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Structure and Significance of the Consciousness Revolution

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The recent swing in psychology from behaviorism to a more subjective mentalist (or cognitive) paradigm is interpreted to be more than a mere Zeitgeist phenomenon and to represent a fundamental conceptual shift to a different form of causal determinism. Traditional microdeterministic conceptions of brain function are replaced by an explanatory view that gives primacy to macrodeterminism. It is argued that the key factor among numerous contributing influences was the appearance in the 1960s of an emergent, functional, interactionist concept of consciousness that gives subjective mental phenomena a causal role in brain processing and behavior. Whereas the basic behaviorist philosophy of science could be adjusted to accommodate advances in computer simulation, information theory, cognitive process research, linguistic and other cognitive developments in the 1960s, behaviorism could not adapt to the new concept of consciousness as causal. The two views, at bedrock, are mutually exclusive and irreconcilable. It is suggested that the new macrodeterminist view represents a more valid paradigm for all science.

The so-called consciousness revolution of the 1970s in the behavioral sciences, referred to also as the "cognitive," "mentalist" or "humanist" revolution, is widely evident and well documented (Block, 1981; Boneau, 1974; Davidson and Davidson, 1980; Dember, 1974; Ferguson, 1980; Gardner, 1985; Heinen, 1980; Hilgard, 1980; Kantor, 1977; Manicas and Secord, 1983; Matson, 1971; Pylyshyn, 1973; Segal and Lachman 1972; Simon, 1982). Behaviorist doctrine, which had dominated psychology since the 1920s, gave way rather abruptly in the early seventies to a more subjective, cognitive or mentalist paradigm manifest in practice as a direct turnabout with respect to the scientific recognition and treatment of mental states and events. Subjective phenomena, including mental images, feelings, thoughts, memories and other cognitive contents of inner experience that had long been banned from scien-

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tific explanation by rigorous objective behaviorist and materialist principles, suddenly made a strong comeback and became widely used and accepted as legitimate explanatory constructs. The accepted role of conscious experience in brain function and behavior changed from that of a noncausal, epiphenomenal, parallel or identical status (and something best ignored or excluded from scientific explanation) to that of an ineliminable causal, or interactional role.

In describing the revolution in question preference is given here to "consciousness" over "cognitive" because in current usage "cognitive" has become ambiguous in that it may or may not imply consciousness and the subjective. One can speak of the incremental rise of a new cognitive science on the one hand (Gardner, 1985), and on the other, of the revolutionary about-face in the scientific treatment of conscious experience. The two are related in many ways—but to combine and mix the two without clear distinctions easily leads to unnecessary confusion. For similar reasons the term "mental" will be used here in preference to cognitive because mental more generally tends to connote processing in the living brain.

In the following we deal specifically with the more narrowly defined development referred to as "the new legitimacy of the subjective" (Stryker, 1981) and exemplified in the interpretation of mental events and imagery, not as epiphenomenal to brain processing but as functional, interactional or causative (Block 1981). The new legitimacy of the subjective is evident not only in the current conceptions of psychology but also in the kinds of experiments and writings undertaken, the kinds of questions asked, journals and societies formed, conferences held and so on which would all have been discouraged under former behaviorist principles as being something less than scientific.

Whereas this turnabout in the scientific treatment and conception of the subjective is today well recognized and accepted, its root causes and meaning remain much less clear. In fact, the change appears to have meant many different things to different scientific communities. For example, the humanistic psychologists refer to the "humanist," "third" or "third force" revolution (the first two "revolutions" having been associated respectively with Watson and Freud) and perceive the new outlook as a realization of the holistic-subjective principles proclaimed by Abraham Maslow, Carl Rogers, and others. (For references see more detailed discussion in sections to follow.) Similarly the cognitive psychologists and phenomenologists point to their own, even longer history of quarrels with behaviorist doctrine in which they have traditionally favored much the same cognitivist or mentalist framework that has become today the majority position. Meantime the computerologists, especially in artificial intelligence, are inclined to see the key to the new outlook in analogies between mental and computer programs and recent developments in computer science. Related thinking credits the new outlook to informa-

tion theory. Others cite "functionalist philosophy" and "transformational linguistics." General systems theorists tend to perceive it as an intrinsic development of general systems theory, while disciples of the "consciousness raising" and "self awareness" movements of the sixties see an impelling role in these and related social activist trends. Others credit advances in the research on perception and imagery—and the list continues, as explained in more detail below.

Many scientists accept the swing to mentalism as simply an outcome of the trends of the times, a Zeitgeist phenomenon with a fadlike quality impelled by many diffuse sociological influences. One commonly hears that "the time was ripe," that after more than 50 years of domination by behaviorist principles and practice, "psychology was ready for a change." At another extreme I ascribe the consciousness revolution in what follows to a specific change in mind-brain theory. According to this view, the shift from behaviorism to mentalism represents a changeover to a revised form of causal determinism, in essence a shift from an exclusive micro-determinist paradigm to one that emphasizes "macro," "molar" or "emergent" determinism.

The new mentalist paradigm is deduced to be a more valid paradigm for all science, not just psychology, and to represent a new "middle way" position in philosophy which integrates positivistic thought with phenomenology (Slaate, 1981). The result is a revised scientific description of human nature and also nonhuman nature and of the kinds of forces in control, a changed world outlook that brings a new era in the science-values relation, a resolution of the freewill-determinism issue and other promising developments in the long standing worldview conflicts between science and the humanities. These and other far reaching humanistic as well as scientific implications call for deeper understanding of the causes and structure of the consciousness revolution and what it signifies.

Mind-brain issues are involved as well as those of the holist-reductionist dispute, both of which easily become entangled in philosophic abstractions and semantics and already have been subject to endless debate without resolution. The consciousness revolution on the other hand is an actual historical occurrence, the nature and causes of which should be subject to some definite answers. By focusing on those factors that actually did convince hundreds, even thousands of minds to reverse their reasoning about consciousness and to relinquish behaviorism in favor of mentalism we thereby bypass innumerable possibly fruitless empty approaches to center in on ideas that already have been proven to count in practice. A pragmatic reference frame is thus obtained for some notoriously elusive philosophic issues with possibilities for fresh diagonals through the time-worn perspectives on mind and brain, emergence and reductionism.

General Presuppositions

It may be taken for granted that a majority of the scientific community involved in the changeover from behaviorism to mentalism did not make special efforts to analyze underlying forces or conceptual foundations but simply followed what they saw others doing. When some authority known to be knowledgeable in such matters is seen to defy behaviorist tradition by using "mental images," "feelings" or other subjective phenomena as explanatory causes of behavior, many others quickly reason that if the authority has found justification they can do the same. The more peers observed to adopt the new practice the greater the tendency for others to follow suit. Such a self-feeding, amplifying, cascade process may be presumed to have played a strong role in helping to bring about the current swing to mentalism.

