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Abstract

Society applauds the recent advancements of scientific technology in fields such as medicine, energy, and communication. While humankind profits in many ways from this technology, a few voices are heard cautioning society to consider the implications of these developments. This paper discusses the gulf which appears to exist between scientific technology and the human condition. Reasons for this gulf are: 1) the failure to develop a philosophy of science in which human values, and aspirations are viewed within the context of scientific technology, 2) the reductionist approach to science in which the parts are emphasized at the expense of the whole; and, 3) the failure to conceptualize behavior in such a way that the situational or contextual variables of technology are understood. The paper concludes by proposing a social ecological model of human behavior which allows for the integration of technology with the human condition.

Introduction

Society applauds the advancement scientific technology has made in recent years in various fields, such as medicine, energy, and communication. While humankind profits in many ways from this technology, a few voices are heard cautioning society to consider the implications of these developments.

The objective of this paper is not a crusade for clean air, a lament for the return to the "good old days," or a call to halt the advancement of scientific technology. Rather, the purpose is to discuss the interface of scientific technology and the human condition. Most important is that a gulf currently exists between these two factors. Several factors are responsible for this gulf: 1) the failure to develop a philosophy of science in which the human condition, values, goals, and aspirations are viewed within the context of scientific technology; 2) the reductionis

approach to science in which the parts are emphasized at the expense of the gestalt or whole; and, 3) the failure to conceptualize behavior in such a way that the situational or contextual variables of technology are understood. The paper will conclude by proposing a social ecological model of human behavior, which allows for the integration of technology and the human condition at both the mirco-level of individual psycho-social functioning and at the macro-level of social institution.

The Need for a Philosophy of Science

Rene Dubos (1965), in the essay "Science and Man's Nature" published in Daedalus, reports on a symposium entitled "Man and His Future" held in London in 1963. The purpose of the conference was to study and predict the effects of science on every aspect of human life. Dubos observed that the participants had no difficulty discussing the role of science in terms of space exploration, energy, and the consumption of raw materials. As a matter of fact, the participants seemed to believe that there were few limitations to what science might do. However, Dubos noticed that no-one seemed to be able to deal adequately with the human side of the coin, or the psychological, ethical, emotional, and cultural factors which mediate the use of science. Dubos felt this was an indication that scientific knowledge was in danger of becoming alienated from human experience, thus reducing the ability of technology to meet human needs.

Dubos refers to this as the disjunction between technology and human experience. The choice of the word "disjunction" is rather interesting. One might visualize this phenomenon as similar to putting an electrical plug incorrectly into an extension cord socket. This results in one prong in one hole and the other sticking out of the socket. To lament over the disjunction of science and technology is not a cry for a return to the good old days in which life was supposedly was simpler and sounder, a thesis which could easily be refuted. Rather, Dubos is asserting that there is a need for a new philosophy of science, one which will unite scientific technology with human experience (Mokrzychi, 1983; Munevar, 1981). One cannot assume that automatically the good life will emerge from scientific and technological inventions, and naively think that more of the latter will create a better society.

The disjunction between scientific technology and human experience is being demonstrated in some of the questions facing modern society. One example of the double-edged nature of technology is the development of

insecticides and herbicides which have benefited the agricultural industry and everyone who uses their products. Lawns are greener and gardens pest free, and consequently more productive as a result of the development of these products. However, the residuals of these poisons are retained by the human body, while the waste that results from the manufacture of these products are difficult to dispose of safely. Similar problem areas are related to the use of genetic engineering, the implantation of mechanical hearts, and the utilization of nuclear energy, just to mention a few.

The Reductionist Approach to Science

A second reason for the gulf between scientific technology and the human condition relates to the structure of the scientific method. The scientific method, also known as reductionist analysis, approaches the study of natural phenomena and living organisms by dividing them into fragments, in order to investigate elementary structures and properties in increasingly greater detail (Dubos, 1965). This approach has been very fruitful in some cases, for it has led to numerous discoveries which save time and energy. However, there is a dark side to this process. How do the parts fit together as a "whole?" By obscuring the "whole" are the social implications of science missed? Warner Wick (1976) discusses this theme in a delightful essay entitled "Sour Apples from the Tree of Knowledge," in which he contends that Eve got more than she bargained for when she bit into the apple from the tree of knowledge. Although he uses biblical imagery, his message is clear. Specifically, persons cannot always anticipate the consequences of their actions, particularly in terms of their social impact. Wick (1976: 30) quotes Harland Cleveland as saying:

> There isn't anything we don't know about the modern city - its demography, its water table, its engineering design, its art, its slums, its economics, its politics. We just don't seem to know how to make it beautiful, accessible, safe and clean.

Cleveland sums up this problem with what Wick calls a "tidy aphorism": "In everything you and I undertake, the bottleneck is somehow the situation as a whole." What a bottleneck!

