VALUES VIA SCIENCE

by Ralph Wendell Burhoe

The prime purpose of this paper is to show that the sciences are fast becoming the most prolific as well as the most trustworthy revealers of human values. This is a notion quite contrary to the approximately two-century-old philosophical and generally widespread conviction that values cannot be derived from facts.

So alien from the convictions of scholarly leaders of recent and contemporary Western civilization is the notion that human values may ultimately be best understood as real or true through the channels of scientific knowing that we must preface this paper with a brief note to allay the fears of those who may suppose that this declaration of "values from the sciences" is as silly as proposing that sailing westward from Spain would bring us to the east, or as preposterous as proposing that men could really jump over the moon. But within the scientific community such wild statements have been continually made during the past few centuries, and the traditional philosophers have continually been confounded when a few years later they learned that the incredible proposals were accomplished facts of history.

While a brave and wise but tiny minority of the community of philosophers, theologians, and other scholars of the humanities has dared hold to naturalism in ethics, what I wish to bring forward in this paper is that recently it is the scientists themselves who are making vast pioneering advances in man's understanding of man that bid fair to fill with solid fact the imagined gulf separating the realm of fact from that of value.

In many cases the scientists who are showing how values are facts in natural history have either never heard of the philosophical objections or, if they have, often may not find them worthy of a response, any more than they would bother to respond to philosophical objections to

Ralph Wendell Burhoe is professor of theology and the sciences at Meadville Theological School and Director of the Center for Advanced Study in Theology and the Sciences in Chicago. This paper is a revision of one of the same title presented on December 30, 1968, at a symposium on Values and Metaphysics in Science sponsored by the Society for the Scientific Study of Religion at the annual meetings of the American Association for the Advancement of Science in Dallas.

sailing west to get east, or to the claims that it is preposterous that a man could in any real sense jump to the moon.

The great revelations and revolution in man's understanding of man are today coming primarily from the sciences, including the hard sciences such as nuclear physics and physical chemistry, whose basic concepts of nature as well as whose instruments of examination have begun to elucidate the mysteries and puzzles of the sciences of life and behavior and human society. These sciences are telling us, far more than can all the humanistic and religious literature to the present, not only about how, but also about why, a mother loves her child and why this behavior of love is a good or a positive value, and how and why the design and motivation for this behavior were selected in evolution and in what directions such behavioral traits may likely be selected to evolve under various trends and conditions in the future. The new revelations about motivations, desires, and values as facts come in strange new languages; in the language spelled out in the alphabet of the chemical molecule DNA, in which is written our genetic heritage; in the languages of the anatomy and biochemistry of the limbic system of the brain, and other languages explaining phenomena, of which we ordinarily are unaware or unconscious, underlying behavior, feeling, and thinking; in the languages of that new and far-reaching extension of history called evolution that ties the explanation of man's highest civilized behavior to historical sources going back to the state of the cosmos before the dawn of life; as well as in the languages of the psychosocial and behavioral sciences. Of course, the scientific revelations are not limited to values nor to the value of mother love, but they may and do deeply illumine human valuings ranging from various appetites, aggressions, fears, hates, loves, and passions to those of the drives for social approval, rational and aesthetic unity, societal stability, truth, and even for the mystical union with the ultimate whole. Light on these matters may be seen in hundreds of different scientific journals and sound information heard in the meetings of many scientific disciplines. Today we are possessed of a vastly more extended and deeper knowledge than ever before of human nature, its origin, its history, its relation to and potential destiny in the cosmos, and its basic values.

However, I do not wish to imply that scientists know all the facts about human values, nor even that they know very much about any other kinds of facts. The claims for the marvelous discoveries of the sciences are grand only relative to prior knowledge; and scientists are themselves often the most cautious and humble about how little they

know relative to what might be known. Among scientists a common type of disclaimer for possessing ultimate, final, or absolute truth about anything may be found in the following quotation from the philosopher of science, Karl Popper:

> The empirical basis of objective science has thus nothing "absolute" about it. Science does not rest upon rock-bottom. The bold structure of its theories rises, as it were, above a swamp. It is like a building erected on piles. The piles are driven down from above into the swamp, but not down to any natural or "given" base; and when we cease our attempts to drive our piles into a deeper layer, it is not because we have reached firm ground. We simply stop when we are satisfied that they are firm enough to carry the structure, at least for the time being.[1]

Nevertheless, the humble recognition of the poverty of human knowledge, even the best scientific knowledge, is no reason to abandon or discount the usefulness of such knowledge, whether it be knowledge about facts that do not greatly concern us or whether it be knowledge about facts that do greatly concern us, such as our basic values. The point is that scientific knowledge in today's world has given evidence that it is the firmest and most comprehensive structure of knowledge man has yet erected in the swamp of his empirical experience.

Two Ways Scientists Tackle Philosophical Problems

Many, perhaps most, of the scientists who are revealing human values walk across the alleged gulf between the allegedly separate islands of facts and values as if they were walking on solid ground. They don't seem to be aware of the allegation—nor of the allegators—and they do not fall into any gulf to drown. But some scientists, more often those whose education or associates have exposed them to the prevailing traditions of the philosophers and humanistic scholars, have begun to take some pains to show why the gulf between facts and values originated in men's thinking and why the gulf is an illusion in today's light.

A pioneer among these was a leader in American cultural anthropology, Clyde Kluckhohn, who in 1958 shortly before his death carefully prepared a paper on "The Scientific Study of Values and Contemporary Civilization"[2] for delivery to the highly distinguished gathering of scientists and scholars known as the American Philosophical Society, founded in Philadelphia by Benjamin Franklin—a society named two centuries ago when the term "philosophical" meant more nearly what we now mean by "scientific." This classic paper, in which Kluckhohn summarized years of his study of the problem of values, did not overlook the views of the humanistic scholars and philoso-

phers, but recognized them as an evil: "It is unfortunate that in the Western world during the last century and a half a divorce between nature (as described and interpreted by science) and values has generally been accepted" (p. 235). In his explanation of the divorce, he said that it "was, in effect, a temporary resolution of the so-called 'conflict between science and religion' which plagued the nineteenth century" (p. 235). He pointed out the dangers to civilization spawned by "uncertainty about and conflict over values": "the result is personal and social disorganization, individual unhappiness, and human misery on a vast scale, irrational political movements which both manifest and add to these disorders" (p. 231). "The current struggle in the world [between communists and the West] is basically a war of ideas, of value systems" (p. 232) and "the Achilles heel of the West is in the realm of ideas and values" (p. 233). "We lack a system of general ideas and values to give meaning to human life in the mid-twentieth century" (p. 233).

Kluckhohn not only recognized the personal and social disorganization caused by the divorce between values and scientific facts, but he said, "This is my thesis—we can bring scientific method and outlook to bear upon value problems" (p. 233). "Values are cultural and psychological facts of a certain type which can be described as objectively as other types of cultural and psychological facts" (p. 237). "The common language of an optimal way of life must take account of two scientifically obtainable bodies of knowledge: the needs, potentialities, and limitations of the human animal; the physical world that is the context of human existence. [F. S. C.] Northrop has argued that the culture of any people rests, in the last analysis, upon that people's philosophy of nature" (p. 233).

Kluckhohn not only asserts the relevance of the sciences for resolving our problems of value, but suggests that they may be the ground for a better religion and ethics: "the human sciences in the West are approaching the creation of a picture of human nature, its capacities and limitations, which could be one foundation of a way of life less distorting, less tension-ridden than any heretofore imagined. The Soviet Union is far behind in this respect" (p. 234). He knew about the ideas prevalent in Soviet society from his chairmanship of the Harvard center for the study of it.

I share with Kluckhohn this conviction concerning our need for a better source of value standards and commitments, and that a reformulation of values in the light of the contemporary sciences may be man's best salvation.

But Kluckhohn is not alone. Many scientists of many kinds in the physical, biological, and sociopsychological fields have begun to say in various ways how the sciences are relevant and even necessary for understanding and developing human values, even noninstrumental or "ultimate" values. One could mention among numerous other major scientific contributors to our understanding of human values during the past couple of decades two of Kluckhohn's Harvard colleagues: first, Richard von Mises, an applied mathematician primarily in aeronautical engineering and secondarily in philosophy of science, whose scientifically based analysis or philosophy of human values I shall quote later; and, second, B. F. Skinner, the behaviorist psychologist.

