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Systems, Messes and Interactive Planning[1]

The Machine Age

Machine Age thinking was *analytical* and based on the doctrines of *reductionism and mechanism.*

Reductionism is a doctrine that maintains that all objects and events, their properties and our experience and knowledge of them, are made up of ultimate elements, indivisible parts. For example, the physical sciences, which ruled the scientific roost during the Machine Age, maintained that everything was ultimately made up of indivisible particles of matter called *atoms*. Although the concept of the atom is generally believed to have been first suggested by the ancient Greek philosopher Democritus in about 420 B.C., it languished for almost two thousand years. It was revived in the Renaissance by such important thinkers as Giordano Bruno, Francis Bacon, René Descartes and Isaac Newton; but as a philosophical rather than a scientific idea. It did not emerge as an important scientific concept until the latter part of the eighteenth century. Since then, the concept of the atom, which no one has ever observed directly, has undergone progressive development; for example, it was later taken to be made up of particles of energy. But it remained the ultimate particle of matter. Today some believe the atom itself has parts called "quarks" or "partons," but they do not deny the existence of some kind of ultimate particle of matter.

Atoms were taken to possess energy and energy was conceived as the power of doing work. Work, in turn, was defined as the production of an effect on matter; for example, moving or transforming it.

Chemists reduced the different kinds of matter to different kinds of elementary substances. Biologists accepted the cell as the ultimate element of life. Gottfried Wilhelm von Leibniz (1646–1716), a major German philosopher and mathematician, postulated the existence of psychic elements—*monads*. John Locke (1632–1704), an equally distinguished British philosopher and prepsychologist, argued for the existence of ultimately simple elements of experience and knowledge—"simple ideas." Much later Sigmund Freud, the founder of psychoanalysis, reduced personality to the interaction between three ultimate elements: the *id, ego* and *superego*. In addition, he and most psychol-

[1] Portions of Chapters 1 and 2 of *Redesigning the Future*. New York/London: Wiley, 1974.

ogists postulated the existence of such indivisible elements of psychic energy as instincts, drives, motives and needs.

Every science sought ultimate elements. But these elements were ranked in order of complexity. Because it was believed that what we experience directly are physical things and their properties, ultimate reality was taken to be physical. Therefore, physics was considered to be the basic experiential science. Even the basic concepts used in other sciences were taken to be derivable from those used in physics. Chemistry was taken to be based on physics, biology on chemistry, psychology on biology and the social sciences on psychology. These dependencies were believed to be one-directional. Nature was believed to be organized hierarchically, as science was.

Analytical thinking is a natural complement to the doctrine of reductionism. It is the mental process by which anything to be explained, hence understood, is broken down into its parts. Explanations of the behavior and properties of wholes were extracted from explanations of the behavior and properties of their parts. The temperature of a body, for example, was explained as a function of the velocity of the particles of matter of which it was composed. An automobile's behavior was explained by identifying its parts and explaining the behavior of each and the relationship between them.

Analysis was also central to problem solving. Problems to be solved were first cut down to size; that is, reduced by analysis to a set of simpler problems. The simpler problems were then solved and their solutions were assembled into a solution of the whole. If the problem to be solved could be reduced to a set of independent subproblems, then the solution to the whole was nothing more than the sum of the solutions to its parts. For example, the problem of running a city was broken down into running transportation, housing, health, education, police and so on. It was believed that if each of these functions was managed properly, even if independently of one another, then the city as a whole could be run properly.

When the whole to be explained could not be disassembled into independent parts, the relationship between them had to be understood in order to understand the whole. Consistent with reductionism, it was believed that all interactions between objects, events and their properties could be reduced by analysis to one fundamental relationship—*cause-effect*. One thing was said to be the cause of another—its effect—if the first was both *necessary* and *sufficient* for the other. An effect could not have occurred unless its cause had, and it had to occur if its cause had. For example, if striking a bell is considered necessary and sufficient for it to make a sound, then the strike is taken to be the cause and the sound to be its effect.

Because a cause was taken to be sufficient for its effect, nothing was required to explain the effect other than the cause. Consequently, the quest for causes was *environment-free*. It employed what is now called closed-system thinking. Laws—like that of *freely* falling bodies—were formulated so as to exclude environmental effects. (The vacuum in which free falling can occur is a *nonenvironment.*) Specifically designed nonenvironments—*laboratories*—were used to exclude environmental effects on phenomena under study.

Environment-free causal laws permit no exceptions. Effects are completely determined by causes. Hence the prevailing view of the world was *deterministic*: everything that occurred in it was believed to be completely determined by something that preceded it. And since it was believed that everything and every event could be reduced to particles of matter and their motion, every phenomenon was believed to be explainable in principle by the laws that governed matter and motion. This belief applied to animate things as well as inanimate. Animate bodies were thus viewed as machines differing in no essential way from inanimate bodies. Hence the physical sciences were believed to be all that is required to explain life. Such as view was called *mechanism.*

Those who held the mechanistic view found no need for teleological concepts—functions, goals, purposes, choice and free will—in explaining natural phenomena. Such concepts were considered to be either meaningless, illusory or unnecessary in science. Philosophers were left to deal with the dilemmas their exclusion produced.

Carried to its limit, reductionistic causal thinking yielded a conception of the *universe as a machine.* It was believed to be like a hermetically sealed clock, an environment-free self-contained mechanism whose behavior was completely determined by its own structure and the causal laws that applied to it. The major question raised by this conception was: Is the universe a self-winding clock or does it require a winder—God? The prevailing belief was that God was required. The world was thus conceived as a machine created by God to serve His purposes, a machine for doing His work. Additionally, man was believed to have been created in the image of God. Hence it was quite natural for men to attempt to develop machines that would serve their purposes, that would do their work.

