CURRICULUM INQUIRY AND THE HOLISTIC WORLDVIEW: EMERGENT CONCEPTS OF SCIENCE, SELF, AND SPIRIT

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PREFACE

I first became interested in the interface between science and spirituality in 1965, when I began studying the "spiritual science" of Yoga through the Self- Realization Fellowship in Los Angeles. In 1970, I came across some rather arcane material in the Rosicrucian teachings that alluded to such an ancient connection, and this sparked my interest in reading about the historical alchemical tradition. Through the early 1970's, while studying comparative religion, philosophy, education and Jungian psychology as an undergraduate, I studied and practiced traditional Tantra and Raja Yoga under the spiritual guidance of Shrii Shrii Anandamurtijii of India, and was intrigued by the interest of the traditional yogic monks in science. However, it wasn't until the publication of Fritjof Capra's book The Tao of Physics, in the mid-seventies, that I really began to comprehend the emergence of a new paradigm in which the ideas long expressed by mystics and yogis might actually prove to be consistent with the ideas arrived at by Western scientists. I entered graduate school in 1987 with the intention of examining these links from a critical, rational perspective,

to determine their epistemological implications, if any, and by extension, their potential impact on curriculum inquiry and practice.

This dissertation is a speculative, philosophical/ conceptual analysis that deals with the construction of knowledge. Coombs and Daniels, in Forms of Curriculum Inquiry (Short, 1991), propose that this form of inquiry

> aims at understanding and improving the sets of concepts or conceptual structures in terms of which we interpret experience, express purposes, frame problems, and conduct inquiries. It is an important part of all curriculum research because the conceptual structures we possess determine the kinds of curriculum policies we can entertain and the kinds of empirical and normative research questions we regard as significant (p. 27).

My explorations into admittedly esoteric dimensions of curriculum theory could not have been accomplished without the support and encouragement of my long-time advisor, curriculum theorist Russell Dobson. I consider it a remarkable act of "synchronicity" (see chapter five for the elucidation of this concept) that our paths crossed when they did, at a time when we both were intrigued with the "new science", as it has come to be called. I wish to thank the other members of my doctoral committee, Dr. Adrienne Hyle, Dr. Larry Perkins, and Dr. David Yellin for their

support of my work at Oklahoma State University. I am deeply appreciative of the intellectual guidance of Dr. Doren Recker, in the philosophy of science; Dr. Joe Pearl, in the study of transpersonal human development; Dr. Michael Taylor, in philosophy; Dr. Randy Koetting, in critical theory; Dr. Dan Selakovich, in the social foundations of education, and to all of the faculty and graduate students at Oklahoma State University who participated in two years of discussion of these ideas through the Institute for the Study of Alternative Paradigms in Education. I am grateful to Dr. Kenneth King, Dean of the College of Education, for supporting my work as research assistant, then associate, then as a Holmes Scholar. Special thanks to the College of Education for awarding me the Robert Glenn Rapp Foundation Distinguished Fellowship, and the Dean J. Andrew Holley Scholarship.

I would also like to thank the Wholistic Education Special Interest Group and the Critical Issues in Curriculum Special Interest Group of the American Educational Research Association for their willingness to sponsor paper presentations and symposia on these topics since 1989. As well, I would like to thank the editors of the Journal of Curriculum Theorizing, both for the opportunity to present portions of these ideas at the annual Bergamo conference, and for honoring me with the Annual Aoki Award in Curriculum for an early part of this work. Colleagues and friends who have been especially influential in the development of my

thinking are Donald Oliver, Chet Bowers, Peter Gray-Whiteley, NoelGough, Aostre Johnston, Bill Doll, Ron Miller, Bill Pinar and Jeff Kane. I thank them all for their support. Though I never met him, I am deeply grateful for the work of curriculum theorist James Macdonald, who really opened up the field of curriculum to the consideration of the spiritual dimension of experience.

Many thanks go to my current colleagues at Goddard College, especially the members of the interdisciplinary feminist research group who have shown real enthusiasm for the work of translating this theoretical framework into practical curriculum considerations. Thanks too, to Steve Schapiro and Ken Bergstrom, my colleagues in teacher education, for their willingness to move forward with these ideas in the development of innovative graduate education for teachers.

I am deeply grateful to members of my family for their support and encouragement through the last few difficult years of this work - to my parents, Shirlie and Jim Rudonick, for their continued material and emotional support, and especially to my four dear sons: Shiva Kumar, who taught himself the principles of quantum mechanics by the time he was fifteen, and who is now providing me with numerous insights into the cultural implications of my ideas through his studies in cybernetics and chaos theory; Shaman, interested in the spiritual dimensions of my work, for his deep insights into Jung's ideas; and to Räm and Christopher,

young fellows who have had to put up with a much-too-busy and somewhat abstracted mother throughout their formative years. Despite my work as a teacher and a scholar for most of the last 30 years, I have learned more about education from my four boys than from any other source, so this work is dedicated to them.

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CHAPTER I

SCIENCE AS NARRATIVE

May God us keep
From single vision and
Newton's sleep.

William Blake

The story of science is a narrative about the world, constructed by human beings. In a somewhat paradoxical way, what we in the Western world know about ourselves as human beings has come to us largely through the investigations of science. This "feedback loop" has led some modern observers to suggest that we are largely responsible for the construction of our own reality. In this introductory chapter, we will take a look at how our human story has both shaped, and been shaped by, the narrative of science.

The scientific endeavor stakes a unique claim among a multiplicity of knowledge systems - the claim that it alone embodies value-free information. The cultural success of modern Western science rests largely upon the heuristic value of separating matters of objective, verifiable fact from the fuzzy realm of subjectivity and human interest.

The work of Thomas Kuhn (1962) however, and other philosophers and historians of science, suggests that science is but one among many narratives, or human stories, subject to the vagaries of cultural imperatives, dogmas, and power.

A Micro-History of the Science Story

Prior to the 17th century scientific revolution, the dominant metaphor for material reality in the Western world was an organic one. This thinking was rooted in Greek concepts of the world as an intelligent organism, concepts which, when refined, modified, and synthesized with later systems of thought produced the spectrum of Renaissance organismic philosophies. Common to all of these was the idea that all parts of the cosmos were related in a living unity, were mutually interdependent, and were reflective of changes in the rest of the cosmos. The smallest grain of sand was linked to the sphere of the stars and constellations in a living "chain of being", an ordered hierarchy in which each member shared particular features with the levels both above and below, yet possessed some unique characteristic. Humans occupied the niche between the animal world, with which they shared sensation, and the angelic realm, with which they shared rationality. Nature was perceived to be the immanent manifestation of God's law in the world. As above, so below. The shift from

Aristotle's natural philosophy to Galileo's mathematization of nature is an early example of a reconceptualization of common data - a new human story - which represented a new way of thinking about physical reality. In significant ways, this shift paralleled the movement away from a pantheistic, naturalistic theology toward an absolutist, transcendent theology. This shift is worth examining, for it represents how the particular forms used to represent reality reflect and sustain particular worldviews.

Aristotle's Story

Aristotle dwelt on a fixed and stable Earth in the center of the universe, nestled in a hierarchy which encompassed the cosmos down through the smallest grain of sand. His was a complex and colorful world, governed by a multiplicity of Unmoved Movers (gods) and subject to their unpredictable whims, tantrums and diverse personalities. The prevailing pantheistic worldview saw Divine energy as immanent in nature, and the animating principle which bound all of nature together insured that everything stayed in, or returned to, its proper (natural) place. On a solid and unmoving earth, the natural place of everything was at rest, and any motion presupposed interference with this otherwise perfect condition. Aristotle brought order and coherence to this world through the combination of astute observation and

deductive logic, providing explanations that would satisfy the Western world for most of the next 800 years.

To accomplish this, he utilized the syllogism, a pattern of logical thinking which employs a major premise, a minor premise and a conclusion, as his main instrument for reaching scientific conclusions. This form was derived from the already existing **geometry (Gr. "earth, to measure")** of his time. The syllogism links a fact (garnered through careful observation) and the reason for the fact in three statements by connecting the term in question with a particular cause. He believed that a comprehensive understanding of all four causes could explain anything in nature.

This geometry starts from the assumption that a certain group of facts are true, tells the meaning of certain words, then proves the truth of statements. Conclusions of this deductive logic are "valid" rather than "true", because the starting premises are articles of faith. "All men are mortal" is a statement reflecting an assumption (all the men you have known or heard of have been mortal). "Socrates is a man" tells the meaning of the word Socrates. "Socrates is mortal" proves, given these meanings and assumptions, to be a valid statement.

Physics for Aristotle **(physis, {Gr.} "nature")**, dealt with ordinary objects - independent, changeable and temporal "stuff". Mathematics, on the other hand, dealt with mental constructions (abstractions), and was dependent, unchanging

and absolute. His assumption that the heavens were composed of a different substance (ether) than earthly matter (which consisted of the elements of earth, water, fire and air) could have accounted for his inability to reconcile mathematical abstractions with physical reality, for like mathematics, the heavenly realm was unchanging and absolute (Spielberg & Anderson, 1987, p. 51). He did not believe that the cause for a physical thing could be derived from mathematics. For Aristotle, ordinary experience was primary. His approach to understanding phenomena was to not interfere or "mess with" nature, but merely to observe. As we shall see, this differed substantially from the approach Galileo took to comprehend and communicate truths about nature.

Transition Between Aristotle and Galileo

Between Aristotle's disinclination to apply math to the physical world and Galileo's collapse of physics and mathematics was a gradual movement to combine physical properties and quantification. The condemnation, by the Bishop of Paris in 1277, of many of Aristotle's central statements epitomized the conflict between Reason and Faith, or more particularly, that between Natural Philosophy and Christianity. For example, Aristotle's insistence that qualities could only be properties in things challenged the

Christian notion of Transubstantiation, which proclaimed that qualities could take on a life of their own (as in the transformation of bread and wine into the body and blood of Christ). The imposition of theological dogma loosened belief in Aristotle's notion that certain things were illogical, or physically impossible, and paved the way for the general acceptance of the miraculous, or God's intervention in the working of nature. This new mindset more easily accommodated the intervention of mathematics in nature also.

An important new development at this time was the use of diagrams to illustrate qualitative changes. A horizontal continuum of change from one state to another was divided into ordinal degrees in this intermediate movement toward quantification. Oresme began to relate quality to quantity, and the 14th century saw a move from thinking proportionally to applying numbers to reality. Area began to have meaning, within the two-dimensional representation of latitude (qualitative intensity) and longitude (extension in space and time). While math was not yet used to predict, or create general laws, or measure precise motions, Oresme's work was an important intermediate step toward conceiving of math as the key to understanding physical reality.

Galileo's Story

With Galileo began the scientific reduction of phenomena to the primary aspects which were measurable

(shape, motion, mass, distance). Secondary aspects, such as color, heat and smell were viewed as accidental relationships between humans and objects, and relegated to the status of "noise" or irrelevant data. The common sense and everyday experience Aristotle had favored were put aside in favor of quantitative, exact laws. The physical "stuff" that had occupied Aristotle was simplified to geometric lines and points, as realism was sacrificed for precision. The notion of an homogeneous, mathematically pure "space" replaced Aristotle's notion of an active, causally relevant "place", justifying the transition from a concern with real "stuff" to a concern for disembodied points and lines. Galileo's acceptance of Copernicus' notion of a moving earth effected a shift from the notion of "rest" to the more dynamic notion of "inertia".

Experiment supplanted *experience*, but experiment was invoked not to <u>prove</u> but to <u>teach</u> what was already known. The system Galileo employed was more rational than empirical. If something was deducible from a geometric proof, that was explanation enough, in Galileo's opinion. His presentation of facts started from a proposition, moved to deduction, then was checked by experiment. As in geometry, a person had to assume the veracity of Galileo's initial assumptions in order to understand further premises. The effort was no longer to try and picture physical reality. Of primary importance was to tend to the math.

Galileo's movement away from Aristotle's empiricism is demonstrated by his justification of the uniform motion of an object in free fall, not on the basis of observation, but on the basis of simplicity. An assumption of an orderly, rational God underlies this premise, in contrast to the chaos of Aristotle's theological multiplicity. God was, by this time, One - omnipresent and omnipotent - a God (extrinsic to nature) who had set down immutable (and simple) laws in the beginning of time to govern the universe. (According to Aristotle, there was no beginning of creation, hence the impossibility of a single lawgiver.) Galileo's God, like mathematics, was the epitome of Reason, whereas the gods of Aristotle's time had often appeared irrational and arbitrary.

Which Story is Most Useful?

The evaluation of the efficacy of one scientific paradigm over another must rest on the question of what one is trying to accomplish. The goal will determine what is counted as important data and what is discounted as noise. Aristotle and Galileo each thought that different aspects of motion, for example, were important to attend to. Galileo attended to distance and time and ignored friction and resistance. Aristotle attended to resistance. Galileo's move toward increasing abstraction and the narrowing of relevant data was an effort to gain precision in the description of

isolated phenomena. Galileo was attempting to develop a new way of doing science. He overturned commonsense concepts by his correspondence of time to latitude and velocity to longitude. This caused people to think in terms of space instead of time, therefore changing the nature of the problem set. Any such conceptual shift redefines basic problems. Much experience was given up in the move toward mathematical abstraction, and such experience was only allowed back into the domain of study as measurements were able to be performed upon it. In classical physics, which Galileo helped to develop, all causes except the efficient cause were, for the most part, put aside. With this, questions of meaning and value diminished in importance and a narrow utilitarian notion of science began to dominate. Aristotle's more holistic appreciation of phenomena gave way to a fragmented and mechanistic approach to understanding the world.

The Mechanistic Worldview

The new mechanical philosophy developed by French thinkers Mersenne, Gassendi, and Descartes in the 1620's and 1630's replaced the animistic, organic assumptions about the cosmos with an atomistic theory, in which dead, inert particles were moved about in space by external rather than inherent forces (Merchant, 1980, p. 125). In this mechanized view of reality, self, society, and the cosmos

were reunified in terms of a new metaphor - the machine. In the old worldview, order had been understood to mean the function of each part within the context of the whole, with power emanating downward through cosmic and social hierarchies. In the new mechanical world "order was redefined to mean the predictable behavior of each part within a rationally determined system of laws, while power derived from active and immediate intervention in a secularized world" (Merchant, 1980, pp. 191-192). The "how" of phenomena occurred, rather than the "why", according to historian Morris Berman, became increasingly important, and the "marriage of reason and empiricism, mathematics and experiment, expressed this significant shift in perspective" (1981, p. 14).

The new mechanistic view of physical reality, unlike the atheistic, materialistic notions which evolved later, was incorporated within a supernaturalistic and dualistic framework. Newton's synthesis of Galilean terrestrial mechanics and Copernican-Keplerian astronomy fostered the perception of a clockwork universe set in motion by God and left undisturbed - an objective universe independent of human will and purpose. This interpretation of material activity centered around the dualism between the passivity of nature and the externality of force, superseding the primacy of process, flux, and change exemplified by the older, organic order, with the stability of structure, being and identity. Classical physics and its accompanying

philosophy structured human consciousness to believe in a world composed of atomic parts - inert parts moved by material and efficient causes:

> God in the beginning formed matter in solid, massy, hard, impenetrable moveable particles, of such sizes and figures and with such other properties and in such proportion to space as most conduced to the end for which he form'd them; and that these primitive particles being solids are incomparably harder than any porous bodies compounded of them; even so very hard as never to wear or break in pieces; no ordinary power being able to divide what God himself made one in the first creation...And therefore, that nature may be lasting, the changes of corporeal things are to be placed only in the various separations and new associations and motion of these permanent particles (Newton, 1730, p. 400, in Merchant, 1980, p. 278).

The vision of nature conceived by Descartes and perfected by Newton successfully effected a division in the human psyche - "mind from body, subject from object, knower from known in a lethal split which has yet to heal" (Hampden-Turner, 1981, p. 30). For the past three centuries, the mechanical, atomistic worldview has been the guiding ideology of the increasingly industrialized and secularized West. The dominant scientific view reduces

material reality to increasingly smaller parts, isolates them from their living context, extracts bits of information and attempts to formulate theories and concepts from such partialities (the relatively new science of ecology has been a significant exception to this mode of inquiry). "Experiment, quantification, prediction, and control formed the parameters of a worldview that (would have) made no sense within the framework of the medieval social and economic order" (Berman, 1981, p. 37), and science has become the mental framework, the mode of cognition of modern society. Three major assumptions of the modern outlook, according to religious philosopher Huston Smith, are that:

1. Reality is ordered.
2. Reason is capable of discerning that order as it manifests in nature's laws.
3. Human fulfillment consists in discerning these laws.

Postmodern Science and the Post-Mechanistic Worldview

Twentieth century physics, perhaps the zenith of rational, theoretical science, while still viewing the universe in terms of fundamental particles, has begun to challenge some underlying assumptions of the prevailing mechanistic worldview with its explorations into the subatomic, quantum world. Frontier thinkers are no longer

convinced that reality is orderly, or that the human mind is capable of grasping that order. The abstractions of theoretical physics have increasingly focused on the invisible structures of the universe, and as physicist Heinz Pagels states,

> The cosmic code has become invisible. The unseen is influencing the seen (1982, p. 311).

While modern physics uncovered a world at odds with our senses, we have, for the most part, come to terms with the notion that apparently solid, motionless objects are actually "alive" with electrons circling their nuclei a million billion times per second All we had to do, according to Smith, to accommodate such facts, was to "replace the earlier picture of a gross and ponderous world with a subtle world in which all was sprightly dance and airy whirl" (1982, p. 8). The postmodern world of quantum physics, however, is not only at odds with our senses, but with our imaginations, presenting us with enigmas for which our present mode of thought may be insufficient. How to conceive of light that is both wave and particle, or of an electron that passes from orbit to orbit without traversing intervening space? The undermining of certainty and continuity occasioned by such multiple crises of perception have contributed to a mindset that has lost the conviction that reality is ordered in any comprehensible way, one which "enshrines the discontinuous and reinforces our ability to tolerate the incommensurable" (Gitlin, 1988).