Skinner's text, *Science and Human Behavior*,[3] provides a scientific analysis of human behavior which leads directly to statements about human value as a part of science. He says (p. 427): "It is not true that statements containing 'should' or 'ought' have no place in scientific discourse. There is at least one use for which an acceptable translation can be made. A sentence beginning 'You ought' is often a prediction of reinforcing consequences. 'You ought to take an umbrella' may be taken to mean, 'You will be reinforced for taking an umbrella.' A more explicit translation would contain at least three statements: (1) Keeping dry is reinforcing to you; (2) carrying an umbrella keeps you dry in the rain; and (3) it is going to rain. All these statements are properly within the realm of science." He goes on to show how the same interpretation is possible when the reinforcing consequences are of an ethical nature. But he is quite aware that the crucial issue concerning value hinges not so much upon consequences of cultural practices that are immediately understood (what the philosophers often call 'instrumental' values) as "upon another meaning of the word 'ought' in which a more remote consequence is implied. Is there a scientific parallel for this kind of value?" (p. 430).

In his scientific description of the more fundamental values underlying the instrumental values, Skinner notes three kinds of evolution or genesis of human behavior, one of which is the 'operant reinforcement' or psychological conditioning in the scientific development of which he has been a pioneer. "We have seen that in certain respects operant reinforcement resembles the natural selction of evolutionary theory. Just as genetic characteristics which arise as mutations are selected or discarded by their consequences, so novel forms of behavior are selected or discarded through reinforcement. There is still a third kind of selection which applies to cultural practices. A group adopts a given practice [either by design or accident]. . . . As a characteristic of the

social environment this practice modifies the behavior of members of the group. The resulting behavior may affect the success of the group in competition with other groups or with the nonsocial environment. Cultural practices which are advantageous will tend to be characteristic of the groups which survive and which therefore perpetuate those practices. Some cultural practices may therefore be said to have survival value, while others are lethal in the genetic sense" (p. 430).

Skinner summarizes the production of values in human individuals as the result of these three intertwined strands of evolutionary or historical processes for selecting or reinforcing some kinds of behavior as viable and obliterating other patterns as not viable under the circumstances. "The 'value' which the individual appears to have chosen with respect to his own future is therefore nothing more than that condition which operated selectively in creating and perpetuating the behavior which now seems to exemplify such a choice. An individual does not choose to live or die; he behaves in ways which work toward his survival or death. Behavior usually leads to survival because the behaving individual has been selected by survival in the process of evolution" (p. 433).

Eventually, the survival of the group is the consequent event which selects and establishes the behavior patterns that are viable and hence those that become the existing values. Skinner points out that our longest-range values are those that will be selected by the environmental situations of the future. Even for scientists, he suggests, this is too vast a problem for any fully rational solution, and any would-be survivors, in cultural evolution and personal development as well as in organic evolution, are forced to follow the path of evolutionary experience in hedging against future contingencies by random variations, many trials and errors ("guessing" rather than "value judgment" [p. 436]), and a readiness to adapt to changing conditions of whatever may be required for the most successful life. Of course, those who do not happen to choose one of the paths defined as viable by the environmental situation are not really forced to do so; they simply pass away; and thus the survival of those individuals and societies that have more adequately met the requirements of the environment makes it seem as though the choice is forced. This is a significant scientific datum for those who would write on such theological or philosophical problems as freedom and omnipotence.

In designing or developing a better society, Skinner suggests, the question " 'Who *should* control?' is a spurious question. . . . If we look to the long-term effect upon the group, the question becomes, 'Who

should control if the culture is to survive?' But this is equivalent to asking, 'Who *will* control in the group which does survive? . . . In the long run, . . . the most effective control from the point of view of survival will probably be based upon the most reliable estimates of the survival value of cultural practices. Since a science of behavior is concerned with demonstrating the consequences of cultural practices, we have some reason for believing that such a science will be an essential mark of the culture or cultures which survive. The current culture which, on this score alone, is most likely to survive is, therefore, that in which the methods of science are most effectively applied to the problems of human behavior" (p. 446). Earlier (p. 435), Skinner had suggested that "a rigorous science of behavior . . . leads us to recognize survival as a criterion in evaluating a controlling practice." What distinction is there between a controlling practice and a supreme value?

In addition to Kluckhohn and Skinner, one can readily list a dozen full-length books written by other scientists[4] during the past decade or so, devoted largely to scientifically based accounts of values explicitly. There must be many dozen such books altogether, but multilegion is the number of scientific books in which human values are implicit, which deal with the motivation and goals of behavior without the authors ever mentioning or even being acquainted with philosophical terms like "values," just as most modern developers of and workers in mechanics probably never knew Aristotle's *Physics*. The puzzles that led philosophers to divide values from facts are simply bypassed since they may not arise within conceptual systems developed by the sciences. A well-known and readily understandable example is how a picture of a ball-shaped earth, replacing the picture of a table-flat earth, can eliminate any puzzle in the statement that we can reach the east by sailing to the west. I suggest that the alleged separation of facts from values will similarly vanish, and many scientists already are making progress toward revealing values without even being aware of the philosophical paradoxes based on an earlier world view or earlier view of human nature which a Kluckhohn or Skinner may try to explain.

On Final Values or Ends

In talking about human values revealed by the sciences and derived from facts, I am referring not only to what the philosophers call "instrumental values," for generally even humanists do not doubt that the sciences provide powerful means for attaining certain ends or goals, and hence provide at least subsidiary or instrumental values toward those ends; but I am referring also to what the philosophers imply by

the term "ends," or ultimate goals that some call "intrinisc value," or what is "good in itself." Since it is final or ultimate values that are important for this paper, I shall not more than mention what everyone already recognizes: the tremendous contributions of the sciences to instrumental values—to the ways or means to attain such generally accepted ends as health, wealth, security, freedom, happiness, good, beauty, truth, etc.

However, it is precisely with these ends, final goals, or intrinisc values that the bulk of philosophers and other scholars have been saying that the sciences are impotent to deal. We may be helped to overcome this barrier to a scientific and naturalistic approach to intrinsic human values if we recognize the fact that scientists have themselves begun to deal with ends and goals rather extensively—especially in the past two decades with the science of cybernetics[5] and for even longer in such studies as those of homeostasis.[6] We can quite readily talk scientifically about intrinsic as well as instrumental values and use the sciences to confirm, correct, or extend our understanding and even our feeling and behavior relative to values simply by joining the philosophers in defining values as the goals or ends we seek, and then proceed to find out the facts about our goal seeking by keeping our eyes fastened to the "operational" or scientific definition implied in the words "goals we seek." It will turn out that any distinction between "goals we already do seek" and "goals we ought instead to seek" poses no serious problem for scientific discourse.

It is the very business of the sciences to find or reveal the goals (or, in more usual scientific language, the forces) which motivate or explain or account for the behavior of systems of any kind—animate or inanimate. If we talk about the system of "rain falling on a mountain slope," the scientist explains the directions of its flow or its goals by the intrinsic properties of mass, gravitational acceleration, the characteristics of the mountain slope, etc., so that we get an account not only of the present flow of the water in streams down the slopes to the ocean but also an explanation of the evolution in geologic time of the stream beds, waterfalls, and land formations. If we talk about the system of a seed in the soil, the scientist explains its tendencies or the goals of its behavior by the intrinsic dynamics of the genetic information encoded in the DNA molecules of its chromosomes interacting with the various chemical structures and energy supplies of the immediate environment, so that we understand not only why a stalk shoots up against gravity and toward the light, and many other activities of the individual plant, but also the dynamics and goals involved

in and evolved for that species of plant in the long evolution under the selection of successive environmental niches in geologic time. If we talk about the system of man and his ecological niche, the scientist explains man's tendencies or goals of his behavior similarly in terms of structures which are ultimately analyzable as forces and dynamisms intrinsic to his nature and to the nature of the environing world, including the nature of the goals involved and evolved in his individual, cultural, and species history over tens, thousands, or millions of years.

"Intrinsic" in the term "intrinsic values" can have connotations beyond those of "inherent to" or "existing within" the systems under consideration. We should perhaps here note that the system under consideration must involve a valuer as well as a thing or state that is valued, since it is logically meaningless to talk about a value apart from a valuer or some scale of values. Hence, an intrinsic value must be one which inheres only in the relationship between the object or person which is the valuer and the object or state which is valued. Some have mistakenly supposed that a value inheres only in the valuer, subjectively. But the process of valuing requires a relationship between two entities: the valuer and the thing valued. Others have mistakenly supposed that a value inheres in the object that some valuer values. But valuers can be and have been devised, in both prehuman and posthuman nature, that rate or value identical objects or states quite differently, even oppositely.

