ON THE MISMATCH BETWEEN SYSTEMS AND THEIR MODELS

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Most contemporary social systems are failing. The educational system deteriorates as functional illiteracy increases. *Head Start* is said to be a failure. So-called healthcare institutions fail to provide needed care to more than 40 million people. In fact, there is considerable evidence that the alleged health care system itself produces and maintains illness and disability. The United States has a higher percentage of its population in prison than any other developed country, but nevertheless has the highest crime rate. Most of the corporations formed each year fail before the year is up. The number of corporate bankruptcies is on an increasing trend. The average life of an American corporation is now about fourteen and a half years. Half the corporations on the Fortune 500 list twenty-five years ago no longer exist. One could go on and on citing deficiencies in the management of our principal social systems.

The unsettling concern is that the same sets of social problems have been with us for most of the last fifty years. Little progress has been made in dealing with them despite the efforts of administrations with both left and right ideological orientations. As a result, many have come to believe that such problems as drug addiction, crime, poverty, inequitable health care, inadequate education and alienation from work and society, are an integral part of modern life and not much if anything can be done about them.

There is obviously no one reasons for all these system failures but, we will argue, there is one very large contributing factor to all of them: the way these systems are conceptualized, modeled. There is a very serious mismatch between most social systems and the models of them that are in use.

Barry M. Richmond, creator of the *Systems Dynamics* model *and I-think language* makes it clear that systems and the models of them in use are not the same. According to him "the way we think is outdated." He goes on to define thinking as:

> consisting of two activities: constructing mental models, and then simulating them in order to draw conclusions and make decisions. The mental model is a "selective abstraction" of reality that we create and carry around in our head. As big as some of our heads get, we still can't fit reality in there. Therefore all mental model are simplifications. They necessarily omit many aspects of the realities they represent.

To think about anything requires an image or a concept of it, a model. To think about something as complex as a social system we use models of similar, simpler, and/or more familiar systems. Unfortunately, as social systems become increasingly more complex, simpler mental models of them do not reflect their emerging properties. This unfortunate mismatch results in an inability to deal effectively with critical social problems.

Why does the mismatch of social systems and their models result in so many system failures? To answer this question we must (1) develop a clear understanding of what a system is, (2) identify the kinds of systems there are, (3) identify the kinds of mental models we often use to represent them, and (4) reveal the effects of mismatching a system and its representation?

THE NATURE OF A SYSTEM

We have dealt with the nature of systems extensively elsewhere. (See Ackoff, 1999, Chapter 1.) However, for our purpose here it is sufficient to recall the following:

1. *A system is a whole that is defined by its function(s) in one or more containing systems.*

2. *Every system contains at least two essential parts and these must satisfy three conditions.*

3a. *Every essential part of a system can affect its behavior or properties.*

3b. *The way an essential part affects the properties or behavior of the whole depends on the state or activity of at least one other part of the system.*

3c. *Groups of essential parts, subsystems, also can affect the behavior and properties of the whole system and none has an independent effect on it.*

Some important properties of a system derive from its definition.

When a system is taken apart it loses its essential properties.

No part of a system can carry out the function that defines the system.

When a system is taken apart its essential parts lose their ability to carry out the function they have in the whole.

Finally:

When the performance of any essential part of a system, taken separately, is improved, the performance of the whole may not be.

THE TYPES OF SYSTEM

There are many different ways of classifying systems. Different classifications have different uses. We have found the one we present here to be the most useful for understanding the poor performances of social systems. Since we believe *choice (*and purposeful behavior which derives from it) is at the heart of human and social development our classification depends on whether the essential parts of a system or the whole can display choice and, therefore, have purposes. This concern yields the four types of system shown in Table 1.

