TACIT KNOWING AND A CONCERN ABOUT
INTERCULTURAL COMMUNICATION BETWEEN MODERN
TECHNOLOGICALLY-ADVANCED CULTURES AND THEIR
PRIMITIVE CONTEMPORARIES

BY

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Chapter I

Introduction to the Problem

Approximately nine years ago a group of people now known as the Tasadays, were discovered in the interior tropical forest of southern Cotabato, Mindanao, in the Philippines. This was their first contact with the outside world. In a book entitled The Gentle Tasaday: A Stone Age People, an American, John Nance, attempted to convey the ethnographic picture of this small society. We now know that Nance's account may well be the last word on the Tasadays. Owing to certain edicts from the Philippine government, the Tasadays have been sealed off from outsiders including modern anthropologists, other scientists and observers, etc.¹

A short while ago there emerged through a revolution an aged leader in the modern state of Iran, whose vociferous avowal to return his people to their former beliefs and customs called forth a reverberating cry of ridicule. We take a position that these two apparently different world events have a significantly ominous bearing upon the interaction described as intercultural communication.

But what could this be? Let us pursue this in a systematic way. Let us focus on intercultural communication between modern cultures and their primitive contemporaries at its earliest expression. For this let us look towards the continent of Africa. A major development that
is quite perceptible currently in this continent is the progressive penetration of modern technology into the lives of many societies that were formerly, and are still to some extent, described as primitive. The general, common sense argument runs something like this: these societies need to develop or be developed, need to be helped in the face of existential problems which they are incapable of managing on their own. Virtually all transaction between modern societies and their primitive contemporaries generate, overtly, from some notion of help or development. So that when we speak of "intercultural communication" in the most rudimentary form between such societies we are essentially talking about an event, the major basis of which is some kind of transaction or exchange involving some form of technology, and the principal objective, development. But let us go a step further.

While we willingly agree that the introduction of appropriate technology will normally generate visible and measurable developments--for example the introduction of artificial-insemination techniques into the Agricultural-Farming business of a non-technological society will eventually give rise to such things as greater meat-yield, a greater milk-production, etc., our question is--is there more to this development than the readily visible, measurable, and helpful? There is some evidence to indicate so.

In an article entitled "The Lure of the Primitive," George Woodcock while discussing the encroachment of technology into the fabric of certain non-technological societies observes that the more these societies assimilate modern technology and become developed or modernized the
more do they continue discarding the arts, beliefs, and customs of their past.\(^2\) There is a quite disarming simplicity about this situation. One might say that it simply follows that if a society is becoming modernized then it is simultaneously becoming less and less primitive. But his simplistic view, like all such views, seriously misses the point. A people's culture is not something that is marketed, or exchanged, or built up schematically, and the magnitude of its impact upon the people who share it is by no means thought to be small or provisional. Some observers (Whorf, Sapir for instance) have argued in favor or virtually absolute cultural determinism. So that for a primitive society, the total discarding of its cultural underpinnings (its arts, customs, beliefs, habits of the past) with the subsequent loss of its culture must be regarded as a serious matter indeed. Woodcock has thus called our attention to a very significant concomitant of development by technology (or other modern means) among primitive and underdeveloped societies, with which modern society may be failing to reckon.

The popularization of anthropology has emerged in mass media within the past twenty years, and the topics presented range from child care as it relates to comparative socialization, to our primate ancestry, and, of course, to what is the essence of human nature. The early writings of Margaret Mead (Coming of Age in Samoa, Sex and Temperament in Three Primitive Societies) conveyed the idea that all human societies must work toward satisfying certain common prerequisites in maintaining themselves, but that particular cultures achieve survival through different ways of living. Thus her writings stressed cultural differences
as they constitute the arc of human response, all forming the totality of human nature. These same ideas were stressed by anthropologists in the 1920's, 1930's, and 1940's (Malinowski, Levy-Bruhl, Levy-Strauss). Does the popular modern anthropological posture reflect the discretion of these experts? We see this as a very pertinent question.

Describing an event that occurred in the Congo when the country became independent in 1960, Mircea Eliade wrote that:

In some villages the inhabitants tear the roofs off their huts to give passage to the gold coins that their ancestors were to rain down. Elsewhere everything was allowed to go rack and ruin except the roads to the cemetery, by which the ancestors would make their way to the village.\(^3\)

Again, referring to the cargo cults of Oceania he wrote that:

...most of the "cargo-cults" demand that while all domestic animals and tools are to be destroyed, huge warehouses are to be built in which to store the goods brought by the dead. One movement prophesies Christ's arrival on a loaded freighter, another looks for the coming of "America." A new paradisal era will begin and the members of the cult will become immortal.\(^4\)

Such behaviors, Eliade observed, generally impressed modern society as mythical, savage, and uncivilized, conditions that would vanish as soon as "the tribes have been civilized."\(^5\)

This response embodies one of the major behavioral expressions in modern society that reflects the popular anthropological posture. It is, in essence, the disposition to regard contemporary non-technological peoples, primitives, as savage counterparts to modern man. They tell him what he was like so many thousand years ago. As to the question of the culture of these primitives, it seems to be more a case of their lack of culture. In other words to behold the contemporary
primitive is to behold "Man" without modern civilization and without modern culture. This situation is clearly very significant.

We find a second major expression (reflecting the popular anthropological posture) at a somewhat more sophisticated level. It is manifest in the stylistic form of many but not all current anthropological accounts. The intention, it appears, is to translate other cultures into categories that are comprehensible to modern understanding with the result that:

...human cultural differences are reduced to a basic level of common denominators that remove the human quality from humanity. Through comparisons in search of similarities, the bizarre, erotic, and exotic customs of the "primitive" are made "rational" for understanding and hence palatable to the Western (substitute Modern) mind. In the form of cultural translation, nothing escapes the anthropologist's ability to comprehend and convey cultural differences; consequently, the uniqueness and finer aspects of a particular cultural life and thought are eroded for the sake of analytic neatness.

The dynamics here are quite clear. We are confronting a disposition bent solely on seeing modern man (or as much thereof) in the contemporary primitive. So that cultural differences must be demonstrated to be merely facades masking various similarities.

For us these two major expressions just described combine to reflect the zeitgeist of the popular current anthropological posture, a posture which, we have now come to see, virtually preconceives the near total insignificance of the intrinsic meaningfulness of primitive culture as a human response. As long as this remains the case we hold that "intercultural communication" between technologically-advanced societies and their non-technological (primitive or underdeveloped)
contemporaries ultimately amounts to little more than a form of cultural engineering with particularly grave consequences for the recipient non-technological society. These consequences the Tasaday may have been secured against thanks to the insightful and timely intervention of the Philippine government, but not so the now modern state of Iran at least as was implied in their leader's commencement avowal to direct the nation back to its former standards, customs and beliefs; in essence quite apparently, to regenerate his country's former culture.

This situation where cultural engineering parades in the guise of intercultural communication is unquestionably a very serious matter. This work of ours represents our response to a very strongly felt need to address this particular, problematic intercultural communication situation with a view to its mitigation.

It is logically clear that in order that intercultural communication between modern technologically-advanced cultures and their primitive contemporaries may genuinely exist, primitive cultures must first be recognized as independent meaningful human responses. Our primary objective, therefore, will be to vindicate contemporary primitive culture. We will demonstrate that all strange and seemingly excessive forms of behavior exhibited in places like the Congo, Oceania, etc., are significant cultural phenomena, and not indicators of mythical backwardness, wanton savagery, or instinct run wild. In sum we will argue that contemporary primitive cultures constitute a legitimate, significant part of the arc of universal human response.
To accomplish this objective we shall adopt an approach quite different perhaps from any other hitherto employed to vindicate primitive cultures. We take the position that the severe myopia reflected in the modern anthropological attitude regarding contemporary primitive cultures has its roots in the epistemological stance of modern technologically-advanced society (i.e., the ideal of knowledge to which modern society is generally committed). Let us offer some justification for this position.

Our literate history is informed with many different definitions of Man's human essence. We have heard of Man defined as a "laughing animal," a "talking animal," a "thinking animal," a "rational animal," a "tool-using animal," the list goes on. More recently Man has been defined as essentially a "symbolic creature" whose existence consists chiefly in the continuous search for and creation of meanings and living within the meanings he has created.* We consider this to be a very pertinent point-of-view the significance of which we will now try to reveal.

First of all we state the following condition: an act of "creating a meaning" is operationally and functionally equivalent to an act of "knowing" or "discovering knowledge." It is no mere accident for instance, that our current English language unquestionably permits the statement "I know what you mean." Meaning inhabits as it were, the realm of knowledge, meaning is knowledge. Operationally to "create a

*See Michael Polanyi's and Harry Prosch's Meaning, Ernst Cassirer's An Essay on Man, Philosophy of Symbolic Forms 1, 2, Kenneth Burke's Language as Symbolic Action.
meaning" just as to "know" or "discover knowledge" is an integrative procedure; one basically integrates a set of items, particulars, clues, data into a whole meaning or a whole component, or item of knowledge. Functionally a meaning or an item of knowledge helps promote one's understanding of a situation. To return to the above mentioned point-of-view we may now substitute "knowledge" for "meanings" without serious distortion. Man's existence consists chiefly in the continuous search for and creation of knowledge and living within the knowledge he has created. We note that man "creates" but that he also "lives within."

We read in this a crucial hint namely, that the fundamental referential point of knowledge if Man himself, Man lives exclusively within the total range of his experentiality.

It is in the light of this description of what we accept as constituting man's human essence, namely, his continuous search for and creation of knowledge, and living within the knowledge he has created, that we take exception to the modern epistemological stance and indict it as the source of the myopia reflected in the modern anthropological posture.

The modern epistemological stance, we are informed, takes the form of a commitment to explicit objectivity as the ideal of knowledge. This amounts to (translates into) a consideration that one can make wholly explicit how one came to know some thing. One finds this conviction reflected in a somewhat oblique way in the educational philosophy of many systems for education where individuals are not only taught "knowledge" but are
tested both on their "quality" and "quantity" of knowledge. More pertinently, however, this conception is reflected in the sweep of knowledge itself.

In contemporary modern society the many fields or centers of knowledge are an overwhelming tribute to the incredible proliferation—increasing segmentation, differentiation and specialization, sub-division, and sub-specialization in (modern) science since its emergence over three centuries ago. In the U.S.A. alone, for example, 900 fields in the sciences (including scientific technology) were listed in the National Register of Scientific and Specialized Personnel, and this, over a decade ago. Indeed so incredibly far has science or scientific technology penetrated the fabric of modern society that the often heard synonyms "technological society" and "technological man" appear to have an unquestionable evidential basis. But another aspect of the situation that is worthy of serious note is the emergence of a kind of "new language" that these fields generally employ. One hears the language of variable, parameters, models, stochastic processes, algorithms, heuristics, minimax, etc. It is clearly the language of mathematics. It is safe to conclude, therefore, that for the authorities on knowledge in modern society, the dominant mode of intellectual experience is mathematical. Their language is rational, mathematical.

While we do not challenge the ingenuity and effectiveness of this language we hasten to point up the observation that for the scientist, and the layman it "creates concepts that cannot be restated in terms of one's experience." The implication of this is very crucial.
It is that this language supports a theory of cognition (i.e., a conception of knowing and of knowledge) in which the condition of man himself as the fundamental referential center of his knowledge is drastically reduced.

The significance of this, we hold, bears directly and totally upon the fact of modern society's commitment to a conception of wholly explicit and thus objective knowledge. We consider it the case that this commitment promotes a readiness to recognize meanings and meaningfulness in a restricted and partially erroneous manner. To be very blunt we hold this modern epistemological stance to be automatically militating against the genuine recognition of the legitimate, independent meaningfulness of primitive, non-technological, contemporary cultures.

Therefore in order to accomplish our primary objective we will first provide an alternative theory of knowing and of knowledge in refutation of the current modern epistemological stance. We shall demonstrate in effect that there is a personal coefficient indispensable to all acts of knowing. It will thus be mistaken to conceive of knowledge as wholly explicit and objective. By this alternative theory of knowing and of knowledge we will extend our epistemology and this in turn will generate insight and leverage that will significantly facilitate the management of the particular intercultural communication problem which we have addressed in this work.
Chapter II

Toward Bringing the Popular Modern Epistemological Stance into Focus

We propose that the modern conception of knowledge, i.e., knowledge wholly explicit and thus objective is essentially a result of the emergence, the proliferation, and the penetration of science into modern society. It is not that science necessarily sought this particular result. The fact rather is that science, as it proliferated, tended to shape culture more and more not only through the impulse of scientific technology but also by providing new points of views and by facilitating new attitudes. For example that the earth is round, that all creatures that we know have a common ancestry, is not obvious to anyone's senses or to our common sense, yet these concepts have become integrated into our daily thoughts, and thus constitute part of the fabric of modern culture. Enlightened laymen now tacitly apply evolutionary concepts not only to living organisms and to man, but also to their social institutions, customs, and arts. For this modern culture is greatly indebted to Darwin's scientific theory of biological evolution. Our job in this chapter will be to follow the shaping or formative process via the emergence of modern science up to the twentieth century so as to reveal how this particular conception of knowledge has emerged. We beg to inform the reader that this is by no means a history of science or a history of technology.
We have been informed that modern science began with Galileo Galilei, the late sixteenth and early seventeenth century Italian scientist. This is clearly a very resonant statement and to better appreciate its impact a brief look at the state of science before Galileo's appearance is necessary.

Medieval science is the term generally used to describe the scientific period that preceded modern science. During this period Aristotle's scientific/naturalistic notions, especially those of his system of physics, were the ones in general currency. The typical medieval scientist or naturalistic philosopher subscribed to such notions as: all elements in nature comprised "essences" or "potential" which determined their growth, their motion, their aims, their purpose, etc. A stone for example, fell downward because its "potential" determined such. Fire moved upwards on the same principle. "Potential" determined the circular motion of heavenly bodies around the earth (this particular dynamic model was the illustration of the geocentric system). The Aristotelian physicist or cosmologist conceived the "natural" circular motion of the heavenly bodies as perfect motion. Additionally the state of "natural" rest at which say, a falling material body must ultimately arrive, was conceived as perfect rest. In brief medieval science was a contemplative science. First principles were primarily the result of intuition and sense observation, verification was primarily by evidence of the senses, objects were defined in terms of the observable qualities. We may now return to the question of Galileo and the beginning of modern science.
Galileo Galilei was a physicist and an astronomer, and he was also a fervent mathematician and geometrician—his *Dialogues on Two New Sciences* testifies to his profound faith in the geometrical character of nature's processes and it is full of geometrical expositions and demonstrations on many topics including that of motion. We must also add that this work was a clear indicator of Galileo's support of Copernican cosmology (the heliocentric system with its mathematically perfect geometry). In addition to all these qualities as a scientist, Galileo was also an ardent experimentalist and a clever craftsman/instrument designer (the telescope and the microscope are two inventions for which he receives great credit). He was greatly interested in the problems of the engineers and instrument makers of his time and the same work, named above, recounts his frequent visits to the Venetian Arsenal and to the shipbuilders' yards, and includes many examples of his solutions of their problems. It is precisely this latter attitude of Galileo's, this "experimental attitude," that caused the germination of "modern science."

