

## SCIENCE AND HUMAN VALUES

*by Jose M. R. Delgado*

To explain the existence of evolving matter and its multiform manifestations, we may accept a supernatural design or reject traditional theological interpretations, pleading ignorance about the origin and purpose of matter and life. In any case we must agree that man has not created the earth, the oceans, other creatures, or himself, and that our world is the product of a chain of events culminating in the appearance of organic life.

The first hominids were only a new kind of mammal fighting for survival among other animals, hiding in caves and participating in the universal hunting game of killing and being killed. Lacking scientific knowledge and proper skills, primitive man was a minor event in the evolving history of the world, unable to modify the course of a river, to cultivate fields, or to improve his own health. His main concern was the search for food which he could not produce. In the face of natural catastrophes such as plagues or floods he felt helpless, and his reactions were limited to resignation, despair, or appeal to supernatural powers without realizing that one day man would not be the slave but the master of his own environment.

The ecological circumstances have been drastically changed with the development of civilization. Awareness of his own existence, construction of tools, acquisition of knowledge, and deliberate modification of nature were the main factors which determined human supremacy over animals. The process of ecological domination, according to purposeful design, represented a victory of intelligence over mindless fate without precedent in the history of any other species. Man's power slowly extended over the surface of the earth, plowing the fields, herding cattle, constructing cities, opening roads, harnessing the power of the rivers, and reaching for the stars.

Opposing human intelligence to natural fate has a dramatic appeal, but in reality the existence of man, together with all his attributes and creations, is solely the result of natural evolution. Man has not created man. No conscious efforts were made to design or modify

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genetic endowment or brain structure. The process was similar to the development of wings, according to laws of biological evolution. We cannot claim that birds fly on the air in defiance of gravity, but only that they use the lifting support of the wind as determined by physical laws. Wings are a gracious gift of nature which did not require scientific knowledge, mathematical calculations, or even the desire to own wings. Likewise the development of human intelligence and creativity has been an automatic process resulting from many thousands of years of history.

#### CIVILIZED CONTRADICTIONS

Modern civilization has created immense resources, improving economic level, material comfort, and health condition and providing a wide choice of food, clothing, dwelling, careers, ideologies, entertainment, and religions. Unfortunately, along with many benefits, undesirable complications have also appeared. Increased food production is upset by overpopulation, industrial gains are handicapped by environmental pollution, greater comforts are disturbed by servitude to machines, and the spectacular scientific discoveries of physics brought with them the threat of atomic annihilation. East and West, blacks and whites, Arabs and Jews, are confronting each other in cold and hot wars. Apparently we have improved our ability to destroy without finding effective ways to solve human conflicts.

In modern generations there is a breakdown of moral values, an inability to find meaning in the traditional systems of belief, and a general sensation of frustration. Individuals are searching for identity while being disturbed by the irrelevance of education, the automation of life, the dehumanization of environment, social injustice, and violence. We may ask if it is reasonable to evaluate the development of a country with statistics of production and consumption, or to rank nations according to their tons of steel, number of cars or megawatts of electricity, without mentioning personal fulfillment, happiness, and love. Is it ethical to structure a world in which more people will survive infancy only to starve later or be sent to their death in war? Human values should be evident in the choice of criteria to judge a civilization: statistics should indicate not only the length but the quality of life; not only the number of employed but the purpose of their labor; not only the numbers being educated, but how given knowledge has enriched the person and the society. The truth is that countries with the highest standard of living do not necessarily provide the greatest individual happiness. It is known that Sweden and the

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United States have a higher incidence of suicides and broken homes than Turkey and Spain. The most serious spiritual crises often appear among an abundance of food and comforts.

It is therefore logical to question the orientation and goals of a civilization which seems to be more interested in mechanization than in humanization, to challenge the consumer society, to reject the idea that a higher standard of living automatically means a more satisfying life, and especially to consider which human qualities should be favored in the development of a future psychocivilized society. These problems are similar in communist and capitalist nations, in underdeveloped as well as powerful countries, although organization and priorities may be different. Just as international collaboration in medical sciences has been highly successful in terms of increasing material results and human understanding, so collaboration should be established for experimental inquiry into the biological structure of the human mind, its basic potential, the cerebral mechanisms of behavior, and the building blocks of personal identity related to the available cultural frames of reference. What is the origin of the similarities and differences in men of all continents, races, and cultures? Which are the biological and ideological sources of conflict? Which are the possible solutions?