TABLE 1. TYPES OF SYSTEM

	Parts	**Whole**	**Example**
Deterministic	No choice	No choice	Clock
Ecological	Choice	No choice	Nature
Animate	No choice	Choice	Person
Social	Choice	Choice	Corporation

Significant continuities exist as we come down the Table and each category contains a variety of systems with important differences between them.[2] It is important to note that there is a hierarchical relationship among the four categories shown in Table 1: each type has or uses parts that are systems of the type above it in Table 1. Nevertheless, each type has a distinct emergent characteristic that distinguishes it from all other system types.

Deterministic Systems

All mechanisms are deterministic systems. Their behavior and the behavior of their parts are determined by their internal structure and their environments. A clock, for example, continues to run only if rewound or has its battery replaced, or is fed electricity, or is kept moving for much of the time. An automobile's behavior is determined by its users and the behavior of its essential parts. But the behavior of its essential parts is determined not by their choices, because they cannot make any, but on their physical state or that of their environment.

Although deterministic systems have no purposes of their own, they normally serve the purpose(s) of one or more complex systems; for example, their creators, controllers, or users. Their function is to provide such a service. Although the parts of deterministic systems do not have purposes of their own, they do have functions of their own: to serve the function of the system of which they are a part. Therefore, the behavior of all parts of a deterministic system is also determined.

The behavior and properties of deterministic systems are determined by their structure, causal laws, and—if they are open systems—by other systems in their environments. (The only completely closed system is the universe,) This is even true of computers; they are mechanisms although they appear to make choices, but it is not so. Their behavior is completely determined by their structure together with the information and program put into them by external sources. If we know these, in principle if not in practice, we can determine what a computer will do in any specified situation. The programmed instructions in a computer are its causal laws. These, together with its internal structure and externally provided inputs, completely determine its behavior.

Deterministic systems can be differentiated by the number of functions they have. For example, an ordinary clock has only one function, to tell time. However, some clocks also provide the date and the day and date, and even temperature, humidity and atmospheric pressure. The more functions a deterministic system performs, the more complex it is. The measure of complexity of a system is the number of variables and their interactions required to explain the behavior of the system.

Ecological Systems

Nature is the most familiar and inclusive ecological system. Some parts of ecological systems can display choice but the whole can not. As Daniel Quinn pointed out (1995), nature includes people, however unaware of this fact they may be. But the effects of their behavior are determined. We can affect our environments and often do, but the ways the environments react to our actions are determined. For example, the purposeful use of fluorocarbons as a propellant or DDT as a pesticide affect our environments, but their effects are determined, not a matter of choice.

Ecological systems are *living* systems in the sense contained in Zeleny's definition. They are self-organizing and self-maintaining. Life is currently defined in terms of *autopoiesis*:

> the maintenance of units and wholeness, while components themselves are being continuously or periodically disassembled and rebuilt, created and decimated, produced and consumed. (Zeleny, 1981, p. 5)

As we will see, it follows from this definition that animated, as well as, social systems are living systems.

Ecological systems serve the purposes of the organisms and social systems that are their parts; they provide inputs necessary for the survival of the biological and social systems (plants) that they contain. They also take the waste discharged by these systems.

Animate Systems

Not all biological systems are animate. Plants, for example, do not make choices but respond to external and internal conditions deterministically. Nevertheless they are also *organisms*. Animate organisms such as humans can make choices but their parts cannot. (Unless otherwise indicated, we will use the term 'organism' to refer only to animated systems.)

Plants *react* to external conditions in such a way as to make their survival possible. However, their reactions are determined, not matters of choice. Reactions are determined; responses involve choice.

Survival is obviously an important objective of animate systems. But their parts—for example, organs—have functions but no objectives of their own. Their functions, however, are necessary for the survival of the whole.

The organs of a human body like machines are mechanisms. The behavior of one's heart and lungs is determined in the same way that the behavior of a motor of an automobile is. Their function, however, is to make life possible, but they do not make choices.

