systems theory in the social sciences

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approaches to systems theory

There is no consensus in systems theory as to the correct approach. Instead, we find a variety of approaches of which L. von Bertalanffy's general systems theory (GST) is only one.

GST has its origins in the anti-reductionist claim of Bertalanffy in the 1920s that the domain of «organismic biology» was legitimate, that the organism was a system, and that the fundamental task of biology was the discovery of the laws of biological systems at all levels of organization. This initial insight led Bertalanffy to conceive of GST.

It is important to realize that GST has gone through a process of development from its inception in the 1930s when, although concerned with the study of systems in general, it concentrated on the theory of open systems to the 1960s when it had become an interdisciplinary study which utilized, in addition to the theory of open systems, cybernetics, information theory, games theory, automata theory and decision theory.

Bertalanffy's 1950 definition of general systems theory is:

> a logico-mathematical field, the subject matter of which is the formulation and deduction of those principles which are valid for «systems» in general.[1]

While there are claims which are peculiar to GST, the various approaches to systems theory have in common the study of systems in general. The other approaches, however, are concerned, in addition to the study of systems in general, with the characteristics of particular classes of systems.

Systems theory is found applied in the physical sciences, the biological sciences, the social sciences, and in technology.

A problem concerning a social system cannot be solved by the inspection of part of the system but requires the systems approach. As Forrester puts it:

> the intuitive solutions to the problems of complex social systems will be wrong most of the time.[2]

The systems approach appeared independently in the various branches of science. The originality and pervasiveness of the systems approach was pointed out by Bertalanffy:

> ...in the past centuries, science tried to explain phenomena by reducing them to an interplay of elementary units which could be investigated independently of each other. In contemporary modern science, we find in all fields conceptions of what is rather vaguely termed «wholeness».[3]

1. Bertalanffy, L. von (1950), «An Outline of General System Theory», *Brit. J. for the Phil. of Sci.,* May, 1950, p. 139.
2. Forrester, J.W. (1969), *Urban Dynamics,* p. 110.
3. Bertalanffy, L. von (1950). *op. cit.*

W. Weaver distinguished three stages in the development of scientific analysis, namely, organized simplicity, unorganized complexity, and organized complexity, and Bertalanffy followed Weaver in this.[4]

Advance in human knowledge has resulted from a combination of the elementalist approach, i.e., searching for the «atoms» of an object, its ultimate, indivisible elements, and the integrative approach, i.e., searching for the wholeness properties of the object. There are still cognitive situations in which the elementalist approach has a heuristic value. Advance has occurred within the tension of elementalism and integratism.[5]

We shall explore, following the example of I.V. Blauberg et al.,[6] the interrelations of systems theory, functionalism, and structuralism and shall examine the logical, methodological and epistemological questions to which they give rise.

It is either held that systems theory is distinct from, but related to, functionalism, or that there are systems ideas in functionalism, or that functionalism is one of a number of approaches albeit an undeveloped approach, to systems theory. The systems approach is shared by systems theory, functionalism and structuralism. Comprehensive expositions of functionalism and structuralism will not be attempted, but only points relevant to the discussion will be made. The application of systems theory to social reality requires the identification of systems[7] and this presupposes the identification of relations and connections which are system-forming, i.e., that produce the effect of wholeness. Provided that the relations and connections are system-forming, there is no restriction on the nature of the elements of the set standing in interrelations and constituting a system.

the logic of connections

Treating connection as a conjunctive concept has resulted in attempts at its explication being unsuccessful. There are no universally accepted criteria for distinguishing between connections and relations. As the connections found in any one system are varied, the problem of how best to classify connections arises. The classification of connections is also a step towards the explication of this disjunctive concept.

4. Weaver, W.(1948), «Science and Complexity», *Am. Scientist*, Vol. 36, 1948, 536-544.

5. Yudin, E. (1977) in *Systems Theory,* Blauberg, I.V. *et al.*, p. 16 et seq.

6. Blauberg, I.V. *et al.* (1977), *op. cit.*

7. Agreement on the concept of system has not been achieved. Two international symposia, the special seminar of the Centre International de Synthèse of April 1956 and the Unesco symposium of January 1959, failed to achieve agreement on the «most adequate» meanings of the term.

Connections are sometimes regarded as «couplings» which are stronger than relations and there is a tendency to seek stronger «couplings» in systems. O. Lange treats connections as unidirectional, i.e., if element E_1 is linked to E_2, it does not follow that element E_2 is linked with element E_1.[8]

V.N. Sadovsky has classified connections as follows:[9] 1. interaction connections, subdivided into connections of properties and connections of objects. A special type of interaction connection is that found between individuals and also collectivities or social systems. These connections may be co-operative or conflicting; 2. genetic connections; 3. transformation connections; 4. structural connections; 5. functional connections; 6. developmental connections, i.e., connections concerned with the replacement of one state of a developing object by another; 7. control connections, which may be either functional or developmental, the classification of which presupposes the explication of the concept of control. Control connections, being system-forming connections, constitute the most important type of connection in systems theory.

the logic of relations

The referent is the term *from* which the relation goes and the relatum is the term *to* which it goes.

According to the number of elements connected by a relation we have *dyadic (binary), triadic (ternary), tetradic* and other *polyadic* relations.

If *a* and *b* «are in the relation R» we write *a*R*b*. If *a*R*b* and *b*R*c*, then *a*R*c*, we have a *transitive* relation. If *a*R*b* and *b*R*c*, then not-*a*R*c*, we have an *intransitive* relation. If *a*R*b* and *b*R*c*, then «*a*R*c*» holds for some but not all of the *a*, *b* and *c* that are members of the field of R, we have a *nontransitive* relation.

A *symmetric* relation takes the form *a*R*b* if and only if not-*b*R*a*. An *asymmetric* relation takes the form *a*R*b* if and only if not-*b*R*a*. With a *nonsymmetric* relation «*a*R*b*» and «*b*R*a*» hold for some but not all *a* and *b* that are members of the field of R.

A relation is *reflexive* where if the referent has it to something it must have it to itself, *irreflexive (aliorelative)* where if the referent has it to something it cannot have it to itself, *nonreflexive* where if the referent has it to something it may or may not have it to itself.

