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# An Essay Regarding the Systems Approach in Social Science from the View of Political Science

Gregg William Smith
*Western Michigan University*

# AN ESSAY REGARDING THE SYSTEMS APPROACH IN SOCIAL SCIENCE FROM THE VIEW OF POLITICAL SCIENCE

by

Gregg William Smith

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# CHAPTER I

## INTRODUCTION

The systems approach, as a phrase loosely describing a wide variety of phenomena, is for the most part a term of the twentieth century. The concept of a systems metaphysic or a systems science, however, has been explicitly or implicitly contemplated in Western thought at least since Plato wrote *Timaeus*.[1] Aristotle postulated in *Physics*[2] and *Metaphysics*[3] a systematic universe that was macro-determined. That is, a universe in which a prime mover caused everything to move according to its nature without being moved itself. Whether or not Aristotle's ideas would be classified as a bonafide system by today's system theorists is dubious depending on which practitioner of systems science one is conversing with. But it cannot be denied that the Aristotelian heritage in Western Civilization induces systems thinking.

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[1]Plato, *Timaeus*, trans. F.M. Cornford (New York: The Bobbs-Merrill Company, 1959).

[2]Aristotle, *Physics*, trans. Hippocrates Apostle (Bloomington: Indiana University Press, 1969).

[3]Aristotle, *Metaphysics*, trans. Hippocrates Apostle (Bloomington: Indiana University Press, 1966).

Philosophers of the Middle Ages meshed together the rhetoric of Aristotle with the teachings of the Judaic-Christian religion to espouse universal systems typified by the Summa Theologica of Thomas Aquinas.[1] The nature and characteristics of macro-determined world systems, such as the Summa Theologica, are derived primarily from intuition, divine revelation, or other a'priori means.

Although these doctrines have the beauty of imparting a cohesive and comprehensive understanding of man and the world he lives in, they lack the countenance of empirical confirmation. With the passage of time and the advance of technology, men of science attempted to verify the tangible tenets of universal systems which in due course were coalesced and propagated as a paradigm by the Catholic Church.

These attempts of empirical verification were, by definition, directed only towards phenomenon that was capable of being observed sensually. Scientific inquiry was therefore not involved in fundamental assumptions such as the existence of a conscious and eternal God. Inquiry was rather relegated to those corporeal details for which there was a technology capable of rendering their manifestations observable, and whose explanation had

[1]St. Thomas Aquinas, Summa Theologica, ed. Anton C. Pegis (New York: Random House, 1948).

previously been intuited as true, but not observably demonstrated as such.

It is worth recalling that the Catholic paradigm postulated the earth as the center of the universe in accordance with Ptolemy's geocentric model. With the use of scientific method, Copernicus (1472-1543) and Galileo (1564-1641) demonstrated that Ptolemy and the Church were wrong and established their heliocentric system as correct.

So it came to pass that science could not investigate the intangible aspect of the Church's ideology, but was quite willing to pass judgment on the tangible, and with ever increasing incidence assailed the Church's intuited ideas about the world as empirically false. Despite the efforts of such great thinkers as Descartes, Leibniz, and Kant to reconcile intuition or divine revelation with scientific method,[1] the two epistemological approaches clashed into a debate that has never been resolved. The historical outcome of this confrontation was characterized by a gradual decline in the confidence of comprehensive systems to explain the material world without regard to scientific evidence, and a corresponding rise in the notion that the knowledge of corporeal truth is limited to what can be empirically established.

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[1]Hans Reichenbach, The Rise of Scientific Philosophy (Berkeley: University of California Press, 1959), p. 100.

Aristotle was a key founder of the school of thought known as the rationalists, and for that is often regarded as the father of science. Modern science, however, has been far more influenced by the parental leadership of the empiricists:[1] Francis Bacon[2] (1561-1626), John Locke (1632-1704), and David Hume[3] (1711-1776). Regarding any approach to knowledge, Hume wrote:

> Does it contain any abstract reasoning concerning quantity or number? No. Does it contain any experimental reasoning concerning matter of fact and existence? No. Commit it then to the flames, for it can contain nothing but sophistry and illusion.[4]

One can only conclude that such a fire should be started with the pages of Aristotle's <u>Metaphysics</u>. In philosophical circles, Hume's ideas were received with mixed feelings. Among men of science, however, Hume and Bacon found enthusiastic adherence for their advocacy of empiricism.

The analytical procedure that emerged from this entailed the isolation of the object under study into its

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[1]loc. cit., p. 78.

[2]Francis Bacon, <u>The New Organon</u>, ed. Fulton H. Anderson (Indianapolis: The Bobbs-Merrill Company, 1960).

[3]David Hume, <u>An Inquiry Concerning Human Understanding</u>, ed. Charles W. Hendel (Indianapolis: The Bobbs-Merrill Company, 1955).

[4]loc. cit., p. 173.

constituent parts, accompanied by cause and effect experimentation which takes place within the framework of Euclidean space and Newtonean time. This method, which some historians of science refer to as classical physics, asserts the aphorism that the whole can only be known through the knowledge of the parts, or, the understanding of something is defined by its parts. Such thinking evokes the famous equation of equality "the whole is equal to the sum of the parts." It is important to note that under this system the knowledge of the parts always precedes the knowledge of the whole. The knowledge of the parts is acquired by means of isolating the part being investigated from the whole. If the part cannot be isolated physically, it is, at any rate, isolated conceptually. This is the context of the term analysis.

Utilization of an analytical paradigm enabled science to make advances that were, without a doubt, unparalleled in magnitude and sophistication. Lavoisier and Dalton, for example, used the empirical method to establish the atomic theory in chemistry, and discredited the caloric and phlogiston theories of the rationalists.

Twenty five hundred years of scientific thought cannot be adequately covered in these few pages and I will not attempt to prove my assertions. Nevertheless, the contemporary development of a systems approach can be understood only by an appreciation of its historical context. That context, as briefly outlined above, asks the questions, can man trust his intuitive perception more or less than his sense perception; and, more importantly, what is the proper relationship between the two approaches?

## The Idea of the Thesis

In this thesis I intend to address the idea of a systems approach for political science; what it entails and how it works. Systems theory is interdisciplinary in nature and, therefore, requires an interdisciplinary approach to its understanding. The design of this thesis is to examine the laws of systems under the aspect of Ludwig VonBertalanffy et al., and isomorphism under the aspect of Anatol Rapoport et al. This essay will critique and coalesce the views of systems theorists who contribute to the examination of the systems approach in political science, for the purose of putting forth a comprehensive sketch of its dynamics, limitations, and implications.

## The Inclusion of Political Science within Social Science

To speak of a systems approach for political science is somewhat of a contradiction of terms. Political science, in fact, is a specialized form of social science that deals with the study of politics. Politics has never been succinctly defined, but is often referred to as the process that decides who will get what, when and how. Politics has always, and will always, play an important role in human society, but it is a role that is inextricably bound together with the other key elements of social organization: the production and distribution of goods (economics), family and social structure (sociology), and culture (anthropology and linquistics). This view is supported by Lasswell. "I have, I trust, made it plain that the fundamental fact of politics is inextricable from human society..."[1] According to Heinz Eulau, as quoted by Apter, "It is quite clear that the study of politics is no longer the exclusive domain of the political scientists, if it ever was."[2]

Social science, the study of human society, is comprised of the five disciplines named above; all of which have an affect on, and are affected by, all the others. The politics, economics, social structure, and culture of any human society constitutes its social system.

Since politics is a part of society and can be understood only in the context of the larger whole, it is erroneous for one to think in terms of a systems approach for political science. Whatever value a systems approach

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[1]Harold D. Lasswell, The Future of Political Science (New York: Atherton Press, 1963), p. 241.

[2]David Apter, Ideology and Discontent (New York: The Free Press, 1964), p. 7.

may yield to political science will be found within the larger framework of social science. Such an approach is necessarily interdisciplinary and encompasses all the disciplines that together are regarded as the social sciences.

