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MANAGEMENT MISINFORMATION SYSTEMS*

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Five assumptions commonly made by designers of management information systems are identified. It is argued that these are not justified in many (if not most) cases and hence lead to major deficiencies in the resulting systems. These assumptions are: (1) the critical deficiency under which most managers operate is the lack of relevant information, (2) the manager needs the information he wants, (3) if a manager has the information he needs his decision making will improve, (4) better communication between managers improves organizational performance, and (5) a manager does not have to understand how his information system works, only how to use it. To overcome these assumptions and the deficiencies which result from them, a management information system should be imbedded in a management control system. A procedure for designing such a system is proposed and an example is given of the type of control system which it produces.

The growing preoccupation of operations researchers and management scientists with Management Information Systems (MIS's) is apparent. In fact, for some the design of such systems has almost become synonymous with operations research or management science. Enthusiasm for such systems is understandable: it involves the researcher in a romantic relationship with the most glamorous instrument of our time, the computer. Such enthusiasm is understandable but, nevertheless, some of the excesses to which it has led are not excusable.

Contrary to the impression produced by the growing literature, few computerized management information systems have been put into operation. Of those I've seen that have been implemented, most have not matched expectations and some have been outright failures. I believe that these near- and far-misses could have been avoided if certain false (and usually implicit) assumptions on which many such systems have been erected had not been made.

There seem to be five common and erroneous assumptions underlying the design of most MIS's, each of which I will consider. After doing so I will outline an MIS design procedure which avoids these assumptions.

Give Them More

Most MIS's are designed on the assumption that the critical deficiency under which most managers operate is the *lack of relevant information*. I do not deny that most managers lack a good deal of information that they should have, but I do deny that this is the most important informational deficiency from which they suffer. It seems to me that they suffer more from an *over abundance of irrelevant information*.

* Received June 1967.

This is not a play on words. The consequences of changing the emphasis of an MIS from supplying relevant information to eliminating irrelevant information is considerable. If one is preoccupied with supplying relevant information, attention is almost exclusively given to the generation, storage, and retrieval of information: hence emphasis is placed on constructing data banks, coding, indexing, updating files, access languages, and so on. The ideal which has emerged from this orientation is an infinite pool of data into which a manager can reach to pull out any information he wants. If, on the other hand, one sees the manager's information problem primarily, but not exclusively, as one that arises out of an overabundance of irrelevant information, most of which was not asked for, then the two most important functions of an information system become *filtration* (or evaluation) and *condensation*. The literature on MIS's seldom refers to these functions let alone considers how to carry them out.

My experience indicates that most managers receive much more data (if not information) than they can possibly absorb even if they spend all of their time trying to do so. Hence they already suffer from an information overload. They must spend a great deal of time separating the relevant from the irrelevant and searching for the kernels in the relevant documents. For example, I have found that I receive an average of forty-three hours of unsolicited reading material each week. The solicited material is usually half again this amount.

I have seen a daily stock status report that consists of approximately six hundred pages of computer print-out. The report is circulated daily across managers' desks. I've also seen requests for major capital expenditures that come in book size, several of which are distributed to managers each week. It is not uncommon for many managers to receive an average of one journal a day or more. One could go on and on.

Unless the information overload to which managers are subjected is reduced, any additional information made available by an MIS cannot be expected to be used effectively.

Even relevant documents have too much redundancy. Most documents can be considerably condensed without loss of content. My point here is best made, perhaps, by describing briefly an experiment that a few of my colleagues and I conducted on the OR literature several years ago. By using a panel of well-known experts we identified four OR articles that all members of the panel considered to be "above average," and four articles that were considered to be "below average." The authors of the eight articles were asked to prepare "objective" examinations (duration thirty minutes) plus answers for graduate students who were to be assigned the articles for reading. (The authors were not informed about the experiment.) Then several experienced writers were asked to reduce each article to $\frac{2}{3}$ and $\frac{1}{3}$ of its original length only by eliminating words. They also prepared a brief abstract of each article. Those who did the condensing did not see the examinations to be given to the students.

A group of graduate students who had not previously read the articles were then selected. Each one was given four articles randomly selected, each of which

was in one of its four versions: 100 %, 67 %, 33 %, or abstract. Each version of each article was read by two students. All were given the same examinations. The average scores on the examinations were then compared.

For the above-average articles there was no significant difference between average test scores for the 100 %, 67 %, and 33 % versions, but there was a significant decrease in average test scores for those who had read only the abstract. For the below-average articles there was no difference in average test scores among those who had read the 100 %, 67 %, and 33 % versions, but there was a significant *increase* in average test scores of those who had read only the abstract.

The sample used was obviously too small for general conclusions but the results strongly indicate the extent to which even good writing can be condensed without loss of information. I refrain from drawing the obvious conclusion about bad writing.

It seems clear that condensation as well as filtration, performed mechanically or otherwise, should be an essential part of an MIS, and that such a system should be capable of handling much, if not all, of the unsolicited as well as solicited information that a manager receives.

The Manager Needs the Information That He Wants

Most MIS designers "determine" what information is needed by asking managers what information they would like to have. This is based on the assumption that managers know what information they need and want it.

For a manager to know what information he needs he must be aware of each type of decision he should make (as well as does) and he must have an adequate model of each. These conditions are seldom satisfied. Most managers have some conception of at least some of the types of decisions they must make. Their conceptions, however, are likely to be deficient in a very critical way, a way that follows from an important principle of scientific economy: the less we understand a phenomenon, the more variables we require to explain it. Hence, the manager who does not understand the phenomenon he controls plays it "safe" and, with respect to information, wants "everything." The MIS designer, who has even less understanding of the relevant phenomenon than the manager, tries to provide even more than everything. He thereby increases what is already an overload of irrelevant information.

For example, market researchers in a major oil company once asked their marketing managers what variables they thought were relevant in estimating the sales volume of future service stations. Almost seventy variables were identified. The market researchers then added about half again this many variables and performed a large multiple linear regression analysis of sales of existing stations against these variables and found about thirty-five to be statistically significant. A forecasting equation was based on this analysis. An OR team subsequently constructed a model based on only one of these variables, traffic flow, which predicted sales better than the thirty-five variable regression equation. The team went on to *explain* sales at service stations in terms of the

customers' perception of the amount of time lost by stoppong for service. The relevance of all but a few of the variables used by the market researchers could be explained by their effect on such perception.

The moral is simple: one cannot specify what information is required for decision making until an explanatory model of the decision process and the system involved has been constructed and tested. Information systems are subsystems of control systems. They cannot be designed adequately without taking control in account. Furthermore, whatever else regression analyses can yield, they cannot yield understanding and explanation of phenomena. They describe and, at best, predict.

Give a Manager the Information He Needs and His Decision Making Will Improve

It is frequently assumed that if a manager is provided with the information he needs, he will then have no problem in using it effectively. The history of OR stands to the contrary. For example, give most managers an initial tableau of a typical "real" mathematical programming, sequencing, or network problem and see how close they come to an optimal solution. If their experience and judgment have any value they may not do badly, but they will seldom do very well. In most management problems there are too many possibilities to expect experience, judgement, or intuition to provide good guesses, even with perfect information.

Furthermore, when several probabilities are involved in a problem the unguided mind of even a manager has difficulty in aggregating them in a valid way. We all know many simple problems in probability in which untutored intuition usually does very badly (e.g., What are the correct odds that 2 of 25 people selected at random will have their birthdays on the same day of the year?). For example, very few of the results obtained by queuing theory, when arrivals and service are probabilistic, are obvious to managers; nor are the results of risk analysis where the managers' own subjective estimates of probabilities are used.

The moral: it is necessary to determine how well managers can use needed information. When, because of the complexity of the decision process, they can't use it well, they should be provided with either decision rules or performance feed-back so that they can identify and learn from their mistakes. More on this point later.

More Communication Means Better Performance

One characteristic of most MIS's which I have seen is that they provide managers with better current information about what other managers and their departments and divisions are doing. Underlying this provision is the belief that better interdepartmental communication enables managers to coordinate their decisions more effectively and hence improves the organization's overall performance. Not only is this not necessarily so, but it seldom is so. One would hardly expect two competing companies to become more cooperative because

the information each acquires about the other is improved. This analogy is not as far fetched as one might first suppose. For example, consider the following very much simplified version of a situation I once ran into. The simplification of the case does not affect any of its essential characteristics.

A department store has two "line" operations: buying and selling. Each function is performed by a separate department. The Purchasing Department primarily controls one variable: how much of each item is bought. The Merchandising Department controls the price at which it is sold. Typically, the measure of performance applied to the Purchasing Department was the turnover rate of inventory. The measure applied to the Merchandising Department was gross sales; this department sought to maximize the number of items sold times their price.

Now by examining a single item let us consider what happens in this system. The merchandising manager, using his knowledge of competition and consumption, set a price which he judged would maximize gross sales. In doing so he utilized price-demand curves for each type of item. For each price the curves show the expected sales and values on an upper and lower confidence band as well. (See Figure 1.) When instructing the Purchasing Department how many items to make available, the merchandising manager quite naturally used the value on the upper confidence curve. This minimized the chances of his running short which, if it occurred, would hurt his performance. It also maximized the chances of being over-stocked but this was not his concern, only the purchasing manager's. Say, therefore, that the merchandising manager initially selected price P_1 and requested that amount Q_1 be made available by the Purchasing Department.

In this company the purchasing manager also had access to the price-demand curves. He knew the merchandising manager always ordered optimistically.

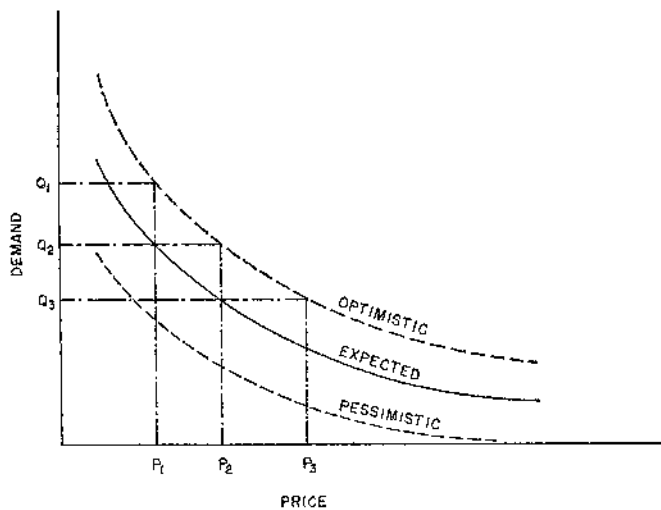


FIGURE 1. Price-demand curve

Therefore, using the same curve he read over from Q_1 to the upper limit and down to the expected value from which he obtained Q_2 , the quantity he actually intended to make available. He did not intend to pay for the merchandising manager's optimism. If merchandising ran out of stock, it was not his worry. Now the merchandising manager was informed about what the purchasing manager had done so he adjusted his price to P_2 . The purchasing manager in turn was told that the merchandising manager had made this readjustment so he planned to make only Q_2 available. If this process—made possible only by perfect communication between departments—had been allowed to continue, nothing would have been bought and nothing would have been sold. This outcome was avoided by prohibiting communication between the two departments and forcing each to guess what the other was doing.

I have obviously caricatured the situation in order to make the point clear: when organizational units have inappropriate measures of performance which put them in conflict with each other, as is often the case, communication between them may hurt organizational performance, not help it. Organizational structure and performance measurement must be taken into account before opening the flood gates and permitting the free flow of information between parts of the organization. (A more rigorous discussion of organizational structure and the relationship of communication to it can be found in [1].)

A Manager Does Not Have to Understand How an Information System Works, Only How to Use It

Most MIS designers seek to make their systems as innocuous and unobtrusive as possible to managers lest they become frightened. The designers try to provide managers with very easy access to the system and assure them that they need to know nothing more about it. The designers usually succeed in keeping managers ignorant in this regard. This leaves managers unable to evaluate the MIS as a whole. It often makes them afraid to even try to do so lest they display their ignorance publicly. In failing to evaluate their MIS, managers delegate much of the control of the organization to the system's designers and operators who may have many virtues, but managerial competence is seldom among them.

Let me cite a case in point. A Chairman of a Board of a medium-size company asked for help on the following problem. One of his larger (decentralized) divisions had installed a computerized production-inventory control and manufacturing-manager information system about a year earlier. It had acquired about \$2,000,000 worth of equipment to do so. The Board Chairman had just received a request from the Division for permission to replace the original equipment with newly announced equipment which would cost several times the original amount. An extensive "justification" for so doing was provided with the request. The Chairman wanted to know whether the request was really justified. He admitted to complete incompetence in this connection.

A meeting was arranged at the Division at which I was subjected to an extended and detailed briefing. The system was large but relatively simple. At the heart of it was a reorder point for each item and a maximum allowable

stock level. Reorder quantities took lead-time as well as the allowable maximum into account. The computer kept track of stock, ordered items when required and generated numerous reports on both the state of the system it controlled and its own "actions."

When the briefing was over I was asked if I had any questions. I did. First I asked if, when the system had been installed, there had been many parts whose stock level exceeded the maximum amount possible under the new system. I was told there were many. I asked for a list of about thirty and for some graph paper. Both were provided. With the help of the system designer and volumes of old daily reports I began to plot the stock level of the first listed item over time. When this item reached the maximum "allowable" stock level it had been reordered. The system designer was surprised and said that by sheer "luck" I had found one of the few errors made by the system. Continued plotting showed that because of repeated premature reordering the item had never gone much below the maximum stock level. Clearly the program was confusing the maximum allowable stock level and the reorder point. This turned out to be the case in more than half of the items on the list.

Next I asked if they had many paired parts, ones that were only used with each other; for example, matched nuts and bolts. They had many. A list was produced and we began checking the previous day's withdrawals. For more than half of the pairs the differences in the numbers recorded as withdrawn were very large. No explanation was provided.

Before the day was out it was possible to show by some quick and dirty calculations that the new computerized system was costing the company almost \$150,000 per month more than the hand system which it had replaced, most of this in excess inventories.

The recommendation was that the system be redesigned as quickly as possible and that the new equipment not be authorized for the time being.

The questions asked of the system had been obvious and simple ones. Managers should have been able to ask them but—and this is the point—they felt themselves incompetent to do so. They would not have allowed a handoperated system to get so far out of their control.

No MIS should ever be installed unless the managers for whom it is intended are trained to evaluate and hence control it rather than be controlled by it.

A Suggested Procedure for Designing an MIS

The erroneous assumptions I have tried to reveal in the preceding discussion can, I believe, be avoided by an appropriate design procedure. One is briefly outlined here.

1. Analysis Of The Decision System

Each (or at least each important) type of managerial decision required by the organization under study should be identified and the relationships between them should be determined and flow-charted. Note that this is *not* necessarily the same thing as determining what decisions *are* made. For example, in one com-

pany I found that make-or-buy decisions concerning parts were made only at the time when a part was introduced into stock and was never subsequently reviewed. For some items this decision had gone unreviewed for as many as twenty years. Obviously, such decisions should be made more often; in some cases, every time an order is placed in order to take account of current shop loading, underused shifts, delivery times from suppliers, and so on.

Decision-flow analyses are usually self-justifying. They often reveal important decisions that are being made by default (e.g., the make-buy decision referred to above), and they disclose interdependent decisions that are being made independently. Decision-flow charts frequently suggest changes in managerial responsibility, organizational structure, and measure of performance which can correct the types of deficiencies cited.

Decision analyses can be conducted with varying degrees of detail, that is, they may be anywhere from coarse to fine grained. How much detail one should become involved with depends on the amount of time and resources that are available for the analysis. Although practical considerations frequently restrict initial analyses to a particular organizational function, it is preferable to perform a coarse analysis of all of an organization's managerial functions rather than a fine analysis of one or a subset of functions. It is easier to introduce finer information into an integrated information system than it is to combine fine subsystems into one integrated system.