Social Systems

All organizations are social systems. They are significantly different from organisms. They contain parts that are animate systems that display choice. (They may also use or have mechanical systems as parts; for example, production equipment in a manufacturing companies.) Organizations display choice. We commonly refer to choices made by corporations, government, and other types of social systems; for example, schools, hospitals, and government agencies. Note also that social systems are usually parts of larger social systems and that these usually contain other social systems. For example a corporation is part of an economic system that contains other corporations. A university is part of an educational system that contains many other schools. Some primitive societies that existed in complete isolation were not part of a larger social system, but became so when discovered.

TABLE 2. POSSIBLE SYSTEM-MODEL MATCHES

Types of Model	*Types of System*			
	Deterministic	**Ecological**	**Animate**	**Social**
Deterministic	DD	DE	DA	DS
Ecological	ED	EE	EA	ES
Animate	AD	AE	AA	AS
Social	SD	SE	SA	SS

Historically, animate systems have often been treated as if they were nothing but complicated deterministic systems. Mechanistic biology dominated biology for centuries. For example, the biochemist Roux is said to have taken the following position:

> According to Roux, biology admits of exact formulation because matter alone exists; there is no ground for a fundamental distinction between the living and the non-living. The animate, appearing as cells with nuclei, developed from the inanimate by the operation of mechanical laws, and is governed by them. (Flower in Clarke and Nahm, 1942, p. 72)

Reil, Lamarck, Rudolphi, Berzelius, Verworn and Loeb are among other eminent biologists who also had a mechanistic point of view of living systems.

Opposition to a deterministic conception of organisms surfaced in the mechanist-vitalist controversy that arose in the late nineteenth century. Mechanistic biologists were unable to adequately account for the nature of life. Today, when life tends to be defined in terms of self-organization and self-renewal, it is apparent that essential aspects of animate systems are not included in mechanistic models of them.

On the other hand, deterministic systems or entities, have seldom been conceptualized as organisms. An exception can be found among some primitive peoples whose beliefs are said to have been "animatistic," which is:

> the doctrine that a great part, if not the whole, of the inanimate kingdom, as well as all animate beings, are endowed with reason, intelligence, and volition, identical with that of man. *(Encyclopaedia Britannica*, Eleventh Edition, Vol. 2, p. 53)

We are not aware of effort to model organisms or mechanical systems as social systems. However, social systems have often been, and still are, modeled as organisms (Beer, 1972) and even deterministically (Forrester, 1961 and 1971). The sociologist Sorokin (1928) summarized the mechanistic interpretations of two prominent social physicists, Haret and Barcelo, as follows:

> In their works the translation of the mechanistic language of social science into that of mechanics goes on in the following way. The individual is transformed into a material point, and his social environment into a "field of forces,"…. As soon as this is done, there is no difficulty in applying the formulas of mechanics to social phenomena; all that is necessary to copy these formulas, inserting the word individual instead of material point, and the term social group instead of physical system or a field of forces. "An increase in the kinetic energy of an individual is equivalent to a decrease in his potential energy." "The total energy of an individual in his field of forces remains constant throughout all its modifications…and so on." (pp. 17-18)

In addition, Sorokin wrote that "H. C. Carey's principles of Social Science is one of the most conspicuous attempts in the second half of the nineteenth century at a physical interpretation of social phenomena." (p. 13) Carey applied such laws as those of gravitation to social phenomena. For example, if an individual is taken as a molecule and the social groups as a body, then the attraction between any two bodies is said to be in direct proportion to their masses (the number of individuals per unit volume) and inversely proportionate to the square of the distance between them. In addition, Carey took centralization and decentralization of populations to be the same as centripetal and centrifugal forces.

