A CRITICAL INVESTIGATION OF POSITIVISM:
ITS ADEQUACY AS AN APPROACH
FOR ACCOUNTING RESEARCH

DISSERTATION

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This dissertation addresses the influence of "positivism" in accounting research. Accounting research has been overwhelmed by "positivism" to the extent that the "scientific method" has become sacrosanct. The dysfunctional consequences include the extreme emphasis placed on methodology. Researchers believe that the methods applied, rather than the orientations of the human researcher, generate knowledge. This belief stems from an extreme objectivist ontological orientation. A second consequence of the "positivistic" influence is a change in direction of intellectual inquiries. Obsession with measurement and quantification has all but eliminated concern for values.

Specifically this dissertation asserts that the "scientific method" has been misapplied and misunderstood. The misapplication is that a method developed in the natural sciences has been blindly accepted and endorsed in the social sciences. It has been misunderstood in the sense that the abstract Cartesian-Newtonian view of reality has been mistaken for reality itself. The ontological assumptions inherent in this view have become integrated
in the Western mind. The axiomatic nature of these assumptions have been ignored.

The primary purpose of this dissertation is to project a point concerning research and knowledge. Hence, there are no "research findings" in the conventional sense. Section I discusses the influence of "positivism" in Western society in general and in accounting research in particular. Section II offers a careful, studied demonstration of the evolution of "positivism." Two key philosophical approaches to "reality" and human "knowledge" are also offered. These are the i) "hard" science of physics and ii) the soft philosophy of Eastern mysticism. Modern physics has radically altered the physicist's view of reality. Likewise, longstanding Eastern philosophical concepts are receiving increased attention. These concepts are discussed in Section III. Section IV applies the ideas developed in Sections II and III to examples of accounting research.
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CHAPTER I

INTRODUCTION: THE INFLUENCE OF POSITIVISM IN WESTERN
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RESEARCH IN PARTICULAR

The history of thought and culture is, as Hegel showed
with great brilliance, a changing pattern of liberating
ideas which inevitably turn into suffocating
straightjackets, and so stimulate their own destruction
by new emancipatory, and at the same time, enslaving
conceptions. The first step to understanding of men is
the bringing to consciousness of the model or models
that dominate and penetrate their thought and action.
Like all attempts to make men aware of the categories
in which they think, it is a difficult and sometimes
painful activity, likely to produce deeply disquieting
results. The second task is to analyse the model
itself, and this commits the analyst to accepting or
modifying or rejecting it and in the last case, to
providing a more adequate one in its stead.

[Berlin, 1962, p. 19]

A strong case can be made for the following general
statements concerning scientific research in accounting (as
well as in perhaps other disciplines of the social
sciences):

i) social science has been overwhelmed by the ideology of
   "positivism" to the extent that the "scientific method"
   has become more or less sacrosanct;

ii) the often pedantic nature of contemporary
    "positivistic" research has resulted in a tremendous
    overspecialization which has taken over at the expense
    of general culture;

iii) the ever increasing pressure to "be scientific" has
    produced a large body of so called "scientific, 
    rigorous research" which is often lacking in relevance;

iv) the vast majority of accounting research has become
"scholastic" and hence suffers accordingly.

Addressing these statements, one is quickly bogged down in trying to determine what is meant by "scientific method" and "positivism". In the present state of accounting research this is a particular problem due the confusion concerning terms. Consequently, throughout this paper the term "scientific method" is used to refer to a mode of research developed by Newton in the seventeenth century, combining Cartesian rationalism and empiricism. This "scientific method" is the mode of research alluded to by Tomkins and Groves [p. 3]:

The majority of existing, rigorous, accounting research seems to fit a fairly well determined set of criteria. Accounting researchers in their desire to move away from the descriptive treatises of yesteryear, almost universally seem to strive to undertake "scientific investigations" of the following form. First, they start with a theory formulated in terms of relationships between categories more often than not based on ideas emanating from previous academic literature; then the theory is used to establish a research problem which is transformed into hypotheses and thence into dependent and independent variables representing the categories involved. This is then followed by precise and highly structured or predetermined procedures for data collection (nearly always in numerical form) which is followed, in turn, by subjecting the data to mathematical or statistical techniques leading to an almost exclusively quantitative validation of the hypotheses tested.

This method may also be referred to as the "hypothetico-deductive" account of scientific explanation [Hempel, 1965]. "Positivism" was the ideology introduced in the mid-nineteenth century by Comte, who argued that the "scientific" or "positivistic" method was the only method appropriate for modern times. By "positivism," Comte meant
the method of observed facts, handled with the use of hypotheses. However, in the accounting literature, the term "positive," which is most closely associated with the Rochester School of Accounting, was drawn from an essay by Milton Friedman [1953, pp. 6-7] which argued for "distinguishing positive economics sharply from normative economics." Hence, the Friedman-Rochester concept of "positivism" is that a scientific theory constitutes systematized knowledge concerning what is. As Christenson [1983] notes, this concept apparently conforms to the discredited position of the "logical positivists." The important point here is that the "scientific method," as defined in this dissertation, and "positivism," regardless of whether it nineteenth century "positivism" or twentieth century "positivism," both share the same fundamental, axiomatic "classical" concepts concerning ontology and epistemology. Consequently, the author contends that the type of research described by Tomkins and Groves is "positive." Henceforth, the terms are used as loosely interchangeable for purposes of this paper.

This dissertation will attempt to show that "positivism" and the Cartesian-Newtonian machine-world view of reality which has dominated much social science research (and particularly accounting research since the late 1960's) has been severely misapplied and even more critically misunderstood. In short, this Cartesian-Newtonian model has
come to be accepted as the accurate view of reality. Hence many ontological assumptions inherent in this view have come to be integrated in the Western mind without being seriously questioned. The axiomatic nature of these assumptions seems to have been ignored. Consequently, there have come to pass many critically important consequences of holding this ontological position which in this author's judgment are very detrimental. They are detrimental not only to the evolution of accounting research, but to knowledge in general as well as to "cultural health."

The intent is not to attack the "scientific method" per se, but rather to try to demonstrate the degree to which its application has exceeded appropriate limits. By appropriate limits, consider the following example: in Einstein's Theory of Relativity, the concepts of absolute space and time disappear. Consequently, Euclid's axioms of geometry are appropriate only if we keep to the boundaries of the earth. It must be stressed that the primary purpose of this dissertation is to project a point concerning research and knowledge. Thus the reader will find no "research findings," "testable hypotheses," etc. He is asked to follow, keeping an open mind, a careful studied demonstration of the evolution of "positivism" and "positive" research. Two key philosophical approaches to "reality" and human "knowledge" are developed in considerable detail. These are i) the "hard" science of physics and ii) the "soft" philosophy of Eastern mysticism.
Physics, from its position at the pinnacle of the hard sciences, has, through its discoveries and advances in modern times, radically altered the physicist's view of reality. Likewise, longstanding Eastern philosophical concepts related to "intuition," heretofore essentially neglected in Western thinking, are receiving increased attention. Taken together these two approaches lead to some interesting conclusions concerning accounting research.

The intended contribution of this dissertation to the literature or to the academic profession is to point out the extreme ontological position held by the Western mind and more specifically by very many accounting researchers; it is an attempt to focus attention on and explore the "roots" of "positivism" as opposed to simply accepting "positivism" and all its inherent assumptions and focusing attention on primarily pedantic methodological issues.

Note that the words "positive", "positivism" and "positivistic" have generally been enclosed in quotation-marks. This usage is following the example of Einstein [1944, p. 281] who wrote that, "just as on the part of a real philosopher, quotation-marks are used here to introduce an illegitimate concept, which the reader is asked to permit for the moment, although the concept is suspect in the eyes of the philosophical police". Although the "scientific method" is not philosophically suspect, the context in which it is used in this paper is, and therefore it is also
enclosed in quotation marks.

Since this paper deals with terms and concepts which may be unfamiliar to some accounting researchers but are of fundamental significance to this paper, a short list of definitions is offered. These definitions have been taken from the *Webster Unabridged Dictionary* unless otherwise indicated.

1) **Ontology**: the branch of metaphysics dealing with the nature of being or reality.

2) **Epistemology**: the theory or science that investigates the origin, nature, methods, and limits of knowledge.

3) **Positivism**: a system of philosophy that is based solely on the positive data of sense experience; empiricism; especially a system of philosophy, originated by Auguste Comte, which is based solely on positive, observable, scientific facts and their relations to each other and to natural law; it rejects speculation on or search for ultimate origins.

4) **Logical Positivism**: a philosophy asserting the primacy of observation in assessing the truth of statements of fact and holding that metaphysical and subjective arguments not based on observable facts are meaningless, meaningful statements being either a priori or a posteriori and synthetic [*American Heritage Dictionary*].

5) **Logic**: the study of principles of reasoning especially of the structure of propositions as distinguished from their content and a method and validity of deductive reasoning [*American Heritage Dictionary*].

6) **Syllogism**: an argument or form of reasoning in which two statements or premises are made and a logical conclusion drawn from them; reasoning from the general to the particular; deductive logic.

7) **Reason**: the basis of motive for an action, decision, or conviction; a declaration made to explain or justify an action, decision or conviction [*American Heritage Dictionary*].

8) **Rationalism**: the principle or practice of accepting reason as the only authority in determining one's
opinions or course of action; in philosophy, the theory that the reason, or intellect, is the true source of knowledge, rather than the senses.

9) **Intuition**: the immediate knowing or learning of something without the conscious use of reasoning; instantaneous apprehension.

10) **Intuitionism**: the doctrine that the reality of perceived objects is known by intuition.

11) **Scholasticism**: the system of logic, philosophy, and theology of medieval university scholars, or schoolmen, from the tenth to the fifteenth century, based upon Aristotelian logic and the writings of the early Christian fathers; an insistence upon traditional doctrines and methods.

12) **Scientific Method**: the totality of principles and processes regarded as characteristic of or necessary for scientific investigation, including rules for concept formation, conduct of observations and experiments, and validation of hypotheses by observation and experiment [American Heritage Dictionary].

13) **Scientism**: the principle that scientific methods used in the natural sciences can and should be applied in all fields of investigation.

14) **Holism**: the theory that reality is made up of organic or unified wholes that are greater than the simple sum of their parts [American Heritage Dictionary].

15) **Holistic**: of or pertaining to holism; emphasizing the importance of the whole and interdependence of its parts; concerned with wholes rather than analysis or dissection into parts [American Heritage Dictionary].

16) **Reductionism**: the belief that complex phenomena could always be understood by reducing them to their basic building blocks and by looking for the mechanisms through which these interacted [Capra, 1983, p. 47]

17) **Metaphysics**: the branch of philosophy that deals with first principles and seeks to explain the nature of being or reality (ontology) and of the origin and structure of the world (cosmology): it is closely associated with a theory of knowledge (epistemology).
Introduction To The Problem: Contemporary Accounting Research

All that remained was the scientific specialist, who knew "more and more about less and less," and the philosophical speculator, who knew less and less about more and more. The specialist put on blinders in order to shut out from his vision all the world but one little spot, to which he glued his nose. Perspective was lost. "Facts" replaced understanding; and knowledge, split into a thousand isolated fragments, no longer generated wisdom. Every science, and every branch of philosophy, developed a technical terminology intelligible only to its exclusive devotees; as men learned more about the world, they found themselves ever less capable of expressing to their educated fellow-men what it was that they had learned. The gap between life and knowledge grew wider and wider; those who governed could not understand those who thought, and those who wanted to know could not understand those who knew. In the midst of unprecedented learning, popular ignorance flourished, and chose its exemplars to the rule the great cities of the world; in the midst of sciences endowed and enthroned as never before, new religions were born every day, and old superstitions recaptured the ground they had lost. The common man found himself forced to choose between a scientific priesthood mumbling unintelligible pessimism, and a theological priesthood mumbling incredible hopes.

In this situation the function of the professional teacher was clear. It should have been to mediate between the specialist and the nation; to learn the specialist's language, as the specialist had learned nature's, in order to break down the barriers between knowledge and need, and find for new truths old terms that all literate people might understand. For if knowledge became too great for communication, it would degenerate into scholasticism, and the weak acceptance of authority; mankind would slip into a new age of faith, worshiping at a respectful distance its new priests; and civilization, which had hoped to raise itself upon education disseminated far and wide, would be left precariously based upon a technical erudition isolated from the world by the high birth rate of terminology. No wonder that all the world applauded when James Harvey Robinson sounded the call for the removal of these barriers and the humanization of modern knowledge.

[Durant, 1961, pp. viii-ix]

In informal discussions with senior academics concerning the state of contemporary accounting research
(i.e., "positivism") two themes have emerged repeatedly. The first is the acknowledgement (and sometimes admission) and often distress that a majority of accounting research is of limited value in enhancing accounting knowledge, theoretical and especially practical. Tomkins and Groves propose that most academics do not use their practical, professional experience in guiding their research in terms of topic coverage or method of investigation. As the 1977-78 "Schism" Committee of the AAA indicated, academics neither spoke the language, nor saw the problems of the practitioners. Hopwood [1984] and Burchell et al. [1980] have argued that particular rationales have been imputed to accounting procedures which may be divorced from the actual roles that these procedures play in practice. Tomkins and Groves [p. 8] suggest that

Academics interested in studying behavior relating to accounting and the "value" of different accounting procedures, therefore, need to place less emphasis on mathematical analyses and modelling, statistical tests, surveys and laboratory tests if these are not associated with specific real world problems in the sense of not relating to specific decision contexts.

Kaplan [1984] has made a similar point in criticizing academics for their preoccupation with esoteric economics and management science journals and their reluctance to "get involved in actual organizations and to muck around with messy data and relationships."\(^2\) At least one academic has stated that he thought that in the years to come, the past fifteen years of "positivistic" accounting research will be
viewed as the "lost generation."

The second and related theme is that this situation is beginning to change. A backlash of sorts to the type of research held in reverence for the past fifteen years is emerging. Tomkins and Groves [p. 6] note the extensive range of authors, mainly philosophers and social psychologists [Goffman, 1959; Berger and Luckmann, 1966; Schutz, 1967; Glaser and Strauss, 1967; and Garfinkel, 1967], who over the years have questioned the validity of the "scientific method" for understanding social behavior.

Blumer [1978, p. 41] comments that

... this conventional protocol of scientific analysis is not suitable or satisfactory for the kind of analysis that is needed in direct examination of the empirical social world. ... (It) forces ... data into an artificial framework that seriously limits and impairs general empirical analysis. Scientific analysis requires two things: clear discriminating analytical elements and the isolation of relations between those elements. The conventional protocol does not pin down in an exact way the nature of the analytical elements in the empirical social world nor does it ferret out in an exacting manner the relation between these analytical elements.

Other authors [Simon et al. 1954; Argyris, 1952; Hofstede, 1967; Schiff and Lewin, 1970; and Baker, 1977] have been cited as advocating a "naturalistic approach" (as defined by Tomkins and Groves) which is antithetical to the "scientific method." However, these authors do not clearly spell out the philosophy underlying their methodology. Recently, however, protests have emerged from within the discipline of accounting which also bring to attention the underlying ontological assumptions of "positivism." For example,
Arrington [1986] has offered some reflections on the production of accounting research, specifically that research is a "social practice" in which scholars attempt to persuade others that the results of their research constitutes knowledge. He has coined the phrase "the rhetoric of inquiry" to describe the sociology of this practice. He maintains that viewing the production of research from the perspective of the inquiry of rhetoric is more descriptive of accounting research than are the idealized, science-driven, empiricism and positivism that we profess. Arrington [1986, p. 1] holds four views which run contrary to contemporary mainstream accounting researchers:

i) the "normative/positive" dichotomy is neither a desirable or even a possible way of knowing in accounting;

ii) academic accountants are storytellers like everyone else; the purpose of their work is to "persuade" each other rather than "prescribe" or "describe." For example, consider who reads the academic journals such as The Accounting Review and the Journal of Accounting Research;

iii) no method, not even the scientific method, can claim preeminence for itself [Feyerabend, 1972]. Furthermore, most of what we know about accounting we know for reasons other than the validating effect of science;

iv) knowledge is a personal and not an objective phenomena. In any case we can not "know" reality (nature) as it might reveal itself in accounting "objectively."

Arrington notes that the idea of knowledge being an "objective" phenomena has been referred to as the "correspondence tradition" and extends throughout much of Western thought. This tradition views knowledge as
"accurate representation, made possible by special mental processes, and intelligible through a general theory of representation" [Rorty, 1979]. As Arrington notes, most all contemporary philosophers would reject this notion, yet it is nonetheless what we profess to our students and to each other. Arrington has borrowed heavily from the work of McCloskey [1984, p. 483], who in economics has termed the way we use this collapsed tradition "modernism: an amalgam of logical positivism, behaviorism, operationalism, and the hypothetico-deductive model of science." To paraphrase McCloskey [1984, p. 579], "if we want to be heard, we are ordered to be objective, quantification is mandated, Ought is orthogonal to Is. This is methodology (capital M) and it has a schoolmarish tone, lurching occasionally toward inquisition. When it is not slapping wrists it is seizing heretical non-scientists and burning them at the stake."

Arrington [1986, p. 6] suggests that "in accounting the enshrined income theorists of the 1960's were victims of a successful coup by those armed with scientific apparati, computer tapes, a psychology of the college sophomore, and the dogma of predictive ability." The result was that questions of "value" were banished and replaced by alleged questions of "fact." To this day "positive" input to normative questions prevails. However, the personal view of knowledge, advocated by Arrington, with an inseparability of subject/object and fact/value causes knowledge to be
viewed as a rhetorical transaction between a researcher, who
must persuade, and a reader who must be persuaded.
Arrington adopts a "consensual theory of knowledge" which
posits that knowledge is that which we have been "persuaded"
to believe. Consequently the production of knowledge is a
process of "making" rather than "finding" and what counts as
knowledge itself is matter of opinion. By adopting the
"consensual theory of knowledge" we view research as an act of
persuasion rather than an empirical description in the
creation of knowledge. Arrington infers concepts of reality
which are very similar to the concepts which are presented
and discussed later in this dissertation. For example, he
states that most of our observations are products of
"experimental value judgements" rather than passively sensed
as naturally-occurring phenomena. Pirsig [1974] makes a
similar point in discussing the subjective process of
developing hypotheses and gathering data.

Chua [1986] argues that mainstream accounting research
is grounded in a common set of philosophical assumptions
about knowledge, the empirical world, and the relationship
between theory and practice. Her comments concerning the
ontological orientation of what she refers to as
"hypothetico-deductivism" are totally consistent with the
arguments put forth in this dissertation. She also offers
two alternative world-views, the interpretive and the
critical, and discusses the consequences of doing research
within these philosophical traditions.
This questioning of the appropriateness of "positivism" is not particular to accounting—the themes are universal. When one investigates what is often called "intellectual history," the development of ideas, one finds related scenarios in other fields. Economics, from which accounting developed, was itself greatly influenced in terms of ontological assumptions of Enlightenment thought. The difference is that while a lot of this emerging concern with ontology and its implications is new in accounting academia, it is more central to and therefore has received more attention in other disciplines. In fact, as a philosophy of science, "positivism" is no longer taken seriously. Passmore [1967, p. 56], for example, says that "logical positivism (the last vestige of positivism) is dead, or as dead as a philosophical movement ever becomes." Morgan [1982, p. 1] notes that

The models and methods of the natural sciences which underlie the so-called "positivist" tradition dominating accounting research has long been recognized as either inappropriate or deficient for the study of social phenomena.

For this reason the choice is made to discuss the situation in a broader social-philosophical context rather than trying to narrowly discuss it with specifics in accounting research. Then once the issues are understood more clearly, the specific aspects of this broader theme which directly relate to accounting research can be discussed.
The "Positivism" Of Modern Man

In the broadest sense, it might be said that modern Western civilization is positivistic, in that metaphysical or religious modes are not congenial to it. This would be true of the average mind, the common man's more than of the intellectual's or artist's. Everyday life is so surrounded with the technological and the scientific, so extensively "rationalized," so conditioned to mechanical models and explanations, that conscious mental life runs naturally and normally in grooves that can be called "positivist," that is, scientific, rational, nonmetaphysical, averse to mysticism or any truths not immediately verifiable by experiment or demonstration. For better or worse, that is the kind of culture most people live in. "What grows upon the world is a certain matter-of-factness," Walter Bagehot wrote.

[Stomberg, 1966, p. 271]

Stromberg is right on target in his depiction of "positivistic," modern man. However, his statement that this is more true of the average mind than of the intellectual's or artist's is debatable. The problem is this dichotomy seems to exclude a good portion of the academic accounting community; those with a substantial degree of formal education in accounting acquired under conditions of contemporary mass education. A case in point is Kinney's [1986] discussion of an approach to introducing "positive," empirical accounting research design to Ph.D. students; an article which is entirely directed towards techniques of statistical experimental design and regression-correlation analysis. The implication is that this is a "pure science only" approach to accounting research [Cooper and Zeff, 1987]. Perhaps if Stromberg were familiar with contemporary accounting research he would amend his statement to say the "positivistic" orientation is
more true of many social science researchers than of the common man or the intellectual or artist.

In this "positivistic" world of modern man, the specialist has taken over at the expense of the generalist. This is certainly true in accounting research. Doctoral and post-graduate training address methodological finesse while often disregarding the more fundamental issues in the world of accounting. Christenson [1983], commenting on the nature of several articles [Watts and Zimmerman, 1978 and 1979] which have won the AICPA's award for a Notable Contribution to the Accounting Literature, states that the standards used to evaluate contemporary accounting research is a reflection of the fact that accounting researchers today are well trained in research methods but hardly at all with methodology. The two are distinguished by Malchup [1963]:

Methodology, in the sense in which literate people use the word, is a branch of philosophy or of logic. . . . Semiliterates adopt the word when they are concerned neither with philosophy nor logic, but simply with methods. Instead of "statistical techniques" they would say "statistical methodology" and instead of "research methods" they love to say "research methodology."

Note that the author could be consistent and place the term "methodology" in quotation-marks as it is generally used incorrectly as Malchup points out. However, this issue, although relevant, is peripheral to the major point of this dissertation and for this reason no quotation-marks will be used. Besides, if this practice were applied rigourously then pretty soon a good portion of this paper would be in
An arsenal of specialized techniques for unearthing scientific, "factual" knowledge, has been developed. Omitted is the quest for values. This is a direct consequence of "positivism" which views the "scientific method" as the definitive method of acquiring knowledge. "Positivism" takes the view that values lie outside the arena of scientific inquiry. Concerning normative responsibilities, Devine [1960, p. 397] notes, "the positivist view asserts that we can argue effectively and logically on matters of fact that pertain to ethics but the validity of ethical principles must be condemned or praised in light of our own feelings'.... argument is possible on moral questions only if some system of value is presupposed."

While this specialization exhibits an impressive degree of technological competence it also has compensating losses in range, depth, and linkage with other fields. "Logical positivism," the last and most extreme vestige of "positivism," demands that even philosophy, the queen of the intellect, be considered to be simply a specialized branch of experimental science. As Stromberg [1966, pp. 427-428] comments, Technique has brought precision and has eliminated much untidiness and cleared up many errors, but it would seem to have entailed a loss of vitality, and to have fragmented thought and culture into unrelated pieces. This fragmentation may be in part responsible for the irrational expansion of blind data-gathering; research which
is far too often simply intended more than anything to demonstrate one's methodological expertise. As Lakatos [1978, vol. i, p. 216] comments,

"Wastepaper-baskets" were containers used in the seventeenth century for the disposal of some first versions of manuscripts which self-criticism—or private criticism of learned friends—rules out on the first reading. In our age of publication explosion most people have no time to read their manuscripts, and the function of wastepaper-baskets has now been taken over by scientific journals.

A much discussed review in the famous London Times Literary Supplement for June 28, 1963, registered violent protest against the "Ph.D. pestilence" which requires or encourages useless and graceless pedantry in the humanities. It has been suggested that the institutional necessity of writing theses and dissertations, under conditions of contemporary mass education may be blamed for some degeneration in research [Stromberg, 1966, p. 428]. Another devastating consequence of overspecialization is the ever-widening gulf between the average man and the expert. The common ground is quickly diminishing.

General Consequences Of "Positivism"

Although some disciplines, such as history, seem to have evolved beyond their "positivistic" stage, this is not the case in the discipline of accounting. As Chua [1986, p. 606] notes, ontologically, mainstream accounting research is dominated by a belief in "physical-realism"; the claim that there is a world of objective reality that exists
independently of human beings and that it has a
deterministic nature or essence that is knowable. She
points out that this ontological belief is reflected in
accounting research as diverse as the contingency theory of
management accounting [Govindarajan, 1984; Hayes, 1977;
Khandwally, 1972], multi-cue probability learning studies
Libby, 1975], efficient capital markets research [Gonedes,
1974; Beaver and Dukes, 1973; Fama, 1970; Ball and Brown,
1968], and principle-agent literature [Baiman, 1982;
Zimmerman, 1979, Demski and Feldman, 1978]. All of these
theories contain the commonality of attempting to discover a
knowable, objective reality expressed through generalizable
laws resulting from an empirical analysis of concrete
structural relationships. Absent, is any expressed doubt,
or even recognition, concerning the axiomatic nature of the
implied Cartesian-Newtonian machine-world view. It appears
that a "scholastic" attitude has developed towards the
"scientific method." As Arrington notes [1986, p. 19],
"scientific inquiry is characterized by a restriction to
issues about which it is possible to secure universal
agreement (within a community of scientists) through the
application of a method that is likely to evoke unanimous
acquiescence. Since science depends on consensus, conceptual
constraints are present: neophites serve an apprenticeship
(a Ph.D. program) where they learn the norms, traditions
beliefs etc. The potential abuse comes when the "norms, traditions and beliefs" of the masters are accepted because of their power and prestige rather than the demonstrated quality of their thought processes. This results in what Kuhn [1970, p. 177] describes as the "invisible college"; a small collective who have "undergone similar education and professional initiations. . . and have absorbed the same technical literature and drawn many of the same lessons from it."

This "scholastic" development is detrimental in many ways. It is detrimental in the sense that the underlying axiomatic assumptions of "positivism" are unchallenged and, in many cases, even unacknowledged. "Positivism" is a system of shared beliefs and, as Chua [1986, p. 602] notes, circumscribes definitions of "worthwhile problems" and "acceptable scientific evidence." As such it has limited the type of problems studied, the use of research methods, and the possible research insights that could be obtained. Other non-"positivistic" methods of research may appear unscientific and lacking in rigour because they are usually evaluated on the basis of the assumptions which have given rise to "positivism". Herein lies the importance of showing that "positivism" is based on unquestioned assumptions.

Consequently the author's primary intention is to demonstrate the tremendous influence that the "scientific method" (the Cartesian-Newtonian mentality) holds on modern man; an influence that extends to an ontological extreme.
Included in this influence is an intolerant adherence to "positivism"; a view that only via the "scientific method" can knowledge be obtained. Morgan [1982, p. 4] comments on our failure to break free of the stifling grip which positivism tends to hold on research through the assumption that all scientific knowledge must be positivist knowledge. Positivism produces one kind of knowledge. Other research strategies generate other kinds of knowledge, which have an equally important role to play in the development of accounting research.

As Pirsig [1974, p. 32] comments,

The scientific point of view has wiped out every other point of view to a point where all other points of view seem primitive.

The prevailing philosophy underlying so much of what is done in many social sciences is based on a nineteenth century ideology ("positivism") which is based on seventeenth century physics (classical or Newtonian)--a philosophy which pictures a machine as a representation of reality.

Some direct consequences of this "positivist" position include

i) the overemphasis on rational vs intuitive thought;

ii) the Cartesian dualism which has separated mind and matter and is most responsible for the "illusion" of a subject/object split which implies that science can be "objective" and "positive" (or free of value judgements). It is interesting to note that the "logical positivists" which hold the most extreme "positivistic" position, employ a verification principle which demands empirical verification but is itself unobservable;

iii) the atomistic, deterministic machine view of reality which has readily lent itself to a reductionist epistemology (as opposed to a holistic epistemology).
Specific Point Of Dissertation

Again it must be emphasized that the intention of this paper is not to attack the "scientific method" per se or even within its appropriate limits. To do so would be to attempt to negate all the scientific and technological gains which have been made since the sixteenth century. Even within the discipline of accounting, it is important to recognize the virtues of the philosophical assumptions which underlie contemporary accounting research. As Bernstein [1976, p. xxii] notes, at their best they have insisted upon clarity and rigor, been committed to the ideal of public and intersubjective tests, and have instilled a healthy skepticism toward "unbridled speculation and murky obscurantist thought." But these liberating ideas have become suffocating straightjackets. Hence, the author is interested in helping to deflat some of the pretensions of science; mainly those related to the Cartesian-Newtonian machine-world view of reality and all that follows accordingly. As Friedman [1978, p. 82] comments, "In the final analysis, the doctrine of objective knowledge insists upon its own inherent superiority over the claims of every other kind of knowing." Friedman's critique is directed at the "totalitarian claims" of science, particularly its preposterous pretension to have cornered the market on what is true. He not only holds that there are other ways of knowing, but that some of them may yield more satisfactory
outcomes than objective knowledge. The intent of this dissertation stems in great part from a belief that as long as the need for food, shelter, etc are dominant then the structure of reason upon which modern science is built is adequate. Otherwise, in the words of Pirsig [1974, p. 110], it is emotionally hollow, esthetically meaningless and spiritually empty.

In particular in this paper it is argued that the "scientific method" has been misapplied, and, more importantly, misunderstood. It has been misapplied in the sense that it was basically a method developed in the natural sciences that has been blindly accepted and endorsed in the social sciences. As noted by Morgan [1982, p. 1],

Accounting research has traditionally developed with the notable exceptions referred to by Tomkins and Groves, by borrowing models and methods from the natural sciences, without really questioning their appropriateness for studying accounting practice.

This misapplication has occurred with little concern for the fundamental differences between physical and social phenomena [Stamp, 1981]. Furthermore, modern physics, embodied in Reality and Quantum Theory, has suggested that the method may not be appropriate for even natural phenomena.

Even more importantly the "scientific method" has been misunderstood. Humans suffer from what Alfred North Whitehead has called the fallacy of misplaced concreteness [Smumpf, 1975, p. 385]. This occurs when the abstract is
mistaken for the concrete. Descartes, followed by Newton made the universe a machine and only a machine. Nature worked according to mechanical laws, and everything in the material world could be explained in terms of the arrangement and movement of its parts. Of course the reasoning mind was capable of grasping the principles of this machine. In a utilitarian or pragmatic sense this may be fine. The fruits of science and technology bear witness to the benefits of using this machine analogy. The problem, however, is that the Cartesian-Newtonian world machine has come to be viewed as reality by most of the modern Western world. One of the most common errors in the human sciences is to confuse the map with the terrain [Friedman, 1978]. The briefest exposure to Eastern philosophy, religion, or modern physics makes this point very clear. It is this legacy, this Cartesian-Newtonian influence, to which this dissertation attempts to draw attention.

Finally, and perhaps most importantly, not only do we have what many consider to be an erroneous view of the nature of reality but, in part because of this view, we seem to have altered the direction of our intellectual inquiries. The ideology of "positivism" has created a modern civilization which is not congenial to metaphysical and/or religious modes. Yet quite interestingly, "positivism" implicitly requires an act of faith as metaphysical as religion or belief in truth, but yet denies such an affiliation [McCloskey, 1985]. Although this focus of the
scientist's attention on quantifiable properties of matter has proven successful in modern [post sixteenth century], science, it has also exacted a heavy toll. According to R. D. Laing [quoted in Capra, 1983, p. 55]

Out go sight, sound, taste, touch and smell and along with them has since gone aesthetics and ethical sensibility, values, quality, form; all feelings, motives, intentions, soul, consciousness, spirit. Experience as such was cast out of the realm of scientific discourse.

Laing goes on to claim that nothing has changed our world more in the last four hundred years than the scientist's obsession with measurement and quantification.

The magnitude of what man lost, when he gained the power to understand and rule the world in terms of dialectic truths; he lost an empire of understanding of what it is to be part of the world, and not an enemy of it.

[Pirsig, 1974, p. 372]

Objective Of Chapter II: Evolution Of History Of Ideas

In simply stating "accounting research by and large adheres to the philosophical branch known as "positivism" which has many ontological assumptions that date back to Descartes. . . .," the reader (who may be unfamiliar with the work of Descartes et al) is at a distinct disadvantage. He is more or less forced to accept or reject this statement on face value. Consequently, it is felt that it will be more useful to actually demonstrate in some detail how the dominant mode of "positivism" as well as its weaknesses and criticisms evolved. This should allow the reader to see for
himself the various ontological assumptions underlying "positivism" and the "scientific method." Hence, one can better make a judgement based more on his own impressions than on someone else's. Of course this author acknowledges a "bias," or more accurately an explicit normative position, in his view which will undoubtedly be reflected in his writing. But, it is argued, this bias, though more explicit, is no more prominent than the implicit biases contained in many "objective scientific" writings.

Consequently, Chapter II is written with a focus on developments in intellectual history before focusing on accounting. The intent here is simply to familiarize the reader with the history of those ideas relevant to "positivism," stated chronologically. A demonstration of these ideas as related to accounting research is addressed in Chapter IV.

Finally, it should be noted that given the breath of this objective, secondary sources will be predominantly utilized. The author feels that this approach is justified for the following reason. This paper makes no attempt to make a conclusive philosophical argument. It attempts only to expose accounting researchers to some fundamental philosophical ideas. Case in point, "positivism" as a philosophy of science was rejected by philosophers more than fifty years ago. Consequently, since the audience of this paper consists predominantly of students of business rather
than students of philosophy, the utilization of analyzes of authors who have devoted their energies to interpreting original sources is deemed appropriate.

Objective Of Chapter III: An Ontological Alternative To "Positivism"

After the chronological examination of these concepts in Chapter II, Chapter III will discuss the "classical" concepts, the assumptions and implications which underlie "positivism" and the "scientific method." These concepts include the dualistic, mechanistic and reductionistic Cartesian-Newtonian machine-world view. This ontological position has had several consequences: One is the illusion of a subject/object split. Another is the belief in a mechanical system which can be described objectively without consideration of the human observer. Another is the belief that reality is rigourously deterministic and causal resulting in the view that any system can be predicted with absolute certainty if its state at any time is known in detail.

