cognitive level are thus quite different from those in the lower-level neurophysiology.

Such a sequence of higher-level cognitive dynamics exerts concomitant downward control over its neurocellular, molecular, atomic, subatomic and other embedded and enveloped constituents by programming their schedule and pattern of activation from above -- again, as seen from outside the system, and thus without disrupting the biophysical laws of microchain causation within these embedded lower-level components. At the same time, as traditionally assumed, the higher-level mental dynamics are also reciprocally determined by, and are dependent throughout upon, their lower-level neurocellular, biophysical, chemical, and other components.

We are not yet at this date in a position to visualize in any concrete or detailed form just how these cognitive emergent patterns might operate as functional wholes in neural network dynamics, because not enough is yet known about the nature and properties of these cognitive networks. That they nevertheless do, however, is strongly indicated in several lines of evidence, such as that from Gestalt psychology. What we subjectively perceive, feel or remember, as demonstrated in early Gestalt studies, can be shown to depend on the Gestalt, pattern, or configuration of the neurocellular elements involved, as much or more than it depends on which particular neural elements carry the pattern. Subjective meaning is thought to be acquired on the so-called "functionalist" principles of modern computational philosophy (Fodor, 1981; Gardner, 1985), involving interaction of these brain-process Gestalts with one another as wholes, and also as they interact with the ongoing contextual matrix of network dynamics (Sperry, 1952) -- just as a word, for example, may acquire different meanings in different sentences and/or contexts.

This "macromental" model for cognitive determinism is actually a ***micro*** plus ***macro*** plus ***mental*** model, in which emphasis is given to the novel ***macro and mental*** features. As perceived by Popper (Popper & Eccles, 1976), the mental is only a special instance of the macro -- but is considered to be sufficiently special to warrant separate mention. In this "double-way" bi-directional model, neither of the reciprocal upward or downward systems of "causal" control are of the common single-level, sequential type of chain causation ordinarily thought of as a cause-effect sequence. Both the upward and downward control systems are exerted continuously and concomitantly over time during a given sequence of cognitive processing. It is important to note further that these interlevel upward and downward forms of determinism are not

symmetric, but quite different in kind. Thus the two counter-flow control systems do not collide, conflict, or in any way counteract each other.

As indicated above, a relativity factor is also involved. The programming influence of the mental on the lower-level constituents is not evidenced within microevents of the given cognitive brain process itself where the known laws of neuroscience still apply. Relative to the rest of the organism, the laboratory and outside world, however, the programming of the constituent neurocellular activation is determined also, and more prominently, by the surround of higher-level cognitive dynamics. The higher-level process carries its lower-level embedded elements in a program determined at the cognitive level.

This concept has been simply demonstrated in what has been called "the rolling wheel analogy", in which it can been seen that a wheel rolling downhill carries along its embedded molecules and atoms "regardless of whether the individual molecules and atoms happen to like it or not" (Klee, 1984; Sperry 1969). Each individual molecule is governed in the usual physiochemical manner relative to neighboring events within the wheel. Relative to the rest of the world, however, the behavior of the molecule is determined much more prominently by the macro properties of the wheel as a whole -- and the same holds for a going mental process and its component biophysical activities. More than a mere shift in frame of reference (Vandervert, 1991), the inclusion of both frames of reference for describing causation takes us from the former incomplete and inadequate standard reductionist paradigm to the more complete emergent interactionist, neomental, or "macromental" position.

The new model places added emphasis on the ***space-time or pattern*** factors in causation as opposed to the ***material, mass,*** or physical factors. The ***space-time patterning*** of component entities, in and of itself, becomes endowed with causal efficacy. The collective spatiotemporal arrangement of physical masses, particles, forces, fields, and so on becomes in itself causal, with effects that are not accountable, as a rule, in terms of known lower-level laws. In any but perhaps the most ultra simple cases, these space-time interrelations are far too complex (over and above those of the 3-body problem) to be explainable by, or reducible to, existing laws for lower level interaction. These highly critical space-time factors are thus lost in attempts to reduce lawful explanations at a given level into laws that apply to the lower-level components. In contradiction to continuing contentions that the causal paradigm of classical Newtonian physics allows no room for consciousness as a causal influence (e.g. Stapp, 1991; Popper, 1972), the above described solution for inserting into brain function the causal

influence of mental states is achieved without discarding the general Newtonian framework.

