CHAPTER 21

Development of the Western Model: Toward a Reconciliation of Eastern and Western Perspectives

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INTRODUCTION

Although communication as a formal discipline is one of the youngest of the sciences, it has roots which extend back through the arts and philosophy at least as far back as the Greeks. Even today, Aristotle's rhetoric plays an important part in the training of many communication scholars.

As a young and eclectic discipline, communication has drawn substance from many related fields and has diversified in theory as well as methods of inquiry. In spite of the diversity of its ancestry and the scope of its ecclecticism, recent developments have led to increased interest in the common characteristics which communication theorists share. Particularly, as communication has begun to find world-wide applications, many workers both theoretical and applied have begun to question the applicability of an essentially Western discipline like communication to problems in the East. This essay, while acknowledging the diversity and

COMMUNICATION THEORY:
EASTERN AND WESTERN PERSPECTIVES

frequently sharp differences of opinion among communication theorists and researchers, attempts to trace the development of communication theory back to its origins to determine the extent to which common themes, axioms, and methods might justify classifying contemporary communication theory as a single Western model.

At the outset it is important to stress that the Western tradition, like the Eastern, is diverse and includes widely different viewpoints which coexist in time. At the risk of minimizing these differences, however, it is convenient to divide the roughly 30-century period during which the Western model has developed into four segments according to the prevailing model of the time. The earliest period, usually called the pre-Socratic period, is characterized by loosely defined beginnings of Western philosophical thought and shares much with the Eastern philosophical tradition. The second period begins with Socrates and lasts through the work of Aquinas into the beginnings of the Renaissance. It is dominated initially by the work of Socrates, Plato, and Aristotle and, later, by influences of Christianity, particularly through the works of Aquinas. The third period dates from Descartes and Galileo until the late ninteenth century and marks the beginning of scientific measurement, while the fourth period dates from Einstein and his predecessors and continues through today. It is wrong to assume sharp cleavages between these periods, and it is equally wrong to assume each of these periods is homogenous in viewpoint. Nonetheless, each of them is sufficiently domianted by a particular view with sufficiently definable characteristics to warrant separate treatment.

THE COMMON MODEL

It is by now commonplace to note that Western thought has its antecedents among the Greek philosophers, and it is almost universally agreed that Thales (circa seventh century B.C.) was the first of the Greek philosophers. What is less well known is the extent to which Eastern and Western thinking were merged during these early origins. Miletus, the largest city in the Greek world and the home of Thales, Aniximander, and Aniximines, was the largest commercial trading center of the Greek world and, as such, was in continuous contact with the East. Land travel to Mesopotamia was common, as was sea travel to Egypt, and there is good evidence that Thales himself traveled to Egypt at least once. There is also general agreement that Thales predicted an eclipse of the sun around 585 B.C., a feat which almost certainly would have required a good knowledge of Babylonian astronomy.

Moreover, the views of the pre-Socratic Greek philosophers often bear a striking resemblance to the principles of Chinese philosophy. Thales thought that there was a single underlying substratum which was itself the source of its own motion—like the Chinese notion of *Ch'i*—although Aristotle suggests that Thales later identifies the substratum with water. Along with the monistic model of Thales, there are also pluralistic views, like the atomistic view of Democritus and others. The atoms of Democritus, however, are not dead matter but, rather, living force themselves and the source of their own motion. We find also the notion of relative polarities or polar opposites, and these even form a basis of the more well-developed Aristotelian model several centuries later. Within this framework of philosophy, and like the Chinese model, humans are not distinguished as fundamentally different from or opposed to nature but are rather an integral part of being and change. Speculation, as in Chinese philosophy, is not ethical in character, and concepts of moral guilt are not strong in the philosophy of this period.

Perhaps closest of all to the Chinese model is the philosophy of Heraclitus, whose idea of endless change and restlessness is well-summarized by his dictum that one cannot step in the same river twice. Although Aristotle considered Heraclitus' position to be an extreme one even at the time, it was by no means unique, and its conclusions—such as the impossibility of capturing reality in words so common in the Chinese view—were recognized by other pre-Socratic Greeks like Cratylus, " . . . who finally did not think it right to say anything but only moved his finger, and criticised Heraclitus for saying that it is impossible to step in the same river twice, for he thought one could not do it even once" (McKeon, 1941, pp. 745-746).

Consistent with Heraclitus' view of a universe in constant flux was his relativistic epistemology—a theory of knowledge which denied absolute, unchanging knowledge and emphasized instead an individual, internal, enlightening experience which was at once personal and uncommunicable. In fact, Heraclitus' writings are frequently Koan-like, intended to stimulate the reader into internal considerations and personal enlightenment, and more rationally oriented Greeks sometimes complained that he wrote nothing clearly.

Heraclitus' most formidable opponent was Parmenides. Parmenides adhered strongly to the *Principle of Noncontradiction*—a principle which is itself at odds with the Chinese *Principle of Infinite Interpretation*. The *Principle of Noncontradiction*, along with Paramenides' monistic view of nature, led him to deny altogether even the possibility of motion and change. The sequence of an (apparently) ripening tomato, for example, required the annihilation of a green tomato and the creation of a red tomato. The tomato could not be both green and red, nor could the green tomato pass into nothing or the red tomato spring into being from nothing. These philosophical difficulties were enough to cause Parmenides to reject sensory evidence of change as erroneous.