Another set of factors of undoubted influence includes a variety of what can be referred to as "subjectivist pressures" that have tended to favor the subjective approach against the dictates of behaviorist doctrine ever since behaviorism first appeared. One source, common experience, includes the natural tendency to perceive our behavior as being directed and caused by subjective mental states, i.e., by our subjective desires, intentions, needs, values, percepts, thoughts, and the like. Added to this pressure from common experience are the more formal professional or disciplinary influences in cognitive, clinical, and humanistic doctrine, reinforced also in psychotherapy, psychiatry, and all the other subdisciplines obliged by the nature of their work to rely heavily on introspection, including such research fields as those involving perception, emotion, and memory.

These various subgroups in behavioral science have for the most part been able to reconcile their findings and thinking with an ultimate objective behaviorist or neuronal explanation. Nevertheless a strong inclination exists to favor any theoretical justification for cognitive explanation and what Carl Rogers (1964a) used to call "subjective knowing." The common dissatisfaction with behaviorism's renunciation of the subjective represents an example of what Kuhn (1970) describes as an invariable antecedent of scientific revolutions, "a common awareness that something has gone wrong" with prior theory. In any case these subjectivist pressures, natural and formal, along with the above-mentioned tendency to follow suit, mutually reinforcing each other, can largely be held responsible for the suddenness with which the general acceptance of subjective explanation occurred once it got started, a suddenness described by Pylyshyn (1973) as having "exploded into fashion."

The specialists meantime are quick to seek out new ideas and titles in their field and are finely tuned to apprehend even subtle conceptual changes. Any new developments quickly became incorporated into their writing with or without references. It is highly unlikely, once an idea for paradigmatic change

gets into the literature, that it will go unnoticed among the specialists. The specialists, however, often with strong professional investments in earlier positions, may tend to resist acknowledging innovation until swayed by majority opinion. Many other related subtle and complex forces may be recognized that, following Kuhn (1970), can be classified under the heading of sociological factors.

Another invariant of scientific revolutions, recognized by Kuhn but perhaps not given enough emphasis, is the appearance of a conceptual innovation that challenges the preexisting paradigm and is incompatible with its foundational concepts. The new concept must also be capable of competing successfully in the open market with the preceding rival view. This would seem to be the *sine qua non* for major revolutions in science: a new concept or theory so incompatible with preexisting theory that the preceding paradigm cannot be stretched to include it. Evident in the Copernican, Newtonian, Darwinian and other recognized revolutions, such a conceptual innovation is the central basic change around which the sociologic and other phenomena revolve and depend.

Sociologic factors may be important but the paradigms of science are not subject to change like fashions in headwear. They tend to be adhered to because of reason, logic and mathematics, and regardless of seeming counterintuitiveness. For example, the rigorous objective tenets of what Skinner (1964) refers to as the behaviorist "philosophy of science" successfully kept in abeyance for over half a century the widespread intuitive pressures favoring subjectivism. This in itself suggests that the switch to mentalism, when it finally did occur, was more than just a diffuse sociological or Zeitgeist trend and had to be based upon revisions in the underlying conceptual foundations. Thus, the effort to understand the consciousness revolution boils down primarily to a search for a critical change in the conceptual foundations of psychology, more specifically for rival new theoretical concepts incompatible with behaviorist doctrine.

Unlike the situation in the Copernican, Darwinian and most scientific revolutions, the rival concepts involved in the consciousness revolution never became generally explicit. This means that the sociologic forces must have played a correspondingly greater role—as evident in the lack of any consensus even today regarding the rationale and the diverse interpretations still being favored among different special interest groups. Even so, these sociological dynamics could have taken a different direction or could have remained anchored in behaviorism. The question is whether it may be possible to uncover, by critical analysis, the underlying rival theory responsible for steering the sociologic trends in the mentalist direction.

Key Factor: A Causal Concept of Conciousness

A key development that seems to fit the foregoing requirements and to have been responsible for the 1970s' swing to mentalism, according to the

present analysis, was the emergence during the 1960s of concepts of brain function and consciousness that introduced a causal view of subjective qualities in brain processing (e.g., Fodor, 1968; Miller, Galanter, and Pribram, 1960; Neisser, 1967; Popper, 1965; Putnam, 1960; Sperry, 1965, 1969b). The result was in direct conflict with and undermined the most basic tenets of behaviorist doctrine. At the same time the new interpretation provided a long-sought logical determinist basis for cognitive, clinical and humanistic psychology. Essentially, the new theory conceived subjective qualities to be emergent properties of brain processes that interact causally at their own cognitive level and also at the same time exert downward causal control in a supervening sense over the activity patterns of their neuronal components.

These revised mind-brain concepts shared with behaviorism the assumption that mental phenomena are determined by physicochemical processes. However, they directly countered the conviction of behaviorism that there is no way these physicochemical processes can be causally influenced by the qualities of subjective experience. In direct contradiction to the behaviorist paradigm, subjective mental and cognitive phenomena were given a causal, functional or interactionist role in brain processing and thereby a new legitimacy in science as autonomous *ineliminable* explanatory constructs. This logical turnaround from a passive to a functional interactional status for subjective experience was further reinforced by the prevailing ambient "subjectivist pressures" already mentioned and also by a new appreciation of the control role of cognition gained from computer science. The combined effect led to a rapid rise of the new mentalist-cognitive outlook as the dominant paradigm in behavioral science.

The terms "interaction" and "interactionism" are used here in the way these have been applied historically to the mind-brain relation, i.e., as used by Popper and Eccles (1977) when they refer to "dualist and psycho-neural interactionism" and by Natsoulas (1984, 1987) when he refers to "monist interactionism." Mind-brain interaction is taken to mean that mental states are causally influenced by brain states and vice versa. The usage in this context does *not*, however, imply an interaction of the mental and physical *within* a given level in the brain hierarchy but rather *inter*level causal influences. Mind-brain interaction is used as a constrast to mind-brain parallelism.

This changed interactional view of the mind-brain relation applied emergent and functionalist thinking in combination with the concept of downward causation (as explained below) to describe a view of consciousness that not only refutes behaviorist doctrine, but contradicts also traditional reasoning in neuroscience. It counters claims that a complete account of brain and behavior can be given, in principle, in strictly objective, stimulus-response and neuronal terms without reference to subjective awareness—as expressed by Sir John Eccles:

> We can, in principle, explain all our input-output performance in terms of activity of neuronal circuits; and consequently, consciousness seems to be absolutely unnecessary! . . . [A]s neurophysiologists we simply have no use for consciousness in our attempts to explain how the nervous system works. (Eccles, 1966, p. 248)

The only available counterargument for this traditional reasoning seems to be that of emergent interaction with downward control which serves to distinguish between the causal role of the mental qualities per se and that of their neuronal infrastructure, providing for the causality of the former as well as the latter. On both counts the emergent downward control concept is critical for upholding mentalism over behaviorism. In these terms the subjective aspects of brain processing can no longer be ignored or excluded in scientific explanation.