THE TURNING POINT: RELEVANT CHRONOLOGY

To more precisely distinguish the interpretation supported here, it will help, firstly, to further extend the historical background beyond the level of scientific disciplines and mainstream doctrine to include that of individual personal precursor views that were present or appeared during the decade prior to the 1970s turnaround in mainstream psychology. Secondly, we need also to recognize that the closely involved debate over emergence, reductionism and wholism has an extremely long history, traced by some philosophers back to Aristotle and Democritus. This debate is still going strong today. The issues therefore are by no means simple, or easily settled. For historical background, there is thus good reason to start, not from any particular individual argument, but from the prevailing majority view and its fluctuations during the preceding decades.

Following a prolonged period in which scientific reductionism and logical positivism had been in favor, the majority view in the 1920s underwent a strong swing toward recognition of emergence and holism, particularly in writings on emergent evolution (e.g., Morgan, 1923; Ritter, 1919; Smuts, 1926). By the 1940's and '50s, however, emergent-wholist theory again was gradually losing ground to reductionist views and by the early 1960s had sunk to an extreme low, overwhelmed by a strong pervasive upsurge of reductionism, occasioned in part by continued successes in physics but generated especially by dramatic new advances in molecular biology. Thus, by the early 1960's reductionism again reigned -- not only in physics (Feynman, 1963), but also in biochemistry (Platt, 1959), molecular biology (Crick, 1966), psychology (Skinner, 1964), information theory (Simon, 1962), philosophy (Armstrong, 1968; Dennett, 1969; Hook, 1960; Klee, 1984; Putnam, 1960; Smart, 1963), and nearly everywhere -- including even in Gestalt psychology, the early prime stronghold of configurational theory (Köhler, 1960). At this time General Systems Theory also was accepting reductionist logic as a basic structural principle (Bertalanffy, 1956; Sperry, 1991b).

This strong upswell of reductive physicalist thinking, described by philosopher Thomas Nagel (1971) as a "wave of reductionist euphoria", was soon again, however, to give way to an opposing wave of holism, emergence and "irreducibility" (e.g., Bertalanffy, 1968; Koestler and Smythies, 1969; Laszlo, 1972; Pattee, 1973; Polanyi, 1968; Popper, 1972). This latter wholist movement has continued since to burgeon into an extreme new high that still today is gaining further ground both within and outside science, extending

even into cosmology (Harris, 1991), and a "postmodern" theology (Griffin, 1988).

This latest mainstream swing from extreme reductionism to an all-time high in wholistic thinking, rather abrupt in terms of historical precedents, poses a key question: "What happened that served to break the 1960's wave of reductionism and turned it around into a general new all-time high for wholism, a development so marked that today it prompts proposals for a new "science of wholeness" (Harman, 1993)? What turned the "reductionist euphoria" of the 1960s into the current boom in holistic "new sciences"? Also in this same period what prompted the rise of similar antireductionist thinking in a "New Philosophy of Science" (Manicas & Secord, 1983)? The logical answer, I believe, is found in those same conceptual developments that enabled the revolutionary turnabout with respect to consciousness.

The five year period starting from about the mid 1960s thus becomes, in this analysis, a crucial turning point in the history of both the reductionist debate and also that on the mind-body problem. It also will be seen that this same period represents a turning point as well for the fact-value or science-values dichotomy (Edel, 1980), and similarly for the ancient freewill-determinism paradox (Deci, 1980). Further, it is these collective changes that are inferred to have set the stage for the subsequent outburst in the 1970's and '80s proclaiming new paradigms, worldviews, epistemologies, and so on.

In our "flow-of-history" analysis, the current swing from reductionism to wholism has much in common with the concomitant swing from behaviorism to mentalism. Both major shifts in mainstream thinking are seen to be interlinked and hardly separable. Both are dependent upon the bi-directional model of causality with its "top-down" emergent determinism. The same modified concept that placed mental states in a causal role, refuted also the adequacy of traditional "bottom-up" physicalism, and gave emergent macro qualities in general (including the mental) a new irreducible causal status. On these terms the so-called 'cognitive revolution' legitimized what Carl Rogers (1969) used to call 'subjective knowing', providing a long-sought theoretic foundation, not only for cognitive, but also for humanistic and social psychology.

