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A SYSTEMS CONCEPT OF SOCIETY: BEYOND INDIVIDUALISM AND HOLISM

ABSTRACT. Three rival views of the nature of society are sketched: individualism, holism, and systemism. The ontological and methodological components of these doctrines are formulated and analyzed. Individualism is found wanting for making no room for social relations or emergent properties; holism, for refusing to analyze both of them and for losing sight of the individual.

A systems view is then sketched, and it is essentially this: A society is a system of interrelated individuals sharing an environment. This commonsensical idea is formalized as follows: A society σ is representable as an ordered triple $\langle$ Composition of σ, Environment of σ, Structure of $\sigma \rangle$, where the structure of σ is the collection of relations (in particular connections) among components of σ. Included in the structure of any σ are the relations of work and of managing which are regarded as typical of human society in contrast to animal societies.

Other concepts formalized in the paper are those of subsystem (in particular social subsystem), resultant property, and emergent or gestalt property. The notion of subsystem is used to build the notion of an F-sector of a society, defined as the set of all social subsystems performing a certain function F (e.g. the set of all schools). In turn, an F-institution is defined as the family of all F-sectors. Being abstractions, institutions should not be attributed a life and a mind of their own. But, since an institution is analyzable in terms of concrete totalities (namely social subsystems), it does not comply with the individualist requirement either.

It is also shown that the systems view is inherent in any mathematical model in social science, since any such schema is essentially a set of individuals endowed with a certain structure. And it is stressed that the systems view combines the desirable features of both individualism and holism.

There seem to be three main conceptions of the nature of society:

(i) a society is just a collection of individuals and every property of it is a resultant or aggregation of properties of its members (*individualism*, *atomism*, or *reductionism*);

(ii) a society is a totality transcending its membership and is endowed with properties that cannot be traced back to either the properties of its members or the interactions among the latter (*holism* or *collectivism*);

(iii) a society is a system of interrelated individuals, i.e., a system, and

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while some of its properties are aggregations of properties of its components, others derive from the relationships among the latter (*systemism*).

In this paper we shall attempt (*a*) to characterize the above views, (*b*) to subject them to a critical examination, and (*c*) to find out which of the three is most compatible with contemporary social science. Since the systems view is far less well-known than the others and has often been mistaken for holism we shall devote more space to it than to its rivals.

It will turn out that individualism and holism are inadequate: the former because it ignores the emergent properties of any society, such as social cohesion and social mobility, and the latter because it refuses to explain them. The systems view lacks these defects and combines the desirable features of the previous views, in particular the hard-nosedness of individualism with the holistic emphasis on totality and emergence.

Moreover systemism is the view consistent with, nay inherent in contemporary theoretical (i.e., mathematical) sociology. This should come as no surprise, since it is true of mathematical modeling in every field of enquiry that it boils down to endowing sets of individuals with certain structures. Indeed no matter what the object of inquiry may be one will try to model it as a set (of individuals or of further sets) endowed with some structure – i.e., as a structured collection of individuals rather than either a shapeless collection of items or a form by itself hovering above the latter. Just think of the graph of any organization: the nodes represent persons or subsystems and the edges relations.

In fact even in the simplest case of mathematical modeling one starts with some set S of individuals of some kind (e.g., persons or else social groups or what have you) and assumes that these units are held together by some relation R – e.g., a family relationship or a work link. The result is a relational structure $\mathscr{S} = \langle S, R \rangle$ representing the interrelated units, i.e., the system in question. A society, we will argue, can be construed precisely in this way, i.e., as its membership together with its structure. A society is thus neither a mere "sum" (aggregate) of individuals nor a Platonic idea (i.e., an institution) transcending them: a society is a concrete system of individuals bearing social relations among themselves and is therefore representable as a certain relational structure. What kind of individuals and what kind of relations will be seen in the sequel.