The Industrial Revolution

Machines, not surprisingly, were thought to be reducible to three basic mechanical elements: the wheel and axle, the lever and the inclined plane. Work was similarly analyzed and reduced to ultimately simple work elements. The process of doing so came to be known as "work study." Machines were developed to perform as many of these basic tasks as was technologically feasible. Men performed those that could not be mechanized. Men and machines were organized into processing networks the apotheosis of which is mass production and the assembly line.

Mechanization—the replacement of man by machine as a source of physical work—affected the nature of the tasks left for man to perform. Men no longer did all the things required to make a product; rather they repeatedly performed simple operations that were a small part of the production process. Consequently, the more machines were used as substitutes for men, the more men were made to behave like machines. Mechanization led to the dehumanization of man's work. This was the irony of the Industrial Revolution. It is not surprising that a society that thought of the world as a machine came to think of man as one also.

The Systems Age

Although eras do not have precise beginnings or ends, the 1940s can be said to have contained the beginning of the Systems Age. The new age is attached to an intellectual framework that is built over and around the one it replaces. The old framework has not been destroyed or discarded; it has been adapted and extended. The new age is a remodeled version of the old. What was "all" in the past has become a "part" of the present. The doctrines of reductionism and mechanism and the analytical mode of thought are being supplemented and partially replaced by the doctrines of *expansionism* and *teleology* and a new *synthetic* (or systems) mode of thought.

Expansionism is a doctrine that maintains that all objects, events and experiences of them are parts of larger wholes. It does not deny that they have parts but it focuses on the wholes of which they are part. Expansionism is another way of viewing things; a way that is different from, but compatible with, reductionism. It turns attention from ultimate elements to wholes with interrelated parts—to *systems*. Preoccupation with systems emerged during the 1940s. A few of the highlights of this process are worth noting.

In 1942 the American philosopher Suzanne Langer (1948) argued that over the preceding two decades philosophy had shifted its attention from elementary particles, events and their properties to a different kind of element—the *symbol*. A symbol is an element that produces a response to something other than itself. Its physical properties are of no essential importance. Charles W. Morris (1946/1955), another American philosopher, built on Langer's work a framework for the scientific study of symbols and the *wholes* of which they were part—*languages*. The works of Langer and Morris were accompanied by the growing importance given to semiotics, the science of signs and symbols, and to linguistics, the science of language. It was natural for many to maintain that what we know about reality is reflected in the signs with which we represent its content and in the language of which these signs are part. But some went farther and claimed that what we know of reality is conditioned by what language we use; hence the nature of reality is to be found in the analysis of language.

In 1949 Claude Shannon (Shannon and Weaver, 1949), a mathematician at Bell Laboratories, turned attention to a larger process of which language was a part—*communication*. He provided a theory that formed the basis for what came to be known as the communication sciences. Almost simultaneously another mathematician, Norbert Wiener (1948) of the Massachusetts Institute of Technology, placed communication into a still larger conceptual context—*control*. In so doing he founded *cybernetics*, the science of control through communication.

Note that this progression from symbol through language, communication and control was one from elements to larger wholes. It was expansionistic, not reductionistic. This expansion did not end with Wiener's work. One more step was taken. In the early 1950s, science went through an "aha" experience and came to realize what it had been up to in the preceding decade: it was becoming preoccupied with systems. Attention was drawn to this concept by the work of biologist Ludwig von Bertalanffy (1968) who predicted that it would become a fulcrum in modern scientific thought. He saw this concept as a wedge which could open science's reductionist and mechanistic view of the world so that it could deal more effectively with problems of living nature—with biological, behavioral and social phenomena—for which he believed application of physical science was not sufficient and, in some cases, not even possible. The concept of "system" has since played an increasingly large role in organizing both our lay and our scientific view of the world. The concept is not new but its organizing role is. Its assumption of this role is a major factor in our "change of age."

A system is a set of two or more interrelated elements of any kind; for example, concepts (as in the number system), objects (as in a telephone system or a human body) or people (as in a social system). Therefore, it is *not* an ultimate indivisible element but a whole that can be divided into parts. The elements of the set and the set of elements that form a system have the following three properties:

- The properties, or behavior, of each element of the set have an effect on the properties or behavior of the set taken as a whole. For example, every organ in an animal's body affects its overall performance.
- The properties and behavior of each element, and the way they affect the whole, depend on the properties and behavior of at least one other element in the set. Therefore, no part has an independent effect on the whole, and each is affected by at least one other part. For example, the behavior of the heart and the effect it has on the body depend on the behavior of the lungs.
- Every possible subgroup of elements in the set has the first two proper-

ties; each has a nonindependent effect on the whole. Therefore, the whole cannot be decomposed into independent subsets. A system cannot be subdivided into independent subsystems. For example, all the subsystems in an animal's body—such as the nervous, respiratory, digestive and motor subsystems—interact and each affects the performance of the whole.

Because of these three properties, a set of elements that forms a system always has some characteristics, or can display some behavior, that none of its parts or subgroups can. *A system is more than the sum of its parts.* A human being, for example, can write or run, but none of its parts can. Furthermore, membership in the system either increases or decreases the capabilities of each element; it does not leave them unaffected. For example, a brain that is not part of a living body or some substitute cannot function. An individual who is part of a nation or a corporation is thereby precluded from doing some things he could otherwise do and he is enabled to do others he could not otherwise do.