### MAN-MADE CAUSALITY OF THE PRESENT CRISIS: THE IMBALANCE BETWEEN MATERIAL AND MENTAL EVOLUTION

In the artificial environment of cities and farming lands, successes and failures are to a great extent man-made creations. This fact has the advantage that, at least in theory, our predicaments are not as unavoidable as in the past. Causality of conflicts can be identified, investigated, understood, and a variety of solutions can be proposed. Polluted rivers can be cleaned by better technology. Human antagonisms can be solved through intelligent compromise. The most precious quality of the human mind is that we can investigate the factors which influence our lives, and use our brains to alter personal fate. A paralyzed heart, for example, does not necessarily mean the death of a patient because we can use a pacemaker to stimulate the cardiac muscle electrically. Natural death can thus be avoided by the artifacts of medical technology.

Although our present crisis is very complex and it is difficult to single out the most significant factors, I would like to propose that the imbalance between the material and the mental evolution of man is one of the most important causes of the crisis. We must realize that most of our thoughts and activities are related to the existing high de-

gree of mechanization of the environment. In industrialized areas, most human effort is devoted to the invention, construction, distribution, repair, use, and disposal of a multitude of artifacts, from automobiles to zippers. The school curriculum, being oriented toward preparing the student to handle instruments and to live in urban artificiality, is heavy in basic sciences. Hunting skill or muscular strength is not essential for survival. Success is measured in volume and numbers rather than in quality. In the complexity of spinning wheels, the humanity of man is often lost. The worst part of this reality is that the system is self-perpetuating. We are so busy constructing instruments and modifying our surroundings that very little time is left for wondering about man himself, and little effort is directed toward scientific inquiry into mental faculties.

Why are most of our intellectual and economic resources devoted to further industry, while only a minor effort is applied to elucidate the cerebral basis of human personality? Is it not true that machines, organization, and politics are, after all, products of mental activity? Why have the cerebral bases of the mind been so grossly neglected? The explanation is relatively simple. We have methodology to examine the skies, the rocks, and the cells. We may transform materials into utensils and engines. The challenge of understanding and manipulating our surroundings was successfully met and the accomplishments were outstanding. Why should time be lost speculating about emotions and thoughts? In any case we lacked suitable methodology to investigate the neuronal basis of behavior. The brain was considered a "black box," the mind a metaphysical entity beyond experimental reach. It was more profitable to build skyscrapers and airplanes than to philosophize about love and hate.

The material evolution of man has grown exponentially during the last decades and our brains have adapted reasonably well to the new demands. Compared with the past, we have much better capacity to handle information, to produce and consume commodities, to enlarge our sensory perceptions with telescopes and microscopes, to increase muscular power by pressing switches, and to multiply our problem-solving capacity by using tapes and computers. The evolution of our brain power has been channeled to meet the materialistic demands of civilization.

In contrast, the most important aspects of mental evolution have not progressed at a similar speed. These aspects are related to the pursuit of happiness, the understanding of man, the planning of a future of peace, love, and fulfillment. Present social behavior is often

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as cruel, destructive, and unintelligent as in primitive times, with the added killing efficiency provided by technology. What is worse, the trend is toward an increase of violence, social coercion, and mental disturbance.

This disparity between a fast-advancing material evolution without parallel improvement in the understanding and control of human behavior represents a growing danger for the future of man. In the past, despotic elites in Egypt, Greece, or Rome represented a limited threat for neighboring countries, but not for the whole of mankind. Today the technology for communication and the new weaponry could reach any corner of the earth and obliterate the whole human race. This power is at the disposal of brains which have not yet learned the wisdom to solve economic and ideological conflicts intelligently. The "balance of terror" created by the big nations reflects the discrepancy between well-developed materialistic technologies and the underdeveloped mind of man. The solutions for human conflicts proposed by sociologists, theologians, philosophers, and other well-intentioned groups have so far not been too successful, and new approaches are necessary. Conflict is essentially a cerebral process, and to find solutions it is not enough to consider poverty, overpopulation, social injustice, and other environmental circumstances; we must also pay attention to the mechanisms in the depth of the conscious brain which interpret the messages from the environment. To illustrate, we know that to forecast the weather it is not sufficient to see if the sun is shining; we also should learn about the patterns of pressure, temperature, humidity, and other atmospheric properties beyond our direct vision and sense; and we need a reliable theory or model of how the system works. To understand a patient's condition it is not enough to see his face or examine his tongue; treatment may depend on a thorough medical knowledge of the intimacies of liver function, metabolic activities, blood properties, and other anatomical and physiological data.