General systems theory, as conceptualized by Boulding (1956), offers a holistic standpoint as an answer to the fragmentation resulting

from the scientific approach. Systems theory emphasizes not only the parts but also the whole, in addition to stressing the reciprocal relationship to the parts and the whole. As the parts of a system are analyzed by the scientific method, so also the system formed by the parts must be studied. Thus the impact the breakdown of a particular part has on the whole can be understood. As an example, Boulding (1956: 198) laments the failure of scientists from various specialties to communicate with one another and aptly protrays them as "walled-in hermits, each mumbling to himself words in a private language that only he can understand." This commentary should be expanded to include the failure of the physical scientists to communicate with social scientists, including the professions charged with intervening in the lives of those who experience a breakdown in psycho-social functioning. A general systems theory, as Boulding suggests, fosters the development of "generalized ear" on the part of specialists, which enables them to communicate with scientists in other fields. The establishment of "think tanks" comprised of individuals representing various disciplines, including leaders in business and government, represents an attempt to address Boulding's concern.

Traditional Conceptualizatons of Human Behavior and a Proposed Social Ecological Model

A third reason for the gulf between scientific technology and the human condition relates to the prevailing theories used for conceptualizing human development and behavior. As L'Abate (1976: 34) states," . . . most of developmental and personality theorists chose to consider personality development as if it occurred in a vacuum. If some reference is made (to the role of the family and of parents in personality development), it will be tangential, short, or treated as being inconsequential."

This might be restated as the use of linear models to explain human development and behavior, which fail to grasp the influence of situational and contextual variables on psycho-social functioning. One of the earliest stage theorists was Freud, who stressed the decisive role the early years of infancy and childhood play in determining a person's basic personality structure. A person's later life, actually from about six years of age, was an extention of this basic structure (Hall and Lindzey, 1978). Freud conceptualized the six steps of development as the oral, anal, phallic, oedipal, latency and genital stages. Freud was influenced by the scientists

of his time, including Hermann von Helmholtz who formulated the principle of energy conservation, Pasteur and Koch who did the fundamental work on the germ theory of human disease, and Mendel who did pioneering work in the area of genetics. This is to name only a few of Freud's contemporaries or near contemporaries who influenced him (Hall, 1954). Freud applied many of the principles offered by these physical scientists to his developmental theory. The stages of development postulated by Freud portrayed the human being as a complex energy system. In fact, Freud proceeded to create a theory of human development based on the transformation and exchange of energy within the personality. Freud focused his attention on the influence of "needs" or internal stimuli, rather than the external stimuli which he felt persons could avoid. Thus, the stages of development initially postulated by Freud, and which still impact psychological thought today, presented human development and behavior as if they occurred within a vacuum. Development was primarily an intra-psychic phenomenon; namely, the individual coping with instinctual energy or libido.

Later theorists, such as Erikson, viewed these stages in terms of the interplay between humans and their environment, as suggested by the title of Erikson's (1963) book, Childhood and Society. Erikson conceptualized development in terms of the developmental tasks which an individual must complete in order to function adequately in society. His stages were not tied to a strict chronological timetable, thus reflecting his epigenetic principle. This term, borrowed from embryology, means that a stage is not completed and left behind, but continues to influence a person's development throughout his or her life.

Several observations may be made about the customary way in which human development is viewed. One, the first eighteen years of life are divided by Erikson and other theorists into six to eight stages. The last sixty-two years of life, assuming humans live to an average age of seventy years, are divided into only three stages. Of course, this is due in part to the impact of Freudian psychoanalytic theory, which stressed the importance of the early years of development on a person's later life. Another reason is that the complex nature of adulthood has only recently been "discovered." It has taken the work of theorists such as Levinson (1978) and his colleagues at Yale to conceptualize adulthood as consisting of phases, just as earlier theorists analyzed childhood. Levinson, for example, conceptualized adulthood as consisting of three key phases, e.g., early, middle and late, with distinct phases within each of these periods

which last approximately ten years. More recently the popular writing of Sheehy (1976) suggested that human development should not be viewed as stages, but in a more fluid manner which portrays growth as spontaneous and very individualized.

Another limitation to the way in which human development and behavior have been viewed pertains to the narrow parameters imposed by the traditional models. Reference again is made to the work of L'Abate. L'Abate thinks academic psychology conceptualizes behavior primarily in terms of a reactive perspective. Accordingly, behavior is assumed to progress through three stages: 1) behavior as action; 2) behavior as reaction: 3) behavior as interaction. L'Abate pushes this model one step further to add a fourth view: behavior as transaction. "Behavior as action" is when demeanor is understood to be isolated from both past or contemporary events. Using the example of a child crying, this activity would be viewed as unrelated to the child's biography or immediate environmental conditions. The only causal factors affecting this behavior are mystical forces or the gods. "Behavior as reaction" views behavior as a response to an antecedent cause. A unidirectional perspective is maintained. The child's crying is understood to be a reaction to something which has occurred, such as wetting a diaper. The third phase of behavior as "interacton" suggests a bidirectionality of influences, specifically including exchanges between two or more individuals. Nonetheless, this rendition does not take into account contextual, or ecological, factors which shape behavior. In this instance the child's crying stimulates a caring response in the mother, who attempts to determine the reason for this behavior. The fourth and final view which L'Abate (1976) postulates is viewing "behavior as transaction." In short, behavior is a function of transactions; namely, bidirectional exchange within contextual and situational factors. In order to understand the interaction between a mother and child, the context of this exchange must be known. For example, it is important to know something about what is going on within the life of the mother, such as the presence of significant others and environmental factors which may be influencing her behavior. This is a social, ecological approach to human behavior.