Galileo's primary intent in making instruments was to obtain aid in scientific observation, and in verification of his scientific hypotheses particularly those on celestial motion. All this was borne of his natural mathematical inclination for greater accuracy and experimental demonstrability; we recall that Galileo supported the Copernican motion of the mathematically perfect geometry of the heavens. This was a completely new method that Galileo introduced into science, this uniting of experimentalism with mathematicism, and with it he eventually geometrized motion, something the medieval scientist did not and perhaps
The "experimental attitude" in itself did not see its birth in Galileo Galilei. History is replete with examples of craftsmanship and forms of technological utility before his time. One could therefore admit, modestly, to a degree of curiosity and improvement-motivation behind these earlier performances. However, it was particularly in the Renaissance period leading up to Galileo's appearance that this attitude was seen to gather considerable momentum. In his work, *Modern Science and Human Values*, Everett W. Hall, who describes the attitude as one which displays the tendency to try new ways of doing things to discover whether they may or may not better accomplish some given aim, or simply the attitude to see, out of curiosity what would happen when a new way was tried, suggests two factors to explain its momentum gain: first, the geographical explorations and discoveries of the Renaissance such as the famous voyage of Marco Polo to China, the rounding of the Cape of Good Hope by Vasco da Gama, the discovery of the New World by Columbus, and the circumnavigation of the earth by Magellan's expedition may have contributed immensely to the growth of the attitude because of the impetus they gave to the development of better instruments and increased knowledge for navigation, to improvement in the designing of ships, and to the arousing of interest in a host of mechanical problems.

Secondly, a phenomenon called the "Commercial Revolution," (this centered around a major change from small scale, mostly local trade to one involving relatively large scale transportation of goods over long distances, and thus creating the need for promoters and organizers), is seen to have caused the emergence of a certain type of personality, a kind of adventurer who thrived basically on long-distance trade. The
emergence of this adventurous merchant-capitalist is said to have elevated at the same time another social element composed of engineers, inventors, navigators, and explorers. All these types, we are informed, were equipped with the experimental attitude.\textsuperscript{21}

Clearly, therefore, the "experimental attitude" as a historical phenomenon predated Galileo and it manifested itself in a large number of practical areas of human concern: navigation, shipbuilding, exploration, engineering, etc. Now it is interesting to note that Galileo frequently used the cannon ball in many of his exemplifications and demonstrations. The reader will recall Galileo's recounts of his visits to the Venetian Arsenal (see \textit{Dialogues on Two New Sciences}) and his solution to some of their problems. Quite a lot of these problems were involved with ballistics, then a major military concern (one must recall that this was a time of very competitive European colonial empires). In so doing Galileo initiated the "fusion" of science and empirical practice. The point of this is that science had now begun to take cognizance of empirical concerns (inventions, engines, etc.). Practice thus would begin to act on theory by generating problems for science, and science by solving the problems so born, generated greater exceptability, efficiency, predictability, etc., and, of course, conditions for further proliferation.

The reader is now better informed as to why Galileo is held to have been the existential basis of modern science. With him came the new scientific method, an impulse toward scientific technology, and great visions for both science and society. The French Academy of
Science and the Royal Society of London for Promoting National Knowledge were two major national scientific societies of the time that welcomed this new science and sought to promote its practice:

They seemed to have sensed the truth that knowledge of the invariable and precisely formulable regularities of nature could be put to use in a way in which an appreciation of nature's inherent goals could not. 22

With a vision that was probably far less scientific, Francis Bacon wrote his utopian *New Atlantis*. In it he demonstrated how science offered power through practical inventions arising out of extensive experimentation. It pictured a group of scientists simply trying out new things and generalizing their results. He realized that this sort of result could be attained and made humanly useful only if there was a social institution specifically devoted to the support and growth of the scientific enterprise. Despite his exaggerated portrayal of this in "Salomon's House," and although Bacon seems to have failed to realize that with the new science, experimentation must somehow fit the mathematical concepts available and in addition must be designed to this end (mere manipulation of nature, mere trying of new things, was not enough) we feel that he exhibited considerable insight into the socio-historical destiny of modern science. We now think that a suitable base has been laid, from which we may work towards our objective in this chapter which, as stated earlier, is to show that the modern conception of knowledge is essentially a result of the emergence, proliferation, and penetration of science into modern society. We will thus leave Galileo Galilei and move on to consider other pertinent seventeenth century contributing forces.
Rene Descartes was a French mathematician and philosopher and his interest to us bears especially upon his attempt to chart the "perfect scientific method." This took the form of Four Rules which he concisely enunciated in his treatise, The Discourse on Method. They were:

Rule 1, to accept nothing as true that is not clear and distinct, so as to exclude all occasions for doubt. For Descartes the phrase clear and distinct specified the two qualities which the objects of science, in order to be objects of science, must possess. The clear was "that which is present and apparent to an attentive mind, in the same way as we assert that we see objects clearly when, being present to the regarding eye, they operate upon it with sufficient strength." The distinct was "that which is so precise and different from all other bodies that it contains within itself nothing but what was clear."

Rule 2, to divide the difficulties under investigation into as many parts as possible, or as may be required, for their solution.

Rule 3, to proceed by degrees from the simplest objects and the easiest to know to a knowledge of those more complex.

Rule 4, to make enumerations so complete and reviews so general that nothing is omitted.

Today these Four Rules may read like so many platitudes but we cannot lightly dismiss these early injunctions evolved by one of the keenest and most creative minds of his age. Actually there appears to be an interesting analogy between them and the Laws of Thought of
Traditional (Scholastic) Logic. Thus Rule 1 clearness and distinctness, represents \textit{determination}; Rule 2, division "into as many parts as possible," represents \textit{identification}; Rule 3, the synthesis from the simple to the complex, represents \textit{computation}. Rule 4 is a special demand for \textit{absolute completeness}. The point of this is that just as The Laws of Thought implicitly posited a kind of absolute objectivity,\textsuperscript{27} The Four Rules of Descartes implicitly posited "not only the world of his contemporary science, but also of formal logic, an objective world, a world analyzable down to, and thence synthesizable up from, exact determinate identities, completely describable."\textsuperscript{28} Furthermore they implied the possibility of a truth that was absolute but still available to human comprehension, at least to any human comprehension that was prepared to follow the perfectly reasonable preparatory steps. This kind of absolute mathematical certitude was a somewhat new dimension to which science was introduced, insofar as The Four Rules curiously and conspicuously made no reference to empirical observation or experiment although Descartes was a contemporary of Galileo. It seemed in a curious way to anticipate the notion of a "value free" science (A Weberian notion)\textsuperscript{29} by which science became the idea and the ideal.

Isaac Newton's contribution to modern science and to popular thought was of extraordinary magnitude but before we attend directly to his work we must, in fairness to the history of modern science, make a brief mention of the work of three individuals: Evangelista Torricelli, Blaise Pascal, and Robert Boyle.

For the Aristotelian scientist it was simply to be admitted as a fact of immediate experience that nature abhors a vacuum. This fit
the general assumption that every region was the proper place of some substance or other. Evangelista Torricelli, a disciple of Galileo, challenged this Aristotelian interpretation putting the description of the phenomenon involved in the language of the new physics. He agreed that we live at the bottom of a sea of air, and it is the weight of this air that explains the difficulty of producing a vacuum. The most significant aspect of his experimentation, apart from the fact that he developed an instrument that "was really the first barometer," was that he introduced concepts such as the weight of air, which were related to matters of observation functionally only, not directly.

This, as was the case with Galileo's concept formulation, made possible the statement of more extensive uniformities. So that the phenomena of vacua could now be formulated in terms of the law of weights (of air) not themselves directly observable but rather functions of the heights of quick-silver and water columns in his barometer.

The French mathematician Blaise Pascal accepted Torricelli's argument and put it to a test by using the barometer to weigh the air at different elevations. Torricelli's theory apparently required that, as the column of quick-silver balanced a lesser weight of air, by being moved to a higher elevation where it was at the bottom of a shallower sea of air, it must become shorter. Pascal's results were affirmative.

Robert Boyle, one of the first members and most active supporters of the Royal Society of London (this was one of the two scientific societies that, as the reader will recall, accepted and promoted Galileo's
new science) also accepted Torricelli's account, and developed and tested another implication of it. Boyle's examination of Torricelli's experiments and conclusions led him to assume that the pressure and density of air stood in the simplest possible relation to one another—that of direct proportion: air that was twice as dense, that is, air that had been condensed (condensation had long been known of) so as to occupy half the space, exerted twice the pressure. His experiments proved this assumption to be valid. This "proof" resting upon Torricellian theory indicated the utility to modern science of uniformities already formulated to state and verify further ones. This dynamic character, we reiterate, was a major asset to the proliferation of science. Let us now return to Isaac Newton and his achievement.

Like Galileo, Newton believed in the mathematical perfection of nature and was himself an excellent mathematician. He is held to have shared, independently with Leibnitz, the mathematical discovery of the infinitesimal calculus which was to be crucially helpful in mathematizing such elusive variables as force, pressure, temperature, color—even time itself, and without which, it is said, "the further development of physical science would have been impossible." Among his distinguished achievements was to render a clearer and more comprehensive statement of Galileo's law of inertial motion. This he did in his famous three laws on "axioms" of motion. The laws were stated in terms of functional concepts introduced by definitions. These definitions were constructed by means of mathematical relations from ultimate elements which alone were capable of experimental determination. Perhaps a tabulation will make this point clearer:
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action = force

force = change of motion

motion (momentum) = velocity x quantity of matter

quantity of matter (mass) = density x bulk

velocity = distance ÷ time

The laws themselves read:

1) Every body preserves in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed thereon.

2) The alteration of motion is ever proportional to the motive force impressed; and is made in the direction of the right line in which that force is impressed.

3) To every action there is always opposed an equal reaction; or the mutual actions of two bodies upon each other are always equal, and directed to contrary parts. 36

The very first point of interest for us is the concept of density in Newton's mathematical-functional definition of "quantity of matter." The work of Torricelli, Pascal, and Boyle prepared the way for this. Newton came to realize that since the same quantity of air could be rarefied or condensed almost indefinitely, then it could not be identified by its bulk alone; it was constant not in its volume but in the product of its volume and density. 37 He eventually concluded that the same quantity of air (or any other substance, to cover his own work in gravitational motions) was no more characterized by a constancy of weight than by one of bulk. Yet for Newton there had to be something constant about it; his alternative was to introduce "quantity of matter" as an
undefined term in its own right, comparable to Galileo's "distance traversed" and "time consumed." The further point of all this is that Newton too thus embarked upon the tendency of modern science to move mathematically away from foundations in sense experience in order to state precisely as many uniformities in as few generalized laws as possible. This tendency to conceptualize, we shall see later, was crucial to the modern conception of knowledge.

We said before that Newton clarified Galileo's statement on inertial motion (by defining terms left undefined) but that he also extended its scope. This he accomplished by his third law by dint of which the law of inertial motion was freed from restriction to individual bodies (in Galileo's case) and applied to systems of bodies themselves acting upon one another. This was the decisive move which set the conditions for Newton's pre-eminent Universal law of gravity. Now modern physics could move to demonstrate the geometric simplicity of celestial and terrestrial motions, and could assert that they obeyed the same laws of mechanics. Thus Galileo's hypothesis could now be scientifically demonstrated. One major impact of all this was the automatic emergence of a mechanistic world-view the quintessential idea of which proliferated, as we shall later see, into numerous other spheres of social thought and social activity.

We will close this discussion on the seventeenth century with a cursory scan of the state of technology. We intend by this to illustrate the dynamic interweaving of science into the fabric of society through technology.
Earlier in our discussion we pointed out that various forms of technology existed prior to the appearance of Galileo Galilei. We also documented the fact that there were many individuals all endowed with the "experimental attitude" (engineers, adventurous merchant-capitalists, inventors, etc.). Galileo himself introduced the "fusion" of science and practice and this, it is to be expected, would have a stimulating effect on the then established crafts. Insofar as the development of new technologies, however, this got off quite slowly. In contrast to present times money to support adequate research was not then readily available and the demand for a new technology had to spring from the general economic development of a community.

One pressing demand, however, was for new sources of power to run pumping-engines for mining operations. When mines got deeper, as shallow veins of ore were exhausted, the need to pump out water and to provide ventilation systems became progressively more urgent. Some inventors attempted to harness the power of fire and steam. Two suggestions were taken from a translation of Hero's book on "Pneumatics" to use his aeolipyle—a small steam jet rotor—instead of dogs to turn a roasting spit, and to use the jet of steam from a bronze kettle to drive an impulse wheel (Branca). Another inventor with many ideas was the Marquis of Worcester whose collaboration with his mechanic, Caspar Kaltoff, illustrated the increasingly active part in the development of applied science taken by socially prominent men (a factor that goes back to Bacon's ideas). The Marquis developed a "water-commanding engine." Other scientists, such as Denis Papier and Huygens, are known to have experimented with the expansive force of gunpowder
and of steam in cylinders fitted with pistons. The development of these power engines was recorded as the first manifestation of new technology. This completes our focus on the seventeenth century and we will now move to the eighteenth.

Terms such as "period of enlightenment," "era of optimism and self confidence," "epoch dedicated to an almost unqualified faith in human progress" have frequently been used to characterize the tenor of the eighteenth century spirit at least in Europe. In England, Locke, sometimes cited as the founder of modern psychology, was greatly influenced by Newton, and indeed he thought that he was doing something in the realm of ideas and their combinations, comparable to what Newton accomplished in the realm of bodies and their motions: "Locke and his successors saw themselves as applying Newton to the mind and the public accepted this interpretation." The Scottish philosopher Adam Smith "consciously attempted to discover the universal gravitational law in economics, the law governing the 'natural price' toward which actual market prices tended everywhere to gravitate. This marked the beginning of scientific economics.