In the correlation of relations, i.e., the number of objects to which the referent or relation may be connected by the given relation, we have a *many-many* relation, a *many-one* relation, a *one-many* relation, or a *one-one* relation.

8. Lange, O. (1965), *Wholes and Parts.*

9. Sadovsky, V.N. in Blauberg I.V. *et al.* (1977), *op. cit.*, p. 140 et seq.

Internal and external relations. An *internal* relation is one that is internal to its terms, i.e., the terms would not be the things they are unless related to it. An *external* relation is one that is not internal to its terms. In another sense, the internality of a relation depends on how its terms are described. At one extreme, it is held that all of a thing's properties are essential to its being what it is and that all its relations are thus internal to it. At the other extreme, it is held that none of a thing's properties are essential to its being what it is and that no relations are internal to it.

A. J. Bahm maintains that every relation involvės both externality and internality, connection and separation, unity and plurality.[10] He argues that to say that two things were only related externally would be to say that they were not related. According to this view, two things that are related form a whole, i.e., they at least share the same relation, and thus the relation is internal to that whole. Insofar as two things are two they are different from each other and the relation is external, being dependent on the two things being external to each other. A relation requires two and only members (relata) between which the relation is established. Angyal recommends restricting the term «relation» to two-term relations on the ground that complex relations are either reducible to two-term relations or, where they are not so reducible, e.g., «*b* is between *a* and *c*», they have the characteristics of systems.[11] Before a relation can be established it is necessary to single out a property of the relata which serves as a basis of the relation.

the concept of system

It has been argued that the term «system» is used in spheres which are so diverse that it is clear that the term has different meanings.

V.N. Sadovsky maintains that a logical sign system and an organismic system cannot be regarded as variants of the same concept.[12] However, it could be argued that system is a disjunctive concept rather than a conjunctive concept.

«System» has been variously defined as: «an integral set of interconnected elements» (V.N. Sadovsky),[13] «a set of elements standing in interrelations» (Bertalanffy),[14] «a set of objects together with relationships between the objects and between their attributes» (A.D. Hall and R.E. Fagen),[15] «set of interconnected elements functioning as a whole» (E. Yudin),[16] «anything that consists of parts connected together» (St. Beer),[17] «anything one wishes to study as an entity» (Blalock and Blalock).[18] A system, unlike an aggregate or assemblage, is characterized by non-summativity of elements and possesses irreducible wholeness properties. Thus, social and cultural systems are characterized by non-summativity and wholeness.

Angyal uses the term «system» to refer to the organization, i.e., the way of arrangement of parts and «whole» to refer to the organized object.[19] There are set-theoretic definitions of «system», e.g., by M. Mesarovic, according to which a system is a set with relations. But it follows from this concept that every object is a system. While it is true that each decomposition of a system represents a set, the system itself is not a set.

A. Uyomov's concept of system employs the categories of objects *m*, properties P and relations R and a second-order relation between objects, properties and relations, namely, the order of transition from one category to another. A system, according to Uyomov, is a set of objects in which a previously specified relation with fixed properties is realized, or a set of objects possessing previously determined properties with fixed relations between them. According to A. Uyomov's concept of system relativity, a specified set of elements is a system only with respect to specified properties of and relations between the elements. The process of identification of a system for a certain object is itself relative. In the generalized system conception a system is not a set, but the wholeness and hierarchical structure may be expressed through a class of various sets and connections between them.

Practically any object can be represented as a system by identifying in it a set of elements, together with relations and interactions between them and integral characteristics. In the case of some objects there are no non-trivial tasks requiring such representation, but the systems view of many complex objects opens up new possibilities for their study.

The systems study of an object is based on the identification of its wholeness properties, hierarchical structure and interconnectedness of its elements. It is necessary to distinguish between the study of a systems object, which may or may not involve the systems approach, and the systems study of the same

10. Bahm, A.J. (1969), «Systems Theory: Hocus Pocus or Holistic Science», *General Systems*, 1969.
11. Angyal, A. (1941), «A Logic of Systems» in *Systems Thinking*. Emery, F.E. (ed.), 1969.
12. Sadovsky, V.N. in Blauberg, V.I. *et al.* (1977), *op. cit.*, pp. 127-8.
13. Sadovsky, V.N. in Blauberg, V.I. *et al.* (1977), *op. cit.*, p. 128.
14. Bertalanffy, L. von (1971), *General System Theory*, p. 55.
15. Hall, A.D. and Fagen, R.E. (1956), «Definition of System». *General Systems*. 1956, Vol. 1, p. 18.
16. Yudin, E. in Blauberg, V.I. *et al.* (1977), *op. cit.*, p. 33.
17. Beer, St. (1959), *Cybernetics and Management*, p. 9.
18. Blalock, H.M. and Blalock A.B. (1959), «Toward a Classification of System Analysis in the Social Sciences», *Phil. Sci.*, April, 1959, p. 84.
19. Angyal, A. (1941), *op. cit.*

object. It is possible to construct different overlapping sequences of relations and connections constituting systems. As an object may be systematically described in different ways, each way involving different components, there is a risk of summing up uncoordinated results unless an integrated model of the system is first built for organizing the study of the system.[20]

A systemic element is only such in relation to a given system, and must be distinguished from the ultimate, indivisible elements of the elementalistic approach. The systemic elements are not considered separately but with respect to the system in and by which they are connected. The elements are not significantly connected with each other, from a holistic viewpoint, except with reference to the system. It is not by means of their properties that the elements participate in the system but by means of their distribution or arrangement in the system.

weighting

There are degrees of systemness.[21] There are degrees and types of connectedness and degrees and types of interdependence of systemic elements. A holon is a system which is at once a subsystem and a suprasystem.[22] Holons differ in the degree and type of connectedness involved. V.E. Frankl remarked:

> I doubt that several persons can merge and enter the holon of a nation to the same degree, the same extent, in the same sense as organs are participating in the wholeness of a human organism.[23]

There is the problem of weighting the differential contributions of the different elements to the system outcomes. Different elements make different contributions to a particular system state and to changes in the system. Elements differ in their degree of functional autonomy in relation to other elements and in relation to the system as a whole. As all these things are a matter of degree their study requires the use of quantitative methods. Parsons is opposed to the necessary weighting of systemic elements because of what he sees as the «plurality of possible origins of change».[24] A.W. Gouldner, however, recommends the weighting of systemic elements.[25]

20. According to K.E.F. Watt: «...we must use a strategy of research which at every stage is designed in terms of the problem of fitting all the fragments together correctly at the end of the research program». He suggests designing the whole research programme in terms of a conceptual model. Watt, K.E.F. (ed.), *Systems Analysis in Ecology*, 1966.