Viewed structurally, a system is a divisible whole; but viewed functionally, it is an *indivisible whole* in the sense that some of its essential properties are lost when it is taken apart. The parts of a system may themselves be systems and every system may itself be a part of a larger system. For example, a state contains cities and is part of a nation; all are systems.

In the Systems Age, we tend to look at things as part of larger wholes rather than as wholes to be taken apart. This is the doctrine of *expansionism.* Expansionism brings with it the *synthetic mode of thought,* much as reductionism brought with it the analytic mode. In analysis an explanation of the whole is derived from explanations of its parts. In synthetic thinking something to be explained is viewed as part of a larger system and is explained in terms of its role in that larger system. For example, universities are explained by their role in the educational system of which they are part rather than by the behavior of their parts—colleges and departments.

The Systems Age is more interested in putting things together than in taking them apart. Neither way of thinking negates the value of the other, but by synthetic thinking we can gain understanding of individual and collective human behavior that cannot be obtained by analysis alone.

The synthetic mode of thought, when applied to systems problems, is called the *systems approach.* In this approach, a problem is not solved by taking it apart but by viewing it as a part of a larger problem. This approach is based on the observation that when each part of a system performs as well as possible relative to the criteria applied to it, the system as a whole seldom performs as well as possible relative to the criteria applied to it. This follows from the fact that the sum of the criteria applied to performance of the parts is seldom equal to the criteria applied to that of the whole. The following illustration makes this clear.

Suppose we collect one each of every available type of automobile and then ask some expert automotive engineers to determine which of these cars has the best carburetor. When they have done so, we note the result. Then we ask them to do the same for transmissions, fuel pumps, distributors and so on through every part required to make an automobile. When this is completed we ask them to remove the parts noted and assemble them into an automobile each of the parts of which would be the best available. They would not be able to do so because the parts would not *fit together*. Even if the parts could be assembled, in all likelihood they would not *work together well.*

An all-star football team is seldom as good as the best team in the set from which the players are drawn. But, you might say, if the all-stars were to play together for a while they might become the best team. Yes, but when they do, some, if not most, of them would no longer be selected as all-stars.

System performance depends critically on how well the parts fit and work together, not merely on how well each performs when considered independently.

Furthermore, a system's performance depends on how it relates to its environment—the larger system of which it is a part—and to the other systems in that environment. For example, an automobile's performance depends on the roads over which it is driven and on the presence and driving of other automobiles on those roads. Therefore, in systems thinking, an attempt is made to evaluate performance of a system as a part of the larger system that contains it. A corporation, for example, is not evaluated by how well it performs relative to its own objectives but rather relative to the objectives of the society of which it is part.

One important consequence of this type of thinking is that science itself has come to be reconceptualized as a system whose parts—the disciplines—are interdependent. This contradicts the hierarchical notion of science in which there is only a one-directional dependence among disciplines and in which physics is taken to be independent of all other empirical disciplines. Scientific disciplines are no longer thought of as dealing with different aspects of nature, nor is nature believed to be organized in the same way science is. The disciplines are increasingly thought of as *points of view*, most of which are applicable to the study of most phenomena and problems. For example, no discipline is irrelevant in efforts to solve ecological problems. Therefore, the environmental sciences include all the sciences.

In the Systems Age, science is developing by assembling its parts into an expanding variety of increasingly comprehensive wholes. The new developments—such as cybernetics; operations research; the behavioral, communication, management and policy sciences and systems engineering—are *interdisciplinary*, not disciplinary. Even the interdisciplines are seen as parts of a still larger whole—the systems sciences—which forms a system of sciences.

In the past, a complex problem was usually decomposed into simpler problems suitable for different disciplines. Then each discipline would solve its part of the problem, and these solutions would be assembled into a solution of the whole. But contemporary interdisciplines do not work this way; a variety of disciplines work together on the problem as a whole. For example, experts in health, housing, transportation, education and other aspects of urban life work together on a city's problem taken as a whole rather than dividing it into parts suitable for each to work on separately.

Unlike traditional scientific disciplines which seek to distinguish themselves from each other and to spin off new disciplines when new areas of interest develop within them, the new interdisciplines seek to extend themselves and merge with each other, to increase the number of disciplines they incorporate and to enlarge the class of phenomena with which they are concerned. They strive for more comprehensive syntheses of knowledge and therefore thrive on interaction with each other. Systems Age scientists are not bound by loyalty to any one discipline or interdiscipline but move easily from one to another.

It will be recalled that in the Machine Age cause-effect was the central relationship in terms of which all actions and interactions were explained. At the turn of this century the distinguished American philosopher of science E.A. Singer, Jr. (1959) noted that cause-effect was used in two different senses. First, it was used in the sense already discussed: a cause is a necessary and sufficient condition for its effect. Second, it was also used when one thing was taken to be necessary but *not* sufficient for the other. To use Singer's example, an acorn is necessary but not sufficient for an oak; various soil and weather conditions are also necessary. Similarly, a parent is necessary but not sufficient for his or her child. Singer referred to this second type of cause-effect as *producer-product*. It has also been referred to since as probabilistic or nondeterministic cause-effect.

Because a producer is not sufficient for its product, other producers (co-producers) are also necessary. Taken collectively, these constitute the producer's environment. Hence, the producer-product relationship yields environment-full (open-system), not environment-free (closed-system), thinking.

