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Throughout the construction of his theory, Bowen made explicit use of conceptual models used in biology, such as symbiosis. Bowen's efforts have consistently striven toward the disciplines and knowledge in natural sciences such as biology, although his resulting theory cannot yet be described as rigorously scientific. Bowen goes beyond recording impressions to observe and accumulate facts. However, in spite of these systematic measures, the Bowen theory is not made up of a series of equations or formulas about highly predictable relationships between clearly defined variables. Many of Bowen's hypotheses remain relatively unsubstantiated and cannot produce the definitively accurate formulas or equations characteristic of more developed sciences.

There are some important similarities between the Bowen theory and science. In general, scientific theory may be described as a shorthand representation of patterns of phenomena that occur repeatedly and are relatively predictable. The Bowen theory consists of concepts that describe repeated and predictable patterns of behavior and that are fairly consistent with each other. Each concept has distinctive qualities but is at the same time

fairly congruent with physical and natural sciences, especially with biology. For example, differentiation can be used to describe cellular processes, as well as qualities of human relationships.

An example of a fairly predictable pattern of behavior in a family is that physical symptoms of dysfunction run a more rapid and irreversible course in a tight emotional system than in a loose emotional system. Also, under most circumstances, life expectancy appears longer in a relatively calm emotional system than in an intense emotional system.

Although much of the Bowen theory may be perceived as abstract, the concepts have been developed from family observations. Attempts to concretize these abstractions may "fix" or "freeze" the theory and inhibit its primary function of summarizing empirical reality. Concretizing the abstractions of any theory makes its intrinsic limitations disproportionately narrow and rigid.

Perhaps the most useful characteristic of a theory is its potential for generating questions that can be asked in any given research situation. A scientist cannot observe behavior objectively from a posture of "knowing what is wrong." Under optimal conditions, a researcher works with a hypothesis that can be reformulated in response to observed facts rather than in reaction to opinion. This exchange between thought and observation

ensures a focus on working ideas rather than on preformulated answers. A theory generated by observation and experiment becomes part of a thinking system. By contrast, conceptualization that proceeds on an intuitive basis becomes part of a feeling system. The Bowen theory is oriented toward a goal of objectivity in observation, thinking, and research.

Science suggests a frame of reference and a series of principles applicable to the study of family behavior. A scientific perspective may indicate the extent to which family interaction may be viewed as orderly behavior. The Bowen theory delineates facts of functioning in human relationship systems taking into account some of the circumstances of particular events. Bowen's systems thinking is an effort to avoid a preoccupation with why something happens. The Bowen theory focuses on what people do and largely discounts verbal explanation of why they do it. In contrast, cause-effect thinking can be viewed as an emotional response to empirical reality. Cause-effect thinking suggests a much narrower theoretical base than the intrinsic interrelatedness of systems concepts.

Family Systems

Several theories of human behavior have been based on scientific models in attempts to conceptualize psychic and emotional functioning with some degree of objectivity. Although the medical sciences have tried to apply neurophysiology to the study of emotional functions, a solid bridge between the two fields does not exist. Most theories about emotional illness have been developed in isolation from other sciences. Bowen's use of the family systems concept is an attempt to relate human emotional functioning to the natural and physical sciences. Through the use of this frame of reference, the assumptions of the Bowen theory are generally broader than those of more conventional theories of human behavior.

Some contrasts can be drawn between Bowen's work and that of traditional scientists. For example, the scope of Bowen's perspective is comprehensive rather than selectively analytical. The assumptions underlying Bowen's conceptualizations suggest a more inclusive, long-range relatedness than many specialized scientific inquiries.

A preliminary phase in the formulation of the Bowen theory was the structuring of hard-to-define observations into facts of functioning. This effort was an attempt to find some form and consistency in the shifting, subjective world of human experience. Bowen's focus on facts of functioning eventually provided a formula for the initial stages of the development of his emotional systems theory. An example of a delineation of a functional fact is the following proposition: It is a fact that people dream, think, feel, talk, love, or hate, but what people dream, think, feel, say, love, or hate is not a fact. The content of people's dreams, thoughts, and feelings is largely determined by

particular affective states that occur in response to a variety of stimuli. The affective States are manifested in many ways and in varying degrees of intensity. Experiences are behavioral consequences of given emotional systems. Functional definitions of these kinds of feeling states may be viewed as relationship facts. Although it is difficult to give an accurate functional definition of love, it is a fact that statements to another important person about the presence or absence of love in self or in the other predictably result in an emotional reaction in the relationship.