Parmenides was not the only Greek to deny motion and change. Zeno, for example, declared motion to be impossible on the grounds that any moving object would need to pass through an infinity of intermediate points which would require an infinite amount of time.

The pre-Socratic period, therefore, was one in which Eastern thought mingled freely with emerging Greek ideas, and it is not to undervalue the originality of the Greeks to say that Western thought can best be understood in the light of these common origins. The next period—the period beginning with Socrates and ending with the birth of classic science—can be seen as emerging out of the ideas of the pre-Socratic period, both Eastern and Western.

THE ARISTOTELIAN MODEL

Although the pre-Scoratic period is marked by a comingling of Eastern and Western thought, the period which begins with Socrates marks a divergence of Greek thinking from the common model. The first step in this divergence is frequently attributed to Socrates, who began to erode the unity of human and nonhuman phenomena by raising the question of ethics in a serious and formal manner. In fact, later commentators such as Cicero suggested that Socrates " . . . brought it (philosophy) into communal life, compelling it to attend to questions of virtue and vice, good and evil" (Guthrie, 1975, p. 8). Aristotle said of this period that " . . . the investigation of nature came to a stop, and philosophers turned their attention to practical morality and political thought" (p. 8). This separation of people from nature continues to this day in Western thought, and even now the activities of society are thought to be "unnatural," for example, by many in the environmental movement. This separation of mankind from nature gave serious impetus as well to the epistemological question—that is, the question of the connection of people and the world of experience.

The question of human knowledge became central for Greek philosophy. In particular, most Greeks (including Plato and Aristotle) conceived of perfect knowledge as absolute and unchanging, while the world of the senses seemed continually in motion and change. Plato clearly accepted a radical disjunction between humans and the world of experience, granting to the world of experience only a shadowy and epiphenomenal existence. Yet Plato would not accept a solution which prohibited absolute knowledge, and so instead adopted a view of knowledge as real but separate from sensory experience. The object of our knowledge, according to Plato, is no in the world of experience but another perfect and abstract world—the world of ideas—which we know only by recollection from a mythical epoch when we lived there. Sensory experience is of no help in gaining this knowledge, although the dialectic method can sometimes help jog our recollections. This is quite different from the Chinese view in which humans hold no special status, since in the Chinese view all beings, human or otherwise, participate equally in the oneness of nature.

It is difficult to overestimate the centrality of the question of motion and change, perception and knowledge, to the development of the Western model. So taken were the Greeks by the materiality of the world of sensory experience and the changing, particular temporality they ascribed to it that they could not reconcile it with the abstract unchanging perfection of immaterial thought. Zeno and Parmenides were prepared to deny altogether the reality of motion and change; Heraclitus allowed himself to deny the abstract and unchanging character of thought. Plato was willing to accept a radical distinction between the object of knowledge and the world of experience.

Aristotle fully accepted the distinction between the concrete changeability of matter and the abstract permanence of thought and attempted to resolve the problem of motion by attributing to every existing entity two principles: a material substrate, whose restlessness accounted for impermanence and change, and an immaterial form, abstract and unchanging, which inhered in the material substrate. This implied for Aristotle a distinction between two senses in which the word "is" was used in Greek. The first meaning of is was "to be" or "to exist" as in the phrase "Scorates is." Such a usage implies that Socrates exists. The second meaning of is was "to have," in the sense of the phrase "Socrates is tall." This second usage, for Aristotle, implied that Socrates "possesses" something; in this case, Socrates possesses the attribute height. This formal quality or attribute, height, is nonmaterial and abstract, which means that it is universal and unchanging and, hence, can serve as a proper object of knowledge as Aristotle thought of it. Yet the notion of change can be reconciled as well, insofar as matter may at one time possess one form and at another time possess another form. Thus, change is the process by which matter possesses at one time and the next a series of abstract, universal, unchanging forms.

Yet Aristotle needed to account for the progression of forms itself. What caused a ripening tomato to have at one time the form green and at another the form red? Where did the redness of the ripe tomato come from? Taken by the systematic character of nature (that is, green tomatoes, if allowed to mature, always become red tomatoes and never ripen into, say, oak trees) and fleeing also from Parmenides dilemma (that is, nothing can come to be from nothing, and nothing can pass into nothing), Aristotle was led to postulate a higher level of form beyond the mere qualitative aspects of an object (such as its color, shape, size, etc.). This higher form scholastic philosophers now refer to as an entity's "substantial form" or "essence." This higher form, or essence, to Aristotle meant whatever it was that made the entity what it was. This form, or the "nature" of the thing, contained within itself as potential all the secondary forms through which the entity could pass during its development. Thus, the form "human" contains within itself as potential the secondary forms size, color, shape, and so forth, which humans can attain. The process of change is the process of moving through these forms already contained as potential in the essence of the entity from its first moment of existence. Thus, all change, and, for that matter, all motion, was for Aristotle a developmental process, whereby an entity becomes in actuality what it has always been potentially.