Hobbes' daring attempt about a century before to transform the concept of "law of nature" from that of moral obligation binding all men as men, quite apart from legal enactments, into that of a scientific law of human motivation probably set the stage for Bentham's pleasure-pain calculus. The aim of course was to find, in the universe of human behavior, an analogue to Newton's University law of gravity, a universal law of human motivation. In his "An Essay on the Principle of Population as it Affects the Future Improvement of Society," Malthus endeavored to
translate circumstances that he observed around him in England and Ireland at the close of the eighteenth century—high prices for food and near famine conditions generally for the lower class, into a universal law of human population control. These were some very significant developments. They represented the emergence of the sciences in human behavior at the impulse of Newton's tremendous success in mechanics. They were thus signal examples of further penetration of science or the method of science into society.

In France the influence of the new science appeared largely as a popular liberation, an enlightenment (France's monarch, Louis XIV, allied with the Roman Catholic Church and the nobility then exercised various draconian methods of control).\(^{47}\) In any event the principal organ for popularizing the new science was "les philosophes." The most outstanding of them were Pierre Boyle, Voltaire, and the "Encyclopedists" whose guiding spirit was Denis Diderot. In England their closest parallel was Jeremy Bentham and "the Philosophical Radicals;" in America, Thomas Paine and Thomas Jefferson.

Les philosophes were not merely zealous in the popularization of the new science and its applications in industry and the trades; they firmly believed in the possibility of a new society.\(^{48}\) They saw the betterment of the human race as a matter of contrivance (through education) and were firmly convinced that the new methods of production could raise the standard of living. It is true that these individuals were of the "intelligentsia," the educated class, but the increase in this century in cheaper, more ephemeral types of publication: pamphlets,
broadsides, new sheets and other literary and popular journals became characteristic media for propagating ideas. Also books became much more available particularly through the institution of the public library. (First public libraries were founded in America, then Europe followed suit.) In these developments in France we realize the shaping or formation impact of science by virtue of its provision of new points of views about social development and by the facilitating of new attitudes (hope for progress through education, etc.).

Alongside the developments in the human sciences there were also a number of major developments in the physical sciences and technology: Antoine Lavoisier "father of modern chemistry" gave the death blow to phlogiston and by the same stroke laid the basis for the law of conservation of matter. In general design, most of Lavoisier's experiments were based upon, if not largely repetitious of the work of others (Boyle, Priestly for example). Lavoisier demonstrated that phlogiston could not yield to a mathematical functional formulation and replaced it with the idea of a constant quantity of matter (as measured by weight calculated by means of a balance). It was this "calculated weight" that generated the law stating that weight remains unvariant through chemical change. Also through his experimentation Lavoisier was able to extend Newton's assumption from "quantity of matter was unaffected by mechanical change" to "quantity of matter was unaffected by either mechanical or chemical change."49

This observation would be consequential for later atomic theory in that in some instances chemical laws could be assimilated to mechanical ones. Joseph Black demonstrated that the 17th century assumption that
different substances had different thermal capacities was incorrect. This experimentation led to the discovery of what he called "latent heat." Another new and important concept that was introduced into chemistry was the concept of chemical individuality. Indeed the chemical industry began, from about the mid-eighteenth century, to play an increasingly important role in industrial life generally. The manner of this development was twofold: 1) Increased demands for such commodities as glass, soap, soda, dyes, and textiles led to an intense ad hoc experimentation, as a result of which there were great improvements in the methods of manufacturing such fundamental substances as the mineral acids and the common alkalis, 2) Attention to changes of weight occurring in chemical reactions, recognition of the existence of different gases, proper realization of the concept of chemical individuality gave rise to striking empirical discoveries.

In the domain of technology Thomas Savery, a versatile military engineer and inventor, associated with Thomas Newcomen to produce the first successful piston steam-engine for pumping water around 1712. This development, we must note, illustrated the effectiveness of association between the craftsman Newcomen and the more theoretical inventor Savery, a case of practice and theory in reciprocal effect. Somewhat later James Watt (1736-1819) developed a condenser for the steam, separated from the cylinder in which the piston moved (regarding the Savery-Newcomen development) and this represented the application of scientific power to the steam engine. Jethro Tull and Viscount Charles Townshend though not scientists were none the less some practical experimenters "applying to agriculture the attitudes and methods that
had already 'paid off' in shipping, warfare, merchandizing, finance and business generally." Tull invented a horse-drawn drill and a horse-powered hoe or cultivator, devices which led to increase in soil cultivation. Townshend's chief innovation was a new system of crop rotation that eliminated the wasteful medieval procedure of requiring the land to lie fallow every second or third year. The work of Robert Bakewell (recording of genealogical tables) was very important in the development of selective animal breeding. This brings us to the end of the first phase of our survey and before we move on to the second (19th and 20th century) we would like to recapitulate the major features we have tried to develop.

With the appearance of the seventeenth century Italian scientist Galileo Galilei we saw a new breed of scientist and the emergence of a "new science" in Western Europe. Inspired by his faith in Copernican cosmology (a heliocentric universe the motion of which was a mathematically perfect geometry) and eminently endowed as a mathematician, experimentalist, and instrument maker he introduced a new method into science—observation by instruments (as opposed to that by the senses) and experimental, empirical testing of scientific hypotheses. The formulation of a concept became one of a "mathematical function" differing from the Aristotelian "qualitative formulation." Some of the immediate scientific advantages were 1) more definite certainty and 2) ability to formulate uniformities in nature in spite of no sense-observable uniformity. Galileo himself developed a general law of inertial motion. In addition his problem-solving demonstrations concerning the Venetian Arsenal and the shipbuilders represented the "fusion" of science with empirical
practice. This event greatly stimulated the then established crafts and set the stage for new developments in technology and instrument making (power engines, Torricelli's first barometer, etc.). The grounds were implicitly laid for industrialism, and even for visions of scientific technological utopianism (Bacon's "Solomon's House"). Descartes legislated for science the way to absolute though humanly-comprehensible truth with his Four Rules. He proposed to science a hypo-statized world capable of breakdown into ultimate parts "pure and simple essences," "the primary and the existing per se." Isaac Newton lifted modern science to a new existential plane not only clarifying Galileo's work by the introduction of new mathimatico-functional concepts but also extending the scope. He bequeathed to science a more refined cosmology, a much more accurate system of mechanics, a more reliable system for the explanation of natural events. All this "brought science and the scientist nearer to the mathematical exactitude of nature itself."  

Eighteenth century Western Europe was aglow from the impact of Newton's successes. A number of human sciences burgeoned in England (psychology, economics, behaviorism, a kind of population genetics), and though of an elementary, tentative form they were signal examples of both the proliferation—and penetration—potential of modern science into a greater area of human society. In France "les philosophes" popularized the new science as the means (through applications in industry and trades) to a new society. The Americans Paine and Jefferson shared their views. The further popularizing of these views and attitudes about the new science was facilitated by the then characteristic print media and later on books and public libraries. The institution of
Public Libraries set the stage for a greater literate public but also a more distant (from science) public later on. In the Physical Sciences there were a number of important discoveries in chemistry: "weight (calculated) remains invariant through chemical change," "quantity of matter was unaffected by either mechanical or chemical change," "latent heat," the concept of "chemical individuality." Indeed by the middle of the century a steadily consolidating chemical industry began to play an important role in industrial life in general. In technology there was the development of the piston steam engine (Savery and Newcomen) and a more scientifically sophisticated model of this in Watt's steam engine. The immediate impact of this of course, would be in mining and metallurgy. Tull, Townshend, and Bakewell all made significant technological contributions to improve agriculture. The new farming methods that they innovated had important social consequences: the ending of feudel rural organization, need for larger fields to cultivate and sew than the manorial strips, production for profit called for larger working units, the need for deliberate separation of herds and flocks for breeding.

What we hope to have accomplished by this recapitulation is the filtering out of a tightened perspective in which the shaping and formative impact of modern science on society is clearly reflected. Science, as we earlier proposed, shaped culture not only through technology but also by providing new points of view and facilitating new attitudes within society. In this respect we feel that a satisfactory case has been presented so we shall now proceed with our second phase which begins with the nineteenth century.
Over the course of the nineteenth century the expansion of the scientific enterprise (the continuing proliferation of science and its increasing penetration into society) advanced at a considerable pace. There were numerous scientific discoveries and developments, and also a great number of technological developments. Although all of these are important to the development of science and the shaping of culture, we shall mention with the reader's indulgence, only some of them. There was Maxwell's electro-magnetic light wave theory in consequence of which optics lost its status as an independent branch of physics and became instead a branch of Electricity and eventually part of general technology. Chemistry developed the "atom hypothesis" which was to account for the chemical properties of matter, and which opened up for atomic physics the problem of explaining, mechanically, the stability of celestial motion.

The reader is asked to recall the work of Lavoisier concerning the nil-effect of mechanical or chemical change on a "quantity of matter." We pointed out earlier that this particular assumption developed by him would be consequential for atomic theory. The historic pile invented by Volta (1745-1827) operationalized the technique of producing electricity as a result of internal chemical changes, and played a highly important role in the development of the science of electricity. Electric batteries, more efficient productions of voltaic piles, were utilized by Davy in 1807 to isolate sodium and potassium by electrolysis of the corresponding fused caustic alkalis. In this discovery were the seeds of great modern electrochemical industries, such as the aluminium industry. Studies of magnetic effects around a wire carrying a
current obtained from a battery led to the discovery of the basic phenomena of electromagnetism, from which stem "the whole of the great electric power-generating and power-using industries of today."57 Discoveries made through precise measurements of energy (J. Black - heat energy, J. Watt - mechanical energy, J. P. Joule - determination of the mechanical equivalent of heat) led to clear understanding and enunciation of the laws of thermodynamics, which today permeate the whole of power production on one hand and are a determining factor for 58 large sections of chemical industry on the other.

There were also a number of communication and print media developments: printing presses (rotary, linotype), the telegraph, the telephone, the radio. The more obvious consequence of these would be greater dissemination of information thus increase in public awareness and literacy.

Amidst all these many developments in the nineteenth century there was a particular one that is of very special interest to us, not only because of its great stimulating impact on the proliferation of science but also because of its conspicuous importance in generating new views and facilitating new attitudes. It was the theory of biological evolution.

The publication in 1859 of The Origin of Species by Charles Darwin was to create an impact on certain areas of science, and on popular thought almost comparable to the publication of Newton's Natural Philosophy According to Mathematical Principles. Darwin's work represented a contribution to the development of biological sciences
by shifting them from a basis that was essentially classificatory and
directly descriptive (after Aristotle, and the 18th century Swedish
botanist, Linnaeus) to the modern experimental basis. In this move
Darwin was seen to have rendered these important services:

1) His criticism of the Aristotelian notion of "fixed species"
was eminently successful in showing that the classification of living
forms had to be replaced by something else as the major objective of
biological science.

2) His mechanism of evolution directly stimulated the tendency
to replace ordinary observation by experimentation.

3) Through his idea of the evolutionary mechanism he saved for
the biological sciences the concept of organic usefulness while denuding
it of its teleological connation. It thus became a factual rather than
a value concept.

The remarkable stimulus Darwin's theory gave to the adoption
of the methods of experimental science to the biological field quickly
spread to genetics, embryology, cytology and related studies. In
addition it greatly influenced more distant investigations such as
anthropology, psychology, and philosophy. All these reverberations are
undoubtedly compelling but another impact to which we would like to
direct the reader's attention concerns the notion of progressive
historical change. We saw much earlier that not long after the appear-
ance of Galileo Galilei and modern science a philosophy (or vision) of
utility and progress entered into modern consciousness. We saw this
vision championed by Francis Bacon, and Les philosophes, and we are
told that men like Condorcet and Franklin wrote of progress as a
theoretical possibility, and placed their hopes for its realization in the future developments of science. Our impression is that it was Darwin's idea of the mechanism of evolution which eventually provided a solid theoretical basis for the concept of progressive historical change. The fact that Darwin's proposition met then with significant religious protestation loses substantial impact when one notices that today in the Western World "most great religions have come to accept a progressive biological view of creation." Neither was it necessary then, nor is it today, to have an exact understanding of the scientific mechanism involved in biological evolution in order to come to accept it (or some version thereof) as a fact. Rather what we must note carefully regarding this entire situation is that concepts that emerge out of science may require little or no justification, beyond their genesis, in order to be generally accepted. We are glancing here at both the authority of science (or fields of science) and its role as a source of concepts. This will receive appropriate focus later on. We would now like to pack the nineteenth century into a more cogent picture.

As we mentioned earlier the expansion of the scientific enterprise in the nineteenth century progressed at a considerable pace. In fact it would be no real exaggeration to say that science, in its broadest sense, began to take virtually every human concern as its province. Near the end of the century claims for the adoption of the scientific method were being heard from those disciplines that did not yet employ it including the social sciences. The conviction, it appeared, was that entities such as political and economic systems and family and interpersonal relationships of other sorts were "subject
to pathologies of their own, which the proper organization of knowledge could ameliorate." The basic assumption here was clearly that any given problem in society could be appropriately resolved by the correct way of knowing, by science. This is not surprising since knowing was now functionally related to doing. Science may have been appealing to its practitioners on abstract grounds, as a mode of progressively uncovering truth but it now drew the support of many more people by its utility in improving the ways of doing, demonstrable in practical results. Scientific technology now made great inroads into industry and indeed for the non-scientist justification by utility became an unquestioned tactic. It is important that we note what has been merely adumbrated here. For the majority of society science (pure science) was something apart. This followed partly from the clearly overwhelming appeal of technology but also from the fact that science had now proliferated to such an extent (augmentation of diverse fields and sub-fields of science) that specialization and compartmentalization became imperative. By dint of the sheer volume of accumulated data the individual scientist or specialist could hope to master little more than a limited sector of any given field. Within science itself this gave rise to both inter- and intra-division. At the same time it also gave momentum to a certain distance between the scientist and other members of society; a feature that was always implicit in the relationship of science and society.

The distinctiveness of 20th century modern society is revealed in many features. In science there has been such remarkable additions as Planck's discovery of the quantum of action, Rutherford's development of the idea of the atomic nucleus, Einstein's law of the photoelectric
effect and his Theory of Relativity, Heisenberg's Quantum mechanics to name just a few. Some outstanding developments in technology were the computer, atomic energy plants, communication satellite systems. Features of distinctiveness also appear at the social level, for example let us consider the dimensions of number and interaction.