This analysis, accounts as well for the broad array of new epistemic developments of the past two decades, all of which appear to share in common with the above, the rejection of traditional microdeterminism (Klee, 1984). Four major transformative developments visible in the recent literature are taken to be involved, all related, and all traceable to origins in this same critical 5-year period. These include (1) the diametric turnabout in the causal status of consciousness; (2) the shift from an extreme "reductionist

euphoria" to extreme holism; (3) a new recognition and wide acceptance all through the sciences of "top-down" emergent determinism; (4) a sudden, still-continuing upsurge in radical new outlooks and paradigms in science and its conceptual foundations (Thagard, 1992). All four can be understood and accounted for in terms of the same basic concepts required for the turnabout in the causality of consciousness.

This brings us to another critical point in my argument, namely, its dependence upon an assumption that the 1970's changeover from behaviorism to cognitivism in mainstream psychology and my own similar shift to mentalism were both effected on the basis of the same theoretic rationale. That is, they both involved the same theoretic shift to the same new mentalist paradigm. Support for this is twofold: Firstly, it hardly seems plausible that the powerful, centuries-old, and seemingly incontestable physicalist paradigm of science with its rigorous exclusion of mentalistic explanation -- along with its half-century-old behaviorist counterpart in psychology -- could suddenly, after having successfully fended off challenges this long, have been abruptly toppled twice within a few years by ***two different*** mentalist theories. The ruling dictum of microdeterminism and the materialist era that mind does not interact with matter, and its time-tested reasoning, presumed to be logically cohesive, complete, and irrefutable, is hardly something for which one would expect to suddenly find two separate errors. This alone appears to justify the assumption that in both instances the conceptual foundation behind the new mentalist/cognitive thinking has to be, in essence, one and the same.

Secondly, this assumption gains added support from chronologic correlations in the historical record as evident in the following brief outline of the early expressions of the "new mentalism". Despite some benefit-of-hindsight claims to longterm advance awarenesses of the coming cognitive/mentalist turnaround, there is widespread historical evidence that adoption of the new mentalist paradigm came with a startling, almost explosive suddenness still looked back upon by many psychologists as an unexplained surprise (Boneau, 1993).

- **1964** An initial brief statement of downward causation in application to evolution, molecular and organismal behavior, including nonreductive downward control of the mental over the neuronal in brain function (Sperry, 1964, pp. 2, 20). This posed a direct challenge to the then-prevailing reductionist outlook and came at a time well before the onset of any awareness of a coming paradigm shift (e.g., Eccles, 1966; Feigl, 1967; Nagel, 1971; Rogers, 1964; Skinner, 1964).
- **1965** First full presentations (Popper, 1972; Sperry, 1965). The new outlook was described by Karl Popper as "a solution to...the classical Cartesian body-mind problem" explaining "***interaction*** of mental and physical states", and bringing "a different view of the world". I presented it as ***"An Alternative Mentalist Position"*** that "restores the mind to the brain of objective science", and "a long sought unifying view" that "would

eliminate the old dualistic confusions, dichotomies, and paradoxes", also as a scheme that gives "plenty of free will, provided we think of free will as self-determination", and finally as an "objective explanatory model of brain function that neither contradicts nor degrades but affirms age-old humanistic values". The mentalist/cognitive paradigm is still viewed today in very much these same terms.

- **1966** Wide exposure in a reprinting in ***The Bulletin of the Atomic Scientists*** (Sperry, 1966) instigated by biochemist-futurist John Platt. This bulletin, with its famous "doomsday clock" and subtitle "**Journal of Science and Public Affairs**," gave very broad exposure in those years across all disciplines, not just among physicists.
- **1969** More specialized presentations: (1) in ***Proceedings of the National Academy of Sciences*** (Sperry, 1969a) later published in full (2) in ***Psychological Review*** (Sperry, 1969b), (3) in philosopher Marjorie Grene's international ***'Concepts of Mind' Workshop*** (Grene, 1974) and (4) in the 1969 ***Proceedings of the Association for Research of Nervous and Mental Diseases, a Program on Perception and its Disorders*** (Sperry, 1970a).
- **1970** A critique in ***Psychological Review*** by Dalbra Bindra (1970), and my response to Bindra (Sperry, 1970b) also in ***Psychological Review*** (In retrospect these two combined were perhaps most influential in tipping the scales.) By the following year publications in psychology were beginning to express growing awareness of a general paradigm shift (Palermo, 1971).