Increasingly, there are signs that people have lost confidence that solutions to pressing problems exist within the assumptions of the mechanistic worldview. In fact, many theorists (Bohm, 1983; Ferguson, 1980; Capra, 1983; Wilber, 1983) suggest that the fragmented and atomistic mode of perception generated by the Scientific Revolution is to a great degree responsible for the chaos, violence, exploitation and destruction in the contemporary world, and all of them have presented their own coherent versions of the worldview on the horizon. The philosophies reflected in these new conceptualizations, while deconstructing or even discounting many of the achievements of science, rest largely upon ideas generated by science. Much of this thesis will be devoted to the changing worldview brought about by some of the more significant scientific ideas of the century.

The Reconceptualization of the Human Subject

Central to changing ideas about the nature of reality is an emerging reconceptualization of the self, or human subject. In We've Had 100 Years of Psychotherapy: And the World's Getting Worse, James Hillman and Michael Ventura suggest a radical redefinition of self. Both Oriental and Occidental traditions, they say, have defined self as

> the interiorization of the invisible God beyond...Even if this inner divine is disguised as a self-steering, autonomous, homeostatic, balancing mechanism; or even if the divine is disguised as the integrating deeper intention of the whole personality, it's still a transcendent notion, with theological implications, if not roots (1992, p. 40).

The redefinition that they are working with begins to approach, as we shall see, a notion of self consistent with changing ideas in science:

> I would rather define self as the 'interiorization of community'...if the self were defined as the interiorization of community, then the boundaries between me and another would be much less sure...and 'others' would include not just other people, because community, as I see it, is something more ecological, or at least animistic. A psychic field. And if I'm not in a psychic field with others - with people, buildings, animals, trees - I <u>am</u> not (p. 40).

This reconceptualization of the self, or the human subject, is not an arbitrary theoretical construction of a bored psychotherapist. It is, rather, embedded in a constellation of cultural events and ideas from such varied spheres as literature, science, the arts, ecology and

metaphysics. To illustrate a deeper layer of connection that links all life, Hillman and Ventura speak of certain historical periods when forceful cultural currents sweep creative people from many disciplines up in the flow of thoughts and events:

> We could say that something courses through the collective and is picked up and expressed in different mediums by different individuals, and that that expression constellates a kind of subcollective around it, a style of music or a school of painting or a branch of science, to articulate back to the collective this impulse that came, originally, from the collective. This something, this impulse, this idea, hasn't a will so much as a force - a force so strong that it's felt by individuals (individual scientists or artists or thinkers) as a compulsion, as something they must express. It's not that there isn't deep personal originality and courage in what we do individually; it's that what we work with as individuals is an impulse or wave or force that courses through the collective we belong to (p. 59).

This sort of reconceptualization of the self is just this kind of impulse, embedded in a larger reorientation of ideas which some innovative thinkers, influenced by Thomas

Kuhn's 1962 book The Structure of Scientific Revolutions, have heralded as a "paradigm shift" (Capra, 1983; Ferguson, 1980). It is a seductive notion, their idea that a small, critical mass of creative thinkers and activists might thrust the planet into a whole new way of thinking and being. Indeed, there are elements of "paradigmatic thinking" in Hillman and Ventura's idea of "an impulse or wave or force that courses through the collective we belong to" (1992, p. 59). Paradigmatic thinking is ambitious thinking.

Paradigms, Worldviews and Jiggling Webs of Reality

In their book Deep Ecology, Devall and Sessions define a social paradigm as the "collection of values, beliefs, habits and norms which forms the frame of reference for a collectivity of people, such as a nation". They posit several elements of thought and action present in a paradigm, or worldview (they use the terms interchangeably):

1. There are general assumptions about reality, including man's (sic) place in nature.
2. There are general "rules of the game" for approaching problems which are generally agreed upon.

3. Those who subscribe to a given worldview share a definition of the assumptions and goals of their society.
4. There is a definite, underlying confidence among believers in the worldview that solutions to problems exist within the assumptions of the worldview.
5. Practitioners within the worldview present arguments based on the validity of data as rationally explained by experts - be they scientific experts or experts in the philosophy and religious assumptions of the worldview (1985, p. 42).

According to John B. Cobb (Griffin,1988, p. 101), worldviews are always and necessarily universal generalizations made from some aspect or aspects of the world as experienced. Stanley Krippner concurs, stating that "worldviews arise from epistemologies which, in turn, are generated by the motivations that control them" (Griffin, 1988, p. 130). From these points of view then, we might define worldviews as tacitly agreed-upon conceptual structures that define, and thus limit, prevailing perceptions of reality, which in turn define, and thus limit, the worldview. This dilemma is surely one of the more significant ironies of postmodernism.

Clearly, a redefinition, or reconceptualization of the human subject is at the core of any emergent paradigm of reality. The notion of "paradigm shifts", however, is

fraught with theoretical and philosophical problems, not the least of which is its essentially modernist overtones. It is very much embedded in Enlightenment notions of progressive, evolutionary change, and while radically different in content, Marx's utopian social order, liberalism's enlightened rational polis, Christianity's rapture, and the New Age millennium all share a common structural component: the notion that history is linear and has a culmination point (Kesson, 1991, p. 46). A paradigm shift implies that a new theoretical framework has emerged, clearly victorious, in the battle for the mindset of the collective consciousness.

I have come to feel much more tentative about the idea of paradigm shifts than many theorists, perhaps because I fear the totalistic thinking that seems inevitable when groups of people feel that they "have found the way". I am also mindful of the necessary relationship between theory and practice, and suspect that most paradigm shifts are primarily mental constructions. Any new way of being in the world must necessarily be more than just an appealing ideology - it must be reflected in the day to day activities we engage in as teachers, as parents, as students, as citizens. With Hillman and Ventura, I feel we should engage less in the attempt to build a new theoretical superstructure than in the tentative articulation of a new theoretical framework:

> We're instigators, goaders, conceptual adventurers, if you like, through whom the new theoretical framework is putting out feelers, announcing itself...leaving cryptic notes in strange places (1992, p. 60).

I resonate with the images in these words - conceptual adventurers, with antennae finely tuned to shifting cultural signals. The idea of leaving cryptic notes in strange places is more appealing to me than proclaiming the arrival of a new worldview. The latter seems distinctly modernist, replacing one theoretical superstructure with another, while the former is distinctly postmodern, hinting at the emergence of new ideas in the cracks and fissures of the modernist edifice.

While this essay will examine some very Big Ideas, my primary focus is on the self, and its relationship to knowledge. The reconceptualization of the human subject, however, can not occur in a vacuum. Like Russian nested dolls, ideas about the self are enfolded in more general ideas of psychology, which are enfolded in even more encompassing scientific paradigms, which are in turn enfolded in a more general worldview. These ideas, as we shall see, are not causally related in any sort of hierarchical way. They are multidimensional and interpenetrating, with every sphere of experience influencing, and being influenced by, every other. Another image which describes this heightened connectivity quite

effectively is that of a web: if we imagine the intersections of the web to be the various aspects of reality (self, community, psychology, science, art, etc.), it is clear that all of the intersections are linked to all the others by connecting threads, additionally, when one intersection is disturbed, the entire web "jiggles". It would be a gargantuan task to examine the entire web of contemporary reality, though Capra (1983) and Ferguson (1980) have certainly made heroic efforts to do just that. The purpose of this essay is much less ambitious. It is to explore just a few of the intersections and connecting threads of this web - those that connect the larger emerging framework of scientific inquiry to a specific psychological theory of the human subject. As a curriculum theorist, I remain intrigued by some primary questions about knowledge and the human subject:

Where does knowledge come from?

How do we know what we know?

What knowledge is most important?

What is the relationship between the knower and the known?

These epistemological questions bring us continuously around to the fundamental ideas about what it means to be human, to think, to feel, to seek and to question. Our ideas about what it is to be human are intimately connected to ideas about nature and the cosmos. Our ideas about nature and the cosmos have shifted dramatically as a result of the

questions humans have asked of the world. You see? The questions we ask of the world give us knowledge of ourselves, which in turn influences the questions we ask of the world:

> In vague form, we begin to glimpse a conceptual framework in which each of us shares a paternity in the creation of physical reality (Zukav, 1979, p. 91).

It is a complex and intriguing construction of reality we are involved in - one which leads inevitably to paradox and ambiguity. The purpose of this thesis is not to resolve any of these paradoxes, but rather to develop a framework for my own curriculum theorizing that is consistent with contemporary intellectual currents. Embedded in this larger exploration will be an examination of the specific ways in which emerging ideas about the human subject influence our thinking about curriculum theory.

In Chapter Two, I will take a look at the early twentieth century web of connections between science, psychology, ideas about the self, and curriculum theory. In that chapter, it will be clear that developments in curriculum theory were less than consistent with emergent ideas in science. In fact, it will be demonstrated that early curriculum thinking was based on a mechanical conception of reality that was already conceptually outmoded. More disturbing than that, however, is the conclusion that most of our curriculum thinking, especially

its applications, are still grounded in such outmoded conceptions of reality.

In Chapter Three, I will look at three developments in science that have shaken loose the mechanical model of reality, and which have all raised important epistemological questions: the special theory of relativity, the theory of uncertainty, and the theory of chaotic systems. Each of these theories will be examined for the ideas they generated about the relationship of the human subject to knowledge. I will also point out ways in which social scientists (including education researchers) have been overly enthusiastic in their extrapolations from these physical theories.

In Chapter Four, "The Holistic Worldview and the Idea of Participating Consciousness", I attempt to weave together some emergent epistemological threads into a non-dualistic framework that is consistent with new ideas in science and which positions the human subject, as Hillman and Ventura suggest, in a "psychic field". To accomplish this, I have drawn upon the ideas of David Bohm (1987, 1983, 1976), a protege of Einstein's who has developed a comprehensive theoretical framework he calls the "implicate order". As we will see, this theory of the participatory nature of the human subject brings us back around to a reexamination of earlier organic philosophies of nature and human being. This shift from the modern to the postmodern scientific framework is as significant as the shift from the

Aristotelian to the mechanistic worldview, and has been called by some theorists "the reenchantment of science" (Griffin, 1988).

In Chapter Five, I turn to the only psychological framework I have been able to find that can accommodate the transpersonal and cosmological implications of the "new physics". C.G. Jung's controversial and complex ideas of synchronicity and the collective unconscious, developed in collaboration with physicist Wolfgang Pauli, offer what I believe are the connecting links between the ideas of the "new physics" and theories of human cognition. This was both the most necessary and the most difficult theoretical leap for me to take. Necessary, because the new theories of physics are highly abstract and disconnected from ordinary experience, and for them to bring any meaning to the project of curriculum theorizing, I felt that they needed to be grounded in some sort of concrete referential reality. Difficult, because the conjoining of these ideas was no less than a personal transformation, effected by the convergence of two disparate aspects of my personal quest for knowledge. On the one hand, I have spent the last thirty or so years engaged in the study of consciousness through a sustained practice of meditation. While not always sure what the practice held for me, or exactly what it was I was learning, I was consistently compelled to keep at it, despite numerous external distractions. Throughout that time, I kept a fairly regular record of my dreams, a process I began when I

first encountered Jung's ideas as an undergraduate in the early 1970's. Unlike many of my more fortunate friends, who rest content with the wisdom of concrete experience and the contemplative life, I have been haunted by the need to rationally comprehend the non-rational experiences I have had - spending years of graduate study digging into various disciplines for illumination; transpersonal psychology, the philosophy of science, existentialism and phenomenology, curriculum theory. Unlike many other friends and colleagues, who have developed more elegant intellectual theories than I can ever aspire to, I am hopelessly inequipped to engage in theory-building that is not grounded in my own immediate experience. Had I been more susceptible to either the rational or the non-rational, this essay could have been written years ago. As it was, tugged equally by both, it was a long time in the making.

While I have drawn some tentative conclusions for curriculum theorizing from the theoretical framework developed in these pages, I feel that I am just at the point to begin to draw out the implications for teaching, learning, curriculum development and the education of teachers. There are no shortage of existing ideas for the development of a more "holistic" curriculum and learning process. Ron Miller, in his book What Are Schools For?, details an historic educational movement which has its roots in the "perennial philosophy" described by Aldous Huxley

(1970), and which found its early expression in the Romantic philosophy of Jean Jaques Rousseau (1712 - 1778), the child-centered approach of Johann Heinrich Pestalozzi (1746-1827), the sprituality of Friederich Froebel (1782-1852), the radical social criticism of the Transcendentalists (exemplified by the ideas of Ralph Waldo Emerson [1803-1882]), the radical anarchist critique of Henry David Thoreau (1817-1862), and which has found more recent expression in the Montessori movement, the Rudolph Steiner movement, and the work of practitioners and theorists whose writing has been featured in the pages of the Holistic Education Review (1988-present). While these historical and contemporary ideas have contributed to a vital "minority tradition" in educational thought, they have been largely grounded in Idealist philosophies and speculative metaphysics, which accounts for the limited influence they have had during an historical period dominated by empirical science and materialist idealogies. Thus, my efforts have been much more focused on articulating a theoretical foundation from which such a curriculum might emerge by reconceptualizing the human subject in light of new discoveries in science. This, I hope, might provide a rational justification for enlarging the scope of our thinking about human potential in general, and the educational process in particular.

To study the Way is to study the self
To study the self is to forget the self
To forget the self is to be enlightened
by all things
To be enlightened by all
things is to remove the
barriers between one's self
and others.

- Dogen

CHAPTER II

EARLY SCIENTIFIC ROOTS OF CURRICULUM INQUIRY

Historical Roots of Behaviorism

Ideas about education do not develop in a cultural vacuum. They are profoundly influenced by dominant political ideologies, the structure of the economy, intellectual fashions, religious ideals and social mores - influences which create a "network of assumptions" about human nature and needs, the process of knowing, the structure of knowledge, and the purposes of education. The cultural roots of the technicist approach to curriculum practice in general, and curriculum inquiry in particular (variously termed the "positivist" (Bredo & Feinberg, 1982), the "theoretic" (Schwab, in Schubert, 1986, p. 314), the "conceptual-empiricist" (Pinar, in Schubert, 1986, p. 134) or the "social behaviorist" (Schubert, 1986) established themselves in the fertile soil of a newly industrialized America, as it chugged and whistled into the 20th century. The rapid growth of manufacturing in centralized urban areas drew unprecedented numbers of families and laborers off farms and small towns and into the cities. Newly freed

slaves had moved North in the latter part of the nineteenth century to work in the factories. A huge wave of non-English speaking immigrants, mostly from southern and eastern Europe, arrived to fuel the engines of America's technological development. Enormous social problems emerged as the country attempted to assimilate masses of foreigners and former slaves into its wage labor system, and acculturate them to a value system based in Protestantism, democracy, capitalism and a new spirit of corporatism.

Science, as we have seen, had achieved enormous success, due in large part to its systematic process of clearing away non-essential sensory data from the experimental arena. The focus on what could be easily measured had enhanced both its accuracy and its predictive power, as well as its utility. Faith in science was growing steadily, due to the rapid technological advances brought by its application. Causal agents of disease had been isolated and curative chemicals proved effective in its control. Advances in communication and transportation technologies heralded a continuous growth in the standard of living. Expansion - growth - optimism - these were the descriptors of much of the American consciousness around the turn of the century.

Philosophical Roots of Behaviorism

During this period, philosophers were engaged in an intellectual process that paralleled that of their scientific counterparts. A revitalized and resurgent philosophical realism emerged to challenge the orthodox Hegelianism prominent in most universities and clear away the metaphysical debris of Idealism. The well entrenched philosophy of Idealism, as it had been propounded by such thinkers as Immanuel Kant (1724-1804), Johann Gotleib Fichte (1762-1814), Friedrich Wilhelm von Schelling (1775-1854) and Georg Wilhelm Friedrich Hegel (1780-1831) was

> the elaboration and systematization of (the) basic proposition that *mind* is the primary and irreducible fact of individual experience..that mind is prior; that when we seek for that which is ultimate in the world, when we push back behind the veil of immediate sense experience we will find that which is ultimate in the whole universe is of the nature of mind, or spirit (Wingo, 1965, p.125)

The central organizing principle of Idealism, despite the various forms it had assumed, was *the principle of the priority of consciousness*. G. Max Wingo summarizes the tenets of Idealism concerning knowledge and truth with the following four propositions:

1. The universe is rational and orderly and, therefore, intelligible.
2. There is an objective body of truth that has its origin and existence in the Absolute Mind and which can be known, at least in part, by the human mind.
3. The act of knowing is essentially an act of reconstructing the data of awareness into intelligible ideas and systems of ideas.
4. The criterion of truth for an idea is coherence; that is, an idea is true when it is consistent with the existing and accepted body of truth.

Idealism has historically been conceived as the "ancient and implacable enemy of all forms of materialism" (Wingo, p.126). It is consistent with the religious conception of human nature embodied in the Hebraic-Christian view of the world, in its conceptions of "Man" as the highest expression of the creative power of God; of a world which is a manifestation of Divine Intelligence; and of a human destiny which aims to unite the consciousness of Man with the Ultimate. But in this emergent and progressive new age of science and practical wisdom, consciousness was not of much interest to thinkers who were concerned with the measurable and the quantifiable. So, while scientists were busy clearing away the "noise" of extraneous sense-data in their laboratories, the " New Realists", as they came to be

called, were equally busy clearing away the epistemological remnants of Idealism. The battle, in the late 19th and early 20th century, between what had become a fairly orthodox Hegelianism and a revitalized philosophical realism, revolved around the speculative, system-building metaphysics of Idealism as opposed to the emphasis upon logic, commonsense and the scientific method espoused by the new realists (Wingo, p.162).