Perhaps the most obvious fact about the world which today confronts the modern individual as a "given" is the number of encounters he or she has, and the volume of names, events, and information there is to master. On the job, in school, in the neighborhood, in a profession, in a social milieu, an individual today (compared to less recently passed times) knows literally hundreds and perhaps even thousands of other persons; and with such developments as the multiplication of mass media, the enlargement of the political world, the enormous multiplication of public personalities, etc., the number of persons one knows of accelerated at a steep rate of increase. Yet in all this we see not only the distinctiveness of numbers but also, and quite logically, that of interaction—physical (through travel, larger workunits, larger housing compounds, etc.) and psychological (primarily through the mass media). This distinctiveness of numbers and interaction is thus clearly present.

The above examples of distinctive features of modern society at the scientific, technological, and social levels are not exhaustive but as a legitimate pursuit this is outside own primary concern. The distinctive feature upon which we have chosen to focus is the modern conception of knowledge.
Apart from the considerable number of fields that have emerged in the sciences and the overwhelming presence of technology in modern society there are other ways in which the impact and influence of scientific modes of thinking are reflected. Today, for instance, there is a strong trend towards the acceptance of professional expertise in politics and business. The influence of this mood is seen in the increasing bureaucratization and professionalization of government and industry and in the growth of "scientific" approaches to management and administration. The predominant aim appears to be one of breaking down large problems into a number of finite parts that are felt to be soluble with the methods and evidence available. For this reason we do not believe that it is too fanciful to claim that practical affairs in modern society has adopted the scientific spirit of tackling solvable problems.

Another way in which modern society reflects the impact and influence of the scientific mode of thought is through some of the dominant themes of science. One such theme, for example, is evolution and natural selection, and the derived philosophical concept of progress. Today the idea of evolution is so much taken for granted that there is a tendency to forget that until the nineteenth century it was still quite strongly believed that the present state of society and man was the result of degeneration from some antecedent golden age or hypothetical ideal "state of nature." Actually Karl Marx, a contemporary of Darwin, may well have been the first to present revolution as a forward movement into a more "advanced" previously non-existent state of human society. In any event, in the nineteenth century the idea of evolution
particularly the concepts of natural selection, competition between
species, and the "survival of the fittest" were seized upon as an
explanation of and justification for a laissez-faire attitude to the
growth (development) of society. We are informed that

In the United States and Britain the first science
of sociology was built upon an interpretation of the
ideas of natural selection. A whole generation of
future American businessmen was educated in the ideas
of men like Sumner.64

This brand of sociology emphasized the dangers of allowing organized
society (government and other legislative bodies) to interfere with the
inexorable laws of social evolution.

Today in the twentieth century a subtle change of emphasis has
crept into the interpretation of natural selection. The modern evolu-
tionary biologist tends to stress the concept of the "ecological niche"
and the fact that natural selection, when looked at more carefully,
leads to a kind of cooperation among species, a cooperation which
results from finer and finer differentiation of function and of adaptation
to the environment.65 The implication here is that natural selection
generally leads not to the complete domination of one species, but
rather to a finer and finer branching of species, a sort of division
of labor which tends ultimately to minimize competition. Once again
we think that to suggest a parallel here between the changing scientific
interpretations of biological evolution and changing attitudes towards
cooperative action in human societies, or to suggest that there is some
significant connection between the modern view of ecology and the pro-
gressive division of labor and specialization of function which are
characteristic of modern economic organizations is far from being
irresponsible. Some examples of other dominant themes of science through which the impact and influence of scientific modes of thinking in society is reflected are "relativity," "uncertainty," "feedback," "energy," and "information and noise." In specific regard to the modern conception of knowledge we propose that it reflects the impact of a predominant mathematical mode of intellectual experience.

Whence did this particular mode of intellectual experience originate? To answer this we must return to Galileo Galilei and the emergence of modern science. The reader will recall our mention of Galileo's profound faith in the mathematically perfect geometry of nature's processes. The reader will also recall that with the new scientific method introduced by Galileo the business of scientific observation was assigned to specific instruments over the perceptive mechanism (human senses) of the scientist. In consequence of this a concept was formulated in quantitative or mathematico-functional terms and not in terms of humanly perceived qualities. A scientific hypothesis would now be tested against "scientifically-observed" data and not against the evidence of the senses. This brief description informs us upon both the point (place) of origin and the basic character of the mathematical mode of intellectual experience. Let us examine this matter in more depth.

In the facts of instrument observation over sensory data, quantitative formulation of concepts over a qualitative one, and the method of testing a scientific problem against "scientifically observed" data one sees a sustained effort to suppress the subjectivity of the
scientist in the determination, discovery or pronunciation of scientific knowledge. Of course it might be said that the advantage of this is that knowledge becomes much more reproducible and can thus be made to command a higher degree of agreement among observers at different times and places. We concur with this claim, but at the same time does it not also say something about the character or nature of knowledge, at least the knowledge derived from this mathematical mode of intellectual experience? We are thinking here especially of the conception of knowledge as being "objective" from the standpoint of both the scientist and the layman. Take for example the theoretical physicist so dependent on his mathematical formulae. With his subjectivity suppressed how can his formulae be said to be meaningful to him except through their mathematical elegance or their abstraction? What is his referent for meaning outside mathematics? As for the layman how is he to relate mathematical symbolism to any form of direct experience? But all this, one might rejoin, strictly describes the format of the physical sciences. After all the mathematical mode of intellectual experience emerged as we saw in Galileo's dealings with inanimate objects. Let us therefore consider those sciences that deal with animate objects and quite specifically human individuals. Let us look at the Human (Social) Sciences.

Not long ago neurologists told us that:

The existence of something called consciousness is a venerable hypothesis: not a datum, not directly observable... (Hebb), and that although we cannot get along without the concept of consciousness actually there is no such thing...(Kubie), and that the knower as an entity is an unneccessary postulate (Lackey).66
It surely could not have been the case that these neurologists did not know the difference between consciousness and unconsciousness. We suggest rather that their denial is quite consistent with the dictates of the mathematical mode of intellectual experience on account of which phenomena must be purged as it were of all subjectivity and expressed in measurable and scientifically manageable terms. We find this to be also the case today with behaviorists who tell us that "Human thought is human behavior." Of course we are not challenging the right of these experts to hold such views. We wish simply to point out that they generate from a particular scientific mode of thinking and that their expressions and operations tend to suppress and even deny human subjectivity for purposes of reproducibility and demonstrability, etc.

We have already slightly touched upon the theme of a dominant scientific mode of thinking as the source of concepts (Darwin's theory of biological evolution and the concepts of evolution, progress, etc.). We note that with the enthronement of physics and the natural sciences in the 18th and 19th centuries and the appearance of a mechanical cosmology the key terms in the social sciences were Force, Motion, Energy, Power. We observe that while these terms have specific referents in physics they seem to be far less amenable to rigid operational specificities in social analysis. As the natural sciences progressed through the nineteenth and into the twentieth century the social sciences added new biological analogies to the metaphors derived from physics: evolution, growth, organic structure, function, etc. The pattern that has unfolded here is that of the progressive adaptation of the language (i.e., the major heuristic concepts) of the social
sciences, to dominant modes of scientific thinking. Let us now enquire into the current status of the language of the social sciences.

Today one listens to the "language" of the social sciences and one hears a "new" language of variables, parameters, models, stochastic processes, algorithms, heuristics, minimax. It is the language adapted especially from our new "intellectual technology" (linear programming, decision theory, simulation). Perhaps here (Human 'Social' Sciences) more than anywhere else is the dominant mathematical mode of thinking reflected. We must be careful to point out that the mathematics that is influential here is not the deterministic calculus of classical mechanics but a calculus of probability. But this does not alter the fact that this socio-scientific vocabulary operates out of a cosmology within which the elegance of formal ingenuity, and abstract formulae are the sole referents. It may affect the range of knowledge, i.e., problems become more well-defined, more finite, and the range of knowledge reduces as a consequence. But the proper character of knowledge is not altered, knowledge is still acquired at the expense of subjective influence (input).

Over three centuries ago Rene Descartes confronted the philosophical world with the peripheral, almost accidental position of the human subject in the scheme of things. Man's characteristic way of perceiving the world in terms of sensory qualities were, for Descartes, obviously quite defective. In truth properties such as color, weight, consistancy, etc., did not reside in external objects but were "secondary qualities" which "represent nothing to us outside our own mind." 69
Scientists have been less troubled than the philosophers over this since they chose to simply circumvent the problem by enlarging as much as possible the world that can be objectively measured and relying as little as possible on the "senses." Thus the perception of color as a qualitative judgment was converted by science into a pointer reading on a spectrophotometer; the pitch, intensity, and quality of audible sounds emerge as numbers from an audio analyzer, while qualities named hot and cold have long since been reduced to readings on a thermometer. It would be quite rash to say that scientists were consciously prompted by some esoteric philosophical purpose to reduce subjective perceptions to objective pointer readings. It is fairer to say that they were prompted by the desire to see objects too small or too far away to be seen by the naked eye, to hear more than can be heard by the naked ear, to acquire greater reproducibility and demonstrability and, clearly of paramount importance, (the desire) to render the physical world in terms that could be conveniently inserted into mathematical formulae.

All these purposes have been triumphantly advanced, as revealed in the tremendous proliferation of science since its emergence, and hardly anyone in modern society can be unaware of the tremendous power scientific knowledge has afforded. On the other hand human subjectivity and human experientiality has had to pay a heavy cost. Knowledge generates concepts which the layman cannot restate in terms of his own experience, but let us not hurriedly conclude either that the theoretical physicist is able to convert all his mathematical formulae into experiences or thoughts meaningful to his own senses and reason, or that the general biologist readily finds traces of the creativeness of life in
the macromolecules he isolates from the cell. The point is that the commitment to this ideal of objective knowledge is comprehensive. Of course one may say that this is only an ideal but is there any question that failure to conform to it seriously compromises a scholar be he a scientist or humanist?

For the well-trained, clearheaded scientist the commitment to this scientific ideal is perhaps merely a matter of design. We have endeavored to emphasize throughout this chapter the very crucial role that this inclination to objectivity has played in the successful development of science. But for the ordinary believer, the ordinary citizen, the non-scientist, the commitment to this ideal has all too often spawned an attitude of scientism: only what can be established scientifically is true, valid for everyone, and worth pursuing. We see this attitude reflected in the current modern anthropological posture. To regard our primitive contemporaries in terms of their "lack" of civilization, or to presuppose that they are underdeveloped simply because they lack modern technology, or to be willing to esteem only those aspects of their culture that appear similar to aspects of our modern culture is, in our decided opinion, to exercise a scientistic spirit.

The primary objective of this thesis is to vindicate contemporary primitive culture. We feel that objective knowledge as an ideal and an idea in modern society is misleading, not particularly to genuine scientists but to the vast majority of the remainder of modern society. One of the serious consequences of this, we hold, has been a
very enfeebled understanding at best of our contemporary primitive cultures as intrinsically meaningful human responses. As such "intercultural communication" as it involves these cultures is a misnomer. Let us therefore pass to the next chapter where we shall offer an alternative ideal of knowledge--Personal Knowledge, in the hope of reinstating that vital element, human self-referentiality, in all knowing and thus all knowledge. This move will greatly facilitate the accomplishing of our objective by furnishing a criterion that is incontestably more legitimate than scientism upon which to build our case for the independent meaningfulness of contemporary primitive culture.
Chapter III

The Alternative Theory of Personal Knowledge: All Knowing is Personal Knowing—Participation through Indwelling

The previous chapter's discourse has acquainted us with the engendering and the progressive fostering of the modern commitment to the ideal of objective knowledge. The conspicuous event of the current dominance of a mathematical mode of intellectual experience in the majority of the fields of science and particularly in the social sciences as deduced through the "new" language was argued to be crowning confirmation of modern society's commitment to such an ideal.

One particularly harmful attitude that was held to spawn from this commitment was the scientistic attitude—only what can be established scientifically is true, valid for everyone, and worth pursuing. This attitude was espoused to be a fulcrum for a lamentably myopic modern anthropological posture regarding our primitive contemporaries. The aim of this thesis, the reader will recall, is to vindicate contemporary primitive culture as an independently meaningful human response. In this chapter therefore, we will attempt to show that the ideal of detached or objective knowledge is misconceived. We shall argue, to the contrary, that a personal coefficient is indispensable to all knowing or all knowledge. By this demonstration we seek to accomplish
two major goals:

1) To offer a more complete and more accurate account of how man comes to know or to mean.

2) To establish thereby a more adequate criterion against which we may plead our case for the independent meaningfulness of contemporary primitive culture.

It is quite interesting to note that as cautious a philosopher as Immanuel Kant who was so bent on a very strict determination of the rules of pure reason, occasionally admitted that into all acts of judgment there necessarily entered a personal decision which could not be accounted for by any rules. In a rather short chapter of his *Critique of Pure Reason* entitled "The Schematism of the Categories," Kant addressed the question of the applicability of his pure categories to experience. By what imaginative leap—such was the question in Kant's mind—is the perception of a round plate related to the conception of a circle? How can a crude empirical object such as a plate have anything in common with a pure geometrical idea such as a circle? Though he appears to have been far from happy in this chapter on the Schematism, Kant finally resolved to assume the "homogeneity" of sensory experience and conception, and then, as if this were not already enough for his purpose, he went on to introduce "a third thing," half sensory and half intellectual, which somehow lay between the two and yet was neither of them. To this third thing, this "mediating representation," he then gave the name of "schema" and explained that it was "a product of the imagination...a rule of synthesis of the imagination." Its use, he said, "is an art concealed in the depths of the human soul, whose real modes
of activity nature is hardly likely ever to allow us to discover." 72

Although Kant was very concerned with physical science his assumption of a necessary homogeneity between experience and the concepts is still quite curious especially when applied to instances involving other kinds of experience. But it is a thing of even greater wonder how a critique of pure reason could accept the operations of such a powerful mental agency, this "schema," totally exempt from any analysis, and yet make no more than a few scattered references to it. There was an ultimate agency which, unfettered by any explicit rules, decided on the subsumption of a particular experience under a general rule or concept and of this agency Kant himself could say only that it was what constituted our "so-called mother-wit." 73

Could it be that Kant's controlled reticence on this matter, and, for that matter, that of many generations of scholars after him, except a small number of logical analysts who may themselves have misrepresented the "epistemological situation," 74 were indications of a desire to avoid the issue of this ultimate agency for fear of destroying the fundamental conception of knowledge? We must incline to agree that they were for our theory of Personal Knowledge, it will become evident, is erected precisely upon the principle of an indispensable and unspecifiable personal coefficient in all knowledge or all acts of knowing. The reader is informed that we shall be relying principally on the work of Michael Polanyi throughout this chapter, who is the originator of the theory of Personal (or otherwise called Tacit) Knowledge.
The General Structure of Tacit Knowledge

Before getting underway with the description that this heading entails we wish to first answer the question—whence did the concept of tacit knowledge derive? It appears quite certain that it is the mechanism underlying the formation of Gestalt from which Polanyi derives the conception of tacit knowing. He asserts that:

Gestalt psychology has demonstrated that we may know a physiognomy by integrating our awareness of its particulars without being able to identify these particulars, and my analysis of knowledge is closely linked to the discovery of Gestalt psychology. But I shall attend to aspects of Gestalt which have been hitherto neglected. Gestalt psychology has assumed that perception of a physiognomy takes place through the spontaneous equilibration of its particulars impressed on the retina or on the brain. However, I am looking at Gestalt, on the contrary, as the outcome of an active shaping of experience performed in the pursuit of knowledge. This shaping or integrating I hold to be the great and indispensable tacit power by which all knowledge is discovered and, once discovered, is held to be true.75

Thus it is clearly the case that the structure of the Gestalt is recast into a logic of tacit operation, and this obviously changes the entire range and perspective of the subject of integration. We may now construe all forms of knowledge—scientific, artistic, skillful, etc., as various forms of integration, and the result of personal, artful discovery. All knowing thus becomes a personal art. We may now pass on to an actual description of the structure of tacit knowing.