21. See K. Popper (1972), «Of Clouds and Clocks», *Objective Knowledge*.

22. Koestler, A. in *Beyond Reductionism*, Koestler, A. and Smythies, J.R. (eds.) (1972), pp. 210-211.

23. Frankl, V.E. in Koestler, A. and Smythies, J.R. (1972), *op. cit.*, p. 219.

24. Parsons, T. (1951), *Social System*, p. 494

25. Gouldner, A. W. (1970), *The Coming Crisis in Western Sociology*, p. 226 et seq.

disequilibrium of system

A system may be in disequilibrium, with the structured conditions for the attainment or maintenance of the preferred state and with a constant lag between the new preferred state and the old structural arrangements. A society's normative inconsistency is sometimes, at least partially, accounted for by this disequilibrium. The assumption of a society's normative consistency results not from a functionalist or systems approach but from the assumption of equilibrium.

structure of a system

The structure of a system consists of that which remains constant under the transformation of the system. As Laszlo puts it:

> These constancies and invariances furnish the systemic elements in reference to which theoretical structures can be built.[26]

Parsons defines «structure» as:

> the features of the system which can, in certain strategic respects, be treated as constants over certain ranges of variation in the behavior of other significant elements of the theoretical problem.[27]

G. S. Sčur uses the term «structure» to refer to the hierarchic set of related elements of an entity and the term «system» to refer to the hierarchic set of connections among the elements of structure.[28]

time and systems

Analysis does not involve the concept of time in general, but that of the specific time of the system.

The distinction between historical time and the time of functioning is based on the distinction between respective temporal scales. Historical time is different for different systems and different segments of evolution may be covered in chronologically identical time spans. Inner historical time has its own units of measurement which are related to changes in structure. The time of functioning takes as its unit of measurement the realization of a definite function, or a set of interconnected functions. In both historical and structural analysis, we may be concerned with the time of reproduction of a certain structure. In historical analysis this will be regarded as the

26. Laszlo, E. (1972), *Introduction to Systems Philosophy*, p. 101.

27. Parsons, T. (1961), «A Paradigm for the Analysis of Social Systems and Change», *Theories of Society*, Parsons, T., Shils, E.A. *et al.* (eds.), 1961.

28. Sčur, G.S. (1966), «On Some General Categories of Linguistics», *General Systems*, 1966, p. 149.

minimum, but in structural analysis as the maximum specific time of the system.

Social structure assumes a certain period of time and abstracts repetitive behaviour from it. Macro-time refers to periods so long as to invalidate a given social structural schema. Micro-time refers to periods too short to invalidate a given social structural schema.

It is meaningless to speak of the structure of a system. When can a set of relations amongst systemic elements be said to be relatively fixed and therefore a structure? One can only say that structure is exhibited for the period chosen.[29]

homologies and isomorphisms

Bertalanffy makes the claim:

We can ask for principles applying to systems in general, irrespective of whether they are of physical, biological or sociological nature. If we pose this question and consistently define the concept of a system, we find that models, principles, and laws exist which apply to generalized systems irrespective of their particular kind.[30]

According to Bertalanffy, the logical homology or structural correspondence of systems gives rise to isomorphic laws in different fields.[31]

Bertalanffy maintains, and is followed in this by A. Rapoport,[32] that the classification of systems may be based on mathematical homologies, in particular, isomorphisms. According to GST, classifications of systems may be derived from classifications of mathematical models. If a system is specified as a particular mathematical model, it is seen to be isomorphic to all systems specified in terms of the same type. To the extent that a system of equations underlies disparate phenomena, these phenomena must exhibit homological laws. Homologous variables or parameters may be found in two or more isomorphic models. Terms for such homologous variables and parameters must play the same part in the respective theories.

It is held that knowledge from disparate disciplines may be integrated by the utilization of mathematical homologies. It has been pointed out, however, that isomorphisms are incapable of expressing the specificity of systems objects under study.[33] It is clear that laws of nature cannot be derived from the logical and mathematical homologies of systems.[34] The claim that laws of nature could be discovered in this way led Ashby to remark:

... this discipline (GST) always seemed to me to be uncertain whether it was dealing with physical systems, and therefore tied to whatever the real world provides, or with mathematical systems, in which the sole demand is that the work shall be free from internal contradictions.[35]

It is true that mathematical structures created to represent reality contain deductive consequences, but the status of these deductive consequences as laws of nature depends on their success in characterizing reality and not on their role in a mathematical structure.[36]

E. Laszlo, on the basis of GST, assumes the universal existence of socio-cybernetic processes,[37] but whether or not a given social system is a cybernetic system is a question which can only be answered by inspection.

Hempel points out that a study of systems in general would have to investigate all possible types of functional relationships, and that although systems laws would constitute a subclass of these, there would be no way of identifying them.

Blauberg and Yudin state:

As long as the general systems theory was interpreted in scientific terms exclusively (in the sense of the most general theory of systems), the doubts in the scientific productivity of such a theory were quite legitimate.[38]

They go on to state that the subject-matter of general systems theory, in their conception, is the complex of systems theories. However, they are in no position to legislate and general systems theory must be judged according to the way it is presented by its disciples.

classification of systems

Systems have been classified according to type of system-environment interaction as follows:
1. open and closed systems 2. absolutely closed systems, relatively closed systems and open systems (G. Klir) 3. relatively open and relatively closed systems.