Thus interpreted the mentalist paradigm clearly leans heavily on holistic doctrine with extensive antecedents in earlier writings on emergence, holism and epistemology (e.g. Herrick, 1956; Morgan, 1923; Polanyi, 1962; Ritter, 1919; Sellars, 1922, 1943; Smuts, 1926 and others). The mentalist movement of the 1970s, however, represents the first occasion in which emergent reasoning has gained acceptance to the extent of becoming the dominant paradigm for a large scientific discipline. What needs to be explained is why the anticipatory threads of holistic thinking changed from the status of occasional, scattered, personal and often obscure philosophy, or at most minority science, into the majority practicing paradigm of the behavioral sciences. The new success I believe is attributable primarily to the combining of emergentist thought with the concept of downward determinism and with the functionalist view of the subjective applied where they count most, i.e., to consciousness and mind-brain interaction.

Behaviorism had not been threatened by earlier emergent views as applied to biological evolution or in Gestalt psychology where no mind-brain interaction was implied. Behaviorism had not been threatened either by previous conceptions of the mind-brain relation including identity theory, epiphenomenalism, double aspect theory, dualism or dismissal of the mind-brain question as a pseudoproblem (Skinner, 1964, 1971). Dualism posed contradictions, of course, but its status in science from the 1920s through the 1960s was so weak that it represented no real threat. On the other hand, behaviorism could not coexist with the new causal interpretation of consciousness which was explicitly antibehavioristic.

The Computer Program Analogy

Other views of the consciousness-cognitive revolution have ascribed a major role to developments in information theory and computer science, particularly to artificial intelligence and the computer program analogy (e.g. Gardner 1985;

Hilgard 1980; MacKay 1982; Neisser 1967). Although the computer developments forced adjustments in behaviorist policy in regard to cognition they did not demand an abandonment of its founding philosophy. The behaviorist philosophy of science could live with the computer program model of cognition much as it had with the "cognitive behaviorism" of Tolman (1925, 1926) decades earlier. In a number of ways computer simulation can be seen (Rosenberg, 1986), not as refuting behaviorism but as doing the reverse: demonstrating that a concrete objective explanation of mental processing is possible in science without recourse to introspection or conscious awareness. Since neither computers nor their programs were generally supposed to be conscious, the computer model was not taken initially as a model of subjective experience and did not represent a threat either to basic behaviorist philosophy nor to the general microdeterminist paradigm prior to parallel processing models (Rumelhart, McClelland, and PDP Research Group, 1986).

With regard to the causal determinist issue (see below), the computer model was neutral and could be interpreted either way. It was neutral also on the issue of whether mind and brain interact, or run in parallel, or are identical. Much depends on its validity as a model for mind and brain and this has come increasingly to be questioned (Churchland and Churchland, 1983; Libet, 1980; Natsoulas, 1980; Rosenberg, 1986; Searle, 1980). Much depends also on how the causal relation between program and hardware is to be interpreted, i.e., whether merely sequential and feedback, or top-down etc. The computer models, further, can be readily interpreted in terms of the identity and "double aspect" views of Feigl (1958), as stressed by MacKay (1984) and others, and thus hardly require a new mentalist paradigm in which subjective qualities per se have explanatory legitimacy. All things considered it would appear that the paradigm shift in the early 1970s from behaviorism to mentalism had to come from other sources.

Two Differing Views of Causal Determinism

It is important to remember in this context that the basic behaviorist philosophy as propounded by Watson, Kantor, Skinner and others still remains a powerful explanatory paradigm and is upheld by a strong minority within psychology (see Catania and Harnad, 1984; Natsoulas, 1983). It is still claimed by its supporters to be quite applicable, in ways that have worked for decades, to all the modern findings in cognitive science, including the recent observations on imagery (Block, 1981) and artificial intelligence (Skinner, 1984, 1985). In the final analysis, we come down to two opposing views of physical reality, two different worldviews, each claiming to provide in principle a complete and valid explanation.

The strength by which behaviorism succeeded in dominating psychology

for over half a century stemmed in no small measure from its firm entrenchment in 20th century scientific materialism or microdeterminist doctrine. This made behavioral science consistent with the rest of natural science. To topple behaviorism at its base required therefore that the conventional reductive microdeterminist reasoning of science itself must be toppled also. Only the principle of emergent or molar determinism (as discussed in more detail below) appears to qualify. Whereas the basic behaviorist paradigm was not jeopardized by computer science nor by other cognitive developments of the 1960s, it could not cope with this causal concept of consciousness. If the new interactionist view of consciousness were correct, the opposed behaviorist philosophy of science had to be wrong.

The changeover in behavioral science to mentalism (and thereby to emergent principles of causal determinism) has not been accompanied meantime by a similar shift in the more exact sciences such as physics, chemistry and molecular biology. These have continued to adhere in majority opinion and practice, to traditional reductionist, materialist doctrine. The result is that we have in science today two major conflicting doctrines of causal control, two conflicting scientific descriptions of the kinds of forces that govern ourselves and the world. The classic view reduces everything to physics and chemistry and ultimately to quantum mechanics or some even more elemental, unifying theory. Everything is supposed to be governed from below upward following the course of evolution. Science, in this traditional microdeterminist view, presents a value-devoid, strictly physically driven cosmos and conscious self, governed by the elemental forces of physics and chemistry, ultimately by quantum mechanics. By this long dominant physicalist-behaviorist paradigm there is no real freedom, dignity, purpose or intentionality. These are only aspects or epiphenomena of mind which in no way influence the course of physical events in the real world or in the brain.

According to the new mentalist view, by contrast, things are controlled not only from below upward by atomic and molecular action but also from above downward by mental, social, political and other macro properties. Primacy is given to the higher level controls rather than to the lowest. The higher, emergent, molar or macro phenomena and their properties throughout nature supersede the less evolved controls of the components. The concepts of physical reality and the kind of cosmology upheld by science in the two conflicting views thus differ vastly, particularly with respect to their psychological and humanistic implications.

Both sides in the debate agree on the existence and prevalence of microdeterminism. The question at issue is whether things are determined *exclusively* from below, upward or whether downward causation is also operating. If the control of a system is exclusively in terms of its elements, then a complete account of conscious brain function is logically possible without including

conscious experience, as behaviorism and neuroscience have long maintained. Conversely, if the principle of emergent interaction with downward determinism is valid then the emergent subjective properties become ineliminable explanatory causal constructs.

A main overriding concern in attempts to better understand the consciousness revolution relates to its bearing on this ongoing macro versus micro debate. In the final analysis the arguments stand or fall on the issue of micro versus macro determinism. We need to know if the shift from behaviorism to cognitivism is an endorsement of macrodeterminism. Is the consciousness revolution a revolution for all science? I believe it is and that the behavioral sciences may be leading the way to a more valid paradigm for science in general.

Emergent Interaction and Downward Control

The concept of downward control and how it works in emergent interaction is critical for the present claim that fundamental concepts of causation are at stake. The fact that downward, top-down, emergent, molar or macro causation continues to be contested, especially in the exact sciences, but also in philosophy (e.g. Kim, 1983; Klee, 1984; MacKay, 1982), indicates that it either has not been adequately explained or that it fails to hold up under examination. Because it lies at the heart of our present thesis some further explanation is in order before proceeding.