## Introductory Remarks Regarding the Systems Approach

The word "system" is from the Greek word "systema" which means to bring together, and in our language connotes a complex of unity and thus, an interaction and interrelation of parts. System is defined as an "orderly combination or arrangement of parts, elements, etc., into a whole; especially, such combination according to some rational principle; any methodical arrangement of parts."[1]

Systems theory is the study of systems, and requires in all cases the assumption that systems exist, i.e., there are parts that interact with each other to make wholes. The conceptual emphasis of a systems approach is, logically, on systems (wholes) as opposed to the parts of a system. The delineation of what is a system and what is a part in a larger system is problematic and often becomes arbitrarily resolved in accordance with the level of complexity one wishes to deal with.

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[1]Funk & Wagnalls, Standard College Dictionary (New York: The Reader's Digest Association, 1967).

Advocates of systems theory and general systems theory are found within many disciplines including mathematics, physics, natural science, social science, life science, and engineering. Each of these disciplines use the systems approach for their own purpose, and therefore conceptualize and define systems in a way that corresponds to their goals and the special problems they encounter. Yet, there are certain metaphysical assumptions that are, more or less, common to all systems proponents.

Since each practitioner of systems science will work in the special area that is dictated by his/her field of study, a maximum knowledge of the limits and dynamics of systems can be obtained only through an interdisciplinary examination of contemporary systems thinking. I have, therefore, in the interest of acquiring a well founded, comprehensive understanding of the idea of a systems approach in social science, sought out noted authorities of systems from disciplines other than the social sciences. The aim of my research has been to use those authorities who contribute to the knowledge and understanding of the systems approach in the social sciences, even though they may not be social scientists themselves. David Berlinski,[1] for example, has provided an important critique, from a methematician's point of view, of mathematical systems

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[1]David Berlinski, On Systems Analysis (Cambridge, Mass.: MIT Press, 1976).

used in social science.

Let this serve as an introduction, and allow me to proceed to a more precise discussion of the theory systems, the particular attributes of the systems approach in social science, and the implications for political science.

## CHAPTER II

## THE DEVELOPMENT OF SYSTEMS THEORY AND GENERAL SYSTEMS THEORY

In the introduction of this thesis I gave a brief account of the historical context from which the systems approach emerged. Laszlo has summarized this position and espoused the systems view as a new paradigm that resolves the two historical approaches.

> In the history of Western science, atomistic and holistic ways of thinking have alternated. Early scientific thinking was holistic but speculative; the modern scientific temper reacted by being empirical but atomistic. Neither is free from error, the former because it replaced factual inquiry with faith and insight, and the latter because it sacrifices coherence at the altar of facticity. We witness today another shift in ways of thinking: the shift toward rigorous but holistic theories. This means thinking in terms of facts and events in the context of wholes, forming integrated sets with their own properties and relationships. Looking at the world in terms of such sets of integrated relations constitutes the systems view.[1]

The systems view rejects the idea that an understanding of a phenomenon, which is an integrated part of a larger phenomenon (system), can be achieved by isolating the integrated phenomenon from the larger

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[1]Ervin Laszlo, The Systems View of the World (New York: George Braziller, 1972), p. 19.

whole. According to Sutherland, "...many systems are so effectively integrated that there is simply no 'part' which can be abstracted from the whole without losing significance."[1]

Opponents of the systems approach criticize this position by pointing out the immeasurable amount of knowledge made possible through analysis by isolation the systems view rejects. The extreme conclusion of this criticism leads to the argument that since all phenomena, except the universe, exist within a larger whole, only the universe qua universe can be studied--which is absurd.

The systems theorist responds to the first point of contention by acknowledging the invaluable role analysis has played, and will continue to play in scientific progress. They point out, however, that analysis through isolation has in many documented instances led to confusion, contradiction, and distortion of the object under study. The systems approach offers an alternative methodology for those areas where analysis has yielded unsatisfactory results. Bertrand Russell wrote:

> Scientific progress has been made by analysis and artificial isolation...It is therefore in any case prudent to adopt the mechanistic view as a working hypothesis, to be abandoned only when there is clear evidence against it.[2]

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[1] John Sutherland, A General System Philosophy for the Social and Behavioral Sciences (New York: George Braziller, 1973), pp. 38-39.

[2] Bertrand Russell, Human Knowledge, Its Scope and Limits (London: Simon and Schuster, 1948), p. 2.

Systems scientists have found evidence against the mechanistic view and consequently, in those cases, advocate its abandonment.

The seond point of contention against the rejection of mechanistic analysis alludes to the legitimate problem of levels (the scope and/or limits of a model). Supposing the universe to be a system in which everything occurs, even the most fanatical systems scientist would want to use a model smaller than the universe for most scientific inquiry. Obvious practical reasons dictate the necessity for such artificial limitation or isolation. The problem that faces the systems scientist when selecting the scale or level of model to be used is addressed by VonBertalanffy:

> The danger is oversimplification: to make it conceptually controllable, we have to reduce reality to a conceptual skeleton--the question remaining whether, in doing so, we have not cut out vital parts of the anatomy.[1]

It is interesting to note that the problem with analysis is the opposite of this; the danger is overspecification without reference to the larger whole.

Because of problems such as those regarding levels of inquiry the systems approach must be flexible, but must always bear in mind the systems principle that an object within a system cannot be fully explicable apart

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[1]Ludwig VonBertalanffy, General Systems Theory (New York: George Braziller, 1968), p. 200.

from the system. Philosophically, this is expressed by P.D. Ouspensky:

> In order to understand a thing, you must see its connection with some bigger subject, or bigger whole, and the possible consequences of this connection. Understanding is always the understanding of a smaller problem in relation to a bigger problem.[1]

In Sutherland's view:

> In its fundamental aspects, the holistic modality applauded by the general systems theorist does not deny either the value of empirical analysis or the occasional reduction of entities for scientific manageability. It, simply, demands that some awareness of the whole precede the attempt to appreciate the parts.[2]

All of this begs the questions--why is this so? What is wrong with the precepts of mechanism and isolation, and why is the procedure of analysis invalid? The answer to this question revolves around the fact that the validity of the type of analysis exemplified in classical science depends upon two conditions:[3]

1. Interaction between the object of inquiry and other objects be nonexistent or weak enough to be neglected.

2. Relations describing the behavior of objects in intercourse be linear, i.e., the sum of the parts is equal to the whole.

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[1]P.D. Ouspensky, The Psychology of Man's Possible Evolution (New York: Alfred A. Knopf, 1966), p. 100.

[2]Sutherland, op. cit., p. 39.

[3]VonBertalanffy, op. cit., p. 19.

VonBertalanffy claims:

> We may state as characteristic of modern science that this scheme of isolable units acting in one-way causality has proved to be insufficient. Hence, the appearance, in all fields of science, of notions like wholeness, holistic, organismic, gestalt, which all signify that in the last resort, we must think in terms of systems of elements in mutual interaction.[1]

It has proved to be insufficient because its procedure ignores relations between objects, relations that are a part of each object's nature, but cannot be rendered through analysis by isolation. Consequently, knowledge of a whole that is derived from the analysis of its parts is incomplete and warped because the analytical sum of the parts is not equal to the whole. What is missing is the phenomena that is manifested through the intercourse of parts. This phenomena, as well as the parts, are what determines the whole in reality.

"Thus a 'systems approach' became necessary."[2] It is on this point of parts in interaction that systems theory is founded. Klir cites the deficiencies of analysis to conclude that "A new way of looking at the world has evolved in which individual phenomena are viewed as interrelated rather than isolated, and complexity has become a subject of interest."[3]

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[1] loc. cit., p. 45.

[2] loc. cit., p. 4.

[3] George Klir, Trends in General Systems Theory, ed. George Klir (New York: Wiley-Interscience, 1972), p. 16.

It is worth repeating that systems thinking and systems technology has existed since ancient times. Research since World War II, however, has tended to support the systems view, and discredited the results of mechanistic analysis. This repudiation of analysis was not general, but was directed at specific fields which, subsequently turned to systems as an alternative paradigm. This was perhaps, most striking in areas affected by Einstein's breakthrough in relativity. The theory of relativity is a system of time, space, and matter. Other systems models that grew out of Einstein's work were applauded as successful. There can be no doubt that this success induced researchers in other fields to develop system approaches for their questions that purely analytical models have not adequately answered.