29. Blalock H.M. and Blalock, A.B. (1959), *op. cit.*
30. Bertalanffy, L. von (1971), *General System Theory,* p. 33.
31. Bertalanffy, L. von (1950), *op. cit.,* pp. 138-9.
32. Rapoport, A., «General Systems Theory» in art. «Systems Theory», *Inter. Encyc. of the Soc. Sciences.*
33. Lektorsky, V.A., Sadovsky, V.N. (1960), «On the Principles of Systems Research», *General Systems,* Vol. V. 1960, p. 174.
34. Ervin Laszlo in Bertalanffy, L. von (1975), *Perspectives on General Systems Theory,* p. 11 et seq. argues that Bertalanffy created, not a falsifiable theory, but a new perspective. This would be a complete answer to his critics if it were true, but unfortunately it is not.
35. Ashby, W.R. (1968), «Principles of the Self-Organizing System», in *Modern Systems Research for the Behavioral Scientists,* Buckley, W. (ed.), 1968, p. 10.
36. Berlinski, D. (1976), *On Systems Analysis,* p. 10.
37. Laszlo, E. (1972), *Introduction to Systems Philosophy,* p. 102 et seq.
38. Blauberg, I.V. and Yudin, E. (1977) in Blauberg, I.V. *et al., op. cit.,* p. 291.

Systems may also be classified according to the ontological status of their elements.

To Bertalanffy, an open system is one having a continual inflow and outflow of both matter and energy, whilst a closed system is one having neither inflow nor outflow of matter but having the possibility of energy exchange. Thus, such a system is not completely closed.

Under certain conditions an open system may reach a flow equilibrium or steady state, i.e., a system state in which macroscopic quantities are constant but microscopic processes of input and output go on continuously. An open system in a steady state is able to perform work. Open systems, unlike closed systems, are characterized by equifinality, the steady state, if reached, being independent of the initial conditions.

To Parsons, an open system, unlike a closed system, is one affected by changes in its environment. It is engaged in processes of interchange with its environment, and may be seen as a subsystem which is dependent on other subsystems for essential inputs.[39]

P.A. Weiss maintains that all systems are open systems. As he puts it:

> Basically all systems must be expected to be open somewhere somehow.

But he holds that practical considerations demand that some systems be treated as closed:

> ... on practical considerations, we accept (of systems) their putative deviations from absolute autonomy as «negligible» (negligible; not non-existent), treat them as «essentially» autonomous, and call them «closed» systems.

According to Weiss, if we find that we have drawn the system boundary in such a way as to omit some «essential» interrelation formerly regarded as «negligible», we can always correct our mistake by extending the boundary so as to include it.[40]

G. Klir [41] divides systems into: 1. *absolutely closed systems:* systems without system-environment interaction; 2. *relatively closed systems:* systems with system-environment interaction limited to certain inputs and outputs; 3. *open systems:* systems capable of receiving and responding to all impacts of the environment.

There is no system, however, without system-environment interaction and no system is capable of receiving and responding to all impacts of the environment. The assumption of a reciprocal impact of system on environment is invalid.

When we refer to an open system we always imply the property or properties in relation to which we regard the system as open. If we use the concepts of relatively closed system and relatively open system, we recognize, firstly, that a system is only open with respect to definite parameters and, secondly, that it cannot be completely closed.

Social systems differ according to the ontological status of their elements. On the one hand, social systems may be concrete systems, in which case their elements are persons or sets of persons, or, on the other hand, abstract or analytic systems, in which case their elements are constructs.

This distinction may be used to elucidate Lockwood's distinction between social integration, which focuses on the orderly or conflictual relationships between the actors, and system integration, which focuses on the orderly or conflictual relationships between the parts of the social system.[42]

In system integration analysis, unlike in social integration analysis, social processes which cut across a multitude of groups are brought together.[43] For example, in Parson's theory all social processes relevant to a particular functional problem are brought together.

teleological explanation

Teleological explanation is accounting for a given phenomenon by its being contributory to the goal sought or maintained by the system. Teleological explanation is possible without any metaphysical or finalistic overtones. It is wrong to suppose that a teleological explanation asserts that an effect precedes its cause. The belief that they would otherwise be asserting that an effect precedes its cause has led some writers, such as C. G. Hempel and E. Nagel, to maintain that «X occurs for the sake of Y» means either that X is a sufficient condition for Y, i.e., that X will bring about Y, or that X is a necessary condition for Y, i.e., that Y will not occur without X. A teleological explanation of X is that X occurs for the sake of Y, with the implication that an alteration in Y will bring about an alteration in X, that an alteration in the goal will alter the behaviour of the system. The alteration in the goal precedes the alteration in the behaviour of the system and in the behaviour of the system cause precedes effect.

P. Sztompka gives the following account of teleological explanation:

39. Parsons, T., «Social Systems», in art. «Systems Theory», *Inter. Encyc. of the Soc. Sciences.*
40. Weiss, P.A. in Koestler, A. and Smythies, J.R. (1972), *op. cit.*, p. 17.
41. Klir. G., Vallach, M. (1967), *Cybernetic Modelling.*
42. Lockwood, D. (1964), «Social Integration and System Integration», in *Explorations in Social Change,* Zollschan, G.K. and Hirsch, W. (eds. 1964).
43. Mouzelis, N. (1974), «Social and System Integration», *Brit. J. Sociol.*, Dec. 1974, p. 395.

If we assume that the system has a built-in mechanism that pushes it toward the preferred goal state in spite of changing circumstances, i.e., that it has a sort of inner program oriented to that final state, then we obtain a solution free from both metaphysical and finalistic overtones.[44]

ontological status of social wholes

Ontological individualism denies reality to social wholes. S. Lukes claims that both F.A. Hayek and K. Popper accept ontological individualism, but M. Lessnoff doubts whether anyone has ever held this view.[45] It would seem, however, that the view has been held and that the holistic controversy, in part, concerns it. Hayek maintains that terms designating social wholes are really theories about the relations of individual events, and that the wholes exist «if and to the extent to which» the corresponding theories are correct.[46] To Popper, social wholes are unobservable, theoretical entities comparable to the theoretical entities of physical science.[47]

According to H. Spencer:

... it is the permanence of the relations among component parts (of a society) which constitutes the individuality of a whole as distinguished from the individualities of its parts.[48]

But permanence of the relations is unnecessary for the preservation of the system, although some stability is necessary to constitute a persisting system.