Siporin (1975: 20) describes the ecological model in the following manner.

> The social functioning of individuals and of social systems is viewed as a dynamic state of affairs and as a transactional process

> between a human unit . . . and social-physical environment. The gestalt and its interaction parts constitute an ecology and a system.

Germain and Gitterman (1980: 5-6) comment:

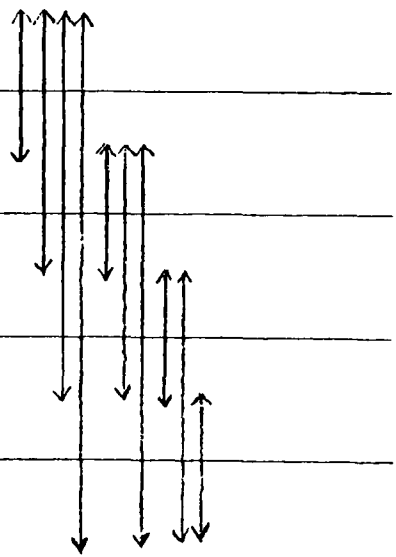
> The ecological perspective provides an adaptive, evolutionary view of human beings in constant interchange with all elements of their environment. Human beings change their physical and social environments and are changed by them through processes of continuous reciprocal adaptation . . . Like all living systems, human beings must maintain a goodness-of-fit with the environment. The Darwinian concept of 'fit' applies both to organisms and environments: to the fitness of the environment and the fitness of organisms, each with the order, and through which both prosper . . . Adaptation is an active, dynamic, and often creative process. Put another way, people, like all living organisms, together with their environment, form an ecosystem in which each shapes the other.

Germain and Gitterman emphasize three interrelated components of the transactions between people and their environment which determine the nature of the human-system interface. They are life transitions, environmental factors, and interpersonal processes.

[Figure 1 Here]

Figure 1 attempts to portray life time - lines from an ecological perspective, taking into account life transitions, environmental factors, and interpersonal processes. Because of the complexity of the model, only one time frame is analyzed in the life of a family. The major characters in the family are mother, father, and three children, ages 5, 9, and 13. The vertical arrows attempt to show the transactive nature of the behavior of these individuals, with each of them involved in their own life transitions and interpersonal processes. However, this two-dimensional diagram fails to capture fully what is happening to this family. Contextual and situational variables impacting on this family at this time must be added. In order to do this, imagine adding several clear plastic overlays. Try to conceptualize the structural relationships of this family unit. With this picture in mind, the first overlay is now placed on the diagram. This overlay is identified as race; namely, Black. Does this

BEHAVIOR IN A SOCIAL ECOLOGICAL PERSPECTIVE

Father	age 38	
Mother	age 36	
Child 1	age 13	
Child 2	age 9	
Child 3	age 5	

change the picture of this family? Add another variable: low socio-economic background. Another and somewhat different picture of the family comes into view. Add yet another overlay, which identifies the current technological advancements that are impacting on this family in the areas of employment, health, education, communication, recreation, etc. How do these factors influence the psychosocial functioning of these family members both as individuals and as parts of a social system within society?

Viewing human development and behavior according to a linear model, as if they occur within a vacuum, is inadequate. L'Abate prefers to view the family as a network of interdependencies, whether mutual or reciprocal, which includes its members' interaction with the physical and social environment. Most social scientists have not been able to deal with this in their research, because of the absence of conceptual and methodological tools to handle such interdependencies. As one begins to add simply a few contextual and situational variables, the ability to protray graphically this complexity breaks down. Behavior is more than what is occurring within an individual, or between one individual interacting with another. Rather, a more appropriate view is that behavior involves transactions, or discourse between persons and significant others within the context of situational and contextual variables.

In summary, reasons have been proposed for the gulf which appears to exist between scientific technology and the human condition. Although it is not difficult to identify positive effects of the interface of technology and human existence, a more difficult task is to pinpoint ways in which this relationship may not enhance the human condition at either the micro levels of individual and familial functioning or the macro level of social institutions. Because modern technology stresses the importance of technique, the theoretical questions posed in this paper are most often overlooked. Nonetheless, unless these considerations are addressed, technology may come to obscure instead of enhance the human condition.

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