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SYSTEMS THEORY

by

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Recently I found in my mailbox an announcement that recent advancements in "Human Behavior Science" could now make me a "Winner" in my varied relationships with others. Self-understanding, happiness, and personal success could now be gained through a new perspective on life. The brochure explained:

About 2 years ago, a new theory exploded in the world of Human Behavior research. It is called General Systems Theory—and it is a totally new way of looking at humans and their environments. The idea is that each of us lives at the heart of a dynamic system. Everything you do (your input) produces a reaction from others (feedback). As a result, each one of us can change the entire system just by changing our input. (emphasis original)

It would cost \$126 for twelve tape cassettes to show me how to put this new research to use and become a winner.

Scholars and practitioners who are doing anything at all useful relative to social problems as they are popularly perceived will be familiar with the periodic appearance of the hucksters, using their ideas as bait for a quick profit. In fact, the arrival of the profiteers may be looked upon by some as a form of flattery and a reassurance that we are doing something useful. Others may see it as the price that must be paid for innovation. "If you can't stand the hoakam," Bertram Gross once paraphrased, "get out of the kitchen. That's where new ideas are cooked up." (1968) Still, to extend the metaphor a bit, test kitchens usually use better ingredients than do mass production lines. Finding the all-beef patty under the ketchup, onions, pickles, and oversized bun is not always easy. What's cooked up may be convenient, but it is not always nourishing.

Systems Theory has generated a lot of excitement in the last decade. It has also spawned more than its share of pitchmen, enough so that it is in danger of being discredited before its genuine potential in many fields of practice has been fairly tested. Wearing the double halo of Science and Corporate Efficiency conferred by its association with the aerospace industry and the Pentagon, it has been enthusiastically offered to Federal and State governments (Chartrand, 1971; Hoos, 1969 & 1972) as well as private individuals and organizations as a way of solving complex social problems like mass transit,

crime, and welfare dependency. As with any situation where expectations are raised (at high cost in contract fees) and then left unfulfilled, the reaction may indict basic ideas and intemperate applications alike.

Let us, then, look more closely at the history and logic of systems theory and try to assess its strengths and weaknesses as a guide to social work practice. Remembering Gross' admonition, we must be tolerant of the confusion and error that are part of the ferment of innovative thinking and yet wary of its intoxication. To change the metaphor from food to drink: Getting too high makes one a dangerous driver and an easy mark. This is, after all, the practitioner's special problem. He or she must deal daily with the lives of real people, not imaginative constructs. After a yeasty session with intoxicating ideas, theorists can always sit in the back seat and sing; but the practitioner is the one who has to get behind the wheel and drive safely home.

A BRIEF HISTORY

Systems theory as we know it is a product of the late 1940's, but its intellectual background goes deep into the nineteenth century. This history is worth knowing about because it provides insight into some of the perils of systems thinking.

Systems theory's inspiration in both classic and modern periods is strongly biological. The comparison of society to a biological organism spawned several generations of sociological theory and laid the groundwork for the systems idea. The first generation was led by the English sociologist Herbert Spencer. It became known, after the 1859 publication of Charles Darwin's Origin of the Species, as "Social Darwinism." (This label itself is a good example of intellectual opportunism, because Darwin had little to do with the social applications of his biological ideas.) The purpose of comparing society to a biological organism was to emphasize the complexity, interdependence, and evolutionary adaptability of a society. For Spencer, this led to the conclusion that the only kind of social change possible was that which took place at the glacial pace of biological evolution. Planned intervention in social problems by legislators and other do-gooders was both unnecessary and doomed to failure by the unanticipated consequences of disturbing "natural" processes.

More recent organismic sociology has repudiated the crudeness of Social Darwinist politics, but its tendency to respect the status quo and distrust change has persisted. Many find a definite connection between the organismic analogy and these political conclusions. Thus, the relative simplicity of this earlier formulation is an aid to understanding the logic of organismic thinking. Of particular interest is the argument between conservative and liberal wings of American

Social Darwinism, represented by William Graham Sumner and Lester Ward respectively, over the differences between biological and social organization. (See, e.g., Hofstadter, 1955) Ward argued that human intelligence allowed intervention to improve on the wastefulness of nature. Social organization was the result of "synergy," the combination of "genetic" (biological) and "telic" (human choice) forces. This argument previews a current argument in systems theory. (Buckley, 1967, 13)

The second intellectual generation in organismic thinking is dominated by Emile Durkheim, a French sociologist of the 1890's. Durkheim downplayed the evolutionism of the Social Darwinists and did not despair of constructive intervention in complex societies. He was, however, supremely concerned with order and structure. He was convinced of the dependence of people on an organized society cemented by agreed-upon norms and values.