S. Andreski affirms the entitivity of social groups, holding that an entity can be said to exist if an attribute can be predicated of it which cannot be predicated of any other entity.[49]

D.T. Campbell points out that it is methodologically improper to assume that a social aggregate is an entity or system, and maintains that the social aggregate's entitivity or systemness is a hypothesis to be tested.[50] As spatial cohesion is a criterion for the attribution of entitivity, there is a tendency for the attribution of entitivity to depend on the nature of human perception.

The systems approach implies that properties are attributable to social wholes. A social system, in this view, has irreducible properties of its own.

Popper maintains that there are two meanings of whole: (a) a totality, i.e., all the properties or aspects of a thing, together with the interrelations of elements, (b) certain properties or aspects of a thing which make it an organized structure rather than a «mere heap». In this case it is appropriate to say that «the whole is more than the sum of its parts». «The more» does not stand for something in addition to the parts, but to their organization. Popper maintains that social scientists confuse totalities with Gestalt wholes, and assume that social wholes are Gestalt wholes. Popper argues that a totality cannot be made an object of scientific study because a piece of the world may be described by widely different propositions and that such a list is infinite. All description is necessarily selective and we can never grasp the «concrete structure of social reality itself».

It is certainly important that social scientists should not assume that social aggregates are social wholes. But social scientists take a selective interest in social aggregates, whether organized or not, and are concerned with those properties which are attributable to them.

Popper's argument is only effective against a particular form of holism, a metaphysical holism which is no longer defended.[51]

hierarchy

By analytic levels, structural levels, integrative levels, or organizational levels, we mean that laws, functional relationships, correlations, or associations are found to exist between variables or other entities each of which subsumes entities at a lower organizational level and is itself subsumed with others under an entity at a higher organizational level. Organizational levels stand in the relationship of progressive inclusiveness and constitute a hierarchy.

E. Laszlo[52] represents the progressive inclusiveness of systems thus: $[(a \subset b) \subset c] \subset n$.
The levels are cumulative upwards.[53]

S.F. Nadel points out that the phenomenal properties of facts on one level disappear on the next lower level, so that there is a break, a relevant discontinuity, between one level and the next, each level being governed by regularities peculiar to it. This disappearance of the phenomenal properties of facts on one level on transition to the next lower level is known as phenomenal regression and is the opposite of the emergence of new properties on transition to a higher level.[54]

45. Lessnoff, M. (1974), *The Structure of Social Science,* p. 7.
46. Hayek, F.A. (1964), *The Counter-Revolution of Science,* pp. 54-5.
47. Popper, K. (1961), *The Poverty of Historicism,* pp. 135-6.
48. Spencer, H. (1897), *Principles of Sociology,* p. 447.
49. Andreski, S. (1972), *Social Sciences as Sorcery,* pp. 183-4.
50. Campbell, D.T. (1958), «Common Fate, Similarity, and Other Indices of the Status of Aggregates of Persons as Social Entities», *Behavioral Science,* 1958, p. 17.

44. Sztompka, P. (1974), *System and Function.*
51. For Karl Popper's argument see Section 23 «Criticism of Holism», *The Poverty of Historicism,* 1961.
52. Laszlo, E. (1972), *op. cit.,* p. 52.
53. Feibleman, J.K. (1954), «Theory of Integrative Levels», *Brit. J. Phil. Sci.,* May, 1954.
54. Nadel, S.F. (1951), *Foundations of Social Anthropology.*

C. Grobstein thinks of the transition from one level to the next higher level as a set-superset transition. So the entities belonging to a given level can be represented as:
$S=[A,B,C,...N]^R$, where S is a set, A,B,C,...N are the components, R is the sum of the relationships among the components. S itself is a component of a set and each component is a set.[55]

Allport maintains that when we are in a position to work with an entity that we experience at one level, the entity as experienced by us at the next lower level disappears.[56]

However, when working at a given level we are able to recognize that the internal structure of the entity exists although the internal structure is largely irrelevant for operations at this level.

A hierarchical structure is often thought to be an entity composed of certain kinds of parts, each of which is composed of other kinds of parts, etc. But the various kinds of parts of a hierarchical structure do not necessarily form a linear order of parts, subparts, sub-sub-parts, etc.

According to R.L. Causey, a hierarchical structure is one which involves at least two structural descriptions and at least two genera of parts, the structural descriptions being a description of the whole as composed of certain kinds of parts, and a description of at least one of these parts as a structure composed of certain sub-parts.[57] The way in which parts are integrated may vary from one level to another in a hierarchically-structured whole.

The nonlinearity of the order constituted by integrative levels has also been pointed out by J.K. Feibleman.[58]

J.K. Feibleman presents the following propositions concerning integrative levels:
1. Each level organizes the level or levels below it plus one emergent level. 2. Complexity of levels increases upwards. 3. In any organization the higher level depends on the lower, i.e., in any object which extends over more than one level, which it must do if it exists at any level above the physical, the higher level depends for its continuance upon the lower. 4. In any object which extends over more than one level, the lower level is directed by the higher. 5. The more integrated an organization, the more extensive and severe will be a reverberation. 6. The more complex the organization, the more unstable, and thus the time required for a change in organization shortens as we ascend the levels. 7. The higher the level, the smaller its population of instances. From the point of view of population, the integrative levels form a pyramid. 8. Events at any given level affect other levels. 9. It is impossible to reduce the higher level to the lower, as each level has its own characteristic structure and emergent properties.

It is a fact that complex systems possess a relatively simple structure and are intelligible, which is in accordance with traditional empiricism with its assumption of simplicity and intelligibility, but is something that requires an explanation, in the light of the fact that the study of complex systems would suggest a degree of complexity leading to unintelligibility.

The explanation is that the dynamics of a complex system results in a simplified structuring of that complexity. Those evolving systems survive which become hierarchical. The development of subassemblies leads to a relatively simple structure. The detail of the subassemblies is irrelevant to the lower-frequency interactions among the larger segments. As H.A. Simon puts it:

> The loose vertical coupling permits the stable subassemblies to be treated as simple givens, whose dynamic behavior is irrelevant to assembling the larger structures.[59]

Only the inputs a subassembly requires and the outputs it produces are relevant to the larger aspects of system behaviour. Hierarchy enables the components at any given level to preserve a measure of independence and to adapt to their special aspects of the environment without destroying their usefulness to the system.