The ideas of this dissident group were most fully articulated in a book entitled The New Realism (1912). Despite many differences of opinion, the New Realists held some basic tenets, or postulates in common. First, they posited the existence of a world independent of consciousness, in contrast with an Idealism that viewed the world as constructed by the subjective mind. This "principle of independence", stated that there exists

> a world of things and events and relations among these things and events, and this world is not dependent for its existence and character on its being known.
>
> (Wingo, 1965, p. 164).

The other major thesis of realism is that we can know this independent world *as it is*, in its essential nature, at least partially. This proposition has generated a number of epistemological problems for realists of this century, but for the original insurgents, there was a general agreement

that we could know the world directly, in its real character. In other words, they perceived a direct correspondence between external objects and the thoughts or words we have about them, and further, they posited that no intervening mental construct, or state is necessary to account for this knowledge. The criteria for truth, within this framework, is whether or not an idea corresponds with the reality to which it refers:

> Knowing, then, is the uncovering of the realities (facts) that exist independently of their being known and truth is a property ideas have when they correspond to the realities to which they refer (Wingo, 1965, p.183).

This "correspondence theory" was compatible with both common sense and the more refined empiricism of the scientific enterprise, and it is difficult to overstate the influence it has had upon the thinking of scientists, philosophers and educators of the 20th century.

The New Realists solved some of the thorny problems that had been generated by dualism, with the development of a new theory of the mind. They discarded the notion that *mind* was a "thing" or special substance, located somewhere in the body. While acknowledging that some sort of structure (a nervous system) was essential for the functioning of the mind, they proposed that consciousness was rather, a *process*, which established a certain type of relation between an organism and the objects in its

environment. Inherent in this idea was the view that this mind/process did not exist simply in the organism, but is also out in the environment with the object of its perception. To sum up this admittedly sketchy treatment of an important philosophical development, then, this theory of consciousness eliminated the dualism between subject and object which had troubled philosophy from its inception, and provided an explanation for the view that our awareness is of an existing independent reality, rather than of a subjectively constructed one. More importantly for our purposes, this philosophical perspective was linked to a new development in scientific psychology, the behavioristic interpretation of consciousness.

The Emergent Science of Behavior

Ralph Barton Perry, a new realist, proposed an interpretation of consciousness which illuminated the connection between the new philosophical realism and the emergent science of behavior, which contained the following tenets:

1. Consciousness and awareness are behaviors. Behavior is a process of reacting to stimuli.
2. The presence of a stimuli presupposes the existence of an objective environmental state of affairs.

3. Behavior is always "caused" - it is never spontaneous.
4. The character of the response is a function of the nature of the situation (Wingo, 1965, p. 173).

Not all philosophical realists were inclined toward the behavioristic interpretation of consciousness, and many rifts were to occur in this movement. Both intellectual developments, however - philosophical realism and the new science of behavioral psychology - were profoundly linked to the ever-increasing influence of mechanistic science on cultural life. Given the enormous success of this science in explaining and predicting natural phenomena, it was inevitable that it would finally turn to the field of human behavior.

Physical Science and Behavioral Science

When Idealism reigned as a dominant philosophical perspective, the traditional subject matter of psychology had been consciousness, or mind. Since the contents of the mind were private and subjective, it followed that the primary methodology for investigating its mysteries was introspection. This method of self-observation took a variety of forms which ranged from reporting immediate sensory impressions to the deep probing of emotional experiences. Descartes's observations of the relations

between nervous stimuli and mental processes, like many early psychological investigations, had both an empirical component and an introspective component. What distinguished this method, however, from the methods of physics, biology or chemistry was its subjective quality. Observations varied from observer to observer, in contrast to the general agreement that could be reached about what a number of observers might see in the test tube or under the microscope. By the second decade of the 20th century, the irreconcilable differences in the introspective reports issuing from psychological laboratories investigating identical questions convinced most psychologists that a genuine new science of the mind must be based upon the study of behavior (Woodworth & Sheehan, 1964, p.4). Behavior alone could provide the much needed external data about which different observers could agree, and by which theories could be validated.

Just as the physics of Galileo in the 17th century had exerted a great influence upon the thinking of early psychologists such as Descartes and Hobbes, newly developed sciences in the 19th century had an influence on the emerging science of the mind. Philosophers (remember, in these days, philosophers and psychologists were just beginning to differentiate themselves), impressed with the achievements of chemistry, "sought to discover the elements of conscious experience and their laws of combination" (Woodworth & Sheehan, 1964, p.10). Even more influential

than chemistry however, was the flourishing experimental science of physiology, with its study of the sensory organs, nerves and brain, and indeed, the science of behaviorism can be said to have sprung from the attempt to unite psychology and physiology. The psychological laboratory sprung out of the physiological laboratory, and after the founding of the first psychological laboratory by Wundt in Leipzig, Germany, (in 1879), this new experimental science took off.

While earlier psychologists had been satisfied with observations gathered from memory and introspection, the experimentalists depended on definite recorded data of external events, and experiments were devised that met the stringent requirements of empirical science. Successful science, remember, depends upon the principle of uniformity - events must lend themselves to observation, classification and the expression of mathematical regularities. Laws of nature derived from these uniformities enable scientists to make predictions. There was great hope that all of the important problems of psychology would be solved by this methodology.

Other developments in the philosophy of science were to have a profound effect upon the development of a science of behavior. Physicalism, later termed operationism, was the view that

> Consciousness, as an object of observation by science, reduces to the operations by which

> consciousness becomes known to scientists (Boring, 1961).

The observed data then (whether a verbal or a motor response to a stimulus) upon which a theory of the mind could be built, could only be behavior. No longer could the subject's reconstruction of what went on in his 'consciousness' be the primary datum for the experimentalist (Woodworth & Sheehan, p.5). Logical Positivism, such as that promoted by the Vienna Circle in the 1920's, also had an impact on this new science, with its attempt to eliminate metaphysics from the assumptions of philosophy. A.J. Ayer, one of the early logical positivists, developed what he called the "verification principle", that

> for a statement to be meaningful, it must be either purely definitional (analytic) or else verifiable (synthetic) by one or more of the five senses. All other statements (ethical, theological, and metaphysical statements) are non-sense, or meaningless (Geisler & Feinberg, 1980, p.50).

The logical positivism of the Vienna Circle then, relied upon an empiricism based on sense-data and observation, and a rationalism based on self-evidently clear and consequential arguments. All of these movements - physicalism, operationism and logical positivism sought to purify the language of science,

> to rid science itself of the "pseudo-problems" which arise in the attempt to translate into the language of physical reality that which is itself unobservable or metaphysical or physically undemonstrable (Woodworth & Sheehan, p.4).

We sometimes forget, in this contemporary climate of critique of positivistic, empirical investigations, that positivism was originally conceived as a liberation from existing traditions. The phrase "positivism", coined by Auguste Comte, implied knowledge grounded in sensory experience rather than myth or metaphysics, facts which could be explained by general laws and integrated into coherent theoretical systems, and theories which were empirically testable with results which were reproducible. While it now seems apparent that this paradigm is far too rigid and narrow to provide an adequate understanding of how knowledge is constructed, at the time it seemed like the paradigm for true knowledge of the world (Bredo & Feinberg, 1982) and of the human mind.

Early Players in the Behaviorism Game

Ivan Petrovich Pavlov (1849-1936) was a Russian physiologist who was involved in the study of reflexes. Much of his understanding of the human mind and behavior was based on his experiments with dogs, in which he would apply

a neutral stimulus (such as a bell or a light) simultaneously with a stimulus (food) that was closely linked to a response (salivation). He found that if these stimuli were presented together a sufficient number of times, an "association" was formed, and further, that the association became stronger the more the paired stimuli were presented together. He believed that all organisms possessed two sets of reflexes: one; a fixed, innate set of relatively simple reflexes, and two; a set of acquired, or conditioned reflexes. All complex learned behavior, he contended, "is brought about through the combination of several simple conditioned reflexes, which are physiological - not mental - processes" (Rachlin, 1990, p.39). The relationship to the "chemistry model" is apparent here. Further, he believed that physiologists, through objective observations, would eventually be able to successfully predict the behavior of all organisms, including humans. This assumption was to have a powerful influence over the direction of the emergent discipline of psychology.

The study of such "animal psychology", which focused on the comparison of instinctive (innate) behavior with behavior that occurred when an environment was modified in some way (acquired behavior), was interwoven with early studies in human psychology, behavior, child study and learning theory. In 1901, for example, Willard S. Small published the first animal study which employed the maze. It was entitled "The Mental Processes of the Rat", and the

insights of subsequent experiments were applied to the study of childhood learning.

In 1896, Edward L. Thorndike, one of the most influential behaviorists, had begun to experiment on children as part of his graduate studies at Harvard University. The authorities feared repercussions from these experiments, however, and "deprived of children, Thorndike turned to chickens"(O'Donnell, 1985, p.166), completing a classic study in comparative psychology entitled "Animal Intelligence". He based his subsequent educational and psychological theories on his animal researches, and was considered by Pavlov and the other Russian reflexologists to be the founder of behaviorism (Pavlov, 1923, preface).

Thorndike's major contribution to learning theory was the notion (largely drawn from British "associationism") that all learning is the establishment of a bond between a stimulus and a resulting activity. His theory, labeled "connectionism", viewed Mind as the sum total of connections between situations which life offers and the responses that man makes (Joncich, 1962). He posited two general laws that related to this "stimulus-response" theory of learning, "Exercise" and "Effect". The notion of "Exercise" states that the more frequently a response occurs, the greater tendency there is for its repetition. The notion of "Effect" states that responses that have pleasurable outcomes have a "stamping in" effect which favors their reoccurrence, while responses that result in unpleasant

results are likely to be eliminated. It was not just the simple stimulus and its resulting response which was important to Thorndike, but the effects (of satisfaction or annoyance, for example) that followed, that were important. While Jeremy Bentham and other British philosophers had previously formulated the notion that humans tend to seek out experiences which provide pleasure and avoid those which inflict pain (Hill, 1963, p.57), Thorndike was the first to apply such "reinforcement theory" to the psychology of learning. To Thorndike, it was the job of psychology to determine, through quantitative measurement of responses which incentives were the most powerful and productive.

John Broadus Watson was another "animal experimentalist" who was a contemporary of Thorndike. His animal experiments have been considered "the chief causal agent in the birth of behaviorism" (O'Donnell, 1985, p.180). He too, argued that since it was impossible to verify introspective reports, the science of psychology should rely solely upon external behavior. It is difficult to overstate the influence of this early psychology on education. Indeed, by 1910, over one-third of the psychological profession was interested in educational problems.

Perhaps the most well known behaviorist of all, B.F. Skinner sought the answer to the question of what external events (stimuli and reinforcers) could produce desired behavioral responses (learning). One of his major contributions was the idea of "frequency of responding" as a

dependent variable, which became a major emphasis in educational research:

> In the decades that followed, results of research were reported in terms of ratios and intervals and frequencies and curves, using running time meters, impulse counters, and cumulative recorders of various kinds (Darling-Hammond & Snyder, 1992).

Skinner's psychological ideas, and their connection to the control of individual behaviors and social organizations came to popular attention in his novel Walden Two (1948). The behavioral trend in psychology, the new realism in philosophy, an overriding interest in technical efficiency as it related to industrial production, and an interest in social control on the part of an emergent managerial class created a web of assumptions about human nature and learning that engendered what has come to be known as scientific curriculum planning, a curriculum "based on efficiency and standardization" (Doll, 1993). Early curriculum theorists such as Bobbitt, Charters, and Cubberly took their lead from the industrial model of activity. In 1916, educational historian Elwood Cubberly exemplified the aims, purposes and value base of mass schooling with the following statement:

> Our schools are, in a sense, factories, in which the raw products, children, are to be shaped and fashioned into products to meet the various demands of life...this demands good tools,

> specialized machinery and continuous measurement of production to see if it is according to specifications (p. 338).

This factory model of education perceived human beings as the raw material of production, specifying bits of information and skills as the manufacturing process and an obedient and productive worker as the finished product.

At this time, scientific management principles were being developed and applied to increase industrial efficiency. Frederick Taylor's studies of time and motion placed productivity in a central position, with the individual human being but a cog in the production process. Work was analyzed, fragmented and reordered into the most efficient arrangement possible. This type of activity analysis, applied to education, became the foundation of early curriculum development. The mind, as well as the body, was harnessed to meet the increasing needs of capital.

Around this time, Alfred Binet and Theodore Simon developed the first test that claimed to measure intelligence (Gould, 1981). This intelligence testing, combined with the analysis of the activities of various social groups, encouraged a differentiated curriculum based on the probable social destinations of students. W.W. Charters developed a curriculum for girls, based on their probable destination as homemakers and caretakers. Working class boys were trained for simple slots in the production

process through rote learning and discipline. Upper class boys were given the skills to become part of an emergent professional and managerial class. An overarching interest in social control demanded this sifting and sorting of students, all of it justified by dubious scientific assumptions about "innate capacities" and grounded in a general theory which understood social distinctions to be biologically ordained.

Ralph Tyler (1949), known as the Father of Behavioral Objectives, further augmented the control of the learning process with a model of curriculum planning distinguished by an emphasis on clearly defined objectives, specified behaviors, and predictable outcomes. This model of educational practice is still very much with us, and while the factory model of education has been refined, it still guides much of our thinking. The metaphors found in much educational jargon are revealing: classroom management, efficiency, time-on-task, cost-effectiveness, input/output, programming, feedback, objectives - language more suited to the production process than to human learning and development (Dobson, Dobson, & Koetting, 1985).

In recent years, James Popham, UCLA measurement professor, inspired an increased dependence on standardized testing, evaluation and measurement-driven instruction (Jackson, 1992, p. 141) with his famous, or infamous (depending which side of the political fence you're on) quote "if it can be taught and learned, it can be measured".

In the 1960's, Benjamin Bloom provided us with a rigidly ordered hierarchy of thinking skills, which educators are now expected to program into their lesson plans. In the 1970's, Madeline Hunter rose to educational fame and fortune with her formulas which guaranteed predictable learning outcomes. The 1980's witnessed a preoccupation with the basics, and a wave of interest in "mastery learning", a reductionist model which focuses on the acquisition of discrete intellectual skills. The most recent educational trend is "Outcomes-Based Education", which according to originators Bill Spady and Kit Marshall, is a "new theoretical and operating paradigm" (1991, pp. 67-72), but which largely derives from Tyler's objectives-based model of curriculum development. Critics of these contemporary trends in education (Apple, 1992; Giroux, 1988; Kraft, 1993) suggest that these narrow, reductive approaches to curriculum mask a continuing interest in the control of the learning process and the elimination of less easily measurable outcomes, such as critical literacy and intellectual open-mindedness. William Doll, in his (1993) book, A Post-modern Perspective on Curriculum suggests an even more significant theoretical problem - that the linear, sequential ordering of bits of information, the pre-set goals, the clear beginnings and definite endings, the dichotomous separation of ends and means, and the desire for control are

> embedded in the metaphysics of modernist science and in the scientism American curriculum thought has embraced (1993, p. 54).

Twentieth century curriculum theory then, is still grounded in a Newtonian science model that understands events as a narrow chain of cause and effect, easily measurable if all the data about the system is available, and amenable to prediction and control. But postmodern science is no longer so certain about these assumptions, as we will see as we turn, in Chapter Three, to three modern scientific theories that have shaken our epistemological assumptions. Just as the physics of Galileo in the 17th century had exerted a great influence upon the thinking of early psychologists such as Descartes and Hobbes, and as the newly developed sciences in the 19th century had an influence on the emerging science of the mind, postmodern science is exerting its influence on our maturing understanding of the human subject and the nature of knowing.

CHAPTER III

SHIFTING WEBS: NEW DEVELOPMENTS IN SCIENTIFIC THOUGHT

Einstein's Theories of Relativity

One of the most profound by-products of the general theory of relativity is the discovery that gravitational "force", which we had so long taken to be a real and independently existing thing, is actually our mental creation...The same is true for "nonsense". We call something nonsense if it does not agree with the rational edifices that we carefully have constructed. However, there is nothing intrinsically valuable about these edifices... like measurements of space and time, the concept of nonsense (itself a type of measurement) is relative.

Gary Zukav: The Dancing Wu Li Masters, pp. 186-187.

The 20th century revolution in physics, spurred in part by Einstein's development of the Special and General Theories of Relativity, produced important shifts in our assumptions about the nature of the physical universe, as

well as major consequences for scientific method itself. Challenges to the notion of purely objective truth have come from relativity, quantum theory and indeterminacy. One of the primary foci of the revolution has been the reevaluation of the act of observation (Garrison, 1988). Gary Zukav perceives an "inevitable trend toward the merger of physics and psychology" (1979, p. 161), of which Einstein's development of the Special Theory of Relativity and the General Theory of Relativity were harbingers. I believe that while Einstein's process of discovery certainly laid the groundwork for such an assumption, Einstein himself would have maintained a narrower interpretation of the relationship between consciousness and sense-data than Zukav does. In this section of Chapter Three, I will explore the development of Einstein's theory of special relativity, examine relativity's challenge to objectivity, and attempt to make sense of the concept of nonsense.