Singer went on to show why studies that use the producer-product relationship were compatible with, but richer than, studies that used only deterministic cause-effect. Furthermore, he showed that a theory of explanation based on producer-product permitted objective study of functional, goal-seeking and purposeful behavior. The concepts *free will* and *choice* were no longer incompatible with mechanism; hence they need no longer be exiled from science.

Later, the Oxford University biologist Gerd Sommerhoff (1950) independently came to the same conclusions as Singer. In the meantime, Arturo Rosenblueth, Norbert Wiener and J.H. Bigelow (1943; 1950), who collaboratively laid the foundations for cybernetics, showed the great value of conceptualizing the new self-controlling machines developed during World War II as functioning, goal-seeking and purposeful entities. In effect, they showed that, whereas it had been fruitful in the past to study man as though he were a machine, it was becoming at least as fruitful to study self-controlling machines as if they were men. Thus, in the 1950s, *teleology*—the study of goal-seeking and purposeful behavior—was brought into science and began to dominate our conception of the world.

In mechanistic thinking, behavior is explained by identifying what caused it, never by its effect. In teleological thinking, behavior can be explained either by what produced it or by what it produces or is intended to produce. For example, a boy's going to the store can be explained either by his being sent there my his mother or by his wanting to buy ice cream. Study of the functions, goals and purposes of individuals and groups—not to mention some types of machine—has yielded a greater ability to evaluate and improve their performance than did the study of them as purposeless mechanisms.

The Postindustrial Revolution

The doctrines of expansionism and teleology and the synthetic mode of thought are both the producers and the products of the Postindustrial Revolution. But this revolution is also based on three technologies the first two of which were developed during the First Industrial Revolution. One of these emerged with the invention of the telegraph in the first half of the nineteenth century. It was followed by Alexander Graham Bell's telephone in 1876 and Marconi's wireless in 1895. Radio and television followed in this century. Such devices mechanized *communication*, the *transmission of symbols*. Since symbols are not made of matter, their movement through space does not constitute physical work. The significance of this fact was not appreciated until recently.

The second technology emerged with the development of devices that can *observe* and *record* the properties of objects and events. Such machines *generate* and *remember symbols* that we call *data*. The thermometer, odometer, speedometer and voltmeter are familiar examples of observing machines, instruments. In 1937 there was a major advance in the technology of mechanized observation when it "went electronic" with the invention of radar and sonar in England.

Instruments can observe what humans cannot without mechanical aids. But observation, like communication, is not physical work.

The third and key technology appeared in the 1940s with the development of the electronic digital computer. This machine can *manipulate symbols logically*. It is able to process raw data in such a way as to convert them into usable form, into *information*, and to convert information into *instruction*. Thus it is both a *data-processing* (information-producing) and a *decision-making* (instruction-producing) machine.

The technologies of symbol generation, storage, transmission and manipulation made it possible to mechanize *mental work*, to *automate*. Automation is what the Postindustrial Revolution is all about.

Development and utilization of automation technology requires an understanding of the mental processes that are involved in it. Since 1940 many interdisciplines have been developed to generate and apply understanding of these mental processes and their role in control. These interdisciplines include those previously mentioned: cybernetics; operations research; the behavioral, communication, management and policy sciences and systems engineering. Such interdisciplines provide the "software" of the Postindustrial Revolution just as industrial engineering provided much of it for the First.

Neither the hardware nor the software of the Postindustrial Revolution provides panaceas for our problems. They can be used either to create or to solve problems, and they can solve them either well or badly. The net effect of this revolution will depend on how well we use its technology and the ends for which we do so. The revolution can become retrogressive if we do not control it. It is controllable, but we may not control it or we may control it badly.

The future depends greatly on what problems we decide to work on and how well we use Systems Age technology to solve them.

The Organizing Problems of the Systems Age

Because the Systems Age is teleologically oriented it is preoccupied with systems that are purposeful; that is, with systems that can display choice of both means and ends. Most of what interest remains in purely mechanical systems derives from their use as tools by purposeful systems. Furthermore, Systems Age man is most concerned with those purposeful systems whose parts are also purposeful—with *groups*; in particular, with those groups whose parts perform different functions—*organizations*.

All groups and organizations are parts of larger purposeful systems. Hence all of them are purposeful systems whose parts are purposeful systems and which themselves are part of a larger purposeful system. All the organizations and institutions that are part of society, and society itself, are part of such three-level hierarchical systems.

Therefore, there are three central problems that arise in the management and control of purposeful systems: how to increase the effectiveness with which they serve their own purposes, the purposes of their parts and the purposes of the systems of which they are part. These are, respectively, the *self-control*, the *humanization* and the *environmentalization* problems.

The self-control problem consists of designing and managing systems so that they can cope effectively with increasingly complex and rapidly emerging sets of interacting problems in an increasingly complex and dynamic environment. The humanization problem consists of finding ways to serve the purposes of the parts of a system more effectively and to do so in such a way as to better serve the purposes of the system itself. Finally, the environmentalization problem consists of finding ways of serving the purposes of environmental systems more effectively and doing so in such a way as to better serve the purposes of the system itself.

The Self-Control Problem

When one purposeful system controls another of which it is part, the first *manages* the second. Management involves *decision making*, and decision making involves *problem solving* whenever the decision maker is in doubt about the choice to make. Therefore, problem solving has traditionally been taken to be an essential function of management. Through systems thinking, however, we have come to doubt the existence of problems and solutions to them. This doubt, and the sense in which "existence" is a part of it, requires explanation.

