Proposal for a Velvet Revolution in the Sciences of Mind

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INTRODUCTION

The 1990's have seen a resurgence of a radical reductionist program to eliminate mind as it is understood in "folk psychology." The program is spearheaded by a group of philosophers and scientists who call themselves eliminative materialists (Churchland, 1984). This posture harks back to the radical behaviorism of the earlier part of the century. But in the Epilogue of Plans and the Structure of Behavior (Miller et. al, 1960), the book often cited as initiating the cognitive revolution in psychology, the authors declared themselves "subjective behaviorists." They showed how one could "do science" on the expressions of verbal behavior (folk psychology) by experimental analysis and by "enactment": that is, by simulations of such expressions in computer programs in order to understand thought processes. Several further publications (Pribram, 1971a & b; 1979; 1986) made a plea for a comprehensive holistic psychology, a science of mind, that would embrace the contributions of behavioral, cognitive and existential approaches.

Fundamental to achieving such a holisitic science of mind is an understanding of the process of inquiry. For the most part scientific investigation proceeds in a downward, reductive direction from an initial set of observations. On occasion, however, an upward synthesis is

attempted and attained. In these attempts, insightful reorganizations of our knowledge base occasionally come into view.

Ivan Havel is leading an endeavor that aims for just such insights. It is perhaps not too farfetched to suggest that what Ivan and his colleagues and those of us whom they touch are striving for is a "velvet revolution" in our understanding not only of the contents but the very process of science. The sciences of mind are fundamental to this endeavor. These sciences have not sprung up *de novo* but are rooted in traditions reviewed and most recently expressed in Western philosophical thought.

There are two dualities that have intrigued thoughtful philosophers, dramatists, mystics and scientists over at least the past two millennia. One of these is the mind/brain duality. The other and related, is a duality within mind; two ways in which the experiencing subject experiences the self: as a body-centered "me" and as an episode-centered, narrative "I" (Pribram & Bradley, 1998). This essay is an attempt in the Havel spirit to examine these dualities.

A caveat: Thinking in terms of dualities is a primitive analytical tool. To deconstruct any issue in terms of dualities can only serve as a first step. Dualities initiate a dialectic which then provides a synthesis from which a hierarchically-organized tree of systems, subsystems and supersystems can be constructed. There are other forms of organization less amenable to dichotomizing: for instance, the distributed/enfolded order characteristic of holography and the multivariate phase spaces used in non-linear dynamics. I will use these tools where appropriate to characterize one or another of the dualities under discussion. But doing so, tends to blur the boundaries between the dualities.

A SYNOPTIC HISTORY OF DUALISTIC THINKING:

Today we usually attribute the sharp distinction between mind and matter to Descartes. However, Rene Descartes articulated a duality that goes back to the origins of propositional utterances: a subject, an object, and a verb that ascribes to the subject an aspect partaken of, or an "intention" taken toward an object. Holophrases, words such as *Om* in Sanscrit and *Yaveh* in Hebrew which mean "being", enfold, or rather fail to unfold propositional meanings. Holophrases are said to have preceded propositional utterances in the development of languages, just as holophrases precede the development of language in children. The process of being becomes a being, a subject with a beard who hands commandments to Moses, an object.

For Descartes, the thinker is subject; all else is object. Emanuel Kant, however, pointed out that the objects of thought are ideas and ideas have two sources: sensory initiated phenomenal experience (images of objects), and *noumina*, the thinker's reasoned contributions. Thus, the thinker and the contents of thought all became subjective -- and knowledge of the objective, "material" aspect of the world, "iffy".

Arthur Schopenhauer, bothered by this indeterminacy, our inability to "really" know the world because of our entanglement in it, came to emphasize the role of the thinker, of energy and "will", of intentions, in unraveling the iffiness of the images. He noted that the unraveling of the world knot, made up as it is of entanglements of phenomena and noumina, is up to us. This provides us with the freedoms to explore and with the opportunities to shape the world we inhabit. Today we often hear that the solution to certain of our social problems is not just money but political will. This insight is very much in line with that of Schopenhauer.

In a sense, Schopenhauer returns to the wholeness that the holophrase encompasses and indicates that humans, by virtue of operating in a proposition-like mode, by their intentions, have

the opportunity to mold the images or representations we experience and therefore our interpretation of the world. More on this shortly.