1. BRIEF STATEMENT OF THE THREE RIVAL VIEWS

Every theoretical view of society and, for that matter, of any concrete object, has two components: an ontological and a methodological one. The former concerns the nature of society, the latter the way to study it. That is to say, in matters sociological and, in general, scientific and philosophical, *X-ism* = ⟨*Ontological X-ism*, *Methodological X-ism*⟩. We shall be concerned with three *isms*: individualism, holism, and systemism. Let us begin by giving brief summaries of each – so brief that they may seem like caricatures. (For recent statements of the two classical positions see O'Neill Ed. (1973).) And let me hasten to acknowledge that individualism, holism and systemism do not cover the entire spectrum of sociological thought.

Individualism

Ontology

OI1 A society is a set of human individuals. The supraindividual totalities are conceptual not concrete.

OI2 Since social totalities are abstractions they have no global or emergent properties: every social property is a resultant or aggregation of properties of the members of the society.

OI3 Since there are no systemic properties, a society cannot act on any of its members: group pressure is the sum total of the pressures exerted by each group member. Interaction between two societies consists in interaction between their individual members. And social change is the totality of changes in the individual components of the society.

Methodology

MI1 The proper study of society is the study of the individual.

MI2 The ultimate explanation of social facts must be in terms of individual behaviour.

MI3 Sociological hypotheses and theories are tested by observing the behaviour of individuals.

Holism

Ontology

OH1 A society is a totality transcending its members.

OH2 A society has gestalt or global properties. These properties are emergent, i.e., not reducible to any properties of individuals.

OH3 Society acts on its members more strongly than they act on society. Interaction between two societies is a whole-whole affair. And social change is supraindividual although it affects the individual members of the society.

Methodology

MH1 The proper study of society is the study of its global properties and changes.

MH2 Social facts are explainable in terms of supraindividual units such as the state or supraindividual forces such as the national destiny. Individual behaviour is understandable (though perhaps not explainable) in terms of both the individual concerned and the action of the entire society on him/her.

MH3 Sociological hypotheses and theories are either beyond empirical testing (antiscientific holism) or are tested against sociological and historical data (science-oriented holism).

Systemism

Ontology

OS1 A society is neither a mere aggregate of individuals nor a supra-individual entity: it is a system of interconnected individuals.

OS2 Since society is a system, it has systemic or global properties. Some of these properties are resultant or reducible and others are emergent – they are rooted to the individuals and their interplay but do not characterize them.

OS3 Society cannot act on its members but the members of a social group can act severally upon a single individual, and the behaviour of each individual is determined not only by his genetic make-up but also by the role he plays in society. Interaction between two societies is an individual-individual affair, where each individual occupies a definite place in his society. And social change is a change in the social structure of a society – hence a change at both the societal and the individual levels.

Methodology

MS1 The proper study of society is the study of the socially relevant features of the individual as well as the research into the properties and changes of society as a whole.

MS2 The explanation of social facts must be in terms of individuals and groups as well as their interactions. Individual behaviour is explainable in terms of all the characteristics – biological, psychological, and social – of the individual-in-society.

MS3 Sociological hypotheses and theories are to be tested against social and historical data. But the latter are all built out of data referring to individuals and small groups, for these alone are (partially) observable.

On the whole, social philosophers have favoured either individualism (like Mill) or holism (like Hegel). On the other hand social scientists, whatever their declared philosophies, have *de facto* adopted the systemist point of view insofar as they study groups of interrelated individuals (in particular their structure and evolution), and recognize the specific nature of societal systems such as organizations. (For the typical position of the practicing sociologist see Blau (1974).) Even supposed holists like Marx and Durkheim have acted as systemists in recognizing that social wholes are created, maintained and dissolved by the actions, concerted or divergent, of individuals. And even ardent individualists like Hayek and Homans have recognized the specificity of the human group and the reality of social relations. The extremes are nowadays being eschewed by social scientists and adopted almost exclusively by social philosophers: individualism by Popper, Watkins and Winch, and holism (or rather a mellowed version of it) by Mandelbaum, Brodbeck and Danto. (See Brodbeck Ed., 1968 and Krimerman Ed., 1969.) The dispute between these two schools is becoming less and less relevant to social science with the proliferation of mathematical models there. More on this anon.

We turn next to a brief analysis of individualism and holism, one which will show the need for the systems view.