This brief discussion of "classical" concepts is followed by a discussion of the developments in physics which challenged the Newtonian model and began a transition (in physics) from "classical" (Cartesian-Newtonian) concepts to a new conceptualization of reality. A major point of this dissertation is that many if not most of these modern concepts have failed to become integrated into modern
Western thought. We still adhere to the Cartesian-Newtonian view of reality and all that it entails. This is precisely the reason the author is using a pre-twentieth century definition of the "scientific method"; the intended contribution of this paper would be greatly diminished if more of these modern concepts were integrated into modern Western thought.

The suggestion is offered that Eastern mysticism may be a superior philosophical base for the findings of modern physics than is the dominant Western philosophy of "positivism." This point is especially important because modern physics which is an extreme specialization of the rational Western mind has developed concepts and reached conclusions which are remarkably similar to those of Eastern philosophy. In short, physicists are now dealing with a nonsensory experience of reality (subatomic) and have realized that their intellect which is fed by three-dimensional sensory inputs is limited in dealing with this reality. Eastern mysticism however, has always recognized that reality is greater than three-dimensional and therefore long ago began to address the types of questions which modern physicists only began to address in the early twentieth century.

Following this suggestion the primary concepts of Eastern mysticism are introduced. Included are discussions of the role of the intellect in Eastern mysticism as well as comments on rational and intuitive thought. The French
philosopher Henri Bergson reached a similar conclusion; that rational knowledge is relative because it is influenced by the mental constructs produced by our intellects. Only by transcending the intellect and intuitively experiencing reality can one overcome the constraints of these mental constructs.

A more detailed description of Eastern mystical philosophies, including objectives and approaches to these objectives is then offered. This includes a brief but specific discussion of Hinduism, Buddhism, Chinese thought and Taoism, and Zen. The several fundamental themes which are present in all these Eastern philosophies include

i) the emphasis on the intuitive and the awareness of the limitations of the rational intellect and language;

ii) the idea that everything is a manifestation of one ultimate oneness and that the world perceived through our intellect is an illusion;

iii) the idea of an objective world and a subject/object split is an illusion;

iv) the chief aim of Eastern thought is to overcome this illusion.

Then the primary concepts of modern physics are introduced. These concepts resulted from a crisis in science which far exceeded the preceding Copernican and Darwinian revolutions. For the first time physicists faced a serious challenge to their ability to understand the universe. Each time they asked a question in an atomic experiment, nature answered with a paradox, and the more they tried to clarify the situation, the sharper the
paradoxes became.

As with Chapter II, this section will rely predominantly on secondary sources for precisely the same reason previously mentioned. The intent is simply to introduce, with enough detail to make them understandable, the primary concepts of Eastern mysticism and modern physics which differ so radically from Western "positivism."

Quantum (atomic) Theory, along with Relativity Theory, destroyed such "classical" Newtonian concepts as: i) absolute space and time; ii) elementary solid particles; iii) the strictly causal nature of physical phenomena; and iv) the idea of an objective description of nature.

Quantum Theory has come to recognize probability as a fundamental feature of atomic reality which governs all processes. Subatomic particles do not exist with certainty at certain places, but rather show "tendencies to exist." Also the "observed particles" (we cannot directly observe the particles but rather only their "trails" or consequences) exist and have meaning not as isolated entities, but only in the context of their being an intermediate system between the processes of preparation and measurement. Quantum theory thus reveals an essential interconnectedness of the universe. It forces us to see the universe not as a collection of physical objects, but rather as a web of relations between the various parts of a unified whole. The human observer is very much a part of this
unified whole; he decides how he is going to set up the measurement and this arrangement will determine to some extent the properties of the observed "object." If the experimental arrangement is altered then the properties of the observed objects will change in turn.

Relativity Theory states that space is not three-dimensional and that time is not a separate entity. Both are intimately connected and form a four-dimensional continuum called "time-space." Hence, all measurements of time and space lose their absolute significance. Relativity Theory also states that mass is nothing but a form of energy. Therefore, particles can no longer be seen as static objects, but rather must be conceived as dynamic patterns. Einstein's General Theory of Relativity, which included gravity, states that space and time are curved. Hence, Euclidian geometry is no longer valid in such "time-space."

Quantum and Relativity Theory suggest that the universe is a dynamic web of inseparable energy patterns—a view quite different from the Cartesian-Newton view of a machine-like objective reality existing independent of the observer.

This discussion should begin to make some of the ontological and epistemological implications of modern physics apparent. These implications include the view that the classical idea of scientific objectivity can no longer be maintained, hence the myth of a value-free science is also challenged. No longer can the scientist play the role
of a detached objective observer, but rather he becomes involved in the world he observes to the extent he influences the properties of the observed objects. The concept of the "participator" replaces that of the "observer." The classical mechanical view of reality must be discarded in order to understand atomic and subatomic reality. Modern physics makes the realization that our three-dimensional sensory inputs are limitations in experiencing the greater than three-dimensional reality. Modern physics has also shown other sciences (this is of particular importance to this dissertation) that scientific thinking does not have to be reductionistic and mechanistic, but that on the contrary holistic views are scientifically sound. Modern physics has come to understand the limits of the Cartesian-Newtonian world view as undoubtably other disciplines are now doing. It has demonstrated the necessity of going beyond the mechanistic and reductionistic approach inherent in "positivistic" methodology.

It is acknowledged that the author is perhaps substituting one extreme ontological position (Eastern mysticism) for another (the Cartesian-Newtonian machine-world view) and that there exist ontological positions lying between these two extremes. The author's intention is to increase awareness of the axiomatic nature of "positivism" as well as the philosophical and ontological implications of modern physics and Eastern mysticism. Those readers
interested in further exploring specific ontological positions are encouraged to consult Morgan and Smircich's [1980, p. 492] six-way classification of the nature of the social world. Their six basic ontological assumption sets include

i) reality as a concrete structure (the Cartesian-Newtonian world view);

ii) reality as a concrete process;

iii) reality as a contextual field of information;

iv) reality as symbolic discourse;

v) reality as social construction;

vi) reality as projection of human imagination.

Objective Of Chapter IV: "Positivism"
In Accounting Research

Chapter IV demonstrates the impact of "positivism" on accounting research. Two examples of "positivism" are discussed in an effort to demonstrate how the "classical" concepts discussed throughout this dissertation are inherent in these sources. The first source is an article by Robert Sterling, "The Nature and Verification of Theories," in which he argues that accounting should be a "science." As a consequence of making this argument he discusses the scientific approach. This affords an excellent opportunity to look at the "scientific method" as it is being advocated in accounting research. Statements made by Sterling are analyzed in order to point out their inherent implicit assumptions. The second source is the article "Empirical
Accounting Research Design for Ph.D. Students" by William R. Kinney. In his article, Kinney expresses a point of view which is becoming the exclusive standard for empirical research in accounting. He [1986, pp. 338-339] states that the purpose of his article "is to show how a basic framework for evaluating (and doing) empirical research in accounting can be obtained in a short introduction..." and that the approach is generic in that it "focuses attention on the essence of scientific inquiry in accounting." This affords another excellent opportunity to look at the "scientific method," not only as it is being advocated in accounting research, but more specifically as it is being advocated as an approach for doctoral students. In particular, his definition of research is far too narrow for application in a field such as accounting.

"Positivism" In The Practice Of Accounting

As noted by Chua [1986, p. 602], "positivism" is a system of shared beliefs which, as such, defines what problems are worthwhile and what "scientific" evidence is acceptable. This "scientific mentality" has unquestionably filtered down into the practice of accounting. As has been pointed out by several writers [Kaplan 1983, 1984; Peters and Waterman 1982] a numerative, rationalist approach has dominated the business schools. This approach has in part fostered the belief that the well trained (the implication
is **technically** well-trained) professional manager can manage anything. In particular, this approach seeks a detached, analytical justification for all decisions. Hayes & Abernathy quoted in Peters and Waterman [1982, p. 47]:

> We believe that during the past two decades American managers have increasingly relied on principles which prize analytical detachment and methodological elegance over insight... based on experience.

This is a knowledge that seeks to be precise about the unknowable.

This situation is further aggravated by the very nature of our financial accounting model; a transaction based historical cost model which is often supported on the basis of its "objectivity." Scheinbruner, [quoted in Peters and Waterman 1982, p. 44] notes that

> If quantitative precision is demanded, it is gained, in the current state of things, only by reducing the scope of what is analyzed so that most of the important problems remain external to the analysis.

Given that internal managerial accounting is greatly influenced by financial accounting this situation may lead to a fixation on the cost side of the equation where the numbers are "hardest." To the extent that this issue is discussed in the accounting literature, it is generally implied that information provided by accounting staff personnel is "neutral." Accountants are admonished to be "free from bias" [ASOBAT, 1966].

Kaplan [1983] has suggested that rather than simply bringing tools to or relying on "passive optimizing models" where an inherited subject/object split simply accepts the
environment as given without any concern for "interaction," we need to "get into" the issue. In terms of this dissertation we need to develop more of the perspective discussed in Chapter III.

The prevailing view of the modern Western world ("positivist"), as described in Chapter II has manifested itself in the "applied social sciences," and in particular business. As a consequence

i) there is an inherited "subject/object" split;

ii) there has been the application of over the past twenty-five years of the disciplines of Operations Research, Statistics, and Micro-economics [Kaplan, 1984]. Note that these are all rational quantitative disciplines;

iii) and there has occurred a direct dependency from Frederick Taylor's school of Scientific Management, the following of which are some of the shared beliefs:
   a) low cost producers are the only sure cost winners;
   b) analyze everything—if a little is good, then a lot must be better; therefore
   c) apply things like Discounted Cash Flow analysis to risky investments like R&D;
   d) control everything;
   e) get the incentives right and everything else will follow [Kaplan, 1983].

These result in "passive optimizing models" which generally speaking, can only deal with "quantitative" variables. Therefore these models may ignore other important variables. Per Kaplan [1983] the problem with these models is that the emphasis is restricted to the parameters of the model, and it is often difficult to "see beyond it (the model)." Also the "benefits" are confined to the parameters of the model, therefore the benefits must usually be quantifiable which
they generally are not (at least not at the time the analysis is being performed).

Objective of Chapter V: Ontological And Epistemological Implications

Chapter V will present a synthesis of the ideas introduced and discussed in the preceding sections. Chapter I discusses the excessive influence of "positivism" in accounting research. It also discusses some of the dysfunctional consequences of this influence. The most apparent consequence is the extreme emphasis placed on methodology and "quantitative rigor" in an attempt to appear "scientific." It is believed possible to do "objective" or "value free" research. Researchers believe that the methods applied, rather than the orientations of the human researcher, generate knowledge. This belief, in turn, stems from an extreme objectivist ontological orientation. Tradeoffs are made between relevance and rigor. Hence, much "scientific, rigorous" research is excessively pedantic and lacking in relevance. A second consequence of the "positivistic" influence is a change in direction of intellectual inquiries. Obsession with measurement and quantification has all but eliminated concern for values.

Specifically this dissertation asserts that the "scientific method" has been misapplied and, more importantly, misunderstood. This assertion is developed in Chapter II. It is hoped, that by chronologically tracing
the development of "positivism," the reader will see that it is an axiomatic philosophy which was greatly influenced by seventeenth century, Newtonian mechanics. It is hoped that the reader will also see that the "scientific method" was a method developed in the natural sciences but which has been blindly accepted and endorsed in the social sciences. The abstract Cartesian-Newtonian machine-world view of reality has, in the Western mind, been mistaken for reality itself. Bergson, in particular, notes how the Western mind naturally inclines towards materialism. The consequence is that many of the ontological assumptions inherent in this Cartesian-Newtonian view have come to be integrated in the Western mind without being seriously questioned. The axiomatic nature of these assumptions have been ignored.

Chapter III introduces a radically different view of "reality" and human "knowledge," as contrasted to the Western view discussed in Chapter II. Physics from its position at the pinnacle of the hard sciences, has, through its discoveries in modern times, radically altered the physicist's view of reality. Likewise, longstanding Eastern philosophical concepts related to "intuition," heretofore essentially neglected in Western thinking, are receiving increased attention. It is intended that Chapter III be employed to dialectically understand the axiomatic nature of the philosophy developed in Chapter II.

The synthesis of ideas developed in Chapters II and III is provided in Chapter V. This synthesis offers several
implications which include the following. First, and most importantly, the classical ideal of scientific objectivity can no longer be maintained. A corollary is that the myth of "value-free" science is challenged. The concept of an "objective observer" needs to be replaced with that of a "participator." An "organic" view is more fundamental than the "mechanistic," fragmented view, inherent in "positivism." "Holistic" thinking is just as acceptable, if not more so, than the "reductionist" thinking which is central to "positivism." Most importantly, we must abandon our narrow view of science.
CHAPTER II

THE EVOLUTION OF HISTORY OF IDEAS, i.e., THE DEVELOPMENT OF THE ONTOLOGICAL ASSUMPTIONS AND KEY ELEMENTS UNDERLYING "POSITIVISM"

This chapter attempts to demonstrate how the whole of scientific activity is based on assumptions and to bring to light these assumptions by tracing their chronological development. It is beneficial to understand how the Western world reached the ontological position it now holds. It is especially important to note the "forks in the road" where one set of ontological assumptions were implicitly chosen over another. The importance of explicitly understanding one's ontological position cannot be overstated. As Chua [1986] notes, one's ontological position lies prior to and governs subsequent epistemological and methodological assumptions. Epistemological assumptions decide what is to count as acceptable truth by specifying the criteria and process of assessing truth claims. Methodological assumptions indicate the research methods deemed appropriate for gathering valid evidence. For example the roots of Western thought can be traced to the first period of Greek philosophy in the sixth century B.C. However at approximately the same time much Eastern thought was being developed and refined. Hence, two radically different paths
were taken by Western and Eastern thought.

Perhaps if we better understand the tentative nature of the ontological position we now generally hold and how we reached that position, we may be a little less pretentious concerning "positivism" and "science." This is especially important considering the divergence between Continental European and Anglo-Saxon philosophical thought (European thought being more metaphysical whereas British thought is more "positive"):

Anyone who has attended international congresses is aware that, even putting aside Marxism and its derivatives, there exist in the modern world two distinct types of philosophy, without any living communication between them; there is on the one hand the logico-mathematical neopositivism which predominates in the Anglo-Saxon countries and in parts of Scandinavia, and, on the other, there are the doctrines of metaphysical inspiration, whether existentialist or not, current in Germany, France, Spain and the countries of South America.

[Gabriel Marcel quoted in Stromberg, 1966, p. 423]

Emphasized is the point that ideas are very much a function of the theme of the time and emerge and maintain themselves in a particular context rather than being definitive. As suggested by Chua [1986, p. 603], "all human knowledge is a social artifact; it is a product of the constituting labor of people as they seek to produce and reproduce their existence and welfare [Habermas, 1978]." "Positivism" has a definitive/absolute feel and claims preeminence, mainly because of its historicism; i.e., the idea that we have evolved beyond theology and metaphysics and have finally reached the final and most appropriate
philosophical orientation. Note that this implies the eighteenth century notion of an inevitable march forward. "Logical positivism" takes an even stronger stance by deemphasizing the role of metaphysics and limiting the realm to which we direct our intellectual inquiries. Consequently, this author takes the position that knowledge of the past is vital to our understanding of the present, and of the human situation generally, a position that to understand anything we must study it genetically, by tracing its growth.

According to Stromberg [1966, p. 2] at any particular time and place there is a specific set of influences on the human mind. These include

i) the legacy of past ideas available at the time;

ii) a social context, consisting of all sorts of phenomena prominent in the environment of the times, political, economic, etc; and

iii) other contemporary strains of thought and expression.

After acknowledging these influences, it becomes readily apparent that few if any intellectual systems can stand the test of absolute logic. As Stromberg [1966, p. 2] notes

The great philosophies have all turned out to be postulates at bottom, mere assertions, fiats, resting on something assumed to be without proof. This is as true of "scientific" structures such as Marxism, Newtonian physics, and logical positivism as it is of "metaphysical" ones.

Friedman [1978, p. 90] comments on the use of posits:

... in the construction of the world, such knowledge,
because of its objective character, tends to be used with confidence, as though it were true knowledge. Users of knowledge would rather not hear of "posits," they prefer facts.

"Positivism": The Culmination Of Western Thought

This chapter also seeks to demonstrate that the basic attitude underlying current scientific activity is that the world runs according to laws, reason, and that improvement lay mainly through the discovery of these laws and their applications. As a consequence aesthetic improvement is not apparently deemed very important. This basic attitude of the modern era of the European mind is generally acknowledged to have begun in the seventeenth century; a time of cultural and "intellectual" as well as "scientific" revolution (chiefly in physics and astronomy). This modern view reached it pinnacle in the nineteenth century with the philosophy of "positivism." Note the term "modern" takes its meaning in context to the terms "ancient" and "medieval." It has frequently been declared, that "the modern world as far as mental outlook is concerned, begins in the seventeenth century" [Bertrand Russell]; that this change in mental outlook brought about by the sciences in the seventeenth century "outshines everything since the rise of Christianity" [Herbert Butterfield]; and that "the vision of reality that had supported the rational consciousness of men for a thousand years was fading" and being replaced by a new one [Meyrick Carre] [Quoted in Stromberg, 1966, p. 36].
"Positivism" In Accounting Research

Generally speaking, the accounting literature as evidenced by the content of journals such as The Accounting Review and in particular the Journal of Accounting Research, appears to have embraced the philosophy of "positivism." Concerning those researchers who explicitly advocate "positive" accounting (the Rochester School), as Christenson [1983] shows, their philosophical position is muddled at best. They conform neither to Friedman's instrumentalism nor to Popper's falsification criterion but apparently to the discredited position of the earlier "logical positivists." In short, they believe in a confused notion of empirical testibility. Despite their lack of clarity as to whether theories are "verified" or "falsified," there is widespread acceptance of Hempel's [1965] "hypothetico-deductive" account of what constitutes a "scientific explanation" (see Chua 1986 for a discussion of this account). Chua [1986] notes that this "hypothetico-deductive" model of scientific explanation is referred to as the "scientific method" by Abdel-khalik and Ajinkya [1979] and Mautz and Sharaf [1961]. Peasnell [1981], Hakansson [1973], Gonedes and Dopuch [1974], and Scapens [1982] through their reviews of financial and managerial accounting, illustrate that to do empirical research is to conduct it within a "hypothetico-deductive" model. (Peasnell uses the phrase "hypothetic-positive"). To illustrate the degree to which "positivism" exists in the
literature, the two staunch advocates of "positive" accounting, Watts and Zimmerman, have twice won (1978 and 1979) the AICPA's award for a Notable Contribution to the Accounting Literature. In 1979 Zimmerman also won the Competetive Manuscript Award of the AAA. Consequently, by accepting a "positivistic" orientation the profession has at least implicitly embraced the "scientific method" and as a consequence an extreme emphasis has been placed on "quantitative rigor."

This is not to imply that "positivism" has been universally accepted. Quite to the contrary. A significant amount of attention has been directed towards what this author would call a normative debate; whether accounting should be "positive" (i.e., concern ourselves only with "what is") or "normative" (i.e., concern ourselves with what "should be"). The inference is made that "positive" research is void of value judgements. The problem here is that it is assumed (by at least some people engaged in the debate) that "positive" research is possible and the only question is whether that is what we want to do or should do. The primary point of this dissertation is that the idea of "positive," value-free, objective research is an illusion resulting primarily from the Cartesian-Newtonian ontological orientation.

The quantitative methods used in the social sciences which are drawn primarily from the methods of the natural
sciences, are appropriate for capturing a view of the social world as a concrete structure. In manipulating "data" through these methods, scientists are in effect attempting to freeze the social world into structured immobility and to reduce the role of human beings to elements subject to the influence of a more or less deterministic set of forces. Note that this is exactly the issue which got Kant to thinking—i.e., the idea of free will. This was also a prominent theme in the later works of Dostoevski. According to Morgan and Smirlych [1980, p. 497]:

They are assuming that the social world lends itself to an objective form of measurement, and that the social scientist can reveal the nature of the world by examining lawful relations between elements that, for the sake of accurate definition and measurement, have to be abstracted from their context. The large scale empirical surveys and detailed laboratory experiments that dominate much social research stand as examples of the principle types of method operating on assumptions characteristic of the objectivist extreme of our continuum.

This "objective extreme" as well as a "subjective extreme" is discussed in detail in Chapter III as they are of fundamental importance to the implications of modern physics and Eastern philosophy.

Given that "positivism" dominates the accounting literature, the intention at this point is to trace the developement of "positivism," from its roots in later Greek thought through its last vestige, "logicial positivism," in the early twentieth century. It is suspected that a fair degree of confusion exists among accounting researchers concerning the ancestory of "positivism." As previously
mentioned, the accounting literature's use of the term "positivism" generally refers to the Friedman-Rochester concept which originated in the 1950s [Zimmerman, 1980] and was introduced in the accounting literature in the 1970s [Jensen, 1976]. For this reason, many researchers may incorrectly view "positivism" as a relatively new philosophy. This may go a long way in explaining why so few contemporary accounting researchers are aware of the discredited position of "positivism" among philosophers and many social scientists.

In particular the chronological development of three key elements/aspects of "positivism" are examined. The three elements/aspects are

i] an assumed subject/object split;

ii) the illusion of "positive" or "objective" as opposed to "normative" research; and

iii) the adoption of a "reductionist" as opposed to a "holistic" ontological view.

Specific Consequences Of "Positivism" In Accounting Research

A consequence of the "subject/object" split illusion is the illusion that it is possible to do "positive" or "value free" research. There are two very serious consequences of this attempt to do "positive" research. The first is a shift in emphasis to and an overconcern with "methodology" which derives directly from the attempt to obtain "objective" knowledge. This tremendous concern for rigor
has led to a tremendous emphasis on and preoccupation with "quantitative methods." As Morgan and Smirlych [1980, p. 499] note,

A preoccupation with methods on their own account obscures the link between the assumptions that the researcher holds and the overall research effort, giving the illusion that it is the methods themselves, rather than the orientations of the human researcher, that generate particular forms of knowledge. The development of any theory would be better served if researchers were more explicit about the nature of the beliefs they bring to their subject of study. Much of the debate and criticism over methodology involves researchers who are failing to communicate with one another because they hold varying basic assumptions about their subject.

Morgan and Smirlysch [1980] contend that the virtues of techniques and methods cannot be determined and categorized in the abstract, because their precise nature and significance is shaped within the context of the assumptions on which the social scientist acts. "Qualitative research," as does "quantitative research," stands for an approach rather than a particular set of techniques, and its appropriateness is contingent on the nature of the phenomena to be studied. Hence, the neglected feature of all social research is that it is based on implicit and largely untested ground assumptions. It is the testing of these ground assumptions of the rival views which constitute the really important methodological issues. For the most part, social scientists have been so concerned with generating research that articulates a view of the world consistent with their underlying assumptions that the more fundamental need to test these assumptions has passed almost unobserved.
This seems to be a problem in part because of the seemingly apparent tradeoff between relevance of problems and rigor. As suggested by Arrington [1986, p. 18], "the classical advice to drop a topic because it is not publishable speaks to the preemption of the classical 'wonderment' by the sociological 'acceptability'."

Consequently, Arrington [1986] contends that what is accepted, rejected, and how change takes place in accounting research is "sociological" more than "epistemological."

This concern with quantitative methods can in part be attributed to an incorrect belief in "primary qualities."

These "primary qualities" will be discussed at length subsequently, but in short, it is the idea that certain qualities are "inherent" in objects and therefore can be objectively measured.

Although of secondary concern in this dissertation, but nonetheless extremely important, the second consequence of the belief that it is possible to do "positive" or value free research derives from the view stated by Comte that "positivism" is the natural or historical successor to theology and metaphysics. "Positivism" holds that neither of these alternative systems of acquiring knowledge are congenial to modern man. According to "positivism" we can know nothing but of the world of phenomena and as a consequence our attention has in too many instances been
narrowly directed towards blind data gathering and away from issues such as ethics and values. The whole bend of thought has been altered. This mode of thought received its greatest influence from Descartes and Newton and was more or less cumulated in the nineteenth century with Comte. The common cry is "just give me the facts, then I'll make a value judgement." The problem is simply the omission of any underlying value system—the "positivist" approach with its fanatic adherence to the "scientific method" appears to preclude one. But even this supposedly neutral position has an inherent flaw. As Weber [1949] recognized, the "positive" position is itself a value position which cannot logically be argued as "superior" to a position that makes explicit value judgments. The very distinction between fact and value is itself a value judgment. As many people have argued, it amounts to conservative support for the status quo.

Desired Consequences Of Chapter II

Serious attention needs to be paid to the ideas of the "irrationalists" such as Henri Bergson and Alfred North Whitehead as well as the findings and ontological implications of modern physics (Quantum Theory and Relativity Theory); that of a dynamic, interrelated, organic view of reality which is so fundamental to Eastern philosophy. Hence, Chapter III introduces and discusses at some length the major concepts of Eastern philosophy and
discuss the many parallels with the finding of modern physics.

Following the discussions in Chapters II and III, it should begin to become clear what the requirements for effective research in these situations are. Morgan and Smirlych [1980, p. 498] argue that scientists can no longer remain as external observers, measuring what they see. Instead they must move to investigate from within the subject of study and employ research techniques appropriate to that task. If one recognizes that the social world constitutes some form of open-ended process, any method that closes the subject of study within the confines of a laboratory, or merely contents itself with the production of narrow empirical snapshots of isolated phenomena at fixed points in time, does not do justice to the nature of the subject.

It is hoped that by tracing the history of Western philosophical thought it will become clear to the reader that we have arrived at this position of "positivism" only after encountering several "forks in the road." These "forks in the road" are significant because they are places where modern thought could have taken a different path. An excellent illustration of this point is found in the history of economic thought in the contrast between David Ricardo, the deductive thinker, and Thomas Malthus, the inductive thinker. The whole course of economic thought—the problems addressed, the methodology adopted etc—could have been
drastically different had it gone in the direction of Mathus instead of Ricardo. One will recall that the Classical School of Economics provided the first fully developed, logically deduced, comprehensive model which attempted to depict how a market economy operated. This model employed an isolated, detached abstraction methodology for determining "universal laws." Although the Classical School was fathered by Adam Smith, in many ways it owes a far greater debt to David Ricardo. Smith, as did Malthus, employed a historical inductive approach to analyzing economic problems. In fact, from the time of Smith to that of Malthus and Ricardo, economics was both "positive" and "normative." While Malthus advocated a normative approach to economics, it was Ricardo who in attempting to create a theory of distribution, introduced the purely abstract and deductive approach which is inherent in all subsequent mainstream economic theory. Ricardo moved the discipline of economics to a "positive" position which attempted to identify "universal laws." Hence, what was formerly Political Economy now became Economics. Given this new focus in economics, the great contributions would come from persons such as Jevons, Keynes, Samuelson and Friedman. Although the theories of these men may differ, they all share the similarity of employing comprehensive, logically derived and highly quantified models.

It is also hoped that the reader will become acquainted
through this paper with some fundamental criticisms or weaknesses in the predominant Cartesian-Newtonian ontological view (to which "positivism" strongly adheres).

The characteristics of the firmly established Cartesian-Newton machine world include the following:

i) it is dualistic, mechanistic, and reductionistic;

ii) the Newtonian universe, in which resides all physical phenomena is the three-dimensional space of classical Euclidean geometry; there is an absolute space with absolute time. Hence, all changes in the physical world are described in terms of a separate dimension, time, which again is absolute, and has no connection with the material world. It flows smoothly from the past through the present to the future. The elements of the Newtonian world which move in this absolute space and absolute time are material particles. They are small, solid, and indestructible objects out of which all matter is made. The Newtonian universe is atomistic as well as mechanical and deterministic [Capra, 1983, p. 65].

Some of the consequences of the Cartesian-Newtonian world view include:

i) the illusion of a "subject/object" split resulting from Descartes' dualism and Newton's atomistic world:

As a result of the Cartesian division, the world was believed to be a mechanical system that could be described objectively, without ever mentioning the human observer; such an objective description of nature became the ideal of all science [Capra, 1983, p. 66];

ii) an emphasis on cause/effect relationships resulting from the mechanical view of nature which are closely related to a rigorous determinism. The giant cosmic machine is completely causal and determinate;

All that happened had a definite cause and gave rise to a definite effect, and the future of any part of the system could—in principle—be predicted with absolute certainty if its state at any time was known in all details [Capra, 1983, p. 66];
iii) the emphasis on "hard" science and technology which
directly follows from the overwhelming success of
Newtonian physics and the Cartesian belief in the
certainty of science; and

iv) the success of Newtonian physics has resulted in
physics becoming the model for other areas of inquiry.
Herein lies the importance of the philosophical
implications of the finding of modern physics.

Finally it should be pointed out that the ensuing
discussion generally concerns physical as opposed to social
phenomena. The reason for this is twofold. First, the
natural sciences and physics in particular, have since the
sixteenth century been at the forefront of scientific and
philosophic thought, to the extent that philosophy has
become modeled after science. The developments in the
social sciences generally seem to emulate the natural
sciences. Secondly, if the argument that the Cartesian-
Newtonian world-machine is far less adequate than generally
believed for physical phenomena, then a much stronger
argument can be made that it is inadequate for social
phenomena. For example, Stamp [1981] in response to
Sterling's [1979] argument that we abandon the specific
criteria of accounting and adopt the general scientific
criteria of empirical testability and relevance, comments on
the differences between the empirical domains of physics and
accounting.
Introduction to Development of Western "Positivistic" Thought

The forthcoming sections shall demonstrate how the attributes of "positivism," as well as the assumptions which are fundamental to "positivism," evolved in Western thought. These attributes comprise what is referred to in this dissertation as the Cartesian-Newtonian machine-world view. It is a world view which posits a logical reality. This notion of rationalism dates to the beginning of Western thought. It is a view which is also "mechanistic" as opposed to "organic." In other words, the machine is used as an analogy for reality. This "mechanistic" orientation was developed in the seventeenth century. Three other fundamental attributes of "positivism," its dualism, its determinism and its reductionism, stem directly from this "mechanistic" view and developed at roughly the same time. The dualistic aspect of "positivism" has fostered the illusion that the world exists and can be described "objectively." Hence, there is an assumed "subject/object" split. Herein lies the empirical nature of "positivism"; the view that knowledge is based solely on objective, observable scientific facts. The deterministic aspect of "positivism" posits that the world consists of inert matter in mechanical relationships. Because of the rational aspect of "positivism," these mechanical relationships are assumed to be causal. "Positivism" is reductionistic in that it is
believed that phenomena can always be understood by reducing them to their basic building blocks and by looking at the relationships between these fundamental entities. It is contrary to a holistic view which emphasizes the importance of the whole and the interdependence of the parts.

Forthcoming also, are criticism of the Cartesian-Newtonian view. Causality is argued to be metaphysical; it cannot be demonstrated either logically or empirically. From this attack on scientific thought, there developed the notion that there are two types of knowledge, rational and intuitive. Knowledge acquired via the "scientific method" is knowledge of the "world of appearances" or the world of phenomena. However, knowledge acquired intuitively is knowledge of the "world of substance" or of the noumenal world. The process of "knowing" came to be seen as a joint affair between the knower and the thing being known. Because of the preexistence of concepts existing in the mind, rational knowledge is relative. Knowledge acquired intuitively occurs without the intrusion of the "preformed structure" of the mind, and is therefore absolute.

The Great Tradition: The Greeks

Western thought can be traced back to the ancient Greeks in approximately the sixth century B.C. This first era of Greek thought was dominated by dramatists and poets. Science, philosophy and religion were not separated. A key figure at this time was Heraclitus of Ephesus. Heraclitus
believed in a world of perpetual change, of eternal "becoming." To him all static Being was based on deception. He taught that all changes in the world arise from the "dynamic and cyclic interplay of opposites" and he saw any pair of opposites as a unity. This unity contains and transcends all opposing forces and he called it "logos" [Capra, 1975, p. 25]. It is interesting to note that these ideas of Heraclitus are amazingly similar to both the fundamental concepts of Eastern philosophy and the implications of modern physics.

**Atomism And Division Of Spirit And Matter**

The split of this unity began with the Eleatic School. Parmenides of Elea advocated the idea of Unchangeable Being (static reality). In the fifth century B.C. philosophers began to contrast the ideas of Heraclitus and Parmenides. This led to the assumption that the Being is manifest in certain invariable substances. This invariable substance was the first concept of "the atom, the smallest indivisible unit of matter." These Greek atomists subsequently began to draw the line between spirit and matter, picturing matter as being made of several "basic building blocks." These "basic building blocks" were purely passive and intrinsically dead particles moving in a void. The cause of motion was not explained but was generally believed to be associated with external forces. In subsequent centuries this image became an essential feature of Western thought, of the dualism
between mind and matter, body and soul. As this idea of a division between spirit and matter took hold attention was turned towards the spiritual world, rather than the material world— to the human soul and problems of ethics [Capra, 1975, p. 26].

It was Aristotle (384-322 B.C.) who summarized and systemized the scientific knowledge of antiquity. Although a distinction had been made between spirit and matter, Aristotelism was still monoistic; the body and the soul were considered two aspects of the same thing. It was not until Descartes in the seventeenth century that Western thought became truly dualistic and viewed the mind (thinking substance) as something completely separate and distinct from matter (extended substance). Cartesian dualism separates the physical and the spiritual world.

**Optimistic Rationalism**

"Optimistic rationalism" was the chief thought of the later Greeks. This was the belief that the external world has a logical order which the human mind can apprehend. Furthermore, conceptual language can almost exactly express this order. This faith in a rationally ordered world is traced back to Plato (428/27-348/47 B.C.) and is often referred to as "Platonic Rationalism." This "rationalism" as the West was to come to know it was a reaction against the language of poetic metaphor; it was abstract, metaphysical and dominated by a Platonic mistrust of the phenomenal world.
It is the phenomenal world that we experience through our senses. Hence, this Platonic mistrust was in essence a mistrust of our senses. Only by overriding the senses and employing pure reason, could the saving principle of order be obtained. The model of this "reason" was mathematics or deductive logic. Mathematics was not just believed to be a language to describe nature but some felt it was inherent in nature. Pythagoras claimed that "all things are numbers" [Capra, 1975, p. 40]. It is very interesting to note that Eastern philosophies in a very fundamental way extend this idea of mistrusting the senses. They have a mistrust, or more correctly an awareness, of the limitations of the intellect. Human thought processes and language are limited by the three dimensional reality we experience through our senses. Consequently, whereas the Western world has considered the intellect superior to the senses in that it is less limited than the senses, the Eastern world has considered intuition and direct awareness superior to the intellect for the same reason; it is less limited than the intellect.