2. An Analysis Of Information Requirements

Managerial decisions can be classified into three types:

(a) Decisions for which adequate models are available or can be constructed and from which optimal (or near optimal) solutions can be derived. In such cases the decision process itself should be incorporated into the information system thereby converting it (at least partially) to a control system. A decision model identifies what information is required and hence what information is relevant.

(b) Decisions for which adequate models can be constructed but from which optimal solutions cannot be extracted. Here some kind of heuristic or search procedure should be provided even if it consists of no more than computerized trial and error. A simulation of the model will, as a minimum, permit comparison of proposed alternative solutions. Here too the model specifies what information is required.

(c) Decisions for which adequate models cannot be constructed. Research is required here to determine what information is relevant. If decision making cannot be delayed for the completion of such research or the decision's effect is not large enough to justify the cost of research, then judgment must be used to "guess" what information is relevant. It may be possible to make explicit the implicit model used by the decision maker and treat it as a model of type (b).

In each of these three types of situation it is necessary to provide feedback by comparing actual decision outcomes with those predicted by the model or decision maker. Each decision that is made, along with its predicted outcome,

should be an essential input to a management control system. I shall return to this point below.

3. Aggregation Of Decisions

Decisions with the same or largely overlapping informational requirements should be grouped together as a single manager's task. This will reduce the information a manager requires to do his job and is likely to increase his understanding of it. This may require a reorganization of the system. Even if such a reorganization cannot be implemented completely what can be done is likely to improve performance significantly and reduce the information loaded on managers.

4. Design Of Information Processing

Now the procedure for collecting, storing, retrieving, and treating information can be designed. Since there is a voluminous literature on this subject I shall leave it at this except for one point. Such a system must not only be able to answer questions addressed to it; it should also be able to answer questions that have not been asked by reporting any deviations from expectations. An extensive exception-reporting system is required.

5. Design Of Control Of The Control System

It must be assumed that the system that is being designed will be deficient in many and significant ways. Therefore it is necessary to identify the ways in which it may be deficient, to design procedures for detecting its deficiencies, and for correcting the system so as to remove or reduce them. Hence the system should be designed to be flexible and adaptive. This is little more than a platitude, but it has a not-so-obvious implication. No completely computerized system can be as flexible and adaptive as can a man-machine system. This is illustrated by a concluding example of a system that is being developed and is partially in operation. (See Figure 2.)

The company involved has its market divided into approximately two hundred marketing areas. A model for each has been constructed as is "in" the computer. On the basis of competitive intelligence supplied to the service marketing manager by marketing researchers and information specialists he and his staff make policy decisions for each area each month. Their tentative decisions are fed into the computer which yields a forecast of expected performance. Changes are made until the expectations match what is desired. In this way they arrive at "final" decisions. At the end of the month the computer compares the actual performance of each area with what was predicted. If a deviation exceeds what could be expected by chance, the company's OR Group then seeks the reason for the deviation, performing as much research as is required to find it. If the cause is found to be permanent the computerized model is adjusted appropriately. The result is an adaptive man-machine system whose precision and generality is continuously increasing with use.

Finally it should be noted that in carrying out the design steps enumerated

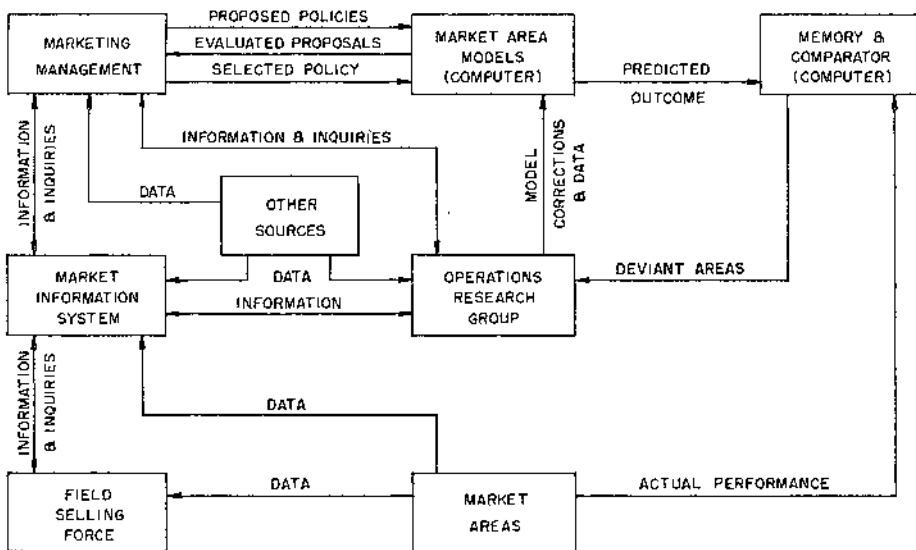


FIGURE 2. Simplified diagram of a market-area control system

above, three groups should collaborate: information systems specialists, operations researchers, and managers. The participation of managers in the design of a system that is to serve them, assures their ability to evaluate its performance by comparing its output with what was predicted. Managers who are not willing to invest some of their time in this process are not likely to use a management control system well, and their system, in turn, is likely to abuse them.

Reference

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TOWARDS A SYSTEM OF SYSTEMS CONCEPTS*

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The concepts and terms commonly used to talk about systems have not themselves been organized into a system. An attempt to do so is made here. *System* and the most important types of system are defined so that differences and similarities are made explicit. Particular attention is given to that type of system of most interest to management scientists: *organizations*. The relationship between a system and its parts is considered and a proposition is put forward that all systems are either variety-increasing or variety-decreasing relative to the behavior of its parts.

Introduction

The concept *system* has come to play a critical role in contemporary science.¹ This preoccupation of scientists in general is reflected among Management Scientists in particular for whom the *systems approach* to problems is fundamental and for whom *organizations*, a special type of system, are the principal subject of study.

The systems approach to problems focuses on systems taken as a whole, not on their parts taken separately. Such an approach is concerned with total-system performance even when a change in only one or a few of its parts is contemplated because there are some properties of systems that can only be treated adequately from a holistic point of view. These properties derive from the *relationships* between parts of systems: how the parts interact and fit together. In an imperfectly organized system even if every part performs as well as possible relative to its own objectives, the total system will often not perform as well as possible relative to its objectives.

Despite the importance of systems concepts and the attention that they have received and are receiving, we do not yet have a unified or integrated set (i.e., a system) of such concepts. Different terms are used to refer to the same thing and the same term is used to refer to different things. This state is aggravated by the fact that the literature of systems research is widely dispersed and is therefore difficult to track. Researchers in a wide variety of disciplines and interdisciplines are contributing to the conceptual development of the systems sciences but these contributions are not as interactive and additive as they might be. Fred Emery [3] has warned against too hasty an effort to remedy this situation:

It is almost as if the pioneers [of systems thinking], while respectfully noting each other's existence, have felt it incumbent upon themselves to work out their intuitions in their own language, for fear of what might be lost in trying to work through the language of another. Whatever the reason, the results seem to justify the stand-offishness. In a short space of time there has been a considerable accumulation of insights into system dynamics that are readily translatable into different languages and with, as yet, little sign of divisive schools of thought that for instance marred psychology during the 1920s and 1930s. Perhaps this might happen if some influential group of scholars prematurely decide that the time has come for a common conceptual framework (p. 12).

Although I sympathize with Emery's fear, a fear that is rooted in a research perspective, as a teacher I feel a great need to provide my students with a conceptual

* Received June 1970.

¹ For excellent extensive and intensive discussions of 'systems thinking', see F. E. Emery [3] and C. W. Churchman [2].

framework that will assist them in absorbing and synthesizing this large accumulation of insights to which Emery refers. My intent is not to preclude further conceptual exploration, but rather to encourage it and make it more interactive and additive. Despite Emery's warning I feel benefits will accrue to systems research from an evolutionary convergence of concepts into a generally accepted framework. At any rate, little harm is likely to come from my effort to provide the beginnings of such a framework since I can hardly claim to be, or to speak for, "an influential group of scholars".

The framework that follows does not include all concepts relevant to the systems sciences. I have made an effort, however, to include enough of the key concepts so that building on this framework will not be as difficult as construction of the framework itself has been.

One final word of introduction. I have not tried to identify the origin or trace the history of each conceptual idea that is presented in what follows. Hence few credits are provided. I can only compensate for this lack of bibliographic bird-dogging by claiming no credit for any of the elements in what follows, only for the resulting system into which they have been organized. I must, of course, accept responsibility for deficiencies in either the parts or the whole.

Systems

1. A *system* is a set of interrelated elements. Thus a system is an entity which is composed of at least two elements and a relation that holds between each of its elements and at least one other element in the set. Each of a system's elements is connected to every other element, directly or indirectly. Furthermore, no subset of elements is unrelated to any other subset.

2. An *abstract system* is one all of whose elements are concepts. Languages, philosophic systems, and number systems are examples. *Numbers* are concepts but the symbols that represent them, *numerals*, are physical things. Numerals, however, are not the elements of a number system. The use of different numerals to represent the same numbers does not change the nature of the system.

In an abstract system the elements are created by defining and the relationships between them are created by assumptions (e.g., axioms and postulates). Such systems, therefore, are the subject of study of the so-called 'formal sciences'.

3. A *concrete system* is one at least two of whose elements are objects. It is only with such systems that we are concerned here. Unless otherwise noted, 'system' will always be used to mean 'concrete system'.

In concrete systems establishment of the existence and properties of elements and the nature of the relationships between them requires research with an empirical component in it. Such systems, therefore, are the subject of study of the so-called 'non-formal sciences'.

4. The *state of a system* at a moment of time is the set of relevant properties which that system has at that time. Any system has an unlimited number of properties. Only some of these are relevant to any particular research. Hence those which are relevant may change with changes in the purpose of the research. The values of the relevant properties constitute the state of the system. In some cases we may be interested in only two possible states (e.g., off and on, or awake and asleep). In other cases we may be interested in a large or unlimited number of possible states (e.g., a system's velocity or weight).

5. The *environment of a system* is a set of elements and their relevant properties,

which elements are not part of the system but a change in any of which can produce² a change in the state of the system. Thus a system's environment consists of all variables which can affect its state. External elements which affect irrelevant properties of a system are not part of its environment.

6. The *state of a system's environment* at a moment of time is the set of its relevant properties at that time. The state of an element or subset of elements of a system or its environment may be similarly defined.

Although concrete systems and their environments are *objective* things, they are also *subjective* insofar as the particular configuration of elements that form both is dictated by the interests of the researcher. Different observers of the same phenomena may conceptualize them into different systems and environments. For example, an architect may consider a house together with its electrical, heating, and water systems as one large system. But a mechanical engineer may consider the heating system as a system and the house as its environment. To a social psychologist a house may be an environment of a family, the system with which he is concerned. To him the relationship between the heating and electrical systems may be irrelevant, but to the architect it may be very relevant.

The elements that form the environment of a system and the environment itself may be conceptualized as systems when they become the focus of attention. Every system can be conceptualized as part of another and larger system.

Even an abstract system can have an environment. For example, the metalanguage in which we describe a formal system is the environment of that formal system. Therefore logic is the environment of mathematics.

7. A *closed system* is one that has no environment. An *open system* is one that does. Thus a closed system is one which is conceptualized so that it has no interaction with any element not contained within it; it is completely self-contained. Because systems researchers have found such conceptualizations of relatively restricted use, their attention has increasingly focused on more complex and 'realistic' open systems. 'Openness' and 'closedness' are simultaneously properties of systems and our conceptualizations of them.

Systems may or may not change over time.

8. A system (or environmental) *event* is a change in one or more structural properties of the system (or its environment) over a period of time of specified duration; that is, a change in the structural state of the system (or environment). For example, an event occurs to a house's lighting system when a fuse blows, and to its environment when night falls.

9. A *static (one-state) system* is one to which no events occur. A table, for example, can be conceptualized as a static concrete system consisting of four legs, top, screws, glue, and so on. Relative to most research purposes it displays no change of structural properties, no change of state. A compass may also be conceptualized as a static system because it virtually always points to the Magnetic North Pole.

10. A *dynamic (multi-state) system* is one to which events occur, whose state changes over time. An automobile which can move forward or backward and at different speeds is such a system, or a motor which can be either off or on. Such systems can be con-

² One thing (x) can be said to produce another (y) in a specified environment and time interval if x is a necessary but not a sufficient condition for y in that environment and time period. Thus a producer is a 'probabilistic cause' of its product. Every producer, since it is not sufficient for its product, has a coproducer of that product (e.g., the producer's environment).

ceptualized as either open or closed; closed if its elements react or respond only to each other.

11. A *homeostatic system* is a static system whose elements and environment are dynamic. Thus a homeostatic system is one that retains its state in a changing environment by internal adjustments. A house that maintains a constant temperature during changing external temperatures is homeostatic. The behavior of its heating subsystem makes this possible.

Note that the same object may be conceptualized as either a static or dynamic system. For most of us a building would be thought of as static, but it might be taken as dynamic by a civil engineer who is interested in structural deformation.

System Changes

12. A *reaction* of a system is a system event for which another event that occurs to the same system or its environment is sufficient. Thus a reaction is a system event that is deterministically caused by another event. For example, if an operator's moving a motor's switch is sufficient to turn that motor off or on, then the change of state of the motor is a reaction to the movement of its switch. In this case, the turning of the switch may be necessary as well as sufficient for the state of the motor. But an event that is sufficient to bring about a change in a system's state may not be necessary for it. For example, sleep may be brought about by drugs administered to a person or it may be self-induced. Thus sleep may be determined by drugs but need not be.

13. A *response* of a system is a system event for which another event that occurs to the same system or to its environment is necessary but not sufficient; that is, a system event produced by another system or environmental event (the *stimulus*). Thus a response is an event of which the system itself is a coproducer. A system does not have to respond to a stimulus, but it does have to react to its cause. Therefore, a person's turning on a light when it gets dark is a response to darkness, but the light's going on when the switch is turned is a reaction.

14. An *act* of a system is a system event for the occurrence of which no change in the system's environment is either necessary or sufficient. Acts, therefore, are self-determined events, autonomous changes. Internal changes—in the states of the system's elements—are both necessary and sufficient to bring about action. Much of the behavior of human beings is of this type, but such behavior is not restricted to humans. A computer, for example, may have its state changed or change the state of its environment because of its own program.

Systems all of whose changes are reactive, responsive, or autonomous (active) can be called reactive, responsive, or autonomous (active), respectively. Most systems, however, display some combination of these types of change.

The classification of systems into reactive, responsive, and autonomous is based on consideration of what brings about changes in them. Now let us consider systems with respect to what kind of changes in themselves and their environments their reactions, responses, and actions bring about.

15. A system's *behavior* is a system event(s) which is either necessary or sufficient for another event in that system or its environment. Thus behavior is a system change which initiates other events. Note that reactions, responses, and actions may themselves constitute behavior. Reactions, responses, and actions are system events *whose antecedents are of interest*. Behavior consists of system events *whose consequences are of interest*. We may, of course, be interested in both the antecedents and consequences of system events.

TABLE 1
Behavioral Classification of Systems

Type of System	Behavior of System	Outcome of Behavior
State-Maintaining	Variable but determined (reactive)	Fixed
Goal-Seeking	Variable and chosen (responsive)	Fixed
Multi-Goal-Seeking and Purposive	Variable and chosen	Variable but determined
Purposeful	Variable and chosen	Variable and chosen

Behavioral Classification of Systems

Understanding the nature of the classification that follows may be aided by Table 1 in which the basis for the classification is revealed.

16. A *state-maintaining system* is one that (1) can react in only one way to any one external or internal event but (2) it reacts differently to different external or internal events, and (3) these different reactions produce the same external or internal state (outcome). Such a system only reacts to changes; it cannot respond because what it does is completely determined by the causing event. Nevertheless it can be said to have the *function* of maintaining the state it produces because it can produce this state in different ways under different conditions.

Thus a heating system whose internal controller turns it on when the room temperature is below a desired level, and turns it off when the temperature is above this level, is state-maintaining. The state it maintains is a room temperature that falls within a small range around its setting. Note that the temperature of the room which affects the system's behavior can be conceptualized as either part of the system or part of its environment. Hence a state-maintaining system may react to either internal or external changes.