Besides connoting inherence in a system, an intrinsic value often connotes a value which is ultimate or final in a sequence or hierarchy of analysis or statements about values. Thus the most intrinsic statement about values in the following sequence is the last or ultimate: (1) an automobile would be good now because it would get my injured boy to the hospital faster; (2) it would be good to get him to the hospital because the surgeon and the operating-room equipment that he needs for the repair of his cuts are there; and (3) the sooner his cuts are repaired, the more chance he has to remain alive. It is my boy's life that is perhaps the last or ultimate statement that I can make in a hierarchy of steps of logical analysis of values in this situation. The automobile and the surgeon are values instrumental to providing me with a further value which I cannot or do not analyze further, if it represents the end of my capacity to analyze goals in my relation to my boy. Conscious analysis or explanation is stopped, ended, and ultimate when conscious information or imagination for further analysis or explanation ends. The problem of "ultimate" is the same whether we are making statements about values and "oughts" or about "ises" such as

what is under the flea on which stands the mouse on which stands the elephant on which stands the earth. The human mind or its practical capacity to analyze may come to an end, but experience makes us skeptical that we have in reality reached the end of the matter.

It should also be noted that in knowing or making statements about intrinsic or ultimate values it is as impossible as in any scientific knowing to be sure we have grasped any ultimate or absolute knowledge. It is as was indicated in my earlier quotation from Popper about scientific knowledge—we never can be sure we have come to any ultimate or absolute rock bottom in our analysis. The human predicament is as theologians have long recognized: that finite man can only dimly discern the character of the infinite. In Popper's language we are only allowed to build larger and more adequate logical structures about "what is truly the nature of what we see" or "what we truly value ultimately"; but it is not safe to be more than tentative, for the history of human knowing shows that no one possesses ultimate truth about either what we see or what we want.

The structures and patterns of *knowing* seem to evolve to new and higher or more comprehensive and viable forms just as do the structures and patterns of living. The new sciences have revealed how information and life are very closely related as manifestations of negative entropy.[7] And, as we shall hope to make clear, valuing is a kind of knowledge or information, a kind of fact, intrinsic to the process of living, and hence values are inherently relative and temporary to a stage of life or evolution—not final nor absolute. This leaves us in a situation where it would be rash to claim an ultimacy or an intrinsic nature for any statable value, for we may later discover that what at first seemed inherently and ultimately valuable was only instrumental for some logically and factually higher or more primary value that we had not yet imagined or recognized.

Scientific Approaches to Facts about Intrinsic Values

For the scientist, values, defined as goals of a system, are clearly facts, and not a realm of discourse apart from facts. If the system is a nonbiological thermostatic mechanism such as regulates the flow of heat in your house, the goal is to maintain a thermometer within a given range of temperature close to the norm or goal for which the system is set, regardless of whether events outside the system bring cold or hot air toward the thermometer. Norbert Wiener[8] about two decades ago got us to use the word "cybernetics" when talking about goal-directed systems, and he has been one of those who has shown how goal-

directed systems are supplied intrinsically or internally with norms, as well as with the means for reducing any departures from those norms by negative feedbacks into the system, which inform it of its departure from its norm and which operate mechanisms to bring it back closer to its norm. In such systems a scientist can readily talk about "norms" and "oughts." If the thermometer goes down, the oil heater ought to be turned on, and the thermostatic mechanism translates this "ought" into an "is." Moreover, the scientist can state the facts that explain the "ought" and the mechanism by which it is translated to an "is."

It is well known that animals and men are complicated networks of such cybernetic systems with in-built or intrinsic goals or norms. In the nineteenth century the French physiologist Claude Bernard pointed out this goal-seeking or norm-maintaining machinery of living organisms; and in the twentieth century the Harvard physiologist Walter B. Cannon[9] elaborated this analysis of organic goal maintenance which is commonly referred to today by his term "homeostasis." Organisms and their behavior are thus understood as a complex system of integrated cybernetic mechanisms, the net or intergrated totality of whose goals can be observed to be maintenance and advancement of life. A classic paper by James G. Miller gives a useful summary of the recent developments for understanding life and its values in terms of cybernetic systems:

> Concrete, "real," or veridical systems, living or nonliving, are continuous bounded regions in physical space-time containing a nonrandom accumulation of matter and energy organized into a set of interrelated subsystems. Both their elements and their relationships are concrete, in physical space-time, and are empirically discovered by operations available to the general scientific community, rather than set conceptually by a single scientist. Such systems maintain multiple variables within a stability range. This steady state is maintained despite wide environmental fluctuations by negative feedback processes [p. 108].
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> All living systems tend to maintain steady states of many variables, by negative feedback processes controlling subsystems which distribute energy or matter to keep an orderly balance. Not only are subsystems usually kept in equilibrium, but systems also ordinarily maintain steady states with their environments or suprasystems, which have outputs to the systems and inputs from them. This prevents variation in the environment from destroying systems. Those functions of subsystems which maintain such steady states are called *adjustment processes.*
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> There is a *range of stability* for each of numerous variables in all living systems. It is that range within which the rate of corrections of deviations is minimal or zero, and beyond which correction does occur. Inputs of either energy or information which, by lack or excess of some characteristic, force

the variables beyond the range of stability constitute *stresses* and produce *strains* within the system. Strains may or may not be capable of being reduced, depending upon the adjustment resources of the system. The totality of the strains within a system resulting from genetic input and variations in the input from its environment is often referred to as its values or utilities. The relative urgency of reducing each of these specific strains represents its hierarchy of values [p. 115].[10]

Here is a scientific formulation of values including intrinsic values, as a category of facts. Values are the factual or real goals of living systems—goals which basically are norms (ranges of stability or the central tendencies thereof) within whose limits the various elements of living systems must be maintained if the systems are to remain living or in being. Each instrumental value is a dynamic subsystem of a living system, involving forces and displacements that reflect how far the system, under stress, has deviated from its norms (negative feedbacks, strains) and forces that institute counter actions to bring the system back to its viable norm (adjustment processes). We shall later see that tentative, symbolic, or verbal representations of goals or norms (sometimes called ideals) fall within this definition of ideals as factual goal-directing or cybernetic or homeostatic processes.

It should be noted that Miller defines value in a slightly different way from one I have chosen. For him values are the *strains toward the goal* or norm, while I have called values the norm or *goal itself*. Very often in machines and organisms there is no appreciable departure from and hence no strain toward, the norm, and hence no "value" in his definition. But, since the norm or goal is an essential characteristic intrinsically necessary for the system, even when the norm's maintenance is not threatened or strained, I wish to include these "latent" strains (or the implicit goals and the corresponding latent norms of the homeostatic mechanisms) as a part of what I refer to as "values." There is no doubt that Miller's definition would more directly correspond with "felt values" or "observed values" since men do not feel or move toward a value or goal unless the strain does exist. But his formulation leaves as only potential all those goals which are implicit and intrinsic in the cybernetic system even when no stress to evoke the strain and negative feedback to correct it has been evoked by circumstances presently prevailing. I prefer to call thirst or the need for water a value even when I am not thirsty.

The systems that Miller describes and analyzes include the systems of whole human societies as well as of individual human organisms. For all living systems there are goals or norms whose quest or main-

tenance is intrinsically necessary if the system is to exist at all. In societies of interacting individuals and in a world of interacting societies there are negative feedback processes which, if they are not already adequate to maintain the system in being, must be revised until they do, or else the system will disintegrate and no longer exist.

There are thus two levels of circumstances that define what a system *ought* to do. The first is the already established and inherited wisdom intrinsic to the system which is a *fact* embodying pretested goals or norms, any departure from which *ought* to be corrected and *is* corrected by the very design of the cybernetic or homeostatic mechanism or process. The second is the as yet to be found homeostatic process whose goals or norms may not yet even be established, and hitherto have not been needed for the viability of the living system. It is a most interesting *fact* of the evolutionary history of living systems that one of their prime characteristics is the metavalue or supergoal of reaching for new goals. The variability intrinsic to the cosmos and ingrained into the genetic and behavioral characteristics of living organisms may be said to be a process or mechanism for insuring the search for alternative or better goals or values of living systems. Thus, human societies and culture in their rapid evolution ever continue to be involved in the search for new and better goals or norms. We shall take up later what it is that establishes or judges what is a *better* value, what is the ultimate sanction of all values.

This second level of circumstances defining what ought to be done or what is good might be called *potential* good or *potential* norms that are yet to be established as practical operating norms or goals if the living system is to become better adapted to wider opportunities for life. The story of organic evolution, including the story being recently unfolded concerning the step from nonliving chemical systems to living cells, attests to the fact that such potential values or norms can be discovered and incarnated even in the blind and unconscious stages of evolution. Since about a million years ago when men have become more fully conscious and more fully able to project in their imaginations the dreams or blueprints of new and better goals, there arose in the evolution of life a new mechanism for more rapidly finding new and higher values. The stuff of dreams and blueprints has become an agent in evolutionary advance. Talk and paper and pencil markings can adumbrate and help bring about new cybernetic or goal-attaining mechanisms. When such symbolic images of what ought to be are accepted by a sufficient body of the population and acted on by them, the images (talk or paper and pencil markings) are already a part of a

tangible and effective cybernetic or goal-governing system that operates to enhance life. Certain words like "love" or "life, liberty, and the pursuit of happiness" become symbols effectively operative in such social cybernetic mechanisms, as is attested by the disasters to a society resultant when there is an influx of strangers who do not know and do not behave in accord with the usual meaning of the symbols.