The Middle Ages: Scholasticism

The dominant theme of the middle ages was the reconciliation of the two dominating modes of thought; Christianity and Aristotelian philosophy. Aristotle systematized and organized ancient scientific knowledge and
philosophy. Medieval "scholasticism" was the philosophy based on the authority of the Latin fathers and Aristotle. Two reasons the Aristotelian model of the universe remained unchallenged for so long was the lack of interest in the material world, and the strong hold of the Christian Church which supported Aristotelian doctrine throughout the middle ages.

The first rebellion against what was viewed as sterile reason was the "humanistic movement." It turned to literature as an antedote to the severely unimaginative intellectualism of the scholastics [Stromberg, 1966, p. 14]. However, it was the scholastics who taught us to think in orderly fashion, to clarify, criticize and observe. In this sense the twelfth and thirteenth centuries laid the foundation for "logical thought" upon which modern science would be built [Stromberg, 1966, p. 27].

Note the fundamental differences between ancient, medieval and modern thought. Ancient thought pursued the goals of wisdom, of understanding the natural harmony and living with it. Stress was put on living the "right life." The world view was also very organic and vitalistic. Ancient science is most strongly differentiated from modern science in that it was almost totally non-empirical. Medieval thought was based on a combination of reason and Christian faith. Its primary goal, which was inherited from the Greeks, was the understanding of the final cause of things, teleology. Hence, the emphasis was on the significance and
meaning of things rather than prediction and control. Modern thought (positivistic) has basically eliminated faith and metaphysics as well as teleology. It has replaced the organic, vitalistic world view with a mechanistic, reductionistic world view. It is also totally empirical.

The Scientific And Intellectual Revolutions Of The Seventeenth Century

In 1543 Copernicus (1473-1543) introduced "heliocentrism"; the theory that the earth revolved around the sun and not vice versa. In his ability to visualize a heliocentric universe, he was later praised by Galileo, not for his scientific behavior, but rather for his "imagination" [Stromberg, 1966, p. 29]. This is an important point because the scientific method deals with establishing what we already "know." New knowledge comes from intuition. Pirsig's [1974, p. 241] analogy of a "train of knowledge" makes this point. Any intellectually conceived object is always in the past and is therefore unreal (only the present is real). Reality is always the moment of vision before intellectualism takes place. Intellectuals have the hardest time seeing reality because they are so quick to snap everything into intellectual form. Science is this train of knowledge, dealing rigourously with what we already know. These early "scientists" were at the cutting edge of the train. They dealt with where the train was going and not where it had been. As Stromberg [1966, p.
59] notes, from Copernicus to Newton, seventeenth century scientific genius was marked by "visionary dreams, imagination and daring theory." The question which arises here, in today's suffocating "scientific climate," is whether these types of "visionary dreams, imagination and daring theory" can survive long enough to develop into acceptable theories. Modern physics offers an excellent example. Only by discarding their "positivist" orientation, were physicists able to overcome the paradoxes which arose when they asked questions of atomic and subatomic phenomena and to develop the concepts of modern physics.

In the early seventeenth century Galileo (1564-1642) took charge of the Scientific Revolution. He established, beyond reasonable doubt for educated men, the Copernican "hypothesis." Perhaps most crucial of all was his discovery of the "laws of inertia." He was the first to combine empirical knowledge with mathematics and is therefore seen as the father of modern science [Capra, 1975, p. 27]. Although he has been called the greatest of experimental scientists, what he really excelled at was "scientific imagination," in the conception of hypotheses, in knowing what experiments should be performed. Galileo's Platoism was a central idea, perhaps faith, believing that "the universe is a book written in mathematical language." A faith that the intelligible structure of nature will be
revealed in mathematical formulas.

In order to make physical nature subject to mathematics, or quantitative treatment, Galileo suggested a division between "primary" quantities (size, shape, motion, mass, number) and "secondary" (all other) qualities of things. Only the "primary qualities" were regarded as real and therefore meaningful to science. This perception of the existence of "primary" qualities inherent in "objects" is one of the cornerstones in the development of "objective research." It has in large part contributed to the present overemphasis in quantitative methods which is found in "positive" disciplines. The last four hundred years bears witness to the scientist's obsession with measurement and quantification.

The New Science And The Intellectual Revolution

Between the sixteenth and eighteenth centuries there was a dramatic shift in the way people pictured the world and in their whole way of thinking. Prior to the sixteenth century the dominant world view was "organic," and rested on two authorities, Aristotle and the Church. The nature of medieval science was based on both reason and faith and its main goal was teleology. The problem with this concept was that progress became impossible until ultimate meaning and significance was abandoned. To forget about ultimate purpose and simply classify and measure observable properties was a less ambitious, but more fruitful aim.
Consequently, the revolution against "teleology" was a very vital part of the Scientific Revolution [Stromberg, 1966, p. 38].

The "organic" picture of the world which was typical of the Greeks, was replaced by a "mechanistic" picture of the world. The machine became the analogy for physical reality. Also a new method of inquiry was forthcoming. Advocated forcefully by Francis Bacon (1561-1626), it involved the mathematical description of nature and the analytic method of reasoning conceived by Rene Descartes (1596-1650). The "Baconian spirit" profoundly changed the nature, and more importantly, the purpose of scientific quest. From the time of the ancients the goals of science had been wisdom, understanding the natural order and living in harmony with it. In the seventeenth century the attitude changed to its polar opposite (in Chinese terms from yin to yang; from integration to self-assertion). Capra [1983, p. 56] suggests that since the time of Bacon, the goal of science has been to acquire knowledge that can be used to dominate and control nature.

Upon reflection, it seems that two very significant things occurred at this time. This seems to be the first instance of "detaching" oneself from the object in order to study it. It also seems that scientists were beginning to mistake the "measurable characteristics" of things for the things themselves.
Descartes and Cartesianism

Descartes was quite keen on mathematics because it seemed to display a quality of "certainty." He believed that logic, particularly postulational reasoning of the geometrical type was an infallible tool which could be applied to nature to "deduce physical laws from self-evident propositions." The dream of Descartes was to develop a complete science of nature about which he could have absolute certainty. This science, like mathematics, would be based on self-evident first principles. Hence, Cartesian certainty is mathematical in its essential nature. Descartes believed (as did Galileo) that the key to the universe was mathematical structure and, consequently, in his mind science was synonymous with mathematics [Strumpf, 1975, p. 246].

The crux of Descartes' method is radical doubt. He doubted everything he could manage to doubt—all traditional knowledge, the impressions of the senses, and even the fact that he had a body—until he reached the one thing he could not doubt, the existence of himself as a thinker: "Cogito ergo sum: I think, therefore I am." From this self evident first principle, Descartes deduced that the essence of human nature lies in thought. All the things we conceive clearly and distinctly are true. He called such clear and distinct conception "intuition" and affirmed that "there are no paths to the certain knowledge of truth open to man except evident intuition and necessary deduction" [Capra, 1983, p. 59].
Descartes placed tremendous emphasis on "method." He felt that there was no problem which could not be solved by human reason, provided the "correct" method was employed. This method, the Cartesian method, is analytic. It consists of breaking up thoughts and problems into pieces and arranging these in their logical order. In what is now termed "Cartesian Dualism," mind and matter are separate and fundamentally different. Mind is viewed as more certain than matter [Strumpf, 1975, p. 254]. All substances were reduced to "res cogitans" (thinking matter) and "res extensa" (extended matter) which was physical matter. Hence, Cartesian Dualism separates the physical and spiritual world, extended substance and thinking substance. Note that one of the more fundamental problems with this dualism is the fact that one must assume that the bodies of men have no relationship with their minds except for an accidental one.

One of the many profound effects of the Cartesian division on Western thought has been to teach us to be aware of ourselves as isolated egos existing "inside" our bodies. Capra [1983, p. 59] suggests that this dualism has led us to set a higher value on mental than manual work.

In order to handle the physical world Descartes viewed it as mechanical and exactly subject to laws. He purged it of the last remnants of "Aristotelian vitalism." In Descartes' "machine-world" the universe was a machine and
nothing but a machine. There was no purpose, life or spirituality in matter. Nature worked according to mechanical laws, and everything in the material world could be explained in terms of the arrangement and movement of its parts. And of course the reasoning mind was capable of grasping the principles of this machine. Hence, seventeenth century "rationalism" found its primary prophet in Descartes.

From Descartes' machine-world people learned to think of the natural world as consisting of inert physical matter in mechanical relationships, rather than as a great organism analogous to a living thing. They would make a sharp separation between the world of the mind and the world of matter. They would cease to seek the intangible "essence" of an object but instead would concentrate on its observable properties [Stomber, 1966, p. 41]. This machine-world view was not just limited to the natural world. In his attempt to build a complete natural science, Descartes extended his mechanistic view of matter to living organisms. Plants and animals were simply considered machines. Human beings were inhabited by a rational soul that was connected with the body through the pineal gland in the center of the brain. As far as the human body was concerned it was indistinguishable from an animal-machine [Strumpf, 1975, p. 255]. As a consequence of this view, scientists, encouraged by the success in treating living organisms as machines, tended to believe that they are nothing but machines [Capra,
1983, p. 60]. The "reductionist approach," such a fundamental part of "positivism," followed directly from Descartes. "Reductionism" is the belief that all aspects of complex phenomena can be understood by reducing them to their constituent parts. Reductionism is best understood in contrast to the opposite "holistic approach" which emphasizes the importance of the whole and the interdependence of its parts.

Consequently the whole elaboration of mechanistic science in the seventeenth, eighteenth and nineteenth centuries, including Newton's grand synthesis, was but a development of the Cartesian idea. Descartes gave science its general framework—the view of nature as a perfect machine, governed by exact mathematical laws [Capra, 1983, p. 60].

**The Newtonian Revolution**

Sir Issac Newton (1642-1727), in the late seventeenth century, realized the Cartesian dream and completed the scientific revolution. He developed a complete mathematical formulation of the mechanistic view of nature, and thus accomplished a grand synthesis of the works of Copernicus and Kepler, Bacon, Galileo and Descartes.

Newton united Galileo's laws of the motion of falling bodies to Kepler's laws of planetary motion and, hence, decisively resolved the debate about the relative motion of the earth and sun. Newton did not invent the theory of
universal gravitation, but merely gave it rigorous formation and exact proof. Via the "inverse square law" he explained that the forces that drew a falling body to earth were the same as the forces that held the moon in its orbit. Concerning gravity, Newton said "I do not pretend to know" its causes. He only described "how" it works (Calder, 1980). According to legend, the decisive "insight" occurred to Newton in a "sudden flash of inspiration" when he saw an apple fall from a tree. He realized it was the same force pulling that apple to the ground that pulled the earth towards the sun. This is a good example of the point made earlier, that the scientific method deals rigorously with what we already know and that new knowledge comes from insight or intuition.

Perhaps Newton's greatest contribution to science was the synthesis of the two opposing trends in seventeenth century science—the "empirical, inductive method" represented by Bacon, and the "rational, deductive method" represented by Descartes. This synthesis has led, more or less, to the present scientific method. Newton held that mere hypothesis (a theory uncorroborated by experiment) had no place in science. Theories, regardless of how logically attractive were not to be accepted unless "proved" in experiment. Clarity was no proof of validity. Again note that the scientific method deals with what we already know. Its real purpose is to make sure that we are misled into
thinking that we know something that we actually don't know. It is intended to give credibility to what we already know. It does not generate new knowledge.

By this time the Cartesian-Newtonian machine-world and its characteristics had become fairly well established. It was dualistic, mechanistic, and reductionistic. The Newtonian universe, on which all physical phenomena resided was the three dimensional space of classical Euclidean geometry. It was an absolute space with absolute time. Consequently, all changes in the physical world were described in terms of a separate dimension, time, which again was absolute. This absolute time had no connection with the material world and flowed smoothly from the past through the present to the future [Calder, 1980]. The elements of the Newtonian world which moved in this absolute space and absolute time were material particles; small, solid, and indestructible objects out of which all matter was made. Newton's world was atomistic as well as mechanical and deterministic.

The consequences of the Cartesian-Newtonian world view include the illusion of a "subject/object" split which resulted directly from Descartes' dualism and Newton's atomistic world. As a result of the Cartesian division, the world was believed to be a mechanical system that could be described "objectively," without ever mentioning "the human observer." Such an objective description of nature became the ideal of all science. It was believed that everything
could be reduced to cause/effect relationships. Hence a rigorous determinism was assumed. The giant cosmic machine was completely causal and determinant. All that happened had a definite cause and gave rise to a definite effect. Consequently the future of any part of the system could—in principle—be predicted with absolute certainty if its state at any time was known in all details [Capra, 1983, p. 66]. Finally, the overwhelming success of Newtonian physics combined with the Cartesian belief in the certainty of science, led eventually to an emphasis on "hard" science and "hard" technology in our culture. Physics became the "model" for other areas of inquiry. As will be shown, these ideas became ingrained in the minds of men during the European Enlightenment. They became so entrenched, so much a part of how the Western world views reality, that when the radical concepts of modern physics were developed in the early twentieth century they made comparatively little progress in dismantling the Cartesian-Newtonian world view.

The Seventeenth-Century Revolution In Political Thought

By the late seventeenth century fundamental elements of "positivism" had been more or less worked out. However, they still had not been thoroughly communicated to the common man. The task remained for John Locke (1632-1704) to spread the main ideas developed in physics via political thought. Locke was the dominant figure in political thought...
as he set his force of common sense against emotional thinking and authority and hence spoke the authentic voice of the Enlightenment [Strumpf, 1975, p. 274]. His importance lies in his tremendous influence on eighteenth century thought. One of his greatest assets was his remarkable ability to mediate between philosophy and the common man. Said George Santayana, "had Locke's mind been more profound, it might have been less influential [quoted in Stromberg, 1966, p. 103]."

As the scientists of the seventeenth century had rebelled against authoritarian Aristotlian science, Locke rebelled against authoritarian Aristotlian political thought. Locke was very much influenced by Descartes and Newton, and because of his subsequent influence on eighteenth century thought he was instrumental in enhancing the Cartesian-Newtonian influence.

Following Newtonian physics, Locke developed an "atomistic" view of society, describing it in terms of basic building blocks, the human being. As physicists reduced the properties of gases to the motion of their atoms, so Locke attempted to reduce the patterns observed in society to the behavior of its individuals. Thus he proceeded to study first the nature of the individual human being, and then tried to apply the principles of human nature to economic and political problems [Capra, 1983, p. 69]. Locke, like Descartes sought to develop a system of thought using logic.
He differed from Descartes in that he substituted experience for Descartes' foundation of innate ideas. In this sense, he was an empiricist rather than a Cartesian rationalist. Both Aristotle and Descartes believed that men were born with an inherent rationality, an ability in the mature mind to assent to certain logical propositions "a priori."

However, Locke believed that the intellect plays a "passive" role as a sort of registry for sense impressions; the intellect operates like a "blank page." "Our mind is a tabula rasa," he says, "and everything comes to it from sensation." The "tabula rasa" is a blank tablet on which knowledge is imprinted once it is acquired through sensory experience [Durant, p. 256].

Locke was guided by his belief that there were laws of nature governing human society similar to those governing the physical universe. Hence, the function of government was not to impose law on the people, but rather to discover and enforce the natural laws that existed before any government was formed [Capra, 1983, p. 69].

As Stromberg [1966, p. 104] notes, the logical problem with Locke's view of the mind as a blank tablet was that on one hand the intellect was blank, waiting for the senses to imprint knowledge, while on the other hand it still somehow had the facility of finding general laws, of attaining to "clear and certain" truth, truth of a mathematical order of certainty and clarity. Locke attempted to deal with this logical paradox (i.e., is the mind a blank tablet or can it
reason?) by utilizing Galileo's distinction between "primary" and "secondary" qualities. The primary qualities are essential attributes of things. They are really "there" and we perceive them as they are. But, on the other hand, secondary qualities are not in the objects, but in our minds. But in doing this, Locke raised the severest of sceptical doubts to which Berkeley and Hume responded. If we get knowledge through our senses, then we can never have the certainty Locke sought. We can know our sense impressions and our own ideas, but we can not assert that they correspond to what exists in the outer world. We cannot accept a "direct copy" theory of perception, where the mind "copies" what is out there exactly as it is.

As of this time the transformation to modern man was in full swing. The foundation, in terms of thinking, had been laid. People began to think of the world as consisting of inert matter in mechanical relationships, rather than as a holistic organism. They would make a sharp distinction between the world of the mind and the world of matter. This dualism contrasts with the monoism of Aristotle, and is greatly responsible for the Western illusion of a subject/object split. And perhaps most importantly, man would cease to search for the intangible "essence" of objects, but would instead concentrate on their observable properties. Although the subsequent increases in science and technology, following from this view, were to be
tremendous, they were not without a cost. We now know that
the universe is not like a machine, but rather like a giant
interrelated cosmic web. We know that the view of reality
developed in the seventeenth and eighteenth centuries, an
image which has lasted down into our era even in spite of
the revelations of Einstein and Plank, was a set of mental
constructs not necessarily corresponding to any objective
reality. Although this view has proved useful as a tool, it
has been said that this was the most fruitful error in all
history [Stromberg, 1966, p. 41]. Numerous historians have
suggested that the old-fashioned world of man was
psychologically more satisfying than the modern one. The
"discarded image" as C.S Lewis has called it, the "little
world of man" [J.B. Bamborough] had more unity, more kinship
between man and nature, more sense of man being the hub and
center of the cosmos. As Stromberg [1966, p. 17] suggests,
it was, arguably, a world of greater ontological security
and esthetic inspiration. Seventeenth century science and
philosophy was to detach man from physical nature. This
detachment led to a "dissociation" or estrangement between
man and nature. According to Pirsig [1974, p. 372]:

The magnitude of what man lost, when he gained the
power to understand and rule the world in terms of
dialectic truths; he lost an empire of understanding of
what it is to be part of the world, not an enemy of it.

This separation of nature from mind was quite new and
revolutionary in Western thought. Nature, as Lord Alfred
Whitehead has written, became "a dull affair... merely the
hurrying of material, endlessly, meaninglessly. . . hard, cold, colorless, silent, dead [quoted in Stromberg, 1966, p. 40]."

The European Enlightenment

The European Enlightenment spirit was born between 1690 and 1730. It is said to have officially begun with Voltaire in 1733-34. It was characterized above all by an inquisitive scepticism that probed old myths and took nothing on faith. Equally characteristic of the Enlightenment, along with its bold criticisms, was its faith in "reason." Note that in the that eighteenth century "reason" was more likely to connote Newtonian science than Aristotlian philosophy or logic.

The Enlightenment's inquisitive scepticism was not limited to philosophy and science. Within a short time "reason" had invaded both religion and ethics.

The hallmark of the enlightenment was the "philosophes" and their friends, the would be philosopher-kings. One of the major attacks of the "philosophes" was towards intolerance (generally religious). This is an interesting point because they themselves were intolerant of opposition to their own views. As Stromberg [1966, p. 133] comments, "reason is one thing and not another, and to believe strongly in it is to embrace a form of intolerance, even if one choses to regard it as 'enlightened intolerance'.”
George Berkeley (1685-1753) aimed criticisms at Newton and Locke mainly because, like Pascal in the seventeenth century, he felt their outlook seemed hollow and materialistic [Strumpf, 1975, p. 284]. He launched the first serious criticism of Enlightenment thought. Berkeley saw that no scientific theory can claim to be describing the nature of things as they really are. All that can be said is that it is a set of symbols that works, by means of which we gain predictability within a certain range of phenomena [Durant, p. 257].

Berkeley specifically attacked the notion of "primary" and "secondary" qualities. It is recalled that Locke had used this notion of primary and secondary qualities in his attempt to resolve the logical paradox of having the mind be both a blank tablet upon which sensory inputs are recorded, and also capable of discerning general, fundamental laws. Locke had pointed out that we have "ideas" of external objects in our minds, knowing them only as they appear in our minds. In other words we do not know the thing directly but through our senses. However, Locke picked up the argument initiated by Galileo that some qualities (primary) are inherent in objects and are therefore not dependent on our senses as are secondary qualities.

Berkeley argued that all qualities are equally subjective. According to Berkeley [quoted in Stromberg, 1966, p. 147], "it does not exist, unless it is perceived;
to exist is to be perceived." "The color is not in the desk but in us; no sensation can be a senseless thing." In this sense reality becomes mental in that only "spirits" (minds) and "ideas" (sensory data fed into the mind) exist [Strumpf, 1975, p. 285]. However, Berkeley asserted that the world was as he had left it; "everything is just as real as ever. I hope that calling a thing an 'idea' makes it not less real [quoted in Stromberg, 1966, p. 148]."

Modern philosophers would generally agree that Berkeley was correct in abolishing substantive qualities of things. In fact this part of his analysis has proven most enduring. Hence, in this way Berkeley partly undermined Enlightenment materialism.

**David Hume**

David Hume took Locke's empiricism and demonstrated how it led to scepticism. His starting point was Berkeley's criticism of Locke's argument that there are inherent qualities in material objects. However he rejected Berkeley's belief in minds arguing that the same analysis can be applied to the mind--there is no substance called the "mind," just a series of psychic happenings. Therefore how can we prove from experience "I exist?" All we really know is that acts of perception are being performed. Hume then engaged in an examination of causal inference. He maintained that if we do anything beyond simply recording the external world then we need causal inference. However,
there is no certain proof of the validity of any such inference. It cannot be demonstrated logically; there is nothing to imply a "necessary" connection between objects. Nor can causal inference be demonstrated empirically. Hume was an empiricist, and maintained that all knowledge is "particular." To imply that knowledge is "universal" implies that we have experienced every situation. Hence, Hume concluded that we do not experience cause and effect--we assume it. The course of nature may continue always uniformly the same, however this is in fact not demonstrable. Rather the statement is probabilistic, albeit highly probabilistic. Hume concluded that it is "custom," and not reason which supports our scientific laws [Durant, p. 258]. Hume took the position that the causal principle is the foundation upon which the validity of all knowledge depends. Because of the the flaw in the causal principle, Hume argued we can have no certainty of knowledge [Strumpf, 1975, p. 293].

Hume also attempted to find a "science of politics" but quickly aborted this endeavor. He decided that political phenomena can not yield such laws as mathematics [Stromberg, 1966, p. 150].

The Birth Of The Social Sciences In The Enlightenment

Needless to say, the eighteenth century held "science" in great repute. The spirit of the times was a spirit of observation and exactness. The "scientific method," the
creation of Descartes and Newton, was now considered infallible, even in spite of Berkeley and Hume's criticisms. Consequently all that remained was to apply reason and this method to other areas where superstition and disorder still existed.

Consequently it was the Enlightenment that founded the social sciences as they have developed in the modern world; economics, sociology, historical studies, political science, psychology, anthropology. In economics for example, anyone who is even vaguely familiar with mainstream economic thought should be able to see the way economic "science" fitted the outlook of the Enlightenment. It sought general laws, it reduced the social organism to a machine, and it employed abstract deductive logic in order to comprehend all of this. And of course, if one considers accounting to be the "applied" child of economics then it follows that the Cartesian-Newtonian influence is inherent in accounting thought as well.

It should be apparent that the the error made concerning the interest in the human sciences seems to lie in the effort to reduce social phenomena to physics, to make Newtonian machines of man and of society.

Generally speaking, the "goals" of public policy were shaped during the Enlightenment. Material welfare and happiness to name two. Although we take these goals for granted today, because they are so intrenched in our
thinking, at the time they were new concepts. The Greeks for example, had valued wisdom over happiness. It was in this period that our basic habits of thought and even speech were developed. The framework for the "positivism of modern man" was laid.

Although the eighteenth century was the "age of reason," there were some who opposed Enlightenment thought. The Romantics (who rebelled against the Enlightenment in much the same way that the humanists rebelled against the scholastics) saw what might be called the "philistinism" of the Enlightenment; its disparagement of poetry, original imagination, anything sublime or "enthusiastic" [Stromberg, 1966, p. 175]. The Romantic movement brought in the personal statement, individual insight, and penetrating intuition. Concepts which were by and large polar opposites to those of the Enlightenment. Although a good deal of Enlightenment thought has continued (British Utilitarianism, Political Economy), the French revolution officially ended the Enlightenment period by discrediting the ideas of the eighteenth century philosophers.

Upon reflection the Enlightenment can be, as Whitehead noted, an "age of reason based on faith." It began with the confidence that scientific empiricism would lead to certain general laws. But empiricism issued in scepticism, and failed to find these simple general laws. The faith in reason was a faith in clarity, that everything would come out neatly; it was a faith in science without metaphysics
Immanuel Kant And The Revolution In Philosophy

Immanuel Kant, in the late eighteenth century, made what has been called a "Copernican revolution" in philosophic thought. His impact on thought has been compared to that of the French Revolution. He was the critical mediator between dogmatism (rationalism) and scepticism (empiricism).

Kant (1724-1804) was motivated by Hume's scepticism and sought to rescue science from this scepticism which had evolved from Locke's empiricism. Hume had said all knowledge was derived from experience. This statement struck at the very foundation of rationalism; i.e., that reason can derive knowledge about realities beyond experience simply by moving from one idea to another as one does in mathematics. Hume then struck at the notion of "causality" saying it could not be demonstrated. Consequently we really can't come to know much through experience either.

Kant argued that the mind was not "passive" as Hume suggested, but rather it contains the organizing principles which impose order on experience. According to Kant, the mind contains forms and categories which are the basic concepts which give meaning to experience. The raw data of experience are converted into information via these
organizing principles. These "fundamental conditions of thought itself" are "a priori," i.e., they are not derived from experience. In this sense the mind is "creative" and not passive. It is not our senses that enable us to experience reality, but a "preformed structure" within the mind that prepares us to receive and understand sensory impressions [Durant, p. 267].

It is important to note that Kant was not an "idealists" in the sense that some of his followers were. Rather he tried to point out that we could not "understand" the sensory impressions our minds receive if we did not have minds equipped with a rational system. Hence, according to Kant, the apparently "logical" world we experience, may not, in fact, be logical. Things may appear to be rational or classifiable and subject to order, such as cause and effect, not because they are rational but because the "preformed structure" of our minds are rational. Consequently we interpret our experiences as being rational. The importance of this observation cannot be overstated! The Western mind contains a more logically biased "preformed structure," as compared to other cultures. Herrigel [1971] offers an excellent narrative of the problems the Western mind encounters when trying to comprehend an Eastern view of reality. Herrigel, a German philosopher, went to Japan and took up the practice of archery toward an understanding of Zen. At one point his Zen Master tried to work through a Japanese introduction to philosophy in an attempt to help
Herrigel from a side he already knew. He finally laid down the book and remarked that he now understood why a Western mind would find it so hard to learn the art of archery. Castaneda [1968, 1971, 1972] encountered an identical problem in trying to understand the world of Don Juan, a Yaqui sorcerer. Don Juan realized that the reality of day-to-day life consists of an endless flow of perceptual interpretations, which individuals who share a membership, for example a common culture, learn to make in common. Through teachings which occurred over a ten year period, Don Juan tried to make his system of sensible interpretation accessible to Castaneda. This accessibility, was equivalent to a process of resocialization in which new ways of interpreting perceptual data were learned. Given the developments in modern physics, one no longer must consult an alien culture in order to become aware of how the West interprets experience. Einstein's universe, embodied in Relativity Theory, is a world which is extremely difficult for our "logical" minds to grasp [Calder, 1980]. Concepts of curved space and relative time run counter to the Newtonian universe which was set on a Euclidian plane with absolute time. The Western mind has clung to Newton's world, mainly because it fits neatly into the "logical, preformed structure" of our minds. This is a fundamental point which will subsequently be elaborated on in Chapter III.
Kant rescued scientific knowledge from the scepticism of Hume, by developing what has come to be called "Kantian dualism." Through "logic" we can come to know the "world of appearances" or the world of phenomena. But it is through "intuition" that we can come to know the "world of substance" or the nomenal world. In other words, Kant made the distinction between the properties of things vs the "thing-in-its-self" [Durant, p. 272]. Scientific knowledge is knowledge of the world of appearances. As Strumpf [1975, p. 301] observes, by employing this dualism, Kant was able to proclaim the equal wonders of the starry heavens and the moral law. The starry heavens referred to the determinate Cartesian-Newtonian world machine and the moral law implied that man, unlike some other elements in nature, possesses freedom in his behavior. Hence, Kant resolved the paradox of a deterministic and at the same time non-determininistic world.

Kant was also quick to note that each of his realms was flawed for man. From the scientific, phenomenal world we can get clear and "useful" knowledge, but it is only a "knowledge of appearances." Rather it is from the spiritual, nomenal world we get "ultimate truth," but ordinarily we can not reach it.

The heritage of both "positivists" and "idealists" can be directly traced to Kant. The "positivist" says we cannot know anything about the "real" world so therefore we should not worry about it. Rather we should just worry about the
world of appearances. On the other hand, the idealist simply views the world as a mental construct. Idealism, more often called "Kantian noumenalism" is a romantic or mystical direction stressing the role of the poet or religious intuition in touching the deepest reality by nonscientific methods [Stromberg, 1966, p. 202].

As previously mentioned, the impact of Kant has been compared to that of the French Revolution and consequently his influence has been quite significant. It would seem, at least to the author, as though Kant did a pretty good job of clearing up a lot of misconceptions concerning the Cartesian-Newtonian view as well as pinpointing its major limitations. As mentioned at the outset of this paper, this dissertation takes the position that the Cartesian-Newtonian world-machine view and all that it entails has been misunderstood. Kant appears to have addressed this. He appears to have destroyed the naive and arrogant world of science. He showed it to be a mere world of surface and appearance, which did not deal with the thing-in-itself. However, even though Kant's influence is undoubtedly tremendous among philosophers, this influence does not appear to have trickled down into the arena of the common man the way the Cartesian-Newtonian influence did. Our error, it seems, is that we have mistaken the knowledge derived from the scientific method as being knowledge of "reality." And the problem is greatly compounded when this
conception of "reality" extends beyond acquired knowledge and into our modes of thinking and behavior.

Kant's work is also very important in that it made the human mind and soul more important and sacred than did Locke's. Locke would have the human mind to be determined, passive, and dictated to by external conditions. As Stromberg [1966, p. 204] observes, Kant made the human mind the hub and focus of everything. It was self-determining and free. Even in its phenomenal aspects it dictated to nature rather than being dictated to.

Kant appears to be the first of the modern philosophers to really develop an awareness of an alternative view of reality which can only be arrived at by a nonrational process. This point is picked up and expanded by several Western philosophers such as Bergson and Whitehead. As was briefly discussed previously, it is also one of the most central points of Eastern philosophy. Both will be discussed later.

A point which has relentlessly bothered the author, can now be addressed in light of Kant's dualism. Kant claimed that scientific knowledge, although only a knowledge of the "world of appearances," could be useful. This would seem to infer that the justification for scientific knowledge was its usefulness. An excellent example is technology, the offspring of Newtonian science. Newton's universe has been replaced with Einstein's universe, and yet we still employ Newtonian physics for practical purposes. The absurdity of
using Newton's universe, instead of Einstein's universe, for purely theoretical work should be obvious. Consider the situation in accounting research. Very little concern seems to exist for enhancing practical accounting knowledge [Tomkins and Groves]. The acquisition of knowledge for its own sake, without any concern for ultimate application, seems to be justification enough. The problem, in the author's view, is that the "non-practical" research in accounting employs an ontological model which has been all but discredited. This seems to be about as justifiable as using the Newtonian model to do theoretical work in physics. In other words, if accounting academics were using the "scientific method" to address and successfully solve practical problems, this could be justified on an instrumentalist basis [Friedman, 1953]. The end could justify the means. So what is the accomplishment of "non-practical" accounting research? It doesn't address, much less solve, practical problems, and it provides "theoretical" findings which have employed a discredited philosophy.

**Romanticism**

The Romantic period is said to have begun in 1762 and lasted only until about 1830. It's creative moment occurred between 1789-1801. Romanticism emerged as a reaction to the Enlightenment. It countered rationalism, mechanical materialism, classicism as well as all other ingredients of
the Enlightenment. It brought attention to a chief weakness of the Enlightenment, its neglect of the imagination.

Defining Romanticism is difficult because it was more of a mood than a doctrine. Stromberg [1966, p. 210] includes such things as expressing one's emotions, a love of nature, the quest for new experience, and most importantly the view of society as an organism rather than a machine, and the belief in intuition as a source of truth. Romanticism is important because it was the first major reaction to the Cartesian-Newtonian machine-world view as well as rationalization's claim as the only source of truth. The combination of Romanticism and Kantian Idealism developed a vision of reality as basically spiritual. It was in some sense, a pre-seventeenth century vision which suggested a unity of this world spirit linking man to nature. Romanticism turned attention away from the scientist and rationalist and towards the artist and the poet who feels the "Infinite Spirit" in him when he creates. By working "intuitively," the artist can elicit, at a flash, the truth residing in the noumenal world of which Kant spoke. This is a truth much deeper than the experimental or analytical truth acquired via the scientific method. This view anticipated the "Irrationalists" which included Nietzsche, Freud and Bergson.

The basic factor in this intellectual revolution was the philosophy of "subjective and intuitive truth" which
views the mind as participating in shaping reality. This was mainly a gift of German philosophy. As mentioned previously, there is a very significant divergence between Continental European and Anglo-Saxon philosophical thought. European thought is metaphysical whereas Anglo-Saxon thought is more "positivistic." This divergence has its roots in this period.

With respect to "subjectivism" it has been said that no one had previously conceived the knowing process except in terms of the object known. Knowledge no longer involved only the object, but now included the subject as well. This is one of the fundamental philosophical implications of Quantum Theory. That the concept of an "observer" must be replaced with that of a "participant." The mind partly creates the external reality it grasps. As Stromberg [1966, p. 218] points out, one of the central insights of the Romantics was that any system built on the passiveness of the mind must be false.

Classical Ideologies Of The Mid-Nineteenth Century

The classical ideologies which emerged in the mid-nineteenth century evolved out of a period containing very distinct characteristics. This was a period which displayed the "Victorian" frame of mind. This implied, among many things, middle-class domination, comfortable bourgeois virtues, industrialism and free trade and political stability. Classical economics, with its "utilitarianism"
dominated the educated public's mind in Britain. Utilitarianism, the moral and political philosophy of Jeremy Bentham and John Stuart Mill, was derived from Enlightenment hedonism. Its Enlightenment legacy was its severely rationalistic nature. Utilitarianism was hedonistic in that it inferred that the whole moral idea of what is "good" can best be understood in terms of the principle of happiness. It proposed that all moral, social and political action should be directed towards achieving the greatest good for the greatest number of people. This was its definition of "happiness."