In general, most systems with 'stats' (e.g., thermostats and humidistats) are state-maintaining. Any system with a regulated output (e.g., the voltage of the output of a generator) is also state-maintaining.

A compass is also state-maintaining because in many different environments it points to the Magnetic North Pole.

A state-maintaining system must be able to *discriminate* between different internal or external states to changes in which it reacts. Furthermore, as we shall see below, such systems are necessarily *adaptive*, but unlike goal-seeking systems they are not capable of learning because they cannot choose their behavior. They cannot improve with experience.

17. A *goal-seeking system* is one that can respond differently to one or more different external or internal events in one or more different external or internal states and that can respond differently to a particular event in an unchanging environment until it produces a particular state (outcome). Production of this state is its goal. Thus such a system has a *choice* of behavior. A goal-seeking system's behavior is responsive, but not reactive. A state which is sufficient and thus deterministically causes a reaction cannot cause different reactions in the same environment.

Under constant conditions a goal-seeking system may be able to accomplish the same thing in different ways and it may be able to do so under different conditions. If it has *memory*, it can increase its efficiency over time in producing the outcome that is its goal.

For example, an electronic maze-solving rat is a goal-seeking system which, when it runs into a wall of a maze, turns right and if stopped again, goes in the opposite direction; and if stopped again, returns in the direction from which it came. In this way it can eventually solve any solvable maze. If, in addition, it has memory, it can take a 'solution path' on subsequent trials in a familiar maze.

Systems with automatic 'pilots' are goal-seeking. These and other goal-seeking systems may, of course, fail to attain their goals in some situations.

The sequence of behavior which a goal-seeking system carries out in quest of its goal is an example of a process.

18. A *process* is a sequence of behavior that constitutes a system and has a goal-producing function. In some well-definable sense each unit of behavior in the process brings the actor closer to the goal which it seeks. The sequence of behavior that is performed by the electronic rat constitutes a maze-solving process. After each move the rat is closer (i.e., has reduced the number of moves required) to solve the maze. The metabolic process in living things is a similar type of sequence the goal of which is acquisition of energy or, more generally, survival. Production processes are a similar type of sequence whose goal is a particular type of product.

Process behavior displayed by a system may be either reactive, responsive, or active.

19. A *multi-goal-seeking* system is one that is goal-seeking in each of two or more different (initial) external or internal states, and which seeks different goals in at least two different states, the goal being determined by the initial state.

20. A *purposive system* is a multi-goal-seeking system the different goals of which have a common property. Production of that common property is the system's purpose. These types of system can pursue different goals but they do not select the goal to be pursued. The goal is determined by the initiating event. But such a system does choose the means by which to pursue its goals.

A computer which is programmed to play more than one game (e.g., tic-tac-toe and checkers) is multi-goal-seeking. What game it plays is not a matter of its choice, however; it is usually determined by an instruction from an external source. Such a system is also purposive because 'game winning' is a common property of the different goals which it seeks.

21. A *purposeful system* is one which can produce the same outcome in different ways in the same (internal or external) state and can produce different outcomes in the same and different states. Thus a purposeful system is one which can change its goals under constant conditions; it selects ends as well as means and thus displays *will*. Human beings are the most familiar examples of such systems.

Ideal-seeking systems form an important subclass of purposeful systems. Before making their nature explicit we must consider the differences between goals, objectives, and ideals and some concepts related to them. The differences to be considered have relevance only to purposeful systems because only they can choose ends.

A system which can choose between different outcomes can place different values on different outcomes.

22. The *relative value of an outcome* that is a member of an exclusive and exhaustive set of outcomes, to a purposeful system, is the probability that the system will produce that outcome when each of the set of outcomes can be obtained with certainty. The relative value of an outcome can range from 0 to 1.0. That outcome with the highest relative value in a set can be said to be *preferred*.

23. The *goal* of a purposeful system in a particular situation is a preferred outcome that can be obtained within a specified time period.

24. The *objective* of a purposeful system in a particular situation is a preferred outcome that cannot be obtained within a specified period but which can be obtained over a longer time period. Consider a set of possible outcomes ordered along one or more scales (e.g., increasing speeds of travel). Then each outcome is closer to the final one than those which precede it. Each of these outcomes can be a goal in some time period after the 'preceding' goal has been obtained, leading eventually to attainment of the last outcome, the objective. For example, a high-school freshman's goal in his first year is to be promoted to his second (sophomore) year. Passing his second year is a subsequent goal. And so on to graduation, which is his objective.

Pursuit of an objective requires an ability to change goals once a goal has been obtained. This is why such pursuit is possible only for a purposeful system.

25. An *ideal* is an objective which cannot be obtained in any time period but which can be approached without limit. Just as goals can be ordered with respect to objectives, objectives can be ordered with respect to ideals. But an ideal is an outcome which is unobtainable in practice, if not in principle. For example, an ideal of science is errorless observations. The amount of observer error can be reduced without limit but can never be reduced to zero. Omniscience is another such ideal.

26. An *ideal-seeking system* is a purposeful system which, on attainment of any of its goals or objectives, then seeks another goal and objective which more closely approximates its ideal. An ideal-seeking system is thus one which has a concept of 'perfection' or the 'ultimately desirable' and pursues it systematically; that is, in interrelated steps.

From the point of view of their output, six types of system have been identified: state-maintaining, goal-seeking, multi-goal-seeking, purposive, purposeful, and ideal-seeking. The elements of systems can be similarly classified. The relationship between (1) the behavior and type of a system and (2) the behavior and type of its element is not apparent. We consider it next.

Relationships Between Systems and Their Elements

Some systems can display a greater variety and higher level of behavior than can any of their elements. These can be called *variety increasing*. For example, consider two state-maintaining elements, *A* and *B*. Say *A* reacts to a decrease in room temperature by closing any open windows. If a short time after *A* has reacted the room temperature is still below a specified level, *B* reacts to this by turning on the furnace. Then the system consisting of *A* and *B* is goal-seeking.

Clearly, by combining two or more goal-seeking elements we can construct a multi-goal-seeking (and hence a purposive) system. It is less apparent that such element can also be combined to form a purposeful system. Suppose one element *A* can pursue goal G_1 in environment E_1 and goal G_2 in another environment E_2 ; and the other element *B* can pursue G_2 in E_1 and G_1 in E_2 . Then the system would be capable of pursuing G_1 and G_2 in both E_1 and E_2 if it could select between the elements in these environments. Suppose we add a third (controlling) element which responds to E by 'turning on' either *A* or *B*, but not both. Suppose further that it turns on *A* with probability P_A where $0 < P_A < 1.0$ and turns on *B* with probability P_B where $0 < P_B < 1.0$. (The controller could be a computer that employs random number for this purpose.) The resulting system could choose both ends and means in two environments and hence would be purposeful.

A system can also show less variety of behavior and operate at a lower level than at least some of its elements. Such a system is *variety reducing*. For example, consider a simple system with two elements one of which turns lights on in a room where

ever the illumination in that room drops below a certain level. The other element turns the lights off whenever the illumination exceeds a level that is lower than that provided by the lights in the room. Then the lights will go off and on continuously. The system would not be state-maintaining even though its elements are.

A more familiar example of a variety-reducing system can be found in those groups of purposeful people (e.g., committees) which are incapable of reaching agreement and hence of taking any collective action.

A system must be either variety-increasing or variety-decreasing. A set of elements which collectively neither increase nor decrease variety would have to consist of identical elements either only one of which can act at a time or in which similar action by multiple units is equivalent to action by only one. In the latter case the behavior is nonadditive and the behavior is redundant. The relationships between the elements would therefore be irrelevant. For example, a set of similar automobiles owned by one person do not constitute a system because he can drive only one at a time and which he drives makes no difference. On the other hand a radio with two speakers can provide stereo sound; the speakers each do a different thing and together they do something that neither can do alone.

Adaptation and Learning

In order to deal with the concepts 'adaptation' and 'learning' it is necessary first to consider the concepts 'function' and 'efficiency'.

27. The *function(s)* of a system is production of the outcomes that define its goal(s) and objective(s). Put another way, suppose a system can display at least two structurally different types of behavior in the same or different environments and that these types of behavior produce the same kind of outcome. Then the system can be said to have the function of producing that outcome. To function, therefore, is to be able to produce the same outcome in different ways.

Let C_i ($1 \leq i \leq m$) represent the different actions available to a system in a specific environment. Let P_i represent the probabilities that the system will select these courses of action in that environment. If the courses of action are exclusive and exhaustive, then $\sum_{i=1}^m P_i = 1.0$. Let E_{ij} represent the probability that course of action C_i will produce a particular outcome O_j in that environment. Then:

28. The *efficiency* of the system with respect to an outcome O_j which it has the function of producing is $\sum_{i=1}^m P_i E_{ij}$.

Now we can turn to 'adaptation'.

29. A system is *adaptive* if, when there is a change in its environmental and/or internal state which reduces its efficiency in pursuing one or more of its goals which define its function(s), it reacts or responds by changing its own state and/or that of its environment so as to increase its efficiency with respect to that goal or goals. Thus adaptiveness is the ability of a system to modify itself or its environment when either has changed to the system's disadvantage so as to regain at least some of its lost efficiency.

The definition of 'adaptive' implies four types of adaptation:

29.1. *Other-other adaptation*: A system's reacting or responding to an external change by modifying the environment (e.g., when a person turns on an air conditioner in a room that has become too warm for him to continue to work in).

29.2. *Other-self adaptation*: A system's reacting or responding to an external change by modifying itself (e.g., when the person moves to another and cooler room).

29.3. *Self-other adaptation*: A system's reacting or responding to an internal change

by modifying the environment (e.g., when a person who has chills due to a cold turns up the heat).

29.4. *Self-self adaptation*: a system's reacting or responding to an internal change by modifying itself (e.g., when that person takes medication to suppress the chills). Other-self adaptation is most commonly considered because it was this type with which Darwin was concerned in his studies of biological species as systems.

It should now be apparent why state-maintaining and higher systems are necessarily adaptive. Now let us consider why nothing lower than a goal-seeking system is capable of learning.

30. To *learn* is to increase one's efficiency in the pursuit of a goal under unchanging conditions. Thus if a person increases his ability to hit a target (his goal) with repeated shooting at it, he learns how to shoot better. Note that to do so requires an ability to modify one's behavior (i.e., to display choice) and memory.

Since learning can take place only when a system has a choice among alternative courses of action, only systems that are goal-seeking or higher can learn.

If a system is repeatedly subjected to the same environmental or internal change and increases its ability to maintain its efficiency under this type of change, then it *learns how to adapt*. Thus adaptation itself can be learned.

Organizations

Management Scientists are most concerned with that type of system called 'organizations'. Cyberneticians, on the other hand, are more concerned with that type of system called 'organisms', but they frequently treat organizations as though they were organisms. Although these two types of system have much in common, there is an important difference between them. This difference can be identified once 'organization' has been defined. I will work up to its definition by considering separately each of what I consider to be its four essential characteristics.

(1) An organization is a purposeful system that contains at least two purposeful elements which have a common purpose.

We sometimes characterize a purely mechanical system as being well organized, but we would not refer to it as an 'organization'. This results from the fact that we use 'organize' to mean, 'to make a system of', or, as one dictionary puts it, "to get into proper working order", and "to arrange or dispose systematically". Wires, poles, transformers, switchboards, and telephones may constitute a communication system, but they do not constitute an organization. The employees of a telephone company make up the organization that operates the telephone system. Organization of a system is an activity that can be carried out only by purposeful entities; to be an organization a system must contain such entities.

An aggregation of purposeful entities does not constitute an organization unless they have at least one common purpose: that is, unless there is some one or more things that they all want. An organization is always organized around this common purpose. It is the relationships between what the purposeful elements do and the pursuit of their common purpose that give unity and identity to their organization.

Without a common purpose the elements would not work together unless compelled to do so. A group of unwilling prisoners or slaves can be organized and forced to do something that they do not want to do, but if so they do not constitute an organization even though they may form a system. An organization consists of elements that have and can exercise their own wills.

(2) An organization has a functional division of labor in pursuit of the common purpose(s) of its elements that define it.

Each of two or more subsets of elements, each containing one or more purposeful elements, is responsible for choosing from among different courses of action. A choice from each subset is necessary for obtaining the common purpose. For example, if an automobile carrying two people stalls on a highway and one gets out and pushes while the other sits in the driver's seat trying to start it when it is in motion, then there is a functional division of labor and they constitute an organization. The car cannot be started (their common purpose) unless both functions are performed.

The classes of courses of action and (hence) the subsets of elements may be differentiated by a variety of types of characteristics; for example:

(a) by *function* (e.g., production, marketing, research, finance, and personnel, in the industrial context),

(b) by *space* (e.g., geography, as territories of sales offices), and

(c) by *time* (e.g., waves of an invading force).

The classes of action may, of course, also be defined by combinations of these and other characteristics.

It should be noted that individuals or groups in an organization that *make* choices need not *take* them; that is, carry them out. The actions may be carried out by other persons, groups, or even machines that are controlled by the decision makers.

(3) The functionally distinct subsets (parts of the system) can respond to each other's behavior through observation or communication.³

In some laboratory experiments subjects are given interrelated tasks to perform but they are not permitted to observe or communicate with each other even though they are rewarded on the basis of an outcome determined by their collective choices. In such cases the subjects are *unorganized*. If they were allowed to observe each other or to communicate with each other they could become an organization. The choices made by elements or subsets of an organization must be capable of influencing each other, otherwise they would not even constitute a system.

(4) At least one subset of the system has a system-control function.

This subset (or subsystem) compares achieved outcomes with desired outcomes and makes adjustments in the behavior of the system which are directed toward reducing the observed deficiencies. It also determines what the desired outcomes are. The control function is normally exercised by an executive body which operates on a feed-back principle. 'Control' requires elucidation.

31. An element or a system *controls* another element or system (or itself) if its behavior is either necessary or sufficient for subsequent behavior of the other element or system (or itself), and the subsequent behavior is necessary or sufficient for the attainment of one or more of its goals. Summarizing, then, an 'organization' can be defined as follows:

32. An *organization* is a purposeful system that contains at least two purposeful elements which have a common purpose relative to which the system has a functional division of labor; its functionally distinct subsets can respond to each other's behavior through observation or communication; and at least one subset has a system-control function.

Now the critical difference between organisms and organizations can be made

³ In another place, Ackoff [1], I have given operational definitions of 'observation' and 'communication' that fit this conceptual system. Reproduction of these treatments would require more space than is available here.

explicit. Whereas both are purposeful systems, organisms do not contain purposeful elements. The elements of an organism may be state-maintaining, goal-seeking, multi-goal-seeking, or purposive; but not purposeful. Thus an organism must be variety increasing. An organization, on the other hand, may be either variety increasing or decreasing (e.g., the ineffective committee). In an organism only the whole can display will; none of the parts can.

Because an organism is a system that has a functional division of labor it is also said to be 'organized'. Its functionally distinct parts are called 'organs'. Their functioning is necessary but not sufficient for accomplishment of the organism's purpose(s).

Conclusion

Defining concepts is frequently treated by scientists as an annoying necessity to be completed as quickly and thoughtlessly as possible. A consequence of this disinclination to define is often research carried out like surgery performed with dull instruments. The surgeon has to work harder, the patient has to suffer more, and the chances for success are decreased.

Like surgical instruments, definitions become dull with use and require frequent sharpening and, eventually, replacement. Those I have offered here are not exceptions.

Research can seldom be played with a single concept; a matched set is usually required. Matching different researches requires matching the sets of concepts used in them. A scientific field can arise only on the base of a system of concepts. Systems science is not an exception. Systems thinking, if anything, should be carried out systematically.

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The Corporate Rain Dance

Most planners ride into the future facing the past. It's like trying to drive a train from its caboose.