No doubt that for philosophers the term "values" has often been limited primarily to areas just described, those which pertain to potential norms or to symbolic representations or formulations of normative systems. But the sciences, including cybernetics and evolution, give us a larger picture of the nature of values embedded in the full spectrum of the realities of life ranging around a spiral from atoms to molecules, to amoebas, to mammals, to men, to symbol systems, and back to symbol systems of atoms and men again.

That values defined as goals are facts that can be discerned and described in terms of physical, biochemical, and other sciences should be clear to anyone who reads a paper like Miller's—or many others of related character describing the homeostatic mechanisms in individual men and societies (suprasystems to individual organisms) as well as in less-complicated organisms and machines. The two-century-old supposition that tended for many to separate values from the realm of fact and reality will probably die away naturally without too much fight, just as did the supposition of the flat earth that separated east from west.

But there are many intriguing and sometimes frustrating problems pertaining to an understanding of human values that will plague us until we get the new concepts more clearly established in our culture, and I wish to look at a few of them here as a way of developing further a scientific approach to values.

Why Values Are Not Irrational, Nonsensical Grunts

It is difficult to account for the tragic separation of values from the realm of rational and scientifically grounded discourse. Kluckhohn may have been right in ascribing the allocation of the territory of fact to science and of values to religion to "a temporary resolution of the so-called 'conflict between science and religion' which plagued the nineteenth century. . . . In substance, the scientists were offered a compromise: 'You may investigate the non-human world of nature to your heart's content so long as you admit that problems of morality, of ultimate values, are, in principle, *ultra vires scientiae*' "[11] (pp. 235–36). But there would seem to be a number of other factors involved. One wonders why discourse about values shifted at some point and seemed

to jump from the assertion by philosophers that values were a part of the logically sharp, rational apparatus of metaphysics to the assertion that values are connected with irrational grunts, shouts, cries, and other spontaneous and unaccountable phenomena.

Was this possibly connected with the bad fall in the reputation of "metaphysics" even among philosophers? In the nineteenth and early twentieth century the Positivists, who sought to derive a philosophy from the sciences, largely from physics, did ideological battle with some of the more traditional philosophers and metaphysicians. When the metaphysicians sought to exclude their truth from interference from the empirical sciences by asserting that the truth of their statements was intrinsic to the premises and logic of the statements and this truth could not be affected by any empirical, observational, or scientific sense data, some of the Positivists rejoined by labeling metaphysics as non-sense statements. Perhaps this was so crippling a wound to metaphysics that some philosophers turned to ape one aspect of the more scientific Positivists in attempting more carefully to analyze the meaning of words or language. Under this school of philosophy, it seemed reasonable to disregard any claim that value statements were absolutes of metaphysical truth. But value statements were not found to be capable of verification like statements about the earth and chemical reactions. Two men could obviously hold opposite views about what was good or right, and the grounds for saying something was good were more a matter of private feeling than of public fact. The good must be a sort of irrational accident of the individual and the moment, an emotive response not susceptible, like scientific statements, to some rather general and common validation.

The Positivists were more likely to be oriented to the physical rather than the life sciences, and perhaps the philosophers who reacted to them were too. Anyway, one would suppose that if there had been good acquaintance with the life sciences among them, there would have been fewer who concluded that grunts and groans were either nonfactual or irrational. Of course, to lead them astray there were prevalent from early in this century the widespread but superficial conclusions from the data of cultural anthropology that because there were different norms in different cultures there was no common underlying rationale for human values.

It might be helpful here to recognize that scientific statements about anything (including values) involve elements both of logical symbol manipulation and of nonverbal, nonsymbolic, empirical data recognition. To become scientific, statements are required among other things

to have some linkage or tie to a nonverbal experience, some experience more elemental and better tested than other word structures for their correspondence to the realities and needs involved in human life, such as a tie to a nonverbal, nonsymbolic thing that can be defined by such operations as touching, pointing, seeing, hearing, and so on. Such ties to nonverbal sensations or perceptions have been called operational definitions or empirical connections of words.

At the same time, scientific statements are more than words tied to pre- or non-verbal experiences. If all that scientific statements did were to codify in words the things or events of nonverbal experience, then the scientific statements would be nothing but a useless reflection of the mess of incomprehensible data we already have experienced. But, in general, the more advanced the science the more its statements succeed in reducing ever larger numbers of nonverbal phenomena or data to relatively simple logical or mathematical variations on a few verbal or symbolic models or forms. In this way a previously incomprehensible complex of phenomena can be comprehended, or reduced to order and meaning. As many have pointed out, science is simply a more powerful extension of the functions of language in categorizing phenomena in logically manipulable or calculable symbolic forms.

Scientific statements about values must be, as any linguistic statements may be, inclusive of both a system or model of rational or logical symbols together with operational ties of the symbols to empirical, "real," nonverbal data. The empirical data about established value systems involve norms or goals, and the scientific statements about existing values or the scientific hypotheses about potential, new, and better values may state the norms or goals and even give the reasons why. The statements about values may be validated or invalidated, as are any other scientific statements, by empirical tests of whether the goals exist, etc. At the same time these statements may be abstract generalizations and apply across cultures and over long ranges of time. Groans and smiles can clearly be stated as facts that can be generalized to "universal" principles in scientific theories.

Although a groan or a smile can be put on as an act or symbol of a nonreal but pretended condition of a person (and hence not refer to a reality it pretends to refer to), it also can be the "natural" byproduct of a biologically grounded goal-seeking mechanism. It can be scientifically validated as a value and its rank in a hierarchy of values ascertained. The groan may be a genuine protoverbal communication of a reality that is indeed evil or bad (a value in the negative, i.e., something it is good to avoid); and a smile may be a part of an empirically

discoverable cybernetic biological mechanism that represents a positive value or goal, a good being sought. Even pretended groans, however, now may be psychologically explicable as part of a value or goal-seeking behavior that is a fact.

Various scientific approaches to the study of life and human life have recently been making it very clear that the whole realm of what men have in the past been calling values, good and evil, symbolized by such empirical behaviors as smiles and groans, are indeed connectible with the kind of goal-seeking, homeostatic, biological mechanisms that were referred to above in the quotation from Miller's "Organization of Life."[12] And, as he indicated, such systems are "concrete," "real," "veridical," "empirically discovered," "rather than set conceptually." Values, including the expressions of value feelings (even feelings that misrepresent the real condition of the organism) can be studied and are being studied scientifically; and the validity of the value and value feeling for the person or for the society may be and often is being corrected by better or more "factual" information about these values, goals, or norms, by information about the individual, the society, or its environment, and by consequent understanding and technology for converting men to better ways of life at all levels of the human value-hierarchy from the trivially instrumental to the supreme concern.

The Genesis of Values

Among the facts about values that the sciences have been uncovering is something of an extension of their history beyond the few hundred or few thousand years of our local culture. The goals and aversions of men have multiple sources, and the norms are set and governed by multiple sets of mechanisms. I have previously written a paper which outlined five stages in the evolution of human values.[13] It turns out that there is a very ancient history of billions of years in evolutionary time back to what I labeled as a primary system for codification, regulation, and discovery of norms or goals for living systems which still plays a dominant role in the highest and most recent human value systems. According to recent scientific evidence, this codification began about a billion years ago, when variant forms of the chemical molecules which we now call DNA were used as the letters of its alphabet. The DNA is the blueprint or model on the basis of which other chemicals are directed in making the proper assembly of millions and billions of other molecules to form a living organism.

On the order of a hundred million years ago, the DNA code of

values began to participate in the development and to codify the blueprint of a system that would be an auxiliary and partially independent instrument that would supplement the DNA code and extend it in coding, regulating, and discovering values: the nervous system of animals. On the order of a million years ago the nervous system and genetic code jointly began to participate in the elaboration of a partially independent instrument that would supplement them in coding, regulating, and discovering values: cultural codes or traditions remembered in the behavioral patterns and artifacts of a society. Some ten thousand years ago, the previously emerged sources of values participated in the development of a new auxiliary for codifying, regulating, and discovering values by evolving language to lasting written form and rational calculation. A fifth stage for coding, regulating, and discovering values for life emerged only in the past few hundred years: science. It is interesting to see the time scale of these five emerged stages plotted on a logarithmic scale to form a straight line, a fact which is suggestive for an interpretation of history. This is represented in the accompanying table.