Assumptions of the Classical Theory of Relativity

The Classical Theory of Relativity was supported by a number of commitments inherent in Newtonian physics. According to Newton, there was a universal and absolute time which flowed equably throughout the universe. There was a separate, independent and empty space which served as the background against which events took place, and time and space were separate entities. There was, somewhere in the

universe, an absolute, unmoving reference frame against which absolute motion might be measured. The classical theory of relativity asserted that the motion of a body could be calculated by adding or subtracting the velocity of the body to or from the velocity of its reference frame (depending upon direction), utilizing the "Galilean transformation laws". Additionally, classical relativity says that if the laws of mechanics are valid in one coordinate system, they are valid in any other coordinate system moving uniformly relative to the first.

With his development of the Special Theory of Relativity, Einstein turned the world of physics upside down by demonstrating that the above commitments (largely grounded in common sense) were no longer "useful". Einstein's vision, in fact, has proven to be more useful than common sense (Zukav, p. 136). Let's examine the ways in which the Special Theory of Relativity overturned the commonsense notions of classical physics.

Time and Space

While Einstein utilized classical relativity (based on Galileo's ideas) in the special theory, he added the assumption of the constancy of the speed of light (based on the Michelson-Morley experiment). If the velocity of the speed of light is the same in all coordinate systems, the assumption that all clocks have the same rhythm must be

thrown out. Assuming the constancy of the speed of light implies that the measuring instruments used will vary from one frame of reference to another depending upon their motion. A moving clock runs more slowly than a clock at rest, and continues to slow down until it stops altogether at the speed of light. "Motion itself causes contraction, and in addition, time dilation" (Zukav, 1979, p. 138).

Different theories assess the temporal relation of events in different ways. Newtonian causality, one of the pillars of classical physical theory, was undermined by Einstein's assertion that the apparent cause of an event could be perceived as following the event, given certain high velocities and the motion and position of an observer. Einstein's focus was on the *perceived* order of events. The ramifications of this focus are explored in a 1957 study by Margenau & Smith (cited by Garrison), who argue that the barrier to establishing definitive causal relationships is a theoretical barrier and not a technological one. In other words, improved measuring instruments will not help because it is observation itself that generates the problem. Einstein's discovery of time dilation demonstrated that there is no universal time that permeates the universe, only "proper" times associated with various observers. Any two events that happen simultaneously in one frame of reference may occur at separate times from another frame of reference (Zukav, p. 145). The concept of temporality is theory-specific. This, according to Garrison, "undermines

any possibility of a superordinate concept of causality" (p. 132).

The concepts of space and time were collapsed in Einstein's theories. Space was no longer viewed as an arena in which events took place; rather, space-time is what is taking place. Matter does not take in space time, it distorts space time.

Absolute Motion

The classical assumption of an "ether", a motionless, invisible substance that permeated the universe, implied an absolute reference frame against which all motion could be measured. The entire structure of classical mechanics, says Zukav, "was based on the fact that somewhere, somehow, there must be a frame of reference in which the laws of classical mechanics are valid" (1979, p. 126). The ether, in addition to supplying a substance through which waves of light could travel, also supplied the co-ordinate system against which all things could be compared to determine whether or not they were moving. The crucial experiment of Michelson and Morley, however, rang a death knell to the theory of the ether, as well as leading to the development of the mathematical foundations of Einstein's theories.

How Theories Change

As we have seen, two major conceptual roadblocks to developing the special theory of relativity were the existence of the ether (it was "nonsense" to think that wave-like structures could be propagated through empty space!) and the corresponding idea of absolute non-motion. Einstein discarded both of these theories because experimental data refused to confirm either one. He considered it "intolerable" to hang onto a theory which had no corresponding characteristic in our system of experience. The other important obstacle to radically reconceptualizing reality was the puzzle of the constancy of the speed of light.

From the point of view of the classical theory of relativity, the constancy of the speed of light was "nonsense". Zukav defines nonsense as that which does not fit into the prearranged patterns which we have superimposed on reality. It corresponds to the notion of "noise" (data which does not support a given theory) and Kuhn's "anomalies". If we experience something as "nonsense", says Zukav, we are experiencing the boundaries of our own self-imposed cognitive structures. That the speed of a beam of light would not increase with the motion of its source defied common sense, upon which the theories of classical relativity rested. The way Einstein dealt with this puzzle was to disregard it as a puzzle and turn it into a

postulate, or a principle, which became the foundation of the special theory of relativity. He accepted the experimental data, gave up the commonsense view and adopted a view which contradicted common sense (it was non-sense). With this conceptual leap, his perception of the nature of time and space was able to shift dramatically.

While Einstein, in a sense, "started fresh" (Zukav calls this "having a beginner's mind") by reconceptualizing a puzzle as a principle, and by disregarding a physical theory which seemed to be the only possibility (light waves must be propagated in something!), he clearly built his theories on the "rational edifices" of previous scientists. The constancy of the speed of light and the non-existence of the ether had previously been demonstrated in the Michelson-Morley experiment. The classical theory of relativity was not overthrown, but expanded to include the phenomena of electromagnetic radiation. And while his theories contributed to the overthrow of many assumptions of classical physics, Einstein stood on Newton's shoulders and refined his ideas (inertia/super-inertia).

The way Einstein began the construction of his theory was with a thought experiment (the free creation of the mind). He then posited a new set of logical commitments (no ether, the constancy of the speed of light), worked out the math, then plugged it into physical data. His story came first, told him what to look for, suggested new and fruitful

lines of inquiry for scientists to follow, and was subsequently confirmed by numerous experimental results.

When Zukav speaks of nonsense, he is developing Kuhn's premise that when data does not fit a prevailing conceptual schema, scientists tend to disregard such anomalies, or "noise":

> Our minds follow different rules than the real world does. A rational mind, based on the impressions that it receives from its limited perspective, forms structures which thereafter determine what it further will and will not accept freely. (1979, p. 160)

Here, Zukav is in agreement with Kuhn that we are "socialized" into a particular conceptual framework which imposes its own interpretation upon the real world. Zukav is not suggesting that a conceptual framework, such as geometry, comes from the mind (as in Platonic Idealism). Rather, he suggests, idealizations abstracted from experience form rigid mental structures which cause us to subsequently question the validity of sensory experience rather than the validity of the idealized abstractions.

Zukav's continual reference, in The Dancing Wu Li Masters, to a "real world" suggests that he believes there might be an absolute reference frame, waiting to be discovered by a process of continuous deconstruction of self-imposed conceptual limits. This "breaking through"

process, according to Zukav, is a description of the means by which Einstein achieved his theories of relativity. Einstein too, believed in a basic, underlying order to the universe - a fundamental truth waiting to be discovered. Whereas Einstein, however, sought the ultimate explanatory principle that would unify all of physics, Zukav seeks to take us beyond rationality altogether, beyond symbols and beyond science to a condition of pure experience, of the Buddhist notion of "that which is".

Both Zukav and Einstein seem to perceive the process of scientific discovery as an evolutionary process. This evolution, for Einstein, "is proceeding in the direction of increasing simplicity of the logical basis". Ironically, such simplicity can only be achieved by the increasing distance of theory from ordinary experience, and the increasing dependence upon complex and precise measurements. With more simple and more inclusive theories, previously disregarded data make "sense". "Nonsense is nonsense only when we have not yet found that point of view from which it makes sense" (Zukav, 1979, p. 117).

It is one thing, however, to posit the necessity for a more inclusive theory that will incorporate the "loose ends" of experimental data, and quite another to suggest that theories are arbitrary constructions of the human mind. I believe that Zukav overstates the case when he says that "there is nothing intrinsically valuable about these edifices". While theory, for Einstein, is "man-made", and

arrived at by "free invention", it is "the result of an extremely laborious process of adaptation: hypothetical, never completely final, always subject to question and doubt".

Though the theories of relativity were developed to explain limited instances of motion, scholars in many disciplines have played fast and loose with the theory. With respect to epistemology, relativity is utilized to support claims that all observations are contingent upon the situation of the observer, and that observations must be meaningful and consistent in regard to the particular situation, or frame of reference. It has opened the way for a multiplicity of interpretations of a given event. Such interpretations are considered to be complementary, because they result in valid accounts of the phenomena, even though they may be incommensurable. I believe that Zukav would rest content with these conditions. I suspect, however, that Einstein is turning over in his grave!

Heisenberg's Uncertainty Principle Revisited

"Paradigm wars" in the social sciences do not so much involve competing interpretations of empirical data, as in the "hard sciences", but rather arguments over the admissibility of different types of data. Until the 1950's, the standard positivistic, establishment, mainstream, objectivity-seeking and quantitative approach was undisputed

except by a handful of marginalized voices, such as that of Sorokin. Functionalism in sociology and behaviorism in psychology had the status of reigning paradigms, and education research drew upon one or the other, depending on whether the focus was on the system or the individual. In the late 1960's and early 70's, critical, dialectical, hermeneutical and neo-Marxian paradigms were promoted as alternatives to the prevailing neopositivist paradigm of quantification, hypothesis testing and generalization. This challenge has continued into the 80's, with the notable addition of feminist theory and the refinement of qualitative, naturalistic research techniques. While the technical and methodological aspects of the confrontation have changed over time, deeper differences lie at the level of epistemology (Rizo, 1991, p. 10), and there is furious debate in social science research over issues raised by the "new philosophy of science" (commonly understood as the implications of uncertainty, complementarity, relativity, chaos, non-locality and indeterminism). This section of Chapter Three will focus on the physical concept of uncertainty and its concomitant assumptions about the nature of the act of observation.

Einstein's Theory of Special and General Relativity made great demands on the capacity for abstract thought, but according to Heisenberg (1930), it still fulfilled the traditional requirements of science (the division of the world into subject and object). It is at this level,

however, that the difficulties of quantum theory begin. In classical physics, the interaction between the observer and the observed object was considered negligible because of the scale of the operations. If not negligible, the effect could be eliminated from results with calculations based on control experiments. With the advent of quantum theory, this relationship became problematic:

> This assumption is not permissible in atomic physics; the interaction between observer and object causes uncontrollable and large changes in the system being observed because of the discontinuous changes characteristic of atomic processes (Heisenberg, 1930, p. 3).

There are a number of justifications for the assertion that the observer influences, to a greater or lesser extent, the results of a quantum experiment. First, it is important to understand that there is no such thing as "quantum reality". Nothing can be said to exist, in the micro-world, until some form of measurement is applied to it. Sub-atomic particles have no existence independent of the blips, ticks, needle movements and interference patterns registered by the subtle and sophisticated instrumentation devised to detect (create?) them. The ability to select which attribute will be measured constitutes, according to Nick Herbert (1985, p. 134), a significant component of the idea that an observer can be said to "create reality". Electrons, says Herbert, have no dynamic attributes of their own - what they have

depends upon how we choose to analyze them. In other words, you can slice up a wave any way you wish! This notion has been interpreted to mean that the unobserved attributes of the quantum world exist in an attenuated state of potentiality until an act of observation promotes some aspect of it to full reality status (this brings to mind the well known Zen koan about the reality status of a tree which falls in the forest with no one to hear it).

Secondly, the Uncertainty Principle is commonly understood to refer to the degree of indeterminateness in calculating the simultaneous values of a variety of paired quantities. It in no way restricts the exactness of a measurement of either of the partners in such a pair. Margenau (1957,p. 361) terms the individual aspects of such correlated observables as position/momentum, time/energy and angle/angular motion "canonically conjugate". The common characteristic of all canonically conjugate pairs is that the product of their physical dimensions has the dimension of action, and for all such pairs, the uncertainty principle holds.

The most commonly cited example concerns the velocity and position of a free electron. If the velocity is precisely known, the position is unknown. Why? In order to locate an electron with precision, you must use gamma rays, the light wave of the shortest wave length. Such a light wave has the largest frequency and great momentum. The

photon emitted to strike the electron acts like a swift projectile, communicating momentum to the electron, thus:

> Every subsequent observation of the position will alter the momentum by an unknown and indeterminable amount such that after carrying out the experiment, our knowledge of the electronic motion is restricted by the uncertainty relation (Heisenberg, 1930,p. 20).

Conversely, to measure the momentum, the photon bullet to be reflected must have a small momentum and a large wavelength, hence:

> ...the accuracy as to position conveyed by a signal of large wavelength is small, for certainly the reflecting object cannot be located in a space smaller than a single wave (Margenau, 1957, p. 368).

In summary, the measurement of certain paired quantities inevitably sacrifices one form of precision to gain another. This is not a measurement problem that can be solved with improved technology because the problem is inherent in the act of measurement itself. Every experiment of this sort destroys some of the knowledge of the system which was obtained by previous experiments. The uncertainty principle does not refer to the past - the position of an electron for any times previous to the measurement may be calculated, but this measurement can't be used as the initial condition for the calculation of future progress of

the electron (because of changes in momentum caused by the measurement of its position).

The co-existence of two seemingly contradictory quantum effects (the perfect accuracy of quantized attributes and the mutual uncertainty of conjugate attributes) troubles philosophers more than it troubles physicists. Most physicists are pragmatists, and the predictive power of quantum theory has been demonstrated in thousands of replicable experiments.

The inequality sign in position/momentum equations has created the impression, according to Margenau, that one never quite knows what the uncertainties are, even when the incremental changes are well defined. Such ignorance, he says, is spurious, for the uncertainty axiom tells how to calculate the distribution, and hence the standard deviation when the state function is given. The epistemological doctrine of quantum theory then, has merely moved from the classical notion that a single observation could determine the kind of knowledge needed for prediction to the incorporation of statistical uncertainty into its equations. It

> relates the state of atomic systems to an aggregate of datal experiences and not to a single complex called one measurement (Margenau, 1957, p. 363).

It is ironic that a concept such as uncertainty, arrived at through a painstaking inductive approach via selected

experiments, should provide such an important foundation stone of the postpositivist critique of empirical, quantitative research in the social sciences. A recent (April 1989 - May 1991) series of articles in the prestigious journal, Educational Researcher, highlights the arguments over the usefulness of utilizing Heisenberg's Uncertainty Principle in social science research, and I turn now to some of the wider elaborations of the theory.

Unpredictability, Uncertainty and Indeterminism in Human Behavior

A recurring theme in educational discourse throughout the past two decades is a debate over epistemology. The debate centers around qualitative vs. quantitative approaches to research. Various arguments are presented to support the notion that human behavior is essentially unpredictable and indeterminate. A number of researchers have utilized the Heisenberg Uncertainty Principle to support a naturalistic, ethnographic, or qualitative research agenda (See Goetz & LeCompte, 1984; Guba, 1981; Guba & Lincoln, 1982; Lincoln & Guba, 1985; Patton, 1980; Piel, 1978; Tranel, 1981).

The most obvious critique of the use of the Heisenberg Uncertainty Principle to challenge the "rationalistic paradigm" is the fact, cited by McKerrow & McKerrow, that

"the principle was discovered in the context of the rationalistic paradigm" (1991, p. 17). It is inappropriate, they assert, to use the principle to negate the paradigm within which it was discovered and utilize it to defend a competing paradigm. Tranel (1981), goes so far as to suggest that the Uncertainty Principle asserts that "one can no longer speak of certainty and predictability and measurement in the area of the physical sciences". Nothing could be further from the truth. Sub-atomic physics is an incredibly accurate measurement system, *within a statistically accurate realm of probability*. McKerrow and McKerrow further critique some popular assumptions of the Heisenberg Uncertainty Principle: a) that there is uncertainty in everything and b) that the observer changes what is real. They agree with Hofstadter (1985, p.465), who asserts that quantum mechanical reality does not correspond to macroscopic reality. While this critique corresponds with the dominant view among physicists, there is no clear agreement about what constitutes the dividing line between micro and macro systems. While Cziko (p. 22) concedes that at the macro level, quantum effects generally cancel each other out, he cites a couple of examples in which the separation between the two spheres is less than obvious. One is the role of sub-atomic particles in genetic mutation, the other is the possibility that random individual electrons could cause a computer malfunction. And as he reminds us, we can only speculate at this time about the

role of quantum randomness in cognitive processes. Generally speaking however, the Uncertainty Principle covers the simultaneous measurement of paired quantities. While its influence has been tremendous, in that its restrictions changed physics to a probabilistic science, there is nothing inherent in the principle to suggest that it applies to macroscopic phenomena.

In social science research, the observer affects what is observed in numerous ways. The choice of variables to include in the study, the values and biases of the researchers, the level of interference in the activity being studied all influence the results of social inquiry. The idea of indeterminacy, as developed by Quine, arises within the attempt to assign meanings to the behavior of individuals and groups culturally different from the researcher. Explanations of behaviors must remain indeterminate, because the researcher brings already established linguistic and conceptual frameworks to the task of understanding. Concepts of meaning and reference are "empirically empty" (Miller & Fredericks, 1991, p. 5), unlike scientific theories, which can be assessed more objectively, hence their susceptibility to underdetermination. But this conceptual indeterminacy has nothing to do with the more specific kind of measurement difficulties covered by the Heisenberg Principle.

Contenders on the qualitative side of the social science research debate challenge the tendency of

quantitative researchers to build theoretical models and construct macro-level generalizations. They criticize these tendencies for a number of reasons. First, models can lead to an overemphasis on form, at the expense of the subject matter itself. Second, models oversimplify the complex relations between various forms of behavior. Third, models overemphasize rigor at the expense of essential details. (Miller & Fredericks, 1991, p. 18). Most supporters of a qualitative approach, such as Cziko, propose an expanded notion of research - an essentially descriptive and interpretive approach that "proliferates rather than narrows", and captures the complexity of human behavior. The conflict reflects a much wider debate in the field of scientific endeavor - that between those who would narrow the field of study to achieve precision, and those who would sacrifice some rigor for the inclusion of a wider range of phenomena. The debate harks back to the beginning of the Scientific Revolution, when Galileo first applied mathematics to simple physical phenomena. It is a plea for an Aristotelian conception of "practical wisdom" and contextualized inquiry - a rebellion against the abstraction and mathematization of (human) nature.