The amazing "Generation of the 90's" (Hughes, 1961) contained many who contributed to contemporary sociological theory, but it was Durkheim who had the most impact on American mainstream sociology of the mid-twentieth century. This became the third generation of organismic sociology and is generally known as Structural-Functionalism. Though functionalist sociology is discussed elsewhere in this volume, its major features must be recalled here because they are part of the context of systems theory in social work. One of the influential books in the development of both systems theory and functionalist sociology was W.B. Cannon's The Wisdom of the Body (1932). The concept of homeostasis, coined by Cannon, is one of the key difficulties in the application of systems theory.

Homeostasis is the tendency of a biological organism to seek and keep some kind of operating balance in its internal processes, or, at least, to keep processes within certain limits. This concept, when added to the Durkheimian concentration on a social order based on an integration of structured norms and values, leads with unfortunate ease to the conclusion that internal social change is largely self-regulatory. Thus, we come back to the general area of Spencer's "hands-off" attitude. It also leads to an identification of disorder with disease, something Durkheim encouraged by his references to social "pathology." If social change takes care of itself in the "body politic," then groups advocating conscious planned intervention in social processes or planned restructuring of society will be viewed with suspicion. Indeed, radicals may be seen as a social disease. They may even appear to be diseased themselves and in need of therapy to restore their mental, and our social, health. If social workers take this viewpoint, they may find themselves taking very repressive roles in society.

Functionalist sociologists and their critics have argued about these issues for some time. (see particularly Demerath and Peterson, 1967; Reynolds and Reynolds, 1970) It is just one example of the

practical implications of models. More will be said as we discuss the details of systems thinking. It is important, however, to know at the outset that systems theorists do not face the dilemmas of homeostasis all by themselves. They've had a lot of company and can perhaps learn from others' struggles. Failure to appreciate the long history of the organismic analogy results, I think, in an underestimation of its difficulties in practice.

Organismic sociology is one of the contributors to modern systems theory. Information theory and cybernetics are the others. Information theory is a mathematical development which arose from the need to measure the capacity of electronic communications equipment. The need to measure, in turn, seems to have come from the desire, in the post-war period, to sell this equipment to buyers concerned with relative capacity to broadcast. This hardware concern was met by the application and development of a kind of probability theory first used in thermodynamics to describe the movements of gases. (This is where the concept of "entropy" first enters. About this, more later.) Information theory did not stay confined to the world of mathematicians or electronics engineers. The possibility of its application to biology was immediately grasped. W. Ross Ashby's Design for a Brain (1952) was the culmination of several years of considering the human organism as an information processing machine. Norbert Wiener's Cybernetics (1948) is a related effort, popularized later in The Human Use of Human Beings (1950).

The possibility of a new, comparative understanding of humans and the most sophisticated of machines through the mathematics of information probabilities brought systems theory into being. Ludwig Von Bertalanffy was one of those most impressed by the potential of the systems concept for bridging the distance between social, organic, and mechanical knowledge. He coined the term General System Theory in 1937 while part of a philosophy seminar with Charles Morris at the University of Chicago, though he didn't publish the idea until after the War. Organization, he felt, was the key to understanding the world. The various components of the universe, be they atoms, people, or societies, were less important than the way they were put together. Thus, an organism might be just one example of an "organized system." (Rapoport in Buckley, 1968, xx) A society might be categorized as a kind of "complex adaptive system." (Buckley, 1967, 5) The real excitement of sys-

1. In classic Information Theory, "information" refers only to the capacity to send messages. Received and stored information is not included in "information." Hence, Communication Theory has arisen as a broader, less strictly mathematical, field of study. You can get into trouble, in some circles, by using "information" and "communication" interchangeably.

tems theory, particularly the idea of General System Theory,² was that it was not just another variety of organismic sociology, but that it promised to be a basis of unification of all the sciences. Moreover, the basis of this unity was not just another metaphorical comparison, but one where structural isomorphism (sameness of shape) might be established and where mathematical precision could be employed to nail it all down. This is indeed an intoxicating idea. Imaginative social work scholar/practitioners were understandably drawn to it along with others from many fields. But what, specifically, has the systems notion to offer social workers beyond the promise of eventual unification of the physical and social sciences at the most abstract of levels? Can it provide any concrete guidance to the complex reality that social workers experience daily?

THE USES OF THEORY

It might be worthwhile to ask at this point: What can a social worker reasonably expect from a theory? Theories are more or less systematic assemblages of terms or concepts and relationships that offer explanations. They are frames of reference, organized or unorganized, that we refer to for guidance, consciously or unconsciously, in developing some trans-situational basis for action. They involve generalizations that go beyond individual situations and yet are not so general as to be untestable. An example of the latter problem are horoscopes whose predictions are vague enough to fit almost any event that does occur. Sociological theories, because they are concerned with the more abstract and general levels of social organization, often have this problem. General Systems Theory, we have seen, is particularly abstract because it seeks the organizational similarities of such a vast range of being: physical, organic, and socio-cultural.