Components at any given level have a functional efficacy which is independent of their subcomponents. Complex systems evolve from simple systems much more rapidly if there are stable intermediate forms.[60]

Nature is organized in levels because hierarchic structures provide the most viable form for any system of even moderate complexity.

Views vary as to the ontological status of organizational levels.

As to the relationship between organizational levels and descriptive levels, we have at one extreme the view that laws are entirely objective and determine the organizational levels and at the other extreme the view that whatever the underlying reality may be, what we understand by laws are structured by the descriptive levels we choose.

It has been held that some of the hierarchies reflect the structure of nature and that others are the result of convention.

55. Grosbein, C. (1973), «Hierarchical Order and Neogenesis», in *Hierarchy Theory*, Pattee, H.H. (ed.), 1973.
56. Allport, F.H. (1965), «Logical Complexities of Group Activity», in *Philosophical Problems of the Social Sciences*, Braybrooke, D. (ed.), 1965.
57. Causey, R.L. (1977), *Unity of Science*, pp. 138-9.
58. Feibleman, J.K. (1954), *op. cit.*
59. Simon, H.A. (1973), «The Organization of Complex Systems», in Pattee, H.H. (ed.), (1973), *op. cit.*
60. Simon, H.A. (1962), «The Architecture of Complexity», *Proceedings of the Amer. Phil. Soc.*, 106, 1962.

Bertalanffy appears to take the realist view:

Reality ... appears as a tremendous hierarchical order of organized entities...[61]

Piaget appears to take the conventionalist view. He observes that phenomena are not found to be completely organized at each level and that «it is the level that creates the phenomena».[62]

systems paradoxes

Systems paradoxes are the result of the mutual conditionability of the solution of two problems, i.e., the solution of one problem presupposes the solution of the other.

The following three systems paradoxes are the primary ones. Other systems paradoxes are the result of the application of these.

The two problems characterized by mutual conditionability are given after the exposition of each paradox.

The paradox of hierarchy[63]

Describing an object as a system requires that its components can be described as subsystems and that it can itself be described as a subsystem of a larger system. This results in the paradox of hierarchy.

Describing the components of an object as subsystems presupposes that the subsystems can be described as systems and presupposes that the system of which they are subsystems can be described as a system.

Describing an object as a subsystem of a larger system presupposes that the object can be described as a system and presupposes that the system of which it is a subsystem can be described as a system.

A. the problem of describing a system.
B. the problem of describing a subsystem.

The paradox of wholeness[64]

A whole can only be understood in terms of its parts, but the parts can only be understood in terms of the whole.

A. the problem of understanding a whole.
B. the problem of understanding its parts.

61. Bertalanffy, L. von (1950), *op. cit.,* p. 164.
62. Piaget. J. (1965). *Insights and Illusions in Philosophy,* p. 82.
63. See the discussions by V.N. Sadovsky in Blauberg. I.V. *et al.* (1977), *op. cit.,* pp. 270-271 and «Problems of a General Systems Theory as a Metatheory», *Ratio,* June, 1974:33.
64. Compare formulation of paradox by V.N. Sadovsky in Blauberg, I.V. *et al.* (1977), *op. cit.,* pp. 271-272 and in «Problems of a General Systems Theory as a Metatheory», *Ratio,* June, 1974:33 with that of F. Schelling, Schelling, F. (1957), *System des transzendentalen Idealismus.*

The systems-methodological paradox

The construction of a description of a specific system requires the construction of the methodology of systems research, but this presupposes the construction of a description of a specific system.

A. the construction of a description of a specific description.
B. the construction of the methodology of systems research.

As systems paradoxes are the result of the mutual conditionability of the solution of two problems, they involve the logical circle:

$$\vdash A \vdash B \vdash A \vdash B \vdash A$$

where A and B represent the two problems.

The interpretation of systems paradoxes

Systems paradoxes may be resolved in various ways. The paradox of hierarchy only applies to systems where hierarchicality is recognized. If hierarchicality is not recognized, the paradoxicality disappears.

The paradoxicality of wholeness is unconvincing. System decomposition may be into elements which have been separated and are no longer parts or into parts. It is unacceptable that these parts possess the wholeness properties of the system under study as the wholeness properties of the system are irreducible.

Parts are elements which are integrated in a whole and we maintain that each part is related to the rest of the whole. Understanding the parts simultaneously will mean understanding the whole. The systems-methodological paradox requires a temporal resolution.

Systems paradoxes are neither semantic nor logical but are of an intermediate type, as they can neither be resolved by specifying the respective semiotic rules nor by the exclusion of the source of paradoxicality. Systems paradoxes become partially resolved in the process of constructing systems thinking and become amenable to a temporal resolution. Problems are solved on the basis of preliminary, incomplete and partial data.

Introducing temporal parameters, represented by subscripts of A and B, we obtain:

$$\ldots \vdash A_i \vdash B_j \vdash A_k \vdash B_l \vdash A_m \ldots$$

functionalism

Functionalism has been conceived very broadly as the doctrine that the parts should be related to the whole of a society and to one another, but this is not in accordance with the views of functionalists.

The broad conception of functionalism according to which functionalism is synonymous with sociological analysis and non-functionalism is synonymous with reduction or pure description is maintained by Kingsley Davis.[65] According to K. Davis:

Given its subject, the least it (sociology) could do is to relate the parts to the whole of society and to one another.[66]

K. Davis goes on to say that definitions of functionalism go beyond the relating of a part to the specification of *how* it does this relating, namely, by seeing one part as «performing a function for».[67] But this is just the point. Functionalism is something more than the doctrine of the relating of a part.

Merton maintains that in its approach to theory, method and data, functionalism is weakest in its approach to method, whereas Sztompka maintains that the importance of functionalism lies in its method.[68] However, Merton is referring to the details of method, whereas Sztompka is referring to the strategy of theory construction.