In the Machine Age, problems were thought of as "out there," as purely objective states of affairs. But John Dewey (1930), the great American philosopher, challenged this notion and argued that decision makers have to extract problems from the situations in which they find themselves. They do so, he said, by *analyzing* the situation. Hence problems are products of thought acting on environments; they are elements of problematic situations that are abstracted from these situations by analysis. What we experience, therefore, are problematic situations, not problems, which, like atoms and cells, are conceptual constructs.

We have also come to realize that no problem ever exists in complete isolation. Every problem interacts with other problems and is therefore part of a set of interrelated problems, a *system of problems*. For example, the race problem, the poverty problem, the urban problem and the crime problem, to mention but a few, are clearly interrelated. Furthermore, solutions to most problems produce other problems; for example, buying a car may solve a transportation problem but it may also create a need for a garage, a financial problem, a maintenance problem and conflict among family members for its use.

English does not contain a suitable word for "system of problems." Therefore, I have had to coin one. I choose to call such a system a *mess*. This concept is as central to this paper as is that of a "system." This paper is about messes. This section is about "mess management."

A mess is a system of external conditions that produces dissatisfaction. It can be conceptualized as a system of problems in the same sense in which a physical body can be conceptualized as a system of atoms. Therefore, problems that can be decomposed to simpler problems are really messes. Ultimately simple problems, like any ultimate elements, are abstract subjective concepts. Such elements cannot be observed because we cannot conceive of anything that can be observed but not taken apart. For example, we cannot see geometric points; they are abstractions. What we see and call points are small areas. Therefore, even what appears to us as a simple problem is really a "minimess."

In the Machine Age, messy problematic situations were approached analytically. They were broken down into simpler discrete problems that were often believed to be capable of being solved independently of one another. We are learning that such a procedure not only usually fails to solve the individual problems that are involved, but often intensifies the mess. The solution to a mess can seldom be obtained by independently solving each of the problems of which it is composed. This appears to be the case, for example, in our current handling of the urban mess. Efforts to deal separately with such aspects of urban life as transportation, health, crime and education seem to aggravate the total situation.

The attempt to deal holistically with a system of problems is what *planning*, in contrast to problem solving, should be all about. In the Machine Age, a great deal of effort went into the development of effective methods of problem solving but little thought was given to planning. In the Systems Age, more attention is being given to development of effective methods of planning.

Planning

For many years social and organizational planning was ignored and held in disrepute in the United States and other Western nations because of its association with communism. The communists believe in strongly centralized planning. Hence it was incorrectly assumed by many Americans that planning necessarily implies a strong central government or management. It was only after noncommunist France successfully planned its recovery from World War II, and did so without either centralized planning or concentration of power at the top, that we began to understand that planning can serve any political or organizational philosophy, just as problem solving can. It can increase the effectiveness of either a decentralized democracy or a centralized autocracy.

There are many managers and administrators who still do not believe in planning. Attitudes toward it vary a great deal but they can be grouped into four general types: *inactive, reactive, preactive* and *interactive*. These attitudes are mixed in varying proportions in each individual and organization and the mixture may change from time to time or from situation to situation. Furthermore, a wide variety of attitudes toward planning may be found in any one organization at any one time. Nevertheless, one of these attitudes usually dominates the others in both individuals and organizations. In a sense, these four attitudes are like primary colors; they can be mixed in many different ways to provide a wide range of secondary attitudes and these change under different "lighting" conditions. Despite the variety of mixtures in which they are found, the pure forms are easily recognizable.

After I have described the "pure" attitudes in what is obviously a biased way, I nevertheless argue that under different conditions each may be best. Therefore, as will be apparent, my bias derives from what I believe our current condition to be.

Inactivism

Inactivists are satisfied with the way things are and they way they are going. Hence they believe that any intervention in the course of events is unlikely to improve them and is very likely to make them worse. Inactivists take a do-nothing posture; they try to "ride with the tide" without "rocking the boat." Their management philosophy is conservative. They seek stability and survival. They are willing to let well-enough alone and hence are what have come to be known as "satisficers."

Inactivists believe that most apparent social and environmental changes are either illusory, superficial or temporary. They typically see those who cry "Crisis!" as panic mongers and prophets of doom. Inactivists recall the pervasiveness of such cries and crises throughout their society's or organization's history and point to the pervasiveness of the dooms foreseen. Because their society or organization has survived all of their previous crises, inactivists argue, there is no reason to believe they will not continue to do so.

Inactive organizations require a great deal of activity to keep changes from being made. They accomplish nothing in a variety of ways. First, they require that all important decisions be made "at the top." The route to the top is deliberately designed like an obstacle course. This keeps most recommendations for change from ever getting there. Those that do are likely to have been delayed enough to make them irrelevant when they reach their destination. Those proposals that reach the top are likely to be farther delayed, often by being sent back down or out for modification or evaluation. The organization thus behaves like a sponge and is about as active.

Inactivists take a position on an issue only when forced to. "Forced to" means that doing so is the only way left to keep changes from being made. Wherever possible, words are used in place of action. Inactivists are prolific producers of policy statements, white papers, strategy documents, position papers, reports, memoranda and any other kind of document that can substitute for action.

Another prevalent means by which inactivity is achieved consists of setting up committees, councils, commissions, study groups, task forces and what-have-you at the drop of an issue. The responsibilities of such groups are deliberately left vague so that they can spend most of their time in defining their functions and in jurisdictional disputes. When one of them manages to generate a recommendation, those who were not represented in the group can object to their lack of representation and have another group formed to take them into account. This process can go on indefinitely, particularly if augmented by occasional personnel changes.