Downward determinism has been illustrated in terms of biological hierarchies (Campbell, 1974; Sperry, 1964); the mind-brain relation (Sperry, 1965), using simple physical examples such as a wheel rolling down hill (Klee, 1984; Sperry, 1969b); and in terms of its theoretical logic (Sperry, 1981). In the brain it includes the control by the higher mental activity over the lower neuronal activity—expressed in 1964 as follows:

> . . . a molecule in many respects is the master of its inner atoms and electrons. The latter are hauled and forced about in chemical interactions by the overall configurational properties of the whole molecule. At the same time, if our given molecule is itself part of a single-celled organism such as paramecium, it in turn is obliged, with all its parts and its partners, to follow along a trail of events in time and space determined largely by the extrinsic overall dynamics of *Paramecium caudatum*. When it comes to brains, remember that 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. At the top, in the human brain, 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)

Spelled out more fully, in the following year (in relation to consciousness and evolution—with direct implications for freewill, values, and the worldview

of science [Popper 1965; Sperry 1965]), this emergent control concept was presented as a new solution to the mind-body problem. It was also described by Popper as a new view of evolution and a different view of the world. Perceived to lead to a compromise or middle way philosophic outlook that is neither dualism nor traditional materialism, it denied that the mental can exist apart from the functioning brain. At the same time it accepted the objective causal reality of mental states at their own level as subjectively experienced. The downward control aspect, later dubbed "downward causation" (Campbell, 1974; Popper, 1978; Popper and Eccles, 1977) has also been referred to as "emergent causation," "holistic control" and "molar determinism" (Klee 1984; Sperry 1986) in opposition to the traditional microdeterminism of materialist doctrine.

Because the concept is critical for the idea of a more valid scientific paradigm and continues to be disputed, some further explanation is attempted in the following passage using simpler examples which will serve also to emphasize the universality of the principle. As such an illustration, consider a molecule in an airplane leaving Los Angeles for New York. Our molecule, say in the water tank or anywhere in the structure, may be jostled or held by its neighbors—but, these lower level actions are relatively trivial compared to the movement across the country. If one is plotting the space-time trajectory of the given molecule, those features governed from above by the higher properties of the plane as a whole, make those governed at the lower molecular level insignificant by comparison.

The same principle applies throughout nature at all levels. The atoms and molecules of our biosphere, for example, are moved around, not so much by atomic and molecular forces as by the higher forces of the varied organisms and other entities in which they are embedded. The atomic, molecular and other micro forces are continuously active but at the same time they are enveloped, submerged, superseded, "hauled and pushed around" by, or "supervened" by an infinite variety of other higher molar properties of the systems and entities in which the micro elements are embedded—without interfering with the physico-chemical activity of lower levels.

Reductionists claim that the entire flight of the plane from Los Angeles to New York can be accounted for in terms of the collective atomic and molecular activity, eventually quantum mechanics. The "macro" answer asserts there is no way that quantum mechanics can describe the multinested spatial features of the plane's structure which govern the flight as much as the molecular components per se. Similarly, the timing factors, as in its various motors, could not be accounted for by quantum mechanics. The plane will have radio, computer, and TV circuits. If one were to disconnect two elements in these circuits and reconnect them in reversed manner, the whole system would fail. The particular connections of the circuit plan cannot be deter-

mined from quantum mechanics; the laws for circuit design come from a higher level. In general, subatomic physics fails to give a full account of these higher organizational features.

The same applies to the circuit plan and function of the nervous system. If one were to plot the firing pattern for a given cortical neuron involved in cognitive function, the bursts of activity would, of course, be correlated with the local excitatory and inhibitory inputs to the given cell. At the same time, the timing of the neuron's firing, as well as that of its local input, would also be found to be determined predominantly by the train of mental events that happens to be in process. A change in mental programming brings corresponding major changes in the given neuron's activity pattern.

Most everyone agrees that neuronal events determine the cognitive events, but it is also true that the mental events, once they emerge, interact with other mental events at their own level and in the process also exert downward control to determine concomitantly the firing pattern of their neuronal constitutents. The controls work both ways, upward and downward as well as sequentially. In "emergent interaction" or "emergent determinism" the mental events control neuronal activity at the same time that they are determined by them. The downward control view contends that the higher emergent forces and properties are more than the collective effect of the lower because critical novel space-time factors are not included in the laws governing the components (see Rumelhart et al., 1986).

It may be objected that examples of interlevel causation in which both levels are physical are no help to explain the mind-brain relation where one level is mental and thus by definition nonphysical. Our present thesis discounts such objections claiming the pertinent causal principles are the same. Brain processes have many unconscious as well as conscious emergent properties. Just because some emergent properties are subjective does not mean their basic interlevel causal control relationships are therefore different. Identity theory disposes of this issue semantically by calling the subjective properties physical properties.

In probing further the micro versus macro dispute it may help, at the risk of being repetitive, to focus on a simple familiar example, such as the downward control exerted by a molecule of water over its hydrogen and oxygen atoms. It usually is agreed that the laws defining the behavior of the atoms, particularly their course through time and space, become quite different after the atoms become joined together as a molecule. Although the atomic properties in the main are preserved, the atoms, once joined, are obliged to follow a new space-time course determined predominantly by the higher properties of the water molecule as a whole.

Many reductionists concur but argue that the new properties of the molecule are themselves determined entirely by those of the atoms and in fact can be

completely predicted from the atomic properties. The macrodeterminist answer holds that predictability is not the issue here. Being able to predict the formation of novel emergent properties does not make the new properties go away or make them any less real, less novel or less important and powerful as causal determinants. The macrodeterminist can accept that the entire course of evolution is predictable, *in principle*, starting from subatomic properties, but this does not change the argument that evolution *does* occur, that new properties and control forces *do* emerge and that when they do, they exert downward control over their constituents which, as a result, are thereafter governed by new scientific laws.

The old reductionist claim that the properties of the molecule are nothing but the collective effects of the constituent atomic properties usually becomes qualified, these days, by the addition of some phrase to include the new organizational or spatio-temporal relations. With very simple entities, like the water molecule, the spacing and timing may be closely determined by the atomic properties themselves—but this does not hold for more complex entities, as in our airplane, for example, where the coherent configuration may be a product of anything from chaos to an inventor's insight. Again, however, to be able to describe how the formation of the new properties was determined does not provide scientific descriptions or laws for the new entities. The point is that the new emergent entity with its new spatio-temporal arrangement and resultant new properties, once it has come into existence, deserves to be treated and recognized in its own form for what it is—not solely as a collection of its elements in a special new space-time arrangement.