There are several important consequences of this view. Change and motion as phenomena of our sense experience are saved, since change can be seen as the process whereby abstract, universal forms are taken on and lost by an entity which itself does not cease to exist in the process. The object of knowledge—which for the Greek mind needed to be abstract and unchanging—is placed back in the world of experience rather than in a world of its own. Like Plato's world of ideas, the object of knowledge is the form which the object possesses. Nor is it necessary to assume that qualities come to be from nothing, since the qualities or secondary forms ("attributes") which any object can take on are contained in potency in its substantial form from its first moment of existence. In spite of its power, the Aristotelian model never provided a satisfactory basis for the scientific understanding of motion and change.

In order to construct his resolution to the paradox of permanence and change, Aristotle was forced to ascribe a certain set of characteristics of motion and change which cause serious difficulties in peculiar ways. Specifically, motion is seen as an interim process between two points of rest, a discrete phenomenon intervening between two discrete states. In the case of physical or local motion, for example, a body must always be thought of as moving from one place to another place. Physical bodies are seen as moving or tending to move, barring interference, toward their proper place. The proper place of heavy objects is the center of the universe, and the proper place of light objects (like fire) is at the periphery of the universe. While the entity is moving, it is not, in the true Aristotelian sense, anywhere. A moving body has no place but, rather, is in the process of giving up one place to settle in another. In the same way, any changing entity is not in any state during its change but, rather, is in a semireal state of transience.

To be sure, there is some advantage to this semireal view of motion and change. It provides one resolution of Zeno's paradox, in that it makes it unnecessary to assume that a body passes through an infinite number of points on its journey from one point to another, thus, using up an infinite amount of time. But there are disadvantages as well.

Initially, such a view focuses attention away from the process of motion itself and places it on the terminals of motion. Since all motion is seen as a discrete bridge between one state of being and another, explanations of motion tend to focus on the state of affairs prior to the motion and the state of affairs subsequent to the motion. Additionally, they tend to force consideration of motion as a qualitative category—that by which new places or states or characteristics are attained—and make it difficult to think of motion and change quantitatively. Motion and change tend to be characterized as means to ends, whether those ends are "intended" or not.

Even though the notion that physical bodies were in some sense moving toward ends was not taken in its most naive sense, that is that the objects in some sense intended their motion, nonetheless, the view of motion as discrete jumps from place to place presented an insuperable barrier to the emergence of a well-developed quantitative physical mechanics. Medieval physicists still believed that, when a force was applied to a body, that body took on an "impetus," and the nature of that impetus determined the distance that the object would travel. When the impetus was exhausted, the body would return to its (natural) state of rest. What happened during the motion, for example, whether the body moved most rapidly during the beginning of its travel and then progressively slower until the impetus was used up, whether it moved increasingly quickly, whether it moved more and more rapidly until midpoint then slowed to rest, or whether its motion would be uniform throughout its flight, was not known. This is well worth noting, since today the notion of quantitative analysis of motion is completely commonplace, and even the lay person thinks naturally about velocity and acceleration, particularly in societies where automobiles are in widespread use. Yet, 17 centuries after Aristotle, the greatest minds of Europe were baffled and frustrated in their attempts to quantify motion. By and large, medieval attempts to quantify the Aristotelian laws of motion were unsuccessful in spite of the work of Bradwardine and others, and even Galileo initially believed that every object moved always at its own "natural velocity," a constant velocity proper to itself at which it tended to move.

It was apparently the middle of the fourteenth century before philosophers began to escape the Aristotelian framework sufficiently to generate dynamic quantitative interpretations of physical motion. The fact that motion had been a specific focus of attention for a large span of time no doubt helped weaken the conception of motion as a mere intermediate stage between two terminal states of being. It was Buridan who seems first to have set down the concept of uniform motion, a concept which is at odds with the idea of motion as an interim process between two "real" terminals. Buridan suggeted that, once set in motion, the impetus of the body would endure forever unless opposed by some other force, thus effectively anticipating Newton's first law of motion sometime in the middle of the fourteenth century.

These mathematical difficulties were inherent in the character of the concepts that the medieval scientists inherited from the Greeks and are rooted in the distinction between the continuous and the discrete that permeated Western philosophy. Generally, the quest for a reconciliation of mind and matter described above can be characterized as an attempt to reconcile a conception of motion as continuous with a conception of thought as discrete. The mathematical process of counting or quantifying is essentially a process of establishing a correspondence between the elements of two classes. Thus, when we count the number of coins in our hands, we establish a correspondence between the elements of the class "coins in my hand" and certain of the elements of the whole number system, that is, 1, 2, 3,. . . . If there exists an element in the second class for each element of the first class, then the second class can be said to adequately represent or quantify the first class.

If motion is seen as a continuous phenomenon, and thought as a discrete phenomenon, then no such correspondence can be established. No matter how finely the discrete members of the mental class are divided, an element of the continuous class motion can always be found which will be between any two of them, and thus there will always be an infinitely large number of elements of the class of motion for which no analogue can be found in the class of thought.