By Russell L. Ackoff

OUR attitude toward planning in the United States has gone through a major transformation in the last 10 years. Until then planning was associated with Communism and, therefore, was considered to be a bad thing. Since then it has been put into the category of what Winnie-the-Pooh called "good things." But the fact that planning probably has become the most frequently discussed topic in management literature does not mean that a lot of it is being done. Instead, a lot of what is being done is *called* planning. These are two very different things.

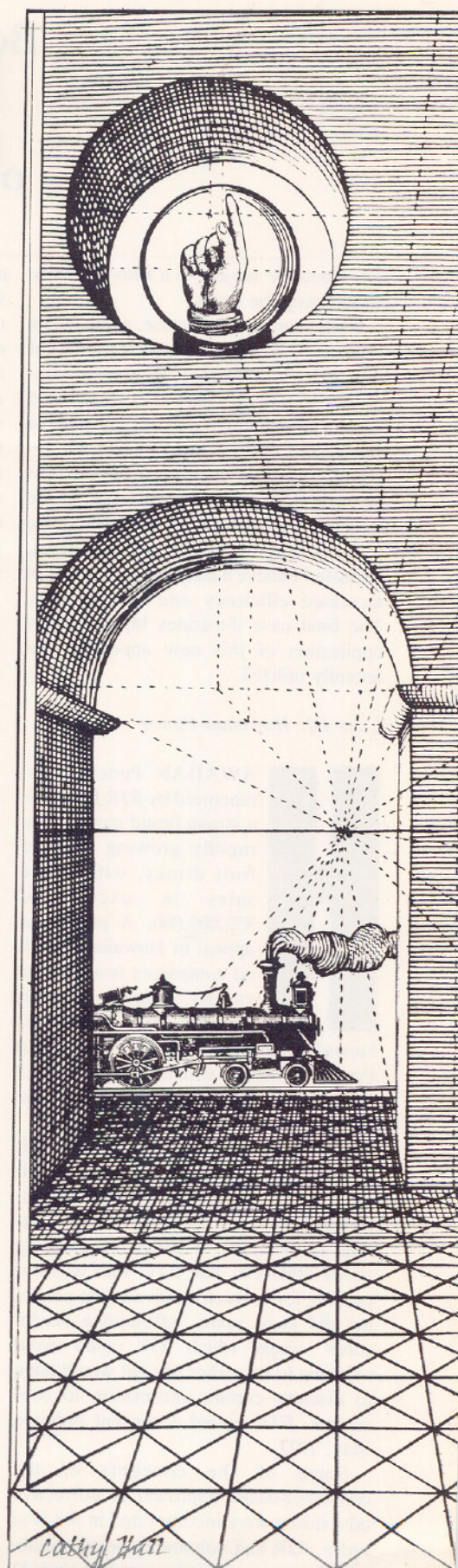
Recently, a prominent business magazine featured an article on how a corporation I have worked in makes its planning decisions. The article was based on interviews with the corporation's executives. It was a fascinating piece – of fiction! It had absolutely nothing to do with the way decisions were actually made; it described how the executives would *like* to have made their decisions. I find such public deception about corporate planning objectionable on two counts. First, it reinforces the shaky, unsuitable (but undisclosed) basis on

which most planning is done. Second, I think it's unethical because it leads shareholders and investors to expectations which are ill-founded; they – and the employees – have a right to know how executives actually plan.

Most of the planning that I have seen in about 250 American and foreign corporations is like a ritual rain dance performed at the end of the dry season to which any rain that follows is attributed. Rain dancing has no effect on the weather even though it may have therapeutic effects on the dancers. Despite this, I find that as a so-called professional planner I'm repeatedly asked to help improve corporate dancing, not to help control the weather.

The rain dancing is usually led by Chief Bottom-Up or Chief Top-Down. Bottom-up planning is often initiated by a chief executive officer who hears a lecture about the necessity of planning and decides to do something about it. He calls for the senior vice presidents and says, "Gentlemen, it's about time we had a corporate plan. I want a five-year plan for the corporation one year from now. So you should each give me plans for your area of responsibility 11 months from today." They salute, say, "Yes, sir," and withdraw. Then they call a meeting with the junior vice presidents and say much the same thing as the chief executive officer did, but they give their subordinates 10 months to submit their plans, leaving a month to coordinate and integrate the plans. This process continues down the line until the lowest level managers are called. If there are more than 12

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Top-down planning is usually initiated when senior executives go into hiding in the Bahamas.

levels in the organization they may be directed to submit their plans six months ago!

Because the lowest level managers have little if any time for planning they usually make a list of projects that have been hanging around for a while. These are seldom treated in any systematic way. They are merely described and their cost and expected return are estimated. Then they are passed up to the next level where a little filtering and combining is done; also costs and expected returns have safety, or fudge, factors added to them. And so on up until a massive collection of unrelated projects reaches the chief executive officer. He deals with the whole as his subordinates dealt with their unrelated parts.

The result is a hodge-podge, not a plan. Fortunately, the output is taken no more seriously than promises made in church. The so-called plan is seldom if ever consulted. It is used occasionally to impress visitors who do not examine its content.

Top-down planning is usually initiated when the senior executives go into hiding in the Bahamas or some reasonable facsimile and prepare a "white paper" laying out corporate objectives and the broad strategies by which they are to be pursued. This becomes the corporate sermon from the mount. It is passed down to the next level for translation into terms relevant to that level, and so on to the bottom. But it is no more effective than the bottom-up hodge-podge.

NOW I want to look more closely at why there is so much rain dancing and then suggest a program for corporate weather control.

Most managers and management educators say the essential activity of management is "decision making" and "problem solving." For this reason management education increasingly focuses on developing the ability to make decisions and solve problems. In the last 10 years, however, some of us involved in

planning have come to realize two rather surprising things about all this: first, problems do not exist – they are a figment of our imaginations; second, if they did actually exist they would have no solutions.

These assertions obviously require some explanation.

Consider the nature of textbooks for a moment. They present students with a set of clearly-labeled subject headings. At the end of each chapter students are given a set of well-formulated problems that usually have only one correct solution. As a result, students tend to think of life as a series of clearly-defined episodes at the end of which they are given well-formulated problems to solve. But no manager ever has a regular and guaranteed supply of well-formulated problems.

Instead, as William James, the great American philosopher-psychologist of the turn of this century, observed, life presents us with "great big buzzing confusions." His student, John Dewey, who became an equally great philosopher, analyzed such buzzing confusions and tried to identify the ultimate elements of which they were made. He discovered that the ultimate element of confusion is what we call a "problem."

Dewey's discovery has a very important implication for planning: it implies that problems are related to great big buzzing confusions as atoms are related to objects. In other words, problems, like atoms, are conceptual abstractions – we cannot experience them directly. But we *can* experience confusion which is made up of problems, just as we can experience tables and chairs which are made up of atoms. It is in this sense that problems can be said not to exist.

A few years ago I coined a term to replace the awkward expression "great big buzzing confusion." I called it a "mess" because I couldn't resist the pun: mess-management.

A mess is not merely an aggregation of problems; it is a *system* of problems. This means that the problems interact. Therefore, if we do the usual thing and break up a mess into its component problems and

try to solve each one separately, we will not solve the mess. For every time we solve a problem, we create new ones. Example: if my son presses me because he wants an automobile, and if his pressure constitutes a problem for me, and if I finally relent and decide to get rid of that problem by giving him an automobile – then I create a whole new sequence of problems.

On a larger scale, in the public sector, an urban mess is decomposed into problems labeled transportation, housing, health, education, utilities, and so on. In corporations, the same is done for problems labeled finance, production, marketing, research and development, and so on. These are usually planned separately.

But problems aren't entities which can be destroyed; they are simply part of a sequence: problem/solution; problem/solution; and so on beyond the horizon. Problems are also linked in parallel; again, they are interactive. So how we solve one problem affects the solubility of others. That's what I mean when I say we must deal with "messes," not problems. Only when you have viewed a mess as a system of problems can you explain how it is possible to "improve" every part of a city (or corporation) separately and still have the whole get worse.

Planning has to do with the future. But planners can look at the future with entirely different perspectives. Over the past 20 years, most planning I have observed represents three basic points of view.

The first is the *reactive* or *retrospective* point of view. It accounts for nearly all of what is called planning. It is preoccupied with identifying and fixing up bad situations. It expresses a desire to return to a previous state, one which is considered preferable either to the current state or to the state toward which the future seems to be taking us. The reactive planner tries to buck the tide and swim back to a familiar shore.

This type of planning tries to get rid of deficiencies in an organization one by one. It takes messes apart, identifies their component problems, and designs sepa-

rate projects to solve them. There are usually more projects than available resources can support. Therefore, this type of planning concentrates on selecting "top priority" projects and allocating most resources to them.

The reactive planner walks into the future facing the past. He has a good view of where the organization has been and is, but no view of where it is going. Such planning is like trying to drive a train from its caboose. It is preoccupied with tactical questions, ignoring strategic issues. It is *satisficing* (satisfactory plus sufficing) – trying to do good enough, but not as well as possible.

In reactive planning the principal tactic for removing a deficiency is to try to identify a simple cause and suppress or repress it. For example, when an "alcohol problem" developed in the United States earlier in this century, alcohol was identified as its cause and prohibition followed. (Recall that this created more serious problems than it solved.) Today we have what is called a "narcotics problem." What's our solution? Repress narcotics. We don't learn much from our previous mistakes.

The second type of planning (most prevalent among professional planners) can be called *preactive* or *prospective* planning. It consists of "predicting and preparing." It is based on the belief that things are getting better all the time. Therefore, it is concerned with accelerating the approach of the future. It doesn't try to buck the tide, but rides on its leading edge, so as to get to where the tide is going before anyone else does. Then it plans to collect a toll from all who arrive later.

Forecasting plays a fundamental role in such prospective planning. It tries to predict accurately both the problems and opportunities that the future will bring, so that it can minimize the one and maximize the other.

Preactive planning focuses on *programs* – sets of interconnected projects directed at producing a desired future state. Such planning tends to be strategically oriented; it deals with longer-range objectives than reactive planning does.

Also, it deals with more of the organization – not just with its deficient parts taken separately. But the external environment in which an organization operates is beyond the planner's boundaries. If he knows yellow-fever mosquitos are on the way, he tries to inoculate everyone against malaria rather than to divert or destroy the mosquitos.

The preactive planner tries to optimize, to do as well as possible, not merely to do well enough. Unlike the reactive planner whose principal tools are judgment, intuition, and experience, his are science, technology, and experimentation.

However, preactive planners are confronted by a dilemma that they are reluctant to face, one that arises from their preoccupation with forecasting. They will buy or support almost any effort to produce a better view of the future whether it involves use of the Delphi method, econometric models, time series analysis, or what not. But they do not ask a fundamental question about forecasting: Under what conditions can we forecast the future accurately? The answer, unfortunately, is: Only where the future is *completely determined* by the past.

It is clearly not consistent to assume that the future of the *environment* is determined but not the future of the organization engaged in planning. It turns out, then, that the only conditions under which the future can be predicted accurately are the determined ones that nothing can be done about. Then why forecast?

This dilemma has recently given rise to a new approach to planning which can be called *interactive* or *introspective*. It is fundamentally different than the other two approaches.

The basic approach of the interactive planner is "make it happen." He is unwilling either to return to a previous state, settle for his current state, or accept the way things are going. Unlike the other two types of planners he believes that the future is largely under an organization's control. It depends more on what we do between now and the future than on what has happened up until now. Therefore, he

conceives of planning as *the design of a desirable future and the invention of ways to bring it about*.

THIS planning posture has important consequences. First, since politics is often defined as the art of the possible, most planners are really concerned with finding out what is possible in the minds of people who wield power, in the private sector as well as the public sector. So they actually play politics but call it planning. Instead, planning should be the art of the *impossible*. Planning ought to convert what is initially considered to be impossible into what is subsequently accepted as possible. The interactivist planner tries to do more than optimize – he tries to *idealize*, that is, do better in the future than the best that is conceived of now.

Second, the interactive planner does not believe that most of the relevant future can be accurately predicted because he believes it depends on choices *yet to be made*. Therefore, the only useful way of preparing for a largely unpredictable future is to design organizations, institutions, and societies that are capable of rapid, effective learning and adaptation to changing internal and external conditions. For this reason, interactive planning emphasizes organizational design and management.

Third, the interactive planner focuses on all three aspects of an organization – the parts (but not separately), the whole, and the environment. He believes that often the most effective way of influencing the future of an organization is to change its environment. He may not have as much control over the environment as he has over the organization, but he uses as much as he has up to the hilt.

To illustrate, I will compare planning to the practice of medicine:

□ Reactive planners try to treat symptoms where they occur, mistaking symptoms for causes. They act like a

doctor who always tries to treat headaches with brain surgery.

□ Preactive planners look at the whole system, and interpret a difficulty as a symptom of a systemic deficiency, not of an isolated part. So they might first try to treat headaches by changing diet or prescribing new eye-glasses.

□ Interactive planners focus on the interaction of the system and its environment. They are like a doctor who considers treating a patient's persistent headaches by having him take a new job in a different environment.

AS interactive planning has developed in the past few years, my colleagues and I have identified a set of basic principles and specific steps for the planning process. It is beyond the scope of an article to detail the whole process, so I want to focus on two elements which I believe make interactive planning unique: the first entails moving from the past to the future in a very special way; the second entails starting in the future and working back to the present.

The first unique element is what I call a "reference projection" – an extrapolation from the past into the future, based on the assumptions that neither the system nor its environment will change in any fundamental way. The planner knows these assumptions are false. Therefore, a reference projection is not a forecast in the usual sense. We will soon see what type of forecast it is.

First, consider an example. In 1960 we prepared a reference projection for an automobile manufacturer based on the assumption that the company could continue to grow in the future as it had in the past without any fundamental change in what it was doing. We projected that by the year 2000, the cost of maintaining the 1960 level of urban traffic congestion would be more than 12 times the largest amount ever spent in one year on *all modes* of urban transportation. Such ex-

penditures, we felt sure, were not going to be made. Furthermore, we determined that if they were made, more than 100 percent of the cities' surfaces would be covered by streets and parking lots!

Now we can say what a reference projection is: it is a forecast of *what cannot happen*. Its usefulness lies in pointing out where changes must occur in the future. Such projections do not tell us what will happen because that depends on decisions that have yet to be made; but by telling us what won't happen, they focus attention on critical aspects of the future. They identify where the creative opportunities are.

In a projection prepared for the Fourth District Federal Reserve Bank headquartered in Cleveland, we extrapolated the amount of hand-processed paper work it handles, using data from 1946 to 1973. We also estimated the number of people required to handle it. By the year 2000 the required space would exceed the total amount of commercial space available in Cleveland. Therefore, something in the system must change. What will change depends on what the Bank plans to do, but it had better do something, and quickly.

Now let's turn to the second unique element, the most critical step in interactive planning: *idealized redesign* of the organization. To start, I'll describe it by example.

In the early 1950's I was doing some work with a friend in the R&D laboratory of a public utility. When I got there one morning he said to me, "Russ, you're going to have to keep yourself busy for an hour or two because the boss called a meeting I have to attend. I don't know what it's about or how long it will last." Then, as an afterthought, he added, "Why don't you come with me? No one said that visitors aren't allowed." I said "OK" and went along with him to a small auditorium where about 20 or 30 people had gathered.

The boss entered, went to the podium, and with a very serious look on his face said, "Gentlemen, our entire system was destroyed last night." People looked at him as though he were crazy. After a pause, the boss continued, "I know what

you're thinking – that the system has not been destroyed. But from now on, in this laboratory we're going to act as though it has been. One year from today I want a design of a system to replace the one we now have, assuming it has been wiped out completely. There will be no financial, legal, or other types of restrictions on the design. But it must be technologically feasible. I don't want a piece of science fiction. And it must be capable of supporting itself if it were built. It must be operationally viable."

Then he explained, "I've been here for a long time. When I look back on what's been done here during that time, much of it has been unimaginative and uncreative because we've been constrained by what we have in place. Most of our work has been directed to removing its deficiencies, not to developing the system we would like to have." That meeting started a process that produced designs of almost every major innovation that has occurred in the system since then, and many more yet to come.