For an accurate, complete, scientific description of nature, the *spacing* and *timing* of all the multinested elements at all levels must be included. Science has laws for the behavior of the material, mass-energy elements but in general does not have laws for the complex multilevel space-time components. The space-time, or pattern factors, however, are *automatically incorporated* in the laws for the macrophenomena, as for example, in classical mechanics. Properties manifest at subatomic levels tend to be bound up and controlled by properties at higher levels. If an uncertainty principle is operating at sub-atomic levels this does not necessarily imply that this uncertainty operates in the whole natural order at large, or characterizes the essence of reality.

It is frequently objected that if science has been wrong on this issue, how could it have been so eminently successful? It needs to be remembered in this connection that microdeterminism in itself is very valid. It is not contradicted by the acceptance of emergentism and downward control; neither is the value of the analytic, reductive methodology of science. It is only the *exclusion* of macrodeterminism that is claimed to be in error, and science has not excluded macrodeterminism in *practice*, only in its philosophy, theory and outlook. The microbiologist, for example, consistently relies on macro-

determinism and downward control in the treatment of molecular activity. It is in treating organisms, not molecules, that biology usually becomes reductionistic. The laws of classical mechanics are heavily macrodeterminist. In general, science has always depended on macrodeterminist principles though this has usually remained tacit and unrecognized.

Rise of Mentalism: Chronological Correlates

The deduction that the mentalist overthrow of behaviorism involved a paradigmatic shift to changed concepts of causation as described in the foregoing gains added support from chronological considerations. It is commonly agreed that the new acceptance of the cognitive in behavioral science was greatly aided by developments during the 1950s in information theory and computer science, which became widely disseminated in psychology particularly through the 1960 volume of Miller, Galanter, and Pribram and later through the 1967 textbook on *Cognitive Psychology* by Ulrich Neisser. Information theory and the computer program analogy were already well developed by the end of the 1950s (Ashby, 1956; Feigenbaum and Feldman, 1963; Von Neumann, 1958) and had become familiar in psychology by the mid 1960s. The major changeover from behaviorism to mentalism, however, did not take place until some five years later. Although the timing of developments in computer science by no means excludes these as a possibly important influence, the correlation does not appear to have been particularly close or direct.

The thinking in computer science as it existed during the 1950s into the early 1960s is well represented in the 1963 book, *Computers and Thought*, edited by E.A. Feigenbaum and J. Feldman. As discussed earlier, one searches in vain for any principles that overturn behaviorism's microdeterminist philosophy or the materialist reasoning in neuroscience, or otherwise explain the later turnabout on consciousness. An intensive examination of related hierarchy theory and interlevel controls almost a decade later (Dewan, 1976; Wimsatt, 1976) indicates that relevant antibehaviorist, downward control ideas were only then beginning to be applied in this area. The current mentalist-functionalist philosophy of the new cognitive science (Fodor, 1981; Gardner, 1985) thus does not appear to have been applied to the computer program model (Neisser, 1967) until after it had already been stated in reference to the mind-brain relation. In other words it was only after the consciousness revolution had already appeared in mind-brain science that the corresponding concepts became applied in computer science.

Cognitive psychology, humanistic psychology, and the phenomenological school can argue in each case that behavioral science has simply come around at last to recognize and accept the relative merits of their respective, long

expressed oppositions to behaviorism. These schools, however, and their respective arguments had been present for many years, even decades, without bringing down the reign of behaviorism. Cognitive theory and phenomenology extended back at least to the 1920s to Tolman and Husserl and was updated in work such as that of Miller, Galanter, and Pribram (1960). All this had failed, however, prior to the mid sixties to overthrow the opposing, and firmly ensconced, behaviorist contention that a full scientific account of behavior can best be provided in strict, objective terms consistent with physicochemical science and without recourse to subjective experience.

The humanistic movement, though more recent, is based in holistic, emergent and gestalt principles which also go back into the 1920s and 1930s and had likewise failed for many years to shake the behaviorist logic. The writings of Abraham Maslow and Carl Rogers up to and into the mid 1960s did not invoke downward causation or other deterministic principles that could refute behaviorist reasoning, or that of neuroscience as expressed above by Eccles. Well into the 1960s proponents of both phenomenology and behaviorism were still vigorously debating their opposed philosophies without significant give on either side (Kantor, 1969; Koch, 1964, 1969; Maslow, 1968; Rogers, 1964a, 1969; Skinner, 1964, 1971; Wann, 1964). The situation as it still stood in the mid 1960s was summarized by Carl Rogers at the close of his 1964 "Humanist of the Year" address as "two sharply divergent and irreconcilably contradictory points of view [the behavioristic and the humanistic]. If in response to this you say, 'But these views *cannot* both be true,' my answer is, 'This is a deep paradox with which we must learn to live' " (Rogers, 1964b, p. 40).

Despite the apparent explanatory value and seeming causal potency of cognitive phenomena as commonly used in humanistic, cognitive, phenomenologic and also evolutionary reasoning, neuroscience and psychology could always claim that it is only the underlying neural correlates of these subjective states that are causative and that these objective physiological elements are what real science and evolution are based on, not on the correlated epiphenomena. The continued coexistence of the two very different—in many respects incompatible—explanations of human nature had come to be accepted *in practice* despite their being despaired of *in theory* as an unfathomed paradox. Something new and different, therefore, over and above what had existed through the 1950s and early 1960s, seems needed to account for the explosive turnabout that occurred in the early seventies.

Setbacks in corollary aspects of behaviorist doctrine, not directly involving its central tenets concerning subjectivity and introspection, are sometimes associated with the downfall of behaviorism. These include the espousal of an extreme environmentalism, an "empty cranium" stimulus-response peripher-

alism and also behaviorism's earlier pro-nurture, anti-inheritance stance, all of which suffered major corrective revisions prior to the 1970s (e.g. Bruner, 1964; Chomsky, 1959; Koch, 1954; Stevens, 1951; Tolman, 1952). Although contributing to a general disillusionment with behaviorism, none of these negated the central core of behaviorist philosophy nor called for the acceptance of subjective phenomena as explanatory constructs. Along with inadequate correlations in timing, this would seem to disqualify these ancillary developments as having been essential factors in the rise of the new mentalism.

Among various developments that might satisfy both the temporal and logical requirements, it is not easy to find anything more direct than the emergence during the mid and late 1960s of the interactionist concept of the mind-brain relation in which conscious experience was conceived to play a causal role in brain function and behavior. While the behaviorist philosophy could encompass most of the 1960s' advances in cognitive science, this was not true with the new emergent causal or interactionist view of consciousness which points up a critical shortcoming at the core of the behaviorist paradigm and also that of traditional neuroscience.

Described from the start as a mentalist (but not dualist) view (Fodor 1968; Sperry, 1965), and invoking emergence (Popper, 1965), functionalism (Fodor, 1968; Putnam, 1960; Sperry, 1952), downward causation (Sperry, 1964, 1965) and psycho-neural interaction (Bindra, 1970; Sperry, 1969a, 1969b, 1970a, 1970b), this changed concept of consciousness directly confronted and negated the central founding precepts of the behaviorist philosophy of science. Correlations with the ensuing swing to mentalism, which manifested its greatest momentum in the early 1970s, could hardly have been more close and direct with respect to both the conceptual relevance and also the timing. Further distinctions in the analysis and appraisal of the shift to mentalism are drawn below in reference to some other interpretations.