When viewing a pair of stereoscopic pictures in the usual way, with one eye on each of the two pictures, we might regard their joint image as a whole, composed of the two pictures as its parts. But let us take a closer look at what is going on here. We note that, when looking through a stereo viewer, we actually see a stereo image at the
focus of our attention but at the same time we are also aware of the
two stereo pictures in some peculiar nonfocal way. We seem to look
through these two pictures, or past them, straight at their joint image.
We are indeed aware of them but only as guides to the image on which we
focus our attention. This relationship of the two pictures to the
stereo image may be described by saying that the two pictures function
as "Subsidiaries" to our seeing their "Joint" image, which is their
joint meaning. This is the typical structure of tacit knowing, which
will now be developed in some detail.

We shall assert that the grounds of all tacit knowing are items,
or particulars, like the stereo pictures for example, of which we are
aware in the act of focussing our attention on something else, away
from them. This we shall call the "functional relation" of subsidiaries
to the focal target. We may also call it a "from-to relation" and we
can say that this relation established a "from-to knowledge" of the
subsidiaries—"a knowledge of them as they appear functionally in
establishing the object of focal attention." Tacit knowing, evidently,
is thus a from-to knowing. The reader may have observed that this from-
to operation implies a kind of dual awareness. We shall address this
point before too long.

The change of appearance which occurs when the viewing of a pair
of stereo pictures transforms them into a stereo image is soon to
exemplify another characteristic aspect of from-to knowing. We note
that a stereo image "has a marked depth and also shows firmly shaped
'solid' objects not present as such in the original pair." The
point here is that a stereo image involves us in a novel sensory experience
which has been created by tacit knowing. Such "phenomenal transformation" is a characteristic feature of from-to knowing. In this manner "the coherence we see in nature has an actually new sensory quality not possessed by the sense perceptions from which it is tacitly created." 78

Earlier on we said that the stereo image is the "joint meaning" of the stereo pictures and with this we anticipated another feature of from-to knowing. We have seen that the subsidiaries of from-to knowing bear (are made to bear) on a focal target. Whatever a thing bears on in this manner may be called its meaning. Thus the focal target on which they bear (or are made to bear) on is the "meaning" of the subsidiaries. We may deem this an act of sense-giving and regard it as the "semantic aspect" of from-to knowing.

We have now identified three fundamental aspects or features of tacit knowing: the functional, the phenomenal, and the semantic. Let us now, for the sake of clarification and familiarity, focus upon a few examples.

As a simple case let us consider the from-to structure of the act of reading a printed sentence. We note that the sight (reading) of the printed words "guides our focal attention away from the type to a focal target that is its meaning." 79 We here recognize both the "function" of from-to knowing and its "semantic" aspect. To recognize the "phenomenal" aspect we must consider that a word used in a particular sentence has a totally different look to the user as compared to the way it looks to someone else who is meeting it as a totally foreign word. The point is that the familiar use of a word renders it in a rather
bodiless or transparent way in a sentence. It (the sentence) might thus be said to involve us in a novel sensory effect (its meaning) and it is in this way that we find the "phenomenal" aspect of the from-to structure of the act of reading a printed sentence.

Let us take another example. Consider the case of tactile cognition: of using a stick to probe one's way in the dark so as to detect obstacles in one's path. This kind of exploration by someone familiar with it is a form of from-to knowing in that what one actually does is attend subsidiarily to the feeling of holding the stick in one's hand, while the focus of one's attention is on the far end of the stick, where it detects an obstacle in one's path. This perception is the "function" of this form of tacit knowing. Also since what one actually feels is the far point of the stick as it touches an object, much more so than the sensation of the stick pressing on one's fingers and palm, we also have here the "phenomenal transformation" aspect of tacit knowing. The information that one obtains by feeling with the point of the stick is the meaning of one's tactile experiences with the stick: it tells one what it is that one is observing by the use of the stick. Thus we have the "semantic" feature of this particular act of from-to knowing.

Our analysis has confronted the reader with a number of facts about tacit knowing: that it is basically a from-to knowing, that it invariably involves three fundamental aspects (functional, phenomenal, semantic), etc. We shall now confront the reader with the further fact that there is one single thing in the world we normally know only by relying on our awareness of it for attending to other things. This
unique thing is our body. It has long been established by physiologists that the way we see an object is determined by our awareness of certain efforts inside our body, efforts which we cannot feel in themselves. Thus we are told that

the localization of an object in space is based on a slight difference between the two images thrown on our retinas, the accommodation of our eyes, and on our control of our eye motion, supplemented by impulses received from the inner ear, which vary according to the position of the head in space. 80

The point is that we become aware of all these things going on inside our body only in terms of the localization of the objects at which we gaze, and in this sense we may be said to be only subsidiarily aware of them. In fact we may now say that to know something by relying on our awareness of it for attending to something else is to have the same kind of knowledge we have of our body when we rely on it to know things outside it. As such then our subsidiary awareness of items, particulars, tools, clues, etc., can be regarded as a condition in which they form part of our body. While we rely on a tool or an interpretative framework, these items are not handled or scrutinized as external objects but instead "we pour ourselves into them and assimilate them as part of ourselves." 81 This describes the act of indwelling which derives from the structure of tacit knowing, and which we shall bring up later on.

We have thus completed our description of the general structure of tacit knowing. We have seen that it includes a joint pair of constituents: subsidiaries and a focus. Subsidiaries exist as such by bearing on the focus to which we are attending from them. Otherwise said, the functional structure of from-to knowing includes jointly a
subsidiary "from" and a focal "to" (we may sometimes have a focal "at"). Let us be reminded that this pair is not linked together of its own accord. The relation of a subsidiary to a focus is formed, as we have pointed out, by the act of a person who integrates one to the other. The point that is here being emphasized is that it is the person, the knower, who sustains the integration and the implication of this is quite important.

Regardless of whether one says that the knower integrates the subsidiaries to a focal target, or that for the knower the subsidiaries have a meaning which fills the center of his focal attention the fact is that this entire triad is dissolved if the knower shifts his focal attention away from the focus and fixes it on the subsidiaries. For example, if, instead of looking at the stereo pictures through the viewer, one takes them out and looks at them directly, one loses sight of the joint appearance on which one had focused before. Again if one focuses one's attention on a spoken word and sees it merely as a sequence of sounds, the word soon loses the meaning to which one had attended before. Or again, if a concert pianist focuses his attention away from a particular musical performance and concentrates instead on say the several motions that compose his playing he will paralyze the performance of his musical piece.

These facts may be very simple common knowledge but they involve remarkable consequences for our theory of tacit knowing. They confirm a view that we can be aware of certain things in a way that is quite different from focussing our attention on them. They thus prove the
existence of two kinds of awareness that are mutually exclusive: a from-awareness and a focal awareness. They also confirm that in our focal awareness of a thing we see it as having a meaning, a meaning which is dissolved when we focus our attention on the thing of which we have had only a from-awareness. In other words, to substitute a focal awareness for a from awareness, incurs a sense deprivation according to the principles of tacit knowing.

It is of utmost importance to note that this dual awareness in tacit knowing is not the result of the fact that we cannot become focally aware of all the subsidiary clues that entered into an integrated meaning. Let us suppose that it were possible, in principle at least, to identify all the subsidiaries involved in achieving a particular focal integration. Still would we find that anything that functions as a subsidiary ceases to do so when focal attention is directed upon it. It "turns into a different kind of thing, deprived of the meaning it had while serving as a subsidiary. Thus subsidiaries are--for this reason and not because we cannot find them all--essentially unspecifiable." Clearly therefore, what makes awareness subsidiary is its functional character, and furthermore, we must now also distinguish between two types of unspecifiability of subsidiaries which now loom before us: "One type is due to the difficulty of tracing the subsidiaries—a condition that is widespread but not universal; the other type is due to a sense deprivation which is logically necessary and in principle absolute." As we mentioned earlier the recasting of the structure of Gestalt into a logic of tacit operation significantly changed the range and
extended the perspective of the act of integration. Henceforth Polanyi
would construe all knowledge, "I shall always speak of 'knowing'...to
cover both practical and theoretical knowledge" as the result of, and
only of, the tacit power of shaping or integrating particulars. We
have chosen to speak for Polanyi so that it is our task to now show this
to be the case. To this end we have developed the following schema:
In the genius of scientific discovery we recognize one of the highest
and perhaps even the highest form of tacit power integrating (or tacit
knowing). We shall therefore treat this particular form of from-to
knowing as the high point of our focus. Perception, which Polanyi
describes as the most impoverished form of tacit knowing, will mark
our low focal point. These two focal points will then function as
boundaries in between which we feel such forms of knowing as connois-
seurship (the expert diagnostician for instance) and skilful performance
can safely be put. These two forms provide "examples of knowing, both
of a more intellectual and more practical kind; both the 'wissen' and
the 'konnen' of the Germans, or the 'knowing what' and the 'knowing how'
of Gilbert Ryle," While this schema does not include every conceivable
form of integration we feel that it is adequately representative of the
more important and interesting departments of human knowledge with the
major exception of works of art which we shall treat separately.

What I have prophesied two and twenty years ago, as
soon as I discovered the five solids among the heavenly
orbits - what I firmly believed long before I had seen
Ptolemy's Harmonics - what I had promised my friends
in the title of this fifth book, which I named before I
was sure of my discovery - what sixteen years ago I urged
to be sought - that for which I have devoted the best
part of my life to astronomical contemplation, for
which I joined Tycho Brahe...at last I have brought it
to light, and recognized its truth beyond all my hopes...
So now since eighteen months ago the dawn, three months ago the proper light of day, and indeed a very few days ago the pure Sun itself of the most marvelous contemplation has shone forth—nothing holds me; I will indulge my sacred fury; I will taunt mankind with the candid confession that I have stolen the golden vases of the Egyptians, in order to build of them a tabernacle to my God, far indeed from the bounds of Egypt. If you forgive me, I shall rejoice, if you are angry, I shall bear it; the die is cast, the book is written, whether to be read now or by posterity I care not; it may wait a hundred years for its reader, if God himself has waited six thousand years for a man to contemplate His work. 87

This statement was uttered by Johan Kepler in a moment of scientific discovery; at an instant therefore, of the particular form of from-to knowing that is science. Now while his exclamation about God's having waited for him for thousands of years could conceivably be dismissed as a piece of sheer literary fancy, what are we to make of such an unbridled outpouring? Kepler most certainly does not make light of his ecstasy, his overpowering joy and excitement at his discovery. Indeed to undergo a process of discovery of the solution to a vexing problem would significantly facilitate our appreciation of Kepler's emotional effusion but still it should not be said that his words merely reported his personal feelings, nor, and this is quite obvious, do they merely constitute a simple statement of fact. So the questions remains—What are we to make of these words of Kepler's? The answer, we feel, is readily provided by Polanyi who points out that:

They asserted as a valid affirmation of science something else than a fact: namely the scientific interest of certain facts, the facts just discovered by Kepler. They affirmed, indeed, that these facts are of immense scientific interest and will be so regarded as long as knowledge lasts. 88

It is, above all, this assertive quality of Kepler's words, which we wish to impress upon the reader's attention for it unmistakably
points to a non factual dimension that is intrinsic to scientific discovery. Thus have we exposed our hand so let us now follow this line of development and enquire into the nature of scientific discovery.

It is a commonplace that scientific research must normally start from a problem. Generally a good problem can assure successful research and an original problem will usually generate original research. But how does a scientist see a problem, any problem, let alone a good and original problem?

We may now suddenly find ourselves at a loss to answer this. In his *Meno* Plato called our attention to the apparent contradiction in our situation by pointing out that to search for the solution of a problem is an absurdity; for either one knows what one is looking for, and there is no problem; or one does not know what one is looking for, and thus one cannot expect to find anything. What Plato here revealed was that if knowledge is explicit, i.e., capable of being clearly stated, then we cannot know a problem or look for its solution. Yet the fact still remains that a scientist sees a problem and pursues its solution, which oftentimes gives rise to discoveries. There is, we suggest, only one acceptable answer to our paradoxical situation of how a scientist sees a problem and then pursues the discovery of its solution, and that is that we can know things, and sometimes very important things, that we cannot tell.

We have thus resolved our situation by invoking a kind of tacit knowledge which consists in the intimation of something hidden, which the scientist may yet discover. We can identify another important
manifestation of these mental powers. Great scientific discoveries, we
often hear, are marked by their fruitfulness. This claim is generally
accepted as true. But how, one wonders, can we recognize truth by its
fruitfulness? Can anyone recognize that a statement is true by appre-
ciating the wealth of its yet undiscovered consequences? This of course
would be quite nonsensical, if we had to know explicitly what was yet
undiscovered. It makes sense only if we admit that we can have a tacit
knowledge; or better yet perhaps, tacit foreknowledge of yet undiscovered
things. This, incidentally, is the kind of foreknowledge the Copernicans
must have meant to affirm when they passionately maintained, against
heavy pressure, for more than one hundred years before Newton proved
the point, that the heliocentric theory was not merely a convenient way
of computing the paths of planets, but was really true.\textsuperscript{89} There are
further important implications of knowing that a statement is true to
which we shall later return.