Herbert Spencer, the nineteenth century evolutionary philosopher, provides a striking example of biological modeling of social systems. His position was summarized by Hussong (1931) as follows:

> Spencer himself groups together under four heads those comparisons of life and society which result in showing three phenomena well known to characterize *life*, to be no less characteristic of anything to be called a *society*. They are: (1) growth; with which is associated (2) increasing differentiation of structure, and (3) increasing differentiation of function. (p. 23)

To clarify his first point Spencer argued as follows:

> In both biological and social organisms, growth is evidenced by the same phenomena. In both, there are increases in mass—in the biological individual, and expansion from germ to adult form; in the social, and expansion from small wandering bodies to great nations. In both, aggregates of different classes reach various sizes—among which biological organisms, the Protozoa rarely increase beyond a microscopic size; among social organisms the primitive Tasmanian seldom form large groups, while the empires of civilization include millions of people. In both, increases by simple multiplication of units is followed by union of groups and unions of groups of groups. In both, finally, a multiplication of individuals goes on within each group of units. (p. 23)

Stafford Beer (1972) introduced a celebrated model of what he called a "viable system," one that is based on a model of the human brain. He took the requirements for effective individual and organizational behavior to be the same. The difficulties in implementing his model derive from the purposeful nature of the parts of organizations. Organismic models do not take the purposes of the parts of an organism into account. However, such models may be usefully applied to social systems in those rare cases in which the purposes of the parts are very limited or are

apparently not relevant, for example, in organizations that are managed or ruled *autocratically*. The more autocratic an organization is, the more useful an organismic model of it can be.

A problem arises in applying an organismic model to social systems because of (1) the increasing education of the (human) members of a social system, (2) increasing technology that they must master to do the tasks assigned to them, and (3) the increasing variety of demands made on them. When those managed, governed or ruled know how to carry out their functions better than those who manage, govern or rule them, the less effective autocratic management or rule is. A *democratic* organization—one in which the members have considerable freedom and opportunity to make choices—can't be adequately modeled as organisms precisely because such modeling misses this most important characteristic of such a social system, the ability of its parts to make choices. These choices can (but may not) significantly affect the choices made by the whole. For example, plans and programs selected at the corporate level may fail to be implemented because of opposition to them by individual members of the corporation with responsibility for their implementation.

We recently asked a group of managers in an executive development program that had just completed working on a case, what would happen if they presented their solution to the relevant corporation's senior management. The class members said that these managers would probably finds a number of reasons for not accepting it, and if they accepted it, it would probably not be implemented as intended because of opposition to it by those who would be responsible for its implementation. We then pointed out that *the managers and the implementers were part of the problem, not external to it.* In the organismic model of the corporation which the class had unconsciously used, the purposes of those who had to approve of any proposed action, let alone those who had to carry it out, were not taken into account. Had the class used a social systemic model they would have treated acceptance and implementation of its solution to the problem as part of the problem, not as separate from it.

In the political arena finding what is normally thought of as a solution to a problem, and getting it accepted and implemented are usually treated separately rather than as necessary aspects of the problem. For example, many laws are simply not obeyed or enforced and therefore solve nothing. Laws that made homosexual behavior illegal are a case in point. President Clinton's proposed solution of the national health care problem was rejected by Congress whose approval was required before it could be enacted. Furthermore, many problem solutions that are implemented are sabotaged by those who implement them. This is the case when alleged solutions facilitate corruption.

MISMATCHING SYSTEMS AND MODELS

One can model a part or an aspect of a social system as a mechanism and by so doing may improve the performance of that part or aspect of the system, but this can reduce the performance of the whole. Optimization of the parts of a social system can affect performance of the whole For example, minimizing finished-goods inventory (hence the cost of carrying it) can reduce sales that, in turn, this can reduce corporate performance.

Recall that every essential part of a system can affect the performance of the whole but cannot do so independently of other essential parts. Therefore, in changing performance of any essential part, its effect on the system as a whole should be taken into account.

Deterministic Models Applied to Organizations

In the early stages of industrialization, machines replaced thousands of agricultural workers. This resulted in a very large number of unemployed unskilled workers that could have had a destabilizing effect on western societies. It was then that a new way of manufacturing "came to the rescue." Production processes were designed much as an assembly of parts each of which involves a very simple and repetitive task. Then unskilled workers could be assigned to these elementary tasks and be treated as replaceable machine parts. Subsequently, as Taylor (1911) showed, they could be studied as machines through time-and-motion studies and have their productivity increased. This mechanical model of production converted the army of former agricultural workers into industrial workers.