The "computer program analogy" of mental function, a competing concept, can also be said to qualify in respect to chronology and is frequently cited as having had a strong influence in bringing about the consciousness revolution. Presented at length in a 1960 book by Miller, Galanter, & Pribram (1960) and more pointedly later on by Ulrich Neisser (1967), the computer analogy was surely influential in opening the way to a better appreciation of cognitive factors in a control role in brain function. The computer-program relation, however, can equally well be viewed, like most other physical phenomena, in traditional analytic reductive physicalist terms, and generally was so taken prior to the introduction of downward causation in the mid 1960s. In itself, the computer-program analogy does not demand a shift to mentalism, nor to a causal or emergent view of conscious experience. It can hardly be said, in itself, to legitimize 'subjective knowing' and clearly had not done so by 1963-64 when the ongoing debates in psychology between behaviorists and phenomenologists (e.g., Koch, 1964; Rogers, 1964; Skinner, 1964; Wann, 1964) continued in the same vein as before, essentially unaffected by any new cognitive or mentalist approach. Further, the impact of the volume by Miller et al., plus the influence of related work of this period with computers, information theory and Artificial Intelligence, had failed collectively to alter the basic "in-principle" reductionist position or the basic causality reference frame of leaders in this field (Simon, 1962).

The factors responsible for psychology's abrupt swing to mentalistic explanations, not clear at the time, still remain today subject to ongoing controversy. Most psychologists tend to overlook emergent interaction and the above cluster of related developments in favor of various others more directly affiliated with research programs and theory confined to psychology proper. As yet, however, no consensus is apparent and various subfield splinter groups continue to vie with one another in ascribing the origins to their own specialty (e.g., Amsel, 1989; Baars, 1986; Bolles, 1990; Dember, 1974; Gardner, 1985; Matson, 1971; Palermo, 1971; Wasow, 1989). According to the present analysis, the majority of these alternative views either fail to stand up in historical examination or they deal with the various subordinate theories of the behaviorist period not critical to **Behaviorism *per se*** as an overarching paradigm that made psychology consistent with neuroscience and the other natural sciences (Reese & Overton, 1972; Skinner, 1964). Criticism and/or the abandonment of such subordinate "behaviorist" theories did not demand any shift to a new worldview, or to a new explanatory paradigm, nor include any logic to counter the microdeterminist tradition.

Behaviorist doctrine, for example, prior to the 1950s was heavily invested in conditioned reflex learning (Koch, 1964), and this included reliance on pre-natal conditioning to an extent that the very concept of instinct as posited in European ethology had become a term of derision among American behaviorists (Lehrman, 1953; Lorenz, 1937). The behaviorist denunciation of any inheritance of behavior traits was supported by abundant, seemingly unequivocal experimental evidence that the growth and formation of nerve connections is diffuse and nonselective (Hamburger, 1990; Weiss & Taylor, 1941). This case against instincts, however, was later turned around in the 1940s by new experiments showing that intricate inherited nerve networks can indeed be grown into the brain directly, unaided by learning, and organized with great precision through an elaborate scheme of genetically-controlled chemical coding of individual cells (Sperry, 1951).

Another serious flaw in early behaviorist theory was pointed out soon after by Karl Lashley (1951) in his critique of chained stimulus-response associations as the basis for serial order in behavior. Lashley used language as a main example and this was reinforced later by linguist Noam Chomsky (1959) with an added suggestion that the deep structure of language is not learned, but inherited. Such inheritance, previously unthinkable, had become theoretically plausible by the mid-1950's as a result of the growing evidence for high precision and complexity in the inherent chemoaffinity factors in fetal brain organization (Sperry, 1956). Other theoretical thrusts of the behaviorist era including extreme peripheralism, the environmental emphasis, "black box" and "empty organism" concept, and Hull's Stimulus-Response scheme

for a comprehensive theory covering all behavior, also came into decline and helped contribute to a growing loss of confidence in so-called "behaviorist" answers.