The Bowen theory developed in response to the dilemma created when conventional medical and psychiatric practices excluded family members, other than a patient's parents, from treatment. Conventional theory, which is based on the study of individuals, postulates that illness in a patient developed in relation to the parents or to other close family members. In contrast to this rather narrowly defined frame of reference, the Bowen theory views each person as an occupant of a position in an extended family emotional field or network. This network includes each parent's extended families of origin. Instead of requiring diagnosis and treatment directed only toward patient and parents, the Bowen theory considers a multitude of relationships in several generations of the same family. A person is coached on how to interact more maturely with many family members, with the goal of becoming a more responsible self.

Bowen's systems concepts describe family behavior rather than explain it in terms of cause and effect. without using a cause-effect model, the Bowen theory defines a chain of events. In characterizing relationships between physical symptoms of dysfunction and a family emotional field, emotional factors are perceived as "having something to do with" the symptoms rather specifically causing them.

People tend to be so deeply entrenched in cause-effect thinking that the use of these concepts becomes fixed. Cause-effect thinking appears particularly rigid where conceptualizations that "explain" social relations are examined. In the fields of medicine and psychiatry, the cause-effect medical model has remained the cornerstone of most practice. The Bowen theory is considered conceptually and therapeutically out of step with medicine and conventional psychiatry in spite of its working effectiveness in treating emotional problems.

The ability to think or theorize in terms of family systems appears inversely correlated with the degree to which one is emotionally involved in one's family. The ability to observe and understand a family system depends on the level of emotional tension a therapist or researcher experiences. A molecular scientist may move beyond cause-effect thinking in his specialty area but will generally lose objectivity and revert to cause-effect thinking when participating in an emotional system. A family therapist who uses an

emotional systems perspective may also be able to remain objective and to refrain from blaming others as long as emotional tension in the clinical setting is within comfortable limits. The therapist automatically reverts to cause-effect thinking in conditions of high tension.

In general, people think in terms of cause and effect most of the time in calm periods and all of the time in tense periods. In its assignment of specific causality to human problems, such thinking is frequently inaccurate, unrealistic, irrational, and overly righteous. In this respect, some contemporary scientists may be viewed as imitating their "expert" ancestors, although they may pursue different kinds of evil influences, eliminate different kinds of witches and dragons, and build different kinds of temples to benevolent spirits (Bowen 1973).

Although there are several critical differences and discrepancies between a systems frame of reference and what is generally considered to be the realm of science, there are some important similarities. Systems thinking tends to be a more general and a more comprehensive means of description and conceptualization than is usually found in science. Scientific analysis does not adequately account for the interdependency implicit in systems thinking. However, prediction remains a primary goal for both systems thinking and science, and the thrust of both kinds of inquiry is similar.

When a family is selected as a unit of study in scientific research, boundaries are defined in terms of membership and nonmembership. Although ascribed membership (being born or adopted into a family) is generally a more potent emotional relatedness than achieved membership (being married into a family), both kinds of membership are significant within the complexities of overlapping and interdependent relationships.

A family may be regarded as a large system when viewed from a multigenerational perspective, even though family membership may be more restricted than membership in social or work systems. Examining several generations in the same family increases objectivity, as this focus broadens the basis for comparing different processes and behavior. This broad definition of family is relatively alien to conventional definitions of family, although research based exclusively on nuclear families is necessarily fragmented and unrepresentative of the entire emotional field of a family. Scientific inquiry may be more productive if it is focused on the extended parts of a family system.

Scientific Reality

Science is a way of perceiving and describing phenomena. Science is widely thought of as "superior" knowledge in that it is derived from relatively objective observation and records of changes in phenomena. The ultimate

test of a scientific proposition is generally considered the verifiability and accuracy of its predictions (Cotgrove 1967).

Through observations and experiments based on a perceived underlying order of varied physical and chemical phenomena, scientists have articulated discovered regularities as compact scientific laws. Laws that have been combined and related to each other become theories, which are regarded as a reliable basis for further calculation and prediction. A scientific theory is essentially a system of information-laden descriptions of already-known facts and a system of general explanations. In physics, for example, the theory of relativity and the quantum theory are inclusive theories with which most laws of physics can be explained. Since these theories explain many laws, they can also explain a multitude of different phenomena. An important objective of science is the construction of such comprehensive theories (Zetterberg 1965). Science defines the interdependence of phenomena. In families, this focus can be on the complex network of emotional relationships in several generations (Kerlinger 1964).