The impact of the use of a mechanistic model of organizations on productivity was so great that in one generation it provided an amount of goods and services that surpassed all previous expectations.

Enterprises created in the nineteenth century were conceptualized (as the universe was) as mechanisms created by their gods to do their work. Their owners had virtually unlimited control over their organizations; they were not yet subject to significant interventions by and constraints imposed by governments and unions.

The enterprise conceptualized as a mechanism had no purpose of its own, but it had a function that was to serve its owner's purposes. The principal purpose of its owner was to make a profit.

This concept of an enterprise could survive in the latter part of the nineteenth and early part of the twentieth century for the following reasons. First, the skills required of the work force were low and there was a plentiful supply of unskilled workers. To a large extent they were illiterate immigrants who had low aspirations for themselves but high aspirations for their children. Second, there was no form of social security, hence work was the only way to support oneself and ones dependents. Third, because there was a large pool of people looking for work, workers could easily be replaced. They were treated as if they were replaceable machine parts. The only alternatives available to the unemployed were to be supported by others or destitution. Therefore, most people were willing to work under any conditions, however difficult, and most of them had to do so.

Summarizing, deterministic models may work very well when applied to parts or aspects of a social system when these parts or aspects are considered in isolation. However, when the performance of each part or aspect of a system taken separately is improved, the performance of the whole may be reduced, and usually is.

The extent of the benefit or harm done by using a model that is not of the same type as the system modeled depends on the level of development of the system involved. For example, when it was initiated, Henry Ford's production system approximated a mechanical system for the previously noted reasons.

But, Henry Ford's phenomenal success in the creation of a mechanistic mass-production system marked the beginning of the end of production era. It contained the seeds of its demise. He failed to appreciate how his success had changed the game by transforming the problem from production to marketing. When he said, "they can have any color [of automobile] they want as long as it is black," this gave Alfred Sloan of General Motors the opportunity to gain domination of the market by focusing, not on production, but on how to sell. The marketing era emerged. It

gave rise to a new set of challenging questions, the most important of which were: (1) How respond to increasing demand for variety and diversity? and (2) How organize and manage the increases in size and complexity that resulted from increasing variety and diversity?

Organismic Models Applied to Social Systems

There were a number of developments between the two World Wars that made deterministic modeling of social systems less and less effective. (1) Technological developments required workers with increasingly greater skill. This in turn required more educated workers and subjecting them to more on-the-job training which became an investment. This made workers more difficult to replace. (2) Union and government interventions in management increased, particularly as related to the health and safety of the work force. (3) The threat of financial destitution associated with unemployment decreased as social security emerged. (4) Business and government organizations took growth to be necessary in order to respond effectively to demand for an increasing amount and diversity of products and services. The diversity of outputs and the new technologies required more growth than could *financed by internally generated profit*. Therefore, many businesses went public in order to raise the capital required to fuel continuous growth as well as technological improvements; management and ownership were separated. Finally, (4) as the size and complexity of organizations increased, decentralization of control became necessary, but this was incompatible with a mechanistic conception of organization. Deterministic systems require centralized control. No driver in his right mind would drive a car with front wheels that he/she could not control.

In an organization that requires invariant functioning of its parts (as deterministically conceptualized bureaucracies do), decentralization leads to disorganization, if not chaos. This is so because, as we have argued, improving the performance of an essential part of an organization taken separately, often reduces the effectiveness of other parts and the whole. This is why many organizations continually oscillate between centralization (to retain control of their parts) and decentralization (to cope with increasing size and complexity).

Because of these changes, enterprises went public; the company became a *corporation* (derived from 'corpus' meaning 'body') and the law came to treat it as an animate individual. The chief executive became the "head" of the firm. no longer its god. (Mechanisms do not have “heads.”) Managers became the clergy that facilitated communication between employees and the organization’s gods, its owners, the stockholders. Like the clergy, managers claimed to know the will of the corporate gods by revelation.