2. CRITICISM OF INDIVIDUALISM AND HOLISM

Individualism is untenable because when consistent and radical it involves the denial of social relations, which are the very glue of a community that distinguishes it from a mere arbitrary set of humans. (The most eminent living individualist has declared that "social relations belong, in many ways, to what I have more recently called 'the third world' or 'world 3', the world of theories, of books, of ideas, of problems" – Popper (1974), p. 14.) Indeed, if a society is nothing but its membership then there is no question of there being relations among the members of the society, since a relation between individuals x and y is neither in x nor in y. Surely if x and y are related then being related to y is a property of x and similarly for y. But the very definition of such unary properties presupposes the logical as well as ontological priority of the given binary property or relation. Thus, being an employee is bearing the relation "is employed by" to somebody. In general call R the binary relation in question and P the unary property of being R-related. Then $Px =_{\text{df}} (\exists y)Rxy$, whereas the converse definition of R in terms of P is impossible.

The individualist may wish to rejoin that a binary relation is just a set of ordered pairs of individuals and that, in general, an n-ary relation is a set of ordered n-tuples of individuals. But this will not do, because the notion of an ordered n-tuple involves the very notion of a relation – otherwise one has an unordered n-tuple, i.e., a homogeneous set of n elements. What is true is that the graph or extension of a relation is definable as a set of n-tuples of individuals, namely those that have this relation among themselves. But a relation is not identical with its graph, just as a unary property is not the same as the set of individuals that happen to possess that property at a given moment. The upshot is this: relations, in particular social relations, are not reducible to sets of individuals.

Consider the simplest possible sociological statement about an individual, namely "Person b belongs to social group G_i", or "$b \in G_i$" for short. Before being able to make such a statement we must have conceived the idea of the social group G_i. And this requires partitioning the membership S of the given society into groups (equivalence classes), one of which is G_i. This partition must have been induced by some equivalence relation $\sim$, such as that of having the same occupation. That is, the above statement "$b \in G_i$", presupposes that the society σ, far from being an unstructured set of individuals, can be analyzed as a family of sets of such, namely the collection of social groups of σ. (Mathematically: G_i is a member of the quotient of the membership S of σ by the equivalence relation $\sim$, or $G_i \in S/{\sim}$.) The same holds, *a fortiori*, for any of the more complex sociological statements.

In sum, every statement made in a sociological context asserts or presupposes that a society, far from being either a mere collection of individuals or else a totality within which the individual is lost, is a structured set of individuals, the structure consisting in a certain set R of relations on the collection S of individuals composing the society. Surely the individualist is right in claiming that the set S is an abstraction since it is a set. (Sets do not consume, produce, or fight: they are concepts.) And the holist is right in claiming that a particular society is not a set but a concrete totality with a definite structure. Yet, because of his hostility to analysis, and especially to mathematics, the holist is incapable of describing this very structure, so in fact he misses R as much as the individualist does. To the systemist, on the other hand, both membership (composition) and structure (set of relations) are abstractions if taken separately: what is real is the structured membership representable by the ordered pair constituted by S and R. To sum up, the theses we are considering boil down to the following schemata:

Individualism: $\sigma = S = \{a, b, \ldots, n\}$, where only the n members of S are real.

Holism: σ is an unanalyzable totality with n parts none of which is separately real.

Systemism: σ is a concrete totality analyzable into S and R (or representable as $\langle S, R \rangle$), and it is as real as the members of S.

The individualist might not wish to dispute the systemist thesis but, if he is consistent, he must insist that the structure R of σ is somehow 'contained' in, or deducible from, the properties of the individual member of σ. In short he will contend that every social predicate is reducible to a bunch of individual predicates. (For a brilliant defense of this thesis see Homans (1974).) But we saw that this claim is logically untenable. Let us emphasize this point with reference to family relations. Of all the family relations the most important is that of belonging to the same family. We say that, for any members x and y of S, x is $\sim_f$ related to y just in case x and y belong to the same family:

$$x \sim_f y \quad \text{iff there exists an } F_i \text{ such that} \quad x, y \in F_i,$$

where F_i is the ith family of the given society at a given instant. Individualism notwithstanding, this entity, F_i, is a concrete system not an abstraction: it behaves as a unit in certain respects just as much as the system of molecules that compose a body of water. Just as these molecules are held together by hydrogen bonds, so a family is held together by certain interpersonal bonds of affection and interest. So much so that, when these bonds weaken or disappear, the family is ripe for disintegration or conversion into a mere aggregate of individuals.