On those rare occasions when an inactive organization takes action it is almost certain to be understaffed and underfinanced. This minimizes any possible impact it might have.

Feasibility is the principal criterion used by inactivists in selecting means. Ends are more likely to be fitted to means than conversely. As A.O. Hirschman and C.E. Lindblom (1969)—perhaps the best-known spokesmen for this position—suggest in their proposed strategies for decision making, "Instead of simply adjusting means to ends, ends are chosen that are appropriate to available or nearly available means." Inactivists tend to want what they can get rather than try to get what they want.

When inactivists intervene in the course of events they do so as little as possible. In the words of Hirschman and Lindblom, "Attempts at understanding are limited to policies that differ only incrementally from existing policy." Little wonder they call their overall strategy "disjointed incrementalism."

Inactivists have a greater fear of doing something that does not have to be done (errors of commission) than of not doing something that should be done (errors of omission). Hence they tend to react only to serious threats, not opportunities. By so doing they practice what has come to be known as "crisis management."

In general, the only organizations that can survive inactive management are those that are protected from their environments by subsidies that ensure their survival independently of what they accomplish. The most conspicuous examples of such organizations in our society are universities, government agencies and publicly protected private monopolies such as utility companies.

Needless to say, inactivists do not believe in planning. They do not even believe in problem solving.

Reactivism

Reactivists prefer a previous state to the one they are in and they believe things are going from bad to worse. Hence they not only resist change but they try to unmake previous changes and return to where they once were. They are generally nostalgic about "the good old days." Their propensity to return to the past makes their management philosophy reactionary.

Reactivists are moved more by their hates than by their loves. Their orientation is remedial, not aspirational. They try to avoid the undesirable rather than attain the desirable. They see very little new in anything proposed and still less that is worthwhile in what they accept as new. Their reaction to most proposed changes is, "We tried it and it doesn't work." For example, a railroad executive once told me, after I had proposed using linear programming to solve a problem, that he had tried it on the problem about 10 years ago and it had not worked. At the time linear programming was considerably less than 10 years old.

Because technological change is so conspicuous and because the past has always had less technology than the present, technology is the reactivists' principal scapegoat for whatever ills they perceive. They prefer art to science: the art of muddling through to the science of management. In dealing with problems, they rely on common sense, intuition and judgment based on long experience. The longer the experience, the better. They believe experience is the best teacher and the best school is the school of hard knocks. For this reason, they place high value on seniority, immobility and age and allocate status and responsibility proportionately thereto.

Reactivists dislike complexity and try to avoid dealing with it. They reduce complex messes to simple problems that have simple solutions—solutions that are "tried and true." They are panacea-prone problem solvers, not planners. They try to recreate the past by undoing the mess they believe the planning of others has wrought.

Unlike inactivists, reactivists do not ride with the tide; they try to swim back to a familiar shore. It is not surprising, therefore, that once successful but now declining institutions and organizations are particularly susceptible to this point of view.

Preactivism

Preactivists are not willing to settle for things as they are or once were. They believe that the future will be better than the present or the past, how much better depending on how well they get ready for it. Thus they attempt to *predict* and *prepare*. They want more than survival; they want to grow—to become better, larger, more affluent, more powerful, more many things. They want to do better than well enough; they want to do as well as possible, to *optimize*.

Preactivists are not only concerned about doing something wrong (errors of commission) but also about *not* doing something right (errors of omission). Consequently, they are as occupied with potential opportunities as they are with actual and potential threats. They attempt to identify and deal with problems before they become serious and, if possible, before they arise. For this reason they are preoccupied with forecasts, projections and every other way of obtaining glimpses of the future. They believe the future is essentially uncontrollable but that they can accelerate its coming and control its effects on them. Therefore, they plan *for* the future itself.

Preactive planning and problem solving is based more on logic, science and experimentation than on common sense, intuition and judgment. Unlike reactivists, preactivists tend to credit science and technology for most of the progress we have enjoyed and to blame current problems and crises on their misuse or abuse. They seek to solve problems and exploit opportunities more through research and development than by individual and institutional change. They are hardware, rather than software, oriented; thing, rather than people, oriented. When they must deal with people, they prefer to deal with them collectively, impersonally, rather than individually because they believe collective behavior is more predictable.

Preactive decision makers and planners tend to think of the system to be managed in terms of the resources over which it has direct control. They are preoccupied with allocation and use of these resources within the system. They do not try to influence other systems in the environment; they tend to perceive the environment as constraining rather than as enabling. Hence they are competitive rather than cooperative when other systems are involved.

If the management philosophy of the reactivist is reactionary, of the inactivist, conservative, then the preactivist's is liberal. Preactivists seek change *within* the system, but not change *of* the system or its environment. They are reformers, not revolutionaries. They seek neither to ride with the tide nor to buck it, but to ride in front of it and get to where it is going before it does. In this way, they believe, they can take advantage of new opportunities before others get to them.

Preactive planners take their function to consist of producing plans and presenting them to those empowered to act, but not involvement in implementing approved plans. Preactivists see planning as a sequence of discrete steps which terminate with acceptance or rejection of their plans. What happens to their plans is the responsibility of others.

Interactivism

Interactivists are not willing to settle for the current state of their affairs or the way they are going, and they are not willing to return to the past. They want to design a desirable future and invent ways of bringing it about. They believe we are capable of controlling a significant part of the future as well as its effects on us. They try to *prevent*, not merely to prepare for, threats and to *create*, not merely exploit, opportunities.