Alternative Views

Research in perception and mental imagery has undergone recent developments in conjunction with computer science and mentalist philosophy with a result that a causal role is now being ascribed to mental images, percepts and related subjective phenomena (Block, 1981). It is claimed that the new empirical findings require an active causal participation of mental images. Developments in this area, including the establishment of the *Journal of Mental Imagery*, are taken in some quarters to have had a significant influence in helping to bring about the new acceptance of the subjective.

Perceptual phenomena have always been considered to be causal in the language of the subjective but with no implication that a complete explanation is not also possible in objective neuronal terms. It is difficult to see that

the new findings about perception are any more than this, or that they present, any more than Gestalt psychology, for example, fundamental new obstacles to an objective interpretation in terms of the neural correlates. The recent findings of Paivio (1971), Shepard (1975), Kosslyn (1980), and others are, of course, more readily explained in terms of mental images and other mental constructs. However, this did not deter the behaviorist-materialist-reductive approach in the past. As summarily stated by Ned Block (1981, p. 8), "The claim that image-experiences are epiphenomenal rather than functional is no more challenged by Kosslyn's and Shepard's empirical data than traditional epiphenomenalism is challenged by the fact that pains are followed by groans [that] seem to be caused by them." The same reasoning applies as well to other recent findings on cognitive processes in general. The new results, like those in the past, remain open to explanation on either the traditional microdeterminist or the new macromentalist basis.

The information processing paradigm, although already touched on in reference to computer simulation, is sometimes singled out in a special theoretic sense, as having generated key ideas behind what Simon (1982) describes as "the new way of looking at things." Donald M. MacKay in particular has persistently applied information theory, communication engineering and computer science to arrive at a "flow of information" view which, as currently presented (MacKay, 1982, 1984), poses a direct challenge to the present thesis. Explicitly rejecting emergent interaction and put forward as a more valid mind-brain solution than the one favored here and with strong support in neuroscience (Szentagothai, 1984), MacKay's position would seem to demand some accounting in the present context.

During the 1950s and 1960s MacKay propounded a *double aspect* position popular in mind-brain theory at the time in which the mental and the physical were described as "complementary internal and external aspects of one and the same situation" (MacKay, 1966). A strict physical determinacy of brain function was stressed. "No physical action waits on anything but another physical action" (MacKay, 1966, p. 438). With the burgeoning of the new mentalism in the 1970s, MacKay's presentation correspondingly became more promentalist until in the 1980s it is hardly distinguishable in many salient features from that supported here. Points of agreement seem to include (a) the causal efficacy of mental activity (MacKay, 1978; Sperry, 1965, 1969b), (b) the rejection of dualism on the one side and of traditional physicalism on the other (MacKay, 1982; Sperry, 1965, 1969b), (c) the arrival at a mid-way compromise philosophy (MacKay, 1982; Sperry, 1965, 1969b), (d) the assertion that this middle-way position means that classical physics does not reduce to quantum mechanics, hence no overthrow of classical physical theory is required (MacKay, 1982; Sperry, 1981), (e) the claim that subjective unity, perceptual constancy and other subjective qualities depend, not on isomorphic mind-

brain correlations but on *functional* interaction in brain processing (MacKay, 1982; Sperry, 1952).

Despite the extensive congruence, however, some very critical differences remain: downward causation is rejected by MacKay along with any interaction between the mental and the physical. Like Feigl (1958, 1967), MacKay conceives the two to be distinct non-interactive categories, each a causally complete description within itself. Like Feigl he refers to "two languages," "two logics," "two stories," for one and the same thing (MacKay 1966, 1978, 1982)—with the recent curious assertion that each is in itself causally "complete" but, at the same time, "inadequate" (MacKay, 1982). The acceptance by MacKay since the mid 1970s of "the causal efficacy of mental activity" (MacKay, 1978) is later explained to have been only *within* the mental level, not in an interactional sense (MacKay, 1982), and is no more than has always had commonplace acceptance. Thus, although MacKay's sophisticated terminology often leads the reader to believe otherwise, he seems to come back to a consistent dual aspect mind-brain parallelism. E.M. Dewan (1976), like MacKay, also uses control systems engineering but arrives at a quite different model for consciousness fully consistent with emergent interaction.

General systems theory is frequently referred to as lending conceptual support to the new holistic outlook. Systems, involving wholes and parts, are easily related to emergence, whole-part relations, holism, etc. The doctrines of emergence and holism, however, antedate general systems theory by at least several decades. Originally general systems theory centered in the idea that systems of different types have much in common in the way of laws and abstract principles governing the interrelationships of the components (von Bertalanffy, 1956). It was theorized that if these principles are learned for one type of system they would then apply to other types of systems in other sciences. The theory, however, has not lived up to early expectations because the interrelations of the parts in different systems, especially in different sciences, have proven to be so different that few useful commonalities could be found. The situation was summarized by Herbert Simon (1962, p. 467).

> A number of proposals have been advanced in recent years for the development of "general systems theory" which, abstracting from properties peculiar to physical, biological, or social systems, would be applicable to all of them. We might well feel that, while the goal is laudable, systems of such diverse kinds could hardly be expected to have any non-trivial properties in common.

The outstanding exception, of course, that has proven to be far from trivial is the relationship of a whole system to its parts and vice versa. As a result, systems theory has turned increasingly in recent times to the field of part-whole and hierarchic problems and the kinds of holistic and emergent control issues raised here (Bahm, 1984).

Consciousness raising movements along with counterculture activism of the sixties, plus related books of the period such as *The Psychology of Consciousness* by Robert Ornstein (1972) may also be mentioned as having been thought to have contributed in different ways to the swing to mentalism. Although these developments reflect and enhance general subjectivist pressures, they do not appear to have introduced any new mind-brain theory, logic, basic scientific principles or other conceptual grounds that would be adequate to overthrow behaviorist-materialist doctrine. A 1980 volume devoted to the paradigm shift and its multiple manifestations and portent (Ferguson, 1980, p. 18) interprets the broad paradigm change of the seventies as a "historic synthesis" combining "the social activism of the 1960's and the 'consciousness revolution' of the early 1970's." An extensive collection of signs of socio-ideologic change is brought together emphasizing the far reaching influence of the new outlook plus other related and unrelated developments, but no attempt is made at discriminative analysis or evaluation.

Further Repercussions

It is not surprising that a major about-face in the conception and treatment of consciousness, at the epicenter of all knowledge and understanding, should have extensive ramifications and repercussions. The new mentalist paradigm has been entwined, directly and indirectly, with a number of associated developments of the past fifteen years. These concern more the meaning and significance of the new paradigm than they do its origins—though in some instances they have been inferred to have also had an influence in generating the new outlook.