CURRENT PERSPECTIVES ON THE MIND/BRAIN RELATION

At least since the time of Newton and Leibniz three hundred years ago, two rather different conceptual schemes have dominated thinking with respect to the *Mind/Brain* relation. Both are concerned with the lawful *relation* between observed events. But the Newtonians express these relations in terms of the relations among *entities*, whereas the Leibnizians explain them in terms of the constructive transactions among *forms* (structures). The following statements place the Leibnitzian view into succinct apposition with the currently received Newtonian view as held by most neuroscientists:

1. Looking downward in the process of inquiry, the received view: Brain, by relating the input from the physical and social environment as obtained through the senses, organizes mental phenomena.

2. Looking upward in the process of inquiry, the Leibnitzian view: The pervasive formative principle of the universe is a hierarchy of *monads*[1]. Mental processes discern the pattern of the cosmos by virtue of the brain's *intunement* (albeit imperfect) with these *monads*, the forms inherent in the universe.[2]

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[1]Monads encompass one another, are interpenetrating "windowless" structures that come up in a variety of "sizes," culminating in a "supermonad" that includes all others.

[2]Or, as C.S. Peirce so poetically stated it: "Every single truth of science is due to the affinity of the human soul to the soul of the universe imperfect as that affinity no doubt is" (4)

Almost all behavioral- and neuro-scientists would today subscribe to some form of statement one, while statement two reflects the belief of many theoretical physicists.[3]

Those whose conceptualization operate primarily in the ***space-time*** domain find the Newtonian emergentist view of mind most compatible, while those who are sensitive to the ***spectral*** domain (i.e. produced by interference among waves) are comfortable with the Leibnizian view.

Recent advances in brain science which has rarely until now looked upward in the hierarchy of inquiry, give considerable credence to the Leibnizian view, which is thus worth exploring.

The mind-brain ontology developed in this fashion is *monadic* and therefore *monistic* in the sense of denying a duality between mind and matter. Rather, another class of orders lies behind the level of organization we ordinarily perceive. The ordinary order of *appearances* can be described in *space-time* coordinates. The other class of orders is constituted of fine-grain *distributed organizations* which can be described as *potential* because only after "radical" transformation is their palpability in *space-time* terms realized. When the potential is actualized, information (the form within) becomes ***unfolded*** into its ordinary space-time manifestation; in the other direction, the transformation ***enfolds*** and distributes the information much as this is done by interfering wave forms, as in the holographic process. Because work is involved in transforming, descriptions in terms of energy (measured in quantum theory as wave length multiplied by Planck's constant) are suitable, and as the <u>form</u> of energy is what is transformed, descriptions in

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[3]For instance, Pauli in a letter to Fiarz (26 November 1926) stated that: The individual systems of quantum mechanics [e.g. wave and particle] are windowless monads and there is, nevertheless, always the right fraction which reacts according to calculations.

terms of information, that is, entropy (and negentropy) are also suitable. Thus, on the one hand, there are *enfolded* potential orders; on the other, there are *unfolded* orders manifested in space-time.

When one looks upward in the process of inquiry, one reaches a level where superficial manifestations trans-formable into one another are separable from more fundamental *invariant* (unchanging) structures such as those embodied in DNA which in-form transformations (Pribram, 1996). For instance, among the *instantiations*[4] of Beethoven's Sonata (Opus 111) are an initial composition (a mental operation completed while Beethoven was already totally deaf!) a score (a material embodiment) a performance (more mental than material) a recording on compact disc (more material than mental) and the sensory and brain processes (material) that make for appreciative listening (mental). But in the transitions from one instantiation to the next, a certain relation-structure remains *invariant* (the same). This *invariant* structure is unaffected by the centuries of "performances, recordings and listenings;" It is the *essence* of Beethoven's Opus 111. (For a detailed and sophisticated development of this thesis, see Artur Rosenblueth's *Mind and Brain*, MIT Press, 1970, Chapter 6).

As Rosenblueth and I (Pribram, 1986) have pointed out, what remains *invariant* across all instantiations is abstract structure, "in-formation", the form within. Thus, according to this analysis, it is Platonic "ideals," interpreted as informational structures, that motivate the philosophical dialogue spawned by the information revolution (e.g. "*information processing*" approaches in *cognitive science*) and distinguishes this dialogue from the continuing dialogue

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[4]By instantiation of a universal (form or organization) is meant one of its reifications, i.e. embodiments (see Pribram 1971b; 1991). For instance A, α, a are instantiations of the A design, which is universal.

between mind/brain dualists such as Popper & Eccles (1977), materialists such as Dennett (1991), and the Churchlands (1986) and mentalists such as Searle (1992) and Sperry (1980), a vestige of the now waning industrial revolution.