Even at the higher levels of abstraction, theories are useful to practice in that they help organize and sort out from the many possible things going on in the world those things most likely to be important in a particular situation. They sensitize one to look for things that might not otherwise be noticed. They suggest what should be focused on and what is peripheral. Hopefully, this selective, hierarchical, explanation will get down to the level of individual situations so that some guidance to action is possible. Also, this guidance ought to be so phrased that one can judge after the event if it worked or failed. Sociological theories are often frustrating to social workers because they provide too little specific guidance to action. Freudian psychology, on the other hand, has a good deal to say about practice. Its problems relate to its prescriptions being constructed so that they

2. Though Bertalanffy reserved the singular form for his General theory, this usage has not been widely adopted. Systems theory will be the phrase used here.

can't be judged right or wrong. Any event or outcome can fit into the diagnosis. Rosenhan (1973), Goffman (1961) and others have shown, for example, how easy it is to interpret current and past behavior of an ordinary life into a pathological pattern. The practitioner, then, has the vexing problem of deciding what is true and what will work. Doing controlled research is not usually within his or her range of options. And, for a variety of reasons we have no space to discuss, he or she cannot often use the research of others to provide a guarantee of successful action. The best one can do is know something about how to ask the right questions (theory) and how to recognize good answers when they appear (methodology).

It is my contention that systems theory, like most macro-level theories, is not likely (at least at the moment) to provide concrete, proven guidance to practice. It is, and will probably continue to be, used as a frame of reference for practice, organizing within its broad scope a variety of micro-practical theories and techniques. (see, e.g. Anderson & Carter, 1974) Let us proceed to look at the kinds of questions systems theory encourages us to ask, the ones it doesn't ask, and the general direction it takes us. In the process, it will, I hope, become apparent why systems theory in practice has been such a mixed blessing and is so easily exploited by the profiteers.

CHARACTERISTICS OF SYSTEMS

The usual definitions of a system are simple and general: "a totality of elements in interaction," or "the dynamic interrelatedness of components," (Buckley, 1968, xxiii-xxv) or "a whole which functions as a whole by virtue of the interdependence of its parts." (Rapoport in Buckley, 1968, xiv) Two salient characteristics of systems theory are prominent in these definitions: a concern for wholes and for interrelatedness. From the first concern derives the problem of establishing boundaries: what is part of the system and what is not? What is outside the boundary of the system in question is labeled "environment." Allied to the second concern, interrelatedness, is the problem of "homeostasis." It is often assumed, particularly by social work systems theorists, that the major process characterizing the relationship of components of a system is the homeostatic tendency, mentioned earlier, of seeking balance or at least smoothness of operation. These are all, as we have seen, legacies of organismic sociology. The advent of cybernetics brought the idea that the key to interrelationships and their balancing tendencies was information. Thus, analysis of "messages" and "feedback" revealed important things about organization of both living and non-living systems. The basic concept of system, then, directs our attention to problems of wholes and their parts, their boundaries, their major processes (chiefly, homeostasis), and the information exchanges that drive these processes.

To this list must be added two other concepts from the Post-War

interplay of biology and information theory. "Entropy" is the assumed universal tendency of systems toward disorganization, randomness, and chaos. "Equifinality" is the assumption that there is always more than one way to arrive at a given end. These are the concepts we must now examine.

Before we proceed, however, we must note a preliminary problem of theory-building that systems theory makes especially important. Though analogies, models, and metaphors are ubiquitous in theory-building, systems theory makes analogizing a major indoor sport. This is both legitimate and dangerous. Walter Buckley points to the shift in biological theory from concern with substance to concern with organization as a major inspiration of systems theory. This means that outwardly dissimilar things can yet embody similarities in operation. "The major goal of the General Systems Research movement is to trace out...structural similarities, and structural differences, between 'substantively' different systems." (1967, 3, emphasis original) Similarities are not to be taken for granted. They are to be tested, not assumed. Ida Hoos' indignant comment on attempts in California to use aerospace systems analysts to tackle social problems is worth mention here:

In the real world, there appears to be about as much justification for committing society's sundry malfunctioning systems to the care of a systems analyst whose sole claim to expertise is technical as to call a hydraulic engineer to cure an ailing heart because his speciality is pumping systems. Although the term 'system' can be applied to both space hardware and social problems, the inputs are vastly different, as are the controls and objectives.
(1969, 23-24)

The interesting potential in the discovery of structural similarities between systems of different orders remains in the realm of poetic metaphor until the practical limitations of those similarities are carefully spelled out.

WHOLAS AND HOLISM

The encouragement to look at things as wholes is one of the most widely appealing aspects of systems theory to social workers and other practitioners. The tendency of social work to concentrate on one-to-one interventions using psychological theories has diminished in recent years and a counter tendency which tries to consider the influences of larger social structural forces is gathering support. Systems theory offers the promise of eventually being able to relate micro-social problems to macro-social forces.