So an idealized design is a picture of the system its designers would build *now* if they were free to replace the current system with whatever they wanted most. It is subject to only two constraints: technological feasibility and operational viability.

Why engage in a process as fantastic as this? For a number of reasons. In general terms it turns the planning process around 180 degrees – instead of planning *away from a current state* we start planning *toward a desired state*. That means planning from the future to the present in contrast to conventional planning which goes from the present to the future. The eyes of the planners are focused on ultimate objectives – ideals – throughout.

Idealized redesign has specific benefits. First, it facilitates widespread participation in the planning process. No one is an expert on what ought to be; everyone's opinion is relevant. Arthur Burns has no special knowledge of what the banking system ought to be, however much he knows about what it is and is not. He can't tell me what my local bank ought to be

Bottom-up planning is taken no more seriously than promises made in church.

doing for me. My opinion on that is just as relevant, if not more so, than his. The president of a company may have more useful opinions than a janitor on how the company ought to finance its growth, but the situation is reversed when it comes to keeping the company facilities clean.

The second advantage of idealized design lies in its focus on the processes of learning and adaptation to change. This becomes clear when we consider how an idealized design differs from a utopian design. To begin with, it does not pretend to be a perfect state. Rather it is built on the realization that our concept of the ideal is subject to continuous change in light of new experience, information, knowledge, understanding, wisdom, and values. Furthermore, the designers engaged in idealization cannot answer all the questions they have about what the system ought to be. Therefore, they must design a capability for answering these questions experimentally. So it is an *ideal-seeking* system, unlike a utopia which pretends to be beyond improvement.

A third advantage of the idealization process lies in its stimulation of creativity. Creativity is normally inhibited by conscious or unconscious self-imposed constraints based on what seems feasible and acceptable to others. The idealized design removes consideration of feasibility (except technological), acceptability, and the usual financial, legal, and other types of constraints. Therefore, it releases our imagination from the bonds that keep it from roaming creatively.

Finally, and perhaps most important, is the impact idealized design has on our concept of feasibility. It can convert the impossible into the possible.

Now, if interactive planning is so useful, why isn't more of it being done?

For one thing, there are not many people who consider themselves to be professional planners. Of those who do, not many use this conception of planning. Over time, I hope this will change through the education process. But the more basic reason is that very large numbers of

people in management are essentially in the reactive, the inactive, or particularly in the preactive mode. They feel they can deal with the future, and thereby the present, by predicting and preparing.

Some of them are actually succeeding. So the ones who aren't look at the successful ones and say: "We're not succeeding because we're not doing it as well as they're doing it." They ignore the fact that preactive planning works best in high-technology corporations such as IBM, Xerox, and Polaroid. These companies tend to be optimistic about the future because the future of their technology seems to be good. In other words, the future is going to be better than the present, let's predict what it's going to be, identify the opportunities, and exploit the hell out of it.

ACCEPTANCE of interactive planning is largely a matter of intellectual unrest in individuals. Where they are in positions of authority they can do something about it. But there are a lot of enthusiastic people who are in positions where they can't do anything about it. People in positions of authority normally will turn to it only as a last resort when faced with a problem that's critical to their survival.

Today there are corporations threatened by long-run problems of *over-employment*, too much manpower. They are in a bind because the cost of efforts to reduce overemployment is extremely great, including a threat to the survival of an organization. It is increasingly difficult, particularly as a result of union and legal activities, to get rid of unnecessary people. And since society isn't taking care of them very adequately, there is also a question of justice and conscience. I have run into this problem in at least 10 different contexts in the last year; people are tremendously worried about it. But no standard approach to planning will "solve" this "problem."

Another contemporary survival prob-

lem is the corporations based on classes of products whose consumption cannot continue to grow in the future as they have in the past, nor even grow as rapidly as the economy. They must change the nature of their business in a very fundamental way. Food companies are a good example. General Mills has diversified into toys and Anheuser-Busch is strong in family entertainment. This last quarter of the 20th century has its equivalents of the buggy whip manufacturers who disappeared in its first quarter.

A final word. People often ask me how I know when things are going well in interactive planning. My answer always is, if you have to ask that question once you're in the process, then it's not going well. If it succeeds, there is no need to make fine measurements. Basically it is, and ought to be, a crusade. It's not solely an intellectual activity. Planning becomes a way of life, the essential activity in management, and everybody in the organization has an opportunity to contribute. When an organization passes through the planning threshold, people begin to get a sense of their capacity to design and create a future. Ultimately, it is far more gratifying than rain dancing. ■

Suggested Reading

IGOR ANSOFF, *Corporate Strategy*, McGraw-Hill Book Co., 1965. *A different but related look at corporate planning.*

C. WEST CHURCHMAN, *The Systems Approach*, Delacorte, 1968. *A seminal work on the strengths and weaknesses of this approach, particularly as it applies to planning.*

HASAN OZBEKHAN, "Planning and Human Action," in *Hierarchically Organized Systems in Theory and Practice*, ed. by Paul A. Weiss, Hafner, 1971. *A thoughtful exposition of the theory of interactive planning.*

RUSSELL L. ACKOFF, *A Concept of Corporate Planning*, John Wiley and Sons, 1970. *An early formulation of interactive planning, then called "adaption," in the corporate context.*

A SYSTEMIC VIEW OF TRANSFORMATIONAL LEADERSHIP

by Russell L. Ackoff

INTRODUCTION

In the recent past I have been asked several times: What do systems thinkers think about leadership? I don't know what they think about it because I haven't asked them. In fact, I didn't even know what I thought about it. But the repeated question pushed me into answering the question for myself.

Like many other systems thinkers I have had to sit through what feels like endless sessions discussing leadership and how to create leaders. I have found them vacuous and a terrible bore. Therefore, to think about it substantively and in a non-boring way is a challenge, one I take up here.

I have scanned the large and growing literature dealing with leadership without finding inspiration in it. Nor have I found any evidence of an increase in either the quantity or quality of leaders produced, particularly transformational leaders. My superficial survey convinced me that to a large extent the sterility of this literature is due to the ambiguity associated with the concepts of leadership and transformation.

ADMINISTRATION, MANAGEMENT, AND LEADERSHIP

These terms are often used interchangeably. What a waste! There are important differences they can be used to reveal. Therefore, I have defined them in a way that is directed at improving leadership and bringing about more significant organizational transformations.

Administration consists of directing others in carrying out the will of a third party, using means selected by the same party.

Management consists of directing others in the pursuit of ends using means both of which have been selected by the manager. (*Executives* are managers who manage other managers.)

Leadership consists of guiding, encouraging and facilitating the pursuit by others of ends using means, both of which they have either selected, or the selection of which they approve.

In this formulation, leadership requires an ability to bring the will of followers into consonance with that of the leader so they follow him or her *voluntarily*, with enthusiasm and dedication. Such voluntarism, enthusiasm, and dedication are not necessarily involved in either management or administration.

LEADERSHIP IS PRIMARILY AN AESTHETIC FUNCTION

Leadership has been poorly understood largely because it is primarily an *aesthetic* function and aesthetics are also poorly understood. It is one of the four aspects of development identified by Ancient Greek philosophers each of which is separately necessary but all of which, taken together, are sufficient for continuous development. These are the pursuits of *truth*, *plenty*, the *good*, and *beauty/fun* (*aesthetics*).

Truth. The pursuit of truth is the societal function of science. Technology is the application of science and education is the principal means used by society to disseminate the output of science and technology. Together they enable people to pursue their ends more efficiently.

Plenty. The pursuit of plenty is a function of institutions that are concerned with (1) producing and distributing the resources that make possible the pursuit of ends as efficiently as possible (for example, economic enterprises), and (2) protecting the resources acquired against their appropriation, theft, or destruction by others or nature (for example, the justice system, the health system, environmental protection, the military, and insurance).

The Good. The pursuit of the good involves the dissemination of ethical and moral principles. This is carried out by religious and educational institutions, and more recently the field of psychiatry. It entails promoting cooperation to enable the attainment of more objectives than could otherwise be obtained. This, in turn, requires eliminating conflict within individuals (peace of mind) and between individuals (peace on Earth) because conflict limits the number of objectives that can be obtained.

Beauty/Fun. The pursuits of beauty and fun are inseparable aspects of aesthetics. Together they make possible the continuous pursuit of ideals, ends that can be approached indefinitely but never attained.

The role of aesthetics is not as well understood in our culture as are the roles of science, technology, education and economics, or even as well as ethics-morality. *Management science*, *management technology*, *management education*, and *management ethics* have at least some meaning for most. On the other hand, the *aesthetics of management* conveys meaning to very few.

Science, technology, and economics focus on *efficiency*, but not *effectiveness*. The difference between efficiency and effectiveness is important to an understanding of transformational leadership. Efficiency is a measure of how well resources are used to achieve ends; it is value-free. Effectiveness is efficiency weighted by the values of the ends achieved; it is value-full. For example, a men's clothing manufacturer may efficiently turn out suits that do not fit well. Another less efficient manufacturer may turn out suits that do fit well. Because "fit" is a value to customers, the second manufacturer would be considered to be the more effective even though less efficient than the first. Of

course, a manufacturer can be both efficient and effective.

Put another way: efficiency is a matter of doing things right; effectiveness is a matter of doing the right things. For example, the more efficient our automobiles have become, the more of them are on city streets. The more of them on city streets, the more congestion there is. The efficiency of an act can be determined *without* reference to those affected by it. Not so for effectiveness. It is necessarily personal. The value of an act may be, and usually is, quite different for different individuals. The difference between efficiency and effectiveness is also reflected in the difference between *growth* and *development*, and development is of greater concern to a transformational leader than growth.

GROWTH AND DEVELOPMENT

Growth is an increase in size or number; development is an increase in competence. Standard of living is an index of growth, but quality of life is an index of development. Either growth or development can occur without the other. Rubbish heaps grow but do not develop. Professors can develop without growing. Growth does not necessarily involve an increase in value; development does. A company can grow without increasing its value but it cannot develop without doing so.

Values are the concern of ethics and aesthetics. Therefore, they are necessarily involved in the conversion of efficiency into effectiveness. The production of data, information, knowledge, and understanding are primarily functions of science. The production of *wisdom*, which presupposes all four, is primarily a function of ethics and aesthetics because it involves the conscious insertion of values into human decision making and evaluation of its outcomes.

Wisdom. Effectiveness is a product of wisdom which enlarges both the range of consequences considered in making a decision and the length of time over which the decision is believed to have possible consequences. By taking long- as well as short-run consequences into account, wisdom prevents sacrificing the future for the present. For example, our technology enables us to keep terminally ill people alive at great cost. But is this the right thing to do in the long run? Is it wise? Might the same resources be better used elsewhere?

Wisdom is required for the effective pursuit of ideals, and therefore is required of leadership. Leaders must also have a *creative* and *recreative* role in the pursuit of ideals, and these are aesthetic functions.

AESTHETICS

In *The Republic*, Plato wrote that art was a potentially dangerous stimulant that threatens the stability of a society. Aristotle's conception of art was very different from Plato's. While Plato saw art as a stimulator of disruptive changes; Aristotle saw it as cathartic, a palliative for dissatisfaction, hence a producer of stability and contentment.

He saw art as something from which one extracts satisfaction here and now; as *recreation*.

These apparently contradictory views of art are actually complementary: they are two inseparable aspects of ideal-pursuit. Art *inspires*, produces an unwillingness to settle for what we have and a desire for something better. It is the product and producer of creative activity, change; it is essential for continuous development. Art also entertains, recreates, yielding fun from what we do regardless of what we do it for. It is the satisfaction we derive from "going there" in contrast to the satisfaction derived from "getting there." Recreation provides "the pause that refreshes." It recreates creators. We would not be able to maintain continuous pursuit of ideals without payoffs along the way. Now, how does all this relate to leadership?

Leadership, Visions, and Strategies

According to Jan Carlzon (1987), who provided SAS Airlines with transformational leadership, a leader must encourage and facilitate formulation of an organizational vision in which as many stakeholders as possible have participated. He must create

an environment in which employees can accept and execute their responsibilities with confidence and finesse. He must communicate with his employees, imparting *the company's vision* and listening to what they need to make that vision a reality. To succeed...he must be a visionary, a strategist, an informer, a teacher, and an *inspirer*. (p.5, italics mine).

My concept of a vision is a description of a state that is considered to be significantly more desirable than the current state. It is a state that cannot be approached without a fundamental change of direction, a change of the *status quo*. It takes courage to lead such a change and it requires instilling courage in others. This involves more than persuasion; it requires the ability to *inspire*. Unlike persuasion, inspiration evokes a willingness to make sacrifices in the pursuit of long-run objectives or ideals. Therefore, visions that induce others to pursue them must be *inspiring*. An inspiring vision is the product of a creative act, of *design*. Inspiring visions are works of art and those who formulate them are artists.

Leadership also requires the ability to implement pursuit of the vision. Inspiration without implementation is provocation, not leadership. Implementation without inspiration is management or administration, not leadership. Therefore, leaders must be both creative, in order to inspire, and courageous, in order to induce implementation.

An inspiring, courage-evoking vision requires a mobilizing idea, an idea that need not appear to be realizable.

... man has been able to grow enthusiastic over his vision of...unconvincing enterprises. He had put himself to work for the sake of an idea, seeking by magnificent exertions to arrive at the incredible. And in the end, he has arrived there. (Jose Ortega y Gasset, 1966, p. 1)

Visions may consist of either positive or negative images. Positive images incorporate something that we do not have but want, for example, law and order, a clean and healthy environment and peace. Negative images incorporate something that we have but do not want, for example, crime, poverty, a disease or an enemy.

Negative images are much easier to formulate and more easily mobilize people. However, they are often counterproductive, resulting in outcomes that are less desirable than the one we are trying to get rid of. For example, when the United States tried to get rid of alcoholism by prohibition, it neither got rid of alcoholism nor alcohol but got organized crime. We try to get rid of criminals by incarcerating them despite the fact that studies have shown that the likelihood of a crime being committed by those released from prison is higher than that of criminals who have not been imprisoned.

VISIONS AS IDEALIZED DESIGNS

Positive visions that can mobilize transformations can be produced by *idealized design*. In this process those who formulate the vision begin by assuming that the system being redesigned was completely destroyed last night, but its environment remains exactly as it was. Then they try to design that system with which they would replace the existing system *right now* if they were free to replace it with any system they wanted.

The basis for this process lies in the answer to two questions. First, if one does not know what one would do if one could do whatever one wanted without constraint, how can one possibly know what to do when there are constraints? Second, if one does not know what one wants *right now* how can one possibly know what they will want in the future?

An idealized redesign is subject to two constraints and one design principle: *technological feasibility* and *operational viability*, and it is required to be able to learn and adapt rapidly and effectively. Technological feasibility means that the design only incorporates technology known to be feasible. This does not preclude new uses of available technology. This constraint is intended to prevent the design from becoming a work of science fiction. Operational viability means that the system should be designed so as to be capable of surviving in the current environment *if* it came into existence, but it need not be capable of doing so.

The product of an idealized design is *not* an ideal system, and therefore, not utopian, because it is subject to continuous improvement. The design produced is the best *ideal-seeking system* that its designers can currently conceive. (They should be able to conceive of a better one in the future by realizing the design objective of rapid and effective learning.)

Summarizing this much, then, a transformational leader is one who can formulate or facilitate the formulation of an inspiring vision of something to be sought even if it is unattainable, although it must at least be approachable without limit. The leader must

also be able to encourage and facilitate (inspire) pursuit of the vision, by invoking the courage required to do so even when short-term sacrifices are required, by making that pursuit satisfying, fun as well as fulfilling.

WHY LEADERSHIP CANNOT BE TAUGHT

Teaching, and therefore courses, cannot produce great leaders precisely because leadership is essentially an aesthetic activity. The most schools can do is provide some of the tools and techniques usable in creative work but they cannot create creativity. One can be taught to draw, sculpt, compose and write better than one would otherwise, but one cannot be taught to do so creatively with excellence.