Platonic ideals are limits of real ideas. Bertrand Russell's relation-structures (1948) provide the manner by which these limits are attained. In-formation conceived as negentropy is neither material nor mental. Thus a scientific pragmaticism akin to that practiced by Pythagoreans and early Ionians[5], will most likely displace mentalism and dualism as well as materialism as a central concern of philosophy. Both the ideal mathematical structures which are essentially mental and the material structures in which they are instantiated are "real". Perhaps, by temperament, some of us need to be grounded in the nitty gritty of experimental and observational results as much as we are moved by the beauty of theoretical formulations expressed mathematically. Thus, the tension between *idealism*, and *realism* which characterized the dialogue between Plato and Aristotle, will replace that between mentalism and materialism. This change in tension will lead to a new surge of experimentation, observation and theory construction in the spirit of a Pythagorean and Peircian pragmaticism.

In summary, one answer to the questions as to how mind and brain become coordinate rests on looking upward in the hierarchy of inquiry. This direction of inquiry leads into understanding a monad-like structure which in today's terms is represented in quantum physics by the spectral domain (holonomic quantum holography). Although engineers daily use the spectral domain in radar, crystallography and tomography--wherever image processing is important--cognitive neuroscientists are, as yet, only barely acquainted with the pervasive distributed nature

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[5]"The claim of the early Ionians that nature was intelligible was based on their view that the practical arts were intelligent efforts of men to cooperate with nature for their own good." (B. Farrington, 1961, p. 46.) This view was shared by Charles S. Peirce and Norbert Wiener.

of this order. It is now necessary to make accessible, both by experiment and by theory, the rules for "tuning in" on the universal order cognized by Leibniz through his invention of the differential and integral calculus -- an order that we are apt to call spiritual.

"THE HARD PROBLEM"

The outstanding successes in the psychological and neurosciences is filling the apparent gap between mind and matter with a plethora of data that firmly establish, in great detail, the way in which our experience can be related to brain organization. This success recalls the recent successes in Darwinian theory, where the evolutionary gap between human and non-human primates is being filled with new discoveries almost daily.

But some philosophers are not satisfied. They divide the issue into hard and easy: what we are accomplishing, they claim, is the easy part. They agree that to some considerable extent the cognitive revolution in experimental psychology and its influence on neuropsychology is successfully formulating a true psychological science that takes subjective experience seriously, and at the same time is filling the mind/brain gap. But they note that it is much harder to bridge another gap, that between our personal experience and the experience of others.

These philosophers who are not satisfied have a point, and the point harks back to Descartes, Kant and Schopenhauer. There is a duality between my subjective experience and that of others. Nonetheless, I believe the current philosophers are in error in restricting the hard problem to conscious awareness of our own and others' experiences. Descartes' duality was corrected by Kant: <u>All</u> our experience involves phenomenal representation and "noumina". Neither our senses nor our cognitions readily provide us with unadulterated replicas of what's "out there." That is why we must apply ourselves to understand, not only our conscious

awareness and its relation to that of others but the origins of all our experience. In short, the hard problem applies to all knowledge, all science, not only to the study of consciousness.

The hard problem is the problem of knowing, the ontological problem of epistemology. It is the problem of unraveling the world knot, almost harking back to the Cartesian problem of cogito vs. all-else. However, the new way that Kant and Schopenhauer sensed the all-else, indeed adds to our sophistication, in that the all-else is to be included in the hard problem -- and to resolve this problem on the plane that they established does require active involvement, intent, will. Neuropsychological and neuroscientific research is the current expression of this intent.

While psychologists and neuroscientists are resolving the mind/matter duality from one perspective, quantum physicists have been tackling the issue from another. Bohr, Heisenberg, Dirac and Wigner, each in his own way noted that how we approach an observation determines it to a large extent. As Wigner described it to me personally some years ago, we no longer have observables in quantum physics, we have only observations. Bohr's complimentarity and Heisenberg's indeterminacy principles make the same Kantian point (see Henry Stapp's superb resume of their thinking entitled The Copenhagen Interpretation in the Am. Jl. of Physics 1972, 40 (8) pp 1098-1116). All of science, not just psychological science, is beholden to the "the hard problem."

Where does that leave us? Above, I noted that our intense interest in the mind/matter duality was fostered by the industrial revolution. Most scientists are materialists and have begotten mentalists (as for example Roger Sperry [1980] and John Searle [1983]) who perceive flaws in the materialist position. But materialism and mentalism bear the same relationship to each other as "down" and "up" -- one would not exist without the other. Which comes first, our experience of the material world or the material brain that makes the experience possible? Is the

chicken an egg's way of reproducing itself -- or is it the other way around?