Being an equivalence relation, $\sim_f$ induces a partition of the membership S of the given society σ into disjoint subsets covering the entire S – namely the collection of all the families of σ. Call this collection of families $S/\sim_f$ or the quotient of S by $\sim_f$. This new set, $S/\sim_f$, is composed of a certain number m of families:

$$\mathscr{P}_f(\sigma) = S/\sim_f = \{F_1, F_2, \ldots, F_m\}.$$

We can say that this partition constitutes the *family structure* of σ. Similarly with any other partition of S, e.g., into social classes, income groups, ethnic groups, religious groups, political groups, etc. There will be as many partitions of S as there are social equivalence relations, and in general the various partitions will not be the same. Calling $\sim$ the set of all n such relations, we designate by $\mathscr{P}_i(S) = S/\sim_i$ the partition of S induced by $\sim_i \in \sim$. This can also be called the *ith social structure* of σ. And the totality

$$\mathscr{P}(S) = \{\mathscr{P}_i(S) \mid \mathscr{P}_i(S) = S/\sim_i \,\&\, \sim_i \in \sim \,\&\, 1 \leqslant i \leqslant n\}$$

may be regarded as the *social structure* of σ. This is a *systemic property* of σ and so is every element $\mathscr{P}_i(S)$. Moreover these are not properties of the individual members of σ but global properties of σ emerging from certain mutual actions among members of σ. Neither the individualist nor the holist accounts for these emergent properties: the former disowns them, the latter refuses to analyze them.

These systemic properties are of course not the only ones that characterize a social system: they are just typical of it. Further emergent or gestalt properties of a society are social differentiation (in particular stratification), cohesion, mobility, and stability. These are not properties of the individual components of a society nor are they properties of its membership collectively. On the other hand, *pace* the holist irrationalist, all systemic properties are *rooted* to properties of individuals and their interactions – to the point that they cease to exist when the individuals themselves become extinct. Likewise the bulk properties of a body of water, such as its transparency and freezing point, are not properties of the individual water molecules but functions of certain intrinsic and relational properties of those individual components. And while the stability of a system, whether physical or social, is not a property of its individual components, it is an outcome of the latter and their interplay. In general: while not all systemic properties are *reducible* to component properties, all of them are *explainable* in terms of components and interactions. Shorter: emergence, though undeniable, is not irrational.

So much for a criticism of the views superseded by systemism. Let us now sketch our systems view of society.

3. SOCIETIES AS SYSTEMS

We construe a concrete (or nonconceptual) system as a collection of concrete things linked with each other and with a common environment. More precisely, we lay down

DEFINITION 1. The triple $\langle \mathscr{C}(\sigma), \mathscr{E}(\sigma), \mathscr{S}(\sigma)\rangle$ represents a *system* σ iff

(i) $\mathscr{C}(\sigma)$, called the *composition* of σ, is a nonvoid set of concrete things;

(ii) $\mathscr{E}(\sigma)$, called the *environment* of σ, is a nonempty collection of concrete things distinct from the components of σ and acting on or acted upon by the latter;

(iii) $\mathscr{S}(\sigma)$, called the *structure* of σ, is a nonvoid set of relations (e.g., spatial relations), couplings (e.g., physical connections) and equivalence relations among members of σ or between members of σ and members of $\mathscr{E}(\sigma)$.

It seems obvious that atoms, molecules, bodies, organisms and societies satisfy this definition, so they can be called 'systems', and advantageously, because the mere use of this word elicits the precise question "What are the composition, environment, and structure of the given system?" – which neither the individualist nor the holist stand encourages.

We now clarify the notion of a systemic property.

DEFINITION 2. Let P be a bulk property of a system σ (i.e., a property of σ as a whole). Then

(i) P is a *resultant* property of σ iff P is also a property of some of the components of σ;

(ii) otherwise P is an *emergent* or *gestalt* property of σ.