For present purposes the main point to note here is that none of these types of theoretical setbacks, individually or collectively, served to overthrow Behaviorism *per se* as a conceptual framework, a philosophy of science, or overriding metatheory that rejects introspective mentalist explanations and restricts behavioral science, like the neuro- and other natural sciences, to what is physical and measurable. Remaining "behaviorists" today defend their position with claims that the exclusion of mental constructs had been merely a methodological principle. Actually at the time, and in harmony with brain research, physics, and the rest of science, it was much more than this. Behaviorist thinking through the 1950's, as in the rest of science, excluded the idea that conscious subjective qualities can have any interactive influence on the course of physical brain function. Conscious states, that is, were held to be **epiphenomenal**, not **causes** of behavior (Skinner, 1964; Wann, 1964, p. 135).

MIND MERGED WITH MATTER: IS IT MATERIALISM? DUALISM? MENTALISM?...OR?

The new conception of mental states in a causal interactive role was classified by Popper (1972), and by many others since, as a "dualistic" solution. This was in accord with past terminology in which 'mentalism' traditionally had been equated with 'dualism'. In contrast, however, I have described this new form of mentalism from the start (Sperry, 1965) as a quite different intermediate position which is monistic, not dualistic. In my view, mental phenomena as dynamic emergent properties of physical brain states, become inextricably interfused with, and thus inseparable from their physiologic substrates. At the same time, they are taken to be not identical to the brain substrate in the way that an emergent property is distinguished from its infrastructure, even though it is critically dependent upon and determined by its component microevents. Mental states, though not observable or measurable at present, are presumed in principle, to be something accessible to eventual scientific description "like the interior of the earth" with further advances in technology (Sperry, 1969). It thus becomes a moot question as to whether this modified concept of a mental state as a dynamic emergent, that retains the subjective quality or "raw feel", should now be called a "material" or a "mental" process.

Either way, the overall outcome is a coherent hierarchic view of nature with increasingly complex physical systems at different levels having diverse emergent properties which include the mental emergents of the brain-mind

system as part of a monistic natural order. The traditional difference between the physical and the mental (as subjectively perceived) is deliberately retained, but these previously separate, dual realms now become inextricably merged. Questions and opinions are continually being raised as to whether this type of mind-brain solution ought to be called **materialistic** or ***mentalistic***. It is only natural that persons with previous investments in one or the other, should want to call it a modified form of their previous position. Confirmed dualists Popper and Eccles (1977), for example, espoused it as dualistic "psychophysical interaction", whereas I preferred to call it a nondualistic "new", "neo-" or "alternative" mentalism (Sperry, 1965). The latter better serves to distinguish the new features. It calls attention to the reductive physicalist errors of the past, and also emphasizes the revolutionary, radically revised world-outlook and story which the new solution brings to science. I have outlined elsewhere other reasons (e.g., Sperry, 1965, 1980, 1987, 1991b) why 'mentalism' seems to me, overall, to be preferable to 'materialism', if not from philosophic traditions, at least from the standpoint of behavioral science and common usage.

About ten years after Popper and I had separately described this new solution to the mind-brain problem (Popper, 1972; Sperry, 1965) and some four years after its adoption by mainstream psychology in the new mentalist paradigm (Dember, 1974; Matson, 1971; Palermo, 1971), the same solution was rediscovered by philosopher Mario Bunge (1977, 1980), but renamed as a new "emergentist materialism" -- with myself conveniently misclassified as a dualist, and psychology's shift to cognitivism not mentioned. This ongoing controversy over terminology has caused puzzlement and confusion from the start (Bindra, 1970; Sperry, 1970b). Psychologist Thomas Natsoulas (1987), specializing in the history of consciousness, correctly points out that the new answer blends together features from previously opposed solutions, and then, in reaction to its misclassification as "dualism", calls it a type of "physical monism". Why the more recent philosophic innovation "property dualism" (e.g. Lahav and Shanks, 1992) is hardly a useful solution from the scientific standpoint was explained early on (Sperry, 1970).

Certainly Bunge's "materialism" and Natsoulas' "physicalism" still find more ready acceptance in modern science and philosophy than does "mentalism". In retrospect, it might have been wiser had I chosen some emergent materialist/physicalist label from the beginning. However, it still seems to be a mistake overall to abandon the age-old commonsense distinction between mind and matter, the mental and the physical. This basic common distinction long preceded the varied philosophic and scientific terminology. The highly distinctive specialness of conscious states with their subjective qualities

does not go away just because they are taken to be emergent properties of physical brain processes.