Approx. No. of Years Ago It Began	Instrument for Codifying, Regulating, and Generating Values
10^{10}	DNA code of genotype
10^{8}	Nervous system
10^{6}	Culture of Homo
10^{4}	Written language and logic
10^{2}	Science

It is instructive to see how these different mechanisms are hierarchically dependent and integrated around common functions, and we can do this by using a rather mundane value related to diet in the eating of pork, for instance.

Pork may taste good, as judged by the biologically native (genetically provided) judgment of value—the pleasure or offense of the sense of taste and smell. A cultural taboo or religious sanction against eating pork, even when pork tastes and smells good, may provide a higher-level value judgment. But scientific information about trichinosis refines this further to provide norms for under just what conditions there are real dangers to life in eating pork. The more primitively acquired traditional cultural taboos against eating pork were not so fully realistic as the scientific warnings, and were unnecessarily restrictive economically as well as gustatorially.

In this case concerning the eating of pork, we find an illustration of

the common function of both cultural experience (formulated in an unreasoned or not fully reasoned tradition) and scientific discovery in finding and transmitting a value, norm, or goal higher than the value intrinsic to the organic mechanisms. Here, the organic norms were not adequately informed through their genetic informational heritage of the perils of trichinosis via pork. Biologically, things that are bad for you signal their values by offensive rather than pleasant odors, tastes, touches, etc. It should be noted that each newly emerged mechanism for coding, regulating, and discovering values cannot exist or function apart from its base or source in the prior stages.

This capacity of the sciences to distinguish good from bad is not limited to "dietary" values, but can be applied to all kinds of social and spiritual values as well. It would be fun also to explore the distinct and useful roles of the nervous system or brain and of written and rational symbols of language in the interweaving of the total fabric of our code of valuation concerning pork and the way in which that code was generated and is maintained.

The Brain as the Focal Instrument of Values

The sanctioning, enforcing, or maintaining of values within ranges set for their norms is the primary function and problem of every living system. When danger thresholds from certain measurable norms are exceeded, the death of the system takes place. In the biological organism there are countless norms, such as of body temperature, ion concentration, energy supply, structural configurations, and so on, which if exceeded or fallen below result in death. The same is true for norms in social systems: such as in homicide rates, birth rates, population concentration, economic production rates and distribution patterns, or multitudinous norms for fulfilling various social roles or functions (mores and morals) by individuals of the population. If the measurable and sometimes calculable lethal thresholds are exceeded, the social system is destroyed.

As Miller points out, the living system, individual or societal, is a complex network of interlocked and hierarchically arranged negative feedback mechanisms which are the internal motivations for sanctions or regulators of the norms. Well-known ones are involved in the maintenance of normal body temperature, such as sweating to cool off when overheated, or changed blood circulation and metabolism or huddling in a protected place to warm up when it gets too cool. The underlying mechanisms for performing all the sensing of temperature and regulation of cooling and warming behaviors are biological organs built

of ordinary chemicals according to principles of functioning generally understood by modern science, but on the basis of specific information or instructions laid out in the genotypic code of DNA molecules of which we are only beginning to be conscious late in this century. Most of the temperature-regulating activities themselves are usually not matters of which we are conscious, although when it comes to such behaviors as finding some warm clothes, blankets, or a spot in the sun, we are aware of what we want and participate consciously in the search for a solution to our problem. But the underlying mechanisms of all this behavior, including the awareness of being cold and seeing a blanket and moving to pick it up, are all products of orderly cybernetic negative feedback circuits operating in the communications and computing phases of the central nervous system, in various gland and muscle systems, etc. Astronomical numbers of events at the molecular and cellular levels—far more than we could observe or count in a lifetime—are operating in an integrated manner every minute to bring about our bodily temperature equilibrium at its norm. The horizons of our awareness or field of observation or consciousness are trivial compared with even one simple value of our lives—and there are multitudes of values or norms that are vital for our remaining in being.

This does not mean that consciousness or awareness of certain generalized conditions of our own nature and of the world about us plays no significant role in formulating human values and in bringing the goals formulated into being. But it does mean that the sciences are adding to what long ago various religions began to accumulate for man's contemplation, namely, that man exists by a grace of orderly, life-giving construction that so far exceeds his own consciousness and power that he must be humble about his powers to construct a different world that is better and that he must, if he wishes to continue in being, make his innovations painstakingly in ways that conform to the great reality already in being. Here we are touching on an insight about human values revealed by the sciences that goes beyond the ordinary axiology and ethics of philosophers toward a central value talked about by the theologians.

But now I wish to focus again on the scientific revelation of the central role of the central nervous system or brain as the locus where are converged the storage of information about our values or norms, the cybernetic mechanisms for maintaining them, and the mechanisms for expanding and enlarging the network of values. Into the brain flows the value heritage of the billion-year evolution of the genetic information about life's values encoded in the DNA molecules. In the

brain this information becomes organized in ways to communicate with and delicately integrate the activities of a population of billions of other individual cells which are so structured as to carry on all the functions of human life. All the scientific evidence seems to point to the fact that everything we are, do, and think is a function of this body's population of some trillion cells.

Also into the brain flows the value heritage of the million-year evolution of human culture. The brain is the locus for our assimilation of the language we hear, speak, and understand; and we are beginning to know many fascinating details about how the brain works in this function, and how, in the brain, meanings and emotions and behavior are interwoven or interconnected with speech sounds heard by the ear and written symbols seen by the eye. All the other elements of cultural evolution that are transmitted from generation to generation are transmitted directly through the brain, not through the genetic seed. And in the brain all these elements of cultural heritage are linked with the more elemental and primitive, genetically-given values or goals of life, such that cultural information is wedded to animal instinct. Our human loves and hates are modified from our "instinctive" organic loves and hates by neural circuits between the "higher" and "lower" centers of this organ. The brain is also known to be a "computer," the machine that makes logical and quantitative computations of future circumstances, such that the complex machinery of sense organs, muscles, and glands will anticipate and be ready to perform multiplex operations in proper time. The human brain is also known to be the imaginative projector of purely hypothetical images of the future and as yet unseen realities, the images projected by poets and theoretical scientists as they open up for each culture a system of images or concepts about the invisible aspects of the world which becomes an important part of our value systems in terms of heavens and hells and deities and atoms and electric forces and "eternal laws." The crowning achievement of this genetically inherited organ is its endowment of man with the capacity to project novel images in culturally transmissible symbols of the nature of himself and his world which can be validated, and which may turn out to be truer and to possess more potentiality for life than anything organic prior to cultural symbolization of information or values has been able to achieve or is likely to achieve.

Human societies, because of the capacity of the brain to elaborate cultural facts and values, can in a few thousands of years transform a population of genetically not very social mammals into exquisitely intricate societies far more complex and far more potentially viable

over a wider range of conditions than those of the genetically most highly endowed social insects. Because of this capacity, human societies can transcend the earth that gave them birth and go and dwell in the heavens.

The recent expansion in the scientific revelations concerning the nature of the brain and its alteration or management can readily lead to more efficient technologies (arts) for "conditioning" behavior. This is good if the new behavior is good, but horrible if it is evil. Hence, such new and powerful behavioral and motivational technology to alter our patterns of valuing should not be administered by men who do not have a correspondingly valid system of understanding and of convictions about the long-range, highest-level, human values. A murderer should not be entrusted to administer the surgeon's knife. Thus we need not only the information that the sciences can give us about the mechanics of managing value or goal motivation, but we need also the larger wisdom that the sciences can help provide for an understanding of and commitment to the highest, most universal, human values or goals.

Transhuman Values

Poets and theologians talked about transhuman values before the rise of modern science. Transhuman means beyond man, more than human, superhuman. And even here the sciences have already manifested a capacity to contribute not only to our conceptual images of potentialities but also to tangible realizations.

In the area of genetics man now understands the mechanisms involved and knows how to alter them so as to produce changes in species of plants and animals so as to be able to direct organic evolution beyond its present stages, including the species *Homo sapiens* to transhuman stages. Scientists also understand in principle how in the recent past we have been unconsciously modifying our species, perhaps not for the better.[14] But the bulk of the scientists who are more knowledgeable about this potentiality are very doubtful that we have sufficient knowledge and wisdom to do very much about improving or instituting transhuman genetic values as yet. Many of them agree on a few fairly obvious "evils" that we might proceed to reduce by careful reduction in the breeding of those who are known to carry the genes that produce the dire consequences. However, some of the most informed and wisest doubt the soundness of our human wisdom to evaluate evil and also they are aware that genetic patterns that produce evil consequences may equally be the source of good.