For example, the total consumption (but not the production) of a given social system is a resultant property of it, as it is just the additive aggregation of the individual consumptions. Not so the social structure of the system or its cohesion: these are emergent properties. No doubt they may in principle be explained in terms of interpersonal relations; but this does not render them any the less systemic. Besides, social psychology has shown that many a property of individuals cannot be explained but by considering their social setting.

We now characterize a biological community or ecosystem as a system σ the components of which are organisms sharing an environment and transforming it. Note the ingredients: a collection S of living things, a set $\mathscr{E}(\sigma)$ of things called the environment of the former, a set R of relations among components of the system, and another set T of relations consisting in the various ways in which the members of S transform members of $\mathscr{E}(\sigma)$. More explicitly, we make

DEFINITION 3. The system represented by the triple $\langle S, E, R \cup T \rangle$ is a *biological community* or *ecosystem* σ iff

(i) $S = \mathscr{C}(\sigma)$, i.e., the composition of σ, is a nonvoid set of organisms of given kinds (species);

(ii) $E = \mathscr{E}(\sigma)$ is the environment of σ;

(iii) $R \cup T = \mathscr{S}(\sigma)$, i.e., the structure of σ, is the union of two sets of relations, R and T, where

(*a*) R is a nonvoid set of relations and couplings (or connections) in the set of m-tuples of organisms, with $m \geqslant 2$, called the *social relations* of σ;

(*b*) T is a nonempty set of relations from $S^p \times E^q$ to E, with $p, q \geqslant 1$, called the *transformation* of the environment of σ by members of σ.

That is, an ecosystem is a system characterized by social relations and relations of transforming the environment. Every member of R is defined on S^m (i.e., it is an m-ary relation) and it represents a physical or an informational coupling (e.g., an interaction) among members of S. As to T, it contains all the relations of members of S with their environment: consumption, production, pollution, and so on. In the simplest case a single organism transforms a single element of E into another part of E, i.e., $p = q = 1$. At other times the transformation is the outcome of the joint action of several organisms, i.e., $p, q \neq 1$.

If we now restrict the membership S of an ecosystem to a population of the same animal species we obtain the general concept of an *animal society*, such as a living coral reef or a colony of ants or a troop of baboons. And if we are interested in human societies we must make a further specification and seize on some of its peculiarities *vis à vis* other animal societies. We assume that the *differentiae* are these: (*a*) the members of S happen to be human – otherwise a family of chimpanzees or even a society of robots might qualify; (*b*) the membership of every human society includes individuals engaged in a particular kind of environment-transforming relations, namely work; (*c*) the set of social relations among the members of a society contains a distinguished subset of men-transforming relations, such as managing and teaching. Consequently we propose

DEFINITION 4. The animal society represented by the triple $\langle S, E, R \cup T \rangle$ is a *human society* σ iff

(i) the membership S of σ is a subset of the human species;

(ii) the set T of transformation relations includes a nonempty subset $W \subset T$ such that each element of W is a relation from a subset of $S^p \times E^q$ into a nonvoid subset A of E, representing the transformation by some members of S of certain things in E (e.g., tree branches) into things in A (e.g., levers);

(iii) the set R of social relations includes a nonvoid subset $M \subset R$ such that every element of M is a relation in S^m, with $m \geqslant 2$, representing some action of members of S upon members of the same set.

(iv) σ is self-supporting.

A more precise characterization of the relations in W and in M is given elsewhere (Bunge, 1974). Suffice it here to say that each element of W represents work of some kind done by members of the society on their non-human environment, composed of the natural environment and the artificial environment, the latter being the collection of products of all the kinds of work σ engages in. As for M, it is the set of man-transforming or managing relations, such as administration and teaching.

We close this section by defining the notions of societal property and societal change. P is said to be a *societal property* (or feature) iff there exists a human society σ such that σ possesses P. Clearly, P is a *resultant* societal property iff P is a societal property and a resultant one – otherwise it is an *emergent* property. (Recall Definition 2.) Finally a change or event in σ may be characterized as a change in some of the properties of σ. Hence any change in some societal properties is a *social change*. In particular, changes in work relations or management relations are social changes.