Preactivists, according to interactivists, spend too much time trying to forecast the future. The future, they argue, depends more on what we do between now and then than it does on what has happened up until now. The major obstacle between man and the future he desires is man himself.

Interactivists are not willing to settle for survival or growth. They seek self-development, self-realization and self-control: an increased ability to design and control their own destinies. They are neither satisficers nor optimizers; they are *idealizers*. They plan to do better in the future than the best that presently appears to be possible. They pursue ideals that they know can never be attained but that can be continuously approached. Thus, to them, the formulation of ideals and the design of idealized futures are not empty exercises in utopianism, but necessary steps in setting long-range directions for continuous development.

They treat ideals as relative absolutes: ultimate objectives whose formulation depends on our current knowledge and understanding of ourselves and our environment. Therefore, they require continuous reformulation in light of what we learn from approaching them.

Because of the accelerating rates of technological and social change, interactivists try to design the systems they control so as to increase their ability to learn and adapt rapidly. They maintain that experience is no longer the best teacher; it is too slow, too ambiguous and too imprecise. Therefore, they attempt to replace experience by experimentation wherever possible. They try to design the implementation of every decision as an experiment that tests its effectiveness and that of the process by which it was reached.

No aspect of a system is precluded from change. Interactivists are willing to modify a system's structure, functioning, organization and personnel as well as its allocation and use of resources. Unlike preactivists, interactivists try to induce cooperative changes in environing systems, changes that are as fundamental as those they seek for the systems they can control directly. They consider the world, not merely their neighborhood, to be their arena.

Interactivists consider technology to be neither good nor bad in itself but to have a potential for either. Its effects, they believe, depend on how people use it. Thus, they view behavior and technology as interrelated aspects of *socio-technical systems*. They treat science and the humanities as two aspects of one culture, not as two cultures. Like the head and tail of a coin these aspects can be discussed or viewed separately, but they cannot be separated.

According to interactivists, science is the search for similarities among things that are apparently different, and the humanities are the search for differences among things that are apparently similar. Scientists seek the general and humanists seek the unique. To deal effectively with a problematic situation one must be able to determine both what it has in common with previously experienced situations and how it differs from them. Awareness of similarities enables us to use what we already know; awareness of differences enables us to determine what must still be learned if the situation is to be dealt with effectively. The humanities furnish us with the problems, science and technology with means for solving them.

Interactivists are radicals; they try to change the foundations as well as the superstructure of society and its institutions and organizations. They desire neither to resist, ride with nor ride ahead of the tide; they try to redirect it.

Despite my obvious bias in my characterization of these four postures, there are circumstances in which each is most appropriate. Put simply, if the internal and external dynamics of a system (the tide) are taking one where one wants to go and are doing so quickly enough, inactivism is appropriate. If the direction of change is right but the movement is too slow, preactivism is appropriate. If the change is taking one where one does not want to go and one prefers to stay where one is or was, reactivism is appropriate. However, if one is not willing to settle for the past, the present or the future that appears likely now, interactivism is appropriate. My bias for interactivism derives from my belief that our society can be much improved and that it is not tending to improvement. Our intervention is therefore required.

Inactivists and reactivists at best treat planning as a ritual or prayer that may bring the intervention of a superior force in the course of events. They do not view it as a process which directs one's own intervention. Preactive planners try to accelerate the future and control its effects on the system they plan for, but they do not try to redirect it. Interactive planners do. Preactive planning deals with products rather than producers. For example, a preactive urban transportation planner tends to assume continued growth of demand for automotive transportation and no significant change in the nature of the automobile. These, he assumes, are out of his control. Therefore, he tries to reduce projected future congestion by increasing the number and size of streets and roads and by expanding other modes of travel. The interactive planner, on the other hand, considers such things as changing the automobile and the city so that the demand for transportation and roadways is modified. He attempts to manipulate the producers of problems as well as their effects.

The short-to-medium range future receives the attention of the preactivist. The interactivist gives more attention to the long-range because he believes that short-run gains are frequently paid for by larger long-run losses. Therefore, he believes it is essential to seek a proper balance between long- and short-run consequences of current behavior. The ability to perceive and be governed by long-run consequences is the essence of wisdom. Knowledge may be enough for effective problem solving but it is not enough for effective planning. Planning also requires wisdom and wisdom is as much a product of the humanities as it is of science.

Interactivists have extracted four principles of planning practice from their experience:

- *Participative planning.* The principal benefits of planning are not derived from consuming its product (plans), but from engaging in their production. In planning, process is the most important product. Hence, effective planning cannot be dône *to* or *for* an organization; it must be done *by* it. The proper role of the professional planner is not to plan for others but to facilitate their planning for themselves; that is, to provide everyone who can be affected by planning with an opportunity to participate in it and to provide them with the information, instruction and motivation that will enable them to carry it out effectively.
- *Coordinated planning.* All aspects of a system should be planned for simultaneously and interdependently. No part or aspect of an organization can be planned for effectively if planned for independently of any other part or aspect. For example, planning to reduce crime should involve all aspects of the criminal justice system and more: education, housing, employment, health services, welfare and so on. All societal functions should be dealt with. In planning, breadth is more important than depth and interactions are more important than actions.
- *Integrated planning.* In multilevel organizations like governments or corporations, planning is required at every level and planning at each level should be integrated with planning at every other level. In organizations whose objectives dominate those of their members, such as corporations, strategic planning (selection of ends) tends to flow from the top down and tactical planning (selection of means) tends to flow from the bottom up. This flow is usually reversed in a system whose primary function is to serve its members. Strategy and tactics are two aspects of behavior. Strategy is concerned with long-range objectives and ways of pursuing them that affect the system as a whole; tactics are concerned with shorter-run goals and means for reaching them that generally affect only a part of the organization. Although they cannot be separated in principle, they often are in practice. This means that one or the other type of planning is not carried out consciously and, hence, is not made explicit. Both types should be used interdependently, consciously and explicitly.
- *Continuous planning.* Because purposeful systems and their environments are changing continuously, no plan retains its value over time. Therefore, plans should be updated, extended and corrected frequently, if not continuously. Continuous planning is necessary if a system is to learn and adapt effectively. A plan's actual performance should be compared frequently with explicitly stated expectations. Where they deviate from each other significantly, the producers of the deviation should be identified and appropriate corrective action taken.