Zeno's attempt to reduce motion to a discrete phenomenon, that is to see any moving body as passing through an infinite number of discrete places or points, resulted in an absurd conclusion: Such a passage through an infinite series of points implied the passage of an infinite amount of time. Zeno's conclusion, of course, was that motion was impossible, when in fact what he had really established was a problem inherent in the discrete conception of motion.

Heraclitus, on the other hand, clearly characterized motion as a continuous phenomenon and abandoned any hope of establishing a correspondence with the discrete character of thought as he conceived it. Thus, he abandoned hope of knowing the nature of physical reality in any absolute sense. Parmenides too found the way to discrete characterization of the world of sense experience barred, although for different reasons.

The idea of terminals of motion implies that the spatial manifold in which motion occurs is heterogenous, i.e., that there are some points in space where objects are more prone to go than others. There are places in space toward which objects tend to move, and once having arrived, tend to remain.

The heterogeneity of space implies that motion is not linear and, moreover, that the deviations from linearity may not be very clear. The shortest distance between two points may not be a straight line, since some particularly dense or impermeable region of space may be on the line between two points. This means that motion may at times take on very complex curves even in the absence of any imbalance of forces.

The idea of terminals of motion implies that the point at which a moving object will come to rest is given by the force which initiates the motion. Thus, the natural state of being is to be at rest, and the notion of continuous, uniform motion (Newton's first law) is foreign to this system.

No matter how philosophically satisfying such a theory of motion may be, it presents mathematical difficulties especially for an age in which the special non-Euclidian geometries, the calculus, and the probability theory do not yet exist.

The Aristotelian conception of motion is relevant to human behavior not only because of its epistemological consequences but because locomotion, that is, movement in physical space, is a special case of change in general for Aristotle. Human behavior is itself a type of motion, and Aristotle's psychology parallels his ideas of physical motion exactly. Behavior, for Aristotle, was the semireal state between two states of act. In behavior, as in physical motion, the individual moves through a series of discrete states of conditions (forms). Similarly, Aristotle's notion of causality requires that the cause of each state preexist the state itself, or else one would need to say that an event was its own cause. Thus, Aristotle located the cause of the act proximately in the mind of the actor as a goal (final cause, that is, an end). These goals are themselves dependent on the unbroken chain of causality which traces back to the "uncaused cause." Even Protestant conceptions of human behavior conform in essential respects to this model, although in the Calvinist tradition, the choices made by people have been predetermined by an all-knowing God.

The question of human freedom has always proved troublesome to thinkers who embrace the *Principle of Noncontradiction,* and even in pre-Socratic times, philosophers attempted to account for freedom and volition by ascribing the power of arbitrary motion to the substrate or atoms of which the universe was thought to be composed. Within the Catholic theology, the contradiction between an omniscient God who created all being and the free and voluntary action of individual humans is thought to be resolvable only on the basis of faith as revealed by God. Within the Calvinist tradition, the will is thought to be constrained from the first moment of creation. Even though the question of the freedom of the will, which arises as a consequence of the blend of the Aristotelian entelechy or goal orientation on the one hand and the Platonic–Socratic notion of moral responsibility on the other is still seriously debated today in the West, the foundation of the dispute—that humans do indeed act for ends—is seldom called into serious question.

Like the mores of Sumner (1979), the notion of goal orientation holds sway over the Western mind to a large extent because of the lack of serious alternative models within the Western discourse. Imbued as the West is in the *Principle of Noncontradiction,* it makes no sense to the Westerner to suggest—as do many Chinese philosophers—that we forego goals and not seek ends. While this may be a cause of enlightenment to the Eastern mind, to the Western mind it seems like a contradiction to accept the goal of having no goals. Moreover, imbued as it is in 30 centuries of essentialistic thought, it is hard for Westerners to think of this Aristotelian model as anything but by the way humans "really are," whreas for the Chinese who accept the *Principle of Infinite Interpretation,* it is only one possibility (see Chapter 2, this volume).

THE CARTESIAN MODEL

At the root of the Aristotelian model lies the incompatibility of the continuous flux of experience and the categorical and discrete permanence of thought. Aristotle's solution to the dilemma was to posit a two-fold structure for the world, one part of which was continuous and undifferentiated—the material substrate or primary matter—and the other part—substantial form—which was abstract and categorical, like Aristotle's conception of thought. Thus, Aristotle created a categorical component of experience—substantial form—which was compatible with and therefore the object of human knowledge. This solution resolved old difficulties but created new ones, particularly concerning dynamics. It is now common among scientists to note that in spite of the greatness of Greek mathematics and science, the work of the Greeks was completely static, and dynamics—the quantitative analysis of motion and change—is the unique product of the Renaissance.

The development of Renaissance dynamics may be seen to rest directly on a complete reversal of the Aristotelian strategy. Rather than restructuring our conception of the world as discrete and categorical to fit the discrete and categorical Greek conception of thought, Renaissance scientists instead developed a continuous model of reasoning to conform to the continuity and flux of experience. While the logic of Aristotle is categorical, the logic of Renaissance science is comparative and continuous.