Students are taught to seek solutions that their teachers expect; student success depends on it. This even carries over to corporate managers who, when presented with a problem, want to know what kind of solution their bosses expect. This approach precludes creativity because creativity is the production of solutions that are *not* expected. Transformational leaders are driven by ideas, not by the expectations of others. They are skillful at beating the system, not surrendering to it.

UNDERSTANDING SYSTEMS

A transformational leader must understand the nature of a system such as a corporation, school, hospital, church, government, or United Nations, and how transformation of a system differs from a transition. For me:

A system is a whole defined by one or more functions, that consists of two or more essential parts that satisfy the following conditions: (1) each of these parts can affect the behavior or properties of the whole; (2) none of these parts has an independent effect on the whole; the way an essential part affects the whole depends on what other parts are doing; and (3) every possible subset of the essential parts can affect the behavior or properties of the whole but none can do so independently of the others.

Therefore, a system is a functioning whole that cannot be divided into independent parts and be effective.

Classifying Systems

There are obviously different ways of classifying systems. The choice of a classification scheme should depend on its intended use. For my purpose here - making clear what a transformation of a system is - the critical classifying variable is *purpose* and purpose is a matter of *choice*.

An entity is purposeful if,

(1) It can produce the same functionally defined outcome in different ways in the

same environment; for example, a person who can reach a destination by driving, using public transportation, or walking.

(2) it can produce functionally different outcomes in the same and different environments; for example, a person who can read in different environments and can write or converse in any of the environments in which it can read.

Although the ability to make choices is necessary for purposefulness, it is not sufficient. An entity that can behave differently but produce only one outcome in anyone of a set of different environments is *goal-seeking*, not purposeful. Control mechanisms - for example, a thermostat - are goal - seeking. In contrast, people are obviously purposeful systems, and so are certain types of social groups.

Types of Systems

There are four basic types of systems:

1. *Deterministic*: systems in which neither the parts nor the whole are purposeful.
2. *Animated* systems in which the whole is purposeful but the parts are not.
3. *Social*: systems in which both the parts and the whole are purposeful.
4. *Ecological* systems in which some of the parts have purposes but not the whole.

These four types of system form a hierarchy in the following sense: animated systems have deterministic systems as their parts; for example, various human organs operate as mechanisms. In addition, animate systems such as people can create and use deterministic systems such as clocks and automobiles, but not vice versa. Social systems have animated systems (people) as their parts. All three types of system are contained in *ecological: systems*, some of whose parts are purposeful but not the whole. For example, Earth is an ecological system that has no purpose of its own but contains social, animate and deterministic systems.

THE BUSINESS ENTERPRISE AS A DETERMINISTIC SYSTEM

Business enterprises were initially thought of as machines created by their gods, the owners, to do their work. Enterprises, like all machines, were taken to have no purpose of their own, but were believed to have only the function of serving their owners' purposes. The owners' principal purpose was taken to be to obtain an adequate return on their investment of time, money, and effort. This required that enterprises make a profit. Making a profit came to be thought of as the only legitimate function of an enterprise, a belief still held by many, and far from dead as reflected in the writing of Milton Friedman (1970):

...there is one and only one social responsibility of business-to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of

the game... (p. 125)

This point of view is far from dead.

Owners of early enterprises had the power to run their businesses with virtually no constraints. They were god-like in the small worlds they had created. Although employees were known to be human, their personal interests and purposes were irrelevant to their employers. Workers were retained only as long as they were ready, willing, and able to do what the owners wanted. When they no longer were, they were discarded and replaced, like replaceable machine parts, by others who were compliant and usable.

In the early days of industrialization the work done by most employees required little or no skill, and unskilled labor was plentiful. In general, this work force had little education and, therefore, relatively low levels of aspiration. Many were immigrants with only a very limited knowledge of English. They aspired more for their children than for themselves. For most workers, employment was necessary for survival; unemployment meant economic destitution. At that time there was no social security, no unemployment insurance or welfare, and the average compensation of workers was not large enough to enable them to insure themselves against unemployment. Little wonder, then, that many were willing to work under almost any conditions; they had to.

By the end of World War I, the mechanistic conception was largely replaced by one that was biological, organismic. There were a number of reasons for this transformation. The levels of worker education and aspiration had increased largely as a consequence of compulsory public education. Government began to regulate working conditions thereby reducing the power of the owners and protecting at least the health and safety of members of the work force. Unions emerged, improving the conditions of work, work itself, compensation for it, and job security. All this made the owners less god-like.

However, the most important reason for the transformation from the mechanistic to the organismic conception of enterprises was that, even by reinvesting all their profits in growth, their owners could not exploit all the opportunities for growth. In addition, the increased technology of production required increased amounts of investment in facilities and equipment. Therefore, to unleash growth and productivity, many owners had to raise additional capital by selling stock. This required most of them to relinquish at least some control over the enterprises they had created. The survival and growth rates of the enterprises that raised investment capital by "going public" were much greater than of those whose owners elected to retain control and constrain growth.

When an enterprise went public, its god disappeared. Stockholders were numerous, dispersed, anonymous, and unreachable by members of the work force. Some of the larger corporations acquired more than a million shareholders. Therefore, God disappeared; ownership became an abstraction. How was communication with this abstraction to be obtained? There was a precedent; nineteen hundred years earlier, a western God had disappeared and became an abstract spirit with whom ordinary men

could not communicate directly. An institution and a profession - the church and its clergy - were created to bridge the gap. Similarly, as the nineteenth century drew to a close, management (the church) and managers (the clergy) were created to control enterprises in the alleged interests of their owners, and to discern and communicate their will to the employees. Managers came to know the will of the shareholders in the same way the clergy claimed to know the will of God, by revelation.

The principal effect of the dispersion of "ownership" was to give effective control of enterprises to their managers. James Burnham (1941) referred to this as a "managerial revolution." He argued that enterprises were now run by managers primarily for their own benefit, not the owners. Profit came to be thought of as a means, not an end. Like oxygen for a human being, profit was thought of as a means necessary for the survival and growth of the enterprise, not the reason for it. At the turn of the century, the American humorist Ambrose Bierce (1967) caught the spirit of this change of perspective in his definition of 'money': "A blessing that is of no advantage to us excepting when we part with it" (p. 226)

THE ENTERPRISE AS AN ANIMATE ORGANISM

Like all biological entities, the enterprise was considered to have survival as a purpose of its own. Growth was believed to be essential for it. The opposite of growth, contraction, was slow death. Publicly owned enterprises came to be called "corporations." This word derives from the Latin word 'corpus,' meaning 'body,' (Organisms have bodies, machines do not.) Moreover, in the eyes of the law, the corporation was endowed with the status of a biological individual. In 1886 the Supreme Court ruled for the first time that a corporation should be construed as a person (Mouzelis, 1974, p. 183). Biological metaphors invaded organizational thinking. The chief executive was called "the head" of the organization. Other biological concepts were applied to enterprises; for example, viable, healthy, sick, paralyzed, energetic, and survival of the fittest. Such concepts are still commonly used.

Because of continuing advances in mechanization, the skills required of workers continued to increase. Those who had the required skills were not as plentiful as those who didn't. It was costly to replace skilled workers; expensive training was frequently involved. As a result, they were treated more like difficult-to-replace organs than easily replaceable machine parts. Employee health and safety received increasing attention from both unions and government. However relevant were the functions of workers, their personal interests and purposes were not an appropriate concern of their employers.

Expansion of social security and increases of personal savings (resulting from increased compensation for work) reduced the connection between economic destitution and unemployment. Furthermore, unions negotiated increased job security. These developments encouraged dissatisfied employees to protest against what they considered to be unfair labor practices and bad working conditions. Management and labor came to see themselves as irrevocably opposed to the other, much as many

philosophers took mind and body to be.

Although the biological view of the enterprise still prevails, it has eroded significantly since World War II. At that time, a major portion of the work force was drafted into military service. Nevertheless, demands for production were very great. Young people, the elderly, and especially women were drawn into the work force. (Recall Rosie the Riveter and Tillie the Toiler.) These replacements for drafted workers were motivated more by patriotism than by the need for money. Many were supported by allowances given by the government to dependents of servicemen. Managers who wanted high productivity from members of this patriotically motivated work force could not obtain it by treating them as replaceable machine parts or even as functioning organs; they had to be treated as human beings with purposes of their own. Even managers had to be treated differently because they began to behave differently. As E. E. Jennings (1971) observed:

Then came World War II...and innovation was needed at all levels; no one person could possibly know enough to maintain corporate viability.

Corporations began placing their chips on young men not yet mesmerized by the loyalty ethic...

Young executives grew self-confident that they could manage their own careers... When they saw upward mobility arrested, they opted for opportunities elsewhere....

The most mobile had the best chance to achieve and acquire experience; mobility bred competency that in turn bred mobility. Rapid executive turnover became a fact of life. (p. 29)

Ex-GIs returning to civilian work wanted to be treated as unique individuals with needs and desires of their own. This was reflected in the permissive way they raised their children. As a result, the post-World-War-II "baby boomers" were even less inclined than their parents to tolerate authoritarian management. Most members of the permissive "Spock" generation had not experienced a depression, and therefore, economic destitution was an abstraction to them, but job mobility was concrete and real. Furthermore, they did not attribute as much importance to material possessions as their parents had. They did not adopt the Protestant work ethic and they did not consider work to be an inherently good thing. Rather, they thought of work as a necessary evil or a means to an end. Recall the hippies of the 1960s and 70s.

Workers of the permissive generation expected their interests to be taken into account by their employing organizations. As many managers failed to do so, alienation from work became widespread. According to a report submitted to the Secretary of Health, Education, and Welfare in 1973:

...significant numbers of American workers are dissatisfied with the quality of their working lives. Dull, repetitive, seemingly meaningless tasks, offering little challenge or autonomy, are causing discontent among workers at all occupational levels. This is not so much because work itself had greatly changed; indeed, one of the main problems is that work has not changed fast enough to keep up with the widespread changes in worker attitudes, aspirations, and values. A general increase in their educational and

economic status has placed many American workers in a position where having an interesting job is now as important as a job that pays well. Pay is still important: it must support an "adequate" standard of living and be perceivable as equitable - but high pay alone will not lead to job (or life) satisfaction. (pp. xv-xvi)

Protest groups, outside as well as inside corporations, proliferated. Consumerists and environmentalists felt that they were being adversely affected by organizations of which they were not a part. These groups held corporations responsible for their allegedly harmful effects on society, its members, and the environment. This contributed to bringing about a transformation in the way people thought of an enterprise; they began to think of it as a social system.

THE ENTERPRISE AS A SOCIAL SYSTEM

Because of internally and externally applied pressures, corporate managers became aware of the need to take into account the concerns, interests, and objectives of (1) the people who were part of the systems they managed and (2) the larger systems that contained them-for example, society-and other systems and individuals who were parts of the same containing systems. In addition, these managers obviously had to be concerned (3) with the purposes of the organizations they managed. This preoccupation with the purposes of parts and containing wholes made it increasingly difficult for managers to think of their organizations as either mechanical or biological systems. They began to think of them as systems in which people individually and collectively played the major roles.

This social systemic view maintains that executives have duties beyond maximizing value for shareholders. For example, Hicks B. Waldron, chairman of Avon Products Inc. wrote:

We have 40,000 employees and 1.3 million representatives around the world.... "We have a number of suppliers, institutions, customers, communities. None of them have the same democratic freedom as shareholders do to buy or sell their shares. They have much deeper and much more important stakes in our company than our shareholders." (Hoerr and Collingwood, 1987, p. 103)

A SYSTEMIC TRANSFORMATION

A system is transformed when the type of system it is thought to be is changed; for example, from a deterministic or animate system to a social system. As such it is a part of, and responsible for, the ecological systems that contain it. Therefore, a transformational leader is one who can produce, or encourage and facilitate the production of, a mobilizing vision of a transformed system. Equally important, the leader must be able to inspire and organize or have organized an effective pursuit of that vision and maintain it even when sacrifices are required.

The transformation to a social-systemically conceptualized and managed corporation requires a number of fundamental changes including the following: First,

because most employees in corporations today can do their jobs better than their bosses can, the traditional notion of supervision must be altered. Instead, their bosses have a responsibility for creating working conditions under which their subordinates function as well as they know how. This requires that their subordinates have a great deal more freedom to work as they want than they have had up to now.

Second, leaders have an obligation to enable their subordinates to do better tomorrow than the best they can do today; that is, to provide them with opportunities for continuous development through on- and off-the-job education and training.

Third, managers should manage the interactions (not the actions) of their subordinates and the unit managed with other internal and external units so as to maximize their contribution to the organization as a whole.

These three requirements are best met in a democratic corporation (Ackoff, 1994, Chapter 4), one in which (1) all stakeholders can participate directly or indirectly (through elected representatives) in making decisions that affect them, and (2) in which every one with authority over others individually is subject to their collective authority. Without the support of his/her subordinates, peers and superiors, no one can manage effectively.

Fourth, internal units that supply products or provide service to other internal units must be as efficient and responsive as possible to those they serve. This can only be done by making these internal sources compete against external sources of supply or service; that is, to operate within an internal market economy (Ackoff, 1994, Chapter 5). This precludes both internal bureaucratic monopolies and the need for benchmarking. It also eliminates the generation of "make work" and the excess personnel associated with it which has led to downsizing.

Fifth, the organization's structure should be such that it is ready, willing, and able to change rapidly and effectively. Traditional tree-like hierarchies cannot do this. Several alternatives that can come closer to providing the flexibility required including networks, and horizontal, matrix and multidimensional organizations (Ackoff, 1994, Chapter 6).

Finally, the organization must be capable of rapid learning and adaptation. All learning derives from experience, our own and others'. Mistakes are the ultimate source of learning which occurs when they are identified, diagnosed and corrected. Facilitation of these processes requires creation of a learning-adaptation support system, one that identifies early errors in expectations, assumptions, and predictions and corrects strategies, tactics and operations appropriately. Learning effectively from others requires creation of a culture in which constructive conversation and discussion is continuous.

The transformation of a corporation from an organismic to a social system is only one kind of transformation through which it can be put. However, in the current environment - characterized by an increasing rate of change, interdependence,

complexity, production and dependence on knowledge and information, global competition, and so on - there is no other type of transformation that can bring about the necessary focus on employees, customers, and the other corporate stakeholders. A corporation that fails to see itself as an instrument of all its stakeholders will probably fail to use, and be used by, them effectively enough to survive in the new environment.

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TABLE 1. TYPES OF SYSTEMS

Type of System	Parts	Whole
Deterministic	Not Purposeful	Not Purposeful
Animated	Not Purposeful	Purposeful
Social	Purposeful	Purposeful
Ecological	Purposeful	Not Purposeful

Russell Ackoff Presentation

Systems Approach to Terrorism
Conference

July 15 -16, 2002

Our government's current policies and activities reveal a lack of understanding of both the causes of terrorism and the mind-set of terrorists.

The USA's position on terrorism is considered futile and of negative value by many experienced with terrorism abroad.

**For example: A professor in South Africa
And former student of mine (25 years ago) recently wrote :**

I have...followed the USA response to this problem with alarm. There is no way you (USA) will succeed in getting rid of this problem with all the military might, financial might, and various responses I have seen so far. It will take a long time, because USA is big and strong, but you cannot win this, in the sense that the terrorists will be defeated. I grew up in a society structured around terrorism, I have seen this in my own and other countries:

**You will not overcome this ... unless
there is a culture and value shift of
enormous magnitude. You will contain
it for short periods, but “getting rid of it”
requires to rethink your society....**

Johan P. Stumpfer

**I hope here to initiate some such
rethinking.**

**I begin with the nature
of “fundamentalism.”**

Those who cannot cope with change effectively — with chaos and complexity — either try

- **to prevent it (*conservatives*),**
- **to unmake it (*reactionaries*), or**
- **to make disjointed incremental adaptive changes to relatively limited aspects of the real world (*liberals*)**

Some reactionaries seek generalized ways to unmake or suppress change, real or imagined, and agents of change, real or imagined.