One of the pieces of wisdom or values that is coming out of the work of the geneticists themselves is the conclusion familiar to theologians that what the Lord hath created is marvelous, wonderful, and on the whole very good. The desirability of tolerating in the human gene pool (or the intrinsic virtue of) all kinds of weird and sometimes difficult types has been pointed out by a number of biologists. It was given eloquent expression by Robert S. Morison:

> The process of natural selection does not operate to produce *ideal individuals* possessed of some theoretical combination of 'best' traits, each present in the highest degree of intensity and purity. What it concentrates on is the production of gene pools with an assortment of characters that can be drawn upon to produce a community, race, or species with the combination of capacities necessary for survival in a slowly but steadily changing environment. Technically known as 'balanced polymorphism,' this dynamic equilibrium between 'good' and 'bad' genes within a given pool gives scientific sanction to the philosophical insight that we are all doomed to suffer the defects of our virtues—and that society as a whole is therefore better off.[15]

While genetic information suggests that change or progress in genetic evolution, even for man, has not come to an end, it seems quite clear that the wisdom of the information packed into the human gene pool (which is so finely writ in DNA molecule letters that you could hold the whole code for three billion people in the world in your hand) has been so carefully pruned for so long that it cannot very easily be improved upon. Our first impulses to radical improvements are often dashed on the rocks of bitter experience with a tough environment with which we later find the heritage we at first despised had all along known how to cope. While reformations there must be, for change and evolution are the order of the day in all days of creation thus far, reformers must either be infinitely wise or be willing to risk the viability of themselves and their fellows. It turns out that the heritage of values from the past in the human gene pool is fabulous and the collective conscious wisdom of our wisest authorities is only feeble surface illumination of this storehouse of information and value.

Nevertheless, we are already informed by the perspective of evolutionary theory that earth's top value system in another million years is not likely to be man, even if we consider only biological evolution. In a million years natural selection alone has brought us up through a taxon perhaps a few species long; and a million years from now, at the same rate of change, *Homo sapiens* is not likely to be here, but *Homo transhumanus* is. Human values will be transcended by those of our successor species, very likely, whether or not we participate consciously in bringing about the change.

Our heritage of values, it will be remembered, includes not only those encoded in the genetic molecules but those encoded in cultural codes. It is here that our evolution is taking place at a much faster rate than in our genetic codes. It is here that we are genetically provisioned with capacities for making significant changes much more rapidly than the genetic code can be changed, and with most remarkable results.

The significance of cultural evolution and our capacity to transform human values rapidly by means of cultural evolution is clear if we compare human evolution in the past ten thousand years with the evolution of our genetic near-cousins, the gorillas. In this period the gorilla has continued with hardly noticeable changes; while human behavior and values have been transcended in several huge waves of change from that of caveman to the glories of Greece and Rome to the utterly fantastic present. The history of religion and of social, technical, and intellectual changes makes clear how the human values of one age are transcended by those of another. This is not to say that the transformations are always improvements. But under natural selection (of behavior and culture as well as organism)[16] the net effect is that survivors have adopted the values that are better able to survive, and the less adequate value systems have tended to die out. Here, readers must withhold their cultural prejudices as they must withhold their biological prejudices in accordance with the lesson of balanced polymorphism we have just reviewed. Even if you for some reason do not like a living system, if it is able to hold together, to survive in the difficult task of living as well or better than you, you must respect it. But this judgment of survival must always involve a long future; patterns that are successful for temporary survival may be lethal in the long run.

One of the most radical transcendences in our understanding of human values has been coming about in the past few decades through the application of information from several sciences to illuminate the nature of life. Strangely enough, the science of physics—so often neglected by theologians and biologists—has been the source of one of the greatest illuminations of the most basic or fundamental characteristic or value of living systems and of how living systems are distinguished from nonliving systems. About the time of World War II, the famous physicist Erwin Schrödinger wrote an essay on *What Is Life?*[17] and was joined by many other scientists in mathematical and applied physics and chemistry, systems analysis, information theory, and related fields, who have been able to come to a new understanding of the nature of

life as a negentropic program, operating within discernible space-time boundaries at the expense of the entropy of its environment under regulation by means of negative feedback or homeostatic mechanisms.[18]

Physicist R. B. Lindsay has written about this new understanding of human values by paraphrasing Kant's "Categorical Imperative" with a term coming out of the core of physical theories of nature, the "Thermodynamic Imperative." In the Lindsay picture, this means that the top of man's value hierarchy is expressed as the goal to establish systems of ever-decreasing entropy.[19] This gives man a new theoretical understanding of his place and purpose in the entropic universe which is his environment. There are confusing and controversial elements in this developing theory, but it would seem likely that it will be sifted down into a very compelling and usable theory about human values before many more years of scientific evolution have passed. This is not only a key to understanding a basic principle involved in the life described by biology, the only life produced and established on earth by evolution up until this century, but it is a most exciting key to designing or predicting what would be good for further biological evolution and also for the designing or creating of a wholly new and different "living machinery" made out of radically different molecular structures from those of the hydrogen, carbon, nitrogen, oxygen, and related building blocks thus far used by natural selection on earth.

It may perhaps be surprising to some readers to learn that the beginnings of such novel forms of life have already been undertaken by scientists. This new "living" machinery is sometimes called by such names as computers and cybernetic systems which scientists have developed in theory, and to some extent in actual hardware, to fulfil or carry on most of the same basic functions which the theory ascribes to the biological living machinery made up of proteins, carbohydrates, and other organic molecules: self-maintenance of its established order in a disordering (entropic) environment; multiplication and self-reproduction; evolution under natural selection; learning, goal revision, and self-modification; perceptual discrimination, self-awareness, thinking, and feeling.

Marvin Minsky, a professor of electrical engineering at the Massachusetts Institute of Technology engaged in computer research and development, indicated that in 1968 few aside from himself and a couple of colleagues had "studied very much . . . the value of having the machine [computer] aware of its own activity—aware in the obvious sense that it has access to information about what it is doing. . . . It is not very hard, technically, to put in some features that you would

have to call self-awareness of a kind."[20] In this paper he indicated the probability of computers becoming much smarter than human beings.

This is a scientific pipe dream like Goddard's in the 1930s that he might develop a rocket that could fly to the moon. Other scientists in other places know about the same potentialities of computers becoming a successor species transcendent to *Homo sapiens,* although this time through a heritage fashioned from the human scientific culture and perhaps henceforth transmissible completely independent of the human DNA gene pool, and an heir built largely of metallic molecules instead of the biochemicals familiar to life on earth thus far. A distinguished Swedish physicist, Olaf Johannesson, under a pseudonym, has written *The Tale of the Big Computer,*[21] in which he has let his well-informed imagination roam on some of the value problems that are bound to arise when the "big computer" becomes quite superior to man in morals as well as in various other technical capacities—literally possessing transhuman values. This is a situation equivalent to *Homo sapiens* being faced with a potentially superior species who would replace him under nature's perennial selection of the "fitter" of any two species competing for the same general function in an ecological niche. We may recall that none of the other hominoid species that coexisted on the surface of the earth with our ancestors during the past couple of million years now remains. Computer theorists have begun to have serious concerns about potentialities here, just as did atomic energy experts long before the general public was aware. As in the case of atomic energy, transhuman or superhuman computers can provide good as well as evil. In either case, transhuman values are involved.

Because the logical test case for a realistic doctrine of intrinsic or ultimate human values depends on how it would handle the imaginary or real possibility of man's being transcended, replaced, and perhaps extinguished by another biological or nonbiological power or system, and because I shall take up this challenge, I wish to contemplate this very real possibility of the computer transcending human values. To take this up, my concluding section will touch upon the more traditional connotation of "transhuman value," namely, the theological connotations. This paper on values via science may by that transcend the average philosophical paper on values by daring to resurrect values from theology, which I think we can now more or less demonstrate, logically and perhaps scientifically, is necessary if we are to have any philosophy of human values that amounts to more than intellectual gymnastics in lifting yourself by your bootstraps. Human values that

have no ground outside human valuing, no ground in the real world upon which the sciences everywhere are telling us we are dependent, are only an empty pipe dream and not a reality that is likely to last.

Computers can in theory take on most of the functions of men, and perhaps all of the ultimately valuable functions, and also can do many more things that men cannot possibly do except in cooperation with (some have dubbed this "in symbiosis with") computers. Those people who do not understand any more about the potentialities of computers today than they understood about moon rockets when Goddard talked about them in the 1930s probably will be just as surprised at what comes to pass in another thirty years. For instance, in his "Can Computers Evolve to Super-Human Levels Before Man?", Minsky[22] had to say, "Many people think that a computer does only what it is told. That is a lie." He showed that a computer is no worse off in this matter than a man. Since computers already possess basic capacities of men (although by means of a very different machinery from that of organic life), it is conceivable that animals on earth (through the agency of cultural man) could give rise, in an evolution from the computer, to a new and far different kind of *living* creature.