**Auguste Comte's "Positivism"**

Auguste Comte's (1798-1857) "positivism" appeared in six volumes between 1830 and 1842 and emerged as the reigning intellectual orthodoxy of the Second Empire in France. Its influence spread to Britain mainly through John Stuart Mill.

Comte felt there was a need for a complete reconstruction of ideas to replace the "intellectual anarchy" that was the aftermath of the French revolution. He argued that the method appropriate for modern times was the "scientific" or "positivistic" method. This conclusion resulted from Comte's "three stages of human development" which maintained that society passes from the theological to the metaphysical and finally to the positive stage, based on the dominant mode of thought in each period [Strumpf, 1975,
p. 341]. By "positivism," Comte meant the method of observed facts, handled with the use of hypotheses.

"Positivism" was also a method which refrained from any conclusions about the substantive nature of reality. Comte agreed with Kant that science studies only the world of phenomena. However, subsequent "positivists" have generally been divided between those who say there is no point in even talking or thinking about what we cannot know, and those who would not rule out speculations and intuitive insights provided we do not confuse these with knowledge of a scientific order. It would seem that at this point, Comte provided the culmination of the shift in emphasis to blind data gathering without any concern for ultimate causes.

Comte, quoted in Stromberg [1966, p. 267], stated that

The human spirit, recognizing the impossibility of obtaining absolute ideas, renounces the search for origins and goals of the universe and the effort to know the innermost causes of things, in order to concentrate on discovery, by experiment combined with reason and observation, of the effective laws, i.e., their unchanging relations of succession and similarity.

It is very important to note that Comte recognized that each of the sciences has to have its own methods. He realized that you cannot "reduce" social science to physics. As Stromberg [1966, p. 268] comments, "certain American sociologists who wish to convert social phenomena into statistics are ignoring the warnings of the founder of their discipline." Stromberg is not alone in his indictment, nor is his indictment limited to sociologists. An extensive
range of authors, mainly philosophers and social psychologists [Goffman, 1959; Berger and Luckmann, 1966; Schutz, 1967; Glaser and Strauss, 1967; and Garfinkel, 1967; Blumer, 1978; Morgan and Smirlych, 1980] and even recently accountants [Stamp, 1981; Morgan, 1982; Arrington, 1986; Chua, 1986] have questioned the validity of the "scientific method" for understanding social phenomena. In fact, this is the primary assertion of this dissertation, that the "scientific method" was a method developed in the natural sciences but which has been blindly accepted and endorsed in the social sciences.

It is easy to agree with Comte that modern Western civilization, in the broadest sense, is "positivist." The technological and scientific permeate almost all aspects of everyday life. Western man has become so extensively "rationalized," so conditioned to mechanical models and explanations, that he has become averse to mysticism or any truths not immediately verifiable by experiment or demonstration. One final point, concerning Comte's influence. It was, and remains, very significant in the Anglo-American world. This is primarily because of the influence of Economics, which is not only the "hardest" of the soft or social sciences, but also is often considered the "mother" of the social sciences. However, in France, "scientism" (the theory that the "positivistic" investigational methods used in the natural sciences should
be applied in all fields of inquiry) was soon widely rejected. There was a return to metaphysics in flat defiance of the "positivists." In Germany, "positivism" never really caught on. It didn't seem to fit with the very romantic and metaphysical ideas of the German philosophers.

The Crisis Of European Thought

Almost without exception, philosophers have placed the essence of mind in thought and consciousness; this ancient and universal radical error must be set aside. Consciousness is the mere surface of our minds, which, as of the surface of the earth, we do not know the inside but only the crust. Under the conscious intellect is the conscious or unconscious will, a striving, persistent, vital force, a spontaneous activity, a will of imperious desire.

[Arthur Schopenhauer, quoted in Stromberg, 1966, p. 332]

Irrationalism: Friedrich Nietzsche

Arthur Schopenhauer (1788-1860), whose ideas branched off from the Romantic and Idealist German philosophers, made the significant impression on the European mind that the "will" is a deeper force than conceptualizing reason. Friedrich Nietzsche (1844-1900), for one, was awakened upon reading Schopenhauer. In analyzing what seemed to him to be a decadent European civilization, Nietzsche concluded that modern man suffered from an excessive development of the rational faculty. As a consequence, man's creativeness, which comes only with the spontaneity of instinct or will, was reduced [Strumpf, 1975, p. 379]. In his The Birth of Tragedy (1871), Nietzsche claimed that this had begun with Socrates and Plato with the triumph of logic over
literature, of reason over will.

It could be said that Nietzsche held many attitudes; the alienated artist, the prophet of the totalitarian state and modern mass-man, as well as a precursor of twentieth century Existentialism. However, he was most of all the "Irrationalist." By probing the drives deeper than reason, he was the anticipator of Freud and Jung. Stromberg [1966, p. 335] has suggested that Nietzsche's influence may indeed be the most important single cause of that divergence between Continental European and Anglo-Saxon modes so often noted in philosophical circles. As mentioned earlier, the Anglo-Americans, with the notable exception of Whitehead, always emphasized empirical science in the mode of Newton. However, on the continent, the more metaphysical ideas of Kant, Hegel, Nietzsche, Schopenhauer, Bergson et al., appear to have flourished.

Henri Bergson

The Frenchman, Henri Bergson (1859-1941), is important because of the primary question he raised. "Is reality as science assumed it to be?" As Strumpf [1975, p. 380] comments, as late as the second half of nineteenth century the major assumption of science was that nature consists of material objects located in space. Matter, it was held, is the final irreducible stuff out of which all things are formed. The model for thinking about the contents and behavior of nature was the model of a machine. All the
particular things in nature were thought to be parts of a larger mechanism. This meant that the behavior of each part could in time be described with mathematical exactness, since material objects moved in space in accordance with precise rules or laws. Moreover, as parts of a mechanism, things were related to each other in a tight sequence of cause and effect. Human nature was also viewed in these material and mechanical terms. As parts of a tightly organized cosmic machine, men were no longer thought of as being "free," or of possessing free will. This ontological orientation, combined with the priority of mathematics and mechanics in science, as well as the stimulation of industry and technology under continually expanding needs, greatly enhanced a "materialistic" perspective. Consequently, the most successful models of the sciences became the models of philosophy [Durant, p. 448].

What Bergson, and later Whitehead, did was to challenge the assumption that the scientific mode of thought could be the sole comprehensive source of knowledge. Bergson specifically addressed several issues, including Darwin's theory of evolution from which he developed his concept of the "vital elan." Also, and of more importance here, Bergson examined the two modes of thought; analysis and intuition. The center of Bergson's idea is that there are two ways to know a thing. The first way implies that we "move around it" while the second way implies that we "enter
into it." According to Bergson, knowledge derived from the first way depends on the vantage point from which the "object" is observed. Therefore this way of knowledge will be different for each observer and in that respect it will be "relative." However, the second way is "absolute," because by entering the object we overcome the limitations of any particular perspective and grasp the object as it really is [Strumpf, 1975, p. 382]. Bergson's idea seems to be a natural extension of Kant's notion that knowing is a cooperative affair between the knower and the thing being known. The "preformed structure" within our minds prepare us to receive and understand experience. Bergson has simply extended Kant's idea by explicitly stating that knowledge acquired via our rational facilities is relative. Note that "positivism" often makes the opposite inference. By positing that reality is deterministic, one is led to believe that by determining universal laws, one can acquire "absolute" knowledge. "Positivism" also makes the opposite inference by viewing knowledge acquired via the "scientific method" to be "objective." The concept of "objective" infers a freedom from bias. It is believed that a method, the scientific method, can eliminate bias. Hence, information acquired is not relative, but absolute.

Bergson felt that rational knowledge was a "practical tool" concerned with useful knowledge but not truth giving because reality may not be divided up and conceptualized [Georgescu-Roegen, 1971, p. 71]. To go around an object is
what is generally referred to as "analysis." "Intuition" is
to enter into an object, to experience it directly without
the intrusion of the "preformed structure" of the mind.
Analysis and description, according to Bergson, require the
use of symbols, which are always imperfect as compared to
the object being analyzed. Symbols are but maps of
territories. Therefore Bergson concluded that scientific
reasoning, which is based on analysis, falsifies the nature
of whatever object it analyzes. As Bergson [quoted in
Strumpf, 1975, pp. 383-384] commented,

Analysis... is the operation which reduces the object
to elements already known, that is, to elements common
both to it and other objects... (therefore) to
analyze... is to express a thing as a function of
something other than itself.

As we come to understand reality, it becomes clear that
reality transcends what could be known about it, since,
as Mr. Lewis points out, all knowing makes abstraction
from the given.

[Henry G. Bugbee, Jr., 1958, p. 176]

Therefore, Bergson argued, the analytic intellect learns by
destroying the object's essence. The essence which is its
dynamic, thriving, pulsing, living, continuing existence,
its duration. To Bergson, this unified, organic, and
dynamic reality, was interrupted by analysis. Life and
movement were halted and separated into several static and
independent parts. This static and disjointed view of
things is exaggerated even more by the use of symbols as all
symbols are abstractions which are lifted out from the
object itself.
Pirsig [1974] offers a very interesting expansion of this idea of two views of knowledge. He describes and discusses what he calls "romantic" and "classical" reality. Romantic reality being the holistic view of reality which Bergson advocates whereas classical reality is the reductionistic view of reality which is the target of criticism in this dissertation.

Strumpf [1975, p. 385] has described Bergson's method of "intuition" as a type of intellectual sympathy which enables one's consciousness to become identified with an object. It is a method which bears a remarkable similarity with Eastern thought.

But the real contribution of Bergson's method of intuition is its inference that to think intuitively is to think in duration [Georgescu-Roegen, 1971, p. 71]. This according to Bergson, is the difference between analytic and intuitive thought. Analysis begins with the static and reconstructs movement as best it can. The movement is the abstraction. However, intuition begins with movement, which it perceives as reality itself. Consequently, immobility is the abstraction. It is a "snapshot taken by our minds." Analytic thought pictures the new as an arrangement of what already exists. It deals with what we already know. As Strumpf [1975, p. 385] comments, although nothing is ever lost, neither is anything ever created. Again, Pirsig [1974] provides a metaphor, his "train of knowledge" illustrates this point. Analytical knowledge is
represented by the cars of the train whereas quality (intuitive knowledge) is represented by the cutting edge of the train. It is where the train is going and not where it has been.

Bergson argued that we naturally incline to materialism, because we tend to think in terms of space. Specifically, we think in terms of three-dimensional Euclidian space. This point is emphasized later in this dissertation in discussing some of the reasons Western man has held on to his classical notion of reality in spite of modern developments in physics which have destroyed these classical concepts. Bergson argued that the geometrical predicability of all things, which is the goal of a mechanist science, is only an intellectual delusion. In mystical Hindu terms, this delusion is known as "Maya." Bergson implied that this intellectual delusion will persist until we come to understand that time is as fundamental as space. He held it is time that holds the essence of life, and perhaps of all reality [Georgescu-Roegen, 1971, p. 71]. Therefore what we have to understand is that time is an accumulation, a growth, a duration. "Each moment is not only something new, but something unforeseeable; . . . change is far more radical than we suppose [Bergson quoted in Durant, p. 451]." When we think of time and space in "spatialized" terms we encounter the paradoxes Zeno spoke of. Zeno's paradox shows us that it is impossible to
construct mobility out of static positions or true time out of instants [Georgescu-Roegen, 1971, p. 63]. The problem is that the intellect is capable of comprehending static parts, but it is incapable of grasping duration or movement. Only intuition can grasp duration and, according to Bergson, duration is reality.

This notion of duration, was never taken seriously by the Western mind. For as Strumpf [1975, p. 386] comments, most philosophers such as Plato, Descartes and Kant sought to interpret the world through fixed structures of thought. Yet, a moment of reflection, should show how inappropriate the concepts of physics are in the world of the mind. For as Durant [pp. 455-456] comments

We think as readily of a mile as of half a mile, and one flash of thought can circumnavigate the globe; our ideas elude every effort to picture them as material particles moving in space, or as limited by space in their flight and operation. Life escapes these "solid" concepts; for life is a matter of time rather than of space, it is not position, it is change; it is not quantity so much as quality; it is not a mere redistribution of matter and motion, it is fluid and persistent creation. . . . Upon gazing upon our inner reality, our selves, which is better known to us than all things else; what do we see? Mind, not matter; time, not space; action, not passivity; choice, not mechanism. We see life in its subtle and penetrating flow, not in its "states of mind," not in its devitalized and separated parts. This direct perception, this simple and steady looking-upon (intueor) a thing, is intuition; not any mystic process, but the most direct examination possible to the human mind Spinoza was right: reflective thought is not by any means the highest form of knowledge; it is better, no doubt, than hearsay; but how weak it is beside the direct perception of the thing itself!. . . By direct perception we feel the presence of the "mind"; by intellectual circumlocution we arrive at the notion that thought is a dance of molecules in the brain. Is there any doubt that intuition here beholds
more truly the heart of life?
The intellect is equipped to deal with the material and spatial world, and hence with the material aspects of spatial expressions of life and the mind. Intuition, on the other hand, deals with the direct feeling of life and the mind, not with their external embodiments.

Bergson utilized these ideas involving modes of thought in his development of the "elan vital." He felt Darwin had failed to address the question of how there can be a continuity of function in spite of successive changes in form? In other words, Darwin had overlooked the functional unity of an organism, which requires that any variation in one part must be accompanied by variations throughout the organism. Evolution, according to Bergson, is best explained in terms of a vital impulse. It is the "elan vital" which drives all organisms toward constantly more complicated and higher modes of organization. Since the intellect can only grasp static things, as he argued earlier, it is therefore not capable of grasping the "elan vital" which is the essence of duration. Intuition and consciousness can grasp this continuous and undivided process, this fundamental reality. Intuition can view all things as expressions, and not parts, of this process. This is a view not unlike the teachings of India's spiritual poem, the Bhagavad Gita. It is the basis of Hinduism, which suggests that the multitude of things and events around us are but different manifestations of the same
ultimate reality [Capra, 1975, p. 99].

Because of the dynamic and continuous "elan vital," Bergson saw "a living being is a center of action; it represents a sum of contingency entering into the world; that is to say, a certain quantity of possible action [Bergson quoted in Durant, p. 451]." It therefore follows that man can no longer be viewed as a passively adaptive machine, as is implied in the Cartesian-Newtonian perspective. Instead, as Durant [p. 451] suggests, man must be seen as a focus of redirected force, a center of creative evolution. Bergson felt that the truth that intuition discovers about reality is that it is continuous, that it cannot be reduced to parts, and that the creative process caused by the elan vital is irreversible [Strumpf, 1975, p. 387].

As mentioned previously, Bergson argued that man naturally inclines toward materialism. "Our intellect, in the narrow sense of the word, is intended to secure the perfect fitting of our body to its environment, to represent the relations of external things among themselves—in short, to think matter [Bergson quoted in Durant, p. 454]." Because the intellect is equipped to deal with inert things it sees all becoming as being. It misses the duration which is the connective tissue of things. In the words of Durant [p. 454]:

In the same way that a "motion" picture camera divides what it records on film into static poses, so the human
intellect catches a series of states, but loses the continuity that weaves them into life. We see matter and we miss energy. For example we thought we knew what matter was, but when we finally got into the atom we found energy.

Even though the mind "thinks matter," neither matter nor geometrical figures represent ultimate reality. As Strumpf [1975, p. 388] suggests, evolution is creative precisely because the future is open, there is no preordained "final" goal.

It is important to note that Bergson did not launch an attack on science within its limits, but rather he sought to deflate some of the pretensions of science. In particular its ability to provide complete knowledge.

Science consists only of conventions, and to this circumstance solely does it owe its apparent certitude; the facts of science and, "a fortiori", its laws are the artificial work of the scientist; science therefore can teach us nothing of the truth; it can serve only as a rule of action.


In general, Bergson's philosophy urged the importance of intuition, spontaneity, and of immediate experience over the "tentacles of cold, prying thought" [Nietzsche] which gives us useful knowledge at the cost of cutting us off from reality [Stromberg, 1966, p. 341]. For example, if you want to know music, rather than analyzing it into notes or even vibrations, simply listen to it.

Bergson is important not just because of his ideas which generally anticipated the philosophical implications of modern physics, but also because of the period in which he introduced those ideas. Durant [p. 465] has suggested,
that in many ways Bergson's relation to the age of Darwin is a replica of Kant's relation to Voltaire. Kant strove to repulse that great wave of secular, and partly atheistic, intellectualism which had begun with Bacon and Descartes, and had ended in the scepticism of Hume. And in this effort he denied the finality of the intellect in the field of transcendental problems. Bergson didn't attack with a Kantian critique of knowledge, nor with the idealist contention that matter is known only through the mind. Instead he followed the lead of Schopenhauer by seeking in the objective and subjective world an energizing principle urging man towards self-fulfillment. His ideas reject the notion that we think of the world as a finished or pre-determined affair, where man is just a cog in the vast cosmic machine. Bergson can be thought of as a breath of optimism within the development of an increasingly skeptical philosophy ("positivism").

The Crisis In Science

This section is intended as brief introduction to the events which led to the rejection of the Newtonian universe in physics. Some general implications are also presented. Although these ideas will be discussed in depth in Chapter III, they are included here in order to maintain the chronological consistency of Chapter II.
The Prestige Of Science

By the beginning of the twentieth century, there had been several advances which were striking tributes to the regularity and constancy of natural phenomena. They included the discovery of

i) the periodic tables of the elements [Mendeleyeff];
ii) the atomic structure of matter [Dalton et al.]; and
iii) the law of the conservation of energy [Helmholtz and Kelvin].

A widespread confidence in science rested on the belief that it was unfolding an accurate picture of reality. The "scientific method" was believed to be solidly based and therefore could not err. As a consequence, other modes of knowledge such as metaphysics and religion were considered obsolete. As Stromberg [1966, p. 343] observes, the men of science had become the prophets of progressive minds to an extent that may be measured by a statement in the British "Annual Register" for 1884 that few other subjects except scientific ones received any attention from the intellectual world.

The New Revolution In Physics

The popular common-sense view of science included the view that

i) reality consisted of material bodies;
ii) atoms were thought of as little billiard balls;
iii) material objects act in a spatial field and temporal
world of the sort familiar to human experience, with an objectively existing space and time;

iv) that all bodies obey the same scientific "laws" like Newton's laws of motion and the law of the conservation of energy.

The universe was pictured as a large machine, consisting of physical bodies in dynamic relationships.

However, in 1897, J. J. Thomson arrived at the concept of the "electron" (a unit of negative electricity) as the least unit of matter. Electrons were invisible and perhaps hypothetical units. Furthermore, they refused to obey Newton's laws.

At roughly the same time, it was discovered that Newton's Law of Gravitation, which had been the foundation of physical science for the past two hundred years, was apparently not accurate. It was discarded along with the classical concepts of time and space in 1917 by Albert Einstein in his General Theory of Relativity, which stated that space is curved by massive bodies [Calder, 1980]. It is the curvature of space which gives the appearance of gravity, not a "force" operating upon objects. Perhaps the most important idea of this time, was the equivalence of mass and energy, which was posited in Einstein's Special Theory of Relativity (1905). Mass is "frozen" energy.

Hence, it was revealed that the universe is not like a "machine." Nor was there anything in it that one could readily call "matter." Quantum phenomena suggests that it became even possible for scientists to hold that reality
fades into an idea when we trace it as far as we can [Georgescu-Roegen, 1971, p. 72]. Longstanding classical Western concepts of space, time, and matter all turned out to be fictions of the human mind. They appeared be the the convenient abstractions of scientific knowledge which Bergson had addressed.

**Relativity Of Space And Time**

The starting point for relativity theory was the Michelson-Morley experiment in the late 1880's. This experiment attempted to measure the speed of the earth by measuring the time it takes light to travel with and against the direction of the earth's motion. The extraordinary result was that there was no difference! The implication was that all speed is "relative" to something else and if there is nothing in the universe that constitutes an ultimate yardstick of measurement, then there can be no absolute speed. We measure speed on earth by reference to the earth itself, postulating that it is stable. But of course the earth is in motion around the sun, and the planetary system is in motion too, relative to other systems and galaxies etc. [Calder, 1980].

Concerning space, it had previously been believed that there was some kind of space-stuff (ether) which was the backdrop for all the objects in the universe. However, it was discovered that space is a nothingness, not a something, and no such substance as "ether" exists. The same is true
for distance as for speed. So now when viewed from a universal and not earth-bound perspective space and time must disappear as absolutes. At the same moment, it is a different time to observers in motion in different parts of the cosmos. Therefore Euclid's solid axioms of geometry were seen to be true only as long as we keep to the boundaries of the earth. This implied that the quality of object certainty that had always been attached to mathematics since the Greeks, the quality that Descartes pursued in his critical method, and the quality assumed to be inherent in the scientific approach was an illusion. It is important to note that Einstein did not say that all things are relative. "Relativity" is a misleading name for the theory, for what Einstein did, in fact, was to discover what was absolute despite the apparent confusions, contradictions and illusions produced by the relative motions of gravity [Calder, 1980, p. 13]

Einstein's first or Special Theory of Relativity, presented in 1905, dealt with high speed motion. His General Theory, introduced in 1917, was expanded to include the effects of gravity. This theory stated that gravity was not a "force." Instead of objects exerting a pull on each other in "space" as had previously been conceptualized in the human mind, Einstein stated that bodies move through the curvatures of space-time which are not independent of each other and become merged in a single continuum. This continuum is curved and deformed by the massiveness of
objects. As Stromberg [1966, p. 345] has noted, others have gone even further, in holding that the physical principles of the universe cannot be visualized in terms of human imagery at all, that they can only be indicated in mathematical formulae. The Einstein formula was brilliantly vindicated on May 29, 1919, by photographs of a solar eclipse, taken off the island of Principe off West Africa and at Sobral in Brazil. It has been stated that on that day the modern relativistic world began [Johnson, 1983, p. 1].

A further blow to classical physics was struck when Niels Bohr, who later became one of the leading theoretical pioneers of the nuclear age, explained that the laws of motion holding for the solar systems do not apply at all within atoms. Thus the laws of Newton, always heretofore assumed to be universal, broke down on both the smallest and the largest fields and remained valid only within a zone of fairly gross sense experience.

Max Planck's Quantum Theory, a theory of atomic behavior, asserted that energy is emitted discretely and not continuously, in little packages, as it were, and not in a continuous stream. Again electrons did not behave in the manner expected; i.e., in the way "ordinary" objects behave in the everyday world. Further research by Einstein, Heisenberg and Broglie disclosed that electrons have properties of both waves and particles. This dual nature of
electrons was easily one of the greatest paradoxes of modern physics. In a manner of speaking, if you observed electrons with your left eye you saw particles in a wave, and if you observed them with your right eye you saw a wave of particles. So electrons are both particles and waves depending on how you observe them. There is another critical aspect to observing electrons. Electrons must be used to observe electrons, and therefore exert a disturbing influence. We can never directly observe electrons, we can only infer their nature. Likewise the behavior of subatomic particles can be predicted only within limits of probability. For example, we cannot know both the position and the velocity of a subatomic particle, in the way that we can know them of larger objects. This, which is known as Heisenberg's Uncertainty Principle strikes at the certainty and complete determinancy which heretofore had been thought necessary for physical science.

Consequences Of Quantum Theory

Sir James Jean [Stromberg, 1966, p. 348] summed up the consequences of quantum theory in 6 propositions:

i) the uniformity of nature disappears;

ii) precise knowledge of the outer world becomes impossible;

iii) the processes of nature cannot be adequately represented within a framework of space and time;

iv) a sharp division between subject and object ceases to be possible;

v) causality loses its meaning; and
vi) if there is a fundamental causal law, this lies beyond the phenomenal world, and so beyond our access.

In the last analysis not even the scientist can get rid of the subjective factor, because as investigator he in part creates the truth. This is the chief merit of the name "relativity." It reminds us that a scientist is unavoidably a participant in the system he is studying. Arthur Eddington pointed out that the scientist creates truth, the answers depending on what questions he asks (Stromberg, 1966, p. 384). Alfred North Whitehead explored the implications of the new science for Western metaphysics, and showed that the mechanistic framework dominant since Descartes and Newton no longer sufficed. Such classical Western concepts as atom and electron, space, and time turn out to be mental constructs not necessarily corresponding to objective reality. The "interference factor" which makes it impossible to observe the tiniest units directly, cannot presumably be overcome. Consequently the indeterminacy of electronic behavior apparently is an ultimate fact, not a deficiency in knowledge that further investigation may remedy. Science, embodied in physics, had lost its simplicity, and in all probability its materialism and mechanism as well. Physics now revealed a "mysterious universe," perhaps always destined to remain, in part, mysterious; a universe perhaps more accurately perceived by the Eastern mystical mind. Stromberg [1966, p. 383] has suggested that the implications of Quantum Theory made it
necessary to resort to something like the "as if" philosophy of Valihinger (1911) and say that all scientific terminology represents "useful fictions." The implications certainly seem to support the thrust of Bergson's argument.

This conclusion that scientific knowledge must be in part subjective and incomplete, should be apparent to the reader given the preceeding exposure to the philosophical ideas from Hume and Kant to Nietzsche and Bergson. As Stromberg [1966, p. 348] notes,

Reason, employing mathematical abstractions and other tools, can take soundings of nature sufficient for practical advantages. But if by "understanding" we mean an adequate model or picture of everything, this must always elude us. In Kantian terms the "thing-in-itself" is not accessible to the categories of the understanding, while the intuition or imagination can contact it only fleetingly and imperfectly.

In Chapter III, the developments which challenged Newtonian physics will be discussed in greater depth along with the philosophical implications of these developments. The fundamental concepts of Eastern mysticism will be presented as it is becoming increasingly clear that they offer a better philosophical base, as opposed to Western "positivism," for the unfolding modern relativistic world.

Alfred North Whitehead: Analysis vs Intuition (Absolute vs Relative)

Alfred North Whitehead (1861-1947) addressed, in general, the same question as did Henri Bergson; was reality as science assumed it to be? Like Bergson, he rejected the
analytical mode of thought which assumed that "facts" exist in isolation from other facts. His main theme was that "connectedness was the essence of things."

Previously a logician, a mathematician and a philosopher of science in England, Whitehead's most significant work was that of a metaphysician at Harvard in the late 1920's and early 1930's. His prime motivation in this later work was the belief that a new scheme of ideas was needed which more accurately reflected the new developments in science. Consequently he sought to draw out the implications of the recent developments in Quantum physics, the Theory of Relativity, and evolution.

The Fallacy Of Misplaced Concreteness

Whitehead was convinced that Newtonian physics was based upon a fallacy, consisting in the doctrine of "simple location," which he called the "fallacy of misplaced concreteness." To say that "a bit of matter has simple location means that, in expressing its spatio-temporal relations, it is adequate to state that it is where it is in a definite region of space and throughout a definite duration of time, apart from any essential reference of the relations of that bit of matter to other regions of space and to other durations of time" [Whitehead quoted in Stumpf, 1975, p. 391].

To mistake the abstract for the concrete is the error that Whitehead calls the "fallacy of misplaced
concreteness." Such things as instants of time, points in space, or independent particles of matter (atoms) may be helpful concepts for scientific study, but they are distortions of reality. They are merely products of intellectual abstraction.

Unlike atoms, Whitehead’s actual entities are "chunks of the life of nature." As such, they never exist in isolation but are intimately related to the whole field of life that throbs around them. Whereas atomistic materialism gives us a mechanical view of nature, Whitehead’s actual entities permit us to view nature as a living organism. This is a view more consistent with pre-Descartes thought, as well as with Bergson’s ideas and the implications of modern physics. It is a view that is also fundamentally similar to Eastern thought. For example, in describing Wordsworth’s romantic reaction against the scientific mentality, Whitehead said, "Wordsworth was not bothered by any intellectual antagonism. What moved him was moral repulsion." Strumpf [1975, p. 389] suggests that Wordsworth was repulsed by the fact that scientific analysis has left something out, "that what had been left out comprised everything that was most important," namely moral intuitions and life itself.

Whitehead argued that because an actual occasion is not a material "thing," it is best understood as an "experience." These occasions do not exist, they happen. The difference is that merely to "exist" implies no change,
whereas to "happen" suggests a dynamic alteration. Whitehead maintained that the subject and the object are both in a continual process of change. Therefore, every experience the subject has affects the subject. In this way, no person can think the same way twice, because after each experience he is a different person [Georgescu-Roegen, 1971, p. 70].

In this way, Whitehead visualized reality as a continual process in which actual entities are constantly becoming. This is a process in which "what" an actual entity becomes depends on "how" it becomes. His emphasis is upon the notion of "creativity" as the fundamental characteristic of the process of nature [Strumpf, 1975, p. 393].

Analytic Philosophy: "Logical Positivism"

It would seem that in bringing this chronological discussion up to the present, the most recent developments in philosophy would reflect the ideas of Bergson and Whitehead to the extent they are consistent with the discoveries in modern physics. Quantum Theory and Relativity Theory are very difficult to reconcile with "positivism." In this way, the basic thrust of "positivism" would be either abandoned or at least significantly altered. It is also puzzling to note that as early as 1934, Karl Popper in Vienna and Gaston Bachelard in France had both
published works that contained fairly conclusive refutations of "positivism" [Chalmers, 1976, p. xvi]. However what actually happened was almost the exact opposite of what one would have expected. A kind of "neo-positivism" emerged which was extended to include warnings about our language. Consequently the new fashion in philosophy became "linguistic analysis."

This "analytic philosophy" has become the dominant philosophical activity in the Anglo-American world. Strumpf [1975, p. 430] comments, that in particular it was Wittgenstein's (1919) version of doing philosophy (philosophical analysis) that has dominated the contemporary philosophy scene in the English speaking world. "Logical positivism," or something similar has remained, particularly in the British universities, as the only respectable kind of "philosophy." Note however, it has scarcely prevailed at all in the Latin countries. Stromberg [1966, p. 386] has suggested that its popularity in the universities seems to relate closely to a principle of rationalization in large professional institutions. This sort of philosophy is not vague, can be precisely graded, is even tinged with the prestige of "science."

However, this is in sharp contrast to the past tradition of nineteenth century philosophers like Hegel who engaged in constructing complete systems of thought. Rather the function of the philosopher is no longer to discover unique forms of information about the world and man. The
discovery of facts is the exclusive task of the scientist. The philosopher instead can render a service by carefully unpacking complex problems whose origin is found in the imprecise use of language. As Strumpf [1975, p. 431] comments:

So in this new way, philosophy became closely related to science—-not as a rival discipline offering propositions of what reality is like but as the proofreader of the scientist's expressions, checking the literature of science for clarity and logical meaningfulness.

In other words, philosophy ceased to be a "search for wisdom" or a quest for absolute answers. Instead it simply became just the clarifier of scientific methods and concepts. The basic postulate was that philosophical method must be "scientific." Science is not only clear, logical, rational, analytical, but also "verifiable by sense experience". This "neo-empiricism" held that only via empirical investigation can knowledge be acquired. In this way, the business of acquiring knowledge was restricted to the empirical scientist. Philosophy was demoted to a support role. The business of philosophy is not to establish a set of philosophical propositions but to make other propositions clear. In many ways this is the crowning touch in the development of the Western "positivistic" mind. In terms of Kantian dualism, the phenomalists have simply decided that the other realm (the Idealists) deserves no attention and that in fact they are to become subservient. Their (the metaphysicians) statements are meaningless to the
extent they do not fit into the "positivistic" mode. This
new development in philosophy strikes the author as
particularly amazing precisely because of the fundamental
criticisms of "positivism" which had just recently been
articulated.

The Vienna Circle

"Logical positivism" originated with a group in Vienna
in the 1920's who called themselves the "Vienna Circle."
The group included such men as Moritz Schlick and Rudolph
Carnap. Ludwig Wittgenstien, although not a member of the
circle, often conversed with them as his book Tractatus
Logico-Philosophicus (1919) expressed their philosophical
view with great accuracy. This philosophy had tremendous
influence in Britian and the United States. This influence
was mainly spread by Wittgenstein, G. E. Moore and Bertrand
Russell. These philosophers were "positivists," and carried
on the "positivist" tradition but with a greater rigour and
clarity by regarding "metaphysics" as not a true object of
knowledge.

The "Vienna Circle" described themselves as "logical
positivists"--their goal being the unification of the
sciences. "Logical positivists" went beyond the simple
"positivism" of Comte by calling for "physicalism," or the
coupling of all statements to physical facts. For this
reason they perceived themselves as heirs to Hume's
empirical tradition. In fact, as Stromberg [1966, p. 384]
notes, some "logical positivists" even denied the right to
talk about things beyond the realm of verifiable sense
experience. Henceforth we could have a "unity of science"
which would give science a common language and tell us all
there is to say [Strumpf, 1975, p. 445]. Central to this
common language was their standard of clarity, the
"verification principle."

This dramatic shift in philosophy began with G. E.
Moore (1873-1958) and Bertrand Russell (1872-1970) in the
early decades of the twentieth century. Theirs was a
reaction to the system building of Hegelian philosophers who
had engaged in metaphysical speculation. Moore was
especially disturbed by the contrast between metaphysical
language and so-called "common sense." Hence, he was
inspired to analyze language mainly in order to clarify it
and make it fit the common sense of its meaning. Russell,
on the other hand, was a brilliant mathematician, who
observed the comparison between the language of mathematics
(which was precise) and the language of metaphysics (which
was loose and obscure). Consequently he attempted to invent
a new language, "logical atomism," which would have the
exactness and rigor of mathematics because it would be made
to correspond exactly to the facts [Durant, p. 478].

Both of these tasks emphasized the fact that philosophy
was no longer concerned with discovery, but with
clarification. It was not concerned with truth but with
Bertrand Russell And Logical Atomism

Russell's main point of departure was his admiration for the precision of mathematics. Note that it was this same admiration for the apparent precision of mathematics which influenced Descartes and resulted in Cartesian rationalism and ultimately the Cartesian-Newtonian machine-world view. Russell felt that since it was possible to construct a logic by which the whole of mathematics could be derived from a small number of logical axioms, it should also be possible to do the same for language. The vocabulary for this new logic would correspond to the particular objects in the world. He therefore set out to analyze certain "facts," which he differentiated from "things." Facts, according to Russell, constitute the complexity of relations between "things" to each other and therefore "it is the analysis of 'facts' that one's consideration of the problem of complexity must begin."