The earliest and perhaps still the clearest description of this new epistemology comes from Descartes. Descartes began by rejecting Aristotle's categorical logic completely and substituting for it a comparative logic:

> But because, as we have often announced, the syllogistic forms are of no aid in perceiving the truth about objects, it will be for the reader's profit to reject them altogether and to conceive that all knowledge whatsoever other than that which consists in the simple and naked intuition of single independent objects, is a matter of the comparison of the two things or more, with each other. (Descartes, 1952, p. 28)

Descartes' comparative logic began by defining the term "dimension" which corresponds to Aristotle's notion of "category" or "attribute."

> By dimension, I understand nothing but the mode and aspect according to which a subject is understood to be measurable. Thus, it is not merely the case that length, breadth and depth are dimensions, but weight is also a dimension in terms of which the heaviness of objects is estimated. So, too, speed is a dimension of motion, and there are an infinite number of similar instances. For that very division of the whole into a number of parts of identical nature, whether it exists in the real order of things or be merely the work of the understanding, gives us exactly that dimension in terms of which we apply number to objects. (Descartes, 1952, p. 31)

While for Aristotle, the categories of attributes were discrete classes to which an object belongs or does not, for Descartes, the dimensions were continuously variable magnitudes, and one inquired as to how much of them an object possesses. This assessment is always made as a ratio comparison to some arbitrary segment of the dimension itself:

> For I can recognize the order in which A and B stand, without considering anything except these two—the extreme terms of the relation. But I can recognize the ratio of the magnitude of two to that of three, only by considering some third thing, namely unity, which is the common measure of both. (Descartes, 1952, p. 32)

Both Aristotle's and Descartes' logic proceed by means of a middle term. But in Aristotle's logic, the middle term is categorical; we may say that A is a member of B, B is a member of C, and, through the mediation of the middle term B, we can see that A is a member of C. But for Descartes, the middle term is not categorical but rather comparative. We can say that A is twice as large as B, that B is three times as large as C, and that, therefore, A is six times as large as C. The middle term serves as a comparative standard against which all other objects are gauged as ratios. Thus, the core of Descartes' logic is continuous rather than categorical. To be sure, Descartes did not invent the logic of the continuous middle term, and its use as a vehicle for measuring physical distances and time predates written history. Even Aristotle knew of it, although it seemed a puzzle to him, and he exhibited his discomfort with it in several places. He said of the measurement of distance and motion, for example.

> Now, one must cognize magnitude and motion by means of the same faculty by which one cognizes time (that is, by that which is also the faculty of memory) . . . " (McKeon, 1941, p. 608).

But later, when he spoke of time, he said:

> There is—let it be taken as a fact—something by which one distinguishes a greater and a smaller time; and it is reasonable to think that one does this in a way analogous to that in which one discerns (spatial) magnitudes. (McKeon, 1941, p. 615)

In this same passage, Aristotle went on to make explicit the notion of ratio comparisons, but the phraseology of the passage seems to indicate a hesitation and uncertainty, and he went on to explain the process and its failures in terms of excessive moisture in the head and abnormally large head sizes.

That the notion of continuous logic by means of ratio comparisons to an arbitrary standard lies at the basis of scientific measurement, however, can be shown clearly by the profuse use of the method by Galileo (1914).

The Cartesian resolution of the problem of a continuous manifold of experience mapped onto a discrete structure of thought, therefore, involves the abandonment of the discrete model of thought in favor of a continuous model as exemplified by the method of ratio-pair comparisons to an arbitrary standard unit. But his logic suffices only to establish how science, as opposed to Greek philosophy, describes experience. The notion of explanation still persists from the Greek period, although with important differences. During the early period of pre-Socratic thought, there was a difference of opinion about what needed to be explained, as we have seen. Some philosophers believed that motion needed to be explained, since the proper state of being was rest, while others suggested that motion was the natural state of affairs and that therefore rest required explanation.

Aristotle was clearly among those who believed that motion required explanation. In Aristotle's categorical system, however, motion was discrete, that is, it occurred or did not, and so the causes of motion were discrete. In the continuous model of Descartes, however, motion and change were variables rather than states, and therefore admit of variation themselves. As such, neither motion nor rest required explanation, but rather changes in the rate of motion became the "explainable" phenomena of science. This notion is formalized in Newton's first law (Newton, 1962). This law is not strictly speaking a law but, rather, a definition of what phenomena are to be considered explainable (Mach, 1915). By definition, Newton required that bodies at rest would remain at rest and bodies in motion would remain in motion unless acted on by some force. By so saying, Newton defined any change in rate of motion (that is, any acceleration) as requiring an explanation. Moreover, since these changes in rates of motions themselves admit of continuous variation, their causes are forces with continuously variable magnitudes.

Through the work of scientists like D'Alembert and Hamilton, "variational principles" have developed whereby we assume that science should seek explanations which minimize the magnitude of unbalanced forces that must be postulated to account for the accelerations observed. On these grounds, for example, we reject the geocentric model of the solar system of Ptolemy, since the unbalanced forces that would be needed to account for the acceleration of the stars in their near-circular orbits around the earth would be vastly larger than the forces that need to be postulated to account for the accelerations of the earth and other bodies in the solar system relative to the fixed stars.