Because of these developments organismic models were increasingly used when dealing with enterprises in particular, and social systems in general. For example, at General Motors Sloan's concept of an organization was essentially that of a single minded animate system. This provided a relatively effective way of managing organizational growth and increasing the diversity of organizational outputs. In his (implicit) model, corporations, like human bodies, were divided into two distinct parts: (1) management, the *brain* (Beer, 1972), and (2) the operating unit, the *body*.

The operating unit, the body, was considered to have no choice, no consciousness. It was restricted to reacting deterministically to instructions coming from management, the brain, and/or events in its environment. Ideally, an operating unit would be a robot programmed to carry out without deviation pursuit of objectives by means both of which were specified by headquarters.

Military organizations, governmental bureaucracies, and autocratic corporations closely approximated the behavior of robots.

The health and safety of the organization and parts of its body, like that of an animate system, became the focus of government and union interventions. The work environment became their focus. The sweat shop and abusive labor practices were outlawed.

As business organizations came to be conceptualized as animate systems rather than mechanisms, production of profit was no longer taken to be its main function. As Peter Drucker pointed out, organizational profit came to be as oxygen is seen by a person, necessary for survival but not the reason for it. Survival became the principal objective of corporations and growth was considered to be essential for it. The opposite of growth, contraction, terminates with death.

Social-Systemic Models Applied to Social Systems

As a result of World War II a large portion of the workforce in western nations was drawn into the military. Replacements included Rosie the Riveter and Tillie the Toiler who were motivated more by patriotism than by the desire for additional income. In many cases, as dependents on those drafted into the military, the government provided them with enough income to survive. Such workers could not be treated as replaceable machine parts or organs of a body that only required consideration of the effects of their work on their health and safety. They had to be treated as human beings with purposes of their own. In addition, unions discovered that corporations working under cost-plus contracts or demands for increased production could easily be induced to make concessions to workers' interests. Work rules went through a profound transformation designed to maximize the number of employees required to do a job. Furthermore, because of the great increase in technological developments, the skills required of the workforce continued to increase dramatically. The more skilled the workers, the harder they were to replace—the more training and education had been invested in them. Technological developments required a significant investment in specialized training of the work force. Management had to obtain an adequate return on this investment. In order to obtain increased productivity from the work force all this generated a need to treat employees as human beings with purposes of their own.

The competence contained in the work force became the most important corporate resource. Exercise of this competence could not be ordered; it had to be induced, and this could only be done by taking the interests of those in the workforce into account.

Children of the post World War II workforce made up the permissive (Spock) generation whose members were not about to be treated as other than purposeful entities in their homes or at work. They expected their interests to be taken into account by their parents and employers and where they weren't, they were alienated from home and work. Their productivity decreased at work (*Work in America*, 1973). The quality-of-work-life movement was an effort to correct this. To summarize: organizations were forced to take the purposes of their employees into account.

In addition, protest groups formed outside organizations insisting that their interests be better served by the organization that affected them, for example, consumerists and environmentalists. The social responsibility of corporations and managerial ethics emerged as major concerns.

By the end of the 1960s it was apparent that the West was experiencing both an accelerating rate of change largely due to technological developments, and increasing complexity produced by growth and an explosion of interconnections resulting from continuously improving transportation and communications, for example, globalization. The socio-economic environment became turbulent, one in which predictability of the future diminished significantly and the only equilibrium that could be obtained was dynamic, like that or an airplane flying through a storm. These changes undermined whatever effectiveness had been obtained by applying organismic models to social systems. Centralized control and the treatment of subordinates as mindless parts became less and less effective.

Increasingly, employees could do their jobs better than their bosses, but only if they were given the freedom to do so. Therefore, the mechanistic and organismic concept of management as command and control, or even more lenient supervision, became less and less appropriate. The functions of management became (1) enabling and motivating subordinates to do as well as they knew how, (2) to develop them so they can do better in the future than the best they can do now, (3) to manage their interactions, not actions, and the interactions of the unit managed with other internal and external organizations. This can only be done with a social systemic model in mind.