So much for a summary characterization of human society in systems theoretic terms. Let us now study the notion of a social subsystem such as the health care system or the political system of a community.

4. INSTITUTIONS AS SETS OF SOCIAL SYSTEMS

The systems approach to social science is particularly illuminating with respect to institutions. The individualist is quite right in rejecting the Platonic conception of, say, the legal system as a disembodied corpus of rules and laws that societies obey or violate. But then he offers no substitute for this holistic fiction. Consequently we continue to employ the expression 'legal system' in everyday life and even in legal science and legal philosophy without purging it of its idealist connotation. Thus we are likely to say that the prevailing legal system compelled so and so to do this and that, or 'L obliged x to do y' for short. No doubt this sentence can be partly translated into 'Judge u (or policeman v) forced x to do y'. But the individuals u and v in charge of enforcing L are not the ultimate determiners: they behave as they do because of what they are, namely members of a certain legal system L that, though ruled by a code, is not itself a code. Those individuals might behave differently in a different legal system, even under the same code. That is, if the persons u and v were incorporated into a different legal system L' they might not compel x to do y but might leave x in peace or force him to do z. This shows that L is not just the set including the individuals u, v and x. Surely neither is L a Platonic (or Hegelian) Idea hovering above these individuals. What is it then? The systemist answer is: L is a subsystem of some social system, i.e., it is a part of a human community set apart by certain peculiar social relations. Likewise with other institutions. Let us take a closer look at this idea. But first the general notion of a subsystem:

DEFINITION 5. Let the triple $\langle \mathscr{C}(\sigma), \mathscr{E}(\sigma), \mathscr{S}(\sigma) \rangle$ represent a system σ. Then σ' is a *subsystem* of σ iff

(i) σ' itself is a system [rather than either a set or a loose aggregate];

(ii) the composition or membership of σ' is included in that of σ;

(iii) the immediate environment of σ is included in that of σ';
(iv) the structure of σ' is included in that of σ.
In symbols,

$$\sigma' \precsim \sigma =_{\mathrm{df}} \mathscr{C}(\sigma') \subseteq \mathscr{C}(\sigma) \,\&\, \mathscr{E}(\sigma) \subseteq \mathscr{E}(\sigma') \,\&\, \mathscr{S}(\sigma') \subseteq \mathscr{S}(\sigma).$$

Now to the notion of a social subsystem:

DEFINITION 6. The triple $\langle S', E', R' \cup T' \rangle$ represents a *social subsystem* iff there exists a society σ such that σ' is a subsystem of σ.

For example, the legal system of a given society is a subsystem of the latter characterized by the following coordinates:

Composition or membership = Judges, lawyers, legal clerks, policemen, litigants, criminals.

Immediate (physical and social) environment = Court rooms, legal offices, legal libraries, police stations, prisons, torture chambers, relatives of members of the system.

Structure = The relations in $M' \subset R'$ consisting in hearing a case, defending, passing sentence, enforcing the latter, escaping, injuring, bribing, investigating, arraigning, etc.

Likewise in the case of all the other subsystems of a social system, such as the health system, the postal system, the school system and the political system. Every society, however primitive, has a number of social subsystems. Hence every social system can be analyzed into a number of subsystems each of which performs a certain function (i.e., is characterized by a peculiar subset of social relations or of transformation relations). And the entire membership of any given society is distributed among its various subsystems, with all of its individual members belonging to several subsystems at a time. (Those who belong to no subsystems at all belong to no society: they are marginal individuals.)

Note that, according to Definition 6, although every social subsystem is a part of some social system, not every part of the latter is a subsystem. Thus the student body of a school is part of the latter but does not constitute a separate subsystem any more than the faculty or the administration of the school do. In fact the mere notion of being a student-body member of some school cannot even be described without the help of the concepts of teaching, teaching facilities, and school administration, involved in the definition of a school.