As noted, the information revolution is beginning to shift the ground from this intense interest in a mental/material duality to the issue that occupied Plato and Aristotle: the ideal versus the real. Already, some mathematicians (e.g. Roger Penrose) have, not unexpectedly, declared themselves on the side of Plato. Dualities such as these are extremely helpful in exposing issues, but as indicated in the introduction, they are relatively primitive tools. Pre-Socratic holistic pragmatisms such as that practiced by Pythagoras in dividing a vibrating string in half to discover the principle of the octave, or, for that matter, the American pragmaticism of Peirce, help to place such dualities in proper perspective.

THE REAL AND THE IDEAL WITHIN CONSCIOUS EXPERIENCE:

The "Me": Within Descartes' Cogito itself several different conceptions, different dualities have caught the attention of philosophers. One, most clearly enunciated by Franz Brentano, is the duality between the perceiver and the perceived (Brentano, 1973). This also reflects the Cartesian duality: The perceiver is minding; all else is that which is being perceived and minded. But contrary to Descartes, Brentano is less interested in that which is being perceived but with the perceiver. Shades of Schopenhauer emerge as the perceiver "intends" his perceptions -- he can even intend "inexistant" percepts such as unicorns.

Brain research has shown (see Pribram, 1998) that systems occupying the posterior convexity of the cerebral hemispheres are involved in organizing Brentano's duality. When the parietal lobe systems are injured a patient may no longer feel the arm on the side opposite the brain injury to be his own. One of my students who suffered such an injury dubbed her arm Alice and stated that "Alice doesn't live here anymore." Despite this loss of belongingness, the arm

routinely performs many tasks such as bringing a cup of coffee to the person's mouth, much to the surprise of the person when she becomes aware of what has happened.

Damage further back in the convexity produces "blindsight." Here again, the person can perform many routine tasks that demand an optical input from the blind side, but the patient is unaware of, is blind to, that input. With an intact brain, we are aware both of ourselves as "see-ers" and of what is being seen.

In these and similar instances, awareness of one's bodily self and the environment are impaired. Alice isn't any longer part of me; the blind-sighted, optically-guided behavior isn't mine. From such observations one can infer that ordinarily these brain systems operate to allow awareness of a corporeal "me" to occur. When impairment takes place, the distinction in awareness between perceiver and perceived no longer exists -- much as a color blind person can not differentiate between red and green. In the absence of differentiation, neither color exists for that person. In the absence of awareness of the difference between perceiver and perceived, neither exists.

The "I": There is another totally different duality that has concerned philosophers. In addition to a self, a me, the concern has been with a transcendental awareness of one's unity with a larger, more universal order. Carl Jung's archetypes address this aspect of experience (Jung, 1933). Paradoxically, this experience is as intensely personal as it is holistic. The experience cannot be analyzed into "in here" or "out there" as in Brentano's intentionality. Rather it partakes of a holy, healthy awareness that lacks boundaries.

Psychological and brain science have recently made great strides in understanding this type of awareness. First, Endel Tulving (see Pribram & Bradley, 1998) differentiated two types of human memory: a dictionary or semantic type and another which dealt with episodes of one's

experience. At the same time, research with non-human primates distinguished a difference between brain systems that dealt with reference memory and those that dealt with trial-by-trial types of processing.

There is good evidence from human neuropsychological research that allows identification between the processes responsible for semantic memory and those of reference memory. These processes are impaired when the posterior convexity of the brain is damaged. Referencing is what is entailed in the Brentano duality, the ability to be aware of the distinction between perceiver and perceived.

There is also good evidence obtained with animals that trial-by-trial processing leads to remembering unique instances and therefore to the processing of episodes. Episodic processing is impaired by damage to the limbic systems that lie on the inner border (thus the term limbic) of the hemispheres of the brain.

Impairment of episodic processing leads to a surprising difficulty. Patients with such impairment are personable and able to interact socially on a moment-by-moment basis by virtue of their intact semantic/referential processing. An interruption or distraction will, however, totally wipe out the episode from further awareness as if that unique instance had never taken place. Therefore, over time, over successive episodes, no personal hermeneutic, narrative "I" becomes established.

The episodic processing that leads to experiencing a narrative "I" is separate from that leading to a corporeal "me." Children who have bilateral damage to the limbic systems from birth, can learn to read and other aspects of semantic processing are unimpaired. A case history (see Ahern in Pribram, 1998) dramatically demonstrates the deficiency in constructing a narrative "I."