## The Diversity of Systems Thinking

There are literally dozens of theories that are considered to be based on system principles: cybernetics, information theory, decision theory, holistic medicine, system analysis, systems engineering, game theory, mathematical system theory, and the theory of relativity to name a few of the major ones. Because of this diversity and the tendency of systems work to be parochial and autonomous, the systems approach often becomes obfuscated. "The terms 'systems,' 'systems concepts,' 'systems approach,' and 'systems science,' are used so widely and so broadly today that they tend to connote fuzzy thinking."[1]

The example of cybernetics is worth illustrating. Cybernetics was founded by Norbert Wiener,[2] and "is an artificial creation...made up of the theory of linear servomechanisms, information theory, the theory of nerve networks."[3] In mathematics, cybernetics is a specialized aspect of the theory of recursive functions.[4] In the engineering, life, and social sciences, cybernetics has evolved into general and specific theories of how information is passed along a channel of communication. In social science, for example, the theory of rumor control is considered to be based on cybernetics. As Berlinski is quick to point out:

> The mathematical spirit is quite different as one passes from discipline to discipline... But from an external point of view...these disciplines are united by more than a common if promiscuous indentification with general system theory.[5]

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[1]R.E. Kalman, P.L. Falb, and M.A. Arbib, Topics in Mathematical System Theory (New York: McGraw Hill, 1969), p. 3.

[2]Norbert Wiener, Cybernetics (New York: John Wiley & Sons, 1948).

[3]Berlinski, op. cit., p. 26.

[4]loc. cit., p. 35.

[5]Ibid.

The Idea and Purpose of the Systems Approach

In light of the magnitude of systems research and the acknowledge "fuzzy thinking" pointed out by Kalman et al., the aim of the systems approach is twofold: First, to comprehensively coalesce the work of systems theorist and scientists for the purpose of defining, in general, what a system is, and to identify principles common to all systems and/or to indentify principles common to certain types of systems. This is the notion of general systems theory. Second, in order to provide data to achieve the first aim, the systems approach seeks to promote systems science in the realm of specific research and problem solving. That is, "A certain objective is given; to find ways and means for its realization requires the systems specialists (or team of specialists) to consider alternative solutions and to choose those promising optimization at maximum efficiency and minimal cost in a tremendously complex network of interactions."[1] VonBertalanffy[2] believes that rigorous work of this kind will give the general systems theorist information that will lead to the development of the first aim of the systems approach

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[1]VonBertalanffy, op. cit., p. 4.

[2]loc. cit., pp. 1-89.

which, in turn, will promote problem solving and research.

Consideration needs to be given to a subtle, but important distinction between general systems theory and systems theory. General systems theory is the study of systems or types of systems qua systems, and examines similarities between system. Systems theory, on the other hand, is the study of particular systems which relate to particular subjects, and not necessarily to other systems. Needless to say, both general systems theory and systems theory comprise the systems approach or paradigm, and both are considered in this paper.

A system is defined as "a set of objects together with relationships between the objects and between their attributes."[1] Hall and Fagen define objects as the components of the system; attributes as the properties of the objects; and relationships as that which tie the system together.[2] VonBertalanffy defines a system as simply "sets of elements standing in interaction."[3]

Thus, the key element of a system is the idea of

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[1]A.D. Hall and R.E. Fagen,"Definition of a System", in Modern Systems Research for the Behavioral Scientist, ed. N. Buckley (Chicago: Aldine Press, 1968), p. 2.

[2]loc. cit., pp. 2-3.

[3]VonBertalanffy, op. cit., p. 38.

parts in interaction, which leads to the systems law that the whole is larger than the sum of the parts. That is, the sum of the individual parts does not account for the interaction between the parts. This is explained by VonBertalanffy who says:

> The meaning of the somewhat mystical expression 'The whole is more than the sum of the parts' is simply that constitutive characteristics are not explainable from the characteristics of isolated parts. The characteristics of the complex, therefore, compared to those of the elements, appears as 'new' or 'emergent'"[1]

In its ideal state, the systems approach would be capable of mathematical expression. Due to cultural and environmental bias, idea expression in common language is often confused in that it lacks the rigorous logic of mathematics. The language of mathematics is logical in form and therefore communicates without misunderstanding. Referring to the systems approach, VonBertalanffy writes "In elaborate form it would be a logicomathematical discipline, in itself purely formal but applicable to the various empirical sciences."[2]

There is some utility, then, in presenting an example of general systems theory that can be elucidated with math.

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[1] loc. cit., p. 55.

[2] loc. cit., p. 37.

A general systems theory to the understanding of uniform growth, whether populations or bank balances, has been developed with the use of differential equations. Any such phenomena can be described by the equation

$$\frac{dQ}{dt} = a_1 Q \qquad (1)$$

This is an equation of uniform growth whose exponential solution is

$$Q = Q_o e^{a_1 t} \qquad (2)$$

Although modest in scope, it is a system; it does explain the phenomena in its domain, and it confirms the idea of parts in interaction. Since it is, however, a system that relates only to uniform growth, it cannot be applied generally. That is, it cannot be applied to other types of growth.

Equation (1) is an aspect of the general equation

$$\frac{dQn}{dt} = fn(Q_1, Q_2, \ldots . Q_n) \qquad (3)$$

Unlike equation (1), not all the solutions to equation (3) are exponential, and thus the general equation does not produce general results.[1] To generalize the application

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[1]Berlinski, op. cit., pp. 5-9.

of equation (3) would require the investigation of "...all possible mathematical types of functional interrelationship."[1] Practical consideration would render the fruits of such an inquiry dubious.

## Isomorphisms

As previously stated, one of the important goals of general systems theory is to identify isomorphisms among different systems which relate to different phenomena. Rapoport describes an incidence of isomorphism as "Two mathematical systems are said to be isomorphic to each other if a one to one correspondence can be established between the elements of one and those of the other and if all the relations defined on the elements of one hold also among the corresponding elements of the other."[2] Isomorphism is hence defined as structural identity between different entities. In perfected form, this identity would entail a one to one mathematical relationship between both entities.

The meaning of isomorphism and potential utility derived from it lies within the concept of systematic parts in interaction. General system theory postulates that if

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[1]Carl Hempel, "General System Theory and the Unity of Science," Human Biology 23 (December 1951):314.

[2]Anatol Rapoport, "The Uses of Mathematical Isomorphisms in General Systems Theory," in Klir, op. cit., p. 46.

a number of systems are isomorphic to each other, the parts and the relationships between the parts of any one system correspond to the parts and relationships between the parts of all the other systems. As a consequence, an understanding of the parts and relationships of a system implies an understanding, objectively adjusted, of any system isomorphic to it. This view is supported by Sutherland who says:

> The key here is the search for isomorphisms among real world phenomena for these, when identified, permit the development of explanatory models or allegories via analogy-building. This allows us to replace several parochialized models with a single higher-order model, thus contributing directly to the efficiency of the disciplines involved.[1]

According to Rapoport, general systems theory should examine, define, and classify those systems that are likely to be isomorphic to other systems.[2] From this, one can extrapolate that in the case of a system that is defined, but for some reason whose properties are not, or could not be ascertained, general systems theory could provide an isomorphic system whose properties are known. Thus a heuristic to the understanding of the one system is made possible by another system by means of, what VonBertalanffy calls, a homology. Homology is defined as a comparison

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[1]Sutherland, op. cit., p. 20.

[2]Rapoport, op. cit., p. 44.

where the "efficient factors are different but the respective laws are formally the same."[1] Berlinski affirms the justification of this:

> A certain set of laws governing the former phenom enon has the same syntactical structure as a corresponding set of laws for the latter phenom enon...Two sets of laws of this kind will be said to be syntactically isomorphic.[2]

For the purpose of conceptual clarity, I will give an example of two isomorphic systems that are small in scope, but logically correct and free from ambiguity; that is they are mathematically explicable.