What is often called the *X-sector* of a given society is the collection of all the subsystems of the given society that perform the same functions – e.g., the production of dairy products, the collection and disposal of refuse, or the distribution of newspapers. More precisely, we can adopt:

DEFINITION 7. Let σ be a human society and call $S(\sigma) = \{\sigma_i \precsim \sigma \mid 1 \leqslant i \leqslant n\}$ the collection of social subsystems of σ. Further, let F be a certain set of social relations or of transformation relations, and let

$$F(\sigma) = \{\sigma_k \precsim \sigma \mid F \subset \mathscr{S}(\sigma_k) \;\&\; 1 \leqslant k \leqslant n\} \subseteq S(\sigma)$$

be the collection of subsystems of σ where the F relations hold. Then

(i) $F(\sigma)$ is called the *F-sector* of σ;

(ii) F is called the *specific* function(s) of the members of the F-sector of σ;

(iii) $G = \bigcup_{\sigma_k \in F(\sigma)} \mathscr{S}(\sigma_k) - F$ is called the *nonspecific* function(s) of the members of the F-sector of σ.

An F-sector of a society need not be a subsystem of it. In fact an F-sector has been defined as a certain set (of social subsystems) whose members need not be interconnected (or acting upon one another). When the members of an F-sector happen to be connected, as is the case with the postal network or the economic system of an area, the F-sector qualifies as an *F-system*.

We are now ready to elucidate the concept of an institution – not to be confused with that of a particular organization such as any given school or club. We construe an institution as the set of all F-sectors for a given F. Thus the set of all state systems is called Government, the collection of all school sectors School, the set of all trade unions Organized Labor, the set of all postal systems Mail, and so on – where the awe-inspiring capitals are probably remnants of the holistic ideology. We make then

DEFINITION 8. Let $\Sigma = \{\sigma_1, \sigma_2, \ldots, \sigma_m\}$ be a set of societies and each F_{ik}, with $1 \leqslant i \leqslant m$, $1 \leqslant k \leqslant n$, the k-th sector of the i-th society σ_i. Then the set

$$\mathscr{F}_k = \{F_{ik} \mid F_{ik} \text{ is the } k\text{-th sector of } \sigma_i \;\&\; \sigma_i \in \Sigma\}$$

of k-sectors is called the *F_k-institution* of Σ.

Note the high degree of abstraction of the concept of an institution: it is a family of sets of concrete things. To endow such a set of sets with properties of persons such as life, having a mind of its own, aggressiveness and the capability of conflicting with similar sets (i.e., other institutions) is to indulge in reification. Note also that not everything that is usually called an institution qualifies as such according to our definition. For example marriage and money are not institutions because they are not families of sets of subsystems. (Marriage is one of the relations belonging in the set of social relations characterizing a family as a system. And money is one of the subsets of the set of artifacts accompanying the market economic system of a certain kind.)

It might be objected that our definition of an institution misses an essential ingredient of every institution, namely its goals and norms. Thus when applying Definition 8 to the case of the Law regarded as an institution, our convention would seem to leave no room for the codes of law regulating the relationships at work in any legal system. The part such rules play is so important that some social scientists – e.g., Parsons – have gone so far as to identify an institution with the set of its norms. This, though an exaggeration, does contain a grain of truth: it is obvious that, unless certain rules are observed, the institution (or rather some of the subsystems forming it) will decay or even become extinct. However, it does not follow that a set of institutional rules (e.g., a constitution) is a Platonic Idea dangling above the corresponding concrete subsystem.

The institutional rules just reflect the way the subsystems function optimally or, if preferred, they are prescriptions for operating the system in an efficient manner (i.e. for attaining its goals or rather those of whom the system serves). Surely such institutional rules can be rendered for the most part explict just as the rules for doing properly some job can be made partly explicit, e.g., in an operating manual for a machine. But the writing down of a rule does not confer autonomous existence upon it: it only suggests, wrongly, that it has one, perhaps because, when inscribed on a clay tablet, or a stone slab, or papyrus, it can outlast its author. The upright (and merciless) judge enforces those rules just as the foreman has the operating manual followed. We may call these actions 'rule directed' as long as we do not commit ourselves to the idealist thesis that the rules exist independently of the rulers, the rule enforcers, and the ruled – any more than the laws of nature are separate from the things satisfying them.