Quantum theory has contributed conceptually to this movement in significant ways. It has reinforced the awareness that "because our descriptions rest upon human constructs that fit our perceptual limitations, they can be neither wholly adequate or exhaustive" (McKerrow & McKerrow,

1991, p. 20). Its wave/particle duality has enabled us to dwell more comfortably with ambiguity and paradox. Heisenberg's Uncertainty Principle is an intuitively coherent metaphor for the difficulties of isolating phenomena to capture a precise measurement, and for the difficulties inherent in making accurate predictions. But as is generally the case when social science attempts to graft concepts from physical science on to its theoretical structure, more is extrapolated from it, in my opinion, than is warranted. It can provide us with the necessary perspective for appreciating a qualitative approach, but it is probably "bad science" to apply it directly to the problems of social inquiry.

Chaos Theory And Self-Organizing Systems

"that in the shadowless atmosphere,
the knowledge of things lay round but unperceived"

Wallace Stevens

If relativity theory caused us to discard the Newtonian illusion of absolute time and space, and quantum theory eliminated the Newtonian dream of a controllable measurement process, then chaos eliminates the Laplacian fantasy of deterministic predictability (Gleick, 1987, p. 6). Chaos, says Alvin Toffler, "is a lever for changing science itself, for compelling us to reexamine its goals, its methods, its epistemology - its world view" (in Prigogine & Stengers,

1984, p. xii). At its core, mathematical chaos theory, or non-linear dynamics, represents "new theoretical tools (which) illuminate the order that lurks beneath seemingly random and impenetrable behavior in nature" (Reiter, 1984, p. 11). Scholars in fields as diverse as physiology, mathematics, physics, medicine, meteorology, chemistry, economics, neuroscience, climatology and literature have embraced this new paradigm. Why the enormous interdisciplinary interest in a new mathematical model? What are the philosophical implications of this new model? And what might it mean for research in curriculum?

From Reductionism to Chaos

The history of ideas, and the major thrust of the scientific effort represents the quest to discover an underlying order or unity in the universe. Confronted with the "messiness" and apparent disorder of material phenomenon, scientists have engaged in a process of isolating phenomena and reducing them to their simplest components for analysis. The trend in reductionism has been to proceed with the analysis of systems in terms of the parts.

Within this mode of operation, irregularities, fluctuations and anomalous behaviors have been dealt with in various ways. Often they are "shoved under the carpet" - ignored until enough of them pile up to become a nuisance.

Sometimes they can be resolved within the existing paradigm, or conceptual framework. If this is impossible, scientists will attempt to modify the paradigm in some way (this is referred to as "tinkering", an appropriate mechanical metaphor for this endeavor). Theories are adjusted, replaced or modified, but the fundamental conceptual framework remains in place. None of these ways of dealing with anomalies, or "noise", require a radical rethinking of basic concepts, or an adjustment of the tacit infrastructure of ideas. Sometimes a sufficient number of anomalies accumulate, or the few that there are become insistent enough that a scientific crisis ensues, and a radical revision in the existing conceptual framework is called for. This constitutes what Thomas Kuhn (1962) has termed a "scientific revolution", and during such a period, scientists experience a restructuring of group commitments, or a transformed view of knowledge.

Such a revolution seems to be occurring with the advent of the new sciences of complexity. The science of the "global nature of systems" posed problems that defied accepted ways of working in science. The old reductionist model no longer seemed to apply to the solution of problems inherent in systems, such as weather, the flow of turbulent fluids, and certain physiological problems, such as those connected with the fibrillating heart. Until recently, the most that scientists could say about such systems was that they were too unpredictable and complicated to understand.

Recently, however, new light has been shed on the elements of randomness inherent in such systems, and this intense scientific scrutiny has yielded up a new dimension in understanding complex systems.

A primary assumption of Newtonian physics is that given the approximate knowledge of the initial conditions of a system, and an understanding of natural law (which in this framework is thought to be both universal and eternal), one could calculate the approximate behavior of a system. Indeed, modern science has pursued the dream of eighteenth century mathematician-philosopher Pierre Simon Laplace, who gave voice to the vision of strict determinism:

> The present state of the system of nature is evidently a consequence of what it was in the preceding moment, and if we conceive of an intelligence which at a given instant comprehends all the relations of the entities of this universe, it could state the respective positions, motions and general affects of all these entities at any time in the past or the future.
>
> Laplace, 1776
>
> (in Crutchfield, et.al., 1986)

Here, Laplace introduces the concept of "reversibility" (the idea that, in a mechanistic universe, events can be traced deterministically backwards in time, as well as forwards). Even Laplace, however, who in Gleick's (1987) words, had "caught the Newtonian fever like no one else", admitted

difficulties in the application of this idealized determinism:

> But ignorance of the different causes involved in the production of events, as well as their complexity, taken together with the imperfection of analysis, prevents our reaching the same certainty about the vast majority of phenomena. Thus there are things that are uncertain for us, things more or less probable, and we seek to compensate for the impossibility of knowing them by determining their different degrees of likelihood. So it is that we owe to the weakness of the human mind one of the most delicate and ingenious of the mathematical theories, the science of chance or probability.
>
> Laplace, 1776
>
> (in Crutchfield, et.al., 1986)

From Laplace's point of view, it was only the limitation of human conception that caused the appearance of randomness -if only humans possessed the omniscient perspective of the Deity, the exact causes of all events could be known, and the future could be accurately predicted. While the verdict is far from in on the existence of "hidden variables", chaos theory has challenged some of the core assumptions of this Newtonian world view. Coupled with the revelation from quantum mechanics that initial measurements are always uncertain,

> chaos ensures that the uncertainties will quickly overwhelm the ability to make predictions. Without chaos Laplace might have hoped that errors would remain bounded, or at least grow slowly enough to allow him to make predictions over a long period. With chaos, predictions are rapidly doomed to gross inaccuracy. (Crutchfield, et al., 1986, p. 49)

At the root of this indeterminacy is a simple discovery that even rudimentary deterministic systems with only a few elements often generate random behavior. This notion is related to what has been called the "butterfly effect" - a sensitive dependence on initial conditions in which tiny differences in input can become major differences in output. According to Crutchfield, et al., "this randomness is fundamental; gathering more information does not make it go away" (p. 46). In other words, the appearance of randomness, spontaneity or surprise in systems is not due to the inadequacy of human perception. It is rather, inherent in many systems themselves, leading chaos theorists to speak of such internal, systemic dynamics as "self-organization", "temporality", "complexity", "equilibrium", "coherence", "instability" and "irreversibility". Matter, in this framework, "is no longer the passive substance described in the mechanistic worldview but is associated with spontaneous activity" (Prigogine, 1984, p. 9).

This is a genuine conceptual departure from the Cartesian-Newtonian view of inert particles colliding with each other in empty space, governed by immutable laws set down in the beginning of creation by an external, Divine intelligence. In the mechanistic model,

> The universe is, therefore, one, infinite, immobile...It does not move itself locally...It does not generate itself...It is not corruptible...It is not alterable.
>
> Giordana Bruno
>
> (in Prigogine & Stengers, 1984, p. 15)

The worldview suggested by chaos theory more resembles the animated, organismic view of the pre-scientific world than it does the clockwork empire of the Enlightenment. We do not, however, have to choose between the disenchanted, alienated world of Newtonian science and the irrationality of the pre-scientific, or anti-scientific worldview. Science, says Prigogine, <u>is</u> enchanted - not because of a concern with magic, or the unimaginable, but because they are beginning to understand the complex processes that form the world (1984, p. 36).

The ambiguity with which we must deal, however, is that this chaos is deterministic, governed by fixed rules that do not involve elements of chance. Evidenced by the striking and elegant geometrics of visual fractal forms, there is indeed, underlying order in chaos, and while this emergent

science does imply fundamental limits on predictability, it also indicates that many random phenomena are more predictable than we used to think.

So where does this leave us in our analysis of the implications of chaos, not only for scientific research, but for philosophical ideas such as determinism, free will, human intentionality and conscious intelligence? The dream of the founders of classical science - to go beyond the world of appearances to reach a timeless world of supreme rationality -has been seriously challenged. Chaos, according to Prigogine, suggests that we may have unveiled "a more subtle form of reality that involves both laws and games, time and eternity" (1980, p. 215). Newtonian science is a revealed science, alien to any social or historical context which might identify it as a result of human activity. The postmodern perspective sustained by chaos theory, on the other hand, perceives events as temporal, historical and context-specific, and nullifies the classical scientific effort to discern timeless eternal cosmic laws. Yet, with the temporality and self-organization, chaos also reveals an elegant underlying order lurking beneath phenomenal appearances. The order, however, is inherent in the phenomena rather than imposed by an external Divine intelligence.

One of the more important revelations of chaos theory lies not in the model itself, but in the process by which it was discovered. Chaos could have been discovered long ago,

according to early developers of the theory (Doyne Farmer, James Crutchfield, Robert Shaw and Norman Packard), but scientists had limited their observations of physical systems to experiences that fit an existing conceptual framework. These men found, however, that when they moved outside the parameters of what had been studied, they found things to which the huge existent body of analysis didn't apply:

> It brought home the point that one should allow oneself to be guided by the physics, by observations, to see what kind of theoretical picture one could develop.
>
> (Packard, in Gleick, 1987, p. 251)

The implication here is that theory should emerge from observations, rather than provide a rigid conceptual framework that guides and limits observations. This of course, is what is known in the social sciences as "grounded theory" and is a common assumption of ethnographic, hermeneutic and other forms of qualitative research. It provides a more open-ended approach to theory-building and knowledge construction, one that attempts to remain, as much as possible, free from prior conceptualization. As David Bohm and F. David Peat make clear in Science, Order and Creativity (1987), much of scientific activity is no longer concerned with direct sensation. Pre-existent theories guide perception, and interaction with the world is mediated

by elaborate technologies that have been devised on the basis of these theories. Furthermore, the questions that scientists ask generally come not from sense data, but from an existing body of knowledge. Bohm and Peat suggest, and the chaos theorists might concur, that science would be better served with a more creative form of perception, rather than one which is rigid and theory-bound, and by allowing the scientific mind "free play" (fluid movement between and among concepts, assumptions, observations and abstractions). This process would allow uninhibited observation, shifting perspectives and a much more tenuous relationship with cherished paradigmatic suppositions.

There are a number of reasons why chaos theory has captured the popular imagination, as well as the interest of so many scholars in so many different fields. Unlike general and special relativity, which find their application in macro/cosmic phenomena, or quantum mechanics, which relates specifically to micro-phenomena, chaos theory actually applies to the visible, human scale - the world of objects we can see and touch. The general interest in unpredictable and evolving systems may reflect a general sense that humanity is in a transition period. Some theorists and cultural commentators find support for the notion of rapid, or punctuated evolution in Prigogine's theory of dissipative structures, and seek corresponding explanations for biological, cultural, social and

psychological transformations in it. Aquarian Conspiracy author Marilyn Fergusen finds Prigogine's theory of dissipative structures analogous to the radical transformation of society by a group of creative, dissident individuals. She quotes Prigogine:

> Fluctuations, the behavior of a small group of people, can completely change the behavior of the group as a whole (p. 166).

She goes on to say that

> Critical perturbations - "a dialectic between mass and minority" - can drive the society to "a new average"...Societies have a limited power of integration...any time a perturbation is greater than society's ability to "damp" or repress it, the social organization will (a) be destroyed, or (b) give way to a new order (p. 166).

Indeed, we find ourselves in an historical moment in which many systems have either collapsed or are teetering on the brink of breakdown. Global ecological crises include warming trends, the loss of the ozone layer, deforestation, species extinction, pollution and soil depletion. Systems of national identity have become highly unstable with the collapse of Stalinist regimes in Eastern Europe and the Soviet Union. Social systems in many cultures have splintered along issues of race, religion, social class, ethnicity and gender. The planet certainly appears to be in

a "far-from-equilibrium" state (Prigogine's term for systems extraordinarily sensitive to small fluctuations). Chaos theory suggests that we might view such an historical period as one of "breakthrough" rather than "breakdown" - that despite the suffering and disorder prevailing, humanity may well be "self-organizing" in creative and unpredictable ways. In the Chinese Book of Changes (the I Ching), the hexagram BEFORE COMPLETION comes at the very end of the book. It represents a transition from chaos to order, and points to the fact that every end contains a new beginning. This hexagram, and the theory of chaos, offer humanity a ray of hope during a period of general despair.

Another reason why chaos theory has captured our imagination is the challenge it offers to the discouragement of "entropy". One of the key themes of chaos theory is the reinterpretation of the Second Law of Thermodynamics - in fact it offers a synthesis of the paradoxical conditions of entropy and evolution. According to the laws of entropy, the universe is losing energy, "winding down" into increasing disorganization and homogeneity. But according to evolutionary theory, life is proceeding from the simple to the complex, from undifferentiated to differentiated structures. "The universe gets 'better' organized as it ages, continually advancing to a higher level as time sweeps by" (Prigogine, p. xx). According to Prigogine and Stengers,

> entropy is not merely a downward slide toward disorganization. Under certain conditions, entropy itself becomes the progenitor of order (Gleick, p. xxi).

The disorderly behavior of simple systems thus acts as a *creative* process - it generates complexity:

> ...richly organized patterns, sometimes stable and sometimes unstable, sometimes finite, and sometimes infinite, but always with their fascination of living things (Gleick, p. 43).

Science, at long last, tentatively embraces, rather than scorns the messiness, complexity and apparent disorder of nature.

Some interpretations of chaos suggest that it is capable of healing the deep historical schism between science and the humanities. In part this is because the theory lays to rest the quest for all-embracing schemas, universal frameworks and immutable laws in favor of a perception of nature that is changing toward the multiple, the complex and the temporal:

> When me move from equilibrium to far-from-equilibrium conditions, we move away from the repetitive and the universal to the specific and the unique (Prigogine & Stengers, p. 13).

Chaos then, resonates with a postmodern consciousness that favors the particular over the universal, quality over quantity, perpetual movement over rest, the concrete over

the abstract, and culture-bound principles over the timeless and eternal laws sought by the founders of modern science. The political and cultural implications of this are enormous, and beyond the scope of this study. Suffice it to say that power is intricately connected with and dependent upon idealized and objective forms of knowledge. Chaos theory appears to have had an effect similar to relativity and quantum mechanics, in that one of science's own discoveries has had the affect of challenging some of its own categories.

Chaos may indeed signal "the end of the reductionist program in science" for many scientists (Gleick, 1987, p. 304), but it certainly does not spell doom for the mathematization of nature. It is a sophisticated mathematical model, which lends itself extremely well to computer applications. There are problems, however, with mapping the human world onto mathematical structures developed to describe the mechanical world of physical objects - whether it be that of celestial mechanics, statistical mechanics, continuum mechanics or quantum mechanics. Those problems derive from the mathematization process itself:

> So when we map the human world onto the mathematics arising in the world of mechanics, the human world can only look mechanical. The structures we employ to express ourselves, literally to 'push out' our thoughts onto these

> symbolic structures, do not allow this human world of ours to look anything else except mechanical (Gould, 1988, p. 16).

Chaos may be, as Gleick says, reshaping the fabric of the scientific establishment, but its value for curriculum theorizing probably lies more in its generative metaphors than in its mathematical models.

Chaos and the Curriculum

As indicated in Chapter 2, much of curriculum planning, instruction and inquiry is embedded in a mechanistic world view. The behaviorist model of learning and the technicist approach to curriculum inherited from Bobbitt, Spencer, Tyler and other founding fathers of curriculum all posit a view of the learner as a "closed system". In a closed system (such as a rock or a log), there is no internal transformation of energy. An open system, on the other hand, might be described as a "flowing wholeness" (Fergusen, 1980, p. 164), involved in a continuous exchange of energy with its environment, highly organized, and in a continual process of becoming. The old paradigm of learning, which finds contemporary expression in the Madeline Hunter model, mastery learning and outcomes-based education proposes a narrow range of predictable learning outcomes, specified behaviors as both means and ends of those outcomes, limited and controlled inputs of information and an emphasis on

educational "products" (memorized facts, written reports, right answers). It has been remarkably successful at turning students into rocks and logs. At the core of the technicist approach to education is the belief that (human) nature is wild, uncontrolled and chaotic. It has therefore, demonstrated a continual effort to impose order where none is thought to exist. This ontological assumption about the nature of being drives many of our educational decisions. If we begin to reconceptualize human nature, or being, in terms of new understandings in complexity, a clearly different understanding of the learner and the learning process might emerge. Chaos theorists speculate about the nature of mind, expanded beyond a simple input-output model:

> At the pinnacle of complicated dynamics are processes of biological evolution, or thought processes...In the development of one person;'s mind from childhood, information is clearly not just accumulated but also generated - created from connections that were not there before (Packard, in Gleick, 1987, pp. 261-262).

This begins to sound a bit like constructivist learning theory, and indeed, educational thinkers including Piaget have been drawn to the study of self-organization. Piaget understood the development of mental schemata to be the result of cognitive disequilibrium in the face of novel environmental circumstances and the resulting accommodation and assimilation that provided for adaptive changes.

According to curriculum theorist William Doll, Piaget's theories were limited to assertions that development could not be rushed, that development occurs via internal mechanisms of action, and that when such development does occur, it happens in a sudden manner, with disequilibrium acting as a positive force (1993, p. 102). Doll has taken the curriculum implications of these theories further than did Piaget, and suggests that within the new model of reality generated by chaos theory, curriculum might rightly be conceived as a "process":

> not of transmitting what is (absolutely) known but of exploring what is unknown (1993, p. 155).

Learning and understanding, he says, are "constructed", rather than "transmitted", through dialogue and reflection, and he suggests that

> curriculum's role, as process, is to help us negotiate these passages (between ourselves and others); toward this end it should be rich, recursive, relational, and rigorous (p. 156).