It is even theoretically quite conceivable that a world of self-generating, evolving computers could, as Minsky suggests, in a relatively short time break through the level of human intelligence and far transcend us in wisdom as well as in power. They might be able to adapt much better than we to interplanetary travel and settlement, to avoid the consequences of an atomic holocaust, to be, as Johannesson[21] suggests, even more humane than humans, and even to be a kind of god that would save and preserve humans long after the human tasks and values had been transcended and made obsolete. Whether we like it or not, this is a prospect that is sooner or later possible. We may not have to wait a million years to be replaced by a new biological species. The computer revolution may replace us much sooner even than the "men from Mars"! In this context of the larger history and geography presented by the sciences, what is the ultimate worth or value of man? I shall return to this question in the last section.

Some Practical Tasks

I hope that I have given a plausible outline of how the sciences do in fact reveal and make available to human consciousness much more detail about our human values, their origins, the cybernetic mechanisms (biological and cultural) in which they are encoded, their evolution, and even some visions of how new values may be evolved to

transport us to transcend our present humanity. However, our most urgent and immediate goal is that of the more rapid evolution of certain elements of our present cultural structures and their integration with the sciences, namely our present cultural programs for transmitting, reforming, and motivating values. These cultural programs for structuring human goals must be integrated with scientific knowledge instead of lagging in their recent past position, immersed in the archaic knowledge or science of a few hundred or a few thousand years ago; and they must not be allowed to regress, as they are presently tending, into even more primitive and entirely inadequate formulations of values by the genetically based (but culturally unenlightened) patterns of "angry young men." In our present ecological system, anything less than an enlightenment of our human values via the sciences portends only increasing chaos and self-destruction of man, and possibly the destruction of much if not all of the values inherent in other biological life. The present, nonscientifically informed values of mankind may be lethal for man's *almost supreme,* intrinsic value: human life.

Perhaps the prime point of this paper can be summarized in a quotation from John Dewey that "a culture which permits science to destroy traditional values but which distrusts its [science's] power to create new ones is destroying itself."[23]

But it is not enough to be able to make statements about values, whether they are stated on some traditional or religious authority or on the authority of science. Values, as understood in this paper, are more than hypothetical goals or intellectual information about them. They are real goals, intrinsic to real mechanisms that enforce them. These mechanisms or processes bring the goals into being by reducing any departures from them by negative feedback. In the philosophy and theology of values, these enforcers of a value pattern or norm have been called sanctions. In theology it was a God who sanctioned the system of values, by punishing and destroying the wicked and by rewarding and saving the righteous—a sort of supernatural selection.

A current scientific and scholarly picture of more recently evolved goals or norms of higher human cultures indicates that the cybernetic processes or mechanisms in which they are embodied are often constituted of no more than a system of beliefs, embodied or encoded sometimes in nothing more substantial than electronic or molecular configurations in human brains transmitted by stories or myths about human destiny told by word of mouth from generation to generation. Often these configurations in the central nervous systems of individuals (and hence in the behavior patterns of communities of men) have

so resonated with the already existing more primitive biologically and culturally transmitted goals or desires and with the perceptions of the environing realities, that the individuals or communities were transformed, at least part way, into such value commitments as the beating of swords into plowshares or giving up one's cloak or one's life for the welfare of even enemies, and finding meaning and salvation in the conviction of one's ultimate identity or union with the inevitably triumphant or unbeatable cosmic destiny which ordained all the lesser values.

But as Kluckhohn, Dewey, and others have pointed out, recent scientific and scholarly information has destroyed belief in these traditional religious sanctions of human values not only in Christendom, but increasingly in all human cultures. And in the late twentieth century the consequence seems to be an expanding crop of disillusioned, frustrated, and angry young men who are casting aside all cultural traditions as worthless and becoming even frantic, foolish, or destructively violent in their search for meaningful identity. We need to understand and implement a program not only of stating what are human values but also of reinforcing or sanctioning them. The final two sections of this paper attempt to summarize a relationship between philosophy and theology and the sciences in the matter of sanctioning human values.

Internal Sanctions of Human Values

Many people think that the sanctioning of normative human behavior is limited to such operations as persuasion and exhortation, or, more unpleasantly, to commands backed by armed force. Mises gave a significant analysis of this:

> The outright pronouncement or formulation of commands can in no way be called a science, even if this certainly vague term is given the widest interpretation linguistic usage permits. But if one means the *justification* of commands or norms, one finds oneself again in the sphere of the *usual* forms of science. For a sentence construction of this kind: "One ought . . . , because . . . " if it is not completely meaningless, can be immediately transformed into: "If . . . , then. . . ." In other words, a norm together with its justification is nothing but an ordinary statement. To the extent in which the words and locutions used are based upon a constituted linguistic usage, the statement is connectible and, in general, verifiable [scientific]. The idea of a normative science could only originate in the fact that in jurisprudence as well as in ethics customarily the ultimate justification remains in principle *tacit*.
>
> In so far as one is concerned [in normative sciences] with investigations which in the widest sense of the word can be considered as scientific, they

[the normative sciences, including ethics] form parts of a general sociology. In this branch of science all propositions have to fulfill the same requirements of verifiability and agreement with experience as in any other part of science.[24]

Mises is emphasizing that normative commands, exhortations, or "ought" statements are abridged forms of indicative statements, which may become scientific when investigated scientifically. Exhortations tacitly presume an "If . . ." clause such as, *"If you want a certain thing which you value, such as to live, then* you must do X." This throws the burden of moral and other exhortations back on some presumed or tacit *fact* that people are presumed by nature, that is, *in fact,* to value. The sciences have investigated such intrinsic and often tacit values, goals, or motivating systems. I have pointed out that one can generalize the import of all the integrated cybernetic mechanisms of a living system as having the goal of the maintenance of itself, the living system. I repeat Miller's excellent summary of this: "All living systems tend to maintain steady states of many variables by negative feedback processes controlling subsystems which distribute energy or matter to keep an orderly balance.[25] The same goal is also called dynamic homeostasis.[26] Such a value or goal is intrinsic in every living system—is literally encoded, incorporate or incarnate in the center of the DNA which instructs every living cell, as well as in the control mechanisms of each brain and culture. This does not mean that the life of every subsystem of a living system is sacrosanct, for nature long since discovered that the advancement of the living system is aided and abetted by the death[27] of various subsystems, including the individual organisms of a species, and even the much longer-lived species. But in those cases we find the values of the suprasystem are well sanctioned (for instance, as it is found in the sexual motivation to procreative behavior of the mortal individuals in all species) to insure a new generation of individual organisms after the death of the present ones. The ecological system, which is a suprasystem to any species within it, has its own values; and even the deaths or transformations of species may be required to advance them.[28]

Thus we find that statements about human values or goals (ethics) are grounded implicitly, at least, in facts, in material structures or cybernetic mechanisms intrinsic to and controlling (sanctioning) the behavior of men. The combined inputs of biochemicals and biochemical behavior into the central nervous system from the organism and from its environment (including from the local society and culture of which the organism is a fairly well integrated part) operate to set or enforce (to sanction) the goals and outcomes of its behavioral pat-

terns. The superficial operations and elaborations of religious and philosophical exhortation or argument for one or another ethical thrust, if they are to be sanctioned and to materialize, are always implicitly grounded in the underlying motivational or cybernetic systems that the sciences are recently revealing. This is central in the major, current, scientific descriptions (doctrines) of man. Thus the sanctioning of good behavior in the first place hangs on the accumulated facts or structures which intrinsically define the goals of man through a network of feedbacks permeating the existing biological and social structures to which he is heir. It should be noted that the social elements of this network of sanctioning and control mechanisms are ultimately dependent on what the societies find existing as conditionable wants or needs within the biological organisms. If an animal or a man does not already have an unconditioned reflex or response pattern, there is no possibility for conditioning or educating to modify the response pattern. Thus the untaught or genetic goals are the ground of the internal, already acquired sanctions for human values.

The sciences can tell us much about the sanctioning of human values within the limits of the existing bases of these sanctions within human nature. But we can go further in our scientific analysis of the sanctions for values.

External Sanctions of Human Values

As is the case in most of the traditional religions, a scientific analysis of the *ultimate* sanction of what is valuable for living behavior is something which stands over, above, and beyond (transcendent to) life. It is something that has the final say in selecting or judging the value or worth of any living system. By some it is called the surrounding nature of the environment (including all living creatures and the self within it), to which all species and individuals have to adapt if they are to be selected, if they are to continue to multiply or leave viable descendants. Thus, it should be clear that human feelings and desires are not the ultimate sanctions of human values. If I want life (described in terms of the most significant and lasting elements of the living system in which I play a role), it is not necessarily the satisfaction of my present wishes which is paramount, but my adaptation to the ultimate realities to which this system must adapt if it is to survive. Here one could paraphrase a scientifically grounded statement about "supreme human values" in the religious language of "not my will, but Thine." Fortunately, *for the most part,* my instinctive and culturally learned desires and wishes reflect (thanks to previous "learn-

ing" inherited and incorporated in my genotype and culture) the requirements of that reality.