Russell felt that since facts have components then they must be analyzable [Durant, p. 479]. Note the strong "reductionistic" theme in Russell's approach.

Language, according to Russell, consists of a unique arrangement of words. Therefore, the meaningfulness of language is determined by the accuracy with which these words represent facts. Words, in turn, are formulated into "propositions." In Russell's scheme there are "atomic
facts" which are facts of the simplest kind. Then there are
"atomic propositions" which are propositions which state
atomic facts. Then there are "molecular propositions" which
are the linking of two or more atomic propositions. The
problem, stated Russell, is that there are no "molecular
facts" and therefore in order to test the truth or falsity
of molecular propositions, you must look to the atomic
propositions of which they are made. Therefore, as Strumpf
[1975, p. 434] notes, in Russell's system nothing can be
said about the world that is not analyzable down to an
atomic proposition, which, in turn, corresponds to an atomic
fact. Russell's logical atomism revived an interest in
Hume's empiricism because of the similarities in approach.
Russell's "atomic facts" roughly followed Hume's argument
that we can only know "particular" things because our
experience is particular.

The most troublesome problem with logical atomism
concerned the existence of "general facts." The whole
argument of logical atomism was based on the assumption that
only atomic facts exist. It had no way of dealing with
"general facts." A second problem was that if only
propositions that "state facts" are significant, then
propositions "about facts" are nonsignificant and therefore
senseless. The result of this would be to make most of
philosophy insignificant. Hence there were strong
metaphysical elements in logical atomism.
"Logical Positivism"

The metaphysical aspect of logical atomism became more and more apparent to Wittgenstein (1889-1951) until finally he became convinced that philosophy must reject the metaphysical elements in logical atomism. The right method of philosophy would be "to say nothing except what can be said, i.e., the propositions of science. . . ." This, for the most part is just what "logical positivism" took as its basic theme [Strumpf, 1975, p. 436].

The "logical positivists" were by temperament attracted to mathematics and the methods of science and henceforth they rejected metaphysics as had the earlier "positivists." But now they had an additional argument emerging from Russell's work in logic and Wittgenstein's powerful formulation for the relation of logic and language in the Tractatus Logico-Philosophicus. Thus the logical and essential character of language renders metaphysics impossible.

The grounds for their blanket rejection of metaphysics was found in their "verification principle."

Rudolph Carnap

Rudolph Carnap (1891-1970) took the position that "the only proper task of philosophy is Logical Analysis." By logical analysis he meant the analysis of all knowledge, all assertions of science and of everyday life in order to make clear the sense of each assertion and the connections
between them. The purpose of logical analysis is to discover how we can become certain of the truth or falsity of any proposition. Hence, one of the principle tasks is to discover the method of verification of that proposition. This verification was predominately empirical, although it could also be logical.

According to Carnap the verification of a proposition is either direct or indirect. If verification is indirect then directly verifiable propositions can be deduced from the indirectly verifiable proposition. He maintained that these two forms of verification, direct and indirect, are central to the "scientific method." Therefore, in Carnap's estimate, any assertion lacking a proposition verified by "perception," is no assertion at all [Strumpf, 1979, p. 438]. This statement appears to be consistent with Popper's "falsification principle," which requires that propositions be stated so as to have "observable consequences." By employing logical analysis, it is only a small step to concluding that metaphysical statements do not constitute knowledge, since they do not include verifiable propositions. According to Carnap [quoted in Strumpf, 1979, p. 438]

Metaphysical propositions are neither true nor false, because they assert nothing, they contain neither knowledge nor error, they lie completely outside the field of knowledge, of theory, outside the discussion of truth or falsehood. . . The danger lies in the deceptive character of metaphysics; it gives the illusion of knowledge without actually giving any knowledge. This is the reason we reject it.
Carnap placed normative ethics and value judgments in the realm of metaphysics. For example, when applied to issues of morality, "logical positivism" would maintain that statements of value which can not be "empirically verified" are merely expressions of preference. As Carnap stated:

[quoted in Strumpf, 1979, p. 439]

A value statement is nothing else than a command in a misleading grammatical form. It may have effects upon the actions of men, and these effects may be in accordance with our wishes or not; but it is neither true or false. It does not assert anything and can neither be proved nor disproved.

What this infers is that it is not possible to derive normative statements (what "ought" to be done) from a description of facts (what "is" done). Note the implicit assumption that it is, in fact, possible to make statements about what "is." As Stromberg [1966, p. 386] has suggested, these modern "philosophes" advised us, in much the same manner as Locke, to consider only what the mind is fitted for and forgot all the rest. Upon reflection, it appears as though modern, Western man has abandoned the quest for understanding the meaning and significance of things (teleology). Instead he became preoccupied with classification and description. Now, it appears that he (the "logical positivist") is suggesting that classification and description serves no other purpose than for its own sake.

In reaction to criticism from Reichenbach, Popper, Lewis and Nagel, Carnap eventually shifted his ground from
verification to "conformation." Eventually this was shifted to "corroboration" [Christenson, 1983, p. 9]. Universal scientific laws cannot be verified in their universal application, only single instances can be verified. Therefore as Strumpf [1979, p. 440] observes, "verification" in the strict sense gives way to the gradually increasing "confirmation" of scientific laws.

A. J. Ayer

However the most extreme statement of this new school came from A. J. Ayer in the 1930's. Ayer suggested, that no problems exist except the factual ones of science. All others can be shown by linguistic analysis to be nonexistent, pseudo-problems. Consequently most of the things philosophers and theologians had been worrying about throughout the centuries--God, freedom, spirit, purpose, morals, etc--represented a complete waste of time. They can be shown to be either wrong statements of the problem, or else purely personal or "emotive" projections of the feelings of the individual concerned, about which there can be no fruitful argument.

The Principle Of Verification

The "verification principle" was formulated as the basic principle for the meaningfulness or the literal significance of a proposition. The principle of verification consisted in the notion that the meaning of a statement is the method of its verification. The assumption
behind this principle was that verification must always rest upon empirical observation, that is, in sense experience. Hence any proposition that could not be verified by the method of observation would be said to have no meaning. However the case of mathematical propositions was treated in a special way [Strumpf, 1979, p. 441]. Obviously it was clear that metaphysics could not pass the test of reasonableness.

The "logical positivists," following Kant, distinguished two types of statements or judgments; analytic and synthetic judgments each with a different basis for its meaningfulness. A judgment is an operation of thought whereby we connect a subject and a predicate. The predicate qualifies in some way the subject. Analytical judgments generally do not increase our knowledge because the subject already contains or implies the predicate. For example, the statement, all triangles have three sides is analytical. The predicate is already implicit in the subject. Consequently, analytic statements are either "tautologies" or "contradictions" and in either case their meaning does not depend on experience, but rather on consistent use of clearly defined terms. Synthetic statements, on the other hand, are either true or false, their truth or falsity depending only on some reference to "facts." Hence, while analytic statements are "a priori," synthetic statements are generally "a posteriori." Analytic propositions have a
"formal" meaning whereas synthetic propositions have a "factual" meaning which is based on empirical observation of the objects referred to in the proposition.

The "logical positivists," thereby concluded that these two types of statements were the only type of statements that could have any meaning at all. Statements that are neither analytical or synthetic have no cognitive meaning or literal significance; they are simply "emotive" [Strumpf, 1979, p. 442].

Opposition To The Principle Of Verification: W. V. O. Quine

This conclusion was challenged by Quine who argued "that a boundary between analytic and synthetic statements simply has not been drawn. That there is such a distinction at all is an unempirical dogma of empiricists, a metaphysical article of faith" [quoted in Strumpf, 1979, p. 442]. Quine also pointed out the dogma of "reductionism," which holds that every meaningful statement can be translated into a statement about immediate experience. Quine concluded that both analytic and synthetic propositions contain only contingent truth and to that extent they do not differ. Indeed the total range of our knowledge, he says, "is a man-made fabric which impinges upon the experience only along the edges." Quine argued that any conflict between a statement we hold to be true and a new experience at variance with it requires an adjustment not only of that one statement but ultimately of all
interconnected concepts. As Bergson and Whitehead did before, Quine pointed out that even in the physical realm where where certainty seems the greatest, we must always be reminded to the effect that physical bodies are themselves only a convenient conceptual tool.

Problems With "Logical Positivism"

Aside from Quine's arguments, other reactions to this "positivistic" movement emerged. The "verification principle" itself fell victim to several serious difficulties. First and most critical was the assumption behind the verification principle that whatever could be said meaningfully would be stated in atomic statements. Scientific language would be reducible ultimately to "observational statements." But this begs the question of what is the "fact" that an observation statement reports. Is it a subjective experience about a physical object or is it a true picture of that object? What about Kant's statement that knowledge is a cooperative affair between the knower and the thing known? As he pointed out, even though we can distinguish between ourselves as the knower and the thing known, we can never know the thing as it is itself, because the moment we know it, we know it as our structured mind permits us to know it! This is the problem of "solipsism," the view that the self is the only object of real knowledge and, therefore, the experiences of one person cannot be the same as those of another. Each person's
experience is different, and all of their experiences are
different from the objectively real world.

The second difficulty encountered, was that the very
place the principle was to have its greatest relevance was
where it had it greatest difficulty. Scientific knowledge
is frequently expressed in the form of universal laws which
are the basis for "scientific prediction." But how can a
statement that makes a prediction be verified? There is no
single fact that can verify, at the present, the future
truth of a general statement. Therefore, such a statement
rigorously subjected to the verification principle would be
meaningless. This difficulty resulted in a compromise in
the rigorous application of the verification principle thus
giving the distinction between the "strong" and the "weak"
forms of the principle. The weak form simply stated that a
statement must be "verifiable in principle," or capable of
verification. A third difficulty encountered was that the
verification principle was not verifiable itself.

The "New" Wittgenstein

Wittgenstein ultimately came to reject his earlier
work, saying it was inadequate because it assumed that
language has really only one function, namely to state
facts. He had later come to feel that language has many
functions. It always functions in a "context" and therefore
it has as many purposes as there are contexts. Wittgenstein
realized that the assumption that all language states facts
and contains a logical skeleton was derived not by observation but by "thought." Hence, as Strumpf [1979, p. 446] notes, "logical positivism" did not develop from an observation of the way language operates and is used, but rather it was the product of thought. For this reason analysis should not consist in the "definition" of language but rather in a careful "description" of its uses. By recognizing the diversity of the functions of language, Wittgenstein inevitably altered the task of philosophy. Philosophy does not provide men with new or more information, but adds clarity by a careful description of language [Strumpf, 1979, p447]. What Wittgenstein sought to do was to shift philosophy's concern from meanings, from the assumption that words carried in them as so much freight "pictures" of objects in the world. Instead, he directed attention, through the assembling, selecting, and arranging of relevant examples, to the actual usages of words.

Concluding Comments And Introduction To Chapter III

To recap Chapter II, the atomistic and rational nature of Western thought was introduced by the Greeks, and further developed in the Middle Ages. The scientific and intellectual revolutions of the seventeenth century had several consequences affecting Western thought. First, the goal of teleology was abandoned in favor of simply observing and classifying observable properties. Galileo introduced
the notion of "primary qualities"; those qualities which are inherent in "objects." Galileo also combined empirical knowledge with mathematics. Perhaps most importantly, the "organic" view of the world was replaced by a "mechanistic" view. This mechanistic framework owes its greatest debt to Descartes who became the prophet of seventeenth century "rationalism." From Descartes' machine-world view, people learned to think of the natural world as consisting of inert matter in mechanical relationships, which could be understood by employing a "reductionistic" approach. From Descartes' dualism come the illusion of a "subject/object" split, which implied that the world could be described "objectively." Newton synthesized the works of Copernicus and Kepler, Bacon and Galileo and thus completed the Cartesian dream by developing a complete mathematical formulation of the mechanistic view of the natural world. He also synthesized the two opposing trends in seventeenth century science; the empirical, inductive method represented by Bacon, and the rational, deductive method represented by Descartes. The result was, more or less, the present "scientific method."

The belief in "reason" quickly invaded other disciplines during the European Enlightenment, the "age of reason." However, science met its first critics in Berkeley and Hume. Berkeley denied the existence of primary qualities in objects and Hume attacked the cornerstone of Western thought, causality. Hume argued that causality is
axiomatic and hence, metaphysical. Kant saved science from Hume's scepticism by developing the notion that there are two forms of knowledge. Through "logic" we can come to know the "world of appearances," or the world of phenomena. But it is through intuition that we can know the "world of substance" or the noumenal world. Hence, Kant destroyed the naive and arrogant world of science by showing that in science we deal with appearances and not the thing-in-itself. He showed the knowing was a joint affair between the knower and the thing being known.

Western thought subsequently focused on only one aspect of Kant's dualism; the world of phenomena. Comte argued that "positivism" or the "scientific method" was the method most appropriate for modern times. By "positivism," Comte meant the method of observed "facts," handled with the use of hypotheses. This was the culmination of the shift in emphasis on blind data gathering without any concern for ultimate causes.

This notion that the scientific mode of thought was the sole comprehensive source of knowledge was challenged by Bergson and Whitehead. They both sought to deflate some of the pretensions of science. Bergson further developed Kant's dualism by examining the two modes of consciousness; reason and intuition. He argued that rational knowledge is relative because it is subject to the preexisting concepts which exist in the mind. Intuition, on the other hand,
allows us to enter the object, to experience it directly without the intrusion of the "preformed structure" of the mind. Bergson, and Whitehead, argued that reality exists in duration, it is dynamic. To think intuitively is to think in duration. But to think analytically, is to break reality into static parts. Analytical thought involves the use of concepts which further remove us from reality.

Developments in physics in the early twentieth century, destroyed several "classical" concepts inherent in the Cartesian-Newtonian machine-world view. The atomistic, mechanistic view of nature was discarded. Reality was discovered to be at least four-dimensional and the Euclidian laws of geometry now longer held. The certainty desired by Descartes was acknowledged to be beyond the grasp of man. Most importantly, knowledge was found to be subjective. The notion of an "objective" observer, gathering independent "facts," was discarded. It was realized that the observer is really a participant, who in part creates the knowledge he is attempting to acquire.

Subsequent to the developments in physics and the criticisms of Bergson and Whitehead, occurances which should have at least significantly altered the basic thrust of "positivism," a kind of "neo-positivism" arose in Western thought. "Logical positivism" was an even more empirical philosophy, which simply decided that metaphysical statements were meaningless, as they did not fit into the "positivistic" mode.
CHAPTER III

ALTERNATIVE ONTOLOGIES: MODERN PHYSICS
AND EASTERN PHILOSOPHIES

Logic presumes a subject/object split: to remove the illusion of this subject/object split it is best to eliminate physical, mental and emotional activity.

[Pirsig, 1974, p. 136]

Any intellectually conceived object is always in the past and is therefore unreal. Reality is always the moment of vision before intellectualism takes place. There is no other reality. ...intellectuals have the hardest time seeing quality because they are so swift and absolute about snapping everything into intellectual form.

[Pirsig, 1974, p. 241]

Introduction To Chapter III

The forthcoming sections describe an ontological orientation which is radically different from the "positive" position discussed in Chapter II. It is an orientation which has always been the basis of Eastern philosophy. It is an orientation that is also acquiring increased attention in modern physics. This view recognizes that reality is greater than three-dimensional inputs we experience. Consequently, it rejects many of the "classical" assumptions and implications which underlie "positivism." This view also acknowledges the limitations of the rational intellect in much the same way as did Bergson and Whitehead.

Several fundamental themes which are present in all
Eastern philosophies are offered. These themes include an emphasis on intuitive, as opposed to rational, thought as a means of determining absolute knowledge. Also is the idea that everything is a manifestation of one ultimate oneness. Reality is also viewed as being dynamic. This stands in contrast to the static Cartesian-Newtonian view of reality. Eastern philosophies also suggest that the world which is perceived through the intellect is an illusion. The notion, fundamental to "positivism," of an "objective observer" independent from the "observed object" is an illusion as well. Perhaps most importantly, is the recognition of the role of the human consciousness.

From the discussion of modern physics and its implications for conceptualizing reality, the same fundamental themes as exist in Eastern thought emerge. It is a view of reality which quite similar to the view offered by Bergson and Whitehead in Chapter II.

The Ontological Assumptions And Implications Underlying "Positivism" And The "Scientific Method"

As late as second half of nineteenth century, the major assumption of science was that nature consists of material objects located in space. Matter, it was held, was the final irreducible stuff out of which all things are formed. The model for thinking about the contents and behavior of nature was the model of a machine. All the particular things in nature were thought to be parts of a large mechanism. This meant that the behavior of each part could
in time be described with mathematical exactness, since material objects moved in space in accordance with precise rules or laws. Moreover, as parts of a mechanism, things were related to each other in a tight sequence of cause and effect. Human nature was also viewed in these material and mechanical terms. As parts of a tightly organized cosmic machine, men were no longer thought of as being "free," as possessing freedom of will [Strumpf, 1975, p. 380].

As noted by Durant [p. 448], the priority of mathematics and mechanics in the development of modern science, coupled with the increasing stimulation of industry to meet the pressure of expanding needs, gave rise to a materialistic orientation. Hence the most successful of the sciences, physics, became the model for philosophic thought. Note the "Logical Positivists" discussed in Chapter II.

Nearly all the progress of mathematics in the nineteenth century was due to the use of the concepts of time and motion in addition to the traditional Euclidean geometry of space [Durant, p. 455]. It is perhaps the view of these two concepts which more than anything else demarcates modern and classical, Newtonian physics.

This firmly established Cartesian-Newton machine-world view of nature could be characterized as the following:

i) it was dualistic, mechanistic, and reductionistic;

ii) all physical phenomena resided in the three-dimensional space of classical Euclidean geometry. Hence, there was absolute space. All changes in this physical world were described in terms of a separate dimension, time,
which was also absolute. It had no connection with the material world and flowing smoothly from the past through the present to the future [Capra, 1983, p. 65]. Matter, the elements of the Newtonian world which moved in this absolute space and absolute time were small, solid, indestructable material particles. Thus Newton's world was atomistic as well as mechanical and deterministic.

Capra [1983, pp. 66-68] has identified the following consequences of the Cartesian-Newtonian world view:

i) the illusion of a "subject/object" split resulting from Descartes' dualism and Newton's atomistic world. Perhaps the most critical consequence of this Cartesian division was that the world was believed to be a mechanical system that could be described "objectively," without ever mentioning the human observer. Such an objective description of nature became the ideal of all science;

ii) a rigorous determinism was posited which viewed nature as being completely causal and determinate. Hence, all that happened had a definite cause and gave rise to a definite effect. The future of any part of the system could, in principle, be predicted with absolute certainty if its state at any time was known in all details;

iii) the overwhelming success of Newtonian physics and the Cartesian belief in the certainty of science led directly to an emphasis on hard science and hard technology in our culture; and

iv) the success of Newtonian physics also resulted in physics becoming the "model" for other areas of inquiry.

**Fundamental Laws In A Deterministic System**

For centuries scientists had been searching for the "fundamental laws" underlying the great varity of natural phenomena. These phenomena belonged to the scientist's macroscopic environment and thus to the realm of his sensory experience. Questions concerning the essential nature of
things were answered in classical physics by reducing all phenomena to the motions and interactions of hard indestructible atoms.

Newton's "classical" mechanics was considered for a long time to be the final theory for the description of all natural phenomena. This was the case until electric and magnetic phenomena, which had no place in Newton's theory, were discovered. The discovery of these phenomena showed that Newton's theory was incomplete and could only be applied to solid bodies; i.e., bodies consisting of a large number of atoms. Newton's theory was also only applicable if the velocities of the phenomena were small compared to the speed of light. When the first condition is not met then Quantum Theory must be applied and when the second condition is not met then Relativity Theory must be applied.

The first development which challenged the Newtonian model, was the investigation of electric and magnetic phenomena, which could not be described by the mechanistic model. In the second development, the concept of "force" was replaced with that of a "force field" by Faraday and Maxwell. Consequently, they were the first to go beyond Newtonian physics. They found it more appropriate to say that each charge creates a "disturbance" or a "condition" in the space around it so that the other charge, when around it feels a force. The culmination of this theory was electrodynamics which realized that light is nothing but a rapidly alternating electromagnetic field travelling through
space in the form of waves. Fifty years later, Einstein realized that no ether existed and that the electromagnetic fields were physical entities in their own right which could travel through space and not be explained mechanically.

Eastern Mysticism Versus Western "Positivism" As A Philosophical Base For Modern Physics

Upon examination it becomes apparent that the changes in thinking brought about by modern physics are ontologically consistent with Eastern mysticism.

For a parallel to the lessons of atomic theory. . . (we must turn) to those kinds of epistemological problems with which already thinkers like the Buddha and Lao Tzu have been confronted, when trying to harmonize our position as spectators and actors in the great drama of existence.

[Niels Bohr, 1958, p. 20]

The contradiction so puzzling to the ordinary way of thinking comes from the fact that we have to use language to communicate our inner experience which in its very nature transcends linguistics.

[D.T. Suzuki quoted in Capra, 1975, p. 53]

The problem of language here is really serious. We wish to speak in some way about the structure of atoms. . . . But we cannot speak about atoms in ordinary language.

[W. Heisenberg quoted in Capra, 1975, p. 53]

Quantum Theory and Relativity Theory, the two bases of modern physics, have made it clear that this reality transcends "classical" logic and that we cannot talk about it in ordinary language. Modern physics can show the other sciences and other disciplines that scientific thinking does not necessarily have to be reductionist and mechanistic, that holistic and ecological views are also scientifically
sound. Those people aware of these developments have learned the limitations of rational thinking. As Capra [1983] suggests scientists do not deal with truth, they deal with limited and approximate descriptions of reality. Note that this is in essence what Kant had said in the late eighteenth century.

This may be disturbing because in Western philosophy, logic and reasoning have always been the main tools used to formulate philosophical ideas. According to Bertrand Russell this is true even of religious philosophies. However in Eastern mysticism it has always been recognized that reality transcends ordinary language. Consequently there is no fear of going beyond logic. This is the main reason that the Eastern models of reality may constitute a more appropriate philosophical background to modern physics than do the models of Western philosophy, and especially "positivism." In fact as Capra [1983, p. 47] notes, modern physics which is the manifestation of an extreme specialization of the rational mind, is now making contact with mysticism which is the essence of religion and manifestation of an extreme specialization of the intuitive mind. This shows very well the unity and complementary nature of the rational and intuitive modes of consciousness; of the yang and yin (yin and yang will be discussed in a subsequent section).

In order to understand the philosophical impact of
modern physics, it is critical to realize that what we see, or hear, when investigating the microscopic world are never the investigated phenomena themselves but always their consequences. Therefore we are only able to "observe" the properties of atoms in an indirect way. So like the mystics, physicists are now dealing with a nonsensory experience of reality and consequently must face the paradoxical aspects of this experience.

The exploration of the atomic and subatomic world brought scientists in contact with a very strange and unexpected reality which shattered the foundations of their world view (the Cartesian-Newtonian machine-world view). It forced them to think in entirely new ways. Nothing like this had ever happened before in science. While the Copernican and Darwinian revolutions had introduced profound changes in the general conception of the universe, changes that were shocking to people, the new concepts were themselves not difficult to grasp. However in the twentieth century, physicists faced, for the first time, a serious challenge to their ability to understand the universe. Every time they asked nature a question in an atomic experiment, nature answered with a paradox. The more they tried to clarify the situation, the sharper the paradoxes became. It was finally realized that these paradoxes were essential aspects of atomic physics and that they arose whenever one tried to describe atomic phenomena in terms of classical concepts [Capra, 1983, p. 76].
These paradoxes exist because of the limitations of the intellect. Both modern physics and Eastern mysticism assert that reality is at least four-dimensional. However the intellect (with its visual imagery) can only comprehend three-dimensional reality. The paradoxes occur when we attempt to apply our three-dimensional concepts to a greater than three-dimensional reality.

The Role Of Paradoxes In Both Modern Physics And Eastern Mystical Philosophy

The question which puzzled physicists so much at first was how electromagnetic radiation could be both waves and particles. In atomic physics many of the paradoxical situations are connected with the dual nature of light or more generally electromagnetic radiation which produces waves and the so-called photoelectric effect [Capra, 1975, p. 56].

In Buddhism and Taoism the tendency is to emphasize the paradoxes rather than conceal them. Chinese and Japanese Buddhists have adopted the Taoist technique of communicating the mystical experience by simply exposing its paradoxical character. Zen Buddhists employ the extensive use of "koans" emphasize the paradoxes. These "koans" are carefully designed nonsensical riddles which are meant to make the student of Zen realize the limitations of logic and reasoning. In other words, they are impossible to solve by rational thought. They are designed to stop the thinking
process and thus make the student ready for the non-verbal experience of reality [Capra, 1975, p. 57].

Capra [1975, p. 58] observes that, as in Zen, the truth of atomic physics was hidden in paradoxes that could not be solved by logical reasoning, but rather had to be understood in terms of a new awareness—the awareness of atomic reality. The classic, Western way of looking at the world was inappropriate. Instead, a radically different ontological orientation was necessary. An orientation that is perhaps much more similar to that of the Eastern world.

Eastern Mystical Philosophy

In contrast to the "mechanistic" Western view, the Eastern view of reality is "organic." For the Eastern mystic, all things and events perceived by the senses are interrelated and connected. They are but different aspects or manifestations of the same ultimate reality. Consequently, our tendency to divide the perceived world into individual and separate things and to experience ourselves as isolated egos in this world is seen as an illusion which comes from our measuring and categorizing mentality. It is called "Avidya" or ignorance, in Buddhist philosophy and is seen as the state of a disturbed mind which must be overcome. Given this perception of reality, the highest aim of Eastern mysticism is to transcend the notion of an isolated individual self and to identify
oneself with the ultimate reality. The attainment of this awareness is known as "enlightenment."

In the Eastern view the division of nature into separate objects in not fundamental as it is in the Western view. The Eastern view is also intrinsically dynamic. In this holistic, organic view of reality, motion and change are essential properties of things. Hence, the forces causing the motion are not outside the objects, as in the classical Greek view (and the subsequent modern Western view), but rather are an intrinsic property of matter. Consequently, the Eastern image of the Divine is not that of a ruler who directs the world from above, but of a principle that controls everything from within [Capra, 1975, p. 29]. A detailed discussion of the classical concept of "force" follows in a later section of this dissertation.

Reason Versus Intuition: The Role Of The Intellect In Eastern Mysticism

One of the major ways in which Eastern thought has differed from the bulk of Western thought concerns the role of the rational intellect. In the West the intuitive mode of thought has almost been completely ignored. It has received some attention (Kant, the Romantics, Bergson and Whitehead to name a few) but in general it has not been taken seriously. The situation is quite the opposite in the East. For example Chinese philosophy has always emphasized the complementary nature of the intuitive and rational modes
of consciousness. This has been represented by the archetypal pair "yin and yang" which form the basis of Chinese thought. Accordingly Taoism and Confucianism have developed in ancient China to deal with the two kinds of knowledge.

The East has always viewed rational knowledge in a strikingly similar manner as did Bergson. Rational knowledge is "relative" because it creates a world of intellectual distinctions—of opposites which can only exist in relation to each other. Note that the concept of opposites is contained in the concept of distinctions. Rational knowledge is thus a system of abstract concepts and symbols, characterized by the linear, sequential structure which is so typical of our thinking and speaking. It belongs in the realm of the intellect, whose function is to discriminate, measure, and categorize. In this sense rational knowledge tends to be fragmented [Georgescu-Roegen, 1971, p. 31].

The "natural world," on the other hand is one of infinite varieties and complexities. It is a "multidimensional world" which contains no straight lines or completely regular shapes. It is a world where things do not happen in sequence but altogether [Georgescu-Roegen, 1971, p. 45]. It is a world where (as even modern physics tells us) even space is curved. Mystics maintain that this world can be known only through intuitive knowledge which is based on a direct, non-intellectual experience of reality
arising in an expanded state of awareness. It tends to be
synthesizing, holistic, and nonlinear. The problem is that
because our representation of reality is so much easier to
grasp than reality itself, we tend to confuse the two and to
take our concepts and symbols for reality [Georgescu-Roegen,
1971, p. 76]. It is one of the main objectives of Eastern
philosophy to rid us of this confusion. This is the primary
point of this paper: that we have come to mistake our
simplistic Cartesian-Newtonian model of reality for reality
itself. As noted by physicist Werner Heisenberg [1963, p.
125]

Every word or concept, clear as it may seem to be, has
only a limited range of applicability.

The map is not the territory.
[Alfred Korzybski quoted in Capra, 1975, p. 36]

Whereas rational knowledge is "relative," intuitive
knowledge, which is derived from experience is viewed by
Buddhists as "absolute." It does not rely on the
discriminations, abstractions and classifications of the
intellect which, as we have seen, are always relative and
approximate. It is the Eastern position that ultimate
reality can never be an object of reasoning or of
demonstrable knowledge. Absolute knowledge is an entirely
non-intellectual experience of reality.

Consequently as we define our system of concepts more
precisely, as we streamline it and make the connections more
and more rigorous, it becomes increasingly detached from the
real world. As Georgescu-Roegen [1971, p. 82] points out this often leads to empty theorizing.

The Limitations Of The Intellect.—Zen, which grew out of Buddhism but was strongly influenced by Taoism, prides itself on being "without words, without explanations, without instructions, without knowledge." It concentrates entirely on the experience of enlightenment and is only marginally interested in interpreting this experience. A well known Zen phrase is "the instant you speak about a thing you miss the mark" [Capra, 1975, p. 41]. The intellect is never seen as the source of knowledge, but rather is used merely to analyse and interpret personal mystical experiences.

Personal experience is... the foundation of Buddhist philosophy. In this sense Buddhism is radical empiricism or experientialism, whatever dialectic later developed to probe the meaning of enlightenment-experience.


Direct insight lies outside the realm of the intellect and is obtained by watching rather than thinking, by looking inside oneself, by observation [Castanada, 1971, 1972]. One Western philosopher, Henry G. Bugbee, Jr. [1958, p. 125] advocates a very similar position. Bugbee advocates an "experiential" philosophy, in which knowledge et al is derived from experience. He also points out that this is at odds with empiricism which is supported by an "experimental" philosophy. In Ch'an Buddhism, the Chinese version of Zen, enlightenment is often referred to as the "vision of the
Tao" and seeing is regarded as the basis of knowing in all Buddhist schools.

The seeing plays the most important role in Buddhist epistemology, for seeing is the basis of knowing. [D.T. Suzuki, 1963, p. 235]

The direct experience of reality transcends the realm of thought and language and since all mysticism is based on such a direct experience, everything said about it can only be partly true. Mystics are interested in the experience of reality and not the description of reality.

**Description Of Eastern Mystical Philosophies**

In Eastern mysticism, the attempt is made to extend intuitive insights to long periods. Ultimately, these insights become a constant awareness [Castanada, 1971, 1972]. This is accomplished through meditative techniques which appear to silence the thinking mind and shift the awareness from the "rational" to the "intuitive" mode of consciousness. Thus in meditation the mind is emptied of all thoughts and concepts in preparation for functioning in its intuitive mode. In the intuitive mode an extraordinary awareness of the environment is experienced in a direct way without the filter of conceptual thinking. In this state the mind is completely alert. Although it takes in all impressions of the surrounding environment, it does not hold onto these sensory images to be analyzed or interpreted. They are not allowed to distract the mind's attention.
Ultimately, the experience of "oneness" with the surrounding environment is achieved [Capra, 1975, p.46].

Hinduism.--The spiritual source of Hinduism lies in the "Vedas," a collection of four ancient scriptures written by anonymous sages. Most of these were composed between 1500 and 500 B.C. It is the fourth Veda, the "Upanishads," which contain the essence of Hinduism's philosophical and spiritual message. However, most Indians learn the teachings of Hinduism not through the Upanishads, but through a large number of popular tales. It is one of these tales, "Mahabharata," which contains India's favorite--the spiritual poem of the "Bhagavad Gita." The Gita is a dialogue between the god Krishna and the warrior Arjuna. The basis of Krishna's spiritual instruction, as of all Hinduism, is the idea that the multitude of things and events around us are but different manifestations of the same ultimate reality. This reality is called "Brahman" and gives Hinduism it's essentially monistic character in spite of the worship of numerous gods and goddesses [Capra, 1975, p. 99]. Brahman is understood as the inner essence of all things.

Another important term in Hinduism is "Maya." This has come to signify the psychological state of confusing the impressions on the mind with reality. As long as we fail to perceive the unity of Brahman underlying all our impressions, then we are said to be under the spell of Maya.
Note however that Maya does not mean that the world is an illusion. Rather the illusion merely lies in our point of view. We think that the shapes and structures around us are realities of nature, instead of realizing that they are concepts of our measuring and categorizing minds [Capra, 1975, p. 100]. Maya is the illusion of taking these concepts for reality, of confusing the map with the territory. Note the parallel with Kant's dualism. Kant argued that through logic we can know the "world of appearances" (phenomena), however it is through intuition that we come to know the "world of substance" (nomena). Maya is apparently the "world of appearances" in Kant's dualistic view of knowledge.

Another important term in Hindu philosophy is "Karma." We are bound by Karma so long as our view of the world is fragmented. As long as we are under the spell of Maya, we think we are separated from our environment and can act independently. Being freed from the bond of Karma means to realize the unity and harmony of all nature [Capra, 1975, p. 101].

All actions take place in time by the interweaving of the forces of nature, but the man lost in selfish delusion thinks that he himself is the actor.

[Bhagavad Gita 8.3]

"Moksha" or "liberation" is the very essence of Hinduism. It is the experience of freeing oneself from the bonds of Karma and realizing that everything, including our own self, is Brahman [Capra, 1975, p. 101].
Buddhism.—Unlike Hinduism, Buddhism had a single founder. Siddhartha Gautama was the "historic" Buddha and lived in India in the middle of the sixth century B.C. Whereas Hinduism is mythological and ritualist, Buddhism is unquestionably psychological [Capra, 1975, p. 105]. The Buddha was not interested in typical philosophic question such as the origin of the world. Rather he was exclusively concerned with the human condition, with the sufferings and frustrations of human beings. Hence his doctrine is not one of metaphysics but rather one of psychotherapy [Fromm, Suzuki and DeMartino, 1960].