Underlying the variational principles are the related concepts of force and inertial mass. In a categorical system, a motion either occurs or it does not, and the cause of the motion is therefore, either present or absent. From the *Principle of Noncontradiction,* it also follows that the cause must be similar to the effect. But in a continuous comparative logic, accelerations occur in greater or lesser magnitudes, and therefore the *Principle of Noncontradiction* demands that the causes of motion must be proportional to the accelerations observed. Force and mass are derived concepts which are constructed so that a proportionality of cause and effect can always be maintained. Thus, for example, if two objects A and B are struck by the same third object, but A accelerates more rapidly than B as a result of the blow, the differences in the accelerations are ascribed to differential inertial masses of the two objects. Similarly, if the same object accelerates more rapidly when struck by one object than when struck by a second, we say that the force imparted by the first is greater than that of the second in proportion to the differences in acceleration.

THE RELATIVISTIC MODEL

As we have seen, the period of Renaissance science was marked by a shift from a categorical logic of classification to a comparative logic of measurement. This led to important rethinking of the character of motion and change. Rather than the categorical distinction "moving or not moving," scientists could now think of relative degrees of motion. The development of the derived concepts of mass and force led as well to the development of the notions of inertia, momentum, and the conservation principles which followed from them. In one regard, however, the period of Renaissance science retained conceptions from the classic Greek period. Most scientists, including Newton, no less, continued to believe in the absolute distinction between motion and rest, stability and change. To demonstrate that there actually existed what might be called an absolute state of motion, Newton proposed a "thought experiment" in which he conceived of a bucket of water tied to a long rope. The rope was wound tightly and released. At the beginning, the bucket would begin to rotate around the axis of the rope, while the water remained at rest. Later, due to friction, the water would begin to rotate at the same speed as the bucket; finally, when the bucket reached the end of its travel and twisted the rope in the other direction, the bucket would stop, but the water's inertia would continue it in motion.

As Newton suggested, at the beginning, when the bucket was moving and the water still, the surface of the water would remain flat, but as the water began to rotate, it would also begin to climb the walls of the bucket due to centrifugal force. Later, when the bucket had stopped but the water continued in motion, the water would continue to climb the walls of the bucket. By this experiment Newton thought he had established that the motion of water and bucket was not merely relative, i.e., the water and bucket were not only moving relative to each other, but thought that he had shown that one could distinguish the water's motion independent of the motion of the bucket.

Mach (1915), however, correctly reasoned later that Newton had performed only half the experiment. Had he held both the water and the bucket completely still and rotated the entire universe around the axis of the rope, the same effects would be observed. Thus, Newton's experiment could not actually distinguish absolute from relative motion.

The implications of this realization have proven very important to modern science, since it demands that there exist no "priviledged" coordinate system. That is to say, observations made by an observer in one coordinate system need not correspond to observations made by another observer in another reference frame in motion relative to the first. More importantly, however, neither observer's observations deserve any more consideration than the other's, since neither coordinate system can be considered priviledged. When observers in different coordinate frames are in nonlinear motion with reference to each other (i.e., are accelerating relative to each other), the situation is even more confounded, since even the laws of inertia in one reference frame will not hold in the other.

This realization led to a reformulation of the goals of science whose full implications have not yet been understood by all working scientists, particularly those in the social sciences. For if indeed states of absolute motion and rest can never be distinguished, science cannot accept as a goal the understanding of motion and rest. Rather, twentieth-century scientists, particularly Einstein, have been led to reconsider science as the process of finding transformations which link the experiences of any observer with the observations of any other. In its most fundamental sense, science becomes the practice of developing communication systems which link human observers.

As Bohr suggested, science is the process whereby scientists make observations and communicate them to others who must check them. Einstein (1956) went further by saying that what we call "real" is that set of experiences which correspond across multiple observers.

In the modern view, we can see a rapid and important reconvergence of the common model of pre-Socratic times. Most important in this convergence is the undertanding that all viewpoints enjoy an equal epistemological footing—a point very similar to the *Principle of Infinite Interpretation.* Moreover, at the very center of the process of comparing observations across observers lies the question of symbol, or more commonly, language. Prior to any social comparison process, observations must be encoded into a symbol system which enables people to compare experiences. To the extent to which the symbol system is inadequate to the representation of the set of experiences, failure of correspondence—or apparently erroneous correspondences—can happen as a consequence of the inadequate encoding itself.

Here again the same question of the categorical structure of thought and the continuous character of experience arise again, but this time it is the vernacular language which is categorical. In general, words represent categories, and experience defined by modern scientific practice appears as a continuum. More and more scientists have had to abandon the categorical language of the vernacular for the continuous language of mathematics. This has led many modern scientists, like Bohr and Heisenberg, to deny entirely the possibility that modern scientific theory can be expressed in words at all. Often theory is completely expressed in an equation that defies translation into vernacular language. Clearly, we see again a convergence of the Eastern and Western model in modern science, since both accept readily the inadequacy of words for the expression of experience.