This child was born with large cysts involving the limbic and frontal part of his brain. He

underwent two surgeries before the age of six months. He has never given any evidence of episodic memory; however, he was capable of learning verbal language to age-appropriate levels. At Age 8 he was able to give his name, age, birthday, and names of family members. He reported his favorite game, television program, and favorite color across trials. Expressive language capabilities were age appropriate and there were no obvious weaknesses in grammar. Despite this, he was unable to recall what he had eaten for breakfast a few hours earlier. He was unable to correctly identify an examiner with whom he had worked that morning from among a group of four people. He was unable to say what he had eaten for lunch after returning from a restaurant.

Obviously episodic processing is not necessary for the establishment of normal semantic processing. The converse is also true: children who suffer injury to the systems that process the corporeal "me" as for instance those who are spastic from birth, have no difficulty with episodic processing and develop a normal narrative "I."

The Agent: Coordinating the "me" and the "I". Such spastic children also develop normal semantic processing, indicating that the "me" has two distinct aspects: one related to sensory input and another to motor output. This separation of motor skills from body awareness is due to the increased importance of these somatic motor systems. The distance senses depend on their motor components primarily to enhance sensory processing. By contrast, the somatic motor system has the ability to skillfully and dramatically change the environmental input. As a result the somatic motor systems in primates, including those of humans, become more distinctly separated from the somatic sensory input systems, whereas there is more overlap between input and output in the distance senses.

Episodic processing also has a distinct motor component. A mediobasal motor system

covers the anterior portions of the limbic cortex and centers on the amygdala, a basal ganglion. Electrical stimulation of this cortex produces marked changes in heart and respiratory rate, in blood pressure and in gastrointestinal contractions. In contrast to the results of electrical stimulation of the somatic motor cortex, only gross turning of the body and eyes away from the side of stimulation are produced.

Within the "episodic brain systems", the input from the body comes mainly from tracts concerned with visceral, autonomic, pain and temperature stimuli. Together these inputs can be classified as mediating hedonic (pleasant/unpleasant), emotional aspects of awareness. There is, therefore, not surprisingly, an anatomical-physiological relationship between hedonic and episodic processing. After all, the narrative "I" experiences the episodes and research has shown that rewards and deterrents are critical in "stamping in" an episode so that it becomes a remembered part of the personal narrative.

Schopenhauer emphasizes the importance of the body in the organization of intention, of will, though he fails to distinguish between the body as a skilled "me" and the body as a hedonic "I." Plans and the Structure of Behavior separated these aspects of will by distinguishing between motivations (hedonic) as predispositions and intentions as dispositions. Intentions, in turn, are divided into strategies (prior intentions) and tactics (intentions in action, as John Searle has called them).

There is a relationship between emotion, motivation, strategy and tactics. As William James pointed out, emotions stop at the skin, motivations (termed in the literature of that time, instincts) reach out beyond. To implement motivations we develop intentions, both strategic and tactical. Separate brain systems are related to each of these behavioral categories: amygdala to emotion; caudate-putamen to motivation; anterior frontal cortex to strategies; and the more

posterior frontal, the precentral cortex to tactics.

Schopenhauer, though well read in the Upanishads fails to follow them in their emphasis on the hedonic aspects of wholeness as exemplified in gardening or in lovemaking, and he therefore fails to understand that agency must incorporate fully the holistic transcendental aspect of the "I." Despite his attempts to ground the will in the body, Schopenhauer's development of body involvement in untangling the world knot results in an agency based corporeal "me", neglecting a contribution from a holistic "I." The consequences of this failure led both Nazi (phenomenalist) and communist (materialist) philosophies to neglect individual incentive, and paradoxically, to an unhealthy, un-holistic, unholy society.

If we follow the lead of the eliminative materialists our society might end similarly. As a judge pointed out at a recent meeting devoted to consciousness studies, reducing psychology to neurons is a category error which would destroy our entire moral structure: We cannot hold neurons accountable for our behavior. One of the eliminatists, Francis Crick (Crick, 1994), has noted that categories are human inventions and that we often change categories as our knowledge increases. But this misses the point: the category error (exemplified by "I am a liar") deals not with what our categories are but with attending level or scale per se. Thus the category error is a not just a trivial philosophical contrivance -- making this error has serious personal, communicative, and social consequences. Kant (who was trained in the law) and Schopenhauer, and even earlier, the Upanishads illuminated a healthier alternative: The humble realization that the way to knowing takes categorical levels and scales of inquiry into consideration. Only by doing so can the form, the structure of knowing, become all of a piece. This is the hard problem: To unravel the world knot through the agency of personal involvement and dedicated work.

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