In a similar way, to understand the behavioral problems of man, his crises of hope, bursts of violence, and ideological conflicts, it is not enough to evaluate human expressions, to hear complaints, or to compute economics. Analysis of intracerebral mechanisms which elaborate sensory inputs will provide a new depth of understanding because ideas and actions—constructive or destructive and pleasurable or painful—all have their origin in neuronal processes which can be identified and modified. Today we can reach the thinking brain not only through the senses but also by electrical and chemical means, using recently developed technology which permits direct communication with the neurons, circumventing the classical portals of entry of the senses. In-

investigators have been able to detect patterns of electrical activity associated with learning, and they have demonstrated that emotional and behavioral responses can be influenced by electrical stimulation of specific areas of the brain. In the near future our understanding of the basic cerebral mechanisms for perception, ideological association, and expression will increase rapidly, providing a biological image of man's personality and of his capabilities for ideological and emotional change. The possibility to explore and to influence the functioning brain represents a critical turning point in the evolution of man because it provides a new understanding for the mind to affect its own structure, activities, and purpose. The knowledge derived from these studies may be decisive to restore balance in our civilization, making the mind—not the machine—the center of future evolution and altering the materialistic orientation of the present system.

#### THE CASTING OF FUTURE MAN

The government of a city requires careful and complex planning to calculate its present and future needs. Suitable means must be available for the transportation of people and supplies, housing, entertainment, and other aspects of urban life. Planning of cities, industries, economies, and communications is an essential requirement of organized societies.

Manipulation of the environment for the benefit of man is usually accepted as highly desirable, and most of us are proud of the colossal efforts involved in constructing the largest bridge, the tallest building, or the biggest airplane. These accomplishments represent the beginning of a new ideological and technological revolution. After modifying the surface of the earth and imposing a human purpose on the surrounding ecology, man is now facing the problem of giving a human purpose to his own existence. The optimistic view of the goodness of science—the more the better—which existed from the time of the Enlightenment has been questioned, especially after the premeditated misuse of knowledge for the creation and application of lethal weapons of war, and after the corrupted use of some technological advances for the economic benefit of a privileged few.

Scientific influencing of the mind may also have both beneficial and undesirable consequences, and, as in the case of atomic research, in spite of obvious risks, it would be naïve to propose a moratorium on brain investigations or on the use of available methodology. The spread of knowledge may be safer than its secret control and exclusive management by elites.

When considering the biological aspects of the mind, several ques-

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tions should be clarified. Are human beings born free with the right to develop their own minds, which should not be unduly influenced by parents or educators? Should personal development follow natural tendencies without being inhibited or indoctrinated by artificial codes? Does each individual possess a unique mind which is his private property, an essential part of his human dignity which must be respected as the source of personal feelings, memories, thoughts, and actions? Is the individual entitled to independence in his behavior and the freedom to direct his own destiny? Most of these questions are idealistic expressions of human rights, but they should be substantiated by supporting biological mechanisms, and if these do not exist, we may be dealing only with wishful thinking and false expectations. A clear case is the "freedom of the newborn," which in reality is a misconception of his neuronal structure and capabilities. Individual freedom is not a natural consequence of physiological development. It must be taught and exercised. If we take freedom for granted we may never enjoy it. If we recognize our initial lack of freedom, we may learn to take the necessary intelligent steps for its creation.

To analyze these ideas in more detail, we must recognize that personal identity is the result of the two classical groups of elements: heredity plus environmental information. The newborn has not the slightest intervention in the choice of these elements. Genes are provided by pure chance and cannot be selected by the parents or by their recipient. Human babies are born so immature and naïve that they are totally dependent upon other people not only for their survival but for their information and experience. The question is not whether the newborn should or should not be shaped, educated, and patterned, but who is going to provide the necessary sensory inputs, what and how much information and experiences should be given, which techniques will be used, and which skills and behavioral reactions we would like to encourage or discourage. Language, beliefs, patterns of response, and many other elements will be acquired in some manner by the baby who cannot select any other cultural set. Children born in France speak French. Where is the newborn's freedom to develop his own mind? His waiting brain will store experiences provided by the environment which will be decisive for his cerebral development and for the structuring of his future personality. Ideologies, prejudices, and information are not invented by the individual but given to him from the immediate culture.