Although the modern relativistic model bears important similarities to the original common model, it would be a mistake to think of it as simply a return to earlier thinking. The relativism of modern science is an advanced relativisim that has been enriched by the advances made during the interim period. The development of the comparative method of Descartes made possible the measurement of the flux of experience rather than simply the realization that experience seemed in continuous change. Moreover, the development of the variational principles made possible the rational choice of common reference frames without denying the epistemological equivalence of all such frames. The development of modern mathematics, particularly the calculus, which allows for an approximation of the continuous by the method of infinitesimal analysis, makes it possible not only to realize the inadequacy of words to express the complex flow of experience but to go further toward the development of language systems like mathematics which express experience to a closer order of approximation. These same mathematical tools, along with the variational principles, allow science not only to recognize the differences in experience that follow from different viewpoints and reference frames but to construct transformations which allow for the translation of the experiences of any observer in any reference frame into the experiences of another observer in another frame.

IMPLICATIONS FOR COMMUNICATION THEORY

This classification of the development of the Western model into four discrete stages is not to be taken literally, of course, and we should realize that the progress through these stages has been uneven. Different disciplines and individuals have passed through them at different rates. Only a few sciences today can be said to be primarily relativistic, and it is safe to say that no discipline whatever has wholly rid itself of preconceptions left from earlier periods of its history. Communication is no exception, and it would be rash to expect that a science so newly created from its philosophical and rhetorical ancestry should be among the most advanced of sciences.

In fact, many of the criticisms leveled against contemporary theory in communications suggest that these theories are mechanical, that is, that they imply a Newtonian or premodern notion of communication phenomena. It is the case that several communication theories bear a resemblance in form to Newtonian science, but the resemblance, in my opinion, is only superficial. The reason contemporary communication theory should not be thought of as mechanical is that the mechanical models of the eighteenth century presuppose the Cartesian measurement model and the comparative logic that goes with them, but communication measurement has not yet reached this stage. With important exceptions, the measurement model in the communication disciplines remains wholly categorical, and the categorical measurement model is incompatible both with the mechanical model of the eighteenth and nineteenth centuries and with the modern relativistic view, just as it is incompatible with the underlying premises of the Eastern model.

It is impossible on logical grounds to construct a mechanical or a relativistic model of any phenomena, human phenomena included, within the framework of a categorical measurement model, and the measurement model of communication has remained categorical. Moreover, many communication theorists have resisted the movement toward comparative measurement models in communication on the grounds that human phenomena are categorical inherently, that is, that they are qualitatively different from nonhuman phenomena. This view is neither relativistic nor mechanical but, rather, Aristotelian in character. The difficulties that communication researchers face in examining and explaining communication phenomena offer a philosophical parallel to the difficulties faced by medieval physicists in their attempts to describe and explain motion within the categorical framework of Aristotle.

Although there is considerable diversity of opinion among modern communication theorists, it is probably fair to say that most current Western communication theory is underlaid by a common general theory whose roots lie in the model of Aristotle. In general, that model would assume that there exists in any situation a set of potential behaviors from which individual persons may choose. Choices among these behaviors are made on the basis of beliefs and attitudes which an individual holds. Beliefs are usually thought of as definitions of the nature of the individual, the objects he or she faces, and the situation within which they occur, while attitudes usually hold some motivational component—that is a notion of liking or disliking. Each situation is also characterized by certain objective factors which facilitate or impede the performance of each potential behavior, such as the age or sex or physical condition of the person, the difficulty of the task, the weather, and so forth. These beliefs and attitudes are themselves influenced by information, which impacts the individual from the objective situation and from other persons. Recently, technological developments have led to partitioning this latter source of information into that delievered directly by another person or persons and that delivered via some electronic or print medium. Changes in the flows of information from these sources are assumed to bring about changes in the categories to which the objects that make up the situation are assigned (belief changes) and changes in the intensities and valances (positive or negative) of the attitudes held toward objects and behaviors. Furthermore, again in the spirit of Aristotle, most communication theories imply a "threshold" model of effects, such that accumulations of forces in favor of the performance of a behavior yield no result until they outweigh those opposing its performance. Once they exceed this threshold level the behavior is performed as a discrete unit or act.

The late nineteenth and early twentieth centuries saw the beginnings of attempts at the measurement of beliefs and attitudes. These early efforts have been for the most part categorical and essentialistic, as have the theories from which they arose. Early scaling theory, following primarily from the work of Thrustone, usually assumed that a culture made available several "positions" toward any object or topic and that the attitudes and beliefs of the members of that culture were given by which of these positions they took. Within this model, attitude changes are given by changes of position which are discrete—one might change from "favorable" to "strongly favorable," for example, on some issue, or from "birthcontrol is unacceptable" to "birth control is unacceptable for the unmarried." Later attempts moved closer to the continuous manifold of modern science but maintained vestiges of the Aristotelian categoricalism and essentialism. Osgood, for example, assumed explicitly that the domain of beliefs and attitudes was itself a continuous manifold, but nonetheless Osgood's conception remains basically Aristotelian. Osgood assumed, as did Aristotle, that the basis of human meaning lies in a set of "bipolar adjectives" or relative polarities. Osgood further assumed that there are three such polarities: good–bad, active–passive, and strong–weak. He further stipulated that these three bipolars lie at the ends of mutually perpendicular axes of equal length which cross at a common origin. Each other point in the continuum so defined has an absolute meaning given by its relative distance from the bipolar end points of these axes. The origin itself, following from this rule, is a point of complete meaninglessness (Osgood *et al.*, 1957).