When advocates present the merits of a systems approach, they often cite examples where important things were left out, thus rendering

the result laughable or disastrous or both. (Halpert, 1968) No one wants to be accused of ignoring some important factor. Moreover, as said earlier, it is good that social workers are wrestling more openly with problems of large-scale organization. Nonetheless, beyond initial sensitization to the "big picture," one must ask whether a systems approach can help us include all the right elements. Obviously, not everything is relevant. Nor are all relevant factors of equal importance. To get an idea of what kind of factors a systems analysis is likely to regard as important, we will have to look further.

It is worth noting that, in practice, systems analysts seem to have as much trouble as anyone else in including all the significant factors. Robert Boguslaw, whose experience among systems theorists leads him to compare them with the nineteenth century utopians, says:

The history of utopian design efforts seem to reveal a high correlation between the use of rigorous rationality within a system design and the omission of significant elements from the system model. (1965, 64)

An example of this myopia is the creation of a criminal justice evaluation system proposed for the State of California by an aerospace firm. It was based on conviction statistics, ignoring all current reservations about such statistics as an index of crime, much less a definition of it. (Hoos, 1970, 209-213)

Another worm in the apple of wholism is the peril of going to the opposite extreme and trying to regiment everything into an overarching plan whether it fits or not. City planners have been accused of this vice. (See, particularly, Sennett's provocative argument, 1970, 87-95.) Even systems theorist C. West Churchman laments that "...large systems are unaesthetic; they are neither beautiful nor interestingly ugly. They are boring, plain, uncreative, abominable, smelly, gray, tasteless." (1968, 198) Thus, we have problems both with leaving too much out and putting too much in, and practitioners of systems analysis don't seem to have any special claim to solving them yet.

BOUNDARIES

The definition of a system requires knowing what's in and what's out. Part of what's outside the boundary of a system (its environment) may be another system. Therefore, careful definition must precede any systems analysis. The fact that systems theory forces the social worker to make such an analysis is a positive contribution. It forces not only some awareness of "the big picture" but also some self examination. Am I part of the impinging environment forcing the client(s) to adapt or am I part of an effort, in concert with the client(s), to alter the impinging environment?

The difficulty with the definition of system boundaries is that they are probably always very arbitrary. Where is the "edge" of a nuclear family, dividing it from an extended family, friendships, work

requirements, community ties, political demands, etc.? But sensitivity to this problem is an advantage. If one is wary of the definition of boundaries, one may avoid the related problem of assuming too quickly that various systems are self-contained or self-regulating, or that they should be.

INTEGRATION

One of the greatest problems of systems theory, as amply demonstrated by its ancestry in organismic sociology, is the tendency to assume that parts of something defined as a system are related to each other without some attempt to see that they are. It is one thing to be on the alert for subtle interconnections and unanticipated consequences. It is quite another to assume, as did the conservative Social Darwinists, that things were so completely and bafflingly intertwined that society should be left completely free of planned direction or change. In taking social work out of the temptation to assume that most problems are individual/psychological ones, will systems theory produce a crop of neo-Spencerians who, while recognizing the social nature of many problems, find them so complex that they despair of solving them and go back to individual therapy as the only profitable use of their talents?

A related problem with a similar conservative outcome stems from the exaggeration of the importance of the varied parts of a system for its survival. If everything in a society is "functional," that is, supports the operation of the system in some way, then to change or eliminate any part may threaten the survival of the system. This leads easily to a conviction that everything that exists in a given social order is necessary and ought to be defended against attack. Thus may an overestimation of integration result in an automatic defense of the status quo. (for a presentation of this problem by the most articulate defender of functionalist sociology see Merton, 1968, ch. I)

A more likely risk is the possibility of overstating not how much things are interrelated but how much they should be interrelated. This is perhaps another way of discussing the problem of rigidified holism. Alfred Kahn says quite bluntly: "Proponents of decentralization, community control, and participatory administration could find their activities in conflict with a systems emphasis." (1973, 146) Is integration an unqualified good and is it the task of social work to increase it? Can all parts of a system be successfully integrated? If not, must we alter the very definition of "system?" In a heterogeneous society, how much integration is necessary to survival or to the maximum satisfaction of its citizens? Are there situations where too much integration could pose a threat to either of these goals?