A damped harmonic oscillator is defined as a system by the equation

$$M\frac{d^2x}{dt^2} + r\frac{dx}{dt} + CX = f(t) \qquad (1)$$

where (x) is position, (M) is mass, (r) is friction, and (C) is elasticity. An electrical circuit containing an inductance, a resistance, and a capacitance in a series is a system defined by the equation

$$L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + c^{-1}q = f(t) \qquad (2)$$

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[1]VonBertalanffy, op. cit., p. 84.

[2]Berlinski, op. cit., p. 23.

where (q) is charge, (L) is inductance, (R) is electrical resistance, and ($c^{-1}$) is capacitance.

Both of these systems have constant coefficients and are linear second order differential equations. They are isomorphic to each other because there is a one to one system relationship between (x and q), (m and L), (r and R), and (C and $c^{-1}$), i.e., position (x) to the oscillator is what charge (q) is to the circuit.[1]

The general systems view postulates that since there is an analogy (Sutherland)/homology (VonBertalanffy) between position and charge with regard to their respective systems, what is learned about one of these can be applied to the understanding of the other.

"...but an obvious objection to the entire concept of syntactical isomorphism is simply that the same law or set of laws may be expressed by sentences that are not syntactically isomorphic."[2] Consider the equations

$$\delta\int_{0}^{T} \left(\frac{1}{2}x^2 - gx\right) dt = 0 \qquad (1)$$

$$\frac{d^2x}{dt^2} = -g \qquad (2)$$

Both of these describe the system (law) of falling bodies

[1] Rapoport, op. cit., pp. 46-48.

[2] Berlinski, op. cit., p. 23.

but are not analogous to one another.[1] It may be, however, that any system that is isomorphic to either of these equations, can be rewritten to be isomorphic to the other.[2]

The role of isomorphisms in general systems theory cannot be overemphasized. According to Sutherland, "... the general systems theorist may be properly categorized as a scientist interested in isolating isomorphism and following such isolations with legitimate analogies as initial working hypotheses."[3] In pointing out the heuristic value of isomorphism, VonBertalanffy has suggested that "One may, for example, suspect that the laws governing business cycles and those of population fluctuations according to Volterra[4] stem from similar conditions of competition and interaction in the system."[5] If one supposes this to be true, the technique of locating isomorphism leads to efficiency in that "...efficiency in a

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[1] Ibid.

[2] For an explanation of the basic mathematical techniques used in general systems theory see: A.G. Hawsen, A Handbook of Terms Used in Algebra and Analysis (London: Cambridge University Press, 1972). G. Birkhoff and G. Rota, Ordinary Differential Equations (Walthan, Mass.: Blaisdell Publishing Co., 1969).

[3] Sutherland, op. cit., p. 24.

[4] V. Volterra, Lecons sur la Theorie Mathematique de la Lutte pour la Vie (Paris: Villars, 1931).

[5] VonBertalanffy, op. cit., p. 104.

science simply means being able to explain the widest range of phenomena with the fewest models or allegories."[1]

In this chapter I have drawn a great deal from the natural and mathematical sciences to ascertain the general nature of the systems approach; its definition, and its concepts. I have done this for two reasons: mathematics, and to a lesser extent natural science, are renowned for their clarity of thought even when they are in error. Also, many of the systems models used in the social sciences are derived from math and natural sciences. Hence, a basic appreciation of the systems approach in math and natural science is a prerequisite to understanding systems theory in the social sciences.

Let this suffice as the fundamental background of the systems approach, and from this, proceed with me to the idea and dynamics of the systems view in social science.

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[1]Sutherland, op. cit., p. 25.

CHAPTER III

# THE RATIONALE FOR A SPECIAL SYSTEMS APPROACH IN SOCIAL SCIENCE

The obvious, but important, delineation of differences that exist between the subject matter of natural and social science needs to be stated. The subject matter of natural science, i.e., physics,chemistry, geology, etc., is distinguished by uniformity in appearance and continuity in action. That is, for example, all water is composed of two parts of hydrogen and one part of oxygen (uniformity); it solidifies and vaporizes according to a particular combination of temperature and pressure (continuity). Since the subject matter of natural science is uniform, what is true about a particular object is true for all objects of that category. This is the principle of induction; what is true for one is true for all. Since the subject matter of natural science has continuity, the cause and effect attributes of an object do not change with time. This leads to the principle of predictability; what is true today will be true tomorrow.

In the social sciences, there is neither uniformity nor continuity in the sense used above. All fields of social science are concerned with investigating man as he is manifested by his actions. Although social science often categorizes individuals into types, everyone knows that each human being is unique; all are genetically and biologically different, all exist in a unique environment, and all have a unique language and thinking process. People are products of incredibly complex experiences, which serve as stimuli for action. From these experiences, which may be contradictory and obfuscated, decisions are made, changed, and remade. Thus, people are not only different from each other, but even the behavior of individuals may vary from day to day.

Rapoport believes that because of the differences between the natural and social sciences, there cannot be direct (syntactical) analogies between the laws of physics, for example, and social laws (if there are any).[1] Nevertheless, Rapoport suggests that there may be reasonable approximations that provide heuristic value.[2]

Because of the differences between the natural and social sciences, it makes sense for the systems theorist to distinguish between physical and social systems; hence, the idea of a special systems theory for social science.

Although the elaborate form of the systems approach

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[1]Anatol Rapoport, "The Search for Simplicity," Main Currents in Modern Thought, 28 (January-February, 1972): 79-84.

[2]Ibid.

would be expressed in mathematics,[1] a particular systems theory does not necessarily have to be mathematical to be of value. According to VonBertalanffy, "If quantization is impossible, and even if the components of a system are ill-defined, it can at least be espected that certain principles will qualitatively apply to the whole qua system."[2] "If an object is a system, it must have certain general system characteristics, irrespective of what the system is otherwise."[3] In reiterating that a system does not have to be mathematically expressible, and does not have to be confined to physical objects, VonBertalanffy write that "System theorists agree that the concept of 'system' is not limited to material entities but can be applied to any 'whole' consisting of interacting components."[4] Thus, the social system is, indeed, in the domain of the systems approach.

## The Social System

There is a widespread and long standing belief that human society is a system that has parts that interact with

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[1]VonBertalanffy, op. cit., p. 37.

[2]loc. cit., p. 106.

[3]loc. cit., p. 85.

[4]loc. cit., p. 106.

each other to constitute a whole. As previously stated, the parts of a social system consist of a political structure, a social structure, an economy, and a culture. The systems approach necessitates that the idea of parts in interaction be conceptualized. Most social scientists pay lip service to the idea that the components of society are connected, and each part exerts an influence on each of the other parts.

From the principles of the systems approach, one can extrapolate that it is ideology that brings the complex to unity in a social system. In making an analogy about the parts of a building and the relations of the parts, Parsons has written:

> ...the stability of the building depends on the properties of the materials out of which it is constructed. But the physical properties of the materials do not determine the plan of the building: this is a factor of another order, one of organization. And the organization controls the relations of the materials to each other...[1]

The organization of a social system is its ideology. All social systems have the components outlined above, but each social system organizes its parts according to its ideology. The significance of ideology will be discussed in the next chapter.

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[1]Talcott Parsons, "An Approach to Psychological Theory In Terms of the Theory of Action," in _Psychology: A Study of a Science_, Vol. 3, ed. S. Koch (New York: McGraw-Hill, 1959), p.84.

## The Systems Approach in Social Science

The systems approach has existed in social science for a long time.

> None of the elements associated with the general systems theory platform is, of itself, unique and unprecedented. The holistic approach is very much in the spirit of the intuitionalistic preference of the German Romantics, eventuating in the grand theories of Marx and Weber.[1]

In the case of Marx, for example, his social system was a function of the means of production. He considered his theory to be scientific even though it was not mathematically explicable, and was not based upon a model from natural science. The magnitude of acclaim and criticism Marx has received over the years is indicative of the impact systems thinking has had on world affairs.