Scientific knowledge tends to emphasize shared uniformities and regularities in phenomena. The accepted reference point of "natural law" within physical sciences suggests that there are certain relatively fixed or settled aspects of human behavior. In contrast, religion and the humanities focus on unique, unpredictable, and unexpected aspects of human behavior.

The supernatural and miraculous are thought to be manifested infrequently rather than continuously or periodically. They are perceived to break through natural laws by interrupting a sequence of predictable events (Darwin 1896). As a result of some of these distinctive differences, science is frequently considered antireligious or irreligious.

Science and evolutionary frames of reference juxtapose human beings and animals with the implication that there are ways to know more about human beings through studying animals. Although this kind of thinking is much criticized, a comparison of human beings and animals implies no more of a lowering of human dignity than does a recognition of the origin of the species. The essence of creative organic evolution may be that it produces completely new and higher characters that are in no way indicated or even implicit in the preceding state of evolution where they originated (Lorenz 1954).

One of the most significant revolutions in the natural sciences during the last thirty years took place in our understanding of animal behavior and human links to the animal world. Primatology and sociobiology are two of the research endeavors that point out the relatedness of human and animal behavior. Until this time, science's unwillingness to reappraise the evolutionary basis of human society appears to have done much to maintain the traditional religious doctrine of human uniqueness, which upholds the

concept of human separateness and distinctiveness from other animals.

From an historical perspective, science is a relatively new kind of knowledge. The view that human relations are not yet generally considered proper subjects for serious scientific study could perhaps be substantiated by public opinion measures. Resistance to the application of scientific methods to human behavior is in some respects the result of tradition. Contemporary conventional social theory and social thought tend to regard social problems as essentially legalistic or moralistic. These "literary" perspectives, which are products of literary traditions, are deeply entrenched in the emotional and aesthetic feelings of people and are difficult to change. Although vested interests in society's status quo generally oppose scientific "progress" in these areas, scientific findings appear to carry with them certain compulsions for acceptance. As scientific methods provide increasing numbers of reliable predictions, scientific criteria become increasingly widely accepted as decisive (Lundberg 1947).

Scientific Process

Scientific process is the objective study and prediction of relations among varied phenomena. This enterprise has a unique characteristic of self-correction. Checks are used to control and verify research findings to attain dependable knowledge. The formulation and application of theories are

means of attaining increased objectivity (Kerlinger 1964).

Owing to the many difficulties inherent in empirical measurement, a scientist often has to accept an explanation "in principle" (Bertalanffy 1968). Scientific concepts characteristic of organized wholes or systems include interaction, sum, mechanization, centralization, competition, and finality (Bertalanffy 1968). Laboratory control in applying these concepts varies considerably among different scientific disciplines. For example, the solar system has never been brought into the laboratory (Lundberg 1947).

Scientific research moves from a phase of definition, during which terminology is formulated, to a phase of proposition and theory construction (Zetterberg 1965). In both stages of development, facts are accumulated and categorized until laws emerge. A distinction that can be made between findings and laws relates to the different degrees of generality and empirical support that findings and laws have. "Lawlike" propositions may be confirmed into systems or theories depending on the strictness of the selected criteria of verification (Zetterberg 1965).

One paradigm of scientific assertion is frequently expressed as "If so..., then so." This model indicates that certain deductions can be drawn from a specific set of circumstances. This criterion of predictability is considered an indispensable component of scientific truth, and it is a cornerstone of the

Bowen theory. In more developed sciences, equations are used to represent rich, substantive concepts and highlight relationships between concepts. Where possible, the overly simplistic and commonly accepted language of causality may be replaced by the formulation of relationships that describe systems (Buckley 1968).

Science is frequently an analytical process that includes isolating variables and tracing their relationship with each other. In this way, some systems and sub systems of interrelated elements can be mapped out (Cotgrove 1967). This process involves abstracting certain aspects of complex phenomena. Although some sub systems of natural phenomena may be isolated and examined with respect to their functions for larger systems, families are very complex and difficult to examine in relation to larger social systems. Bowen focuses on a family as a relatively independent emotional unit.

Modern science tends to move in a direction of ever- increasing specialization. This specialization appears necessary because of the vast amounts of available data and the complexity of techniques and theoretical structures used. Such a development has precipitated a breakdown of science as one integrated realm and a move toward the compartmentalization of different sciences (Demerath 1967).