Teachers and students should be free, Doll suggests, to develop their own curriculum in conjoint interaction with one another, to "self-organize" within their own situational parameters. His new vision of curriculum questions traditional assumptions about authority and epistemology, challenging both the "spectator theory of knowledge" (that reality is apart from us and is waiting to be discovered) and the analytic mode that governs our epistemology and our

pedagogy, and argues for a constructivist relationship between the knower and the known (p. 168). The questions he raises and the challenges he presents us with are far-reaching and significant. I believe however, that his conceptualization of the human subject, while moving toward a postmodern perspective, contains remnants of modernist threads in its fabric. His relational, constructivist subject, still sounds more like Dewey's autonomous, problem-solving (in community) self than like Grumet's "I as a stream of possibilities" or deep ecology's "self as a momentary configuration of energy, a local perturbation in a complex flow pattern" (Kesson, 1990). Doll's interpretations of postmodern science still place human beings at center stage, a problematic position from an ecological perspective, and fall short of situating us in a "psychic field" (as suggested by Hillman and Ventura, in Chapter One). Generative then, as the ideas of chaos theory and complex systems has been to our thinking about curriculum, it is to the work of David Bohm, a physicist and protege of Einstein's, and his theory of the "implicate order" that we will now turn, in order to extend Doll's notions of "interaction" as the key to a postmodern curriculum, to the idea of "interpenetration", a theoretical step which I believe radically challenges the notion of the human subject as autonomous individual. As well, it takes us beyond the idea of constructivism to even more

speculative assumptions about the source and authority of knowledge.

CHAPTER IV

THE HOLISTIC WORLDVIEW AND PARTICIPATING CONSCIOUSNESS

Educational ideas are embedded in particular ontologies and systematic philosophical traditions. We earlier examined two extremely influential philosophical systems that have had consequences for educational thought, Idealism and Realism. Idealism, which was discussed at some length in chapter two, represents the

> elaboration and systemization of (the) basic proposition that mind is the primary and irreducible fact of individual experience (Wingo, 1965, p. 125).

When we push back the veil of sensory experience, according to the tenets of Idealism, we find that which is ultimate in the universe to be Mind. So - the central conception of Idealism is the principle of the priority of consciousness. Though it is difficult to generalize about such a complex and differentiated tradition, most idealists are

> committed to the belief that there is a body of truth, that this truth can be known, and that it must be transmitted to the young (Wingo, 1965, p. 157).

The primary responsibility of education then, to the Idealist, is the apprehension and incorporation of value in the student's life, and the acquisition of value is primarily a matter of learning and assimilating our ethical heritage.

Realism, as we have seen, gave rise to a somewhat different understanding of educational methods and purposes. The technical, input-output model documented in chapter two, for example, is grounded in materialist assumptions that understand the human mind as a "blank slate" (Locke's "tabula rasa") upon which the environment writes its story. This commonsense view of the mind notes that sense organs convey stimuli from objects to our minds, and that this data furnishes raw material for the cognitive processes of the mind to act upon. While the Idealist then, sees consciousness as prior, privileging subjectivity as a primary determinant of human knowledge and behavior, the realist sees the material world as prior, with consciousness an "epiphenomenon" of the interaction of matter and form. Both of these perspectives neglect the full range of experience that influence thought and behavior. Both have supported essentially conservative educational ideas. Idealism has been identified with the cultural transmission model - the "Great Ideas" school of educational theory, while realism has supported a narrow, technical approach to the acquisition of information. Getting beyond these classic dualisms, not to mention reconceptualizing the

resultant educational ideas has presented difficult philosophical and practical problems.

In the remainder of this chapter, I will attempt to delineate the emergent form of a new philosophical conception of the human subject, a holistic perspective which offers a reconciliation of the Idealist/Materialist dilemma and suggests unanticipated dimensions of human experience. As we will see, this framework begins to resemble pre-scientific, animistic ideas, ironic in light of their emergence from the processes of the most sophisticated sciences. This exquisite dance of the premodern and the postmodern has generated the notion of "reenchantment" - of the world (Berman, 1984) of science (Griffin, 1988), and, I would add, of the human subject. This notion of "reenchantment" is an intriguing one, suggesting a shift from a paradigm of fragmentation to a paradigm of interconnection, interdependence, and interpenetration. In the remainder of this chapter, I will try to tease out the implications of these concepts.

Holism as "Nested Order"

Holism as a philosophical alternative to mechanism was first proposed by Smuts in his book Holism and Evolution (1926), in which he proposed a continuum of relationships

among parts from the simple to the complex, in which the unity among parts was affected by and changed by the synthesis:

> Holism is a process of creative synthesis; the resulting wholes are not static, but dynamic, evolutionary, creative...The explanation of nature can therefore not be purely mechanical; and the mechanistic concept of nature has its place and justification only in the wider setting of holism (Merchant, 1980, p. 293).

Smuts' original premise, as well as recent developments in physics, biology, and ecology, concede the explanatory power of the holistic perspective in the study of physical systems. The holistic conceptual framework becomes somewhat more problematic when human consciousness is brought into the equation, however.

Physicist Paul Davies, commenting on the extremes of dualism represented by materialism (the idea that humans behave mechanically in response to external stimuli) and Idealism (the idea that the physical world does not exist - that all is perception), suggests that

> many of the old problems of dualism fall away once it is appreciated that abstract, high-level concepts can be equally as real as the low level structures that support them, without any mysterious substances, or ingredients (1983, p. 83).

The mind, says Davies, is holistic, and exists at a higher (more complex), but equally "real" level of organization than the neurons of the brain. This two level description of the mind and the body improves on the old Cartesian idea of mind and body as two distinct substances. This mind-body continuum of experience, with no clear dividing point between the two spheres, corresponds to Bohm and Peat's idea that there is a hierarchical "nesting" of ranges of complex orders, "some of infinite degree which contain embedded within them many orders of lower degree" (1987, pp. 128-129). They utilize the written novel as an analogy for this idea of nested order, with its infinitely rich and complex order of language and its various suborders of tense, syntax, action, character, and plot. These suborders are complex, but interdependent, as they both condition and are conditioned by, the overall pattern and flow of the novel.

The whole/part relationship becomes central to this holistic model of reality, and the idea of "synergy" plays an important role. Holism, according to historian Morris Berman (1984),

> holds that a collection of entities or objects can generate a larger reality not analyzable in terms of the components themselves; that the reality of any phenomenon is usually larger than the sum of its parts (p. 353).

A contemporary educational scholar, Ron Miller, writing on

holism, tells us that

> Holistic thinking is concerned with relationships, with contexts, with meaning. It is an inclusive worldview, a phenomenological approach to human experience which takes seriously the multiple natural, cultural, social, moral, and spiritual environments within which human existence is situated. Given this frame of reference, holistic thinking is radically nonreductionistic; it aims to bridge dichotomies between mind and matter, individual and society, humanity and nature by seeing such pairs as dynamic relationships rather than logically opposed categories. (1992)

As we can see from these descriptions, holism is a "macro-concept", "distinguished by a compelling impulse toward unity" (Kesson, 1991, p. 45). These ideas challenge a centuries-old concern with a purely reductionist approach to understanding reality. In the eagerness to overcome the reductionism that has dominated the scientific endeavor, however, some scholars are embracing older, Idealist positions. Roger Sperry, Nobel Laureate, writes in a paper entitled Changing Priorities:

> Current concepts of the mind-brain relation involve a direct break with the long established materialist and behavioralist doctrine that has dominated neuroscience for many decades. Instead

> of renouncing or ignoring consciousness, the new interpretation gives full recognition to the primacy of inner conscious awareness as a causal reality (quoted in Griffin, 1988, p. 116)

Indeed, the scope of our methods of understanding reality is expanding, and "the traditional concern with prediction, control and the analysis of parts (has been subordinated to) a new concern for the way the unpredictable whole of things moves (Briggs and Peat, 1989, p. 29). The crucial question, I believe, is whether we can move into this new "holistic" paradigm without stepping into the metaphysical quagmire associated with Idealism.

Implications of the "New Physics" for Theories of Perception

As we saw in chapter three, many of the ideas that have come to us from the "new physics" have challenged the primary underlying assumptions of a long-held mechanistic view of the universe. With Einstein's Special and General Theories of Relativity,

> the idea of a time that flows uniformly across the universe was called into question, for it was shown that the notion of the flow of time depends on the speed of the observer (Bohm and Peat, 1987, p. 108).

Even though these theories only applied to macroscopic systems, moving at the speed of light, the ideas can be said

to have contributed to a postmodern movement away from absolutist thinking toward the notion that things are relative, and dependent on contexts and conditions. Uncertainty, as a fundamental component of quantum theory, has led directly to the consequence of unpredictability. This uncertainty, confirmed by Alaine Aspect in the Paris experiment of 1982, is not the result of inadequate information (as Newtonian science would have us believe) but is intrinsic to the microworld of quantum mechanics. Chaos theory has caused us to rethink our ideas of randomness and determinism, seeing them as not necessarily incommensurable, but as coexistent within more inclusive general notions of order. The Newtonian worldview of absolute time and space, stability, clockwork order and predictability has surrendered to a science and a worldview characterized by temporality, specificity, transformation, and spontaneity. This dynamic new outlook on the universe, says physicist Illy Prigogine, is characterized by the reintroduction of diversity, and therefore the unexpected (Weber, 1987).

New perceptions of the human subject, as participant in this postmodern world, have arisen as a result of this new web of understanding generated from the study of physics. Quantum theory, says Zukav,

> not only is closely bound to philosophy, but also, and this is becoming increasingly apparent - to theories of perception (1979, p. 305).

The implications, says Talbot (1986), "of quantum theory will profoundly change our understanding of ourselves and our role in the universe...equally important is its ability to transform the way we think" (p. 38). Numerous twentieth century physicists have addressed this relationship between physics and consciousness. Classical notions of "scientific objectivity" rested upon the assumption of an external world of nature existing "out there" opposed to an "I" which is "in here". The task of the scientist has traditionally been to observe the "out there" objectively, free of prejudices. The point of view that we can be without a point of view is itself a point of view, however, and both quantum mechanics and postpositivist social inquiry have called the notion of objectivity into question. Whether we are engaged in particle collision experiments or classroom observations, we can not eliminate ourselves from the picture. "We are part of nature", writes Zukav (1979), "and when we study nature there is no way around the fact that nature is studying itself" (p. 31).

> Paul Davies tells us that the quantum theory forms a pillar in what has become known as the new physics, and provides the most convincing scientific evidence yet that consciousness plays an essential role in the nature of physical reality (1983, p. 100).

According to Neils Bohr, the fuzzy quantum mechanical world of atomic reality is only brought into focus when an

observation is made - reality, in other words, only materializes when you look for it! Davies again:

> The commonsense view of the world, in terms of objects that really exist 'out there' independently of our observations, totally collapses in the face of the quantum factor (1983, p. 107).

In 1979, John Wheeler claimed that "the precise nature of reality has to await the participation of a conscious observer (Davies, 1983, p. 111). John Gribben speculated that nuclei and positrons did not exist prior to the twentieth century (since no one ever saw one) - rather, "they were brought into existence by our conception of them" (Wallace, 1989, p. 89). And in Heisenberg's words,

> What we observe is not nature itself, but nature exposed to our way of questioning (Capra, 1975, p. 126).

These are powerful arguments for the notion that our conceptualizations of the physical world, what we in fact <u>can know</u> about the world, is not only influenced by, but is in a significant way determined by, our conceptual framework (our theories), as well as by the instrumentation we bring to the study. Our conceptual frameworks are influenced by a host of complicating factors: perceptions, neuronal connections, habits of mind (conditioning), biases, and perhaps most important, language. Science, indeed, both

shapes and is shaped by our concepts about the world. We are led inescapably to the necessity of the inclusion of the study of consciousness in the study of nature, but this issue raises all of the difficult philosophical questions raised in chapter one:

> Where does knowledge come from?
>
> How do we know what we know?
>
> What knowledge is of most importance?
>
> What is the relationship between the knower and the known?

The Subject/Object Resolution

The new physics challenges us to think beyond the usual framework that posits knowledge as something "out there" to be assimilated by a knower "in here":

> The common division of the world into subject and object, inner world and outer world, body and soul, is no longer adequate (Heisenberg, in Davies, 1983, p. 112).

The world appears more and more to be not a collection of separate, but loosely coupled "things" but a complex, fluid and dynamic network of relations. Clearly, our old concepts are no longer adequate - but just what might this unanticipated unity of science and human experience suggest? Is the world really becoming "reenchanted"?

Physicist David Bohm is one of a number of scientists who have challenged the long held reductionist views. Bohm's ideas "give a scientific shape to the ancient belief that 'the universe is one' (Briggs and Peat, 1989, p. 29). The separate parts of the universe, writes Bohm,

> are seen to be in immediate connection, in which their dynamical relationships depend, in an irreducible way, on the state of the whole system (and indeed, on that of broader systems in which they are contained, extending ultimately and in principle to the entire universe). Thus, one is led to a new notion of unbroken wholeness which denies the classical idea of analyzability of the world into separately and independently existent parts (in Zukav, 1975, p. 297).

Bohm's thesis is that the mechanistic science which reduced matter to ever smaller units governed by external force is giving way to a science based on the primacy of process. Energy and relationship, in this paradigm, become more significant than discrete entities, and Bohm argues for a physics based on this new order. All describable events, objects and entities are but abstractions "from an unknown and undefinable totality of flowing movement" (1980, p. 49), an unbroken wholeness which Bohm calls the "implicate order" (from the Latin root meaning "to enfold"). This implicate order is the unmanifest field of energy, a realm of possibility and potential which he contrasts with

the"explicate" (manifest) order with which classical physics has been primarily occupied. Like a hologram, the implicate order is thought to have information distributed throughout the system. What is truly revolutionary in this new paradigm of perception and experience is the related idea that all of the potential information about the universe is "holographically encoded in the spectrum of frequency patterns that constantly bombard us" (Wilber, 1982, p. 148), and that through attunement with this frequency pattern, the human brain can access patterns of meaning and unitive consciousness. This idea will be explored more fully in the final chapter, for I believe it holds the key to a genuine transformation in our thinking about the learning process. Reality, in this framework, is described as the constant movement of form from the implicate, or unexpressed order, to the explicate, or expressed order. Bohm calls this dynamic process the "holomovement", suggesting a revaluation of our notions of non-rational states of awareness, and a fluidity of perception more reflective of older, more organic modes of understanding. This process physics, like Whitehead's cosmology, "tends to see the basic unit of reality as an 'occasion' which is constantly in the process of transformation and change" (Oliver, 1989).

Bohm proposes a new form of insight based on this notion of "unbroken wholeness", an insight that recognizes the sea of unqualified energy that backgrounds all manifest forms as well as the connections between the manifest and

the unmanifest orders. The greatest human illusion, suggests Bohm, is the mistaking of the manifest, static, and fragmented content of consciousness for the basis of reality, and the simultaneous denial of the more transitory features of the unbroken flow. This fragmented consciousness, which "treats things as inherently divided, disconnected, and 'broken up into yet smaller constituent parts" (1980, xi) is at the core of our fragmentary worldview, which is itself at the core of the numerous social, ecological, cultural, personal and intellectual crises that plague the modern world. Bohm emphasizes the importance of "destructuring the thinker", a process that would enable consciousness to flow unhindered between the explicate and the implicate orders, enabling us to "think coherently of a single, unbroken, flowing actuality of existence as a whole, containing both thought (consciousness) and external reality as we experience it" (ibid, x). Woven through his critique of rationality as a limiting form of perception is this theme of movement:

> Thus the sharp break between abstract thought and concrete immediate experience that has pervaded our culture for so long, need no longer be maintained. Rather the possibility is created for an unbroken flowing movement from immediate experience to logical thought and back, and thus for an ending for this kind of fragmentation (Bohm, 1980)

Ecological Thinking and the "New Physics"

The picture of contemporary physics revealed by Bohm's notion of an "implicate order" complements an emergent ecological worldview, "drawing mutually consistent and mutually supportive abstract pictures of nature in its most elementary and universal and its most complex and local manifestations (Callicott, 1989, pp. 51-52). Bohm's holistic field theory resembles that of eco-philosopher Arnie Naess, who says that deep ecology suggests a "relational total field image (in which) organisms (are) knots in the biospherical net of intrinsic relations (Callicott, 1989, p. 58). The implicate order corresponds to the 'relational total field image', while the explicate order suggests the "knots in the net'. The individual, or the human subject, in this ecological context, is a momentary configuration of energy, a local perturbation in a complex flow pattern. Or from Rorty's philosophical perspective, "it is to substitute a tissue of contingent relations, a web which stretches backwards and forward through past and future time, for a formed, unified present, self-contained substance, something capable of being seen steadily and whole" (1989, p. 41). Self, says Bohm (1976), is but "an abstraction from a whole movement, which thus has only a certain relative similarity or constancy of form and pattern of behavior" (p. 60). These images certainly do provide an imaginative alternative to the Cartesian psychic monad, encapsulated in a hostile and alien material sheath

and locked in a bitter struggle with a material world tempting him ever away from his "true essence".

While an understanding of the organic connectedness of biological life is an important emergent awareness, Bohm's theories go beyond this to propose that consciousness, which he takes to include thought, feeling, will and desire, is to be comprehended in terms of this implicate order also (1980, p. 196). Here is where the boundaries between the self and the "other" really begin to break down. Again, let's turn to the discipline of eco-philosophy to explore this idea.