It is true that we can choose not to structure the education of children, but then we are accepting that the sensory inputs provided by

chance will be superior to any planning and purpose. In the same way as in the absence of suitable genes there is no brain, in the absence of information there is no mind. We must understand that brain development and acquisition of mental functions are not automatic processes like circulation of the blood or growing of hair, but that they depend on the reception of sensory inputs which must be given to the individual. It is known that in animals such as rats or monkeys, deprived at early ages from sensory stimulation, the neurons are impoverished anatomically and chemically, and the individuals suffer from a reduction in cerebral growth which may result in permanent behavioral deficits. Sensory inputs are essential not only for creation of the mind but also for the development of neurons and for the establishment of normal neurophysiological reactions. With the exception of inborn reflexes, patterns of response are learned, stored in memory, and later on released when triggered by suitable stimuli. In general we do not realize that our thoughts and behavior are highly automatic. Let us consider, for example, acts as common as walking. The newborn baby has only disorganized, purposeless movements. Learning to walk is a slow process which requires countless trials and errors, passing a stage of clumsy movements with learning reinforced by the pleasure of reaching a goal or the punishment of falling. After many months of effort, the ideokinetic formulas for motor coordination are constructed, simplified by use, and stored in the brain. While walking we do not consciously direct the contraction of our muscles or their sequences and strength. The program for learned skills unfolds progressively and automatically on demand.

Awareness and choice of responses are luxuries which require time and effort in order to evaluate circumstances. Decisions and responsibility may be tiresome, as we cannot afford an excessive amount of choices which would make behavior very inefficient. We need to automatize most of our acts in order to keep mental mechanisms free for more important purposes. Reading a book, conversing, eating, fighting, or loving—most of the actions of our daily life are quite automatic. The initiation of an act may be voluntary, but its performance and the associated emotional tone are under the command of unconscious cerebral processes which are stereotyped by past experiences. Most of the motor, ideological, and behavioral patterns of response are acquired at the early stages of development when a child's personality is being cast. These ideas, which are the central core of Freudian psychiatry, have been confirmed by modern studies of child psychology (i.e., Piaget) and brain physiology (Harlow). The role of parents and edu-



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cators may be minimum intervention, meaning that the decisive elements for personal determination depend on capricious and uncontrolled environmental circumstances. Alternatively, human intelligence can be used with full awareness and with the deliberate purpose of favoring specific human values and future patterns of reaction. The mind is really the intracerebral elaboration of extracerebral information; and the role of the neuronal networks is the acceptance, circulation, storage, combination, and release of acquired sensory inputs, but not the creation of them.

The main responsibility, therefore, for the initial casting of personality lies not with the individual, but with the persons around him who should decide intelligently the reasons and purpose of the information and models given to the child. This is naturally the most transcendental aspect in the casting of personalities. What type of education? What for? Shall we favor productivity or innovation? Social integration or individual differentiation? Conformism or rebellion? Is there a compromise in the many open roads?

### THE BRAIN AND CULTURAL DESIGN OF VIRTUE

Proponents of "cultural design," such as Skinner, emphasize that behavioral engineering is a common practice even in the most democratic societies, and involves the technologies of education, moral discourse, and persuasion: "Through a masterful piece of misrepresentation, the illusion is fostered that these procedures do not involve the control of behavior . . . but analysis . . . demonstrates a kind of control no less inexorable, though in some ways more acceptable, than the bully's threat of force."<sup>1</sup>

Opponents of cultural design, such as J. W. Krutch (*The Measure of Man*), are concerned about the possible tyranny over men's minds, praising the virtues inherent in disorder which would be lacking in a well-controlled and excessively uniform culture. These objections could be relevant for a specific type of wrong planning; but they do not apply to cultural design in general, considering that, if so desired, education could be directed to discourage tyranny, to increase disorder, or to promote diversity. The risks are not in the system, but in a possible misuse, as with most other human creations.

One of the problems of cultural design is the lack of agreement on the ideal qualities of man, and consequently the vagueness of the proposed behavioral technologies, which as summarized by Skinner would be: "Let men be happy, informed, skillful, well behaved, and productive." More specific and practical ideas are necessary, with the

understanding that some human qualities may be universally accepted as beneficial, such as good health, personal happiness, and a collection of "virtues," including generosity, affection, and truthfulness. Other qualities, however, may be controversial or even a source of conflict among different groups of men, for example, patriotism, religious faith, and political ideologies.