Sztompka divides methodological rules into heuristic maxims, empirical techniques and the strategy of theory construction and holds that it is in regard to the strategy of theory construction that there is a functional method.[69]

R.K. Merton in his codification of functionalism isolated three functional postulates, namely, functional unity, universal functionalism and indispensability.

The postulate of functional unity states that social or cultural items are functional for the *entire* social or cultural system. The postulate of universal functionalism states that *all* social or cultural items fulfil social functions. The postulate of indispensability states that social or cultural items are indispensable.

Merton advances the following criticisms. He points out that the postulate of functional unity is often contrary to fact and cannot be posited in advance of observation and that it even lacks heuristic value since it diverts the investigator's attention from possible disparate consequences for diverse social groups. Social or cultural items may be functional for some groups and dysfunctional for others in the same society.

The degree of social integration is an empirical question and we should be prepared to find a range of degrees of social integration. That all societies have *some* degree of integration is a matter of definition.

The postulate of universal functionalism may divert attention from a range of non-functional consequences of existing cultural forms. A more useful assumption would be that persisting cultural forms have a net balance of functional consequences. The postulate of indispensability involves two propositions, the indispensability of certain functions, which gives rise to the concept of functional necessity or functional prerequisites, and the indispensability of existing social and cultural forms, which gives rise to the concept of functional alternatives, functional equivalents, or functional substitutes.

Just as the same item may have multiple functions, so may the same function be diversely fulfilled by alternative items. Structural constraint is the limitation upon the variation in the items which can fulfil designated functions. Functional analysis requires a specification of the units for which a given social or cultural item is functional. Functional analysis must recognize that a given item may have diverse consequences, functional and dysfunctional. for individuals, subgroups, and the more inclusive social and cultural systems.

Merton states:

functional analysis has no intrinsic commitment to an ideological position.[70]

Conservative ideological implications have been attributed to functionalism by some writers and radical ideological implications have been attributed by others.

According to G. Myrdal:

if a thing has a «function» it is good or at least essential.

It therefore follows that:

a description in terms of their functions must lead to a conservative ideology.[71]

Again, H. Hield maintains that functionalists are:

primarily concerned with maintaining a stable, integrated and harmonious social equilibrium.[72]

La Piere, on the other hand, suggests that functional analysis is inherently critical in outlook:

If an important aspect of any social structure is its functions it follows that no structure can be judged in terms of structure alone. As a social structure it has no inherent value, since its functional value will vary from time to time and from place to place.[73]

65. Davis, K. (1959), «The Myth of Functional Analysis as a Special Method in Sociology and Anthropology», *Am. Soc. Rev.*, Dec., 1959, p. 757.
66. Davis, K. (1959), *op. cit.*, p. 759.
67. Davis, K. (1959), *op. cit.*, p. 758.
68. Sztompka, P. (1974), *op. cit.*, p. 44.
69. Merton, R.K. (1968), «Manifest and Latent Functions», *Social Theory and Social Structure.*
70. Merton. R.K. (1968), *op. cit.*, p. 108.
71. Myrdal, G. (1955), *An American Dilemma,* II 1053.
72. Hield, H. (1954), «The Study of Change in Social Science», *Brit. J. Sociol.*, March, 1954, p. I.
73. LaPiere, R. (1938), *Collective Behavior,* pp. 55-56.

When we turn to the function of the system as a whole, we have to ask the question: Is the system functional to those who operate it? Bredemeier suggests that functional analysis loses its point if it fails to hold in view the needs induced in the actors by the normative definitions of the dominant culture.[74]

According to R. Fletcher, the ahistorical bias in functionalism is the result of anthropologists, who were rebelling against conjectural history, selecting the functional aspect and neglecting the historical aspect of Durkheim's system.[75] Sztompka does not regard the ahistorical bias as a necessary characteristic of functionalism.

A systems model may generate a number of functional models, but a systems model is not derivable from a set of functional models. A purely functional approach to a social system makes it possible to study those connections which correspond to the functions chosen, but only some of the numerous connections in the social system are thereby registered.

Functionalism possesses no recognized methods for identifying and decomposing the system, so that the decomposition carried out may not be the most adequate one, and as different decompositions yield different structures, the initial structure which is chosen arbitrarily, is allowed to determine the decomposition.

The unconvincing attribution of functions to all the elements studied in a functional analysis is partly the result of attempting to synthesize elements that are not the result of a methodical decomposition.

structuralism

The «structural» approach

The term «structure» < L. «structura», has always referred to a whole, the parts of the whole and their interrelations.

Originally of architectural reference, its use was extended to anatomy and grammar. It was introduced into the social sciences by Herbert Spencer. Some writers maintain that the biological analogy resulted in a bias towards the study of observable parts.[76]

However, structure always involved an abstraction from concrete reality. As Fortes said:

> Structure is not immediately visible in the «concrete reality»... We discern structure in the «concrete reality» of social events only by virtue of having first established the structure by abstraction from the concrete reality.[77]

Nadel conceives an individual relationship as «a series of modes of behaviour of A towards B and of B towards A», which already involves an abstraction from concrete events, and proceeds to a social relationship, «that which a set of individual relationships have in common», by a further process of abstraction and conceives of social structure as «a pattern and network of social relationships».[78]

Radcliffe-Brown conceives of social structure as «a set of individual relationships» as distinct from structural form which is that which a set of individual relationships have in common.[79]

It is clear that only concrete behaviour can be observed, yet Radcliffe-Brown in reference to social relations wrote:

It is on this that we make direct observations.[80]

The «structuralist» approach

French structuralism emerged from the concern with «getting behind the facts».

There was first the attempt by Durkheim and Mauss to discover the essential properties inherent in the phenomena studied, which assumed that actors' definitions of social life were inadequate.

Then the *Année Sociologique* writers, such as Mauss, Hertz, Hubert, came to view social structure as consisting of principles of operation underlying observed data.

In structuralism, as in systems theory, the language of levels is employed, but in structuralism «levels» do not refer to organizational levels but to what is below the surface of observed phenomena. What we find is the realist concern with the mechanisms underlying observables.

The structuralist approach is based on the distinction between the most immediate conceptualization and reality and the distinction between ideology and reality. Structuralism does not imply a distinction between appearance and reality, but stresses the importance of going beyond the most immediate conceptualization. Structuralism maintains that ideology differentially obscures social reality, but that social reality is, nevertheless, accessible.