So now we know that by an operation of tacit knowing a scientist
sees a problem. How does he hence pursue its solution? In a classic
eyessay in his work \textit{Science et methode} the French mathematician Henri
Poincare described two stages in the way we hit upon an idea that pro-
mises to solve a scientific problem.\textsuperscript{90} The first stage consists in
racking one's brains by successive sallies of the imagination, while
the second, which could be delayed for hours after one has ceased one's
efforts, is the spontaneous appearance of the idea for which one has
struggled. Poincare declares that this spontaneous process consists in
the integration of some of the material mobilized by thrusts of the
imagination; he also informs us that these thrusts would be useless but
for the fact that they are guided by the special anticipatory gifts of
the scientist.

Poincare's description here is quite elucidating and also
considerably helpful. We have already seen that tacit knowing, the
intimation of a hidden presence that may yet be discovered, is the only
acceptable way to account for how a scientist could validly claim to
know a problem. Poincare now intimates to us that tacit knowing also
accounts for the scientist's capacity to pursue this problem. He tells
us that the repeated thrusts of the scientist's intimation, as he
launches his inquiry, are guided by the anticipatory gifts, i.e., the
tacit knowledge of the scientist. This is a crucial insight into the
nature of scientific discovery. We are now made to understand that
tacit knowing exercises a strategic role in the act of scientific
discovery. This gives rise to a further fundamental point. The imagina-
tion (of the scientist) does not work like a computer, surveying
innumerable alternatives; rather it works by producing material that is
integral to an as yet indeterminate coherence. We are now also made to
see that the scientist becomes responsible to his tacit vision and this
observation established the very crucial condition that the scientist
pursuing a scientific discovery is not at liberty to indulge his
subjectivity.

The scientist's long struggle toward his tacit intimation, some
indeterminate coherence or meaning, eventuates in the spontaneous
appearance of it. He is at last able to focally attend from all the
material mobilized by his imagination, all the subsidiaries therefore,
to his focal target, to his discovery. Our scientist has thus made a
discovery which, now having made, he will hold to be true.

We recall the words of Kepler and their peculiar assertive
quality or, we will now say, the resonance of their truth-bearing
passion. Indeed Kepler rejoiced in his discovery of the five solids
among the heavenly orbits; he thought that the solar distances of the
six planets known to him corresponded to the sizes of the successive
Platonic bodies as measured by the radii of inscribed and circumscribed
spheres.\textsuperscript{91} Even though this view of reality would today be regarded as
nonsense merely and simply because it is no longer believed that the
fundamental harmonies of the universe are disclosed in such simple geo-
metrical relations, still it was close enough to the truth to guide him
aright to the discovery of his three laws of planetary motion. The
point we are here trying to make is that the discovery, which terminates
and satisfies the scientist's long struggle to resolve his problem, is
itself fraught with further intimations of an indeterminate range. So
that in accepting his discovery as true the scientist commits himself to
a belief in all these undisclosed consequences, and this development
clearly points out that for the scientist engaged in scientific discovery
tacit knowing does not only involve the intimation into some hidden
presence in itself but also an intimation into some reality of which
this presence is one manifestation.

But what about the measurements, computations, algebraic rules,
explicit rules, etc., that the scientist used in the pursuit and formu-
lation of the scientific discovery? These are, of course, essential;
but they constitute part of the former interpretative framework of the scientist, and since his discovery alters this interpretative framework, it is logically impossible that he could arrive at his discovery by the strict continuous application of these features (being part of his former interpretative framework). Therefore, while we must admit that the application of various existing forms of explicit scientific thought might produce say, valuable surveys, or might lead to the achievement of greater economy and simplicity within the former or "given" interpretative framework, we do not see that it could advance the principles of science as does a scientific discovery. In consequence we now submit that for the scientist engaged in an act of scientific discovery the use of computations, formulas, existing rules, measurements, etc., is a tacit operation just as say, the use of language, both in our own speaking and in our understanding of what has been spoken by others, is a tacit operation.92

We have here reached our conclusion on the inquiry into the nature of scientific discovery. Tacit knowing was shown to account 1) for a valid knowledge of a problem, 2) for the scientist's capacity to pursue it, guided by his sense of approaching its solution, and 3) for a valid anticipation of the yet indeterminate implications of the discovery arrived at in the end. We saw accordingly that scientific inquiry involves a dynamic exercise of the imagination and is rooted we might say in commitments and beliefs concerning the nature of some indeterminate thing. For the scientist scientific inquiry might be said to be a fiduciary act, but one which depends upon firm beliefs. Its ideal is the discovery of coherence and meaning in that which the scientist
believes exists. Science is not thus the simon-pure, crystal-clear fount of all reliable knowledge and coherence, as it is so often presumed to be, and let us not be hoodwinked by the contention that the statements of science are only probable and merely tentative for the fact is that we (moderners) do accept and vitally rely on scientific observations. In general we do not really treat them as only probable or tentative.\(^9\) The method of science we have seen is not that of detachment but rather that of involvement.

We have thus shown that scientific discovery is a form of from-to knowing. We might now add that it is the considerable working demand placed on the faculty of the imagination, which qualifies this structure of from-to knowing for the title of the highest (or one of the highest) form of tacit power integration. In accord with our plan of presentation we shall now move to consider what we hold to be the lowest form of integration, perception. By perception we are to understand the process which describes simple acts of recognition of significant shapes.

We shall begin our enquiry on perception with an aside the relevance of which will shortly become evident. In 1929 Leo Szilard\(^9\) generated the idea that information was a concept that could be defined in precise mathematical terms. He was the first to point out the connection between the quantity of information we have about the physical world and the physical concept of the entropy of a system. It seems, however, that Szilard's ideas practically lay fallow until some twenty years later when they were rediscovered by C. E. Shannon\(^9\) and precisely formulated in their modern form—the form which has revolutionized modern
communications. Today there is held to be a very close relation between information and probability. In fact, the amount of information in an image or a message is seen to be closely connected with its deviations from a purely random pattern.

One very functional concept that emerged with this development of precise definition of the quantity of information in a system is that of noise, which is defined as the random background on or against which all information must ultimately be recognized. So that today communicologists (communication experts in general) hold that all channels of communication are affected by a certain degree of noise, and they suggest that one apparently reads communication signals against the disturbing background of this noise. Whenever the noise level is high and the true signals scanty one is forced to strain one's attention to pick out the significant sequence, while indiscriminately lumping together as mere background, those signals making up the noise. The strategy of equating noise with background is seen to offer the opportunity for an illuminating transition to a quite general principle that enters into the recognition of significant shapes, i.e., into perception. It is the principle of figure and background contrast.

So that in communication proper, perception (the receiver's recognition of a signal as distinct from the accompanying noise), might be regarded as a particular instance of the contrast between figure and background. This relation has been extensively explored by gestalt psychology and a particularly apt demonstration is the famous ambiguous picture--Rubin's "vases or faces." One may look at this picture in one way and see two faces in profile with an empty space between them,
and then look at it in another way and see a vase in the middle, with an empty background on either side where the faces were previously seen. This experience is seen to indicate that when an area is seen as a figure, it acquires significance and solidity, which it instantly loses when it is made to function as a background. At the same time, the area which a moment ago was more background now becomes a significant and substantial figure. The generalization that can be said to emerge from this is that a figure is something distinctive seen against a background that is indeterminate.

There are some famous experiments in perception, which were conducted by Ames and in which figures were seen against the background of a room, a very special kind of room. Opposite each other in two corners of this room stood a man and a young boy, and the boy was perceived to be taller than the man. This result was effected by distorting the shape of the room so that at the two corners where the figures stood, the height of the ceiling and the distances from the opposite wall differed greatly. The boy, who stood at the corner with the lower ceiling and closer to the observer was seen as taller than the grown man seen further away at the opposite corner, where the ceiling was higher.

This result, which is clearly an illusion, unfolds in two stages both of which warrant attention: First, viewed (with one eye) from the position prescribed for the experiment, the irregularly-shaped room appears normal. Secondly, against the background of this apparently normal but actually skew-angled room, one sees the sizes of persons standing in the opposite corners mistakenly as if they were standing in the opposite corners of a normal room.
The flow of the above account conceals a decisive gap. It describes a sequence of two stages in which clues operate so as to lead one into seeing two figures of quite absurd sizes. But why do clues not operate in the opposite direction? The fact, for example, that young boys are generally smaller than adults could conceivably form a clue to correct the illusory perception of the room and impoverish the experiment.

One would have to admit that clues might in fact operate in this way. Of course it is always possible to look at the experimental arrangement from an illegitimate angle, or one may do some such thing as measure the walls of the irregular room and make certain compensations... etc. In this way the two figures could and would probably be seen in their proper sizes. But the very effort needed to achieve this:

shows how great is the power that operates in the opposite direction. This power resides in the area which tends to function as a background because it extends indeterminately around the central object of our attention. Seen thus from the corner of our eyes, or remembered at the back of our minds, this area compellingly affects the way we see the object on which we are focusing.98

Such is the pertinence and fertility of Ames' experiment that we feel quite secure in using it as a sort of medium through which to now sum up the case on perception. In the first place the experiment corroborates a crucially important point made earlier concerning the interplay of a thing's background and the thing itself. The reader will recall from our enquiry into the nature of scientific discovery that the scientist's tacit knowledge, some as yet indeterminate presence that he had intimated, continuously shaped his inquiry by guiding all his imaginative thrusts until that coherence from which he struggled finally appeared.
Secondly the actual interplay of background and figure involved in the experiment can itself be said to illustrate the primary principle of perception:

the principle that the act of focusing one's attention on a particular object relies upon awareness of many things to which one is not attending directly at the moment, but which are yet functioning as compelling clues for the way the object of our attention will appear to our senses.99

We may thus note that just as was shown in the case of scientific discovery, perception is a form of from-to integration. In both of these cases we are essentially talking about a recognition of a significant shape, coherence, or figure against an indeterminate background, although, as was shown, the indeterminate background is much more consequential to scientific discovery. Perception can be mistaken as in the case of Ames' experiment, and so too scientific discovery as illustrated by the case of Kepler and his discovery of the five solids among the heavenly orbits. Of course it is not being asserted that simple visual perception is equal to scientific discovery as a mode of knowing. Indeed such a claim would always be quite absurd. The analogy with scientific discovery was simply to enhance the claim that perception is a tacit knowing operation or performance.

This concludes our case on perception. We regard it as the most impoverished form of from-to integration principally because the imagination is seen to play a quite minimal role in the recognition of shapes or objects. Having now touched the top and the bottom of our schematic structure we will work within it. Focus will therefore be now directed upon skillful knowing or the discovery of "knowing how."
In the process of learning the mastery of a skill say, bicycle riding, the emphasis of one's knowing could be said to be on demonstrating that one can ride a bicycle. Now are we to believe that the explicit rules of bicycle riding for instance: adjust the curvature of your bicycle's path in proportion to the ratio of your unbalance over the square of your speed, or when falling on the right turn the handle bar to the right so as to deflect the bicycle along a curve towards the right, . . . etc., tell one how to ride? This seems hardly likely. First of all to adjust the curvature of one's bicycle path in proportion to the ratio of one's unbalance over the square of one's speed is so obviously impractical as to be almost impossible. Secondly, if even one could do this it would probably result in little more than falling off the machine for there are, as anyone who has attempted to or can ride a bicycle will agree, a number of other factors to be taken into account in practice (e.g. the tendency to gaze down at the front wheel, the tendency to retain a too rigid posture, fear of falling, etc.) which are omitted in the formulation of these rules.

We could therefore conclude that the literal application of explicit rules do not tell one exactly how to ride. But this is merely because the skill of bicycle riding is a from-to operation. We have already pointed out that the emphasis of one's knowing here lies on producing a result (the actual demonstration of bicycle riding). The effort involved in acquiring this knowledge and skillfully applying it may then be said to be guided by a purpose. It is in the light of this purpose that certain things e.g. explicit rules, certain skillfully coordinated movements of our body, etc., become the subsidiaries from which
to attend to the focal target i.e. a successful performance. Of course after success (or what we believe to be success) we may derive rules of success which may help improve our skill and help us teach it to others but "only if these principles are first re-integrated into the art of which they are maxims."

Since skills in general (skillful performances) are seen to share in common two basic features: a body of explicit rules, and the emphasis solely on demonstration or performance, we can now generalize our case for "skills" thusly:

(a) The final aim of a skillful performance is achieved by the observance of features not known as such to the person following them (e.g. the bicycle rider must observe balance, or the swimmer must observe buoyancy, etc.).

(b) The basic mechanism of all skillful knowing takes the format of focally attending to a particular result (the actual demonstration or performance of the particular skill) while relying for so doing on an awareness of factors not themselves directly attended at the moment, but which yet function as compelling agents in one's achievement.

We thus submit that all skillful knowing is tacit knowing. The individual struggling to master a skill is seen to be involved in fundamentally the same kind of from-to operation as the scientist in scientific discovery, and the perceiver in the act of perception. He strains towards or attends to a figure against an indeterminate background, in the conspicuous absence of explicit guidelines.
This brings us to our case on connoisseurship. This term may be understood to define the art of doing as well as the art of knowing. Connoisseurship, therefore, must not be taken to be perfectly equivalent to skill mastery. Functions such as medical consultant, surgeon, anatomist, wine taster, art dealer, biologist, etc., fall under this particular kind of knowing. Our question of course is: How does the connoisseur acquire his expertise?

A look at the buildings that comprise the medical school of a modern university reveals rows of laboratories and dissection rooms, various kinds of teaching hospitals, medical libraries, etc. Students spend much time in these places diligently reading printed texts, listening attentively to lectures, and carefully noting from pictures and slides. This appears to constitute the basic pedagogic methodology for the descriptive sciences (chemistry, biology, medicine, etc.). But are we to understand that it is these explicit factors which mould a student into say, a general surgeon?

The medical student, we might say, first learns a list of bones, arteries, nerves, and viscera which constitutes systematic anatomy. This is probably hard on the memory, but normally presents no difficulty to the understanding, for the characteristic parts of the body can usually be clearly identified by diagrams. The major difficulty in the understanding, and hence in the teaching of anatomy, arises in respect to the intricate three dimensional network of organs closely packed inside the body, of which no diagram can give an adequate representation. How then does our general surgeon-to-be eventually acquire this topographic knowledge? We know that "Even dissection, which lays bare a region and
its organs by removing the parts overlaying it, does not demonstrate more than one aspect of that region."

Michael Polanyi addresses this issue. He informs us that:

A biologist, a doctor, an art dealer acquire their expert knowledge in part from textbooks, but these texts are of no use to them without the accompanying training of the eye, the ear, and the sense of touch. Only by attentively straining their senses can they acquire the right sense, or feel, for identifying a certain biological specimen, the symptoms of a certain sickness, a genuine painting by a certain master.