In the 20th centruy the systems view has demonstrated the need for, and fostered such ideas as, holistic medicine, environmentalism, Keynesian economics, and behavioralism. These specific system theories, as well as the general theories, typified by Marx and Weber, are regarded as valid and useful, and represent the most successful and most promising aspect of systems thinking. The implications of these theories in the larger realm of a systems approach for social science will be considered in the final chapter and

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[1]Sutherland, op. cit., p. 48.

conclusion of this paper.

At this point I would like to critique some specific examples of the systems approach in social science.

Jay Forrester is a social scientist and a proponent of the systems approach. Forrester fundamentally subscribes to the systems view put forth in this paper.[1] Drawing from the techniques of mathematical systems theory, Forrester has developed specific system models to explain social phenomenon.[2]

In Urban Dynamics,[3] Forrester uses a systems model that proposes to explain the growth and decline of urban areas; not a particular city or group of cities, but all urban areas. Forrester argues that all urban areas have essentially the same qualitative characteristics, such as population, taxes, and employment. According to argument, these characteristics constitute the dynamic components regulating the growth and decline of the urban system. Differences that exist from one city to another are due to quantitive differences in characteristics.

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[1] Jay Forrester, Principles of Systems (Cambridge, Mass.: The MIT Press, 1969).

[2] Jay Forrester, Urban Dynamics (Cambridge, Mass.: The MIT Press, 1969); Jay Forrester, Industrial Dynamics (Cambridge, Mass.: The MIT Press, 1969); Jay Forrester, World Dynamics (Cambridge, Mass.: The MIT Press, 1971)

[3] Ibid.

Since the dynamic characteristics of cities are not fixed but change with time, it is, then, the element of change that measures growth and decline.

In mathematical system theory, the theory of differential equations is the technique employed in the analysis of change.[1] This technique is the principle ingredient in Forrester's model. Each characteristic corresponds to an integral equation.

Forrester uses similar models in Industrial Dynamics and World Dynamics.[2] In the latter, the dynamic components of the system are population, capital investment, natural resources, amount of capital devoted to agriculture, and pollution. Again, the crucial factor of the model is the idea that a change in one component of the system will influence in a particular way a change in the other components, and the change is explicable through calculus. Meadows uses the same method in their systems model.[3]

This kind of systems work is characterized by assumptions that are vulnerable to being questioned as arbitrary, and by mathematical analysis of those assump-

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[1] E.A. Coddington and N. Levinson, Theory of Ordinary Differentail Equations (New York: McGraw-Hill, 1955).

[2] Forrester, op. cit.

[3] Donella H. Meadows, et al., The Limits to Growth (New York: Universe Books, 1972).

tions. Berlinski is critical of this systems theory because the purity of the math involved inevitably becomes tainted by the assumptions of the process. Berlinski states, "...the palpability of solutions to the system--this in qualitative sense--makes the distinction between the theory's assumption and its cardinal conclusions very hard to grasp."[1]

The validity of mathematical models to describe social phenomena where the values of the model are assumptions of the theory has also been doubted by Solow.[2]

The systems approaches typified by Meadows and Forrester are "...ambitious and sustained efforts to see in the human and social systems the elements of a dynamical system amenable to description and analysis by means of a differential equation."[3] The question that arises is not whether the subject matter is a system, or not even if the dynamics of the systems are correctly perceived, but whether the phenomena of a social system can be expressed and measured by ordinary differential equations. The answer from the mathematical community seems

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[1]Berlinski, op. cit., p. 65.

[2]Robert M. Solow, "Notes on 'Doomsday Models'," Proceedings of the National Academy of Science 69 (December 1972); 3832-3833.

[3]Berlinski, op. cit., p. 52.

to be no:

> The theory of ordinary differential equations is one of the glories of mathematical method; together with the theory of partial differential equations, it comprises the chief mathematical instrument in theoretical physics. But mathematicians working in...social sciences have come to see that the simple, straightforward, and standard methods of mathematical physics do not work with the same perfection in the analysis, of say, the passage of fiscal legislation through the lower chanber of the house in Swoboda County, Illinois, as they do in the analysis of the movement of point masses in a field of force.[1]

This position is supported by Hendricks. "There are, generally speaking, two circumstances in which it is difficult to analyze mathematically a social system: the first is when the system is not linear; the second is when it is."[2] Given that this systems approach lacks perfection and is difficult, the question that remains is what exactly is the utility (if any) and limitations of using differential equations in explicating the social system. From my vantage point, the question has certainly not been answered, and probably has not been adequately addressed.

Another approach to systems theory that is prevalent

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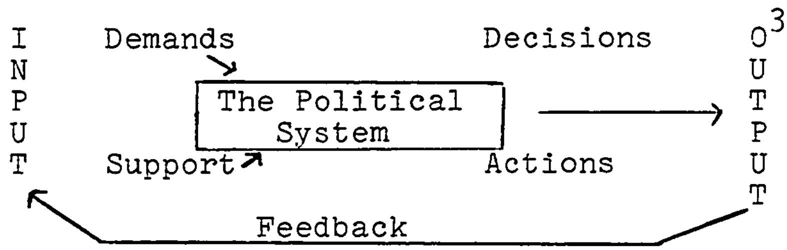
[1]loc. cit., p. 131.

[2]B.L. Hendricks, "Some Confusions in the Qualitative Analysis of the Social Sciences," in Temporal Measures of Uniform Efficiency, ed. B.S. Latvoks (San Francisco: The Maypo Press, 1967), pp. 312-313.

in social science is that exemplified by Easton[1] and Kaplan.[2] Easton has put forth a system model for political process that is, in fact, an analogy to a systems theory that was developed in abstract engineering. The following is a simplified schematic rendering of the system model used by analysts in systems engineering:

$$x(t) \xrightarrow{\text{input}} \text{Process} \xrightarrow{\text{output}} y(t)$$

Easton's model is expressed by the diagram




The concepts of input, process, and output that have worked well in engineering, generally connote entities whose functions are defined and whose attributes can be quantified. These same concepts used in Easton's model,

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[1] David Easton, The Political System (New York: A.A. Knopf, 1971); David Easton, A Systems Analysis of Political Life (New York: John Wiley & Sons, 1965).

[2] Morton Kaplan, System and Process in International Politics (New York: John Wiley & Sons, 1957).

[3] Easton, op. cit., A Systems Analysis of Political Life, p. 32.

in comparison, are not as clearly defined and not as easily quantified. It is not justified, then to assert that the techniques employed in the engineering model have the same validity when used in Easton's model. "Models drawn from the engineering disciplines have always had a certain fascination for the social scientist, though this admiration has often been directed toward techniques that the mathematician looks upon with paternal embarrassment."[1]

This is not to say that Easton's model of the political process is invalid, but it is an analogy--not a homology or isomorphism--to systems engineering. He uses technical language without technical content. This critical analysis of Easton's model does not pass judgment on whether or not his theory is useful in the understanding of political systems, but rather brings to attention the problems incurred when one uses an analogy between systems which are apparently not isomorphic to each other. Chomsky alludes to this problem:

> There is a natural but unfortunate tendency to 'extrapolate' from the thimbleful of knowledge that has been attained in careful experimental work and rigorous data processing, to issues of much wider significance... Experts have the responsibility of making clear the actual limits of their understanding and of the results that they have so far achieved. A careful analysis

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[1] Berlinski, op. cit., p. 109.

> of these limits will demonstrate that in virtually every domain of the social and behavioral sciences the results achieved to date will not support such extrapolation.[1]

In fairness to Easton, it must be added that this paper considers only one aspect of his work--the model illustrated above. Easton has a profound understanding of both the systems view and of the social system. The serious student of the systems approach for social science should examine his contribution carefully.

The intent of this paper is to address three aspects of the systems approach: the intuitive (organic) models of Marx and Weber, the mathematical models of Forrester and Meadows, and the engineering models of Easton and Kaplan.