As with all Eastern philosophies, the intellect is seen merely as a means to clear the way for the direct mystical experience, which Buddhists call the "awakening." The essence of this experience is to pass beyond the world of intellectual distinctions and opposites to reach the world of "Acintya." This is the unthinkable, where reality appears as undivided and undifferentiated "suchness" [Capra, 1975, p. 105].

According to Buddhist tradition, the expression of the Buddha's doctrine is in the form of the "Four Noble Truths." The first noble truth states the outstanding characteristic of the human situation. This is called "Dukkha" and refers to the suffering or frustration which comes from our difficulty in facing the basic fact of life, which is that everything around us is impermanent and transitory.
Suffering arises whenever we resist the flow of life and try to cling to fixed forms (Maya), whether they are things, people or ideas. This concept of impermanence also includes the notion that there is no ego. Buddhism holds that the idea of a separate individual self is an illusion. It is just another form of Maya, an intellectual concept that has no corresponding reality.

The second noble truth addresses the cause of all suffering. This is called "Trishna" and refers to a futile grasping of life based on a wrong point of view which is called "Avidya" or ignorance. It is out of this ignorance that we divide the perceived world into individual and separate things and thus attempt to confine the fluid forms of reality to the fixed categories created by the mind. Note the similarity with the thoughts of Bergson who argued that analysis interrupts the duration of reality. It (analysis) begins with the static and attempts to reconstruct movement as best it can. Intuition on the other hand, perceives movement as reality.

The third noble truth states that the suffering and frustration can be ended. It is possible to free oneself from the bondage of Karma and to reach "Nirvana" which is a state of total liberation. The fourth noble truth is the Buddha's prescription to end all suffering. This is the "Eightfold Path" of self-development which leads to a state of Buddhahood. The first two sections deal with right seeing and right knowing; i.e, clear insight into the human
situation. The next four sections deal with right action. They give rules for the Buddhist way of life, which is a middle way between opposite extremes. The last two sections are concerned with right awareness and right meditation.

"Dharmakaya," the "Body of Being," describes reality as it appears to the Buddhist's consciousness. Dharmakaya is similar to the Brahman in Hinduism [Capra, 1975, p. 110].

According to many authors the culmination of Buddhist thought is found in the "Avatamsaka" school. The central theme of Avatamsaka is the unity and interrelation of all things and events. This is a conception which is not only the very essence of the Eastern world view, but also one of the basic elements of the world view emerging from modern physics.

**Chinese Thought.**—Buddhism arrived in China around the first century A.D. However in an ancient Chinese culture, philosophic thought had already reached its culmination in the late Chou period (500-221 B.C.). Chinese philosophy differs from the other Eastern philosophies in that it has always had two complementary aspects. The Chinese sage deals with both spiritual matters and worldly affairs. He employs both intuitive wisdom and practical knowledge. In the 6th century B.C. these two sides of Chinese philosophy developed into Taoism and Confucianism. Confucianism was the philosophy of social organization. It employed common sense and practical knowledge. On the other, Taoism was
concerned primarily with the observation of nature and the
discovery of its "way," or Tao. According to the Taoists,
human happiness is achieved when one follows the natural
order and acts spontaneously and trusts one's intuitive
knowledge. Tao, or the "way," is the ultimate reality which
underlies and unifies the multiple things and events we
observe. It is the way, or process of the universe [Capra,
1975, p. 116]. The Chinese sage recognizes the patterns of
the Tao and directs his actions according to them. In this
way he becomes "one with the Tao," and lives in harmony with
nature. The Tao is the equivalent of the Hindu Brahman and
the Buddhist Dharmakaya. Taoism was pursued by older people
in order to regain and develop the original spontaneity
which had been destroyed by social conventions (which were
emphasized in Confucianism). It is important to note that
while other Eastern philosophies tend to emphasize only the
intuitive mode of thought (in much the same way Western
philosophy tends to emphasize only the rational mode of
thought), Chinese thought addresses both the intuitive and
the rational. The Chinese believe that whenever a situation
develops to its extreme, it is bound to turn around and
become its opposite.

All manifestation of the Tao are believed to be
generated by the dynamic interplay of the two polar
opposites, "yin" and "yang."

The "yang" having reached its climax retreats in favour
of the "yin"; the "yin" having reached its climax
retreats in favour of the "yang."

The dynamic character of yin and yang is illustrated by the ancient Chinese symbol, "T'ai-chi T'u," or the "Diagram of the Supreme Ultimate" [Capra, 1975, p. 119]:

![T'ai-chi T'u](image)

Fig. 1--Diagram of the Supreme Ultimate

The two dots in the diagram symbolize the idea that each time one of the two forces reaches its extreme, it contains in itself already the seed of its opposite [Capra, 1975, p. 120].

The following associations of yin and yang are offered by Capra [1983, p. 38]:

<table>
<thead>
<tr>
<th>YIN</th>
<th>YANG</th>
</tr>
</thead>
<tbody>
<tr>
<td>feminine</td>
<td>masculine</td>
</tr>
<tr>
<td>contractive</td>
<td>expansive</td>
</tr>
<tr>
<td>conservative</td>
<td>demanding</td>
</tr>
<tr>
<td>responsive</td>
<td>aggressive</td>
</tr>
<tr>
<td>cooperative</td>
<td>competitive</td>
</tr>
<tr>
<td>intuitive</td>
<td>rational</td>
</tr>
<tr>
<td>synthesizing</td>
<td>analytical</td>
</tr>
</tbody>
</table>

Thus yang has come to symbolize movement while yin symbolizes rest. With respect to the two modes of thought, yang is the clear and rational male intellect while yin is the complex
female intuitive mind [Capra, 1975, p. 119]. However it is important to understand that these opposites do not belong in different categories but are extreme poles of a single whole. As Capra [1983, p. 35] notes, nothing is only yin or only yang. Rather all phenomena are manifestations of a continuous oscillation between the two poles. This notion can be illustrated with the following diagram [Capra, 1975, p. 159]:

![Diagram of the unity of opposites](image)

**Fig. 2—Diagram of the unity of opposites**

It should be apparent that given these traits, Western societies have consistently favored the yang over the yin.

**Taoism.**—Like Hinduism and Buddhism, Taoism is interested in "intuitive wisdom" rather than "rational knowledge." Taoism seeks liberation from this world of appearances by acknowledging the limitations and the relativity of the world of rational thinking. More than any other Eastern philosophy, Taoism displays a strong mistrust of conventional knowledge and reasoning. This is based on the firm belief that the intellect can never comprehend the "Tao." Logical reasoning is considered to be part of the
The most extensive knowledge does not necessarily know it (Tao); reasoning will not make men wise in it. The sages have decided against both these methods. 

[Chuang Tzu, ch. 22]

Taoism is also insightful in its realization that transformation and change are essential features of nature. As Capra [1975, p. 126] notes, Taoists claim that all changes in nature are manifestations of a dynamic interplay between the polar opposites "yin" and "yang." They believe that any pair of opposites constitutes a polar relationship where each of the two poles is dynamically linked to the other. This concept lies at the very heart of Taoism.

The "this" is also "that." The "that" is also "this". 
. . . that the "that" and the "this" cease to be opposites is the very essence of Tao. Only this essence, an axis as it were, is the centre of the circle responding to the endless changes. 

[quoted in Fung Yu-Lan, 1958, p. 112]

As noted by Capra [1975], at the time the world view of Taoism was being developed in the East, its essential features were taught also in Greece, by Heraclitus of Ephesus. He shared not only the emphasis on continuous change, but also the notion that all changes are cyclic and that polar opposites are united [Kirk, 1970, p. 307]. Capra [1975] points out that while Heraclitus is often mentioned in connection with modern physics, he is rarely ever mentioned in connection with Taoism. Also note, that this Taoist notion of change contains an absense of force. In other words, change is considered an innate tendency in all
things and situations. Movement occurs naturally and spontaneously. Spontaneity is the Tao's principle of action. Therefore, to the extent that human action should be modeled after the Tao, spontaneity should also be characteristic of all human actions. To act in accordance with nature is to act spontaneously and trust one's intuitive intelligence. Note the parallel here with Whitehead and particularly Bergson. As noted by Stromberg [1966, p. 341], Bergson's philosophy urged the importance of intuition, spontaneity and immediate experience over the "tentacles of cold, prying thought" [Nietzsche] which may give us useful knowledge but which cuts us off from reality.

Zen.—Chinese thought encountered Indian thought, in the form of Buddhism, around the first century A.D. At this time two parallel developments took place. The first led to an interpretation of Buddhism in light of Chinese thought and resulted in the Avatamsaka school of Buddhism in China. The second development involved a concentration of the practical aspects of Buddhism. This led to a special kind of spiritual discipline called "Ch'an." Ch'an is usually translated as "meditation." This philosophy, under the name of "Zen," was adopted by the Japanese around 1200 A.D. As Capra [1975, p. 131] notes, Zen is a unique blend of the philosophies and idiosyncrasies of Indian, Chinese and Japanese culture. However in essence, Zen is purely Buddhist. It has no other aim than the Buddha or attainment
of enlightenment. In Zen this is know as "satori." Zen is also unique in that it concentrates exclusively on this experience and is not interested in any further interpretations. According to D. T. Suzuki, "zen is disciple in enlightenment." Because the experience of satori transcends all categories of thought, Zen is not interested in any abstraction or conceptualization. More than any other Eastern philosophy, Zen is convinced that words can never express the ultimate truth. For this reason, Zen masters despise all theorizing and speculation. Rather they have developed ways of pointing directly at the truth. "Koans," or riddles, are instrumental in exposing the paradoxes of conceptual thinking.

An often referred to illumination of Zen, was provided by Eugen Herrigel [1953]. Herrigel, a German philosopher, describes his experience in taking up archery toward an understanding of Zen. The practice of archery, as with other arts in Japan, are meant to train the mind. D. T. Suzuki notes that the "mind has first to be attuned to the Unconsciousness [quoted in Herrigel, 1953, p. vi]." Consequently, to master an art, technical expertise is not enough. Rather one must transcend technique so that the art becomes an "artless art" growing out of the unconsciousness [Herrigel, 1953, p. vi].
Concluding Comments On Specific Eastern Philosophies.--

Hopefully, at this point one can discern several fundamental themes which are present in all the Eastern philosophies discussed. The first of these themes is the emphasis on intuitive, as opposed to rational, thought as a means of determining absolute knowledge. All Eastern philosophies are acutely aware of the limitations of the rational intellect. A second theme is the idea that everything is a manifestation of one ultimate oneness. This is Brahman in Hinduism, Dharmakaya in Buddhism, the Tao in Taoism and Satori in Zen. A third theme is the acknowledgement that the world we perceive through our intellect is an illusion. Consequently the the "objectiveness" and "independence" of "objects" are all an illusion. The idea of an "objective observer" independent from the "observed object" is an illusion. A fourth theme is an acknowledgment of the limitation of language. The consequence is an emphasis on experiencing reality rather than attempting to describe reality. The final theme evident in Eastern thought is that the ultimate goal or objective is the freeing of oneself from the illusions which are created by the intellect.

It is interesting to note that a majority of these Eastern philosophies were beginning to develop in the time frame of the sixth century B.C. This roughly corresponds to the period when the roots of Western thought were also being developed. As mentioned previously, the early period of
Greek philosophy held rather similar ideas to those of the East. This is particularly true of Heraclitus of Ephesus. Consequently it should be apparent that a tremendously significant fundamental split in ontological positions emerged at about this time and that two separate and quite distinct sets of philosophies developed over the following 2500 years.

**Paradoxes**

Another very important characteristic of Eastern philosophies are their recognition of the paradoxical nature of reality. Indian mysticism, especially Hinduism, deals with the paradoxical nature of reality by clothing its statements in the forms of myths, metaphors and symbols. Chinese and Japanese mystics deal with the language problem by using factual language. They use paradoxes in order to expose the inconsistencies arising from verbal communication and to show its limits. This has reached an extreme in Zen with its koans [Capra, 1975, p. 51]. This paradoxical aspect of reality is very important in the Western world because it was the apparent paradoxical behavior of light that led to Quantum Theory.

**Modern (Atomic And Subatomic) Physics**

The exploration of the atomic and subatomic world brought scientists in contact with a strange and unexpected
reality that shattered the foundations of their world view and forced them to think in entirely new ways. Although events such as the Copernican revolution introduced profound changes in the general conception of the universe, the basic ontological orientation of Western thought was unaltered. However, in the twentieth century physicists faced a serious challenge to their ability to understand the universe. Every time they asked nature a question in an atomic experiment, nature answered with a paradox. It was only after they altered their world view and discarded many Newtonian concepts, that they were able to resolve these paradoxes.

In particular, Quantum Theory (atomic theory) and the Theory of Relativity shattered several Newtonian concepts including

i) the notion of absolute space and time;
ii) the notion of elementary solid particles;
iii) the notion of a strictly causal nature of physical phenomena; and
iv) the ideal of an objective description of nature [Capra, 1975, p. 70].

In 1905 Einstein initiated two revolutionary trends of thought. The first was his Special Theory of Relativity which was later expanded to include gravity and became his General Theory of Relativity. Secondly, Einstein proposed a new way of looking at electromagnetic radiation which was to become characteristic of Quantum Theory, the theory of atomic phenomena. The Theory of Relativity suggests that
space is not three-dimensional and time is not a separate entity. Rather both are intimately connected and form a four-dimensional continuum which is "time-space." Consequently, we can never talk about space without talking about time and vice versa. Also there is no universal flow of time as in the Newtonian model. Hence, different observers will order events differently in time if they move with different velocities relative to the observed events [Calder, 1980]. All measurements of time and space lose their absolute significance.

Relativity Theory also suggests that mass is nothing but a form of energy. Hence, Einstein's famous equation $E=mc^2$ where $c$ is the speed of light. The significance of this is that mass has nothing to do with any substance but is a form of energy. As Capra [1975, p. 88] notes, the fact that a particle is equivalent to a certain amount of energy means that the particles can no longer be seen as a static object, but must be conceived as a dynamic pattern.

A third aspect of the Theory of Relativity concerns the fundamental importance of the speed of light. Whenever we describe physical phenomena involving velocities which approach the speed of light our description has to take into account the Theory of Relativity.

In 1915 Einstein introduced his General Theory of Relativity which included gravity. The gist of the general theory was that the effect of gravity has the effect of
"curving space and time." Whenever there is a massive object the space around it is curved and the degree of the curvature depends on the massiveness of the object. Since time is intimately related to space it is therefore also curved. Consequently, Euclidian geometry is no longer valid in such curved time-space. Also, time will flow at different rates in different parts of the universe.

Note however, that Newtonian physics still may be utilized in the region called the "Zone of Middle Dimensions." Although it is not a correct description of reality, the approximation is close enough in this region.

The notion of elementary, solid particles was finally discarded when the phenomena of radioactivity gave solid proof of the composite nature of atoms. Rather than being elementary particles, atoms consist of vast regions of space in which extremely small electrons move around a nucleus. These electron are bound to the nucleus by electric forces. Quantum Theory made it clear that these particles were nothing like the solid objects of classical physics.

If the effect of Quantum Theory on the physicist's imagination was shattering, what they finally came to understand about subatomic units of matter was even more difficult to comprehend. These are abstract entities which have a dual aspect. Depending on how we look at them they appear sometimes as particles and sometimes as waves. Perhaps one of the most important consequences of our understanding of subatomic matter is that at the subatomic
level matter does not exist with certainty at definite places but rather shows "tendencies to exist [Georgescu-Roegen, 1971, p. 54]." These tendencies are expressed as "probabilities." Consequently all laws of atomic physics are expressed in terms of these probabilities. It is critical to note that these are not probabilities of "things" but of "interconnections." As Capra [1975, p. 78] notes, a careful analysis of the "process of observation" in atomic physics has shown that the subatomic particles have no meaning as isolated entities, but can only be understood as interconnections between the "preparation" of an experiment and the subsequent "measurement." Quantum Theory thus reveals the "basic oneness" of the universe. It shows we cannot decompose the world into independently existing smallest units. The more we attempt to do this the more we find a complicated web of relations between the various parts of the whole. Furthermore, these relations always include the observer in an essential way [Georgescu-Roegen, 1971, p. 75]. According to Capra [1975, p. 78]

The human observer constitutes the final link in the chain of observational processes, and the properties of any atomic object can only be understood in terms of the object's interaction with the observer.

It has long been argued that any empirical epistemology suffers from the "theory dependence of observation." Some form of theory must precede all observation statements. Hence, observational statements are as fallible as the theories they presuppose [Chalmers, 1976, p. 26]. Capra's
observation concerning the human observer could be described as the "experiment dependence of observation." It should be obvious that the classical ideal of an objective description of nature is no longer valid.

Perhaps the most spectacular feat of Relativity Theory is the creation of material particles from pure energy. Recall that Relativity Theory showed that mass has nothing to do with any substance, but is a form of energy. This feat is accomplished when subatomic particles are "banged" together in collision processes involving high energies. Hence high energy physics. Instead of dividing matter again and again and ending up with smaller pieces, we end up with newly created particles from the energy involved in the process. Capra [1975, p. 89] notes that this paradox of divisible but indestructable particles is resolved only once the static view of particles being "objects" consisting of "basic building blocks" is discarded. Instead particles are seen as dynamic processes or pattern, which involve a certain amount of energy which appears to us as their mass. In a collision process, the energy of the two particles are redistributed to form a new pattern. In this way all particles can be transmuted into other particles. They can be created from energy and can vanish into energy.

Consequently, concepts like "material substance" and "isolated objects" have no meaning. The whole universe thus appears as a dynamic web of inseparable energy patterns.
Furthermore the properties of a particle can only be understood in terms of its activity or its interaction with the surrounding environment. To understand subatomic particles, one can no longer view them as isolated entities, but rather they must be viewed as integrated parts of a whole.

Primary Concepts And Implications Shared By Eastern Mystical Philosophy And Modern Physics

From the preceding discussions of Eastern philosophies and modern physics it should be apparent that these two bodies of thought have several fundamental concepts in common. In particular seven concepts will be introduced and subsequently discussed in detail.

The first of these concepts is referred to as the "interrelated cosmic web." This is the fundamental notion that reality is interrelated rather than being comprised of objective "objects" with inherent qualities existing independently of each other. This view places an emphasis on the interconnections or relations between perceived "objects" rather than on the "objects" themselves.

Both Eastern philosophies and modern physics have become aware of the second concept, the "unity of opposite concepts." It could be suggested that the existence of apparent distinct and opposite ideas or concepts would seem to imply that reality is not interrelated. However, this suggestion is quickly dismissed for two reasons. First, the
The concept of relationship is necessary to the concept of opposite. The notion of being opposite has meaning only in relation to something. Secondly, and more importantly, is the recognition that these apparent opposite concepts are the consequences of our intellect. An intellect which is limited by the three-dimensional inputs to our senses. Therefore an awareness of a reality of greater than three-dimensions resolves these apparent opposite concepts.

The third concept is the awareness of a greater than three-dimensional reality. Not only does this awareness resolve apparent opposite concepts, but it also leads to the realization that all the concepts we use to describe nature are limited. These concepts are not features of reality, but rather creations of the mind. They are parts of the map, not the territory. Consequently, whenever we expand the realm of our experience, the limitations of our rational mind becomes apparent. This limitation occurs because we have no direct sensory experience of a greater than three-dimensional reality. We can only observe its three-dimensional "images" in much the same way that we observe a two-dimensional shadow of a three-dimensional object.

The fourth concept shared by Eastern philosophies and modern physics is that of a highly dynamic rather than static reality. Consequently, rather than emphasizing perceived "objects," the emphasis is on movement, flow and change. The world is more appropriately thought of as being divided into different groups of connections or events,
rather than different groups of "objects."

The fifth concept dispells the view of the universe as containing material objects upon which "forces" operate. Material objects are not seen as distinct entities but rather as parts of more fundamental "fields." Hence, there are no "forces," only interactions between particles. The scenario of distinct and objective matter being acted on by some "force" in empty space is discarded.

The sixth concept concerns the deemphasis on perceived "objects." From this deemphasis it follows that Eastern philosophies and modern physics would reject the concept of "fundamental building blocks." This is already the case in the East, and in physics there is the continuing realization that the existence of elementary particles is increasingly unlikely. The interconnectiveness of matter suggests that particles are "processes" rather than "objects." This would infer that the longstanding Western "mechanistic" view of reality should be discarded.

The seventh, and perhaps most important, concept recognized by both Eastern philosophies and modern physics is the important role held by the human consciousness. For if the universe is one inseparable organic whole, then all life forms, including human beings and the human consciousness must be regarded as part of the universe.
The most important characteristic of Eastern philosophies is that of experiencing all phenomena in the world as manifestations of a basic oneness. In the Eastern world there is the awareness of the unity and interrelation of things and events. This oneness is Brahman in Hinduism, Dharmakaya in Buddhism and Tao in Taoism. The normal, Western state of consciousness is not generally aware of this unity. Hence, the world is divided into separate objects and events. Westerners suffer from the illusion that their abstract concepts of separate "things" and "events" are realities of nature. Hindus and Buddhists say this illusion is based on "Avidya" or ignorance, and is produced by a mind under the spell of "Maya." Consequently, the principle aim of Eastern mystical traditions is to readjust the mind by centering and quieting it through meditation. In Sanskrit, the term for meditation, "Samadhi" literally means "mental equilibrium."

This basic oneness of the universe is also one of the most important revelations of modern physics. It becomes apparent at the atomic level and even more so at the subatomic level. Capra (1975, p. 142) notes that modern physics, and Quantum Theory in particular, expresses again and again, the same insight. All phenomena is interconnected, interrelated and interdependent. They cannot be understood as isolated entities but only as
integrated parts of the whole. To illustrate this point the Copenhagen Interpretation of Quantum Theory, developed by Bohr and Heisenberg in the late 1920's, is offered. The starting point of the Copenhagen interpretation is the division of the physical world into an "observed system [object]" and an "observing system." The observing system is the experimental apparatus and is described in terms of classical physics, which can be thought of as a refinement of our everyday language. However, these classical terms cannot be used consistently for the description of the observed "object." The observed systems (object) are described in terms of probabilities. It is critical to realize that the statistical formulation of the laws of atomic and subatomic physics does not reflect our ignorance of the physical situation. Quantum theory recognizes probability as a fundamental feature of atomic reality which governs all processes and even the existence of matter. Subatomic particles do not exist with certainty at certain places, but rather show "tendencies to exist." Consequently, an inescapable paradox emerges in that we know that classical concepts are inadequate at the atomic level, yet we have to use them to describe our experiments and to state the results. So we are faced with two types of description; classical terms for the experimental arrangement and probability functions for the observed objects. This supports that position taken by Bergson and
Whitehead, that we naturally incline to materialism. Georgescu-Roegen [1971, p. 141] argues that the mind can understand phenomena only if that phenomena can be represented by a mechanical model. This goes a long way in explaining why we have held on to the Cartesian-Newtonian description of reality for so long. It is because we can make sense of it. We don't have the language to even talk about this new "reality."

Another important point in this analysis of observation is that the particle constitutes an intermediate system connecting the processes at A and B. It exists and has meaning only in this context. Not as an isolated entity, but as an interconnection between the process of preparation and measurement. The concept of isolated material particles is an abstraction [Bohr, 1934, p. 57]. Hence, the properties of the particle cannot be defined independently of these processes. The basic problem with observation in atomic physics is that the observed system is required to be isolated in order to be defined, yet it must be interacting in order to be observed [Stapp, 1971, p. 1303].

The observed object is a manifestation of the interaction between the processes of preparation and measurement. What happens is that the measuring devices are places so far apart that their main interaction occurs through the exchange of a particle or in more complicated cases of a network of particles [Capra, 1975, p. 149].

Note that the dual wave/particle aspect of subatomic
units means that neither electrons, nor any other atomic "object" has any "intrinsic" properties independent of its environment. The properties it shows will depend on the experimental situation. This would seem to augment Berkeley's argument that there are no "primary" qualities inherent in observed objects. It is also consistent with Kant's position that knowing is a joint process between the knower and the thing being known.

One is led to a new notion of unbroken wholeness which denies the classical idea of analyzability of the world into separately and independently existing parts. . . . We have reversed the usual classical notion that the independent "elementary parts" of the world are the fundamental reality, and that the various systems are merely particular contingent forms and arrangements of these parts. Rather, we say that inseparable quantum interconnectedness of the whole universe is the fundamental reality, and that relatively independently behaving parts are merely particular and contingent forms within this whole.

[David Bohm, 1975]

Note that the probabilities inherent in Quantum Theory are not probabilities of events, but rather of "interconnections." Quantum Theory forces us to see the universe not as a collection of physical objects, but rather as a web of relations between the various parts of a unified whole.

The material object becomes. . . something different from what we now see, not a separate object on the background or in the environment of the rest of nature but an indivisib e part and even in a subtle way an expression of the unity of all that we see.

[S. Aurobindo, 1957, p. 993]

Things derive their being and nature by mutual dependence and are nothing in themselves.

The Einstein-Podolsky-Rosen (EPR) experiment illustrates the concept of instantaneous, nonlocal connections, which is an excellent example of how a quantum phenomenon clashes with our Western view of reality. The EPR experiment was a thought experiment devised by Einstein in response to his famous debate with Bohr concerning the interpretation of Quantum Theory. Bohr held the position that nonlocal connections existed and that probability was fundamental. In other words, he defended modern Quantum Theory. Einstein assailed the theory and held to the position that reality consisted of separate parts, joined by local connections. From this great debate, Bohr emerged the victor. The crux of the EPR experiment, as explained by Bohr [Capra, 1975, p. 343], is that the two particle system is an indivisible whole and cannot be analyzed in terms of independent parts. Even though the particles may be separated far apart in space, they are nevertheless linked by "instantaneous, nonlocal connections." In other words the world is fundamentally inseparable. Thus in Quantum Theory individual events do not always have a well defined cause. We can never predict when and how such a phenomena is going to happen, we can only predict its probability. This does not mean that atomic events occur in completely random fashion but rather that they are not brought about by local causes. The behavior of any part is determined by its nonlocal connections to the whole, and since we do not know
these connections precisely, we have to replace the narrow
classical notion of cause and effect by the wider concept of
statistical probability. Whereas in classical mechanics the
properties and behavior of the parts determine those of the
whole, the situation is reversed in quantum mechanics; it is
the whole that determines the behavior of the parts [Capra,
1983, p. 86]. It should be apparent that the deterministic
Cartesian-Newtonian method of analyzing the world into parts
and arranging those parts according to causal laws is no
longer possible. The concept of nonlocality clearly implies
that the structure of matter is not mechanical. Hence the
concept of separate parts, according to Quantum Theory, is
simply an idealization. This is precisely the point
previously made by Bergson and Whitehead.

Today there is a wide measure of agreement. . . that
the stream of knowledge is heading towards a non-
mechanical reality; the universe begins to look more
like a great thought than like a great machine.
[James Jean, 1930]

Unquestionably the most important implication of this
awareness of a fundamentally inseparable universe concerns
the role of the human observer. Just as the Eastern
mystic's interwoven view of reality always includes the
human observer and his or her consciousness, such is the
case in atomic and subatomic physics. At the atomic level
"objects" can only be understood in terms of the interaction
between the processes of preparation and measurement. At
the end of this chain of processes lies always the
observes, the crucial feature of atomic physics is that the human observer is not only necessary to "observe" the properties of an object, but is necessary even to "define" these properties. Therefore, as Heisenberg [1963, p. 75] suggests, what we observe is not nature itself, but nature exposed to our method of questioning. The observer decides how he is going to set up the measurement and this arrangement will determine, to some extent, the properties of the observed object. If the experimental arrangement is modified, then the properties of the observed object will in turn change. Therefore in atomic physics, the scientist cannot play the role of a detached objective observer, which is implied in the Cartesian-Newtonian view. Rather he becomes involved in the world he observes to the extent that he influences the properties of the observed objects. Note that this is nothing but an expansion and refinement of Kant's idea that knowing is a joint affair between the knower and the thing being known.

The Unity Of Opposite Concepts

In our normal state of consciousness, the unity of contrasts, and especially the unity of opposites, is extremely hard to accept. It represents one of the most puzzling aspects of Eastern thought. To understand this unity of contrasts, one must realize that opposites are abstract concepts belonging to the realm of thought, and as
such they are relative. By the very act of focusing our attention on any one concept we create its opposite [Capra, 1975, p. 157]. Eastern mystics are keenly aware of the relativity and polar relationships of all opposites. In fact this awareness is one of the highest aims of Eastern thought.

The fundamental idea of Buddhism is to pass beyond the world of opposites, a world built up by intellectual distinctions and emotional defilements, and to realize the spiritual world of non-distinction, which involves achieving an absolute point of view.

[D. T. Suzuki, 1968, p. 18]

The whole of Eastern mysticism revolves about this absolute point of view which is reached in the world of "Acintya" or "no-thought." Here the unity of all opposites becomes a vivid experience. By understanding that all opposites are interdependent, it follows that their conflict can never result in the total victory of one side. Rather the conflict will always manifest itself in the interplay between the two sides. This point is best observed in Taoism, where the "Tao" is the unity underlying the opposite concepts of "yin" and "yang." It is the process that brings about their interplay [Capra, 1975, p. 158]. It should be apparent that Western society has failed to understand the interdependency between these two concepts. Western society has tended to emphasis the yang or male side of this interdependency. Hence, there has been an overemphasis on rational and analytical thinking as opposed to intuitive and synthesizing thought. This is at odds with the goal of
Chinese thought which is to strike a balance between the two extremes.

The exploration of the atomic and subatomic world has led physics to a similar view concerning apparently opposite concepts. Their investigations have revealed a reality which repeatedly transcends language and reasoning. The unification of concepts which had heretofore seemed opposite and irreconcilable turns out to be one of the most startling features of this new reality. For example, in Relativity Theory, we transcended the classical concepts of space and time to the higher dimension of space-time. These were two concepts which had seemed to be entirely different, but which have been unified in modern physics. Relativity Theory also suggests that energy and matter are united. Other examples of unified concepts include the following: atomic phenomena behave both as particles and as waves, they are both continuous and discontinuous, they are also both destructible and indestructible.

Note that Relativity Theory is not necessary to experience the unification of seemingly separate entities in a higher dimension. This can be experienced by simply going from one to two dimensions, or from two to three dimensions. For example, consider the diagram of the dynamic unity of polar opposites on the preceding page. The polar opposites [in the one dimensional line] are united in the circular movement [of the two dimensional plane]. Note that there is however, a significant difference between this example and
moving from three to four dimensions. Physicists can "experience" four dimensional space-time through the abstract mathematical formalism of their theories, but their visual imagination, like everyone else's is limited to the three dimensional world of our senses. Because our language and thought patterns have evolved in this three-dimensional world, it is extremely hard to deal with the four-dimensional world of relativistic physics. Eastern philosophy suggests that this problem can only be overcome by dispensing with rational thought, and instead utilizing intuition. Hence, it is through meditation that mystics can transcend this three-dimensional world of everyday life.

An experience of higher dimensionality is achieved by integration of experiences of different centres and levels of consciousness. Hence, the indescribability of certain experiences of meditation on the plane of three-dimensional consciousness and within a system of logic which reduces the possibilities of expression by imposing further limits upon the process of thinking.

[Lama Anagarika Govinda, 1973, p. 136]

Possibly the most famous case of such a unification of contradictory concepts is that of the concepts of particles and waves in atomic physics. At the atomic level matter has a dual (particle/wave) aspect. Particles moving in a wave pattern do not exist in nature, instead the particles move in a circular motion. It is a "disturbance" which is transported along the wave causing the wave phenomenon [Čapra, 1975, p. 165]. Because of this dualism, atomic phenomena have a statistical nature. In other words, atomic phenomena can only be described in terms of probabilities
These "waves" are not three-dimensional waves, like water or sound waves, but are "probability waves." They are abstract mathematical quantities which are related to the probabilities of finding the particles in various places and with various properties [Capra, 1975, p. 166]. Thus by the introduction of probability waves, the paradox of particles being waves is solved by putting it in an entirely new context. However, another set of contradictory concepts emerge, which are even more fundamental. That of "existence" and "non-existence." This paradox is also transcended by atomic reality; we can never say an atomic particle exists at a certain place or that it doesn't exist at a certain place. Note that the particles don't change. What changes is the probability pattern, and therefore the "tendency to exist" in certain places [Capra, 1975, p. 166]. The example of the dual nature of atomic phenomena should make it apparent that physicists, when faced with a reality which lies beyond opposite concepts, have had to adopt a special way of thinking where the mind is not fixed in the rigid framework of classical logic, but rather keeps moving and changing its viewpoint.

The Eastern way of thinking rather consists in a circling round the object of contemplation. . . a many-sided, i.e., multi-dimensional impression formed from the superimposition of single impressions from different points of view.

[Georgescu-Roegen, 1971, p. 54]

[Capra, 1975, p. 166]

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[Capra, 1975, p. 166]

Heisenberg's Uncertainty Principle, named after Werner
Heisenberg, provides the precise mathematical form of this relation between uncertainties of position and momentum of a particle [Georgesc-Roegen, 1971, p. 71]. Specifically the more we impose one concept (i.e., position or momentum) on the physical "object" the more the other concept becomes uncertain. As Capra [1975, p. 173] observes, the fundamental importance of the "uncertainty principle" is that it expresses the limitations of our classical concepts, concepts which are derived from our ordinary macroscopic experience, in a precise mathematical form.

Niels Bohr introduced the notion of complementarity by considering the particle picture and the wave picture as two complementary descriptions of the same reality. Each is only partly correct and each has only a limited range of application. Capra [1975, p. 173] notes that this is the same insight as that of Chinese thought which views opposite concepts as standing in a polar, or complementary, relationship to each other.

Greater Than Three-Dimensional Reality

As mentioned previously, both Eastern philosophies and modern physics possess the awareness that "reality" comprises more than just the three dimensions which we experience through our senses. Eastern mystics emphasize that, in meditation, they go beyond ordinary three-dimensional space. In doing so they also transcend the
ordinary awareness of time. They experience the "eternal now" which is an infinite, timeless, and yet dynamic present [Capra, 1975, p. 197]. This concern with time is central to the position of Bergson and Whitehead. They both argued that time is not a sequence of durationless instants which can be represented by numbers [Georgescu-Roegen, 1971, p. 71]. They maintained that the notion of an instant of time, conceived as a primary simple fact, is nonsense. Just as Quantum Theory has shown the notion of isolated particles to be a fallacy, Bergson and Whitehead argued that the notion of instants of time, existing without duration, is a fallacy. In Relativistic physics, the full meaning of space-time is that space and time are fully equivalent. They are unified into a four-dimensional continuum in which the particle interactions can stretch in any direction [Capra, 1975, p. 205].