BACKGROUND ASSUMPTIONS

The views expressed here come from a background not particularly conducive to reliance on "deep intuitive inner knowing" as an alternative to the scientific mode. One learns, for example, of forms of insanity in which "inner voices", a "radio in the chest", or other more recent fixed fantasies are defended with elaborate and quite rational inner logic. This and many other examples demonstrate a general principle that the mind's inner knowing and reasoning, left to itself, may arrive at all kinds of weird and wonderful convictions not to be trusted. The brain's logical "computational" sequence seems a relatively simple feature of cognitive processing, and much the same whether used to defend a scientific or an insane conclusion. The critical difference lies in how the arrived-at inner mental conclusion checks out when tested by interaction in the outside "real" world.

The scientific method has been characterized and defined in a variety of ways. To me its real essence lies, not in special cognitive features, types of organization, systematics, rationality, technology, and such like, so much as in the insistence that any inner conclusion or "truth" however arrived at, is not to be trusted until checked and double checked (by experiment or otherwise) for consistence with outside reality. This checking process occurs naturally in the course of ordinary behavior and is inferred to be an important shaping feature in the evolution of the mind. Science formalizes and maximizes this principle, and thus stands distinct from other avenues to "truth" and knowing such as inner, or divine revelation. Historically, this is how science got its start and has since proven itself whenever directly challenged by other modes of knowing.

The assumption that the mind/brain system thus evolved in close integration with the outside real world, means also that subjective "commonsense" impressions acquire a reality status less easily undermined by philosophic conjecture or by scientific theorizing, including, for example, the weirdness of non-locality, wholesale instantaneous interconnectedness, an "observer-dependent reality", or other such counterintuitive figments of the "new physics" -- that Einstein and other physicists have themselves found hard to accept (e.g. Klotz, 1988). Like most neurobiologists exposed to the study of evolution, I also take a "realist" position that assumes a world exists out there regardless of whether I or anyone else happens to perceive or measure it. After laborious excavation of a giant ammonite or large dinosaur femur from a known geologic formation of some hundred million years past, one

retains little patience with conjectures that these or their world did not exist until our observation.

AN ALREADY POWERFUL PARADIGM MADE STRONGER

Science, over some three hundred years, has proven itself against all rivals to be our most successful and effective means for explaining, understanding and for working in and with the world we live in. More than any other approach, philosophic, religious, mystic, occult, that of secular humanism, or of just plain commonsense, science has succeeded in being able to "clear the mystery and show the way" in the realm of the natural world. This same science, however, has insisted that we and the entire universe are driven throughout merely by strictly physical, mindless forces of the most elemental kind. Indifferent, purposeless and fatalistic, these forces govern a cosmos which, by scientific theory, has to be devoid of any higher meaning, values, freedom of choice, or any moral difference. Materialist science has long depicted a stark overall life-view of utter "cosmic meaninglessness" (Jones, 1965; Provine, 1988).

This ultimate nihilism, taken along with today's mounting apprehensions about the kind of world to which an "age of science" is leading, plus growing questions about the most basic starting assumptions of science (Harman, 1980), appear collectively to indeed warrant now some intensive reexamination, not only of the metaphysical assumptions of science, but also its plain 'physical' assumptions. Such reexamination in my own case has served only to freshen and further strengthen a conviction that science today, fortified with its changed concepts of consciousness and causation, is now stronger than ever, that science still offers the best available approach to true understanding of the nature and meaning of existence. In the kind of value-belief system upheld by modern science I continue to see "the best hope for tomorrow's world" and "the key to long-term, high-quality survival".

It cannot be overemphasized that I do not refer here to traditional materialist science of the past two centuries, but rather to the new science spawned by the cognitive (consciousness) revolution of the 1970s with its revised principles of emergent, macro, and subjective causation, and embracing reciprocal 'top-down' as well as 'below-up' determinism. I presume here also that these new principles have by now gained sufficient ground in other disciplines that they deserve recognition as today's majority mainstream view. In other words, what started as a revolution within a single discipline is presumed to have become a revolution for all science.