As a point of reference, however, I would like to bring attention to the important aspect of cybernetics in the systems approach. Cybernetics is the study of communication, messages, and feedback. According to Wiener, "It is the purpose of Cybernetics to develop a language and techniques that will enable us indeed to attack the problem of control and communication in general, but also to find the proper repertory of ideas and techniques to classify their particular manifestations under certain concepts."[2]

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[1]Noam Chomsky, Language and Mind (New York: Harcourt, Brace & World, 1968), p. XI.

[2]Norbert Wiener, The Human Use of Human Beings--Cybernetics and Society (Garden City, NY: Doubleday Anchor Books, 1954), p. 17.

Parsegian has written that "...more than anything else, cybernetics aids in the study of relationships."[1] A fundamental principle of the systems approach is the idea of parts in interaction. The interaction of components implies communication between components; thus, the importance of cybernetics in the systems approach.[2]

It is not in the scope of this paper to examine particular social systems. Reference needs to be made, however, to Parsons' theory of societal evolution.[3] In the works just cited, Parsons uses a systems approach to analyze the historical and contemporary evolution of social systems. He supports his theory by examining anthropological evidence from the societies of the Australian Aboriginies to the Soviet Union.

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[1] V.L. Parsegian, This Cybernetic World of Men, Machines and Earth Systems (Garden City, NY: Doubleday & Company, 1972), p.3.

[2] For more information on the use of cybernetics in the systems approach see: Walter Buckley, Sociology and Modern Systems Theory (Englewood Cliffs: Prentice-Hall, 1967).

[3] Talcott Parsons, The Evolutions of Societies, ed. Jackson Toby (Englewood Cliffs: Prentice-Hall, 1977); Talcott Parsons, Societies, Evolutionary and Comparative Perspectives (Englewood Cliffs: Prentice-Hall, 1966).

CHAPTER IV

# SOCIETY AS AN OPEN SYSTEM

Systems theory makes a distinction between systems that are closed and systems that are open. Because social systems are part of the particular time and space that they exist in, VonBertalanffy believes that living systems are basically open systems:

> We express this by saying that living systems are basically open systems. An open system is defined as a system in exchange of matter with its environment...[1] The theory of open systems is part of a general system theory. This doctrine is concerned with principles that apply to systems in general, irrespective of the nature of their components and the forces governing them.[2]

In accordance with being open, a social system must be organized in a way that is suitable to its environment. It is easy to see that such things as climate, water supply, soil, and natural resources are elements that a society needs to adapt to if it is to survive. In addition, social systems must be able to process, or make decisions about, changes in the environment whether external or internal. For example, Marx has demonstrated that the means of pro-

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[1]VonBertalanffy, op. cit., p. 141.

[2]loc. cit., p. 149.

duction of a social system have a significant impact not only on the other components of the system, but on the environment that the system exists in as well.

At any rate, the character of a social system at any particular time is manifested by the beliefs, decisions, and actions of its members. People and nations need to make decisions: whether to have private property, whether to grow crops, whether to have schools, whether to have art, whether to go to war. The aggregation of these kinds of decisions determines the social order.

## The Importance of Ideology in a Social System

My perception of the importance of ideology in a social system has been articulated and supported by other students of social systems. Nevertheless, this aspect of the systems approach is a product of my thoughts. I have proposed the following as a proposition, but I will not provide empirical support nor will I suggest a method to attain empirical verification. It is, then, a view that is reasonable (in my opinion), but may or may not conform to reality.

As stated previously, all societies contain components which all together constitute a social system. From the principles of the systems approach, one can derive the idea that it is ideology that accounts for the scheme of how the parts themselves are defined. According to Geertz, ideology provides "...a template or blueprint for the organization of social and psychological processes, much as genetic systems provide such a template for the organization of organic processes."[1]

I will not attempt to precisely define ideology, but it should be thought of in a broad context. As Apter writes, "For ideology has no specific referent, although, despite its elusiveness, it reamins powerful, meshing as it does at so many different points in our organized lives and intimate selves."[2] When applied to a person or a nation it connotes such things as culture, philosophy, history, language, and religion, and is influenced by experiences and environment. In a sense it refers to what Tocqueville called the genius of the people, and it is perhaps better expressed by the German word "Weltanschauung," which roughly translates into world view.

In this paper it is taken for granted that people and their nations have ideologies in the sense described above. Ideology is, then, theoretically an integral part of a social system even if it is ill-defined or unknown. Such an assumption is supported by Polanyi.

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[1] Clifford Geertz, "Ideology as a Cultural System" in Ideology and Discontent, ed. David Apter (New York: The Free Press, 1964), p. 62.

[2] Apter, op. cit., p. 15.

> The fact remains that they must make up their minds about their material surroundings in one way or another. Men must form ideas about the material universe and must embrace definite convictions on the subject. No part of the human race has ever known to exist without a system of such convictions, and it is clear that their absence would mean intellectual annihilation.[1]

The systems view proposes that the reference point and perceptual framework of decision making is ideology. Erikson refers to ideology as "...an unconscious tendency underlying religious and scientific as well as political thought."[2] Mannheim concurs with this view: "...sociopolitical thought does not grow out of disembodied reflection but is always bound up with the existing life situation of the thinker..."[3]

It is important to note that in a social system the concepts of rationality and morality, i.e., what is good and what is just, are subjective. Apter believes that because ideology "is the link between action and fundamental belief, ideology helps to make more explicit the moral basis of action."[4]

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[1] Michael Polanyi, The Logic of Liberty (Chicago: University of Chicago Press, 1958), pp. 57-58.

[2] Erik Erikson, Young Man Luther: A Study of Psychoanalysis and History (London: Norton Press, 1958), p. 20.

[3] Karl Mannheim, Ideology and Utopia (New York: Harcourt, Brace, 1936), p. 46.

[4] Apter, op. cit., p. 17.

> Its role is to build solidarity, and solidarity is the moral basis of society... This connection between solidarity and morality is the essence of authority...[1]

In a practical sense, it is always the authority that works out the details of the social order. Whether the authority is divine right of kings, one voice/one vote, or the dictatorship of the proletariat, it needs to be justified only to itself.

Ideology provides for this justification, and also, according to Geertz, renders "...otherwise incomprehensible social situations meaningful, to so construe them as to make it possible to act purposefully within them, that accounts...for the intensity with which, once accepted they were held."[2] Therefore, given ideology, it is possible to proceed rationally according to its precepts. This point is illustrated by the fact that historians of Nazi Germany recognize that large segments of the population supported their social order. Their national policy was perceived as moral and rational; and it was, according to the convictions of the Nazi ideology.

The subjective nature of ideology leads to the tautology that the truth is whatever one believes to be true--even though the belief may be false. People and

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[1] loc. cit., p. 20.

[2] Geertz, op. cit., p. 64.

nations act, and justify their actions, according to their perceptions of reality. The example of Hitler's Germany is indicative of the potential for ideology to have adverse effects upon the social system.

> No social arrangement is or can be completely successful in coping with the functional problems it inevitably faces. All are riddled with insoluble antinomies: between liberty and political order, stability and change, efficiency and humanity, precision and flexibility, and so forth. There are discontinuities between norms in different sectors of the society--the economy, the polity, the family, and so forth.[1]

But for better or worse, social systems must be organized in some fashion.

It is in the nature of things that nature favors those properties which result in better environmental adaption and reproduction. This is the principle of natural selection. If one accepts that a paramount goal of social systems (as well as other life systems) is to survive and/or promote the quality of life, and if it can be established that ideology is the organizing component of a social system; then, an ideology must be judged according to its ability to enhance the attainment of this goal. Since social systems are open, it is imperative that ideologies (as the organizing component) be flexible enough to evolve with the environment and not against it.

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[1] loc. cit., p. 54.

As stated, the determining characteristics of an ideology are subjectively derived. This ideological subjectivity, however, can be objectively evaluated if it is assumed that a paramount goal of the social system is to survive and/or contribute to the quality of life, and that this goal is best realized if the characteristics of an ideology are scientifically correct. For example, if science demonstrates that racial inequality is unfounded, then it is assumed that an ideology which has a characteristic that supports racial prejudice will not promote the society's goal of survival and/or the improvement of life.