Ecologist Paul Shepard suggests that the relational concept of the self "extends to consciousness as well as organism, to mind as well as matter" (Callicott, 1989, p. 63). From a "deep ecological" (the philosophical, as opposed to the resource management) perspective, the boundaries between self and other become blurred with the awareness, mentioned before, of the body as a momentarily stable configuration in a vast sea of fluctuating energy patterns. Notions of separation become even more untenable when we understand that the structure and content of the psyche have evolved, as Shepard suggests, through interactions with rock, plant, sea, sky and animal. John Seed suggests a developmental framework for the maturation of ecological thinking when he says

> there is an identification with all life...alienation subsides...'I am protecting the

> rain forest' develops to 'I am part of the rainforest protecting itself'...to 'I am that part of the rain forest recently emerged into thinking' (Callicott, 1989, p. 64).

This kind of thinking represents a genuine convergence of the isolated subject and the object of perception, an almost mystical unification induced by full participation of the knower with the known. No less than this is called for by David Bohm. If we continue to think of the world as separate from ourselves, he says, "constituted of disjoint parts to be manipulated with the aid of calculations", as in the Cartesian paradigm, we become separate, alienated beings, whose main motivation toward each other is control and manipulation. But if we perceive

> an intuitive and imaginative feeling of the whole world as constituting an implicate order that is also enfolded in us, we will sense ourselves to be one with the world...we will feel genuine love for it (Griffin, 1988, p. 67)

The whole world, according to Bohm, "is internally related to our thinking processes through enfoldment in our consciousness" (ibid, p. 67). It requires a quantum leap for us to begin to think that the human mind might possibly encode all of the information, holographically, that is available in the universe. It would certainly lay to rest the "tabula rasa" (blank slate) theory of the mind forever. Older, Absolutist ideas would fall by the wayside too, as we

come to understand the dynamic and ever-shifting qualities of the relationship between the implicate and the explicate order. Bohm's ideas raise a whole host of philosophical, empirical, and theoretical issues to be solved, but like the theories of relativity, uncertainty, and chaos, his ideas provide enormous explanatory power because of their inclusivity. One of the key issues in this new paradigm is the development of a psychology adequate to the transpersonal and cosmological dimensions of the theory. And so, we turn, to chapter five, to some of the more promising investigations into the realms of human experience suggested by this holistic, participating worldview.

CHAPTER V

ENTERING THE MYTHOPOETIC:RECONCEPTUALIZING MIND IN A HOLISTIC UNIVERSE

> ...the human kingdom, beneath the floor of the comparatively neat little dwelling that we call our consciousness, goes down into unsuspected Aladdin caves. There not only jewels but also dangerous Jinn abide: the inconvenient or resisted psychological powers that we have not thought or dared to integrate into our lives...
>
> (Campbell, 1972, p. 8)

In her recent (1992) book, Women Who Run With the Wolves, Clarissa Estés, a contemporary psychoanalyst and storyteller, introduces us to the mythic entity, "La Loba", an archetypal personification of the 'old wise woman beyond time' who stands between the worlds of rationality and mythos. Assuming various mythic forms through the centuries (Mother Nyx, Durga, Coatilique, and Hecate), this archetypal feminine energy serves as a "feeder root to an entire instinctual system" (Estés, 1992, p. 29), mediating between

the cthonic realm of the psyche and the 'upper world' of the ego. Swiss psychologist C.G. Jung termed this locus between the worlds the "psychoid unconscious" and considered it "a place where the biological and the psychological share headwaters, where biology and psychology might mingle with and influence one another" (Estés, 1992, p. 31). In more poetic terms, Estés, a Jungian analyst, describes this mythic dimension as

> the place of the mist beings where things are and are not yet, where shadows have substance and substance is sheer (1992, p. 30).

In Jung's topography of consciousness, the La Loba archetype occupies a central role in the dialectic between the conscious mind and the unconscious, forging a dynamic link between the social self, or "persona" and the subterranean streams of desire, dream, prehension, fantasy and imagination. This conversation between the various layers of the psyche, which Jung documented in many of his patients long after they were "cured" in the ordinary sense of the word, is central to what he called the "individuation process". I understand "individuation" as a process of exploration in which unincorporated aspects of the psyche (Jung referred to these as the "shadow") are brought to light, making whole what was fragmented:

> To be whole means to become reconciled with those sides of personality which have not been taken into account...no one who really seeks wholeness can develop

> his intellect at the price of repression of the unconscious, nor, on the other hand, can he live in a more or less unconscious state (Fordham, 1966, p. 77)

In a 1974 paper entitled "A Transcendental Developmental Theory of Education", curriculum theorist James Macdonald suggested that the appropriate psychological attitude for the coming age would be "a psychology of individuation" (p. 176). Macdonald was intrigued with the psychology of Jung, eschewing more narrow empirical and developmental views that led away from our ontological ground of being. In this chapter, I will begin by elucidating the more important aspects of Jung's complex depth psychology, then pursue Macdonald's idea that the notion of "individuation" should be considered in what he called the "transcendental developmental ideology". I will explore the connection between the movement "toward the integration of inner and outer reality in a meaningful wholeness" (Macdonald, 1988, p. 182) and Bohm's "undivided wholeness in flowing movement" (1980, p. 11). I will look briefly at two of the writings that deal specifically with the relationship between physics and consciousness: the first, a text co-authored by C.G. Jung, the psychologist and Wolfgang Pauli, the physicist, called <u>The Interpretation of Nature and the Psyche</u>, in which Jung explored the idea of synchronicity as an important new category for scientific investigation; the second, physicist Fred Wolf's study of

the relationship between shamanism and physics. Finally, I will conclude with speculation about what these ideas might mean if we were to seriously consider them in our thinking about teaching and learning.

Jung's Structural Model of the Psyche

Jung was at one time an avid student of Freud's work, then later an enthusiastic colleague and supporter of his ideas. In the beginning of their association, Jung was a respectable member of the European psychiatric establishment while Freud was suspect for his highly speculative ideas (Singer, 1973, p. 84). A decade later, Freud was recognized as a giant in the world of psychology, Jung was dismissed as a speculative philosopher, and their relationship had disintegrated. The split occurred largely as a result of Jung's most original and still controversial discovery - that of the collective unconscious. Whereas Freud viewed the unconscious primarily as a dark repository of suppressed infantile sexual impulses, Jung came to understand it as a vast and fertile reservoir of archaic images and primal impulses,

> a kind of infinite area within man (sic), a spaceless space...more primal, more archaic, more primordial still than materiality (Progoff, 1973, p. 166).

This aspect of the psyche has remained largely elusive to reductive analysis, because it is, for the most part, out of

reach of intellectual formulations. Jung acknowledged the difficulty of apprehending the totality of psychic experience through the intellect, and recognized that he had tapped into an area of human experience with which science was largely unequipped to deal:

> the individual imagines that he (sic) has caught the psyche and holds her (sic) in the hollow of his (sic) hand...He is even making a science of her in the absurd supposition that the intellect, which is but a part and function of the psyche, is sufficient to comprehend the much greater whole (Singer, 1973, p. 371).

Reference to this "Ground of Being" (the totality of psychic experience) is found in the collection of traditions termed by Leibniz the philosophia perennis, which contains the historical record of mystical experience (Huxley, 1944). However, some of the most systematic empirical investigations into this realm of experience come to us from the analysis of dreams begun by Jung in the early part of the century, and carried on by analysts of that tradition. Though these studies suffer from all the complexities and ambiguities of earlier studies based on introspection (see Chapter two), the huge quantity of data gathered by Jung during his many years of investigation revealed certain universal structural qualities of consciousness.

The structure of the psyche deduced by Jung can perhaps best be apprehended with the help of a visual image. If we can imagine the collective unconscious (the inherited

psychic substratum prior to personal experience) as the ocean; the ego (defined by Jung as "the complex of representations which constitutes the centrum of my field of consciousness and appears to possess a very high degree of continuity and identity" (Progoff, 1973, p. 72) as the visible tops of islands; and the personal unconscious (lost memories, repressed ideas, subliminal perceptions, etc.) as the wet and sandy shoreline that connects individual experience with the undifferentiated substratum of psychic experience, we can begin to get a sense of the complexity of his model. Jung perceived these various categories of consciousness as having "permeable barriers" in that the material from the "ocean" of the unconscious continually laps at the shores of the ego, reshaping and reforming its terrain, conversely, aspects of personal consciousness are washed down into the undifferentiated depths of the psyche.

Jung claimed the "Self" as a sort of organizing center, the totality of the psyche (distinguished from the ego, which only constitutes a small part of it) (Jung, 1964, p. 162), and suggested that this "Self" (originating as "inborn possibility") performs a regulating function between the unconscious and the ego that brings about the extension and maturing of the personality. This notion of the Self appears to correspond with various mystical concepts - the Greek "Daimon", the Egyptian "Ba-Soul, or the Hindu "Atman" (Jung, 1964, p. 162). Jung came to understand this regulatory function of the Self on the basis of his study of

over 80,000 dreams. The process of analysis developed in this theoretical framework concerned itself with the constant interplay between consciousness and the unconscious, with the

> bringing (of) order out of disorder, purpose out of aimlessness, and meaning out of senselessness (Singer, 1973, p. 12).

Jung's model of the psyche does indeed seem to support the notion of "self-organization" (see chapter three, on chaos theory), with its idea of an organizing "center" of consciousness, capable of bringing fragments of experience into a developmentally coherent pattern.

The Individuation Process

The successful integration of the inner and outer realities known as the individuation process constitutes the central goal of Jungian analysis, and it is this developmental goal that we need to keep in mind when we begin to theorize about the relationship of such an expanded developmental theory to our thinking about teaching and learning.

The inner guiding factor, or Self, according to Jung, was best apprehended through the investigation of one's dreams - spontaneous psychic products which establish themselves through images and symbols. In his extensive investigations into his patients' dreams, Jung noted

invariant patterns of symbolic expression, which led him to formulate the idea of archetypes,

> basic elemental tendencies of the human personality which produce certain specific kinds of thinking patterns common to the entire human species (Singer, 1973, xxxii-xxxiii).

He found these collectively experienced patterns coincidental with certain well-defined themes and records of human mental activity known to us through the various mythic traditions. Joseph Campbell, the well known modern proponent of the mythic tradition understood the important connection between depth psychology and the logic of myth:

> Dream is the personalized myth, myth the depersonalized dream, both myth and dream are symbolic in the same general way of the dynamic of the psyche (Campbell, 1973, p. 19).

In myth, as we know, as well as in dream, the explorer encounters perils and obstacles as well as treasures. Sibylle Birkhauser-Oeri speaks to the challenges inherent in the individuation process:

> (it is) a psychological pattern of development that leads one into a confrontation with one's shadow side and with evil, and also involves owning up to unrealized potential (1988, p. 23).

This encounter with the "shadow" - aspects of personality that have been omitted or suppressed, and which need to be assimilated in order to effect the integration of the

personality - suggests a kind of complementarity of opposites, a common enough theme in numerous mystical traditions. The necessity of integrating the shadow sounds somewhat arcane, but it can be understood in terms of commonly understood psychological principles. Modern, bureaucratic society encourages the construction of one-dimensional "personas" (the masks we wear to assume particular roles in society): the corporate manager who must appear all efficiency and productivity, the minister expected to consistently reflect goodness and light, the mother who exemplifies nurture and self-sacrifice, the academic for whom all areas of life are amenable to rational analysis. The shadow then, becomes "that part of us which we will not allow ourselves to express" (Singer, 1973, p. 215). The danger of suppressing the shadow (Jung sometimes called it the "inferior" part of the personality) is that

> when the unconscious counteraction is suppressed it loses its regulating impulse. It then begins to have an accelerating and intensifying effect on the conscious process (Jung, 1969, p. 79)

The shadow, when denied, finds its own expression, generally in the activity of "projections" - "what we cannot admit in ourselves we often find in others" (Singer, 1973, p. 215) - or in impulsive or inadvertent acts. Jung writes of the centrality of coming to terms with this aspect of the unconscious:

> The shadow is a moral problem that challenges the whole ego-personality, for no one can become conscious of the shadow without considerable moral effort. To become conscious of it involves recognizing the dark aspect of the personality as present and real. The act is the essential condition for self-knowledge, and it therefore, as a rule, meets with considerable resistance. Indeed, self-knowledge as a psychotherapeutic measure frequently requires much painstaking work extending over a long period(Singer, 1973, p. 215).

Individuation as Spiritual Process

Jung understood the ego-personality's coming-to-terms with its own background (the shadow) as essentially a spiritual act, corresponding with the unio mentalis or alchemical union of spirit and soul (Jung, 1963, p.497). Further, he suggested that religious doctrines have all sprung from such primary spiritual experience. This point has of course been challenged by some religious historians and theologians who prefer to believe in the revelatory origins of their particular creeds. Marie Louise von-Franz, however, cites a number of examples from various cultures in which rituals and religious customs have sprung directly from the dreams and visions of individuals. She

demonstrates how these experiences evolve through time, until the original unconscious material crystallizes into clearly defined and repeatable forms, which can be shared with the group, and passed down from generation to generation (Jung, 1964, p. 252). Increasingly, of course, participants in the rituals have no personal knowledge of the original experience, and once meaningful rituals can become dry and lifeless forms. This Jungian conceptualization of the origin of organized religious forms articulates an important difference between religion and spirituality, and highlights an inherent tension between them: while the spiritual process invites an idiosyncratic and unpredictable experience of archetypal energy, religion, more often than not, codifies and sanctions particular archetypes, especially those that serve social needs for order, continuity and stability. I would clarify this difference by describing spirituality as a dynamic, exploratory 'process' and religion as the structured 'form' that emerges to contain, and to some extent control the process.

The above distinction is not meant to privilege spiritual process and discredit religion. The practice and repetition of the original experience, according to Jung, need "not necessarily mean lifeless petrification" (1958, p. 9) - on the contrary, rituals and religious customs may continue to provide a vital context for genuine spiritual experience for centuries. However, most religious

traditions "resist further creative alterations by the unconscious" (Jung, 1964, p. 253) and remain reproductions of one person's individuation experience. I would suggest that it is this incapacity to sustain a dynamic link between their mythic and symbolic constructions and the personal psychological processes of their adherents that accounts, at least in part, for the diminishing relevance of formal religion in many people's lives.

Despite his skepticism about formal religion, Jung had a lifelong interest in the religious impulse, with its infinite variety of forms, symbols and motifs, and in the modern search for meaning which has accompanied the decline of formal religion. He preferred not to think of "God" as an entity, but concerned himself with the "God-images" constructed in his patient's psyches (a Christian theologian once called him a "religious naturalist" (Segaller, 1990, p. 23). We are reminded here of the primacy of the human psyche in the pursuit of religious meaning:

> Without a human psyche to receive divine inspirations and utter them in words or shape them in art, no religious symbol has ever come into the reality of our human life (Jung, 1964, p. 253).

To Jung, the modern discovery of the unconscious, fully grasped, excludes the idea of a transcendent and knowable spiritual reality outside the mind of the human perceiver (Jung, 1964, p. 253), and suggested a Self that is less a

transcendent entity than it is what Grumet calls an "I as a location of a stream of possibilities" (1988, p. 66). The"transcendent function", in Jung's framework, did not signify the achievement of some otherworldly, disembodied condition, rather it involved "the transition from one psychic condition to another by means of the mutual confrontation of opposites" (Jung, 1958, p. 489). It encompasses both process and method:

> The production of unconscious compensations is a spontaneous process; the conscious realization is a method (Jung, 1958, p. 489).

Indeed, it was Jung's phenomenological methodology and his willingness to cope with all forms of psychological manifestation in human activity that attracted Macdonald to his ideas, ideas which have admittedly undergone much revision, especially in the last twenty or so years. Some of the most lucid critique has come from feminist scholars who have challenged the essentialist underpinnings of the principles of the anima and the animus (Spretnak, 1982), and who have questioned the supposedly transcendent and therefore "anti-body" nature of the archetypes (Goldenburg, 1989). While I celebrate the revision of Jung's culturally constructed gender biases (and they were many!), I am less certain of the critique around the notion of archetypes. I am inclined toward Joseph Campbell's understanding of archetypes as biologically grounded:

> The archetypes of the unconscious are manifestations of the organs of the body and their powers (1973, p. 51).

In "The Spiritual Problems of Modern Man", Jung himself seemed to challenge the dualism of the mind/body split. We must, he says,

> reconcile ourselves to the mysterious truth that the spirit is the life of the body seen from within, and the body the outward manifestation of the life of the spirit - the two being really one.

I am mindful here of Merleau-Ponty's articulation of the "Flesh" - a schema which roots the body as a local "opening" and "clearing" in the multidimensional field of being (Levin, 1985, p. 67). This multidimensional "field" of being is consistent with the holistic view of the universe propounded by Bohm and other physicists. Body, in this framework, can be understood as the most dense expression of an increasingly subtle, seamless network of relations extending in principle to the entire universe. A pre-ontological attunement to "Being-as-a-whole", woven into embodiment, facilitates the connection with primordial archetypal energies. It suggests a movement beyond the traditional metaphysical categories in which we have been stuck: materialism/spiritualism, physicalism/transcendentalism, empiricism/idealism, and mind/body to name just a few of the more thorny problems in philosophy.

Synchronicity and Holism

This reconceptualized psycho/physical model of the human subject provides us with a theoretical perspective that might explain some of the many anomalies (understood by Kuhn [1962, p. 52] to be instances when nature violates paradigm-induced expectations) that have arisen in psychology, transpersonal psychology, and para-psychology. For example, Jung documented numerous instances of synchronicity in the experiences of himself and his patients. He defines synchronicity as

> the simultaneous occurrence of a certain psychic state with one or more external events which appear as meaningful parallels to the momentary subjective state - and, in certain cases, vice versa (1955, p. 36).