If we speak of the space-experience in meditation, we are dealing with an entirely different dimension. . . . In this space-experience the temporal sequence is converted into a simultaneous co-existence, the side by side existence of things. . . and this again does not remain static but becomes a living continuum in which time and space are integrated.

[Lama Anagarika Govinda, 1973, p. 116]

It is believed by most that time passes; in actual fact, it stays where it is. This idea of passing may be called time, but it is an incorrect idea, for since one sees it only as passing, one cannot understand that it stays just where it is.

[Dogen, Zenji, 1972, p. 140]

This notion of time is addressed by many Eastern mystics by emphasizing that thought must take place in time, but that vision can transcend it. As Lama Anagarika Govinda
[1973, p. 270] comments, "vision is bound up with a space of a higher dimension, and is therefore timeless."

This notion of time is consistent with the notion that all events are interconnected, but the connections are not causal. In Quantum Theory, particle interactions are taken as four-dimensional patterns without any definite direction of time attached to them. Consequently there is no "before" and no "after" and thus no causation. Similarly, mystics assert that in transcending time, they also transcend the world of cause and effect. Capra [1975, p. 206] suggests that causation is an idea which is limited to a certain experience of the world and has to be abandoned when this experience is exceeded. However, this statement overstates the validity of causation. As Hume argued, causation can not be demonstrated, either logically or empirically.

It appears as though modern physics has confirmed one of the basic ideas of Eastern mysticism, as well as a point Bergson and Whitehead strongly advocated. All concepts we use to describe nature are limited. They are not features of reality, as we tend to believe, but rather creations of the mind. Whenever we expand the realm of our experience, as occurs in the meditative state or when we explore the atomic and subatomic worlds, the limitations of our rational mind become apparent.

Relativity Theory modified such concepts as time and space, which was revolutionary in the history of science as
all the laws of physics require concepts of time and space. As Georgescu-Roegen [1971, p. 72] notes, what distinguishes modern from classical physics is the developments that go against the notion of an event at an instant of time and occurring in a dimensionless point in space.

The view which emerged from Relativity Theory is that all measurements of space and time are relative. This does not mean that all things are relative. Rather Relativity Theory reminds us that the scientist is unavoidably a participant in the system he is studying. Temporal specifications and measurements are relative and depend on the observer [Calder, 1980, p. 13]. This concept of Relativity arises due to the speed of light. Light needs time to travel to an observer but generally this time is so short that it is considered instantaneous. But when the observer is moving in high velocity with respect to the observed phenomena, the time span involving the travel of light plays a crucial role in establishing a sequence of events. Hence observers moving at different velocities will order events differently in time. Because the speed of light is central to Relativity Theory, it (the theory) is important when dealing with large distances (astrophysics) and also with high velocities (subatomic physics). Note that this relativity of time also forces us to abandon the Newtonian concept of an absolute space. Since time is now a relative concept, it is no longer possible to define a definite instant for the whole universe. A distant event
which takes place at one instant may occur before or after that instant for another observer.

The real revolution that came with Einstein's theory was the abandonment of the idea that the space-time coordinate system has objective significance as a separate physical entity. Instead of this idea, relativity theory implies that the space and time coordinates are only the elements of a language that is used by an observer to describe his environment.

[Mendel Sachs, February 1969, p. 53]

In understanding the limitations of the intellect, it is necessary to realize that we have no direct sensory experience of the four-dimensional space-time, nor of the other relativistic concepts. The relativity of concepts produced by our intellect can be illustrated in the following manner. A shadow is a projection of points in three-dimensional space on to a two-dimensional plane. As the position of the sun changes, or the angle of projection, the length of the shadow will change. However the three-dimensional "object" does not change, only its reflection on the two-dimensional plane changes. In this way one should be able to see how the length of a moving object in four-dimensional space projected on three-dimensional space will be different in different frames of reference. This is also true for time intervals. But contrary to spatial distances they become longer, not shorter, as the velocity relative to the observer increases. This means that clocks in motion run slower [Calder, 1980]. This slowing down of clocks in motion has been well tested in particle physics. This is all strange and very difficult to understand became we
cannot experience the four-dimensional space-time world with our senses, but can only observe its three-dimensional "images." Consequently these effects seem paradoxical if we do not realize that they are only the projections of four-dimensional phenomena to our three-dimensional senses.

Eastern mysticism has a strong intuition for the "space-time" character of reality.

The significance of the AVATAMSANKA and its philosophy is unintelligible unless we once experience... a state of complete dissolution where there is no more distinction between mind and body, subject and object... We look around and perceive that... every object is related to every other object... not only spatially, but temporally... As a fact of pure experience, there is no space without time, no time without space; they are interpenetrating.

[D.T. Suzuki, 1959, p. 33]

Einstein's General Theory of Relativity intended his Special Theory to include gravity. This had the effect of making "space-time" curved. The curvature of space-time is caused by the gravitational fields of massive bodies. The equations relating the curvature of space to the distribution of matter in that space are called Einstein's field equations. In curved space-time, the distortions caused by the curvature affect not only the spatial relationships described by geometry but also the lengths of time intervals. Consequently, time does not flow at the same rate in curved space-time as it does in "flat" space-time. The curvature affects space which is related to time and therefore the curvature also affects time. On earth the effects of gravity on space and time are so small as to be
insignificant, but in astrophysics, which deals with massive bodies, this curvature is an important phenomenon [Calder, 1980].

**A Dynamic Reality**

Both the Eastern philosophies and modern physics advocate a view of reality which is highly dynamic, as opposed to the static view implied in the Cartesian-Newtonian view. The emphasis on movement, on flow and change, has always been an essential aspect of the world view of mystics, both in the East and in the West. It is especially prevalent in Buddhism and is best understood in the context of "Karma." The word Karma means "action" and denotes the "active" or dynamic, interrelation of all phenomena. 2500 years ago the Buddha took this traditional concept and extended the idea of dynamic interconnections to the sphere of human situations. Consequently Karma came to signify the never-ending chain of cause and effect in human life which the Buddha had broken in attaining the state of enlightenment.

A wonderful philosophy of dynamism was formulated by Buddha, 2,500 years ago. . . . Impressed with the transitoriness of objects, the ceaseless mutation and transformation of things, Buddha formulated a philosophy of change. He reduces substances, souls, monads, things to forces, movements, sequences and processes, and adopts a dynamic conception of reality. [S. Radhakusnan, 1951, p. 367]

In Buddhism this world of ceaseless change is called "Samsara" and means "incessantly in motion." The
passiveness of Buddhism comes from its affirmation that there is nothing in this world worth clinging on to. In fact, it holds that all the suffering in the world arises from our trying to cling to fixed forms, rather than accepting the world as it moves and changes. Hence, the enlightened one is the one who does not resist the flow of life, but keeps moving with it [Capra, 1975, p. 210].

This dynamism is also fundamental to modern physics. The dynamic aspect of matter is found in Quantum Theory as a consequence of the wave-nature of subatomic particles. It is even more essential in Relativity Theory, where the unification of space and time implies that the being of matter cannot be separated from its activity.

This dynamism in Quantum Theory arises from what is called the "quantum effect." Whenever a particle is confined it reacts by moving faster. Hence, the tendency of particles to react to confinement with motion implies a fundamental "restlessness" of matter which is characteristics of the subatomic world [Capra, 1975, p. 213]. Matter, per Quantum Theory, is always in a state of motion. This is in direct contrast to the passive and inert view inherent in the Cartesian-Newtonian view.

In the astromacroscopic universe of Einstein, we have discovered that the universe is not static, but is expanding. The more distant the galaxy, the faster it moves away from us. In fact some galaxies are moving away faster
than the speed of light and therefore the light from them will never reach us [Calder, 1980]. The following two-dimensional analogy is offered to help visualize this four-dimensional expansion. Imagine a balloon with numerous dots on its surface. The balloon represents the universe and the dots represent the galaxies in that space. When the balloon is blown up, the dots move away from each other. No matter which dot you select, all other dots will move away from it. In the same manner, no matter which galaxy you are in, all other galaxies are moving away from your galaxy [Capra, 1975, p. 218].

Given the relation between the distance of a galaxy and its recession velocity, one can calculate the starting point of the expansion, or the age of the universe. This is known as Hubble's Law. Assuming no change in the rate of expansion, the universe is believed to be about 10,000 million years old [Calder, 1980, p. 199]. The obvious question then is what happened before the universe originated? In asking this question one immediately runs
into several problems of thought and language. As A. C. B. Lowell [1958, p. 93] comments,

There we reach the great barrier of thought because we begin to struggle with the concepts of time and space before they existed in terms of our everyday experience. I feel as though I've suddenly driven into a great fog barrier where the familiar world has disappeared.

This provides a very good example of a point made earlier, i.e., the limitations of our rational thought and the subsequent language.

The dynamic nature of matter is also demonstrated in Relativity Theory by the equilivance of mass and energy which is expressed in Einstein's famous equation "E= mc². In classical physics mass was assumed to be an indestructable material substance. But Relativity Theory tells us now that mass is nothing more than a form of energy. It can be thought of as "frozen energy." Hence, energy can not only take the various forms known in classical physics, but can also be locked up in the mass of an object. Once mass is seen as a form of energy, it is no longer required to be indestructible, but can be transformed into other forms of energy. This can happen when subatomic particles collide with each other. Or sometimes new particles can be created from the kinetic energy when particles collide. As Capra [1975, p. 224] observes, this creation and destruction of material particles is one of the most impressive consequences of the equivalence of mass and energy. Mass is no longer associated with a material
substance, but rather with bundles of energy. Since energy is associated with activity and with processes, the implication is that the nature of subatomic particles is intrinsically dynamic. The particles must not be pictured as static three-dimensional objects, but rather as four-dimensional entities in space-time. Their forms have to be understood dynamically, as forms of space and time. Their space aspect makes them appear as solid objects with a certain mass, but their time aspect as processes involving the equivalent energy [Capra, 1975, p. 224]. More specifically, particles are probability patterns. They are interconnections in an inseparable cosmic web. Relativity theory, so to speak, has made these patterns come alive by revealing their intrinsically dynamic character. It has shown that the activity of matter is the very essence of being. The existence of matter and its activity cannot be separated. They are but different aspects of the same space-time reality.

Eastern philosophers, in their intuitive states of meditation, appear to be aware of the interpenetration of space and time at a macroscopic level. Consequently they see macroscopic objects in a way which is very similar to the physicist's conception of subatomic particles, i.e., as relations or events rather than as things or substance. As Suzuki [1968, p. 53] notes,

Buddhists have conceived an object as an event and not as a thing or substance. . . . The Buddhist conception of "things" as Samakara (or Sankhara), that is, as
"deeds" or "events," makes it clear that Buddhists understand our experience in terms of time and movement.

While European philosophy tended to find reality in substance, Chinese philosophy tended to find it in relation.

[Joseph Needham, 1956, p. 478]

The particles we "observe" are merely transitory patterns of the fundamental dynamic processes. The critical implication which follows from the relativistic nature of subatomic particles is that we cannot understand their properties without understanding their mutual interactions. We cannot understand them in isolation, because they do not exist in isolation. Capra [1975, p. 227] even suggests that because of the basic interconnectedness of the subatomic world we shall not understand any one particle before understanding all the others. What this suggests then, is that the reductionistic approach which is fundamental to the mechanistic Cartesian-Newtonian machine-world view is inappropriate for understanding reality. All developments in physics have strongly indicted that the simple mechanistic view of basic building blocks should be abandoned. The problem is that, as Chapter II suggested, the reductionist tradition is strongly ingrained in Western thought.

Emptiness And Form

The preceding comments concerning a dynamic reality should make it apparent that the distinction between
particles and the space surrounding them loses its original shapeness. Matter and space, the full and the void, were the two fundamentally distinct concepts on which the "atomism" of the Cartesian-Newtonian model was based. But in general relativity the two can no longer be separated. In Einstein's theory, then, matter cannot be separated from its field of gravity, and the field of gravity cannot be separated from curved space. Therefore matter and space are thus seen to be inseparable and interdependent parts of a single whole [Calder, 1980]. The prevailing concept of inertia of matter, Mach's Principle, holds that the inertia of a material object is not an intrinsic property of matter, but rather a measure of its interaction with all the rest of the universe. In other words, in Mach's view, matter only has inertia because there is other matter in the universe [Capra, 1975, p. 231]. So once again modern physics has shown us that material objects are not distinct entities, but are inseparably linked to their environment. Hence, their properties can only be understood in a holistic manner, in terms of their interaction with the rest of the world.

The Cartesian-Newtonian model views the universe as containing material objects upon which "forces" operate. But modern physics has discarded the notion of material objects. It has come to view the concept of "fields," specifically "quantum fields," as being fundamental physical entities. In other words, they are a continuous medium
which is present everywhere. Particles are merely local condensations of the field. They are concentrations of energy which come and go, thereby losing their individual character and dissolving into the underlying field [Capra, 1975, p. 233]. This concept of fields emerged from the theory of Quantum Electrodynamics which was a merger of Classical Field Theory, Electrodynamics and Quantum Theory. It is the theory which describes all electromagnetic interactions between subatomic particles. It is also the first, and the most successful, theory to incorporate both Quantum Theory and Relativity Theory. Quantum Electrodynamics has unified two apparently contradictory concepts and shown them to be merely different aspects of the same reality.

This conception of physical things as transient manifestations of an underlying fundamental entity (fields) is not only a basic element of Quantum Field Theory but is also a basic element of the Eastern worldview. The Eastern view holds that the reality underlying all phenomena is beyond all forms. Therefore, it defies all description and specification. This is especially the case in Buddhism which denies the existence of any material substance and even holds that the idea of a constant "self" is an illusion. The analogy of a water wave can be offered to illustrate this idea. Because of the up and down movement of the wave which contains the water particles, it appears
as though a "piece" of water is moving over the surface. However, what really happens is that the water particles move in circles as the wave passes by. It is a disturbance which is causing the wave phenomenon, not any material particles [Capra, 1975, p. 165].

Fig. 4--Illustration of a water wave

Modern theoretical physics... has put our thinking about the essence of matter in a different context. It has taken our gaze from the visible--he particles--to the underlying entity, the field. The presence of matter is merely a disturbance of the perfect state of the field at that place; something accidental, one could almost say, merely a "blemish." Accordingly, there are no simple laws describing the forces between elementary particles... Order and symmetry must be sought in the underlying field.

[W. Thirring, 1968, p. 160]

The previous comments on Eastern philosophy concerning rational versus intuitive thought have all centered on the idea that the intellect is more limited than the intuitive mode of consciousness. It is interesting to note that from the time of the Greeks, a major argument for rational thought has been the scepticism of the senses. As Plato argued, we can be deceived by our senses as they are unreliable. It is only by employing logic that we can come to find the truth. However, the fundamental argument of
Eastern thought, of Bergson and Whitehead, and of modern physics, is that our rational processes are limited. They are limited to the three-dimensional inputs we can experience. We have no direct experience, for example, of the fourth dimension of space-time. Consequently, it is possible that just as rational thought superceded pure sensory perception, intuitive thought may come to supercede rational thought for much the same reason. Although it is undeniable that we realize the limits of the intellect and the possibilities of intuition, a complete movement from the rational to the intuitive would be highly undesirable. What is needed is the balance between the two extremes which is the fundamental objective of Chinese philosophy.

It should have become apparent that the concept of "force" is no longer useful in subatomic physics. In the subatomic world there are no forces. There are only interactions between particles, mediated through fields, that is, through other particles. Hence, as Capra [1975, p. 240] observes, according to Quantum Theory all interactions take place through the exchange of particles. Consequently the scenario of distinct and objective matter being acted on by some "force" in empty space must be discarded.

**Shift In Emphasis From Objects To Events.**—In entering the subatomic world of particle physics, Quantum Theory alone is inappropriate for explaining particle behavior. The problem is that the energies of the particles are so
high that Relativity Theory must be applied. Hence, a "Quantum-Relativistic" Theory is needed. The first theory of this type was Quantum Field Theory. However, as more particles were discovered, it was soon realized that it was unsatisfactory to associate each particle with a fundamental field. The subatomic world continued to reveal itself as an increasingly complex web of interconnected processes. The framework which seems most appropriate for the description of strong particle interactions (strong interactions hold together the atomic nuclei) is S-matrix (scatter) Theory. While the specifics of this theory are beyond the scope of this paper, the implications of the theory are of tremendous significance. The important new concept in this theory is the shift of the emphasis from objects to events. As such, the basic concern is not with the particles but with their reactions [Capra, 1975, p. 290]. This view is required by both Quantum and Relativity Theory. Quantum Theory has made it clear that a subatomic particle can only be understood as a manifestation of the interaction between the various processes of measurement. Relativity Theory has forced us to view particles in terms of four-dimensional space-time patterns. We must view them as processes rather than objects.

(In modern physics), one has now divided the world not into different groups of objects but into different groups of connections. . . . What can be distinguished is the kind of connection which is primarily important in a certain phenomenon. . . . The world thus appears as a complicated tissue of events, in which connections of different kinds alternate or overlap or combine and
thereby determine the texture of the whole.

[W. Heisenberg, 1963, p. 96]

Note that this view is fundamental to Buddhism. In the words of D. T. Suzuki [1968, p. 55]

Buddhists have conceived an object as an event and not as a thing or substance. . . . The Buddhist conception of "things" as "samskara" (or "sankhara"), that is, as "deeds," or "events," makes it clear that Buddhists understand our experience in terms of time and movement.

The central objective of S-matrix Theory is to describe the structure of hadrons (any class of elementary particles which can take part in a strong interaction) in a dynamic manner, such that each hadron is understood as an integral part of an inseparable network of reactions [Capra, 1975, p. 303]. More specifically, physicists are attempting to derive this structure from three general principles. The first principle is suggested by Relativity Theory and the second two principles are suggested by Quantum Theory. The first principle states that the reaction probabilities must be independent of the displacements of the experimental apparatus in space and time. They must also be independent of the state of motion of the observer. The second principle asserts that the outcome of a particular reaction can only be predicted in terms of probabilities, and that the sum of the probabilities for all possible outcomes must be equal to one. The third principle relates to our notion of cause and effect. It states that energy is transferred over spatial distances only by particles, and that this transfer occurs in such a way that a particle can be created
in one reaction and destroyed in another only if the latter reaction occurs after the first [Capra, 1975, pp. 304-305]. To date, it has not been possible to construct a mathematical model which satisfies all three principles.

As Capra [1975, p. 306] observes, all three of the general principles are related to our methods of observation and measurement, that is, the "scientific" framework. Consequently, if they are sufficient to determine the structure of hadrons, this would mean that the basic structures of the physical world are determined, ultimately, by the way in which we look at this world. Any fundamental change in our observational methods would imply a modification of the general principles which would lead to a different structure of hadrons. What exactly does this imply? The implication is that such such a theory of subatomic particles reflects the impossibility of separating the scientific observer from the observed phenomena. This notion has already been discussed in connection with Kant, Bergson and Whitehead, and with Quantum Theory. Ultimately, it implies that the structures and phenomena we observe in nature are nothing but creations of our measuring and categorizing minds.

Again, this is one of the fundamental tenets of Eastern philosophy. Again and again, we are told that all things and events we perceive are creations of the mind. They arise from a particular state of consciousness and dissolve
again if that state is transcended. Hence, as Capra [1975, p. 307] suggests, S-matrix Theory comes very close to Eastern thought not only in its ultimate conclusion, but also in its general view of matter. It describes the world of subatomic particles as a dynamic network of events and emphasizes change and transformation rather than fundamental structures or entities.

Concept Of Basic Fundamental Building Blocks
Inherent in "Mechanistic" View

The concept of "basic building blocks" is inherent in Western thought. Consequently, it was first used in explaining the world in terms of a few atoms. Then when atoms were found to be comprised of more elementary elements, this concept was used in explaining atoms in terms of a few nuclei surrounded by electrons. Then it was discovered that atomic nuclei were not elementary elements, and again the concept was employed in explaining the structures of the nuclei in terms of two nuclear "building blocks," the proton and neutron. Thus atoms, nuclei, and hadrons (protons and neutrons) were, in turn, considered "elementary particles." However none of them were. Each turned out to be composite particles. As the theories of atomic and subatomic physics continue to reveal the interconnection of matter, as they continue to suggest that particles are processes rather than objects, the existence of elementary particles, or "basic building blocks," becomes
increasingly unlikely. **What all these developments in modern physics indicate is that the simple mechanistic picture of basic building blocks should be abandoned.** Yet, in spite of these developments, the age old "reductionist" tradition which is so deeply ingrained in Western thought has resulted in the continuation of this search for these basic components.

However, there is emerging in particle physics, a radically different school which starts from the idea that nature cannot be reduced to fundamental entities, such as elementary particles or fundamental fields. Rather it takes the position that nature has to be understood entirely through its "self-consistency." In other words, the components of nature must be consistent both with one another and with themselves. This idea, which is referred to as the "bootstrap hypothesis," has arisen in S-matrix Theory and was originated by Geoffrey Chew. The "bootstrap philosophy" constitutes the final rejection of the mechanistic world view in modern physics. Whereas Newton's universe was constructed from a set of basic entities with certain fundamental properties which were not amendable to further analysis, the bootstrap hypothesis explicitily states that the world cannot be understood as an collection of entities which cannot be analyzed further. In the new world view, the universe is seen as a dynamic web of interrelated events. None of the properties of any part of this web is fundamental. They all follow from the properties of the
other parts, and the overall consistency of their mutual interrelations determines the structure of the entire web [Capra, 1975, p. 316]. Thus the bootstrap philosophy represents the cumulation of a view

i) that arose in Quantum Theory with the realization of an essential and universal interrelationship;

ii) that acquired its dynamic content in Relativity Theory; and

iii) was formulated in terms of reaction probabilites in S-matrix Theory.

It is important to note that the bootstrap hypothesis not only denies the existence of fundamental constituents of matter, but accepts no fundamental entities whatsoever. This includes fundamental laws, equations, or principles. Hence, it abandons the essential framework of the Cartesian-Newtonian model which has molded natural science for hundreds of years. What many physicists have come to see, is exactly what Bergson and Whitehead argued, is that all their theories of natural phenomena, including the "laws" they describe, are creations of the human mind. They belong to our conceptual map of reality, rather than reality itself. The theories are limited as our intellect is limited. The problem is that all natural phenomena are ultimately interconnected, and in order to explain any one of them we need to understand all the others, which is obviously impossible. However, what makes science so successful is the discovery that approximations are possible. In other words, if one is satisfied with an
approximate "understanding" of nature, one can describe selected groups of phenomena in this way, neglecting other less relevant phenomena. What seems to appear too frequently in social science research, is the failure to understand this point. First, there is the failure to understand that all our theories provide is an approximate understanding of what we are trying to understand. Secondly, and far more importantly, in utilizing the "scientific method" we far too often omit relevant phenomena. They are simply treated as exogenous variables. Herein lies a critical difference between the Cartesian-Newtonian view and the bootstrap philosophy. The incomplete character of a theory is usually reflected in its arbitrary parameters of "fundamental constraints." These are quantities whose numerical values are not explained by the theory, but have to be inserted into it after they have been determined empirically, or in some cases axiomatically. In the Cartesian-Newtonian view these quantities were regarded as fundamental constants of nature which did not require any further explanation. However, in the modern view, their role of "fundamental constants" is seen as temporary and reflecting the limitations of the present theories. The bootstrap philosophy suggests that they should be explained, one by one, in future theories as the accuracy and scope of these theories increase. Hence, this ideal situation should be approached, but may never be reached, where the theory
does not contain any unexplained "fundamental" constants, and where all its "laws" follow from the requirement of overall self-consistency [Capra, 1975, p. 318]. This idea is contrary to how we are taught science, in particular to Lakatos' Research Programmes [see Chalmers, 1976, pp. 76-80]. Consider the comment of Chew [1968, p. 762-763],

In a broad sense, the bootstrap idea, although fascinating and useful, is unscientific. . . . Science, as we know it, requires a language based on some unquestioned framework. Semantically, therefore, an attempt to explain "all" concepts can hardly be called "scientific."

Note that the requirement of self-consistency, which forms the basis of the bootstrap hypothesis, and the unity and interrelation of all phenomena, which are so strongly emphasized in Eastern mysticism, are just different aspects of the same idea. In the Eastern view, as in the view of modern physics, everything in the universe is connected to everything else and no part of it is fundamental. However, while scientists may be satisfied with an "approximate" understanding of nature, Eastern mystics are not interested in "approximate" or "relative" knowledge. They are concerned with "absolute" knowledge involving an understanding of the totality of life. Consequently, there exists a fundamental difference between the Eastern mystic and the Western philosopher. The Eastern mystic is generally not interested in explaining things. Rather, he is interested in obtaining a direct non-intellectual experience of the unity of all things. In the proper state
of consciousness the realm of the intellect is transcended and causal explanations become unnecessary. They are replaced by the direct experience of the mutual interdependence of all things and events. Thus, as Capra [1975, p. 325] observes, the Buddhist concept of interpenetration goes far beyond any scientific bootstrap theory.

This objective of obtaining a non-intellectual experience of the unity of all things is most apparent in the seemingly non-sensical answers of Zen masters when asked to explain something. Their purpose is to make the student realize that everything is a consequence of all the rest. To explain nature is simply to show its unity. This is why one of the main aims of Eastern mysticism is to free the human mind from words and explanations. To attempt to explain things is to be bound by Karma, to be trapped in our conceptual network [Capra, 1975, p. 322].

In Eastern thought, the notion of "basic building blocks" of matter is generally not encountered. This owes to the Eastern view of the universe as an inseparable whole where all forms are fluid and ever-changing. Hence, there is no room for any fixed fundamental reality.

**The Role of Consciousness In A Holistic Approach**

Another critical aspect of the Eastern view is that it has always regarded consciousness as part of the universe. Human beings, like all other life forms, are parts of the
inseparable organic whole. As Capra [1975, p. 332] observes, the understanding of one's consciousness and of its relation to the rest of the universe is the starting point of all mystical experience. This question of consciousness is obtaining increasing emphasis in Quantum Theory. Although the theory does not at the present, refer to consciousness explicitly, many physicists have argued that the explicit inclusion of human consciousness may be an essential aspect of future theories of matter [Wigner, 1970, p. 172]. Chew makes a similar point concerning the role of consciousness in enlarging the bootstrap hypothesis:

Such a future step would be immensely more profound than anything comprising the hadron bootstrap; we would be obliged to confront the elusive concept of observation and, possibly, even that of consciousness. Our current struggle with the hadron bootstrap may thus be only a foretaste of a completely new form of human intellectual endeavor, one that will not only lie outside of physics but will not even be describable as "scientific."

This developing notion of including the human consciousness in future atomic and subatomic theories strikes a fatal blow to the idea of subject/object split which is fundamental to the notion of "objective" research.

Summary

The investigation of electric and magnetic phenomena challenged the Newtonian model which had reigned since the seventeenth century. Electric and magnetic phenomena had no place in the Newtonian model which reduced all phenomena to the motions and interactions of indestructable atoms.
Hence, the Newtonian model could only be applied to solid bodies consisting of a large number of atoms, and to those whose velocity was small compared to the speed of light. The further investigation of atomic and subatomic phenomena brought physicists into contact with a strange and unexpected reality which shattered the foundations of their Cartesian-Newtonian machine-world view. So long as they clung to their classical concepts, they continued to encounter paradoxes in atomic experiments. The paradoxes were eliminated once an awareness of atomic reality was obtained. This was an awareness of a reality which transcended the three-dimensional world of the senses. It was an awareness which also transcended the intellect, which is fed by its three-dimensional imagery. This new reality was ontologically consistent with Eastern mystical philosophy. Like the mystics, physicists were now dealing with a nonsensory experience of reality.

Modern physics continued to reveal a world much like the world experienced by the Eastern mystic. It is an "organic" world, rather than the "mechanistic" world of the West. It is a world where everything is related, and are but different aspects of the same ultimate reality. The tendency to divide the perceived world into separate things is seen as an illusion which is a consequence of our measuring and categorizing minds. The East holds a holistic view of reality, where motion and change are essential
properties of things. Consequently, Eastern thought differs enormously from Western thought in its view of the intellect. The Eastern view of rational knowledge is strikingly similar to Bergson's view. Rational knowledge is relative. It consists of a system of abstract concepts and symbols. The "natural world" is one of infinite varieties which can be known only through intuitive knowledge, which is based on a direct, non-intellectual experience of reality arising in an expanded state of awareness. The Eastern mystic is aware that our representation of reality is much easier to grasp than is reality itself. Hence, he is aware that we tend to confuse the two and take our concepts and symbols for reality.

The revealed reality of modern physics shattered several classical, Newtonian concepts. Included was the notion of absolute space and time, of elementary solid particles, of a strict causality and the ideal of an "objective" description of nature. Einstein's Relativity Theory suggested that space is not three-dimensional and that time is not a separate entity. Rather they are intimately connected and form the fourth-dimensional continuum of "space-time." Relativity Theory also suggested that mass is nothing but a form of energy, hence it has nothing to do with substance. Einstein's General Theory of Relativity, which included the effects of gravity, found space and time to be curved. Hence, Euclidian geometry was no longer valid in such curved time-space. Quantum Theory
disclosed the composite nature of atoms. Consequently, they were nothing like the solid objects of classical physics. Atoms are composed of abstract entities which have a dual nature. Depending on how one looks at them, they appear sometimes as particles and sometimes as waves. Also subatomic matter does not exist with certainty at definite places but rather shows "tendencies to exist." Hence, "probability" is fundamental to the reality of modern physics. Note that this is not probabilities of "things" but of "interconnections." Subatomic particles have no meaning as isolated entities, rather they can only be understood as interconnections between the "preparation" of an experiment and the subsequent "measurement." Not only does Quantum Theory reveal the "basic oneness" of the universe, but it also makes it apparent that the observed relationships always include the observer. Hence, there is no "subject/object" split. Not only are observations theory dependent, but they are experiment dependent as well. Consequently, the classical notion of an objective description of nature is no longer valid.

There are several concepts fundamental to both Eastern philosophy and modern physics. They both view reality as an interconnected cosmic web. They are both aware of the unity of opposite concepts. They are both aware of a greater than three-dimensional reality, and hence realize that all concepts used to describe nature are creations of the mind.
Reality is viewed as being highly dynamic. Consequently, the emphasis is on events rather than perceived "objects." The concept of "force" operating on material objects is discarded. Material objects are seen as manifestations of more fundamental "fields." Hence, there is no "force," only interaction between particles. These particles are viewed as "processes" rather than "objects." Therefore, the concept of "fundamental building blocks" is rejected. Most importantly, both Eastern philosophy and modern physics recognize the role held by the human consciousness. This strikes a fatal blow to the "positivistic" notion of a "subject/object" split and "objective" knowledge.
CHAPTER IV

THE IMPACT OF "POSITIVISM" ON ACCOUNTING RESEARCH

Donald N. McCloskey [1985], in commenting on the state of contemporary research in economics, notes that since the 1930's economists of all schools have become enchanted by the new and scientific way of talking. Most economic journals nowadays look like journals of applied mathematics or theoretical statistics. He observes that of the 159 full-length papers published in the American Economic Review during 1981, 1982, and 1983 only six used words alone. Only four added to their words tabular statistics alone, the one formal device common in 1931-34. Fully two-thirds of the papers used mathematics explicitly, and most of the others were speaking in a mathematics saturated environment.

There is little doubt that a similar inquiry into the prominent accounting journals, such as the Journal of Accounting Research and The Accounting Review, would yield the same results. Any differences would be minor. While mathematics might not be as predominant as in economics, the accounting journals would, no doubt, contain significantly more experimental, behavioral research than would the economic journals. The basic point is that both disciples have been invaded by "scientism."

While a study of this nature in accounting may be
interesting, the results would hardly be surprising. One would be very hard pressed to find someone who would deny the "positivistic" nature of contemporary accounting research. As an alternative to the rather comprehensive search used by McCloskey, two articles, in this chapter, which are indicative of the general mood in accounting research will be critically examined. These articles will be "critiqued" so as to demonstrate the ontological position they implicitly hold and other implicit assumptions inherent in the "scientific method" they advocate. The first article is Robert Sterling's "The Nature and Verification of Theories" [1975]. The second is W.R. Kinney's "Empirical Accounting Research Design for Ph.D. Students" [1986].

Sterling- "The Nature and Verification of Theories"

Robert Sterling's "The Nature and Verification of Theories" is an excellent example of theoretical "positivism" in accounting thought. His paper is an argument for making accounting a "science" and as a consequence he discusses the "scientific method." This affords an excellent opportunity to look at the "scientific method" as it is being advocated in accounting research.

Sterling begins with the premise that accounting ought to be a science and that the reason people have argued that it can not be a science is because they have defined it as inherently unscientific [1975, p. 6]. He maintains that for
accounting to become a science, a theory concerning empirical phenomena must be devised. Thus a theory of accounting ought to be concerned with the general properties of the model and the general properties of the class of empirical phenomena. Consequently, the purpose of his paper is to make a first step towards defining a science of accounting by explaining the nature and verification of scientific theories. As will become apparent, Sterling assumes that empirical phenomena exists independently and objectively "out there."

Sterling's subsequent description of science is an illustration of the current thinking in accounting research. His position is that of a "falsificationist." Popper's principle of falsification follows from Hume's empirical position that we can only know what we don't know. Falsification is in essence a modified version of "logical positivism"; instead of attempting to "confirm" hypotheses with empirical data, it has the less ambitious objective of attempting to use empirical data to "falsify" hypotheses. Hence, those hypotheses which have withstood rigourous attempts at falsification lend more credibility to their underlying theories. The "logical positivist's" verification principle is replaced by the falsification principle.
Purpose Of Models: Explanation And Prediction

Sterling [1975, p. 16] states that the purpose of a model is to **explain** and **predict** empirical phenomena. By means of a model can conceptually move from observed empirical phenomena to an expectation of unobserved empirical phenomena.

![Diagram of model relationship](image)

Fig. 5--Model of relationship between observed empirical phenomena and unobserved empirical phenomena.

Sterling offers two interpretations of science.

The principle objective of science, other than the description of empirical phenomena, is to establish, through laws and theories, general principles by means of which the empirical phenomena can be explained, accounted for and predicted.