Studies are necessary to determine the behavioral characteristics which can be shared by all men, and conscious efforts should be made to find paths of convergence between individual and social happiness. At the same time it must be emphasized that civilization is in a continuous process of evolution, and that behavioral formulas and human values also evolve. Education should not merely perpetuate the existing system, but also prepare flexible minds able to function effectively in a future which is difficult to foresee. Individual differentiation and individual freedom are essential to avoid stagnation of the available systems, and to favor the search for new and better mental structures. For this purpose, when the child grows and is able to use his reason, it is essential to explain to him the behavioral determinants which have shaped his personality, the reasons for the choice, the type of information and ideas given to him, and then to discuss the existence of cerebral mechanisms structuring his mind, and the possibility of influencing them by new information, experience, and thinking. Being aware of the building blocks of the mind and knowing their supporting neuronal activities, he will find it easier to use the freedom of intelligent choice in order to escape from behavioral automatisms and to combine past information in some original way, leading to the construction of new ways of intellectual and emotional reactivity, and to new solutions for the problems posed by civilization.

A program of psychogenesis for the planned structuring of psychic qualities and values should be started early in the baby's life, based on available physiological, psychological, and psychiatric knowledge about the formation of the child's personality, as well as on the existing cultural norms and the larger environmental realities. In agreement with experimental findings,<sup>2</sup> the postulates of psychogenesis may be summarized as follows: (1) The mind does not exist at the moment of birth; (2) the mind cannot appear in the absence of sensory inputs; (3) individual identity and personal behavior are not properties of the brain which will unfold automatically through neuronal maturation, but are acquired functions which must be learned, and, therefore, which depend essentially on the reception of sensory inputs; (4) the purpose of education is not the unveiling of individual mental func-

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tions but the creation, the genesis of them; (5) symbols from the environment will be physically integrated within the brain as molecular changes in the neuronal structure; (6) man is not born free, but is subservient to genes and education; (7) personal freedom is not inherited nor is it a gift of nature, but one of the highest attainments of civilization which requires awareness and intellectual and emotional training in order to process and choose consciously and intelligently among alternatives; (8) education should not be authoritarian because then mental flexibility is reduced, handicapping creativity and forcing behavioral conformity or producing hyperactive rejection and rebellion. Education should not be permissive either, because then other kinds of automatisms are being developed, determined by the blind chance of environmental circumstances. In a permissive atmosphere, the individual may be a slave of his own emotions, while an authoritarian upbringing creates a tyranny of inhibitions and conformism. Both extremes are undesirable, and it is preferable to direct mental and behavioral development toward a self-determination of goals, knowing that if we want to create free individuals, we must teach them to be so. Understanding of the cerebral mechanisms involved in behavioral responses provides a feedback which modifies these mechanisms, introducing elements of conscious determination.

The human being is a functional trinity of sensory inputs and behavioral responses connected by the essential link of intracerebral processes. The three aspects are equally essential, even if only the first two were considered important in the past. Today we have begun to unravel the secrets of cerebral activities, and a new perspective for the understanding of man is emerging from the experimental complexities of neurobehavioral data.

### NOTES

1. B. F. Skinner, "Freedom and the Control of Men," *American Scholar* 25 (1955-56):11-20.

2. See also Jose M. R. Delgado, "Free Behavior and Brain Stimulation," *International Review of Neurobiology* 6 (1964):349-449; "Personality, Education, and Electrical Stimulation of the Brain," in *Innovation and Experiment in Modern Education: Report of the Twenty-ninth Education Conference*, New York, ed. A. E. Traxler (Washington, D.C.: American Council on Education, 1965), pp. 121-29; "The Basis of Education within the Brain," in *1965-66 Jennings Scholar Lectures* (Cleveland: Educational Research Council, 1966), pp. 101-12; "Radio Stimulation of the Brain in Primates and in Man," *Anesthesia and Analgesia* 48 (1969):529-43; *Physical Control of the Mind: Toward a Psychocivilized Society*, World Perspectives, ed. R. N. Anshen, vol. 41 (New York: Harper & Row, 1969); Delgado and Diego Mir, "Fragmental Organization of Emotional Behavior in the Monkey," *Annals of the New York Academy of Sciences* 159 (1969):731-51.