One difference between general systems theory and more traditional sciences is that characteristics of organization such as wholeness, growth, differentiation, hierarchical order, dominance, and control appear in systems theory but are not generally found in sciences such as physics. The many levels of organization constitute a frequently cited unifying principle in a systems perspective (Demerath 1967). The fragmentation of any single science into schools is not uncommon, even in as rigorous a discipline as mathematics. What is striking in behavioral science is how unsympathetic and even hostile to one an other such schools tend to be (Kaplan 1964).

Although fact gathering is necessary in all kinds of research, science does not primarily consist of data collection. Without a hypothesis, a researcher cannot determine which facts are important for substantiation or refutation and which facts are less significant. Effective experiments cannot be made without several preconceived ideas, and the adequate statement of research problems is a critical research activity.

A research problem generally involves the definition of a particular relationship between two or more variables. A hypothesis is a conjectural statement or tentative proposition that begins to specify the nature of this relationship. Optimally, hypotheses incorporate theory or part of a theory into testable or near-testable forms. A hypothesis may be viewed as abridge between theory and empirical inquiry, and it may be one of the most useful

tools invented to develop dependable knowledge (Kerlinger 1964).

Human Nature and Scientific Process

Recent developments in the natural sciences suggest that human beings are not unique and that human nature, like a body, may be largely a product of evolution (Ardrey 1966). Although some studies have examined human reflexes or reactive behavior, the observation of spontaneous human behavior was undertaken largely by vitalists or mystics until comparatively recently.

Perception of and participation in scientific activities is limited by inherent personal characteristics. Human perception of relationships between systems in the universe is very much influenced by the system of human nature itself. All living species, particularly human beings, can be viewed as a system. Through striving for some understanding of the inner workings of nature, a scientist is a mechanist or a physicalist in believing that the universe is a unit that can be explained, at least in principle (Lorenz 1971). Most human interests to date have focused on a scientific or systems understanding of the universe outside of self, and not on human relationship systems. Even though a physical technology may be gradually supplanted by a psychological technology, science appears to have relatively conquered the universe while at the same time forgetting or even actively suppressing

investigation into the essential characteristics of human nature (Bertalanffy 1967).

One important influence on the reticence shown in this area of study is that human beings are necessarily instruments of observation in the scientific process. A posture of objectivity is perhaps one of the most difficult achievements toward which a human being can work. With view to this difficulty, there can be an inclination to become overly rigid in conceptualizing research on behavior. A danger associated with the necessity of theoretical orientation for a scientific observer, for example, is the possibility of premature closure of ideas. The use of concepts that demand exact definitions of meaning and terms may serve to inhibit an observer who would not normally operate with such controls (Kaplan 1964).

The Bowen theory is based on the observation that similarities exist in all forms of animal behavior. The concepts reflect some awareness of the fact that scientific knowledge has provided a more conscious view of human life. Human beings perceive the universe in entirely different ways than do animals, even though in many respects people's behavior may not be so different. Human beings alone know that their bodies and behavior have evolved and are still evolving and that existence can be placed into a conceptual framework of space and time. Although people have limited options, they possess purpose and exercise choice to a unique degree.

Although much human behavior may be perceived as emotionally reactive and responsive, only human beings have a conscious and orderly sense of values.

Accumulated knowledge, though perhaps a relatively ineffective "force" compared to emotional reactivity, may be important in evolution. Through knowledge, especially scientific knowledge, people can exert some control over their lives and a degree of influence in their own evolution. However, this power may frequently be potential rather than actual, and possible choices are inevitably bound by strict limits (Simpson 1949). Belief in the human capacity to increase awareness through knowledge replaces a robotlike concept of human nature with a systems concept. A systems concept includes imminent activity as well as outwardly directed reactivity and has the potential to account for the specificity of human nature and human culture as well as similarities with animal behavior (Bertalanffy 1968).

There are many opposing views within science. These do not appear to reflect irreducible differences between physical and biological laws as much as the complexity of life processes. One way to overcome some of these contradictions and inconsistencies may be to focus on ways in which systems components are organized (Buckley 1968). By a focus on system s' interrelatedness, common denominators between different disciplines may be identified more clearly.