[Torgerson quoted in Sterling, 1975, p. 16]

Caws writes about "the account of the world" which is presented by models. He defines "scientific explanation" as accounting for particular events by reference to general laws, together with the actual conditions under which those laws act, or accounting for laws by reference to principles still more general.

[Caws quoted in Sterling, 1975, p. 16]
Note that the two interpretations of science offered by Sterling exhibit a decidedly Cartesian-Newtonian influence. They are both deterministic and reductionistic in stating that particular events (effects) can be understood by referring to general laws (causes). Sterling [1975, p. 16] offers Euclidean geometry as an example of how "we move from measured attributes to a prediction of the magnitude of unmeasured attributes," illustrating his Cartesian-Newtonian orientation. As discussed in Chapter II, Euclidean geometry is the model upon which Western thinking was based. One starts with axioms and then move via deductive logic to conclusions. It is axiomatic, rationalistic and deterministic. The problem with Euclidean geometry, as discussed in Chapter III, is that it does not accurately describe our present understanding of reality, that is the four-dimensional reality of modern physics. Hence, its usefulness for understanding and explaining reality is severely limited.

Sterling also cites "prediction" as an objective of model building. He [1975, p. 17] states, "in ordinary usage 'prediction' normally refers to a future state. In scientific usage it refers to any unknown state regardless of the temporal location of that state." This statement implies a deterministic world. Not only is everything deterministic "now," but the relationship between the "now" and the "later" is also deterministic. In other words, the future is determined with no margin for variation by the
present. The future is not "made," rather it is already contained in the present. This denies the possibility for change and interaction which are key concepts of Bergson, Whitehead, modern physics and all Eastern philosophy.

He further states that the "the process of explaining is the reverse of the process of predicting. In predicting we observe inputs and infer outputs. In explaining we observe outputs and infer inputs." The inferred determinism in this statement should be obvious, Sterling assumes that there is a cause/effect relationship between inputs and outputs).

**Discussion Of Prediction And Explanation:**

Sterling offers the following illustration of the relationship between explanation and prediction:

<table>
<thead>
<tr>
<th>PREDICTION</th>
<th>EXPLANATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Utilizing the Pythagorean Theorem:</td>
<td></td>
</tr>
<tr>
<td>if ( a = 3 ) and ( b = 4 ) then ( h = 5 )</td>
<td>( h = (a^2 + b^2)^{1/2} )</td>
</tr>
<tr>
<td>ii) if wages go up, then prices will rise</td>
<td>prices rose because wages went up</td>
</tr>
<tr>
<td>iii) if you get your feet wet, then you will catch cold</td>
<td>you have a cold because you got your feet wet</td>
</tr>
<tr>
<td>iv) if penelope is a swan, then penelope is white</td>
<td>penelope is white because she is a swan</td>
</tr>
</tbody>
</table>

These are the three types of Kantian judgments (a judgment being a connection in thought between subject and predicate), "a priori," "a posteriori" and "synthetic a
priori" [Strumpf, 1975, p. 306]. The first example is a synthetic a priori judgment. It is a priori because it does not refer to experience. It is synthetic because the predicate (5) is not contained in the concept of the subject (3,4). In other words, 5 cannot be derived by a mere analysis of 3 and 4. The second and third judgments are a posteriori. They occur after an experience or observation. There relation between the subject and the predicate is empirical, not logical. The fourth judgment is an example of a syllogism and is therefore a priori. The relation between the subject and predicate is logical, not empirical. The predicate (whiteness) is already contained in the concept of the subject (swan).

Sterling has offered these examples of Kantian judgments but has failed to mention three very important points. The first point concerns a priori judgments. Since the subject already contains the predicate, no new knowledge is obtained. This is a point which has been made throughout this dissertation, that logic deals with what we already know.

The second point concerns synthetic a priori judgments and speaks to one of the cornerstones of the Cartesian-Newtonian view, the illusion of a subject/object split. Synthetic a priori judgments were the type of judgments which Kant was most concerned about and which lead to his notion of the "predetermined structure" of the mind.
Consider judgment i), it contains necessity and universality. If \( a=3 \) and \( b=4 \) then \( h \) has to be 5, and must always be 5. However, 5 cannot be derived by a mere analysis of 3 and 4. The mind, with its predetermined structure, achieves a synthesis of the concepts of the Pythagorean theorem, 3 and 4. It brings something to the objects it experiences. Knowledge is a cooperative affair between the knower and the thing known. There is no subject/object split with objects existing independently of the observing subject.

The third point concerns a posteriori judgments and is similar to the second point just made. These judgments are also synthetic and not just purely empirical. In other words, the "experience" is filtered through the predetermined structure of the mind. This point addresses what is often referred to as the theory dependence of observations [Chalmers, 1976, pp. 20-31]. The view Sterling is advocating is that empirical observation yields a secure basis from which knowledge can be derived. Hence, the "positivistic" notion that scientific knowledge is reliable because it is "objectively" obtained. What Sterling fails to acknowledge, however, is that all observation statements are fallible. They are fallible because they are theory dependent and all theories are fallible. And as Quantum Theory has suggested, all observations are also experiment dependent.
Limitations Of Models:

In discussing the limitations of models, Sterling states that "obviously, psychological explanations require psychological models and it is unreasonable to expect a geometrical model to provide psychological explanations." The influence of Cartesian dualism is obvious. The two disciplines are distinct and separate, with no interaction. To the extent that there is interaction it is brutally severed by building separate and distinct models. Model building is itself a legacy of the Cartesian-Newtonian influence; i.e., that we can abstract the fundamental elements from reality to build a model. Model building also necessitates that reality is deterministic, causal, and reductionistic.

Sterling states that "no model can or is intended to explain everything. All models are restricted to a certain 'empirical domain'. The fact that a geometrical model does not explain psychological motivations is not legitimate criticism of the geometrical model." Here Sterling is making the point that you cannot generalize a model beyond its appropriate domain; i.e., cannot generalize beyond the models "discipline." However it is totally assumed and unquestioned that the "psychological model" can model "psychological reality." The problem is that far too often, models are built which treat far too few variables endogenously. All the other variables, and quite often those which are really important, are considered exogenous.
and simply assumed to be constant. Then it is claimed that the model reflects reality.

**Empirical Testing Of Models**

Sterling takes the falsification position that we can only know those models that have been falsified. This stems from the problem of induction [Chalmers, 1976, pp. 12-18] which is central to empiricism. If knowledge is based on experience, then how is it possible to get from the singular observational statements to the universal statements which make up scientific knowledge? In other words how can one **generalize** from a finite set of singular observations to some universal law? This is the essence of Hume's scepticism. While it is not possible to make inductive general statements about the "truth" of universal laws, it is however, possible to make inductive general statements about the "falsity" of these universal laws. This is the essence of falsification. Hence, falsification suggests that the more attempts at falsification that a model has survived, the more faith we have in it. If they (researchers) fail to falsify the model then it is accepted as "true," or more accurately "well verified." What we mean is that the model has not been falsified. Interestingly, Sterling [1975, p. 21] suggests that "we have great confidence in Euclidean geometry because its individual predictions have been empirically verified time and time again." As discussed in Chapter III, Euclidean geometry has
been found to be an inaccurate description of the four-dimensional reality of modern physics.

In attempting to build his case for empirical testing of models, Sterling [1975, p. 22] argues that disputes between competing models "are in principle unresolvable by argumentation. It is an empirical question—a question of fact—and such questions can be settled only by observation. Thus the implication is clear: models must be empirically tested—the predicted outcome must be compared to a separate measurement." Sterling states that "unfortunately in accounting, as in science in general, empirical questions have sometimes been confused with logical questions. . . the ultimate test of an accounting system is to promote its predictions to separate measurements of the empirical phenomena." Central to Sterling's argument is the assumption that we can successfully "observe" phenomena. There are several fundamental problems with this argument. First, it ignores Kant's position that that knowledge is a cooperative affair between the knower and the thing known. Since falsification is based on empiricism (as opposed to Cartesian rationalism), then it would appear that one would have to accept Kant's position concerning knowledge. The alternative is Hume's scepticism that no knowledge is possible because causality can not be demonstrated. A second problem is that not only does the empirical approach of falsification suffer from the fact that observations are
theory dependent, but that they are also experiment, or measurement, dependent as well. A third, related problem concerns measurement. Sterling's argument implies that there are qualities inherent in the "objects" being measured. As discussed in Chapter II, Berkeley dispelled this notion. Finally, even if falsification were free of the aforementioned problems, a good number of accounting researchers fail to practice falsification correctly. The "positive" approach of the Rochester school attempts to find evidence that is "consistent" rather than "inconsistent" with their hypotheses. They attempt to "confirm" and "corroborate," rather than "falsify," their hypotheses.

**Logical Testing Of Models:**

Sterling however, states that "logic also plays a crucial role in both the construction and operation of models. It is the logical operations that allow us to conceptually move from one set of empirical facts to an expectation of another set of empirical facts." This is obviously a very Cartesian statement. It assumes a world of rational order, in which one can move conceptually from one set of empirical facts to an explanation of another set as is done in mathematics. Sterling [1975, p. 23] goes on to say that "logic is concerned with the relation of symbols to symbols. Empirics is concerned with the relation of symbols to observations for measurements. . . . An empirical question' is one that is answered by examining the real
world—by making observations or measurements." Again, this statement reflects Sterling's illusion that the world we can comprehend scientifically is reality and not just a world of appearances as Kant argued. Sterling [1975, p. 24] states that "models are often stripped of their content in order to lay bare their form and to study the logical truth of their statements. . . . Such models are also called 'axiomatized' because they focus on the axioms and what can be deduced from those axioms. An 'axiom' is a statement that is taken for granted for the purpose of seeing what logically follows from it. A 'theorem' is a logical truth that is deduced from the axioms. . . . One example of an axiomatized model is Euclidean geometry." Although Sterling acknowledges the axiomatic nature of models he apparently fails to acknowledge the axiomatic nature of his "positivist" philosophy.

Specifically, by advocating that models reflect or abstract from reality, there is the inherent assumption (or axiom) that there is a logical world and that knowledge is obtained by discovering the underlying "universal laws" of this logical world. Pirsig [1974, p. 115] makes the point that "lateral drift" often creates "lateral knowledge" which points to the falseness of axioms and postulates underlying one's existing systems of getting at the truth. Sterling also again fails to note that Euclidean geometry, while a good example of an axiomatic model, provides an inaccurate description of reality. By failing to acknowledge that
Euclidean geometry is "true" only if we keep to the boundaries of the earth, Sterling has failed to acknowledge that the quality of objective certainty that had always been attached to pure mathematics vanished in reality too.

Sterling discusses "logical truth" as opposed to "empirical truth." He states that although logical falsity guarantees empirical falsity, logical truth does not guarantee empirical truth. Again, this statement assumes a logical world, hence what is logically inconsistent cannot exist in the empirical world. What about modern physics before Quantum Theory? Upon splitting the atom, physicists found something that was sometimes a particle and sometimes a wave. This baffled physicists as it was apparently contradictory, something was a particle and was also not a particle. What they found to be empirically true did not make any logical sense until they changed their ontological view.

However, even if the ontological position of "positivism" is accepted, what about the situation when two theories (and models) exist which are both logically valid and empirically verified? This is a fundamental, but often ignored problem with the "scientific method."

Observer Agreement:

Sterling claims that "the scientific test for truth is corroboration of the findings of one scientist by other scientists." He suggests that "once you think about it you
will realize that there is no other test for truth available
to us. The lack of other tests forces us to use agreements
among independent, qualified observers in everyday affairs,
as well as in science." Sterling's argument that
corroborated finding is the only test available for
discerning truth is far from self-evident. Consider the
thinking of Nietzsche, Bergson and Whitehead as well as all
Eastern thought. Sterling's emphasis on "independent,
unbiased observers" is central to the "positivistic"
orientation. Chapter III argued that the notion of an
independent observer is an illusion. One of the most
significant implications of Quantum Theory is that the
notion of "objective, value-free" knowledge is an illusion.
The detachment and objectivity assumed in "positivism" does
not exist in reality as we understand it.

Sterling [1975, p. 34] suggests that "independent"
means two different things in this context. First, it means
there must be different observers. A scientist may test his
own work by repeating both his empirical observations and
his logical operations. However, corroboration requires
that different observers perform these tests. Second, it
means that the observers must be free of vested interests in
the outcome of the tests. Is one seriously expected to
accept that accounting researchers are unbiased? What about
the funding that motivates and makes academic accounting
possible? What about the publication status within the
profession? Is one seriously expected to believe that a
university researcher who receives a grant is "indifferent,
independent, and unbiased" in his research? He wants
publishable results! Especially in this increasingly
publish or perish environment.

Sterling elaborates on the idea of corroboration among
observers by stating that they must be corroborated by
"qualified" observers. "In science observers are trained to
be alert for certain attributes . . . . However, science is
intended to be public, not private, as indicated by the word
'agreement' in the test, and, therefore, in the absence of
some limitation (such as color blindness), it is intended
that anyone can become a qualified observer. . . . science is
open to all who take the trouble to become qualified
observers. . . ." This last statement summarizes the
arrogant aspect of "positivism"; that is, once one becomes
qualified, (scientifically trained) then one can perceive
reality (or "scientific" reality). As Feyerabend [Chalmers,
1976, p. 145] claims, "science" is taught as though it is
uncontestably reliable. The institutionalization of
"science" means that anyone aspiring to acquire its
standards, or to become "qualified" in Sterling's terms,
must do so by way of institutional training. To be
"credible," one must be "scientific." As Pirsig [1974, p.
32] comments, "the scientific view has wiped out every other
point of view to a point where all other points of view seem
primitive." For example, witness the following statement by
Sterling, "A class of statements that are not corroboratable by virtue of their form are first person statements. . . . Since they cannot be corroborated, statements of this form—first person reports—are excluded from statements of science. The exclusion of such statements is just another way of saying that science is concerned with public knowledge and first person reports are private knowledge."

This is the "logical positivist" position of dismissing what is often referred to as "anecdotal" information, i.e., information not obtained in a systematic manner. It is part of the justification of excluding all other forms of obtaining knowledge, especially personal judgment and insight. It also is a justification for excluding intuitive and dialectic truth, i.e., all knowledge obtained in an Eastern fashion. To carry this point further, one must distinguish between "wisdom" and "knowledge." The "scientific method" is great for amassing large quantities of data. However, is accounting, as a profession, any wiser for having done this? Georgescu-Roegen [1971, p. 29] makes a very interesting point concerning this excessive data gathering. He claims that it first, discourages potential Newtons from becoming interested in synthesis. And secondly, it is possible that even a Newton might not be able to arrive at any synthesis under the flood of data. Georgescu-Roegen also points out that science now seems to be involved in a vicious cycle. The lack of synthesis
causes us to believe that we do not have enough data. Yet by providing more data we increase the difficulty of achieving synthesis.

Think of all the artists et al which are revered and treated as though they have the gift of insight. Is this not knowledge? What was the whole Romantic reaction to the Enlightenment all about? Or the idea of storytelling and parables, are they not knowledge? Supporters of the "scientific method" would probably respond by saying that those things deal with issues (such as metaphysics, values and ethics) which lie outside the realm of science. It appears that the more scientifically "qualified" one becomes, the greater the risk of moving further away from a concern with values etc. One of the fathers of modern science, Pascal, eventually turned away from it because he felt the prevalence of "scientism" would destroy spiritual values if unchecked.

Kinney- "Empirical Accounting Research Design For Ph.D. Students"

Whereas Sterling makes the argument for accepting a "positivistic" approach and making accounting a "science," Kinney assumes that it is a science. Apparently, Sterling's argument, offered in 1975, reached its audience. Kinney offers a very narrow, and as this dissertation argues, flawed characterization of research. It is one based on the Cartesian-Newtonian orientation. The thrust of his position
is that "empirical research" is the only method of research and that accounting Ph.D. students do not have the appropriate background to do it. Specifically, he suggests that Ph.D. students lack the statistical training for doing research. Consequently, his paper really is a discourse on statistics. Specifically, it describes how to deal with the effect of exogeneous variables in regression-correlation analysis.

The nature of Kinney's paper calls for a more general critique than that of Sterling. Rather than attempting to debate whether exogeneous variables can be ignored, matched ex post, or their effects eliminated via covariance analysis, the critique is directed towards Kinney's view of research as illustrated in his paper.

Kinney's paper contains three sections. The first presents a definition of empirical accounting research, theory, hypotheses, and fact. The second and third sections deal with technical problems of regression-correlation analysis. He suggests that his paper could be used to provide the foundation for a philosophy of science course. He does not offer the empirical approach as only one method of research, but rather as the only method of research. The paper could more appropriately be used for further work in statistical design, but only after it was made clear that the empirical approach advocated should be used only after the researcher determines that it is appropriate for the research task at hand.
Kinney's approach suffers from all the criticisms of "positivism" made previously in this dissertation. He constantly refers to this research as being conducted by "passive observers." He adopts Watts and Zimmerman's [1984, p. 1] naive, "positive," "how-the-world-is" approach as contrasted to the more traditional, normative view that accounting "theory" is concerned with what accounting practices ought to be. His position does not acknowledge that there is debate as to whether it is even possible to do "positive" research.

Kinney accepts the Cartesian-Newtonian orientation completely and consequently suggests that the major problems encountered in accounting research are "technical" (or statistical) problems. Kinney implies, in his conclusion, that the major problem areas in producing a dissertation concern problems with the statistics. He infers that topic selection is influenced not by relevance, but rather by the potential statistical problems which may be encountered. Specifically, the question is how easily can the topic be researched empirically.

It could be argued that Kinney's paper is detrimental, not only because the method it advocates is flawed, but also because it contributes to the naive view of how science is done. The research scenario Kinney offers, that research begins with real world problems which lead to the development of theories etc., is standard rhetoric. Even if
it were possible to do "positive" research, the method advocated in the literature is not how it is actually done. Rather, it is an **idealization**, developed by philosophers of science, of how scientific knowledge is acquired. Feyerabend [Chalmers, 1976, p. 145] argues that if one looks at the classic episodes in the history of science, in general, none of the major advances and revolutions associated with them came about via the "scientific method."

Kinney's statement that research begins with a real world problem is simply not the case in the majority of accounting research. As discussed in Chapter I, the majority of accounting research is unrelated to real world accounting problems [Tomkin and Groves; Hopwood, 1984; Burchell et al, 1980; Kaplan, 1984]. Arrington [1986] argues that accounting research is driven by factors other than idealized scientific wonderment. Cooper and Zeff [1987, p. 8], in a critique of Kinney's article, suggest that if the current trends persist, accounting research and the professional practice of accounting will further separate.

The manner in which Kinney addresses the usefulness of accounting research is also detrimental. As Cooper and Zeff [1987, p. 3] observe, Kinney addresses the usefulness of research only in terms of publication requirements. Note that these are publication requirements in journals which are already extremely narrow in what they regard as acceptable accounting research.
In conclusion, Kinney's paper reflects the general view of research in accounting. In the context of this dissertation, it advocates the flawed and obsolete philosophy of "positivism." It demonstrates how the "doing" of research is introduced to novices (including Ph.D. students). The "positive" approach is advocated as uncontestably reliable. It is introduced not as a system of thought which may or may not be adopted by the individual, but rather as the only system of thought for conducting research.

The critiques of Sterling and Kinney were attempts to demonstrate the ontological positions they implicitly hold. They were also attempts to bring to light the implicit assumptions inherent in the "scientific method" advocated by both Sterling and Kinney. Note, the intention was to illustrate the "positivistic" nature of accounting research, it was not to direct specific criticism at these two authors. Consequently, other examples from the accounting literature could have been used and the conclusions would have been the same.
CHAPTER V

SUMMARY AND CONCLUSIONS

The primary purpose of this dissertation has been to project an ontological viewpoint concerning research and knowledge. Specifically, the author has attempted to create an awareness of the axiomatic nature and the fundamental problems with the Cartesian-Newtonian ontological orientation from which "positivism" developed. First the chronological development of the Cartesian-Newtonian machine-world view was examined. This allowed the reader to see how many of the concepts inherent in this view were simply assumptions put forth as reality. It also allowed the reader to consider the various criticisms of the "scientific method." The criticisms of Berkeley, Hume, Bergson and Whitehead stand uncontested. Modern physics was also examined as representing the pinnacle of scientific thought. The modern physicist's view of reality, one radically different from the Cartesian-Newtonian view of reality, was examined. Eastern philosophy was also examined. The reason was twofold. First, by comparing different ontological positions dialectically, inherent and mostly implicit assumptions are made explicit, thus contributing directly to the objective of this dissertation. Secondly, longstanding Eastern philosophical concepts are
currently receiving increased attention. Primarily because the Eastern view of reality is one that is ontologically consistent with the revealed reality of modern physics.

No attempt is made in this dissertation to prescribe an alternative ontological view in researching specific problems in accounting. The reason is threefold. If creating an awareness could be considered a first step, then determining specific consequences of this awareness, as manifested in specific accounting research problems, would be a second step. First, this second step is simply beyond the scope of this project. As such, it constitutes a future area of attention. Secondly, unless the desired awareness is actually achieved, there is really not much point in addressing specific problems. For this reason, the focus of attention has been placed on attempting to achieve this desired awareness. Finally, and perhaps most importantly, the consequences of altering one's ontological orientation are for the most part unknown. It is a legacy of "positivistic" thought, that consequences should neatly follow from this new ontological position. This legacy misses one of the fundamental arguments of Bergson and Whitehead which is that the future is not predetermined by the past and present but rather is "made" by the present. Modern physics provides an excellent example. As physicists began to develop an awareness of atomic and subatomic reality, they really had no idea where it would take them.
This did much to deflate the arrogant attitude, nurtured by the Cartesian-Newtonian view, that man had solved the mysteries of reality. It is a lesson which could be well utilized by all persons engaging in the acquisition of knowledge.

"Positivism" And The Cartesian-Newtonian Ontological Orientation

"Positivism" is a derivative of the Cartesian-Newtonian machine-world view of reality. It is based on seventeenth century physics and a nineteenth century philosophy, both of which are outmoded. The Newtonian model of the universe was a triumph of "systematic abstraction," and contained several fundamental concepts. The first of these was the notion of causation. Causation, as demonstrated by Hume, was shown to be a matter of faith. Modern physics has replaced causation as the fundamental activity in nature, with perception. Perception is also fundamental to Eastern thought which never developed the concept of causation. The Newtonian model was also built on the principle of "order" and "mechanism," rather than on "organism." An organic view of reality was fundamental to pre-Descartes thought, to Eastern philosophy and to modern physics. A third concept was determinism. This also was shown to be a matter of faith. Reductionism represents the fourth concept. Reductionism contrasts with holism, so fundamental to Eastern philosophy and modern physics. The tremendous success of the
axiomatic Newtonian model led to several classical concepts of reality. The most significant of these concepts, was that there exists an objective reality, independent from the observer. Because of this "subject/object" split, it was believed to be possible to obtain objective knowledge, or knowledge free of metaphysics, morals and personal convictions.

Modern Physics And Eastern Philosophy: Implications For Reality

From both modern physics and Eastern philosophy, comes the view that reality is subjective, not objective. There is no reality independent of the observer. Hence, there can be no objective description of nature. There is no "subject/object" split. Quantum Theory abolished the notion of fundamentally separated objects. It also introduced the concept of the "participator" to replace that of the "observer." As a consequence it may even be necessary to include the human consciousness in its description of the world. Therefore, knowledge is a "personal" and not an "objective" phenomena. Modern physics supports what Kant said long ago, that anything observed is affected by the act of observation. The personal aspect of knowledge manifests itself at two stages of the research process. First, our choices of research questions and decisions about what constitutes evidence are constructs we create as images of our own private reality. Secondly, as Quantum Theory
specifically shows, most of our judgments are products of experimental value judgments rather than passively sensed as naturally-occuring phenomena.

Modern physics and particularly Eastern philosophy have a significantly different view of the role of the intellect from that of "positivism." While the West has exclusively emphasized the reasoning intellect, the East has emphasized intuitive thought. Rational knowledge, as Bergson argued, is relative because it utilizes the abstract concepts of the mind. The preexisting concepts of the mind have a filtering effect. As Kant said, the act of knowing is a joint process between the knower and the thing being known. Intuitive knowledge, on the other hand, is absolute because it does not go through the filter of one's reasoning intellect. The Eastern philosopher also understands that one often remains at the abstract level and confuses these abstractions for reality. Logic is a powerful tool for thinking out what one already knows, but it does not generate new knowledge.

Modern physics is constantly moving towards a view of the role of consciousness similar to that of Eastern philosophy. Subatomic physics has shown us that the object, the instrument and the observer constitute one indivisible whole. The mind is very much a part of the process of observation. "Positivism" with its concern with "objective" reality, has completely ignored the role of consciousness. As suggested by Whitehead and all of Eastern philosophy, consciousness is the tip-end of a continuum of awareness.
Because of its view of consciousness and intuitive knowledge, the essence of Eastern philosophy is to "acquire intimate knowledge" about objects in their natural setting. This is fundamentally similar to the "naturalistic" approach to knowledge advocated by Tomkins and Groves [p. 7].

Eastern philosophy suggests that mystical knowledge can never be obtained just by observation, but only by full participation with one's whole being. Hence, the notion of the participator is crucial to the Eastern world view. Eastern mystics have moved to the extreme position where observer and observed, subject and object, are not only inseparable but also indistinguishable. Consequently, they are not satisfied with a situation such as atomic physics where the observer and observed cannot be separated but still can be distinguished.

As mentioned previously, the view held by modern physics and the East is that of an "organic" world, as opposed to the "mechanistic" world of "positivism." The "organic" view appears to be more fundamental than the "mechanistic" view. This is because Newtonian physics, which is based on a "mechanistic" view, can be derived from Quantum Theory, which implies a "organic" view, whereas the reverse is not possible.

It should be apparent that "positivism" was based on axioms concerning the nature of reality and that these axioms conflict with our present understanding of nature.
Most of the classical concepts fundamental to "positivism" have been discarded in modern physics. Yet the ontological orientation of "positivism" persists and strongly influences research style. Non-positivistic methods seem strange because they are still evaluated on the assumptions underlying "positivism." It is still generally assumed, that all knowledge must be "positive" knowledge. As Rorty [1979, p. 61] suggests, the search for the foundations of knowledge by Descartes, Locke, Hume, Kant, Russell and Carnap represented the "triumph of the quest for certainty over the quest for wisdom." Although no method can claim preeminence for itself, this is exactly what "positivism" has done. "Positivism" claims preeminence because of its "rigor." It prides itself on being rigorous, yet there is no rigorous definition of rigor. Rather rigor is what obtains the endorsement of the leading specialists at the time. In accounting research, this is exemplified in the editorial policies of accounting research journals such as the Journal Of Accounting Research and The Accounting Review. Hence, researchers become preoccupied with publication requirements in journals which are extremely narrow in what they regard as acceptable accounting research.

The Dangers Of "Positivism"

The dangers of "positivism" should be obvious. At the very least, as one continues to become more concerned with
quantitative rigor and moves further away from reality, the occurrence of empty theorizing increases. More likely is the danger resulting from "positivistic" knowledge being peddled as genuine. To illustrate, consider Efficient Market Research and some of its implications [Beaver, 1981]. In particular, Efficient Market Research implies that the role of accounting is to assist the investor in making investment decisions. It also implies that the "naive" investor will be protected because the financial markets are efficient and therefore all securities are properly priced. By properly priced, it is meant that available information is impounded in the price of the security. Hence, when addressing disclosure issues, for example, Efficient Market Research would conclude that substance is more important than form. Regardless of the format, information will get impounded into the price of the security. This could have significant policy implications for those bodies concerned with disclosure, such as the S.E.C. and the F.A.S.B.. The point is not whether one agrees that markets are efficient or not, but rather that research findings which reflect the assumptions, attitudes and convictions of the researchers are offered as "objective" knowledge free from personal assumptions, attitudes and convictions. It is then possible that policy makers may act upon this information as though it were "objective," without realizing that it is, in fact, "subjective." Finally, "positivism" is dangerous because
its philosophical, cultural and spiritual implications actively support a society which is still based on the mechanistic, fragmented world view. "Positivism" fails to see that science points beyond such a view, towards a oneness of the universe which includes not only our natural environment but also our fellow human beings.

Implications For Research

In order to make progress in accounting research, researchers must discard their extremely narrow view of what constitutes knowledge. As Feyerabend [1978] argues, there may not be any clear cut guidelines before hand in determining what will generate good research. We must discard the notion of the "detached, objective" observer and replace it with that of a "participant." Quantum Theory shows that the classical ideal of scientific objectivity can no longer be maintained. Likewise, the myth of a "value-free" science is also suspect. What the scientist observes in nature, is intimately connected with the patterns of his mind; with his concepts, thoughts, and values. The scientist cannot play the role of a detached objective observer, but must become involved in the world he observes to the extent that he influences the properties of the observed objects.

Nothing is more important about the quantum principle than this, that it destroys the concept of the world as "sitting out there". . . . The universe will never afterwards be the same. To describe what has happened, one has to cross out that old word "observer" and put
in its place the new word "participator." In some strange sense the universe is a participatory universe. [J.A. Wheeler quoted in J.Mehra, 1973, p. 244]

We must realize that scientific thinking doesn't have to be mechanistic and reductionist. We must realize the limitations of the Cartesian-Newtonian world view, and, like physicists, modify or even abandon many classical Western concepts concerning reality and knowledge. As modern physics has demonstrated, holisitc views are scientifically sound. We must also realize the limitations of rational thinking and become more open to intuitive thought.

Implications For Academia

Accounting academia must acknowledge the difference between "knowledge" and "wisdom." Until this is done, the "positivistic" approach with its emphasis on blind data-gathering will continue. Science, as it is practiced in social disciplines such as accounting, is a pretty dismal affair. This is primarily because of the stifling influence of "positivism" and its overconcern with quantitative rigor. We must stop teaching "positivism" as if it were uncontestably reliable. Feyerabend [Chalmers, 1976, p. 147] suggests that we need to expand our view of acceptable research and introduce into our educational system the teaching of not only science but of a variety of brands of religion, mysticism, etc. This will give the individual the "choice" of what ideology to choose. Then science will become the exciting affair that it was in the past, not the
dismal affair it is now. Also by broadening our view of what constitutes knowledge, it is more likely that via comparison, implicit assumptions will be made explicit. Perhaps, by broadening academia's view of knowledge, there will be less of a tendency towards an overemphasis on rigor and a tendency towards more emphasis on generating new ideas. By deemphasizing quantitative rigor, it is more likely that more relevant accounting problems will be addressed.

Unquestionably, academics must discard the notion of a fact/value or positive/normative distinction. Not only is it inconsistent with the "personalized" view of knowledge, but it also contributes to the illusion that research is not driven by values other than scientific curiosity. It should be apparent that the greatest progress in advancing our discipline will only come after we drop the useless insistence upon the distinction between the positive and the normative. Questions of value can then be addressed explicitly rather than implicitly.
Footnotes For Chapter I

1. Christenson [1983] shows that the philosophical position of the Rochester School conforms neither to the instrumentalism of Friedman nor the falsification of Popper, but rather to the earlier "logical positivists" who advocated the "verification" of theories via empirical observations.

2. In the 1984 American Accounting Association Doctoral Consortium, this author questioned several attending researchers as to their reaction to Kaplan's comments. Without exception, the reactions were rather negative; the inference was that Kaplan had already "made a name" for himself by doing primarily the type of research that he was criticizing, and that these researchers were unwilling to concede to his indictment of contemporary research because they still had to "make a name" for themselves. In other words, they had strong vested interests in maintaining the status quo in terms of research.

Footnotes For Chapter II

3. Note the methodology is used in the incorrect manner discussed by Malchup in Chapter I.

4. Friedman's instrumentalism can be described as a pragmatic theory that ideas are instruments that function as guides of action, their validity being determined by the success of the action [American Heritage Dictionary]; "... as a body of substantive hypotheses, theory is to be judged by its predictive power for the class of phenomena which it is intended to explain" [Friedman, 1953, p. 8]. Hence, with respect to reality, Friedman would be inclined to say that we don't know reality, we can never know reality, and it doesn't matter if we know reality.

5. Popper's falsification [Popper, 1959, 1965] criterion is one of the two ways in which the belief in empirical testability has been expressed. The argument is that since observation statements are theory dependent and fallible, scientific theories cannot be proved but may be falsified [Chua, 1986, p. 607]. The other expression of empirical testability [Hempel, 1966] implies a "positivist's" belief that there exist a theory-independent set of observation statements which
could be used to "confirm" or "verify" the truth of a theory [Chua, 1986, p. 607].

6. To illustrate this point, as a doctoral student, the author was dissuaded from several topics in the information systems area because it was felt that those topics could not be researched with enough "rigor". At the 1984 AAA Doctoral Consortium the author was advised by one of the attending researchers to forget about doing research in managerial accounting because getting data was too difficult; he suggested auditing where apparently data is more abundant.

7. Note that A. F. Whitehead enjoyed in essence two careers, the first in England was that of a logician, mathematician [he collaborated with Bernard Russell on *Principia Mathematica*] and philosopher of science. However his second career took place in America and occurred later in his life and was that of metaphysician. It is this second career which is referred to throughout this thesis.

8. In the 1984 AAA Doctoral Consortium, this author witnessed several responses to questions voices by many doctoral students concerning ultimate practical applicability of their research. The general response was in the order of "you are an academic, therefore practical issues are not your concern; to enhance your career you need to address 'academic' issues".

Footnotes For Chapter III

9. Note that this is exactly why it was necessary to comment on the use of the term "scientific method" at the beginning of this thesis. It is primarily because the term "scientific method" generally has a pre-modern physics connotation that this paper is being written.

10. In Quantum Theory, then, all interactions are pictured as the exchange of virtual particles. Virtual particles—as opposed to mesons—are massless and can be created with indefinitely small amounts of energy. The distinction between matter and empty space finally had to be abandoned when it became evident that virtual particles can come into being spontaneously out of the void, and vanish again into the void, without any nucleon or other strongly interacting particles being present. Three particles—a proton, an antiproton, and a pion—are formed out of nothing and disappear again into the vacuum. Like the Eastern void, the "physical vacuum", as it is called in field theory, is not a state of mere nothingness, but contains the
potentiality for all forms of the particle world. These forms, in turn, are not independent physical entities but merely transient manifestations of the underlying Void [Capra, 1975, p. 247].
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