Alvin Gouldner has suggested that the latter situation is quite possible and that "de-differentiation" and "functional autonomy," the factors Kahn seems to believe are warned against by systems theory,

might not only be helpful to the operation of a society but may become the only way of saving a system in a threatening environment. Noting such examples as the work of Goffman on the tendency of people to resist total integration (1961), Gouldner suggests that the organization of a social system may be shaped as much by the conflicts and tensions between parts as by their harmonious interaction. (in Demerath & Peterson, 1967, 160) He goes on to describe situations where parts are not only not fully integrated but where actual reduction in integration may be required for system survival. A looser, simpler re-grouping may be necessary to adapt. Community control of social services, Federal revenue sharing, ethnic pride, job enlargement and worker control on the assembly line may decrease integration and heighten disorder but benefit society in the long run. "In short, limited increases in randomness, by way of structural de-differentiation, may be the ultimate defense of systems in the face of extremity." (Gouldner in Demerath & Peterson, 1967, 166) Richard Sennett's The Uses of Disorder offers a similar argument, on both personality and community levels, for the importance of de-regulation and an increase of uncertainty, variety, and conflict for the nurturance of personality and communal growth. (1970) (For a related concern, see section on VARIETY below.)

HOMEOSTASIS AND MORPHOGENESIS

Another hotly contested issue in the history of organismic sociology is the concept of homeostasis. As noted earlier, the assumption of a balance-seeking tendency in societies analogous to the self-regulating properties of biological organisms has led to conservative political conclusions that parallel those stemming from an overestimation of the importance of integration. With a few notable exceptions (Lathrop in Hearn, 1969, 51; Stein, 1974, 38. Stein disagrees with my assessment of social work consensus.), most social work systems theorists assume the central importance of homeostasis. (Janchill, 1969; Kramer & Specht, 1969, 27; Meyer in Kahn, 1973; Shafer in Hearn, 1969, 32; Nelsen, 1972, 631) It is also widely used apart from the rest of the systems concepts in such contexts as psychoanalysis, family therapy, and crisis intervention. (e.g. Wood in Strean, 1971, 50; Scherz in Roberts and Nee, 1970, 229; Rapoport in Roberts and Nee, 1970, 276) Walter Buckley, however, goes to great lengths to show that the concept of homeostasis must be transcended if systems theory is to be useful in understanding social life (1967). It is ironic that, while this book is often cited in the social work literature, Buckley's argument seems to have had so little influence.

Buckley observes that, "...whereas mature organisms, by the very nature of their organization, cannot change their given structure beyond very narrow limits and still remain viable, this capacity is precisely what distinguishes sociocultural systems." (1967, 14) The process of elaborating or changing structure he calls "morphogenesis."

(1967, 58)

Those social workers who have accepted homeostasis as an essential and useful part of systems theory may be aware of the intellectual difficulties this raises and the political conclusions it invites. Some seek to mitigate the problem by the use of a term like "dynamic equilibrium." Others reject equilibrium and homeostasis entirely in favor of the term "steady state." Anderson and Carter, who seem fully aware of the difficulties of homeostasis, define steady state merely as the tendency of a form of organization to persist over time. They stress morphogenesis and even argue, following Buckley (1967, 160), that tension is normal, not pathological; that it is not reduced automatically; and that it may even be produced by a properly functioning system (1974, 18-20). Nevertheless, the term "steady state" remains vulnerable to the same static associations and, hence, debilities as the earlier terms. Its very origins tie it to Cannon's homeostasis (1939, 24).

The reason why social workers should be wary of equilibrium, homeostatic, and steady state metaphors are simply stated, yet they may remain for many unconvincing. To be aware of the status-quo orientation of such concepts is often considered enough to inoculate users against unwitting conservatism. Yet the history of organismic sociology suggests this is not enough. Many have read Merton's eloquent argument that functionalism is compatible even with a Marxist view of social change. This includes, among other things, an indictment of Cannon's attempt to apply homeostasis to societies. (in Demerath & Peterson, 1967, 40) Yet these arguments have not saved functionalist sociology from regular use as an instrument of the status quo. (In addition to Demerath and Peterson, 1967, see also Reynolds and Reynolds, 1970, on this issue). It may well be that in cases like this, theoretical models of whatever construction and logic yield to larger political forces. Yet I suspect that there may be powers of association and subtle persuasion in our theoretical constructs that themselves compel us to move in certain directions and that this can affect the wary as well as the unwary. Some concepts it is better to throw out than try to repair.

SURVIVAL

Survival is the prime value in biological organisms. Integration and homeostasis are usually justified in terms of their contribution to survival. Indeed, those who oppose homeostasis and argue for the utility of less integration, often do so on survival grounds. Gouldner and Buckley, for example, defend autonomy, morphogenesis, or de-differentiation by pointing out their greater adaptability. It is worth considering at this point, if only for a minute, whether this part of the organismic analogy is appropriate at the level of social organization. Should survival be the supreme value here? Should all

organizations and associations be maintained, and is it the social worker's duty to work for their preservation? Is it possible that some might outlive their usefulness or that others should never have been born?