Global structuralism is concerned with observable relations and interactions. The analytic structuralism

74. Bredemeier, H.C. (1955), «The Methodology of Functionalism», *Am. Sociol. Rev.*, April, 1955, p. 179.
75. Fletcher, R. (1956), «Functionalism as a Social Theory», *Sociol. Rev.*, July, 1956.
76. See Glucksmann, M. (1974), *Structuralist Analysis in Contemporary Social Thought*, p. 15.
77. Fortes, M. (1949), «Time and Social Structure», in *Social Structure*, p. 56.
78. Nadel, S.F. (1957), *The Theory of Social Structure*.
79. Radcliffe-Brown, A.R. (1959), *Structure and Function in Primitive Society*.
80. Radcliffe-Brown, A.R. (1959), *op. cit.*

of Mauss and Lévi-Strauss seeks to explain such empirical systems by postulating «deep structures» from which the former are in some way derivable.

The meaning that Lévi-Strauss gives to «structure» in his essay on the subject,[81] namely, a model generating a group of models of the same type, the reaction of which to modifications of its elements is predictable, is not the same as the meaning he gives to it when he uses it in his work. In his study of totemism he treats structure, not as a certain type of model, but a set of fundamental relations between the constituent elements of the phenomenon in question.[82] Lévi-Strauss sometimes uses the term «structure» to refer to the interrelationships found in concrete cases, i.e., particular variants, and sometimes to the general case of which they are examples, i.e., the «syntax of transformations». The syntax of transformations cannot be observed. It is only its manifestations which can be observed. It is the concern with «deep structures» which is structuralist as opposed to structural. Structures, unlike models, are presumed to have an objective existence. Lévi-Strauss explicates the concept of structure as follows:

> An arrangement is structured which meets but two conditions: that it be a system ruled by an internal cohesiveness and that this cohesiveness, inaccessible to observation in an isolated system, be revealed in the study of transformations through which similar properties are recognized in apparently different systems.[83]

Weighting of elements

According to structuralism, the elements of the structure and their interrelationships are weighted. In some forms of functionalism, the systemic elements are weighted and in other forms of functionalism they are unweighted.

Parsonian doctrine affirms the interdependence of systemic parts but leaves them unweighted and does not affirm the dominance of any one part. Parsonian practice, on the other hand, introduces weighting.[84]

conclusion

A survey of systems theory in the social sciences leads to the following propositions.

1. Systems theory, functionalism and structuralism reveal convergences. Organization is to be found not only in systems but also in structures. Organization varies not only in systems but also in structures. Wholes are decomposable into both systems and structures and are decomposable into both in different ways. Functions are attributed not only to systemic parts but also to structural parts. Both systems theory and structuralism are anti-reductionist. Both systems theory and structuralism reject the idea of ungenerated wholes. Both systems and structures, in the structuralist sense, are characterized by nonsummativity of elements and possess irreducible wholeness properties. Systems theory, functionalism and structuralism all encourage quantification.

2. The units isolated by observation do not necessarily correspond to the structural elements in structuralism or to the structural or systemic elements of some other approach.

3. The systems approach does not exclude other approaches, as science continually generates new approaches.

4. Systems theory cannot be dismissed as an unfortunate aberration, an unsuccessful attempt to apply the rigour of the physical sciences to social and biological phenomena.[85]

5. The use of systems theory demands caution and judgment is required to avoid extravagant applications.

6. Caution is required to avoid the inappropriate operational specification of systems terms in the social sciences.

7. A fit between the teleological model and social reality cannot be assumed. A given social system may not be teleological.

8. The systems approach, through its applicability to the different levels of reality, encourages the unity of science.

9. It is important to realize that a system may be in disequilibrium.

10. Systems theory, through being anti-reductionist, permits the study of higher-level phenomena which might otherwise be ignored and which would disappear under a reductionist programme.[86]

11. The systems approach implies that there is a fallacy of composition, i.e., that the inference from distributive to collective predication is invalid.

12. Systems theory bridges the gap between the social and non-social by treating the social as part of a hierarchically-structured reality.

13. Systems theory is found within both the Marxian and non-Marxian frameworks.[87]

81. Lévi-Strauss. C. (1968), «Social Structure» in *Structural Anthropology*, Vol. I.
82. Lévi-Strauss, C. (1964), *Totemism.*
83. Lévi-Strauss, C. (1973), *Structural Anthropology*, Vol. II, p. 18.
84. Gouldner, A.W. (1970), *The Coming Crisis in Western Sociology.*
85. See Berlinski, D.J. (1976), *On Systems Analysis.*
86. P.A. Weiss speaks of: «... the monopolistic position often taken there (in molecular biology), which starves out some of the equally important but sorely neglected problem areas in biology». (Weiss, P.A. in *Beyond Reductionism*, Koestler, A. & Smythies, J.R. (eds), p. 48). Organismic and population biology are legitimate domains which are distinct from, although linked with, cellular and molecular biology.
87. See Sztompka, P. (1974), *System and Function.*

14. The systems approach is sufficiently wide to accomodate the requirements of differing fields with their differing degrees of integration and differing relations between organizational levels.

15. Just as the existence of defects in social investigations does not prove that it is impossible to effectively employ rigorous methods, so the possibility of misapplying systems theory does not invalidate the systems approach in the social sciences.[88]

88. Both R.R. Brown in *Rules and Laws in Sociology* (1973) and E. Ions in *Against Behaviouralism* (1977) claim to have found defects in various social investigations. R.R. Brown is puzzled by the presence of these defects, but remains convinced of the scientificity of his subject, while E. Ions regards the defects as invalidating the use of rigorous methods in the social sciences. Likewise, D.J. Berlinski in *On Systems Analysis* (1976) regards the defects he finds in J.W. Forrester's *Urban Dynamics* (1969) as invalidating the application of systems theory in the social sciences. Scientific aims are not invalidated by present lack of achievement. Berlinski's reference to «the gap that inexorably opens between the conception and the execution of a set of intellectual ambitions» does not invalidate scientific aims.