What he is in fact saying here is that connoisseurship is a form of tacit knowing. Indeed there may be numerous explicit clues and rules available to the learner but the fact is that he must struggle towards a focal point (a certain topographic anatomy, the right sense, or feel, etc.) while relying for so doing on the subsidiaries which include all rules, maxims, etc., mobilized by his imagination.

We have now completed our enquiries into those forms of integration that were defined within our schema--scientific discovery as the highest form, visual perception as the lowest, and skillful knowing and connoisseurship as forms that lay between these boundaries. Let us now, as decided earlier, direct an enquiry into works of arts to show how they too are forms of tacit integration.

Our enquiry into the works of art will include painting, stage-craft, and poetry. In these we feel that we shall have before us some of these major arts that clearly represent something, we will call these the representative arts.

We begin with the old question of why works of art continue to
be honored as "true" although they tell us stories that we clearly understand are not true. I. A. Richards provides a good example of this paradox. He notes that the theatrical presentation of a murder "has a different effect upon us from that which would be produced by ... actual murders if they took place before us." The question is just what is this different effect and how it is produced.

We begin by advocating that the paradox of this theatrical presentation is similar to the paradox generated by a metaphor, the paradox of saying one thing and meaning something else. In a chapter of Meaning entitled "From Perception to Metaphor" Michael Polanyi offers a brief but elucidating demonstration on the structure of metaphor and the source of its power. He speaks of the presentation of a "tremendous spectacle to our imagination" by a metaphor, and explains metaphorical meaning as the result of "man's basic imaginative capacity for integrating two or more disparate matters into a single novel meaning." We are therefore to understand that metaphorical meaning is indeed valid imaginative integration but it exists as such only for the imagination.

Returning now to our theatrical presentation we may say that in witnessing a murder on the stage, we are certainly aware of the setting and the antecedents of the stage murder, all of which are logically incompatible with the murder's being genuine. But, as Polanyi points out in the case of the metaphor, we do not simply dismiss these contradictory affirmations, which would make the stage murder a nonsensical deception, but rather we activate our imaginative capacity to integrate the disparate or incompatible matters into a joint meaning. Of course, as is the case
with metaphorical meaning, this joint meaning which will have the peculiar quality of a dramatic event, will be known to us only in the imagination.

Stage plays have an exceptional range of subsidiaries: the playwright, the director, the actors, the disguises, the whole theatre and the mechanism of stage properties are all involved in a dramatic performance. Poetry and painting upon which we shall now focus are comparatively simpler cases of the structure of art.

Polanyi tells us that:

... once a scientist has made a discovery or an engineer has produced a new mechanism, the possession of those things by others requires little effort of the imagination. THIS IS NOT THE CASE IN THE ARTS. The capacity of a creative artist's imaginative vision may be enormous, but it is only the vision that he imparts to his public that enables his art to live for others. Thus the meanings he can create for his public are limited by the requirement that they provide a basis for their re-creation by the imaginations of other viewers or readers.107

The reader may first observe about this statement, the somewhat indirect implication that technical invention (production of a new mechanism) is held to be a form of tacit integration. We agree that it is insofar as we can say that the inventor sees a problem, anticipates its feasibility and worthwhileness, thrusts his imagination in a direction that promises success, and finally sights a solution that appears satisfactory. This is of course a quite simplified explanation. The reader may consult Meaning, Chapter 6 and Personal Knowledge Chapter 6 for a more elaborate illustration. Of much more importance and pertinence is the major assertion of Polanyi in this statement, concerning the imaginative recreation of meanings.
We interpret the term "possession" to mean simply "use." So that we can say that one does not have to recreate Alexander G. Bell's imaginative vision of the telephone in order to use it. Nor do we have to recreate Newton's imaginative vision of his laws in order to use them. However, if we are to "use" a work of art, that is, to understand and enjoy it aesthetically, we do, apparently have to achieve some kind of imaginative vision. Let us consider how this situation applies in the case of a poem.

I. A. Richards calls our attention to the necessary detachment from a particular personality in poetry, which is mediated by the artificiality of the "frame" into which the poem is cast. He points this out to us thusly:

Through its very appearance of artificiality metre produces in the highest degree the "frame" effect, isolating the poetic experience from the accidents and irrelevancies of everyday existence.108

We accept Richard's basic point about the peculiar status of poetry and the poetic experience but we also see a need to expand upon his notion of the "frame" so as to make his point more cogent.

It is fairly evident that rhythm, the natural outcome of metre, is but one of the many artificialities of a poem. Indeed there are other poetic accessories among which rhymes, expressive sounds, peculiar grammatical constructions, strange connotations of words, and, of course, metaphors are included. We might now say that these constitute the formal structure or "frame" of a poem and it is not difficult to show how this structure performs its cutting-off function.
It is simply true that people normally talk in prose. This applies also for what we might call the usual conversations of poets. It is equally true that almost always, anyone who addressed us in rhymed and metrical speech would probably be taken to be doing this as some kind of joke, unless there was reason to suspect the presence of a pathological condition. It follows from all this that a poem can form no part of a poet's usual personality. Thus we can say that the formal structure of a poem, which will doubtless hold much of the poem's meaning in it, becomes a blockage "insulating the poem from everyday affairs and so also from the poet as a private person."

We also now see conversely, that strictly speaking, it is the poem that speaks to us more so than the poet. The imaginative vision that we have to achieve in order to "use" this work of art, a poem, does not therefore have to include the poet's strictly personal feelings, memories, etc. This is requisite for it is in fact by this principle that every discovery, invention, or work of art becomes "a sort of reality with life, so to speak, of its own."110

But this is not to say that the artificial pattern, the "frame" of the poem constitutes the only poetic subsidiaries from which we "attend" to the meaning of the poem. A poem rendered in prose assuredly loses much of its beauty and may even sound quite shabby. However, it must be admitted that the "story" of a poem can be and is contained in prose. Poetic subsidiaries must therefore comprise the "frame" and also the "story," the prose content of the poem. These must clearly be logically incompatible elements (when seen focally), but we do succeed
in integrating them into a radically novel joint-meaning just as the poet himself has done. Polanyi points this out to us thusly:

Something more than the integration of its frame and its story therefore occurs in our grasp of the reality of a poem. The poem takes us out of the diffuse existence of our ordinary life into something clearly beyond this and draws from the great store of our inchoate emotional experiences a circumscribed entity of passionate feelings. First the artist produces from his own diffuse existence a shape circumscribed in a brief space and a short time—a shape wholly incommensurable with the substance of its origin. Then we respond to this shape by surrendering from our own diffuse memories of moving events a gift of purely resonant feelings. The total experience is of a wholly novel entity, an imaginative integration of incompatibles on all sides.

We may now conclude that just as we can watch a murder in a play in integrated conjunction with its theatrical subsidiaries without either jumping up to rescue the victim or feeling the action on the stage—the pretense of a murder—to be nonsensical, so does our imagination accept the clues (poetic subsidiaries) which the poem offers it for grasping its meaning. It is this meaning rather than the meaning that poetic events would have for us in our ordinary lives, in which we live and thus share the poetic experience. We will now turn to painting and demonstrate how this form of art fits into the same pattern as does stagecraft and poetry. We are of course referring to the pattern of the imaginative integration of incompatibles into a joint-meaning.

Over its many centuries of evolution painting has seen many major innovations within its domain and the one in which we are particularly interested is the imitation of depth by central perspective. In the chapter entitled "Ambiguities of the Third Dimension" of his work Art and Illusion, E. H. Gombrich surveys past observations on the
manifest contradiction between simulated depths in paintings and the actual flatness of the canvas. We find therein a rather interesting guide from the nineteenth century French neoclassical critic Quatremere de Quincy:

> When the painter packs a vast expanse into a narrow space, when he leads me across the depths of the infinite on a flat surface, and makes the air circulate . . ., I love to abandon myself to his illusions, but I want the frame to be there, I want to know that what I see is actually nothing but a canvas or a simple plane.112

Insofar as de Quincy identifies the frame of the painting (a canvas or a simple plane) as distinct from the depth-illusion, the re-creation of which it engenders, he interests us and we assign him a measure of credit. But his insistence that while he abandons himself to the "illusions" of the painting he must know that what he sees is "actually nothing but a canvas or a simple plane" is quite misconceived and Gombrich aptly addresses the point. He reminds us that psychologists have found that illusions are destroyed when we shift our attentions to an alternative view which contradicts the illusion. The point to which he is leading is that to understand or enjoy a painting is for that moment to focally disregard its frame. We agree with Gombrich.

It is to be admitted of course, that alternative views representing alternative integrations of the same scene may totally exclude each other. But this is not the issue here. The reader has already been exposed to ample evidence of the existence of elements that contradict each other when seen focally but which can nevertheless, as subsidiaries, be integrated into a joint meaning. This, we wish to suggest, is precisely what the act of understanding or enjoying painting
involves. We submit that the apparent conflict between the portrayal of depth in the painting and the flatness of its ground (or its plane surface) is resolved by the same mechanism which fuses the contradictory parts of a metaphor, or which fuses the formal pattern of a poem with its story. The painting therefore, as a work of art, represents an integration in terms of visual qualities that do not exist in its separate parts.

We may buttress this point by citing some experimental work by psychologists demonstrating how sensory contradictions are resolved in terms of sensory innovation. Some experimental work by Irving Rock and Charles S. Harris has clearly demonstrated some instances of the sensory resolutions of certain sensory contradictions. A subject who is required to doodle while wearing a right-left inverting prism soon feels his hand to be at the place where his eyes, wrongly, show it to be; asked to write down some letters and figures, he writes them right-left instead of left-right. A more far-reaching integration of conflicting clues, in terms of sensory innovation, has been found to underlie the way one finds one's way around while wearing inverting spectacles.

We are told that it is virtually impossible to get about while wearing inverting spectacles by following the instruction that what—in the case of right-left inversion—is seen on the right is actually on the left, while, conversely, those things seen on the left are actually on the right.

The Austrian psychologist, Heinrich Kottenhoff, informs us on this matter of getting about with inverting spectacles. He has demon-
strated that continued effort to move about while wearing inverting
spectacles produces a novel quality of feeling and action: by integrating
the "inverted" images to appropriate sensorimotor responses, the subject
again finds his way about. 115

This example and the one above plainly illustrate that conflicting
clues (images and sensorimotor responses) are subsidiarily re-integrated
to produce sensory innovation. It is in like manner that the viewing and
enjoying of a painting involves the subsidiary re-integration of its
conflicting clues of depth and flatness to produce the sensory innova-
tion of the total meaning of the painting. For further supportive
argumentation on this particular stance concerning what viewing and
enjoying painting involves, i.e. the "subsidiary awareness" of the frame
in the act of integrating the meaning of reality of the painting, the
reader may consult M. H. Pirenne's "Los Lois de L'optique et la liberte
de l'artiste," Journal de psychologie normale et pathologique 60 (1963):
151-66.

To conclude our discussion on painting we will develop a particular
point that simply follows from our own stance on the subject of under-
standing or enjoying painting. The reader will recall from our discussion
on poetry that a poem's formal structure or "frame" was held to isolate
the poetic experience from the events of our personal, everyday experiences.
Poetic expression is thus quite distinct and transcends everyday reality.
Similarly, the frame of a painting (canvas, brushstrokes, etc.) lends to
the painting a distinctive quality which distinguishes it from a natural
sight. No one for instance, usually regards the external objects
represented in a painting as though they were these actual objects. To
do so would be to reduce, say, a still life of Cézanne to almost abysmal
triviality. Thus artistic expression or the artistic reality of a paint-
ing does not and cannot dissolve into factual reality. It is a vision
re-created by and known only to one's imagination.

We set out to show in this chapter that the ideal of detached
knowledge was a misconception. To this end an act of knowing was recast,
following the work of Michael Polanyi, into the logic of gestalt and
thus all knowing became a form of integration. A hierchic schema of
categories or modes of knowing was then generated with a view to addressing
the major forms of integration current in modern society. Scientific
discovery represented the top form of integration and perception the
bottom or lowest form. In between these two were placed such forms of
integration as skillful knowing (knowledge of a skill) and connoisseurship.
These forms were held to provide examples of the "knowing how" and "knowing
what" modes of knowing.

Our analysis of these forms of integration revealed that knowing
is a process which in no way resembles an impersonal achievement of
detached objectivity. Rather it is rooted throughout in personal acts
of tacit integration. Knowing was seen to be essentially a process of
dwelling in particulars, subsidiary clues, to attend to a focal object
Primarily by means of an act of our imagination. It tantamounts to a
leap of a logical gap and is thus outside the reach of logically specific
formulation. Thus it was intimated that the depth "seen" through a
stereoscope was a new phenomenal experience, not "deducible" in its
unique phenomenological character from the clues that the process of tacit integration integrated, just as the heliocentric concept of the planets "seen" by Copernicus was a new conceptual experience "not deducible" from his available data.

Having thus achieved the understanding that knowing is a process of tacit integration we had thereby shown that the ideal of pure objectivity (in knowing) was a misconception. But we undertook to achieve something more by a digression as it were, into the realm of the representative arts.

The dominantly recurrent point of our examination of three of the major representative arts was that the appreciation of art is the result of a personal act of tacit integration. Though our particular discussion was confined to the representative arts it is our conviction that the appreciation of what is currently deemed visionary art is also a process of personal tacit integration. The reader may consult Meaning, Polanyi and Prosch, Chapter 7 in this regard. It became evident that the meanings created in art by the powerful imaginative integration of incompatibles were essentially facts of the imagination. Artistic meaning or artistic reality did not affirm any facts of our everyday experience. This of course, was certainly not to say that artistic meaning was any less significant.

Indeed what had now become additionally evident was that insofar as we could justly speak of the appreciation of art be it in drama, poetry, painting, etc., we are talking about a particular class of meanings (Polanyi has suggested the term "acceptances" to cover
these meanings in art as well as all other meanings created in the humanities) over which the meanings created in the sciences (Polanyi's general term for these is "observations")\textsuperscript{116} stood in no more favored relation to reality. At least they can stand in no more favored relation to reality strictly on a basis of the supposed presence or absence of personal participation and imagination in one rather than in the other. Thus has the scientific attitude been humbled and thus has our theory of knowing as a process essentially rooted in personal acts of tacit integration opened a way for us to vindicate primitive contemporary culture as a meaningful human response.
Chapter IV

The Case for Our Primitive Contemporaries—

Primitive Cultures Are Independent, Meaningful Human Responses

The reader will recall our reference in the first chapter to various forms of behavior witnessed in the Congo, and Oceania, which were typically esteemed in modern fashion to be "mythical" and "savage" behavior that would disappear as soon as these "tribes" were "civilized."