Such reactionaries become fundamentalists.

Fundamentalism

is a response to an inability to deal with an environment that is undergoing an accelerating rate of change and rapidly increasing complexity - a *turbulent* environment, one characterized by uncertainty and unpredictability.

It does so by accepting a *fixed* set of beliefs about what are acceptable ends and means, and what are meaningful questions and answers to them.

**Fundamentalism is an effort to find
a static equilibrium in a dynamic
environment:**

**to fly through a storm on automatic
pilot.**

To fundamentalists

the “good” requires strict adherence to basic principles and doctrines promulgated to disciples by gurus.

No exceptions are allowed; no transgression is tolerated.

Fundamentalism ends the need for thought, hence dialogue.

There are two types of fundamentalist:

introverted

and

extroverted.

Introverted fundamentalists

- seek isolation from the rest of society, want to be left alone.

For example:

the Mennonites and Mount Carmelite nuns.

Extroverted fundamentalists

consider those who do not accept their doctrines either to be targets for conversion or enemies who obstruct their pursuit of their conception of “the good.”

Therefore, suppression or elimination of their enemies is taken to be necessary.

**Fundamentalists who are willing to use
violence to accomplish their objectives
are *terrorists*.**

**Few fundamentalists are terrorists, but
virtually all terrorists are
fundamentalists.**

To reduce or eliminate terrorism we must enable extroverted fundamentalists to deal with their turbulent environments effectively.

This requires providing them with the knowledge and resources required to achieve what is to them an acceptable standard of living and quality of work life.

As Johan Strumpfer wrote to me:

There is simply too much inequity in the living standards of the 3rd world people, and there are too many of them, for these forces to leave USA and Europe unscathed. If you (USA) do not want to hear this, the the opportunistic forces (terrorists) will exploit it and force the American society to listen.... So the mind-shift that is required is in the first place to see yourself for what you are, and start there.

The shift in mind set that is required involves realization that the inequitable distribution of wealth and opportunity that our policies and activities support and create must change;

and that organizations such as the IMF and World Bank act in ways that preserve all that is wrong in our policies and activities.

**Our policies and behavior, and those
of our allies in the “war against
terrorism” must be changed in five
ways:**

One:

Make available to disadvantaged nations and communities an amount of money and other resources to be used only for development of its members, that is, for increasing their ability to satisfy their needs and legitimate desires and those of others. A *legitimate desire* is one the fulfillment of which does not decrease the ability of any other to satisfy their needs and legitimate desires.

Two:

the funds may only be used in ways determined democratically, that is, by decisions made either by those affected by them, their elected representatives, or elected guardians or advocates of those who are incapable of such participation (e.g., children, the mentally ill, and future generations).

Three:

**Corruption must be excluded from
the handling of the funds and other
resources provided.**

Four:

experts are available to assist
decision makers and those
responsible for implementing
decisions *in any way they desire.*

Five:

Compliance with the four conditions set forth is monitored by a group whose members are agreed to by both the providers of the aid and its recipients.

**These conditions have been met
successfully in a number of
smaller-than-national
disadvantaged communities**

TRANSFORMING THE SYSTEMS MOVEMENT

Russell L. Ackoff

The situation the world is in is a *mess*. This hardly requires documentation; it's obvious. Furthermore, as Leslie Gelb observed (1991), the prospects for improvement are not promising:

...the emerging world requires a new foreign policy agenda, and fresh faces to execute that agenda. The trouble is, the same old "experts" are still running foreign policy and most of them only dimly understand the world they preside over. Indeed, few people today, in or out of Government, have the background and skills to grasp, let alone direct, the new agenda. (p. 50)

Reform will not do it; transformations are required, two kinds. First a transformation of the way nations and international institutions handle global affairs and second, a transformation in the way systems thinkers collectively

conduct the systems movement. The second must come first if we hope to have any effect on the global mess.

Reformations and transformations are not the same thing. Reformations are concerned with changing the means systems employ to pursue their objectives. Transformations involve changes in the objectives they pursue. Peter Drucker put this distinction dramatically when he said there is a difference between doing things right (the intent of reformations) and doing the right thing (the intent of transformations).

The righter we do the wrong thing, the wronger we become. When we make a mistake doing the wrong thing and correct it, we become wronger. When we make a mistake doing the right thing and correct it, we become righter. Therefore, it is better to do the right thing wrong than the wrong thing right. This is very significant because almost every problem confronting our society is a result of the fact that our public policy makers are doing the wrong things and are trying to do them righter. Consider a few examples.

The United States has a higher percentage of its population in prison than any other country, and simultaneously has the highest crime rate. We have more people in prison than are attending college and universities, and it cost more per year to incarcerate them than to educate them. Something is fundamentally wrong.

Most who are imprisoned are subsequently released. As criminologists have shown those released have a higher probability of committing a crime when they come out than when they went in, and it is likely to be a more serious crime. Prison is a school for learning criminality, not a correctional institution.

In quality the health care system of the United States is ranked 37th by the World Health Organization. We are the only developed country without universal coverage; about 42 million people in our country have no health care assured. Moreover, study after study has shown that much of the need for the care that is provided is created by the care that is given; excess surgery, incorrect diagnoses, wrong drugs prescribed or administered, unnecessary tests. The fact is that the so-called health care system can survive only as long as there are people who are sick or disabled. Therefore, whatever the intent of its servers, the system can

only assure its survival by creating and preserving illness and disability. We have a self-maintaining sickness- and disability-care system, not a health care system.

The objectives that must be changed in transformations are not usually those that are proclaimed; rather they are the one actually pursued. For example, most corporation proclaim maximization of shareholder value as their primary objective. Any objective observer of corporate behavior knows that this is an illusion. As a study conducted a while back at GE showed, the principal objective of corporations is to maximize the security, standard of living, and quality of life of those making the decisions. Recent disclosures at Enron and WorldCom, among others, made this abundantly clear.

A similar discrepancy between objective proclaimed and objective practiced can be observed in most organizations. For example, one could mistakenly believe that the principal objective of universities is to educate students. What a myth! The principal objective of a university is to provide job security and increase the standard of living and quality of life of those members of the faculty and administration who make the critical decisions. Teaching is a price faculty members must pay to share in the benefits provided. Like any price, they try to minimize it. Note that the more senior and politically powerful teaching members of the faculty are, the less teaching they do.

Transformations not only require recognition of the difference between what is practiced and what is preached — a transformation called for years ago by Donald Schon (1971) — it also requires a transformation in the way we think. Einstein put it powerfully and succinctly:

Without changing our patterns of thought we will not be able to solve the problems we created with our current patterns of thought.

I believe the pattern of thought that is required is systemic. It is difficult if at all possible to reduce the meaning of "systemic thinking" to a brief definition. Nevertheless, I try.

Systemic thinking is holistic versus reductionistic thinking, synthetic versus analytic. Reductionistic and analytic thinking derives properties of wholes from the properties of their parts. Holistic and synthetic thinking derive properties of parts from properties of the whole that contains them. The creation of the department of Homeland Security is a prime example of reductionistic and analytical thinking; the whole formed by the aggregation of existing parts. In contrast, when an architect designs a house he first sketches the house as a whole and then puts rooms into it. The principal criterion he employs in evaluating a room is what effect it has on the whole. He is even willing to make a room worse if doing so will make the house better.

In general, those who make public policy and engage in public decision making do not understand that improvement in the performance of parts of a system taken separately may not, and usually does not, improve performance of the system as a whole. In fact, it may make system performance worse or even destroy it.

We have not effectively communicated such thoughts to public policy and decision makers. What should we be communicating to them that would, if heeded, transform our global society into one that is just and equitable, one that would reduce if not eliminate the maldistribution of wealth, quality of life, and opportunity? In other words: what should we communicate and be doing that could promote development of the world and its parts by changing the way public policies and decisions are made?

Up to now, those of us in systems have had little or no effect on the global mess. Nevertheless, I believe there is a role that we could play in the dissolution of this mess. What and how might we contribute to its dissolution?

I think we can contribute by making public policy and decision makers aware of ideas and concepts that would enable them to think more creatively and effectively about the mess the world is in. Here I discuss only a few systemic ideas and processes that I wish they understood. There are many others but I would settle for their grasping this much.

The ideas and concepts I identify here are familiar to most systems thinkers even if they would express them differently. I include them here not to inform them but to call their attention to aspects of systems thinking that I believe they should communicate to public policy and decision makers.

DEVELOPMENT VERSUS GROWTH

I hope we can help public policy and decision makers realize that development and growth are not the same thing. Neither presupposes the other. Rubbish heaps grow but do not develop. Einstein continued to develop long after he stopped growing. Some nations grow larger without developing. and others develop without growing.

Growth is an increase in size or number. *Development is an increase in competence*, the ability to satisfy ones needs and desires and those of others. Growth is a matter of *earning*; development is a matter of *learning*. Standard of living is an index of national growth; quality of life is an index of its development. Development is not a matter of how much one has but how much one can do with

whatever one has. This is why Robinson Crusoe is a better model of development than J. Pierpont Morgan.

The quality of life that an individual or group can achieve obviously depends on both their competence and their wealth. Of two societies with the same level of competence the one with the most wealth can achieve the higher quality of life. But of two societies with the same resources, the one with the greater competence can achieve a higher quality of life.

Because development is a matter of learning, one cannot do it for another. The only kind of development possible is self-development. However, one can facilitate the development of another by encouraging and supporting their learning. Nations must stop acting as though they can solve other nations' problems. Nations, like individuals, learn less from the successes of others than from their own mistakes.

One never learns from doing things right because, obviously, one already knows how to do it. What one derives from doing something right is confirmation of what one already knows. This has value, but it is not learning. *One can only learn from mistakes*, by identifying and correcting them. But all through school and in most places of employment we are taught that making mistakes is a bad thing. Therefore, we try to hide or deny those we make. To the extent we succeed, we preclude learning

Furthermore, there are two types of mistakes: *errors of commission*, doing something we should not have done; and *errors of omission*, not doing something we should have done. Examination of the failures or crises that organizations and institutions have experienced reveals that errors of omission are the more serious. For example, In the latter part of the last century IBM got into serious trouble

because it failed to pay attention to the development of small computers, and Kodak got into its current trouble for failing to focus on the development of digital photography until others had successfully staked a claim to it.

Our public and private accounting systems record only the less important type of mistake, errors of commission. Therefore, for executives who want to maximize their job security in a public or private organization that deprecates mistakes and ignores errors of omission, the best strategy is to do nothing or as little as possible. This is the root of the conservatism that permeates the world today.

This nation, I believe, has never had an administration as reluctant to acknowledge its errors as the one currently in office. Because of this it has precluded the possibility of its learning.

We need to learn a great deal more about learning. Our schools at all levels are devoted more to teaching than to learning. For example, it is apparent to anyone who has taught others that the teacher learns more than the students do. Teaching is a much better way to learn than being taught. Schools are upside down. Students ought to be teaching and faculty members should be learning how to help others learn and how to motivate them to do so.

A student once stopped me in the hall and asked, "Professor, when did you teach your first class?" That was easy: I answered, "September of 1941." "Wow!" he said, "You have been teaching for a very long time." I agreed. Then he asked, "When was the last time you taught a course in a subject that existed when you were a student?" This question required some thought but finally I got it. and answered, "September of 1951." He said, "Do mean to say that everything you have taught for about fifty years you had to learn without having it taught to you?" I said, "Yes." "Wow," he said again. "Your must be a pretty good learner." I

modestly agreed. He continued, "What a pity you are not that good a teacher." He had it right: faculty members know how to learn better than they know how to teach. Therefore, they should be acting as resources to students who are either engaged in teaching others, or learning on their own or with others cooperatively.

One of the great gifts I received from West Churchman, whose life we will remember and celebrate tonight, is that he let me go through graduate school teaching most of the courses I needed to take for graduation.

Democracy has to be learned. It cannot be imposed on others. It must be learned by experiencing it. It does not come to us naturally. All of us are brought up by adults who, even in permissive families, are authorities who control us or set limits within which we have freedom. In effect, we are raised in autocratic structures however benevolent they may be. Therefore, in a sense autocracy is more natural than democracy.

I was once involved in a project in Mexico which taught me how democracy could be learned. A group of us from several Mexican universities and a government agency were able to make available to a very remote Indian village in the Sierra Madras Mountains a substantial sum of money the village could use for its development. It alone had to make the decisions as to how to use the money but it had to make these decisions democratically. The only power the team of which I was a part had was to veto any decisions not made democratically and which did not involve development. Town meetings were initiated in the square in the center of the village, and after a series of tries the village members learned how to make decisions democratically. They also learned the difference between development and welfare.

HOW DO WE HAVE TO CHANGE OURSELVES?

... man has been able to grow enthusiastic over his vision of ... unconvincing enterprises. He has pit himself to work for the sake of an idea, seeking by magnificent exertions to arrive at the incredible. And in the end, he has arrived there. Beyond all doubt it is one of the vital sources of man's power, to be thus able to kindle enthusiasm from the mere glimmer of something improbable, difficult, remote. (1966,p.1)

Now, what might the systems community do about the deficiencies I have discussed? Clearly we must learn how through communication to make public policy and decision makers aware of these deficiencies and what to do about them. We are not doing so now. Most of our communication is addressed to each other, not to public policy and decision makers. Our communication is based on our needs not those of others. With the intent of changing this I have several proposals.

First, our principal professional organization, the International Federation for Systems Research, should publish a journal addressed to public policy and decision makers who can affect the global mess. Through expository articles and case studies the journal should help them come to understand systems thinking and its use in their work. It should be distributed to them at no cost. The Federation should cover the cost, if necessary by voluntary contributions of its members.

The Journal, possibly called *Systems Thinking in Public Affairs*, should be supplemented by at least one conference per year held at a site at which a major multigovernmental institution is located. Public policy and decision makers should be invited mostly to discuss their problems and listen to unconventional systemic approaches to them.

In addition, those of us who think of ourselves as system thinkers should contribute to those publications that are read by those in public life whom we want to affect. We should also try to make presentations at conferences they attend. Our professional societies should make it their responsibility to facilitate such participation by informing us of relevant opportunities and, where possible, by arranging jointly sponsored meetings.

Finally, we should engage in assisting development efforts of less developed countries, regions, communities, and neighborhoods. This does not mean imposing our solutions on them but assisting them in implementing their proposed solutions to their problems, even if they are wrong. They can develop more by making their own mistakes than by imitating our successes.

Systems thinking produces radical and potentially revolutionary visions of public institutions. Nothing short of such visions can transform the state of world affairs. I believe we have an obligation to the global society of which we are a part to make every possible effort to bring about a radical transformation of that society into one in which our children do not have to contend with the mess we have created and are exacerbating.

* •

For an effort to redesign our society and its major institutions, see *Redesign Society* by Russell L. Ackoff and Sheldon Rovin, Stanford University Press, Stanford, California, 2003.

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A LITTLE BOOK OF ***f*-LAWS**

13 common sins of management

RUSSELL L. ACKOFF
& HERBERT J. ADDISON

with considered responses by
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Frequently Asked Questions

What are f-Laws?

They're truths about organizations that we might wish to deny or ignore - simple and more reliable guides to managers' everyday behaviour than the complex truths proposed by scientists, economists and philosophers.

How many are there?

Over 100. We've selected just 13 from **Management f-Laws: How organizations really work**. This selection is designed to whet your appetite and get you thinking about the often-unacknowledged realities of organizations: what really motivates managers; why are companies run the way they are; how come they don't work better...?

Why the conversation?

When American management guru, Russell Ackoff, and his co-author, Herbert Addison showed us their *f-Laws*, we asked British author, Sally Bibb, to respond in the light of current organizational thinking and best practice. Sally's is a voice from another generation, another gender and another continent. On every left-hand page we've printed Ackoff and Addison's *f-Law* with their commentary. Opposite, you'll find Sally Bibb's reply. In each case, we've retained their spelling, punctuation and 'voice'.