Interactive planning is a system of activities; hence its five phases are interdependent. They are as follows:

- *Ends planning*: determining what is wanted; the design of a desired future. This requires specifying goals, objectives and ideals; short-run, intermediate and ultimate ends.
- *Means planning*: determining how to get there. This requires selecting or inventing courses of action, practices, programs and policies.
- *Resource planning*: determining what types of resources—for example, people, machines, materials and money—and how much of each will be required, how they are to be acquired or generated and how they are to be allocated to activities once they are available.
- *Organizational planning*: determining organizational requirements and designing organizational arrangements and the management system that will make it possible to follow the prescribed means effectively.
- *Implementation and control planning*: determining how to implement decisions and control them; maintaining and improving the plan under changing internal and external conditions.

The interactive planner initiates ends planning by designing an *idealized future* for the system being planned for. This is a design of the future that begins "from scratch." All constraints other than technological feasibility are removed. One would not assume, for example, direct transfer of the content of one mind to another without communication of symbols. Such a constraint does not preclude consideration of technological innovations but these are restricted to what is believed to be possible. On the other hand, all financial and political constraints are removed. Therefore, the design is an explicit formulation of the planners' conception of the system they would create if they were free to create any system they wanted.

Most system planning is retrospective: preoccupied with identifying and removing deficiencies in the past performance of system components. Retrospective planning moves *from* what one does not want rather then *toward* what one wants. It is like driving a train from its caboose. One who walks into the future facing the past has no control over where he is going. Idealization rotates planners from a retrospective to a prospective posture.

The process of designing an idealized future for a public or private system usually brings about the following five important results.

First, it facilitates the direct involvement of a large number of those who participate or hold a stake in the relevant system. No special skills are required and the process is fun. Playing God always is. People with no previous planning experience quickly become deeply involved. It enables them to criticize the existing system in a completely constructive way.

Second, in this context agreement tends to emerge from apparently antagonistic participants and stakeholders. Most disagreements arise with respect to means, not ends. Idealization is concerned with ends, not means. Awareness of consensus relative to ends usually brings about subsequent cooperation relative to means among those who would not otherwise be so inclined.

Third, the idealization process forces those engaged in it to formulate explicitly their conception of organizational objectives. This opens their conception to examination by others and thus facilitates progressive reformulation of the objectives and development of consensus.

Fourth, the idealization leads those engaged in it to become conscious of self-imposed constraints and hence makes it easier to remove them. It also forces reexamination of externally imposed constraints that are usually accepted passively. Ways of removing or "getting around" them are then explored, often with success.

Finally, idealization reveals that system designs and plans, all of whose elements appear to be unfeasible when considered separately, are either feasible or nearly so when considered as a whole. Therefore, it leads to subsequent design and planning that is not preoccupied with doing what appears to be possible but with making possible what initially appears to be impossible.

For example, in the recently completed idealized design of Paris carried out under the supervision of my colleague, Professor Hasan Ozbekhan, representatives of each of the many political parties in France participated and came to agreement. The design they approved has been submitted to the French public in which it is being widely discussed at the time of this writing. The cabinet of France and the representative body of stakeholders who served as reviewers agreed on the desirability of making Paris a global rather than a French city, an informal capital of the world. Having agreed on this end, they subsequently accepted means that they would have rejected summarily had they been proposed separately or out of this context. For example, they agreed to move the capital of France from Paris and to make Paris an open and multilingual city.

Once an idealized design has been prepared on which consensus has been obtained it is possible to begin planning the approach to that ideal. The output of such planning should be treated as tentative, subject to continuous revision in light of experience with it. The system for making such revisions—the planning-control system—must itself be planned. The concept of continuous control has only recently come into prominence.

Control

In the Machine Age, the world was viewed as a closed system to be understood through analysis. Therefore, ultimate and final solutions to problems were believed to be obtainable. It was an era which John Dewey characterized by its "quest for certainty." In the Systems Age, systems are conceptualized as open and dynamic. Therefore, problems and solutions are conceptualized as snapshots of a moving process. Problems and solutions are in constant flux; hence *problems do not stay solved.* Purposeful systems and their environments are constantly changing. Solutions to problems become obsolete even if the problems to which they are addressed do not. For example, insects develop immunity to pesticides, people to desegregation programs and societies to such laws as those which prohibit the use of alcohol or narcotics.

For these reasons, purposeful systems not only need to deal with problem-systems but they also need to maintain and improve solution-systems—plans—under changing conditions. Hence problem solving and planning have come to be conceptualized as continuous processes directed at approachable but unattainable ideals. Absolute truth and perfect efficiency are never obtained but we can always move closer to them.

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