The primary intent of this chapter is to work for the achievement of an understanding of these, and in short, all the seemingly strange forms of behavior that are exhibited in primitive societies. For we feel that to understand them is to see them as human phenomena, phenomena of culture, creations of the human spirit, and not as pathological outbreaks of instinctual behavior, bestiality, or grossly aberrant childishness.

It is through this approach that we will build our case.

Some fifty years ago the Anglo-Polish anthropologist Bronislaw Malinowski wrote that:

\[\text{Studied alive, myth... is not an explanation in satisfaction of a scientific interest, but a narrative resurrection of a primeval reality, told in satisfaction of deep religious wants, moral cravings, social submissions, assertions, even practical requirements. Myth fulfills in primitive culture an indispensable function: it expresses, enhances, and codifies belief; it safeguards and enforces morality; it vouches for the efficiency of ritual and contains practical rules for the guidance of man. Myth is thus a vital ingredient of human civilisation; it is not an idle tale, but a hard-worked active force; it is not an}\]

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intellectual explanation or an artistic imagery, but a pragmatic charter of primitive faith and moral wisdom. These stories are to the natives a statement of a primeval, greater, and more relevant reality, but which the present life, fates and activities of mankind are determined, the knowledge of which supplies man with the motive for ritual and moral actions, as well as with indications as to how to perform them.

This statement of Malinowski in which he undertook to reveal the nature and function of myth in primitive societies today remains one of the marks of his greatness as a cultural anthropologist. We must quickly note his very important and particularly pertinent lead, namely, that in primitive societies myths constitute the paradigms for all significant human behavior. We know of no serious challenge to this particular cultural anthropological principle. Therefore our work in this chapter will begin with and center around a systematic investigation into the phenomenon of Myth. We shall focus our attention especially on archaic myths—myths that are not yet complicated and adulterated by literary elaboration—in order to see more clearly how myths, as such, function in the meaning-life of our primitive contemporaries. We shall use the works of Mircea Eliade to guide our description of archaic myths, the works of Ernst Cassirer and Lucien Levy-Bruhl for corroborative purposes, and that of Michael Polanyi for additional reference.

**Myth: Description and Function**

In his classic account of man's upright posture, E. W. Strauss writes that:

In upright posture, the immediate contact with things is loosened. . . . The horizon is widened, removed; the distance becomes momentous, of great import.
The direction upward against gravity, inscribes into space world-regions to which we attach values, such as those expressed by high and low, rise and decline, climbing and falling, superior and inferior, elevated and downcast. With this rendition Strauss is to be commended for what we consider to be a very neat demonstration of our upward--and outward--reaching imaginative capacities, and when Malinowski asserts that for the primitive, myth is a "narrative resurrection of a primeval, greater, and more relevant reality" we are led to propose that this "transcendence" is attained primarily through the use of the same mechanism (the imaginative capacity) of the primitive though clearly employed in a much more extensive manner. Therefore, to aid us in this particular inquiry we shall draw a parallel between the structure of myths and that of poetry, when both are understood as agencies for evoking the imagination. Concern about the errors to which the primitive becomes liable on account of his extensive imagi

In his Myth and Reality: World Perceptives, Mircea Eliade sharply distinguishes myth-making from other activities peculiar to the archaic mind (magic, superstition, etc.). Indeed an argument could be made for continuity between myth and magic, but even so continuity does not necessarily preclude fundamental distinctions. Therefore we can accept Eliade's initial division. But within the wider area of
myths he becomes even more selective focussing on the myth of creation. We shall follow him also in this restriction for this land of myth, more so than other myths such as those about superhuman heroes, embraces a cosmic view and the vitally important message of the origin. It is therefore the kind of myth that natives (our primitive contemporaries) carefully distinguish as "true stories" and as "absolutely real."

We begin by quoting Eliade:

"Myth narrates a sacred history, it relates an event that took place in primordial Time, the fabled time of the "beginnings." In other words, myth tells how, through the deeds of Supernatural Beings, a reality came into existence, be it the whole of reality, the Cosmos, or only a fragment of reality--an island, a species of plant, a particular kind of human behaviour, an institution. Myth, then, is always an account of a "creation;" it relates how something was produced, began to be."

We are further informed that for the primitive, myths of creation address all important, valuable matters of life, giving exemplary models for diet or marriage, work or education, art or wisdom, all of which (in the myth) were perfect at the beginning:

"Myths . . . narrate not only the origin of the World, of animals, of plants, and of man, but also all the primordial events in consequence of which man became what he is today--mortal, sexed, organized in a society, obliged to work in order to exist, if man exists, it is because Supernatural Beings exercised creative powers in the "beginning." But after the cosmogony and the creation of man other events occurred, and man as he is today is the direct result of those mythical events, he is constituted by those events. He is mortal because something happened in illo tempore."

We also now discover that these acts of creation were performed
during a time that is different from that in which our ordinary lives go by. This is the "sacred time" of mythical events, which, by Eliade's account; is "qualitively different from profane time, from the continuous and irreversible time of our everyday, desacralised existence," and which is renewed in rituals: "... ritual abolishes profane, chronological Time and recovers the sacred Time of myth. Man becomes contemporary with the explicits that the God's performed in illo tempore."

This entire description clearly generates some important observations concerning the recital of the myth of creation by the primitive. We note that what is involved is not a commemoration of mythical events, but a reiteration of them, a doing-again of what was done "once upon a time." The protagonists of the myth are made present. One becomes their contemporary. This in turn implies that one is no longer living in chronological time but in primordial time, the time when the event first took place:

He who recites or performs the origin myths is thereby steeped in the sacred atmosphere in which these miraculous events took place. The mythical time of origins is a "strong" time because it was transfigured by the active, creative presence of the Supernatural Beings. By reciting the myths one reconstitutes that fabulous time and hence in some sort becomes "contemporary" with the events described.

This distinction is confirmed by Cassirer:

The idea of mana, like the negatively corresponding idea of taboo, represents a sphere distinct from and opposed to daily life, of customary process ... They ... represent the characteristic accent which the magical-mythical consciousness places on objects (any objects).
This accent divides the whole of reality and action into a mythically significant and mythically irrelevant sphere, into what arouses mythical interest and what leaves it relatively indifferent . . .; the sacred does not simply repel it (the profane), but progressively permeates it.126

We proposed earlier on that the "transcendence" of mythical experience was primarily the achievement of the imaginative capacity. The grounds for this belief now begin to emerge. It now becomes clear that the recital of a myth is an experience that is detached from the daily concerns of the reciting person in the same way as the frame aspect of a work of art, we saw this in the previous chapter, detaches us from the concerns of the day. The signally important consequence of this point is that the creation of myth, and also mythical experience must be seen as forms of the integration of incompatibles. Polanyi confirms this when he declares that:

What happens when we accept a myth is what happens when we listen to great poetry or a great play or view a great painting: we are overcome by it and carried away into its own sphere, away from the sphere in which we lived a moment ago and to which we shall presently return.

Archaic myth is detached from the everyday world in the way a strict monotheism is—for example, that of the Old Testament. Our personal involvement in the world is with some parts of the world, while the conception of creation encompasses the whole world—the world that lies beyond or under or through all its parts. The one is concerned with things as parts, while the other ignores these matters and has the totality of all conceivable experiences as its object. Creation is the event by which all conceivable things are believed to have come into existence; and the creator or creators, are supernatural in the sense that they transcend all particular matters. In this sense, therefore, myths of creation are untranslatable into terms that apply to things within the world. Archaic myths and the invocation of archaic myths are therefore of an intrinsically detached nature. They are wholly other than actual human experience.127
We have already seen examples of the integration of incompatibles accomplished for us by the creative powers of the imagination, for instance the combination of depth and flatness in a painting, murders and nonmurders on the stage, etc. We are now being asked to understand that "mythical experience," this reality of being in the presence of agencies existing outside the world and before its existence, but nevertheless operative on and therefore in the world, is likewise an integration of incompatibles accomplished by the creative imagination. But even if this were understood we surely cannot also be asked to understand that the detachment of mythical experience is simply equivalent to the detachment experienced in the grasping or appreciation of artistic reality. The fact is that this is not the case, and in order to make this point very clear we shall now compare the way the mythical imagination detaches the mind from humdrum concerns with the way a work of art produces this effect.

Eliade declares that: "one 'lives' the myth, in the sense that one is seized by the sacred, exalting power of the events recollected."\textsuperscript{128} In this sense a myth may legitimately be said to resemble a great work of art about which the same thing, generally, has been and can be said. But as has already been pointed out, in primitive societies events of creation are believed to be "true" and "absolutely real." So that properly speaking a myth speaks of events "recollected," in their pure, original forms, and not of events "represented" in their artistic, mimetic forms. This distinction is seen to be the grounds for the first significant difference between the "detachment" of mythical experience and that of the appreciation of artistic expression.
A second significant difference emerges from the intimation of both Eliade and Cassirer that the rapture of a myth being sacred surpasses the rapture of art. They both speak (we have already heard Cassirer) of the contrast between myth and ordinary life as a contrast between the sacred and the profane. For this particular stance of Eliade's the reader may consult his *Images and Symbols* where we find him saying that:

...in reciting or listening to a myth, one resumes contact with the sacred and reality, and in so doing one transcends the profane condition, the "historical situation." 129

But these stances of Eliade's and Cassirer's still do not explain enough about the effectiveness of the myth in order that we might better understand how this state of transnatural enrapturement is achieved. To help us on this issue, therefore, we will now first examine the case of the way myth is in fact "lived" by archaic people.

In their work, the *Omaha Tribe*, the authors wrote that: When a child is born among the Osages, "a man who had talked with the gods" is summoned. When he reaches the new mother's house he recites the history of the creation of the Universe and the terrestrial animals to the newborn infant. Not until this has been done is the baby given the breast. Later, when it wants to drink water, the same man—or sometimes another—is called in again. Once again he recites the Creation, ending with the origin of Water. When the child is old enough to take solid food the man "who had talked with the gods" comes once more and again recites the Creation, this time also relating the origin of grains and other foods. 130

This is not a recently-made observation but it would indeed be difficult
to find a more eloquent example of the belief that each new birth represents a symbolic recapitulation of the cosmogony and of the tribe's mythical history. The object of this recapitulation is to introduce the newborn child ritually into the sacred reality of the World and culture, and thus to validate the new existence by announcing that it conforms with the mythical paradigms. But it is quite clear that this is not all. We see that the newborn child is also made to witness to a series of "beginnings." The point of this is that one cannot "begin" anything unless one knows its "origin," how it first came into being. Thus when the child is ready for the very first time to suckle or to drink water or to eat solid food, it is ritually projected into the time of "origin" when milk, water, and grains first appeared on earth.

The idea implicit in this belief of a "return to origin" is that it is the first manifestation of a thing that is significant and valid, not its successive epiphanies. Obviously the reciter of the myth is imitating the Supernatural Beings of mythical time as he conducts the ritual. Hence it might be thought that the whole mythical experience merely involves the imitation of the reciter. But to think this would be to totally disregard the essential role of the "Time of Origin," which, as we have seen, is considered a "strong" time precisely because it was in some sort the "receptacle" for a new creation. We are to understand that the time that has passed between the "origin" and the present moment is neither "strong" nor "significant" (except, of course, for the periods during which the primordial Time has been re-enacted); and for this reason it is neglected or an attempt is made to abolish it.131

In this example concerning the newborn child among the Osages
we have seen the case of a ritual in which the cosmogonic myths are recited for the benefit of an individual. For specific examples of the recitation of the cosmogonic and origin myths for the benefit of whole communities the reader may consult *The Myth of the Eternal Return*, Mircea Eliade, and *Notes on Myth and Ritual in Southeast Asia*, C. T. Bertling.

The process of initiating the young into the knowledge of archaic myths is another feature in the life of primitive society, that is extremely helpful to an understanding of the effectiveness of mythical experience and thus to an understanding of the achievement of a state of transnatural enrapturement. These ceremonies, well known as "rites de passage" involve much more than the mere passage from one age group to another as many often think. We are informed that:

The initiation goes on for years, and the revelations are of several orders. There is, to begin with, the first and most terrible revelation, that of the sacred as *tremendum*. The adolescent begins by being terrorized by supernatural reality of which he experiences, for the first time, the power, the autonomy, the incommensurability; and, following this encounter with the divine terror, the neophyte dies: he dies to childhood—that is, to ignorance and irresponsibility. This is why his family lament and weep for him: when he comes back from the forest he will be another; he will no longer be the child he was...; he will have undergone a series of initiatory ordeals which compel him to confront fear, suffering and torture, but which compel him above all to assume a new mode of being, that which is proper to an adult—namely, that which is conditioned by the almost simultaneous revelation of the sacred, of death and of sexuality.132

We must of course admit of the possibility that Eliade's points in this description may be somewhat overdrawn, but it is nevertheless clear that adulthood, for the primitive, is essentially a
case of the stamping on the mind as it were, the esoteric nature of archaic myths. We learn that this "knowledge" of archaic myths is esoteric

... not only because it is secret and is handed on during the course of an initiation but also because the "knowledge" is accompanied by a magico-religious power. For knowing the origin of an object, an animal, a plant, and so on is equivalent to acquiring a magical power over them by which they can be controlled, multiplied, or reproduced at will.133

(For some particularly suggestive examples see "Miracle Workers and Seers among the Cuna Indians," Erland Nordenskiöld, Revista del Instituto de Etnologia [Tacumian], vol. 11 (1932), p. 464.)

We ought now to have a better grasp on the detachment of the imaginative vision of archaic myths or of the nature of "mythical experience" and, consequently, a clearer understanding of the effectiveness of archaic myth. It is quite clear that the myth is not effective only metaphorically, as in the manner of a poetic image or a painting. But this statement covers up a crucial question that has not actually been addressed. Eliade has claimed that myths of creation are true and their substance real but what are we to understand by this? Consider the terrible, overpowering force of initiation ceremonies, can that be real and truly meaningful which requires such methods of terrorizing indoctrination? We must still deal, therefore, with this question of truth in archaic myths.

It is a matter of simple fact that archaic myths are part of a broader system of archaic beliefs that bristle with absurdities. In his classic work, How Natives Think, Lucian Lévy-Bruhl has argued that the representation of the world accepted by primitive peoples differs