We should all be familiar with the tendency of organizations to perpetuate themselves even to the detriment of the purposes for which they were organized. Charity drives frequently spend more on the costs of organization than on the charity itself. Perhaps it is too much to expect the Cancer Society to resist metamorphosis into the Ingrown Toenail Foundation once a cure for cancer is found. Nor is it likely that heads of Federal agencies will be seen trooping into the President's office asking to be disbanded. Nonetheless, a theoretical orientation that places too high a value on organizational survival might be a dis-service to those concerned with the social welfare of society.

ENTROPY

The introduction of the concept of entropy into social work seems to me a good example of accepting an analogy without checking on its empirical plausibility (is it really present in social systems?) or its metaphoric utility (what does it inspire us to think about?). Entropy is a concept drawn from classic thermodynamics and has most relevance to the distribution of particles in gases. The notion enters systems theory for two reasons. First, entropy was linked to information by the physicist Leo Szilard, defining both in terms of probability. This mathematical formulation of entropy was the basis of the work of Claude Shannon of the Bell Telephone Laboratories and others in the creation of modern Information Theory. A second reason for the popularity of entropy in systems theory is, I suspect, that Norbert Wiener was not only fascinated by its application to information theory but saw in Schrodinger's argument that life is counter-entropic a metaphor for the indeterminacy of modern science. His popular book The Human Use of Human Beings (1954) contains a recurring theme of heroic mankind struggling to create knowledge and order against the tide of entropic chaos. Thus, entropy appealed to early systems theorists because of the neatness with which the unity of the sciences could be demonstrated if this concept could be applied to physical, biological, and social realms,³ and because of the noble role it assigned to humanity. Despite this, I think it is a deadend for social work on both counts.

Empirically, the counter-entropy assertion is impossible to prove in biology. Lila Gatlin, a biophysicist at Berkeley's Space Sciences

3. Wiener does warn the reader in his introduction that he hasn't checked the limitations of this analogy. (1954, 12)

Laboratory, maintains that taking the measurements necessary to establish an entropy difference between higher and lower organisms would probably kill them. "I think," she says, "our classical notions of entropy as they have come to us from presently established 'laws of physics and chemistry' are totally inadequate in dealing with the living system. (1972, 22)

On the level of social organization, the concept of entropy is at best confusing. The things that are metaphorically associated with entropy—chaos, randomness, decay, disorganization, "running down"—may often be found in the company of supposed counter-entropic factors. The mushroom growth of suburban tract developments in the Post-War period brought a good deal of chaos to governments, school districts, and social service agencies. Finding in all of this a demonstration of the Second Law of Thermodynamics is a fruitless undertaking.

The definition of entropy and information in terms of mathematical probability does seem to have empirical use in biology, where Gatlin applies it to the genetic coding process of DNA, and in information engineering, as discussed earlier. But this, Colin Cherry reminds us, is the highly technical realm of "information capacity /which/ may be defined strictly on a mathematical basis, without any of the vagueness which arises when human beings or other biological organisms are regarded as 'communications systems.'" (1966, 41) The concept of entropy, she concludes, "...is one of considerable difficulty and of deceptively apparent simplicity." (216) She even suggests "...that in true communications problems the concept of entropy need not be evoked at all." (217)

Even if the empirical utility of entropy in biological and social systems is quite narrow, it might be justified on metaphoric or sensitizing grounds. William Gordon discusses entropy's utility for social work in the context of interchanges between systems and their environments. For "growth and development" to take place, entropy must be "extracted" and exported to the environment or otherwise redistributed. Social work, presumably on the side of growth and development, may then be defined as trying to reduce entropy. (in Hearn, 1969, 11) This exposition is consistent with classic thermodynamics, but its application to society is less than clear. It calls forth visions of people with wheelbarrows dumping some kind of gooey substance outside the city limits. Gordon does not offer his own vision, but more serious examples can be posited. There are individuals and families that maintain their internal functioning by causing chaos around them. There are corporations whose prosperity is built on environmental disruption. One can think of nations preserving internal order, covering over problems of poverty and inequality, through hatred of an external enemy. These are not, however, inevitable, much less attractive, ways of solving problems. Gordon, I'm sure, would want social workers to carry out entropy exchange with minimum disruption to the environment. Still,

to define social work's goal as the redistribution of entropy seems yet another dubious proposition. It is another step, like homeostasis, toward the over-valuation of order. It further suggests that all growth must be purchased at the price of chaos somewhere else.

EQUIFINALITY

Into this list of potentially dangerous analogies I'd like to interject one that seems quite benign. "Equifinality" is the postulate that "the same state may be reached from different initial conditions and in different ways." (Lathrop quoting Bertalanffy in Hearn, 1969, 59) To put it more humbly: "there's more than one way to skin a cat." This has a good bit of empirical support and provides social workers with increased sensitivity to alternatives. It may also provide decreased anxiety about diversity. For an occupation frequently hemmed in by larger and more powerful social structures, this is probably a good thing.