One of the more direct and obvious of these is the extension from the human to the animal mind. The new acceptance of consciousness along with the changed concept of the mind-brain relation applies also to the animal mind and brain with consequences for the treatment of animal awareness and behavior. Some of the many ramifications in this realm are ably reviewed and evaluated in a recent comprehensive work by Donald Griffin (1981).

By the mid seventies John Eccles had begun to espouse and support a new mind-brain logic (Eccles, 1973, 1976, 1980; Popper and Eccles, 1977) that directly reversed his prior reasoning about the apparent superfluousness of consciousness and which he defined as being essentially the same as that presented here as emergent interactionism (Popper and Eccles, 1977, p. 374). Eccles, however, combined this view of mind-brain interaction with dualist doctrine calling the combination "dualist interactionism." His additions included the 1968 "World Two and Three" concepts of Popper, speculations about possible cerebral mediating mechanisms supported by recent research literature

plus personal convictions concerning the mind-brain interface and supernatural influences in the fetal acquisition of consciousness and in its survival after brain death. These differently derived components were merged and presented as a unit. Sound arguments can be seen (Natsoulas, 1984; Puccetti, 1977; Sperry, 1980) against Eccles' inclusion of the emergent interactionist concept as a form of dualism. Nevertheless, Eccles' extensive promotion of an openly antimaterialist position has had a significant influence in helping to question traditional microdeterminist thinking and in stimulating increased awareness of the issues and of the relevance of brain research.

The philosopher Mario Bunge in the latter 1970s added notable support for the emergentist view, describing it as emergent materialism (Bunge, 1977, 1980). He provides a comprehensive philosophic account but does not include the functionalist and downward control features and mistakenly lists my own position as dualistic. Although the old terminology of philosophy becomes ambiguous and often misleading in the light of the new mentalist position, other specialists (e.g., Dewan, 1976; Engelhardt, 1977; Natsoulas, 1984, 1987; Puccetti, 1977; Ripley, 1984; Slaatte, 1983; Weimer, 1977; Wimsatt, 1976) have not been similarly misled. Bunge's support of emergent materialism came quite late and would appear to be better perceived as a consequence rather than a cause of the new mentalism. Another emergentist view appeared in philosophy in the 1970s under the label "supervenience," which appears to agree with the notion that the mental properties do not *inter*vene but *super*vene (Davidson, 1970, 1973; Kim, 1978; Rosenberg, 1978). A recent discussion of supervenient causation (Kim, 1983), however, indicates that despite the updated terminology, the underlying issues are basically largely where they stood in the mid 1960s prior to the introduction of downward causation.

What seems to be much the same mind-brain position upheld by the new mentalism in psychology has recently been defended by John Searle (Searle, 1980, 1983). Searle similarly rejects both the dualist and the strictly physicalist answers and affirms the reality and causal efficacy of the mental: "I think there really are such things as intrinsic mental phenomena which cannot be reduced to something else . . . . There really are pains, tickles . . . thoughts, feelings and all the rest" (Searle, 1983, p. 262). Restating the mentalist contentions of the 1960s, Searle affirms that "mental states which are caused by brain states can also cause further brain states and mental states." His mind-brain view and the emergent interactionist view appear to differ only superficially. Like Davidson, Searle comes to the mentalist position directly without invoking supporting logic to refute the decades of specific materialist and positivist counterreasoning in neuroscience, biology, psychology and philosophy. As a result, both the functionalist derivation of subjective meaning and the notion of downward causation appear to be relatively neglected.

Mind-brain identity theory has undergone important developments with

respect to the causal efficacy of the mental in the late 1960s and 1970s. In its current form it has wide support, can be reconciled with the causal concept of consciousness and also is considered by some advocates to be a reasonable candidate for a root cause of the current mind-brain outlook. Acceptance of mind as a causative property of brain function along with related consequences and implications has transformed identity theory until it is hardly recognizable today as related to its original pre-1965 form (Natsoulas, 1987; Peacocke, 1979; Ripley, 1984; Uttal, 1978). Herbert Feigl, the father of mind-brain identity theory, described his view in the fifties as a "two languages" or "double knowledge" (of one and the same thing) theory (also as a "double language" or "*two-fold access*" theory) [Feigl, 1967]. As late as 1967, Feigl still continued to deplore any acceptance of emergentism. "If future scientific research should lead to the adoption of one or another form of emergentism (or—*horrible dictu!*—dualistic interactionism), then most of my reflections will be reduced to the status of a logical (I hope not illogical!) exercise within the frame of an untenable presupposition" (Feigl, 1967 p. 160). Needless to say, Feigl would hardly recognize his own theory as currently supported.

The contributions of identity theory have always seemed primarily semantic, making no difference to the practice of either neuroscience or of psychology. In shifting from a noncausal parallelistic view (Feigl, 1967) to the current causal view of mind (Armstrong and Malcolm, 1984) identity theory has followed and reconciled itself with the changing trend of opinion but seems not, in itself, to have introduced anything that would logically force a shift from behaviorism to mentalism, or from micro to macrodeterminism.

A functionalist view of mental states has become in recent years a prominent feature of contemporary cognitive philosophy (Fodor, 1981; Gardner, 1985). Applied to the mind-brain problem in the 1950s, it proposed that subjective meaning derives, not from an isomorphic, topologic, or an "identity" correspondence in the substrate of neural processes, but rather from the overall *functional* interactions (Sperry, 1952, pp. 307–309). According to this early theory: "the same psychic meaning may be obtained from brain patterns the neuronal details of which differ considerably on different occasions. . . . It is only in the overall functional or operational effect that their essential similarity resides. Conscious unity is conceived . . . as a functional or operational derivative." It follows that the functionally derived subjective properties must therefore, by definition, have causal efficacy in conscious cerebral action. The functionalist view was developed further by Putnam (1960) and Fodor (1968) with implications that support emergentist rather than microdeterminist principles. This early thread of functionalist thought is believed to have played a significant role in the swing to mentalism, not so much as a direct impetus but as a logical precursor to viewing consciousness as causal.

In its currently expanded form functionalist philosophy (Fodor, 1981; Gardner, 1985) appears to have much in common with the early emergent interactionist mind-brain theory deduced here to have been the key factor behind the 1970's overthrow of behaviorism. The current functionalism (i.e. Fodor 1968, 1981; Gardner 1985) and emergent interactionism (Sperry, 1952, 1965, 1969a, 1969b) are both described as being mentalistic. Both positions recognize the existential reality of mental states and endow mental events with causative power to affect brain processing and to interact functionally with other mental events. Both reject dualism and both deny that mentalism is equivalent to dualism. Both reject radical behaviorism, reductivism, epiphenomenalism, identity theory and double aspect parallelism. Both agree on the functional contextual derivation of subjective meaning and define mental entities in terms of causal relations. Both sustain supervenient determinism. Both recognize the special difficulties for the functionalist interpretation posed by raw sensory qualities such as color or pain. Both stress the innate basis of consciousness and of cognition and behavior in general. Both are directed to understanding the unknown, largely inherent "brain code." Both claim to be midway philosophic positions that resolve the prior dualist-materialist dichotomy and its modern offsprings and both claim to retain what is most valid from each side of the old dichotomy.