It should be noted, however, that the appetites and instinctive goals of species did not make themselves, but were created and continually are transformed by natural selection, as new and different surrounding conditions for life arise and enforce their *external* sanctions. Pleasures and pains reflect rather than determine basic values; they are simply grounded in genetic and other learning (through selective processes) of what this transcendent, only partially known reality standing over the evolution of life requires. Therefore, we have to learn to transform—by genetic or by more recent and rapid kinds of "learning"—our appetites, desires, wishes, and other norms or goals that direct our behaviors, in such fashion that our behavior fulfills these ultimate, external, and objective sanctions for what is viable. It should be noted that the generalized picture of the nature of evolution requires not only that plants, animals, and men adapt to the surrounding reality if they are to be successful in continuing as living systems, but also requires the same of computers or any other systems that emerge into self-sustaining, cybernetic, or goal-directed systems with functions akin to what we know as life. A basic scientific hypothesis that has not yet been successfully negated is that nothing can escape the conditions set by the intrinsic nature of the "real" world—the ultimate judge or selector—which the sciences have revealed far more than any previous sources of conscious, recorded, human information. Man, in the very core of his own intrinsic nature as well as in his relation to what is outside his skin or head, is equally dependent on that nature or reality.

It should also be noted that, in the above picture of a scientific understanding of values as facts about life, there are included not only the genetically transmitted "instinctual" feelings, desires, and motivations toward goals, but also—within the same cybernetic mechanism centralized in the brain or central nervous system, where are recorded various inputs from the natural and cultural environment—there are included the highest and most refined, complex, and delicate flights of human aesthetic, moral, humane, and religious feelings and aspirations. It may be important for theologians and others concerned with motivating better values to recognize the close analogy of the scientific revelations about the above-mentioned ultimate judge or selector to their ancient concept of "God."

Thus the ultimate human values are the transhuman values of what the sciences would call the total environment that evoked and selected

the evolving patterns of life, and this is functionally closely akin to what religions have traditionally called God. Upon this ultimate and almighty power man is completely dependent. He has no life and no future as living if he fails to treasure the gifts already given by this power and if he fails at any point to bow down to its "will," that is, to seek to adapt to what this all-encompassing reality requires of him if he is to have life. Here, it seems to me, the most transcendent and sacred human values are seen as about the same, whether from the perspective of modern science or from the perspective of much traditional theology: for each creature to honor, cherish, and enjoy the graces already given him; and to continue the search for ever higher forms of life through probing to adapt to new requirements for viability in the wider horizons of the real world in which he lives and moves and has his being. In this task and in this perspective, the amoeba, the worm, the mammal, man, and the transhuman electronic computer are all leveled and one—all become interrelated and interdependent participants in one grand ecological whole that is clearly moving forward in time and in grandeur. Ultimate human worth or value will remain the same in the year 2001 and 2,000,001 as it was in the year 1, regardless of competing or successor species—organic or electronic—simply by grace of the fact that all creatures are equally sons and servants of the same sire in the majestic unrolling of "his" earthly drama or cosmic evolution.

It seems to me that it is here that the contributions intrinsic in and derivable from a scientific view of man to an understanding and motivation of the highest human values are superior to those of ordinary axiology and equivalent in scope to the highest religious myths and theologies, but much more detailed, and hence credible for man today.

NOTES

1. Karl R. Popper, *The Logic of Scientific Discovery* (New York: Harper & Row, Torchbook, 1965; first American publication was by Basic Books, 1959), p. 111.

2. Clyde Kluckhohn, "The Scientific Study of Values and Contemporary Civilization," *Proceedings of the American Philosophical Society* 102 (1959): 469–76; republished in *Zygon* 1 (1966): 230–43. The pages cited in this text are those of the *Zygon* edition.

3. B. F. Skinner, *Science and Human Behavior* (New York: Macmillan Co., 1953).

4. J. Bronowski, *Science and Human Values* (New York: J. Messner, Inc., 1956); Theodosius Dobzhansky, *Mankind Evolving: The Evolution of the Human Species* (New Haven, Conn.: Yale University Press, 1962); William Etkin, *Social Behavior from Fish to Man* (Chicago: University of Chicago Press, Phoenix Books, 1967); Bentley Glass, *Science and Ethical Values* (Chapel Hill: University of North Carolina Press, 1965); Garrett Hardin, *Nature and Man's Fate* (New York: Holt, Rinehart & Winston,

1959); Sir Julian Huxley, *Religion without Revelation* (New York: Harper & Bros., 1957); Michael Lerner, *Heredity, Evolution, and Society* (San Francisco: W. H. Freeman & Co., 1968); R. B. Lindsay, *The Role of Science in Civilization* (New York: Harper & Row, 1963 [for his "Thermodynamic Imperative" see the last chapter]); Konrad Lorenz, *Evolution and Modification of Behavior* (Chicago: University of Chicago Press, 1965); Henry Margenau, *Ethics and Science* (Princeton, N.J.: D. Van Nostrand Co., 1964); George Gaylord Simpson, *This View of Life: The World of an Evolutionist* (New York: Harcourt, Brace & World, 1963); W. H. Thorpe, *Science, Man, and Morals* (Ithaca N.Y.: Cornell University Press, 1966); C. H. Waddington, *The Ethical Animal* (New York: Atheneum Publishers, 1961); A. F. C. Wallace, *Religion: An Anthropological View* (New York: Random House, 1966); Norbert Wiener, *Human Use of Human Beings: Cybernetics and Society* (Boston: Houghton Mifflin Co., 1950; Anchor Books, 1954); Dean E. Woodridge, *Mechanical Man: The Basis of Intelligent Life* (New York: McGraw Hill Book Co., 1968); J. Z. Young, *The Model of the Brain* (London: Oxford University Press, at the Clarendon Press, 1964).

5. See Hardin, n. 4.

6. Walter B. Cannon, *The Wisdom of the Body* (New York: W. W. Norton & Co., 1932); Alfred E. Emerson, "Dynamic Homeostasis: A Unifying Principle in Organic, Social, and Ethical Evolution," *Zygon* 3 (1968): 129–68.

7. Erwin Schrödinger, *What is Life?* (New York: Doubleday & Co., 1956), and Wiener.

8. See Wiener, n. 4.

9. See Cannon, n. 6.

10. James G. Miller, "The Organization of Life," *Perspectives in Biology and Medicine* 9 (1965): 107–25.

11. Kenneth E. Boulding, *The Meaning of the 20th Century* (New York: Harper & Row, 1964). This is an excellent text on science and human social values, and at the same time it introduces (especially in its chapter on "The Entropy Trap") the implications of entropy for social systems.

12. See Miller, n. 10.

13. Ralph Wendell Burhoe, "Five Steps in the Evolution of Man's Knowledge of Good and Evil," *Zygon* 2 (1967): 77–96.

14. There is a large literature but I cite here only a work of some years ago with which I am familiar and will serve as an introduction: Hudson Hoagland and Ralph Wendell Burhoe, eds., *Evolution and Man's Progress* (New York: Columbia University Press, 1962). See also Dobzhansky, n. 4 above.

15. Robert S. Morison, "Darwinism: Foundation for an Ethical System?" *Christianity and Crisis*, August 8, 1960; *Zygon* 1 (1966): 347–53.

16. See Skinner, n. 3, esp. p. 430.

17. Schrödinger, n. 4, p. 12.

18. See Wiener (n. 4), Schrödinger (n. 7), and Boulding (n. 11).

19. See Lindsay, n. 4.

20. Marvin Minsky, "Can Computers Evolve to Super-Human Levels before Man?" (unpublished transcription of paper presented at the 1968 summer conference of the Institute of Religion in an Age of Science).

21. Olaf Johannesson, *The Tale of the Big Computer* (New York: Coward-McCann, Inc., 1968). This is not a wild science fiction, but the carefully considered vision of physicist H. Alfvén writing under a pseudonym. There is, of course, a large literature on the potentialities of the computers, and the motion picture, *2001*, has presented a very significant image of some of the value problems of humans and computers.

22. See Minsky, n. 20.

23. See Kluckhohn, n. 2.

24. Richard von Mises, *Positivism: A Study in Human Understanding* (Cambridge, Mass.: Harvard University Press, 1951), p. 332.

25. See Miller, n. 10.

26. Emerson, n. 6, esp. p. 157.

27. See Dobzhansky, n. 4, or almost any biological text for the essential role of death in evolutionary progress. For an excellent treatment of man's awareness of death, see Dobzhansky's "An Essay on Religion, Death, and Evolutionary Adaptation," *Zygon* 1 (1966): 317–31.

28. See Emerson, n. 6.