Furthermore, in the second half of the twentieth century the unprecedented generation and distribution of both wealth and knowledge resulted in increasing choice and more interdependencies. This changed the nature of social settings and individual behavior. The greater the number of interactions and interdependencies, the more vulnerable social systems became to the actions of a few. The more knowledge available, the greater the value of communication and information. However, advances in information technology and communication did not yield the quality or quantity of control managers hoped for. It was assumed employees would behave like organs in a human body by reacting mechanistically to information provided by the brain, the head of the firm. Therefore, it appeared reasonable to conclude that the malfunctioning of organizations was due either to the lack of information or noise in the communication channels. Increasing effort was devoted to providing more information and better communication.

Unfortunately, this mode of thinking is ineffective in dealing with the complexities of increasing social interactions and interdependencies. It fails to recognize that members of an organization, unlike the parts of an organism, have a choice and do not react passively to the information they receive. Imagine a thermostat that developed a mind of its own. It would not react to information about the temperature in the room that it did not like. This would result in a chaotic air conditioning system. The effectiveness of a servo-mechanism is based on the fact that it does not have a choice and can only react in a predetermined way to the events in its environment. Our organs--heart, lungs, and so on--cannot decide not to work for us. Even when they are defective, we do not conclude that they "are out to get us."

Furthermore, increases in information eventually produces a condition Meier (1963) called "information overload." As the amount of information received increases beyond the amount its receivers can handle effectively, they use less and less of it. Not only do receivers become saturated with information—and therefore cannot receive any more—but they can and do become supersaturated and discard some of the (even useful) information they already have.
An organization with purposeful parts almost inevitably generates internal conflict. Wherever there is choice, conflict is likely. In conflict situations, organismic thinking is ineffective because it tries to resolve conflict by increasing the flow of information between the conflicting

parties. Unfortunately, when conflict is based on differing values or scarcity of resources, an increased flow of information, contrary to conventional wisdom, does not improve but aggravates the conflict. For example, the more information enemies at war have about each other, the more harm they can inflict on each other

The biological mode of organization can be successful, in the short term, in the particular context of paternalistic cultures; where loyalty, conformity, and commitment are considered to be the core virtues. These virtues are reinforced by the security of belonging to a group that in turn protects and provides for its members. For example, Japan, with a relatively strong paternalistic culture, closely approximates an organismic system. Therefore, it has been able to effectively grow economically on the strength of the biological model of organization. In a strong paternalistic culture, conflict can be resolved by the intervention of a strong father figure, whose are respected without hard feelings. To appreciate the power of this type of a leader, recall that such American corporate giants as Ford, DuPont, General Motors, and IBM owe much to their paternalistic founding fathers.

The nature of highly developed social systems is fundamentally different from that of a paternalistic culture. Members of societies that have matured past the secure and unifying umbrella of a paternalistic culture, insist on the right to make choices. But there is a price to be paid for this right; it can induce insecurity and conflict. Purposeful actors, individually or in-groups, who pursue incompatible ends and/or employ conflicting means, generate conflict. Consequently, because of its organismic orientation, corporate America is ill equipped to deal effectively with internal and external conflict. Furthermore, it finds it almost impossible to make the changes required to flourish in its rapidly changing and increasingly complex environment. A significant part of its energy is wasted on futile efforts to deal with such conflict. The frustration that results reinforces its inability to change. This in turn creates a feeling of impotence and hopelessness that immobilizes western governments, institutions, and organizations.

A conflict-free organization can be created by reducing choice, reducing members to robots. Fascist societies and autocratic organizations have attempted to approximate such a state. Such systems are dehumanizing and over time, result in reduced productivity of the workforce and reduced quality and variety of its outputs. This in turn produces a precipitous decline of an economy as is occurring in many western nations. On the other hand, relying exclusively—as organismic modelers of organizations do—on an increasing flow of information and compromise to reduce conflict does not produce encouraging results. Witness the situation in the UN, which has dramatically increased the flow of information between nations and compromise among them.