Society and Science

The scientific understanding of inanimate and animate phenomena is part of a broader process of secularization in society. In many respects, modern science has supplanted the view that human beings were specially created and are subject to divine guidance. Purposive vital urges are symbolic descriptions of evolution rather than realistic scientific explanations (Huxley 1942). The development of science has brought about a demystification of society and life processes.

Science has altered the frame of reference used by most people in contemporary industrialized society. Systems theory offers a new and different perspective on society, even though this frame of reference cannot always be clearly articulated. Owing to its recent development, systems thinking is not widely practiced and is used by only a few professionals, academicians, and researchers (Bertalanffy 1968). Although some parallels have been drawn with engineering, systems concepts can represent living phenomena adequately.

Science has revealed that many facts fail to accord with the wishes or logical preconceptions of human beings. Faced with the necessity for some kind of organization, society faces the dilemma of seeking goals that are not in accord with the limits set by nature (Huxley 1942). One adaptation is to focus scientific investigation on examining limits to which social organization must

minimally conform if it is to be viable. Human freedom exists when a group is not subject to widespread victimization through ignorance of the relationship between natural laws and human desires and aspirations.

In recent years, scientists have become more naturalistic in their studies of animal behavior. As a consequence, society has begun to acknowledge the possibility that individual and social behavior may be based on a wide range of animal-like reactiveness. Whereas past studies of animal behavior were based on observations of animals in captivity, recent studies have examined animal behavior in relatively free environmental conditions. Freud's generation knew comparatively little about these kinds of broad patterns of animal instincts. Society's acceptance of Freud's theories was conditioned before discoveries about animal behavior in natural settings were made (Ardrey 1968). Recent findings from animal studies have provided additional support for the development of the Bowen theory.

Although group behavior is widely acknowledged as more predictable than individual behavior, the application of scientific and systems perspectives to human behavior has been resisted by those who hold traditional beliefs and who view such endeavors as attempts to control relations in society. In society's everyday activities, some degree of predictability is assumed for minimal social organization. If human behavior were unpredictable, people would not be able to have viable relationships

with each other (Cotgrove 1967).

When social behavior is a focus for scientific research, relatively predictable characteristics are suggested and described in the hypotheses formulated. "Understanding," a subjective state in which one feels that things make sense, is qualitatively distinct from scientific proof, which depends on the actual demonstration of the interrelatedness of phenomena. As science is ultimately based on verification, one goal is to discover ways of testing "understanding" empirically (Cotgrove 1967). In its applications to social phenomena, science may be described as a search for constancies and invariants in social behavior. Scientific laws are not mere generalizations that are made when facts have been established. The laws themselves play a significant part in determining what the facts are (Kaplan 1964).

Scientific inquiry is frequently specific and limited. Scientists or researchers do not generally study society but focus instead on some restricted portion or aspect of it. Observation also frequently consists of an active search for what is not readily apparent or is even hidden. Through exposure or discovery, an intimate, sustained, and productive relationship between scientist and social phenomena may be facilitated (Kaplan 1964).

Science is frequently thought to have added a fatalistic or deterministic dimension to interpretations of social reality. However, if society has been

evolving automatically under the influence of irresistible impersonal forces, this assertion is far from suggesting that individuals must submit to these forces. Science has increased social freedom in that one can be said to have a more reliable range of options when one's limits in relation to the universe are defined. Social resistance to such a science of society may itself be described as a product of social education largely derived from deduction, dogma, revelation, and guesswork (Keller 1931).

Conclusion

Bowen's research on interrelationships and behavior within families is distinct from cause-effect studies that generally focus on fewer variables. from the Bowen systems perspective, interaction within the whole family is examined, whereas in cause-effect studies only certain aspects of the whole are analyzed.

Although the prediction of behavior is an important long-range goal for both scientific analysis and systems thinking, the "essence" of the two approaches is different. Scientific analysis generally consists of explanations articulated in terms of "why," whereas systems thinking focuses more on functional descriptions of "how" parts relate to the whole and to each other.

As the most significant family memberships are generally ascribed, it is frequently easier to isolate variables related to behavior in these groups than in less clearly defined work and social systems. The probability of attaining some degree of precision or reality in the study of families may be markedly greater than in the study of other groups. As family interaction is a primary means of socialization throughout life, a family is a significant emotional system to research in an overall effort to describe some of the principles of the most complex human interaction. By a close examination of family dependencies, concepts for a general theory of human behavior can be developed. It is perhaps only through an adequate knowledge of basic principles of family interaction that behavior in other social settings will be understood.

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