This general model in its many manifestations has shown itself to be a cumbersome one when applied to situations of interest to researchers. Overwhelmingly, research has shown most of the variability in human behavior as it is usually defined is left unaccounted for by the model. These failures have led to modifications of the basic model more consistent with a relativistic posture, and today most communication theorists argue that the meanings of objects and the beliefs and attitudes individuals have toward them are relative to the persons who hold them and the situations in which they are found and that the objective meaning of any object or situation is a negotiated product that arises out of the communication among a set of people. Kincaid (1979; Rogers & Kincaid, 1981) presented a convergence model of human communication in which a continuing reciprocal flow of information among individuals results in successive redefinitions of experience which, under suitable circumstances, results in ever increasing agreement among the parties to the communication about the meaning of the situation in question and the objects of which it is comprised. Although the vernacular language makes it necessary to describe this convergence process as a series of discrete stages, in fact Kincaid views the process as a continuous one best modeled by expressions from the calculus. The rate of convergence, for example, represents a velocity in Kincaid's system, (the first derivative of position) and a change in that rate an acceleration (the second derivative). Changes in the rate of acceleration (the third derivative) represent the intervention of control into the system. Furthermore, this model recognizes that the perspective of neither of the parties to a communication is priviledged so that the question of whether one person's view moves toward the other's, the second toward the first, or both mutually closer cannot be absolutely resolved but depends instead on the stipulation of other common reference markers. Thus, the manifold underlying Kincaid's model is clearly relativistic, like Einstein's, rather than absolute, like Aristotle's, Newton's, and Osgood's models.

Inevitably, these more sophisticated theoretical models place heavier burdens on the measurement apparatus than earlier models and require specifically relativistic and precise scaling models. Category scales (like Likert-type and semantic differential type scales) do not provide data of sufficient precision for these theories, and their essentialistic epistemology is inconsistent with the theories. Much more appropriate for these modern theories are the magnitude estimation–type scales of Stevens (1975) and Hamblin (1974), which implement the ratio-type procedure described by Descartes, and the "ratio judgments of separation" scaling model (Woelfel & Danes, 1979; Woelfel & Fink, 1980), which implements the ratio-type procedure along with the method of complete pair comparisons also recommended by Descartes.

Application of these measurement models to modern theoretical perspectives like Kincaid's model is conceptually simple, although the primitive state of the early technology frequently creates practical technical difficulties which at present limit these applications to more advanced centers. Fundamentally, these procedures involve an initial identification of the social objects which comprise a situation for a set of participants and the initial selection of an arbitrary pair of these objects to serve as a measurement standard. All other pairs of objects are then compared to this standard, and the separations of differences among them are expressed as ratios to the initial standard. The result of these measurements is a space or continuum within which the objects are arrayed in a pattern. Although the initial definitions on which this pattern rests are arbitrary, once such initial decisions have been made, the shape of the configuration becomes an empirical matter, with widely different objects far apart in the pattern and similar objects close to each other in the pattern. Since both behaviors and the self may be construed as objects in any situation, measured distances between self and behaviors can be taken as measures of the likelihood of carrying out each such action. Early research shows reliably that behaviors closest to the self are performed most frequently, and increased distances between self and any behavior yield decreases in rate of performance of the behavior. Changes in the structure of the space correspond to changed definitions of the situation, the self, and the objects which comprise them.

The spaces generated by these procedures have no priviledged origin and no fixed boundaries but, rather, are completely relativistic in the same way as the space of modern cosmologists and ancient Chinese philosophers are relativistic. Since the structure of the spaces is dependent on the initial measurement stipulation, the objectivity of the result rests not on any absolute structure of human thought but, rather, on the consensus surrounding the initial stipulations, as is the case in modern physics. Within this model, communication is also a relative concept and refers to the *process* by which the structures of the spaces of the communicating parties are mutually shared among the parties. Within this model, there is no real point to distinguishing "sender" from "receiver" or "source" from "target," since all spaces are on an equivalent epistemological footing, and the appropriate analysis framework is one like Kincaid's convergence model where the modification of the conceptions of the communicating parties is mutual and simultaneous, rather than linear and sequential.

So far the development of these modern models of communication is too recent for them to have found widespread practical application, particularly in developing nations. Those communication models which have found widespread applications are exclusively the premechanical models characteristic of theoretical thinking of the social science of the 1950s. There is no question but that these early models have been inconsistent with basic postulates of Eastern thought. Less well known, however, is the extent to which these models have been incompatible with contemporary Western scientific thought as well. Fortunately the newer models of communication theory and measurement seem consistent both with the underlying assumptions of Eastern philosophical thought and modern Western scientific theory.