"Meaningful parallels" are attributed to chance in a random universe characterized by inert particles linked by linear chains of cause and effect. On the other hand, in an Idealist universe, the coordination of the psychic and the physical are seen as an act of God, or of some principle standing outside of empirical nature. In the holistic model of the universe, however, characterized by "interpenetrating networks of relationships", meaningful parallels or "orderedness" derive from the model itself. Synchronicity, says Jung

> is not a philosophical view but an empirical concept which postulates an intellectually necessary principle. This cannot be called either materialism or metaphysics...If the latest conclusions of science are coming nearer and nearer to a unitary idea of being, characterized by space and time on the one hand and by causality and synchronicity on the other, that has nothing to do with materialism. Rather it seems to show that there is some possibility of getting rid of the incommensurability between the observed and the observer. The result, in that case, would be a unity of being which would have to be expressed in terms of a new conceptual language.

(For just such a discussion of new language possibilities, I would refer the reader to David Bohm's proposal for the "rheomode" (rheo, from the Greek verb meaning "to flow"),

> an experiment in the use of language, concerned mainly with trying to find out whether it is possible to create a new structure that is not so prone to fragmentation as is the present one (1980, p. 31).)

Synchronicity, for Jung, should be added to the scientific categories of space, time, and causality to create a more inclusive theoretical framework for understanding psychophysical parallelism.

Shamanism and the New Physics

Perhaps no other physicist has wandered so far from the accepted pathways of science as Fred Wolf, author of numerous books on physics (Parallel Universes, Taking the Quantum Leap, The Body Quantum). In a recent (1991) book, The Eagle's Quest, Wolf explored the relationship of new ideas in physics to traditional shamanistic ideas, through direct participant-observer research. With his vast knowledge of theoretical physics, and a healthy skepticism, he stepped foot into the mythic dimensions of the psyche with a number of practicing shamans from a variety of cultural traditions. He discovered that the way the shamans saw the world was remarkably similar to the way twentieth century physicists saw the world:

> Quantum physics, like the shamanic belief, indicates that the universe is also made from vibrations and that everything in it is connected by these vibrations (p. 24

Shamans, says Wolf, don't just see things interacting in cause and effect relationships, but as a spider's web of interconnectedness corresponding to the physical theory of "non-locality" (the idea that things taking place here can affect things there in an acausal way). How are events connected to every other event? Wolf explains that objects move as waves in the universe until they are observed.

Consciousness, or the act of observation "collapses the wave function", making what was implicate explicate. Between the causative event and the effect, all possible paths emerge. According to the quantum theory (p. 145), some of these possibilities are remote and require more action. Unobserved objects occupy multiple paths simultaneously, but with observation, one of them emerges (becomes explicate) and becomes a "groove" or habit. Habits of mind arise, says Wolf, through the creation of least action paths. Paths that become habitual become unconscious and we begin to behave in self-consistent loops.

Shamans are able to effect healing, or individuation (the bringing to consciousness what has been buried) by their ability to enter the mythic realm of probability - by choosing non-ordinary reality, they are able to break the laws of habitual observation, freeing their clients of self-destructive habitual thought patterns. To experience this mythic dimension, says Wolf, we must 1) acknowledge its reality, and begin to recognize the information that comes from it, and 2) learn to shift our focus from the foreground (the explicate order) to the background (the implicate order). Through self-observation we can learn to extend the self beyond the boundaries we set up.

Wolf speculates that the memory of atoms is contained in their energy patterns, and suggests that our unconscious minds break down probability waves of energy into energy forms called archetypes. Clearly, this idea corresponds

with Jung's theory that by connecting with archetypal images at the very deepest layer of consciousness extends the notion of self into the realms of the transpersonal and the cosmological. Shamanic physics, says Wolf

> consisted of all the experiences in consciousness that result from seeing the universe as a gigantic hologram or spider's web...by extending one's belief system, it was possible to reconnect with the whole universe - to become one with everything (p. 295).

I quote Bohm once again:

> But if we can obtain an intuitive and imaginative feeling of the whole world as constituting an implicate order that is also enfolded in us, we will sense ourselves to be one with the world. We will no longer be satisfied merely to manipulate it technically to our supposed advantage, but we will feel genuine love for it. We will want to care for it, as we would for anyone who is close to us and therefore enfolded in us as an inseparable part (Griffin, 1988, p. 67)

The story of science has indeed changed. To think that physics would have ever stretched to encompass the mythic dimensions inhabited by shamans is quite remarkable. But we have clearly entered into territory from which there is no turning back. As early as 1930, Arthur Lovejoy wrote

> So little seems to be left of the physical world of the older realism that the residuum may hardly appear worth salvaging (p. 266).

Indeed, as Sir James Jeans so lucidly expressed it, "the universe is beginning to look more like a great thought than a great machine". The philosophical implications of this new science are perhaps best illuminated by physicist Sir Arthur Eddington in his statement "something unknown is doing we don't know what"!

Individuation as a Developmental Goal

When we begin to think of the process of individuation as a developmental possibility, we need to keep in mind the fact that Jung perceived it to be a mid-life activity. I find it, therefore, particularly relevant to the continuing education of teachers, and only indirectly pertinent to our work with younger students. In my work with both pre-service and practicing teachers, many of whom are at a mid-point in their lives, I am growing to appreciate the profound importance of creating opportunities for the kind of growth and exploration intrinsic to the individuation process. Jung was clear on what was of primary importance to teaching and learning, and that was the *relationship* between the teacher and the student. Because of the subtle, but genuine effects of the unconscious mind of the teacher

on the student, he felt that the teacher should be engaged in the process of self-discovery and healing:

> no principles, however sound, no clever technique or mechanical aids can replace the influence of a well-developed personality (Fordham, 1966, p. 112),

and he suggested that it would be to the real advantage of their students if teachers were to learn more about their own inner lives. In accordance with this thinking, I have found that opportunities for renewal, rejuvenation, and creative expression are at least as vital to the professional development of teachers as new methodologies, more sophisticated theoretical frameworks, or increasing attention to rational, critical analysis (this is not to discount the importance of any of the above, but rather to subordinate them to the more inclusive process of individuation).

I am fortunate to work in an institution with an explicit commitment to the education of the whole person, which has given me an opportunity to put these ideas into practice. I am increasingly convinced that creating a secure space in which teachers can explore personally meaningful aspects of the individuation process is fundamental to the development of teachers with vision, purpose and the courage to advocate for the best interests of their students. In an integrated curriculum course that I teach, a primary requirement is that each teacher immerse

herself in the practice of any art form for the entire semester, one that they have a passion for, but have not given themselves the time to pursue. They keep reflective journals about the activities and their responses to the work. Over and over, I have observed this process open up new psychological horizons and suggest radical shifts in their thinking about teaching and learning. Words that collectively emerge from the group at the end of the semester to describe the process inevitably include "journey", "discovery", "affirmation", "transformation", "opening" and "community". All of the elements of the classic mythic quest are present - venturing forth into uncharted territory, overcoming obstacles and perils, battling the shadow (often composed of self-doubt, inadequacies, fears of failure), accepting the shadow as part of oneself and transforming it, discovering a great treasure and bringing it back to the community (often the students they teach).

One of my graduate students writes eloquently in his journal of the relationship between his own spiritual process and his changing ideas about teaching:

> In response to the following quote: "There are many ways to allow processes to unfold, but perhaps the most essential way is to stay with the edge, with the awareness of the group's forbidden communication" (Gablik & Dissanayake, 1992): I find this true on two levels: First, in my own

art process I often find myself transported back to my years growing up at home; there lie the impressions of a world bound up by much forbidden communication, of truths neglected, conflicts unresolved, growth deferred. Even in my dreams I find myself stunted in these years and so if my writing is going to purchase my integrity, if it's to be a dynamic reflection of me dealing with my edge, then I find myself needing to invest in creative ways to revisit the scenes of my boyhood and try to open up a dialogue with the forces that stifled my home, school, church, etc. And so, for example, with the piece entitled "Holy Water" included with this work, I felt very much back in the rural church I grew up in, trying to address the stagnation of the ritual and of people handing over their faith to a lord and in so doing divesting their own responsibility to the depths of spiritual growth. To attempt an examination of this stagnation was to trespass into a forbidden communication...so I'm left trying to engage this dialogue through my art, trying to break down the walls of unconsciousness with a sort of craftiness...in some sense, I'm still the pissed-off child who retreated into reticence because I didn't have words that had a chance of being heard. And now in my lonely cabin in the

> woods, I'm still trying to come up with the words, the images that carry the truth and beauty that transcend the petty, belittling conflicts my ego is locked into.
>
> Secondly, within the group dynamic, especially the classroom, I'm becoming more and more aware of the lines or thresholds or limitations that can become imposed on the group by its fears, insecurities, cautiousness, or simply entropy. In this case, the forbidden communication is the unwillingness to take the risk of exposing one's experience, of coming out of a cynical, detached position, of experimenting with one's own sense of breakdown or vulnerability - of telling one's story. It is, I believe, in pushing out these lines a little further that consciousness is expanded, that the group dynamic feels the strength and vitality of someone venturing out of their walls - and learning becomes a personal and a communal experience. (Steve Lawless, personal journal)

A teacher thus actively engaged in his or her own exploratory process is potentially more appreciative of the exploratory impulses of their students. To clarify this assertion, I'll return to my earlier distinction between spirituality and religion, and examine teaching and learning models germane to each perspective. In most traditional

religious models, especially those identified with dominant patriarchal forms, the primary epistemological model is that of revealed truth. There is a static quality to the available knowledge - it exists prior to and outside of experience. The representatives of the tradition, be they priests or preachers, serve as mediators of religious experience, as theystand between God and the supplicant:

> A priest is a functionary of a social sort. The society worships certain deities in a certain way, and the priest becomes ordained as a functionary to carry out that ritual (Campbell, 1973, pp. 99-100).

Obedience to the Divine will of a Father-God is a central motif in contemporary religions, and "fear, guilt and alienation are some of the results" (Spretnak, 1982, p. xvi).

It's difficult not to draw parallels between this particular description of formal religion and our relatively universal approach to schooling. Despite some lip service to experience and an occasional nod to the "affective domain", education primarily concerns itself with bodies of knowledge which exist prior to and largely outside of student experience. Teachers, often as not, serve as functionaries, carrying out the rituals of an overly-bureaucratized society: standardized tests of basic skills, lessons in appropriate social behavior, etc. If students follow the prescribed behaviors, they may receive

rewards (though these may seem as distant as Judgement Day!) and if they don't obey the strictures from "on high" they might indeed suffer from fear, guilt and alienation.

A second cluster of experiences, loosely termed "integrative" or "holistic" exemplify a more experiential approach to spiritual experience, and more closely correspond with the Jungian quest for psychological wholeness. These would include, according to Spretnak (1982), women's spirituality, goddess spirituality, Wicca, Native American spirituality, Taoism, some forms of Buddhism, Sufism and Yoga, with all of their numerous variations. Within these traditions, experience <u>is</u> "the stuff of wisdom and growth *as an ongoing process*" (p. xvi). Authority in most of these traditions is most often diffused, and spiritual energy is considered "immanent" as opposed to, or as well as, transcendent. Shamanic practices fall within the purview of this latter set of traditions, and it is revealing to compare and contrast the qualitatively different role of a shaman in the teaching and learning situation with that of a priest. Campbell informs us that unlike the priest, who serves a deity who was there before he came along,

> the shaman's powers are symbolized in his own familiar, deities of his own personal experience. His authority comes out of a psychological

> experience, not a social ordination (1973, p. 100).

Like the Jungian analyst who has accomplished extensive work on him or herself, the shaman has traversed the terrain of their own unconscious and can therefore serve as "guide" to the uninitiated. Every journey into the unknown, however, even for the experienced traveler, is a step into mystery. It is this very uncertainty, this risk, this commitment to an unpredictable and unfolding process that we must become comfortable with if we are to approach the possibility of "spirituality in education". Jung describes the attitude of the ancient alchemist, and it (somewhat modified) seems pertinent to the modern teaching and learning situation within a spiritual paradigm:

> Here is a (student) before me whose nature is unknown to me. The nature of the contract to which we will commit ourselves is also unknown to me. And the goal, the end of the process, is equally unknown (1968, p. 393).

Whether we ascribe to one or the other of the teaching and learning models exemplified by the two qualitatively different clusters of spiritual experience outlined above, what is most important is that we understand that even secular educational theories are grounded in often unconscious ontological and epistemological assumptions that must be made explicit if we are to effect any lasting and significant transformation of the educational process.

Art, Archetypes and the Spiritual Process

In the paper in which Macdonald developed his ideas on the transcendental developmental ideology of education, he prophesied that the

> human race is beginning to take another major step into the unknown source of its imagination...that we may be rapidly approaching a new level of psychological and cultural growth from which dramatically new understandings of human potential will emerge (1982, pp. 176-177).

I suspect if he were alive now, he would be somewhat disappointed in the direction much of the "human potential movement" has taken, with some of its more indulgent forms of "self-realization" and the commodification of genuine spiritual impulses. Macdonald called for a balanced approach to spiritual development with the radical "centering of the person in the world", engaged in the dual dialectic between both the individual and the environment and the individual and herself. He suggested that if psychology was to be useful to educational thinking, it must move away from narrow empirical or developmental views, and focus upon the ontological question of human being - "psychological theory must be grounded in existence and utilize the methods of phenomenology if it hopes to cope with Being" (1988, p. 181). He was particularly intrigued with Jung's methodology, and considered that the "centering"

process, which he saw as a psycho-social process, could only occur if the doorway to the unconscious mind is "unlocked and left ajar...the process draws its power and energy from sources that are not completely explicable" (1988, p. 187). Clarissa Estés, whose La Loba character we meant in the introduction to this essay, also alludes to the mystery and ineffable nature of this source while suggesting some fruitful ways of tapping into it:

> this land between the worlds is that inexplicable place we all recognize once we experience it, but its nuances slip away and shape change if one tries to pin them down, except when we use poetry, music, dance or story (1992, p. 30).

It is through the various expressive arts that we might begin to reconceptualize what is genuinely basic to the educational process within a transcendental developmental framework for educational theory. These forms of expression, now thought by some theorists to embody distinct intelligences (Gardner, 1983), open the doorways of perception, connect us with archetypal energies, provide shared frameworks for the enactment of archetypal motifs, and embody shared cultural symbols through which to communicate inner experience. This fourfold process - of perception, connection, enactment and symbolization deserves consideration in an educational theory that holds the individuation process (the quest for psychological wholeness) as a developmental goal.

Contemporary Jungian therapies utilize a variety of artistic and imaginative processes to bring the contents of the unconscious into explicit form - painting, sculpture, sand play, story, active imagination and to a lesser extent, movement. The art therapy world owes a great deal to Jung's influence. Hans Prinzhorn, in his (1972) study of the art work of mental patients suggested that

> creative expression is a spontaneous and unconscious effort of the soul to treat itself in keeping with a 'uniform metaphysical instinct'" (McNiff, 1992, p. 17).

Dance therapists understand that repression and emotional blocks lodge in the musculature of the human body, and they work with expressive movement to unblock rigidified energies.

Jung himself, in his initial investigations into his own psychic processes, struggled to express his overpowering dreams and visions through painting, sculpture and word:

> To the extent that I managed to translate the emotions into images - that is to say, to find the images which were concealed in the emotions - I was inwardly calm and reassured. Had I left those images hidden in the emotions, I might have been torn to pieces by them...as a result of my experiment I learned how helpful it can be, from the therapeutic point of view, to find the

particular image which lie behind the emotions (1963, p. 177).

As a culture we have come to view the arts as a mere decoration or the gratification of self-expression. Art has, as Dewey long ago suggested, become separated from the main currents of lived experience. In evolutionary terms, however, these are relatively recent developments (Dissanayake, 1988), in contrast to the original intents of the world's ancient and contemporary primal peoples, who prioritize the arts in everyday life as "powerful vehicles of personal and collective transformation" (London, 1989, p. 8). The healing systems of Tibetan harmonic singing, and the ritual of Navajo sand painting come to mind as models of the creative use of sound, form and color to effect the individual as well as the communal healing process. Heide Göttner-Abendroth (1982), in her analysis of an emerging modern matriarchal aesthetic, speaks of the primary importance of images and symbols in the transformation of psychosocial reality.

To suggest that we begin to understand the expressive arts as "the chance to encounter dimensions of our inner being and to discover deep, rewarding patterns of meaning" (London, 1989, p. 7), raises the important question of the boundaries between education and therapy. I wish I had an easy answer to this question. As I work increasingly in more "holistic" ways with students, utilizing the expressive arts to make contact with deeper layers of personal meaning,

I am at once convinced of the educational necessity of doing so, and humbled by the additional responsibility. When we deal with the archetypes, we "conjure the gods", and certainly it must be approached with an attitude of respect and reverence. We must, in spite of the difficulties, recognize that we live in a broken world, one desperately in need of healing, one which has lost touch with its very roots of Being - and respond in ways which are commensurate with the depth of the crisis. Jung made us aware that it is usually a precipitous personal crisis that propels the human being into the quest for personal wholeness. Perhaps we have reached such a cultural crisis, one which will demand a "collective individuation process" of us.

La Loba, the Wolf Woman, lives alone in the desert. Her sole work is the collecting of bones. She gathers the old parched bones together and when the last bone is gathered, she sits by the fire and thinks about what song she will sing. At last she assembles the bones into an entire skeleton, sings over them, and restores the furry, pulsing, hungry life to the wolf - "she is known to collect and preserve especially that which is in danger of being lost to the world" (Estés, 1992, p. 27).

While religion can rightly be challenged for its historical oppressions, the recovery of the mystical, primordial roots of tradition is potentially emancipatory. Philosopher David Levin (1985) reminds us that ancient spiritual teaching speaks in the mythic archetypal language

of the body's ontological understanding of Being. We must, however, remember how to sing over the bones.

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