The rules of social behaviour are inherent in the very relationships holding among the members of the system in question. (Much the same holds for any deviations from that behaviour: the delinquent is an outlaw in the sense that he does not observe the code of law but he is as much a member of the legal system as the judge – so much so that there is no need for a legal system where there is no delinquency. An exhaustive definition of any society would have to include not only the relation of getting along with the "representatives of the law", i.e., the power wielding individuals, but also the relation of being in conflict with them.) In short the institutional rules, and also the patterns of breaking such rules and of punishing such infractions, are incorporated into the very social relations that hold the system together. And it is not "society" that sanctions them or punishes any deviations from them – as the holist would have it – but rather some members of a society, namely those in charge of regulating the functioning of the social system. By conceiving of institutional rules as patterns of the optimal or at least desired functioning of the social system, it becomes easier to understand how those rules came about, where they fail, and in which respects they could be improved upon.

5. CONCLUDING REMARKS

The individualist is right in criticizing the holistic reification of sets such as institutions, and in demanding that (certain) holistic sentences be translated into sentences involving only individuals. Thus instead of saying that society punishes deviant behaviour we had better say that some members of any society punish any members of it who behave in a deviant manner. The latter sentence does not involve any reification, it has the quantifiers in the right places, and it indicates clearly what the referents are, so that it is easier to test. However, this translation does not amount to a reduction. In fact both the old sentence and the new one contain the word 'deviant', which makes sense only relative to normal behaviour in a given society, because what is acceptable in one society may not be so in another.

The concept of normal behaviour in a given society is not a purely individualistic concept, since it involves both the concept of an individual and that of a society: it represents a mutual property of an individual and a social system, and in particular a psychosocial property. Yet it is equally important to stress that this property can be explained in terms of properties of individuals and their social links. Thus consider, for the sake of simplicity, an individual property P (such as hair length, longevity, or intelligence) distributed normally in a social system σ with expectation value $E(P)$ and dispersion h. Then we can make the following definitions:

For any component x of σ:

(i) x *conforms* w.r.t. $P =_{df} |P(x) - E(P)| < h$.

(ii) x is *deviant* w.r.t. $P =_{df}$ x does not conform w.r.t. P.

In these formulas $E(P)$ and h are systemic or bulk properties of σ whereas $P(x)$ is a property of individual x. But, because P may be a property of both x and σ, its average $E(P)$, though systemic or global, is not necessarily an emergent property of σ. On the other hand the standard deviation h of the set of values $\{P(x) | x \in \mathscr{C}(\sigma)\}$ is always an emergent property of the system, i.e., one not possessed by any of its individual members. This example just illustrates Definition 2, so there is no need to dwell on it. The only reason for bringing it up is to emphasize that, while the individualist refuses to countenance emergence and the holist extolls it but is unwilling to analyze it, the systems point of view recognizes emergence and encourages the analysis of it. Hence it is in the best position to distinguish what belongs to society from what belongs to its individual members. Besides, it is the one that capitalizes on the advances of mathematical model building in the social sciences. (For recent treatises on mathematical sociology see Boudon (1967), Ziegler (1972), and Fararo (1973). For recent results in mathematical politology see Alker *et al.* (1973), and Bunge *et al.* (1977). For a number of mathematical models peruse the *Journal of Mathematical Sociology*.)

Furthermore the systems view dominates the thinking not only of mathematical social scientists but also of applied social scientists and of imaginative managers of large social systems such as industrial complexes and governmental organizations. Indeed, in all cases where the goal of a study is to monitor or improve upon the operations of a social system, the very first thing to do is to identify the components, the environment and the structure of the system. A second step would be to attempt to disclose the state variables of the system – at the very least its inputs and outputs. A third step may consist in hypothesizing definite relations among the state variables, and a fourth in either simulating these assumptions on a computer or putting them to the empirical test. Not all of these stages may actually be gone through, but, whichever are, what is done conforms with neither individualism nor holism: in all cases what one seeks to uncover and understand are the operations of a system.

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