VARIETY

Related to the concept of equifinality but less widely attended to by social work theorists is the stress on variety that appears now and then in systems theory. Both equifinality and variety are derived from the emphasis on complexity in the organismic analogy. Complex organisms with a variety of parts seem to be more adaptable to new situations than simple ones. One group of social workers analyzing urban organizations from a systems perspective cite Ashby's Law of Requisite Variety: "...an adaptive system must produce at least as many effective responses as the number of demands made by the environment." (Baker, Broskowski, and Brandwein, 1973, 67) Buckley (1967, 90-92) illustrates the survival value of variety in a culture with examples from a Baja Indian group. Homogeneity in a community or society may provide integration and stability, but it may limit the resources available to meet changing circumstances.

The appreciation of diversity and variety in society is a classic theme in at least one part of social work tradition. The legacy of Jane Addams may get new reinforcement if social work systems theorists choose to develop the side of the organismic analogy that stresses the value of variety rather than the side which, following Spencer, sees the organism as too complex to encourage in either the direction of variety or sameness.

FEEDBACK AND CONTROL

Perhaps the most promising, and also the most difficult, aspect of systems theory for the social work practitioner is the topic of "feedback" and its implications for power and social control. Here the organismic background to systems theory has contributed less than has information theory. The self-regulating capacity of certain ma-

chines, from simple thermostats to more complicated self-aiming anti-aircraft guns, were the inspiration of Wiener's choice of labels for his own brand of systems theory, "cybernetics," derived from the Greek word for "steersman." The process by which this self-regulation took place was called "feedback." Feedback presumes the existence of certain maintenance criteria, the ability to monitor operation enough to sense when the criteria aren't being met, and the ability to take some corrective action.

Like homeostasis, this cybernetic kind of "self-regulation" needs careful scrutiny. The first complicating factor we find is that there is feedback and there is "pseudo-feedback." Not every circular relationship qualifies as feedback. Simple organisms eat and reproduce. If there is a lot to eat, they reproduce more, which means they eat more and reproduce more. But they do not cultivate food and do not regulate their population according to the food supply. If the food runs out, they die. The difference is that there is no control, no self-regulation, no corrective action. On the social level, the cycle of poverty might be an example of pseudo-feedback. As with the organisms, one condition affects another which returns directly or indirectly to affect the original. Living in a poor neighborhood means getting a poor education which means getting a poor job which means having poor resources which means living in a poor neighborhood which means... Racial discrimination operates the same way.

Let's take one further example. An actor, through the "feedback" of his audience and critics, is judged to have given a poor performance. This may affect his self-confidence which leads to another, even worse, performance. What seems to distinguish these human "vicious circles" and "deviance amplifications" from "true feedback" is that the reactions, according to Buckley, are "blind" and not controlled. (1967, 69) It looks, however, that the difference is that some were helpful and some weren't. The actor couldn't correct his performance problems, but he probably thought about them. Those involved in poverty and discrimination may indeed not know what they are doing, but they may also not want to do anything differently. Those who have some control of the situation may have an interest in not taking corrective action. This should be kept in mind as we proceed. (see Buckley, 1967, ch. 5)

Even if we use the term "feedback" to cover only those situations where error can be monitored and the "right" corrective actions taken, there are still further levels of feedback effectiveness. The thermostat is the standard example of feedback. It can control the furnace to maintain a pre-set range of room temperature. What if the depletion of fuel or its inflated price requires conserving or rationing? We must redefine "room temperature" by changing the setting on the thermostat. Most error-regulated systems can't do more than maintain a pre-determined steady state. They can't completely restructure themselves to meet radical changes in the environment. Even a thermostat that

would redefine its "comfort zone" according to information from a monitor of fuel reserves could not change over to solar heating.

We must remember, then, that there are different levels of cybernetic "self-regulation" and that there are many points where human redefinition of goals may be crucial. If we wish to apply a cybernetic model to human society, we must remember that the "self-regulation" is us and that reorganization does not take care of itself. It is always important to know who is doing the defining and redefining of goals and of success.

INFORMATION

As we've seen, in the initial formulation of systems theory, one of the factors common to machines, organisms, and societies was the use of "information" as a key to organizational operation and adaptation. Messages of some sort were transmitted through the feedback process, connecting the components of the system and guiding it through the vicissitudes of the environment. This flow of communication illuminated the patterns of organization, identifying the centers of control and their peripheral subordinates. We have also seen how the concept of information was defined by Information Theory in ways that made its use in non-mechanical contexts much more difficult. We are accustomed to use the term in ways closely identified with "meaning" and "knowledge" rather than as a mathematically defined broadcast potential divorced from actual human communication. As with much of the original language of systems theory, the more carefully information was defined, the less portable it was across the different realms of organization. Nonetheless, in its original, broader sense, we may gain at least metaphoric use in examining social organization in terms of information.