Previous inadequacies in the traditional approach of science are still being corrected and remedied at many different levels. Within the behavioral sciences, for example, the new treatment of mental states has promptly been

applied to the animal mind, bringing a more cognitive or mentalist approach in comparative psychology and ethology (Griffin, 1981), not to mention strengthened "animal rights" concerns. The way was cleared as well for a return movement to so-called "folk" or "commonsense" psychology (impossible under behaviorism), and for today's ascendance of a largely new "cognitive science" encompassing computer science, artificial intelligence (AI) and information theory in conjunction with cognitive psychology and cognitive neuroscience. Many participants in this latter field with backgrounds in physics have sensed the makings of an emerging "new science" that stands in striking contrast to their conventional reductive physicalism. A sound theoretic basis is now recognized for the cognitive, humanistic, and therapy-centered schools of psychology, proponents of which all through the decades of behaviorism had been obliged to accept second-class rating because they were "not scientific". The new outlook has helped also to strengthen other approaches dependent on introspection such as research on personality, values, motivation, and the like.

The bidirectional model for causal explanation has found ready application as well beyond psychology in the biological, human, and social sciences, in systems theory, evolutionary theory, and other more remote disciplines including cosmology, philosophy and even theology. Systems theory, for example, since the mid 1960s has become a different entity, infused now with emergent interaction, down-level causal determinism, and irreducibility of the emergent whole (**in principle** as well as in practice), all implanted by the same conceptual developments that were necessary to shift conscious experience from its old noncausal into its new causally interactive role.

In respect to past inadequacies, the new impacts of greatest interest are those that most directly affect the overall scientific worldview. These include such changes, for example, as help bridge the former "two cultures" gulf between science and the humanities, especially changes in the treatment of human values and the age-old freewill-determinism paradox. These logically reverse today the long-standing antithesis between science and ethics (Bixenstine, 1976), and enable, for the first time, the logical derivation of science-based or science-consistent moral guidelines (Byers, 1987). Human values are no longer treated as being merely parallel or epiphenomenal to brain function. Subjective values become causally interactive and thus qualify as legitimate causal constructs, ineliminable for scientific explanation. All the other rich emergent macro phenomena and other higher qualities we customarily value, including the mental, vital and social forces, also are given their due in the new outlook, as well as physics and chemistry. Since the mid-1970s it has become increasingly evident that we are in an

entirely new era with respect to values (Edel, 1980), and that the consciousness revolution might equally well be called a "values" revolution.

Another legendary inadequacy of the standard physicalist paradigm was its direct contradiction of the subjective impression of free will, posing the age-old ***freewill-determinism paradox*** (Rogers, 1964). Today's mentalist doctrine resolves this old dilemma in a way that preserves both determinism and free-will, but in a modified form (Deci, 1980; Sperry, 1965, 1980). Free-will is maintained, but not, however, with complete freedom from all causation. This would make one's volitional decisions and actions meaningless, based merely on random caprice, unaccountable and with no predictive reliability. This is not what we subjectively experience, nor what we want. What we experience is the ability to carry out, as a rule, what we personally, voluntarily choose, wish, intend or decide to do. This kind of subjective volitional power to determine what we say and do is exactly what the new mentalist theory provides, and thus, moral responsibility is preserved.

In conclusion, science today is very different from the science we knew 30 years ago. The change, has little or no effect on the everyday practice, methodology of science, nor on its unequaled potential in the realm of analytic and technologic innovation. The kind of worldview science upholds, however, and scientific descriptions of the conscious self are vastly transformed. The new cosmology of science, no longer incompatible with human values, purpose, or moral responsibility, can now be used for rational debate of social value policies, ethical standards, and guideline principles for world law and justice. Context-dependent principles replace moral absolutes. A premium on evolving **quality**, not quantity, replaces the "go forth and multiply" growth morality that was adequate 2,000 years ago but in today's kind of world is lethal, even evil. Social priorities emerge that are more realistic and sustainable for today's type of world. The "highest good", no longer derived from mystical, otherworldly, or unproven realms, nor reduced to subatomic physics, works out to be an ever-evolving quality of life and all existence including axiomatically the "rights of the unborn" millions of coming generations. Without going through all the intervening logic, reviewed elsewhere (Sperry, 1972, 1991a), the result, in effect, is a new moral compass based in the credibility and neutral universality of science.

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