Therefore, the challenge before us is to create a type of organization that is capable of continuously *dis*solving conflict while *increasing* choice. This requires an organizational concept that is not compatible with either a deterministic or animate model of organization. It requires application of social-systemic models to social systems.

THE SOCIAL SYSTEMIC ORGANIZATION

In other places we (Gharajedaghi, 1985, 1986, and 1999; and Ackoff, 1981 and 1994) have proposed an organizational design that is based on a social-systemic model. It has the following features, none of which are compatible with other than a social systemic model.

1. It is a *democratic organization*, one in which every individual who is affected by what that organization does has a voice in deciding what it does, and in which anyone who has authority over others taken individually, is subject to their collective authority.

2. It has an *internal market economy,* one in which every part of the organization can purchase the goods and/or services it requires from any internal or external source it chooses, and can sell its output to any buyer it wants. Both these types of decision, buying and selling, are subject to overrides by higher authorities who must, nevertheless, compensate the organizational units affected for their loss of income or increased costs due to the higher-level intervention.

3. It has a *multidimensional organizational structure*, one in which units of three different types are located at each level of the organization: units defined by (a) their function (i.e., units whose output is primarily consumed internally), (b) their output (product or services primarily consumed externally), and (c) their users (markets, defined by type or location of customers). This type of organization eliminates the need for continual restructuring. Restructuring is replaced by reallocation of resources.

4. It uses Interactive *planning* which involves (a) formulation of the organization's mess (seeds of self destruction), (b) formulation of an idealized redesign of the organization, one that precludes such self-destruction, (c) determination of the closest approximation to that design that can be realized and (d) planning for it. Such planning then involves (i) selection of the means by which the approximation is to be pursued; (ii) provision of the resources required by the pursuit; (iii) specifying the implementation steps to be taken, when and by whom; and finally, (iv) design of monitoring and control of both the implementation and the effects of the plan.

5. It contains a *decision support system,* one that facilitates learning and adaptation by (a) recording the expectations associated with each decision of significance, (b) the assumptions and information on which they are based, and (c) the process by which the decision was reached, and by whom. It then monitors the implementation, assumptions, and effects of every decision, corrects them where assumptions turn out to be wrong or expectations are not met, and retains in an easily accessible memory what has been learned. Finally, it carries out continuous surveillance of the environment to detect changes that have occurred or are about to occur, changes that require adaptation by the organization.

These requirements are developed in detail in Ackoff (1999).

Any one or subset of these changes can significantly improve organizational performance. However, when all are made together, there is a powerful multiplicative effect, one that is much greater than the sum of its parts.

CONCLUSION

We have argued that it is useful to cast systems and their models into one of four types: deterministic, ecological, animate, and social systemic. The difference between them is a matter of "choice." Deterministic systems and their parts display no choice. The parts of ecological systems can display choice but not the whole. Animate systems can display choice but their parts can't. Social systemic systems display choice and their parts do as well. In addition, they are

usually parts of larger systems that also display choice and contain other systems that do so as well.

Our point has been that when models of one type are applied to systems of a different type, at least as much harm is done as good. The amount of harm (hence good) that is done depends on the level of maturity that social systems have reached. Society and the principal private and public organizations and institutions that it contains have reached a level of maturity that eliminates whatever effectiveness applying deterministic and animalistic models to social systems may once have had.

Finally, we showed five characteristics that we believe social systems designed as social systems should have in order to function as effectively as possible.

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NOTES

1. This article is a revision and extension of an article we published earlier: "Reflections on Systems and Their Models," *Systems Research*, Vol. 13, No. 1, March 1996, pp. 13-23.

2. The classification can be elaborated by distinguishing between choice of ends and choice of means, but doing so would take us beyond the scope of this paper.

3 The measure of complexity of a system is the number of variables and the number and the nature of their interactions that are required to explain the properties and behavior of that system.

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