Bystepping Information Theory, at least for the time being, we are free to ask a number of questions about how communication comes about, how the meaning of messages comes to be defined, how organization itself may be defined by who communicates with whom, how hierarchy is established by the direction of communication, and how power is wielded by the shaping and withholding or denying of information. The consideration of complex organization and, particularly, the nature of organizational power is something that seems to me particularly salient to social workers.

Few of us would deny the ubiquity of power, yet we find it easy to ignore. Social workers, often in an in-between position, need this awareness, however painful, as part of their jobs. They must be acutely conscious of the power they hold—however benevolently—over their clients, the power their agencies have over them, and the power the larger political system has over their agencies. More important, they need to go beyond this recognition, which can lead to resignation, and learn to find the ways whereby they, their clients, and fellow citizens can reclaim some share autonomy and resist the oppression of bureaucracy, greed, and misgovernment. (for one sensitive to this see Polsky in Hearn, 1969)

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The consideration of information and its socially defined meaning leads us back into the basic study of what the structure of society is all about. (Buckley, 1967, 92f) Social workers may have little time for these questions once they are in the field. But periodic reconsideration of basic questions in light of practice experience is indispensable if our knowledge of social problems is to improve.

The consideration of information as the clue to complex organization may produce some much more immediate insights. As a small example, it suggests that normally powerless people may exert some influence in the hierarchy. Secretaries and janitors, the most lowly people on most corporate totem poles, may not have much initiative power, but they can exert a certain amount of veto power. They know things about the organization that the vice-presidents don't; and, if they want to, they can obstruct implementation of policies and generally make life miserable for many more highly placed individuals. I'm reminded of the professor who, after a few weeks of misdirected mail, erroneous classroom assignments, lost travel vouchers and supply orders, and delayed paychecks, decided that he was sorry he'd insulted the departmental secretary. Most Senators are busy enough that they have little time to research the bills their Committees are working on. Therefore, they are extremely dependent on the information supplied by their staff members for day-to-day votes. This can be a tremendous amount of power for an un-elected and frequently very young person. This is not to say that the power of underlings is at all comparable to that of the top executives, but it is not negligible either. Most important, tracing information through the organizational hierarchy can be the start of a greater understanding of organization itself.

Seeing information as power itself may expand our appreciation of social problems on the societal level, too. The fact that major oil companies are the only source of information on energy reserves makes it impossible for anyone to refute claims of shortages. Yet we must be careful not to think that this is the only kind of power in society. After all, if the organizational superordinate doesn't like the information the subordinate is providing, he (or she?) can always fire the whole staff. There are ways to get at oil companies, too.

CONCLUSION

If systems theory is so broad that it allows both conservative and radical interpretation of the same situation, is it any good at all as a guide to practice? Is it anything more than a stylish veneer for a perspective derived elsewhere? Or is it a hip Sears catalogue that we can buy from, higgledy-piggledy, as our whims and budget allows?

It is undeniable that systems theory throws a wide net; it was intended as such. Moreover, its intellectual heritage is diverse enough to have made the many interpretations contained within its hos-

pitiable boundaries inevitable. Still, I think that there is a coherent and consistent systems theory that can be of some definite help to social workers.

The reason I spent time on the historical origins of systems thinking was to get a clearer idea of which themes seem most likely to gain empirical support and where concepts are likely to lead in practice. Not all the concepts currently associated with systems theory are essential to a systems perspective. The systems garden is lush enough to permit considerable weeding and pruning without killing much that is vital. Mindless bouquet-gathering is neither necessary nor advisable.

The systems framework is purposely of the highest abstraction. The idea that possessed its founders was to find structural and organizational unity in all the sciences. The difficulties systems theory has experienced owe much to the fact that its proponents simply assumed similarities to be there rather than examining possible similarities closely in practice. Some biological concepts may be appropriate to society and some may not be. The mathematical definitions of engineering may fit some biological or social phenomena and not others. Analogies from social organization may or may not describe things in other realms. Unification of the sciences wasn't expected overnight.

To the practitioner with problems a little more immediate than scientific unification, there still may be use in a carefully constructed, and probably stripped-down, systems perspective. The example set by Walter Buckley a decade ago still merits following. Even without further modification, it has much to offer social workers. With a reasonable model of this sort one can then begin to examine the lesser known territories of daily human suffering with some kind of map. A map without a lot of details on it is annoying but better than no map at all. It is also a useful supplement to one's memory of where one was last week.

In the process one must 1) always be aware of the potential biases of the map or model from examination of its logic and the history of its past use, and 2) test rather than assume the existence of each reference. Then systems theory may indeed inspire some new insights within an organized framework that will extend their benefit to greater and wider successful application.

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