Although the rational and moral basis of social systems are subjectively understood by society, their ideologies can be objectively evaluated on two levels. Theoretically, an ideology that does not maximize survival and/or the quality of life needs to be revised or rejected. Empirically, an aspect or manifestation of an ideology that is contrary to empirical analysis needs to be carefully reconsidered within the theoretical framework above. Parsons referred to this in stating "The problem of ideology arises where there is a discrepancy between what is believed and what can be established as scientifically correct."[1] Hence, "The social function of science

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[1]Talcott Parsons, "An Approach to the Sociology of Knowledge," Transactions of the Fourth World Congress of Sociology (Milan & Stressa: 1959), p. 49.

vis-a-vis ideologies is first to understand them--what they are, how they work, what gives rise to them--and second to criticize them, to force them to come to terms with (but not necessarily to surrender to) reality."[1]

Ideology has the important function of facilitating the decision-making which determines the social order. Thus, ideology is the organizing component of the social system. The systems approach postulates that a component of a system has an influence on, and is influenced by all the other components of the system; hence, the idea of holism. This principle applies to the component of ideology in the social system. Therefore, ideology is not the central component of a social system but is rather the organizing component. That is, even though ideology is the reference point for making decisions that determine the nature of the other components (political, economic, social, and cultural), the other components have an influence on ideology. I am obligated to point out that this circular relationship provides a possible objection to this scheme of social organization. For the purpose of argument, however, I assume it to be correct.

In the systems approach to social science, understanding a social system necessitates an appreciation of its ideology. Furthermore, ideology is the key to understanding

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[1]Geertz, op. cit., p. 72.

any aspect of society in that it provides the rationale and meaning of its place in the social organization. Lewin believes that social science must be conducted with this in mind, and is critical of research that describes and critiques phenomenon without reference to the system it occurs in. "Observation of social behavior is usually of little value if it doesn't include an adequate description of the character of the social atmosphere or the larger unit of activity within which the specific social act occurs."[1]

Since ideologies act as blueprints for societies, practitioners of the systems approach must be cognizant of the function of ideology in bringing together parts of the social system. From the systems viewpoint, the determining forces of events cannot be understood outside of their ideological framework. Thus, the comprehensive analysis of social process "...is the task of the scientific study of ideology--a task but barely begun."[2] Because "...it is through the construction of ideologies, schematic images of social order, that man makes himself... a political animal."[3]; the study of ideology provides a

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[1] Kurt Lewin, Field Theory in the Social Sciences (New York: Harper and Brothers, 1951), p. 151.

[2] Geertz, op. cit., p. 70.

[3] loc. cit., p. 63.

a quide to man's limits and patterns of behavior. Ideology not only explains why things are the way they are, but is also a reference for predicting the way an individual, a group, or a nation will act given a set of circumstances.

## The Role of Ideology in General Systems Theory

In the scheme of general systems theory, ideology, in addition to its role in the systems work just described, is important with regard to system classification, i.e., the search for isomorphism. It stands to reason to hypothesize that if nations have similar ideologies, they will have similar social systems and similar patterns of action. To the extent that the ideologies of two social systems can be shown to be isomorphic to each other, general systems theory argues that the organization and characteristics of their societies will be similar. Hence, what is known to be true about one, will be hypothetically true about the other.

It is erroneous, however, to say that similar economies, similar political structures, or similar social structures, equate into similar social systems. That is, two societies could have similar economies, but still be fundamentally different from each other. On the other hand, two societies with similar ideologies will be fundamentally similar to each other because it is ideology, and ideology alone, that brings the complex to unity.

It is ideology alone only in the sense that the function of ideology is to facilitate decision-making, i.e., an ideology represents a process, reference, or program for making decisions given a set of circumstances. Since the social system is open, the particular time and space of the society's environment will provide the problems for the ideology to process and resolve. Hence, the idea that if one understands the process, one will be able to predict the decision given any set of circumstances. From this emerges the idea that two nations with similar ideologies may have different economies, for example, because of different environmental circumstances. According to argument, these nations would still be fundamentally similar because given the same circumstances, they would make similar decisions. On the other hand, if the nations were fundamentally different, given the same set of circumstances they would make different decisions. It should be pointed out that such a proposition is problematic in that once any component is different, it will have a different influence upon its ideology.

To be sure, a social system is the product of all its components and each component has an influence on all the others. Indeed, because each social system exists in a particular time/space environment, it may be that ideologies will never be similar to each other. The proposition of this paper, however, suggests that if one is to look for isomorphic social systems, one should begin with an examination and classification of ideologies; thus, the importance of ideology in a general systems theory for social science.

# CHAPTER V

## THE RELATIONSHIP OF MACRO-MICRO THEORY IN THE SYSTEMS APPROACH

In Chapter One, I noted the two epistemological approaches that have competed with each other in Western thought. On the one hand there are the universalist who are sometimes referred to as rationalists, and who identify with the teachings of Aristotle, Aquinas, Descartes, and Kant. On the other hand, there is the school of thought known as the nominalists or empiricists who base their beliefs on the writings of Bacon and Hume. Historically, each of these approaches has provided utility and each has been problematic. Merton compared the characteristics of the universalists and the empiricists and wrote that "For the first group the identifying motto would at times seen to be: 'We do not know whether what we say is true, but it is at least significant.' And for the radical empiricist the motto may read: 'This is demonstrably so, but we cannot indicate its significance.'"[1]

In concurrence with this dichotomy, Gondin sees the central problem of epistemology as asking the following

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[1] Robert Merton, Social Theory and Social Structure (New York: The Free Press, 1968), p. 139.

questions:[1]

1. Is it possible for man to go beyond the immediacy of his consciousness?

2. Is sense perception an accurate representation of reality?

The universalists and the empiricists answer each of these differently.

According to Sutherland:

> ...the ultimate predicates of science and knowledge remain answerable only incompletely, ambiguously, and often simply through the medium of rhetoric.[2] ...we cannot prove or disprove the relationship between reason and reality or between sense data and reality by purely logical or axiomatic means. Neither Kant nor Bacon succeeded in this...[3]

Nevertheless, scientists need to make decisions regarding deductive and inductive methods, whether to begin with what is known or what is unknown, and in general, to address and resolve the assumptions of macro and micro precepts. Since most inquiry involves a combination of the macro and micro views, the question becomes what is the proper relationship between the two concepts.

Lasswell wrote that "No static certainty is to be found in politics or political science, hence the importance

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[1]William Richard Gondon, Prefaces to Inquiry: A Study in the Origins and Relevance of Modern Theories of Knowledge (New York: King's Crown Press, 1941), p. 188.

[2]Sutherland, op. cit., p. 57.

[3]loc. cit., p. 61.

of cultivating an affirmative, inventive, flexible mind."[1] In the spirit of being inventive, the systems approach prescribes a particular relationship between the macro and micro theories. This relationship is offered as a possible way in which benefits of social inquiry can be maximized. Simply stated, Haris has propounded this relationship: "No science is possible, no research can be conducted and no advance can be made except by reference to, and subject to the requirements of, some conceptual scheme."[2] Hence, the conceptual scheme (macro) precedes the empirical verification (micro). For systems advocates, the conceptual scheme connotes the idea that a phenomenon is systematic, i.e., its reality is dependent upon its interaction with other phenomena in an organized fashion. Therefore, empirical research necessitates an appreciation of the organization that determines its reality.

Why is this so? To reiterate, the systems answer is because the whole is more than the sum of the parts. Buckley explains: "When we say that 'the whole is more than the sum of its parts,' the meaning becomes unambiguous and loses its mystery: the 'more than' points to the fact of organization which imparts to the aggregate, characteristics that are not only different, but often not found in

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[1]Lasswell, op. cit., p. 147.