Along with these many broad similarities one finds a few differences: contemporary cognitive philosophy is inclined to go further, firstly, in stressing the independence of cognitive processes from the mediating infrastructure and, secondly, in treating the mind as a device for computation and processing symbols leading to greater emphasis on linguistics and computation. This latter appears to be in large part a consequence of current tendencies to identify the mind-brain problem with problems associated with a flow of information (e.g., Fodor 1981; MacKay 1982; Gardner 1985).

Information processing, in addition to intrinsic complications of its own, involves added dimensions of complexity in the relationship of the symbols, on the one hand, to what they represent and, on the other, to the interpreter of the information. The mind-brain problem is difficult enough in its simplest form without complicating matters further by concentrating on one of its most complex manifestations. The concern with information processing seems to be in large part responsible for diverting current mind-brain theory away from what had seemed a more profound issue raised initially by the functionalist approach (Sperry, 1952, p. 301), namely, that of whether to view the correlated brain process as a representation of the perceived or imagined object, or as a special form of interaction with or upon it.

Many more examples could be cited from a continuing series of ideologic, philosophic and even theological contributions that have appeared since the sixties in which a new world outlook is upheld rejecting both traditional

mechanistic approaches on the one hand and supernatural explanations on the other in favor of a midway holistic or emergentist position. The logical underpinnings of these varied proposals appear, in final analysis, to rest on a common basis similar to that of the new mentalist outlook in psychology. They all boil down to an acceptance, not of many or several, but of one major paradigm change, involving a core principle of causal determinism with wide application to rational explanation in general, not only in science but also in the humanities.

Is the New Mentalism a Modified Materialism?

Since the early 1970s a general trend can be seen in which different mind-brain theories have evolved in directions that tend to converge onto forms of mentalism that are both emergent or molar, and causative. Despite the growing convergence, debate continues to wage over whether the basic target position should be called materialistic. Proponents of identity theory and materialism reason that if the subjective qualities are properties of material brain processes and are inseparable from them, the view must therefore be materialist.

Others of us prefer to not use the materialist label, regardless of the foregoing, for reasons that include the following: the original basic distinction between mind and matter, the mental and the physical, is a useful and sound distinction and is based in immediate direct experience in a way that deserves priority over historical turns in philosophical and other disciplinary semantics. It was the latter that led us, all through the materialist-behaviorist era, to throw out consciousness along with the supernatural and the dualistic. To try now to rectify things by defining materialism to be synonymous with monism appears to be a further error leading into conflict with long accepted *a priori* differences between the mental and material. Our new mentalist paradigm allows finer classifications than formerly were possible when mentalism meant dualism and monism meant materialism for lack of finer distinctions.

Additional strong reasons for rejecting the materialist label are found in the long history of close association between scientific materialism and reductionist "nothing but" reasoning, such that the one has for a long time almost implied the other. By contrast, the mentalist position is emergent, holistic and antireductionist. These changed views of mind and matter in the new outlook need to be emphasized, rather than deemphasized by belatedly twisting the material label in order to include its historically recognized prime antonym, the "mental."

Materialist philosophy by definition has always been distinguished by an emphasis on the material mass-energy aspects of nature at the expense of the

nonmaterial. The new view, in contrast, gives primacy to the immaterial spacing and timing of the elements, i.e., to forms, patterns, organizational properties and also to strictly mental qualities such as abstractions and other "things of the mind" that go beyond mass, with attributes and influences not readily measured, weighed or counted (Williams, 1984). Since the material components and the space-time features can be separated only with much difficulty, if at all, it becomes in practice a matter of emphasis. Both are needed, but there seems good reason today for taking the stand that the long-term, one-sided emphasis on the exclusivity of material, mass-energy determinacy needs to be corrected.

Nor does it seem right to call a position "materialist" if its origination and prime reason for being have been from the outset to contest the materialist brand of thinking that dominated both scientific and philosophic thought up to the mid sixties and which, as late as 1968, was still trying to tell us that "man is nothing but a material object, having none but physical properties," and that "science can give a complete account of man in physicochemical terms" (Armstrong, 1968).

It needs to be emphasized again that the acceptance of macrodeterminism as a principle would not devalue the conventional reductive, analytic methodology of science. It only affects the reductionist descriptions, outlooks and beliefs commonly deduced therefrom. Nor would it invalidate traditional microdeterminist principles, only the claim that these are exclusive and can ultimately account for and determine everything.

Since the mid 1970s many of the implications of the new macro outlook (Sperry, 1983) have been gaining recognition in writings about the "new science," "the new paradigm," "the new realism," "the new cosmology," "the new philosophy of science," "the new era in the science-value relation," "a contagion of reperception," "the reconception of theology" (Kaufman, 1985), and so on. This is not the place to more than just refer to the many developments of this nature, other than to note that the abundant evidence of their precipitous increase in recent years lends credence to the contention that the consciousness revolution in behavioral science represents a fundamental correction applying not only to all the sciences but also to the humanities and to contemporary thought in general.

The idea that the new mentalism might be the prime source in this movement has been challenged from physics. It has recently been claimed that advances in subatomic physics and relativity theory have brought a similar paradigm "shift from the mechanistic to a holistic conception of reality. . . . This new vision includes the emerging systems view of life, mind, consciousness and evolution" (Capra, 1982, p. 16). If in fact science is in the midst of a paradigm change that provides a "new way of looking at things," as many sources now proclaim, it becomes of some urgency to determine whether this

new outlook has its basis in physics or in behavioral science or perhaps in both, or whether the base in both is the same.

Many things point to the conclusion that the new holistic outlook described by Capra originated primarily in the behavioral and mind-brain sciences and could hardly have come from subatomic physics. This in no way detracts, of course, from the importance of the new physics *qua* physics or its changed concepts of the cosmos. The holistic, axiological, social and other humanistic implications follow directly and logically from the changed concept of consciousness. On the other hand, it is not legitimate, according to macrodeterminist principles, to directly transpose properties of subatomic matter to the macro world as in the reasoning of Capra (1975) and also of Bohm (1973, 1980) to a lesser extent. Macrodeterminism, in contrast to reductive physics, leads to a view of physical reality in which the proverbial solid table is no less solid, nor any less different from soft pudding than classical physics affirmed—regardless of changed interpretations in subatomic theory. One can point also to the long interval between the referred-to advances in physics, already well established by the 1930s, and the relatively recent emergence of the new holistic outlook in the early 1970s. It is difficult to believe that the implications in physics were not appreciated or understood until comparisons were drawn with mysticism and Eastern religion.

Wide ranging humanistic implications, on the other hand, are a natural logical consequence of the changed concepts of brain and consciousness. More than advances in subatomic physics and relativity theory, the recent turnabout in the conception of the conscious mind, along with the corresponding macrodeterminist extension to the rest of reality, profoundly alter the kind of universe in which science would have us believe.

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