[2]Errol Haris, Hypothesis and Perception (London: George Allen and Unwin, 1970), p. 203.

the components alone; and the 'sum of the parts' must be taken to mean, not their numerical addition, but their unorganized aggregation."[1] This fundamental principle of systems science is cited by Sutherland to conclude that "...the technics of classical physics simply do not maintain themselves well beyond a certain level of phenomenal complexity...these have served mechanics and electrochemistry rather well in their applications but have had an insidious and disintegrative effect on the human sciences..."[2]

The systems approach, then, proceeds at both the macro and micro level. It first contemplates what reasonably seems to be the component organization of the system under study. "This initial heuristic then serves as a reference for the selection of variables for empirical analysis with the proviso that the results of the empirical analysis be fed back to modify the original heuristic,"[3] It is important to note that in principle the micro is always subordinated to the macro. In actuality, however, this principle is so subtle that it is often difficult to grasp. That is, in contemplating the macro

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[1] Buckley, op. cit., p. 42.

[2] Sutherland, op. cit., p. 41.

[3] loc. cit., p. 40.

view, one inevitably considers existing empirical studies. VonBertalanffy brings attention to this circular paradox. "Analysis has to proceed at two levels: that of phenomenology, that is of direct experience, encompassing perception of outside things, feeling, thinking, willing, etc.; and of conceptual constructs, the reconstruction of direct experience in systems of symbols culminating in science; it being well understood that there is no absolute gap between percept and concept, but that the two levels intergrade and interact."[1]

The crucial element of difference between macro and micro thought is perhaps best expressed by Martin Heidegger. Heidegger believes that the intellect engages in two types of thought, meditative and calculative. "There are, then, two kinds of thinking, each justified and needed in its own way: calculative thinking and meditative thinking... Calculative thinking computes."[2] Meditative thinking is that "which contemplates the meaning which reigns in everything that is."[3] In the systems approach, the macro

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[1] Ludwig VonBertalanffy, Robots, Men and Minds (New York: George Braziller, 1967), p. 94.

[2] Martin Heidegger, Discourse on Thinking, trans. John Anderson and E. Hans Freund (New York: Harper and Row, 1966), p. 46.

[3] Ibid.

view is characterized by meditative thought, and the micro view is characterized by calculative thought, Sutherland writes, "...the holistic platform is an attempt to reunite the conceptual skills of the philosopher with the mechanical and instrumental skills of the laboratory scientist..."[1]

Although the micro aspect of systems theory may be accomplished by specialist, the nature of macro thinking requires an interdisciplinary orientation. In this regard, Lasswell has written that "Many aims of political science can be most effectively achieved if collaboration between political scientists and individuals of closely allied skills is successfully maintained."[2]

The theory of relativity is one of the best examples of the systems approach. Einstein integrated the components of space, time, and matter into a systematic macro theory. It was not until many years after the development of Einstein's theory that there emerged a technology capable of empirically verifying and applying his propositions; thus, the macro preceded the micro. Darwin's theory of evolution can also be cited as an illustration of this process.

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[1]Sutherland, op. cit., p. 40.

[2]Lasswell, op. cit., p. 189.

In this fashion, the systems approach encourages reasoned speculation. Vivian addresses this point:

> All great scientists have in a certain sense been great artists; the man with no imagination may collect facts but he cannot make great discoveries...In order to reach an understanding of the facts...we need the gift of being able to make an imaginative jump from the facts we observe to a general theory...[1]

Lasswell warns, however, that "...a creative act is not fantastic; it must be able to pass reality tests."[2]

Future Directions for the Systems Approach in Social Science

General systems theory, i.e., systems classifications and the identification of isomorphic systems, has to date achieved very little in the social sciences. The idea of equating social phenomena with the phenomena of physical and life sciences has not been convincingly presented beyond the level of superficial analogies. Proponents of general systems theory now seem to be more inclined to pursue system classification within the social sciences than to look for isomorphisms in the natural sciences. "Simply, within the operational domain of the human sciences, the

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[1]Frederick Vivian, Thinking Philosophically (New York: Basic Books, 1969), p. 60.

[2]Lasswell, op. cit. p. 147.

general systems theory potential is to be looked for in its ability to assist us in developing higher-order conceptual envelopes which serve to encompass (and supersede) the competitive lower-order theories of scholastic advocates."[1] In developing higher-order theories through the process of classification and isomorphic identification, the general system theorist hopes to explain, in a general way with a single theory or set of theories, such phenomena as national stability, revolutionary change, and economic growth.

Systems theory in the social sciences is characterized by the intuitive models of Marx and Weber, and/or the mathematical models of Forrester and Meadows, and/or the engineering models of Easton and Kaplan.

Systems proponents recognized the models typified by Marx and Weber as providing heuristic value and advocate its continued development, or perhaps it is better to say, its rebirth.

Regarding models exemplified by Forrester and Meadows there is much criticism, Berlinski concludes that mathematical models of ordinary differential equations cannot reflect the "...intrinsic discontinuity and instability of social and political life."[2] This position is supported

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[1]Sutherland, op. cit., p. 33.

Berlinski, op. cit., p. 105.

by Courant and Hilbert.[1] It appears that social systems and their components cannot realistically correspond to mathematical equations. Mathematics has an undeniable role to play in social science. Consider, for example, the utility of statistics. The future use of mathematics in the systems approach--particularly the use of ordinary differential equations--is an inquiry that warrants further investigation. Such an inquiry cannot be undertaken without the collaboration of social scientists who have an understanding of mathematics with mathematicians who have an understanding of social science.

The type of model illustrated by Easton and Kaplan is regarded as useful but limited. The main drawback is that they are, for the most part, analogies of systems engineering. A criticism of analogy is that it implies "...superficial similarities of phenomena which correspond neither in their causal factors nor in their relevant laws."[2] System proponents advocate that models such as Easton's be refined through the process of empirical research, and enlarged to encompass the attributes of the components of the social system and their organization. Such an endeavor needs to be directed at specific social systems as well as social systems in general.

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[1]R. Courant and D. Hilbert, Methods of Mathematical Physics, vol. 2 (New York: John Wiley & Sons, 1962), p. 127.

[2]VonBertalanffy, General Systems Theory, op. cit., p.84.

## The Pedagogical Aspect of a Systems Approach in Social Science

The systems view is offered as a method for social science. Its potential value (if any) is an open question that has not been answered. "For political scientists who use it, systems thoery is primarily a way of looking a phenomena--it is in many ways a state of mind."[1] The systems approach is, in many ways, a state of mind, a reference point, or a basic orientation, but it is a state of mind that needs to be developed and cultivated. To effectively practice the percepts of systems theory requires a particular method of education.

Since systems advocates postulate society as a system that has components which interact with each other in an organized manner, practitioners of the systems view must be cognizant of those components and their organization. Yet, in most universities it is possible to major in political science, for example, without ever taking a course in economics or sociology. Such a graduate, then, would not possess a state of mind that encompasses the social system. Lasswell write, "There are many grounds for rejecting the contemporary university as a satisfactory model for the forms

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[1]Alan C. Isaak, Scope and Methods of Political Science, revised edition (Homewood, IL: The Dorsey Press, 1975), p. 216.

or organization best adapted to the integrative consideration of fundamental matters in public affairs."[1]

To cultivate the state of mind required by the systems method, social science departments within the university must develop an interdisciplinary, comprehensive, and rigorous curriculum of social science. Such a curriculum would be characterized by required courses in which each succeeding course would be based upon the concepts of the preceding courses. In proposing a new epoch for political science, Lasswell has written "That a political science center would draw on colleagues in history, archaeology, and the adjacent social sciences is to be taken for granted."[2]

The systems approach does not reject the need for specialization. Indeed, the micro aspect of systems theory requires specialists. The effective specialist, however, needs to first be cognizant of the general view of his/her field. According to Lasswell, "From the beginning of their specialized studies the larger context must be kept in sight if the perspectives conducive to creativity are to be nourished and applied."[3] Systems proponents in the social sciences regard the contemporary university as fostering premature specialization.

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[1]Lasswell, op. cit., p. 208.

[2]loc. cit., p. 224.

[3]loc. cit., p. 152.

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