What do you mean by 'the best' organizations?

Sally looks always at how things can be done better. When she talks about 'the best' organizations, she's talking about ones that strive to be:
Collaborative ~ Ethical ~ Flexible ~ Innovative ~ Responsible
~ Sustainable ~ Transparent ~ Trustworthy.

The lower the rank of managers, the more they know about fewer things. The higher the rank of managers, the less they know about many things

Executives make mountains out of molehills; subordinates make molehills out of mountains.

The relationship between executives and subordinates is complementary: neither knows why the other does what they do, nor cares about it. This leaves a large black hole between them into which most important issues and communications fall, lost and, like Clementine, gone forever.

The reason for this state of affairs is that executives are busy asserting their power and their staff are busy trying to impress. So much energy goes into the 'game'. Rarely do bosses and their staff stop and think 'what is our purpose here?' If they asked that question, answered it and acted on the answer then the black hole would disappear.

Why don't they do this? On the bosses' part, it's fear of losing control. On the subordinates' part, it's fear of getting it wrong.

The result: ineffectiveness and a stifling of creativity.

Antidote: Focus on the questions: 'what are we trying to achieve?' and 'how can we support each other?'

Easier route: hire confident people (I mean truly confident people not those who wear it as a mask to hide their insecurity) whose disposition is to be collaborative, who don't need to prove themselves and who are mature enough to say that they don't know, and so ask for help.

The best organizations provide the environment in which collaboration can flourish. Confident, competent people at all levels who share common goals relish collaboration and are open to filling in the 'gaps' in each others' knowledge.

Managers who don't know how to measure what they want settle for wanting what they can measure

For example, those who want a high quality of work life but don't know how to measure it, often settle for wanting a high standard of living because they *can* measure it. The tragedy is that they come to believe that quality of life and standard of living are the same thing. The fact is that further increases to an already high standard of living often reduce quality of life.

Unfortunately and similarly, the (unmeasurable) quality of products or services is taken to be proportional to their (measurable) price. The price of a product or service, however, is usually proportional to the cost of producing it, not to its quality; and this cost tends to be proportional to the relative incompetence of the organization that produces it.

Like economists, managers place no value on work they do not pay for because they can't measure it. Work that has no quantifiable output includes some of the most important work that is done, for example, raising children and maintaining a home. On the other hand, economists place a high value on work that destroys value, because the cost of such work can be measured. Hence the paradox: a prolonged war is a very good way of raising gross national product but reducing quality of life.

When it comes to life goals it's even more basic than that. Managers don't know what they want because they never think about it. One executive told his psychotherapist he was depressed because he felt he wasn't successful. To the therapist he looked successful: good job, great salary, lovely family and beautiful home. She asked how he would know when he was successful. He couldn't answer. He just kept on striving without knowing what he was striving for.

But I agree that, if they get as far as measuring, the measurement is usually quantitative and limited to how much they earn. Certainly the more they earn and the more their standard of living rises the more their quality of life drops. They become trapped by golden handcuffs.

In the workplace it's also true that managers will measure anything that can be quantified in order to be able to set targets. Training is a great example. Many companies measure numbers of days training and numbers of people trained. If the goal is to do lots of training then that's a good measurement. But the goal *ought* to be to develop the workforce to become more skilled. The best organizations explicitly develop employees to fulfil their potential and even advise them on finding jobs outside the organization, if that's what it takes. Measuring skills is harder. It takes time and commitment and, often, the value of training cannot be quantified. How astonishing that such 'input' measures continue to be accepted as valid even though they are value-less.

There is nothing that a manager wants done that educated subordinates cannot undo

The basis of this *f*-Law is as follows: the more *power-over* educated subordinates that managers exercise, the less is their *power-to* get them to do what they want them to.

Power-over is the ability to reward or punish subordinates for meeting or missing their boss's expectations. *Power-to* is the ability to induce them to do willingly what the boss wants them to. Therefore, the ultimate source of *power-over* is physical or economic, but the ultimate source of *power-to* is intelligence.

The effectiveness of *power-over* decreases as the educational level of subordinates increases. It becomes negative when the educational level of the subordinates is higher than that of their bosses.

The exercise of authority is necessary for getting a job done by those who do not know how to do it, as, for example, in using aborigines to build a house. For those who know how to do it, the intervention of authority is an obstruction to getting it done, as, for example, in telling a plumber how to fix a leak.

Power-to also relies hugely on emotional investment. For followers to want to follow they have to feel some sort of emotional connection: loyalty, personal devotion to the vision, a genuine liking of the leader. Any or all of these will do.

It's hard to control any group of employees who are determined not to be controlled. Education sometimes plays a part but not always. However, I've seen many educated employees who have given in to authority for many different reasons. Education, of itself, does not equal the ability to resist unreasonable exertions of power nor the wherewithal to stand up for oneself or one's rights.

The down side is that subordinates who want to resist authority tend to do so in indirect and wily ways. Their ways of protesting tend also to be indirect. This is dangerous for bosses because it means that they may think that they are getting cooperation when actually their subordinates are passively resisting.

The less sure managers are of their opinions, the more vigorously they defend them

Managers do not waste their time defending beliefs they hold strongly - they just assert them. Nor do they bother to refute what they strongly believe is false. For example, they would not defend the statement 'It is necessary for the company to make a profit', or refute the statement, 'It is not necessary for the company to make a profit'. To most managers the former statement is obviously true and the latter obviously false, hence neither requires defense.

Managers consider it futile to argue with those who do not accept what they consider to be obvious. But if one of their opinions of which they are not certain is attacked, they leap to its defense; for example, 'Downsizing is necessary for corporate survival'. It follows from this that a heresy is punished severely only when it involves beliefs that cannot be proven to be either true or false. Religion harbors the largest number of such beliefs. This is why religions experience more heresy than any other social institution. Management handles heretics more humanely than religious institutions. It does not burn them; it fires them.

OK, but only the insecure ones do this. Let's focus on the opposite end of the spectrum too. Good managers are confident in what they know and what they don't know. They actively seek others' help and advice about what they don't know, and they listen to that advice. They're prepared to admit when they're wrong and they're prepared to alter their opinions. If they think they're right they don't mind being challenged and they're prepared to explain and justify their opinion.

Of course this type of manager is rare because it requires putting the ego to one side. Something that most find tough. They would rather be right than effective!

The extraordinary thing is the transformation that can take place when a good manager arrives on the scene. The working atmosphere changes. Staff feel free to say what they think, to express ideas, to voice criticisms and to ask for change. The tone of meetings changes. Work improves. People get on together and work more cooperatively. It's the cheapest and fastest way to bring about a real change in the organization's culture.

The more time managers spend trying to get rid of what they *don't* want, the less likely they are to get what they *do* want

When one gets rid of what one does not want, one is likely to get something one wants even less. For example, getting rid of a television program by changing the channel often yields a program that one wants even less. When DDT was used to get rid of pests it harmed things we did not want to get rid of. Prohibition gave a stimulus to organized crime that was more harmful to society than abuse of alcohol.

The US has the highest percentage of its population in prison and one of the highest crime rates in the world. In a national effort to get rid of crime we intensify our efforts to catch criminals and throw them in prison. Nevertheless, studies have shown that a prisoner released after serving his/her sentence is more likely to commit a crime when released from prison than when he or she went in, and the crime is likely to be more serious.

It is more difficult to define what we want than what we do not want. Nevertheless, a 'getting rid of' strategy is a cop out. Great gains are seldom made easily. Therefore, it is important for managers to know what they would have if they could have whatever they wanted. The best way is to use idealized design. This involves redesigning the organization on the assumption that it was destroyed last night. The only constraints are that the design must be technologically feasible (no science fiction) and able to survive in the current environment. The most effective way of creating the future is by closing or reducing the gap between the current state and the idealized design.

In my view, getting rid of what we don't want *is* an important part of any effective strategy for getting what we want in life in general. In getting what we want, we are often held back by the things we don't want. They drag our attention and energy back. Of course, finding out what we *do* want is crucial too. It's a sequence thing.

A classic example of the problem in organizations is in the area of training and development. Companies spend a lot of time and training budget trying to fix people's weaknesses – trying to make good all-rounders out of all their managers, for example. But most people have neither the aptitude nor the motivation to do everything equally well. It's far more effective to spend time focusing on developing what people are already good at and motivated to do. It's even more effective to select the right people in the first place. And, yes, that means knowing what you want at the outset.

A bureaucrat is one who has the power to say 'no' but none to say 'yes'

Bureaucrats can find an infinite number of reasons for rejecting any proposed change, but can find none for accepting it. Since they cannot say 'yes', if they want to have a proposal accepted, they must pass it on to someone of higher rank. But to do this is to acknowledge a limit to their importance and, therefore, to lose face. Their self-esteem is directly proportional to the number of times they say 'no', and inversely proportional to the number of times they say 'yes'.

In a bureaucracy a 'no' cannot lead to what is considered to be an error, only a 'yes' can do that. Therefore, within a bureaucracy doing as little as possible is the best strategy for avoiding detectable errors.

Maybe also it gives them more of a feeling of power to stop something happening than to allow it. There are two pressures being exerted here. One is external – the bureaucracy within which they work. The expectation of a bureaucracy is that people will toe the line and follow the rules. The second is internal. It may be insecurity that causes them to want to wield power over others; it may be that they don't feel confident taking the risks involved in giving permission for something that those above them may not approve of. Each of these factors feeds the other and reinforces the unproductive nature of a bureaucracy. The best organizations aim to remove the expectation of compliance and eliminate the fear of getting things wrong.

There are obvious bureaucracies – in Britain some Civil Service organizations breed rule-followers. But this type of organisation is what it is and there is an honesty and acceptance about what it is and the limitations that come from that. What's more, everyone knows that Civil Service organizations are bureaucratic – even the people who work in them.

The *really* worrying organization is one that thinks it's something else - the bureaucracy *in disguise*. There are entire organizations that fit this description and others where parts of them are run as stifling bureaucratic systems. These organizations with a deluded sense of what they are really *are* in danger. Because without this recognition they will never be able to change the parts that are holding them back.

The legibility of a male manager's handwriting is in inverse proportion to his seniority

The less legible a male manager's signature is, the higher his rank and the more education he has had.

Female managers are genetically incapable of writing illegibly unless they are physicians. The illegibility of physicians' handwriting is the standard to which all other professionals, including managers, aspire. Illegibility of prescriptions prepared by doctors is responsible for the requirement imposed on pharmacists that they become psychics capable of reading the minds of physicians. The illegibility of handwritten memos from executives is similarly responsible for a similar requirement imposed on their secretaries.

Those managers who have not learned how to write illegibly can nevertheless accomplish the same thing by resorting to obscurity. Computers may help reduce illegibility but they have no effect on obscurity.

The illegible and obscure writings of managers hide what they know (if anything). The illegible and obscure writings of management educators hide what they don't know.

Maybe we should use graphology more. The French swear by it. That way there is no hiding place.

Otherwise, let's promote more women. We are generally much more open, transparent, honest and happy to stand up and be counted. Funny, but these are all characteristics of good leaders too. Men (and bad leaders) spend too much energy on politics, spin, making things look good, or trying to obscure things that are not favourable.

It's changing a little but men of my father's generation were brought up believing that they had to be strong, know all the answers, not show weaknesses and be better than other men. No wonder businesses run by these characters are in such a state: when in doubt, they blag it.

Legibility, rank and sex go together but if it's a man-thing, bring on the women.

The less important an issue is, the more time managers spend discussing it

More time is spent on small talk than is spent on large talk. Most talk is about what matters least. What matters least is what most of us know most about. The more something matters, the less we know about it.

Everyone is an expert on trivia. So everyone can discuss trivialities with equal authority and at great length. This is not true with important issues on which there are alleged experts. Experts, those who know a great deal about a subject, tend to limit discussion to what they know about it. Their authority is vulnerable to new ideas, which, of course, seldom come from other experts, but from non-experts whom experts try to exclude from the discussion.

Experts seldom accept any responsibility for errors resulting from following their advice. However, they accept full responsibility for any successes that result from following their advice, however remote the connection.

This is a serious organizational malaise. Managers feel comfortable discussing trivial issues because there's less at stake. Important issues cause trouble because discussions about them can lead to people taking difficult decisions.

Difficult issues don't usually need experts to solve them. They need willing people to try to understand, evaluate, make a decision and then *do* something. This is risky.

The more difficult the issue the more likely it is that there isn't one right answer. Managers prefer it when there is only one right answer because it lessens the risk of making a mistake. Difficult issues are often also problems whose solution is a journey not a destination. You can start solving the problem only to find that it's not working out as you wanted. Then you need to change course. Many managers would rather *die* than change course. Sometimes there can be overwhelming evidence that the original decision wasn't the best one and that something else needs doing. Some managers see that as having to admit that they were wrong, which they were. They see something wrong in admitting they were wrong. In fact, it's a really valuable thing to do.

In the best organizations, people have no qualms about changing course or admitting that they were wrong. Their aim is to resolve an issue.

When Edison invented the light bulb it took thousands of attempts. He saw each one as increasing his understanding of what didn't work. He didn't see them as failures.

The more important the problem a manager asks consultants for help on, the less useful and more costly their solutions are likely to be

Consultants begin their engagements by gathering very large amounts of data, much more than can be transformed into useful information. No wonder! Their fees are proportional to the amount of time they devote to a problem, not to the amount of good that they do.

The most successful consultants are the ones who are smart enough to see what managers want and give it to them after an extended effort, and do so in long, impressively formatted reports. They provide sanctions for a fee.

The principal finding obtained by all studies conducted by consultants, regardless of the issues involved, is the need for more study. The success of a consultant's effort is not measured by the amount of good it does for the client, but the amount of good it does for the consultant.

It's astonishing that, in these days of obsession with return on investment, consultants are not held to account more than they are. There are three reasons for this:

1. Executives are seduced by data – the more they have, even if it's useless, the more it makes them feel in control.
2. The CEO or someone else very senior usually hires the expensive consultants. Who is going to challenge the CEO's decision?
3. Consultants set themselves up as experts. This provides the executive with another hiding place. "If the expert says so who am I to disagree?"

Consultants - unlike the rest of us - do indeed manage to escape being accountable. The higher their fee, the less accountable they become. The more complex and costly their solutions, the more unlikely it is that they'll be challenged.

Who's going to want to point out that some senior executive's decision to hire consultants has been a huge waste of money?

The best organizations, by the way, are more likely to use internal consultants, form employee problem-solving teams or hire customers and suppliers to solve problems for them.

Managers cannot learn from doing things right, only from doing them wrong

Doing something right can only confirm what one already knows or believes; one cannot learn from it. However, one can learn from making mistakes, by identifying and correcting them. Nevertheless, making a mistake is frowned upon in most organizations, from school on up, and often is punishable. To the extent that recognition of mistakes is suppressed, so is learning.

There are two types of mistakes. Errors of commission consist of doing something that *should not* have been done. Errors of omission consist of not doing something that *should* have been done. Errors of omission are more serious than errors of commission because, among other reasons, they are often impossible or very difficult to correct. They are lost opportunities that can never be retrieved.

Organizations fail more often because of what they have not done than because of what they have done. (Similarly, it is worse to deny a truth than accept a falsehood.) But errors of omission are seldom recorded and accounted for. So, executives who cannot get away unpunished for doing something they should not have done, can usually get away with not doing something they should have done. Since errors of commission are the only type of mistake accounted for, a security-seeking manager's optimal strategy is to avoid such errors by doing as little as possible, including nothing. The most successful executives are those who can create the appearance of doing a great deal without doing anything. Herein lies the root of an organization's disinclination to change.

We come back to the key to successful organizations: the ability and willingness to learn. Big leaps in growth and learning are accompanied by difficulty and pain. That's as true for individuals as it is for corporations. We don't tend to learn when we are toddling happily along. There is no reason for us to.

The opportunity for real and useful learning comes in the face of adversity. Some choose to take that opportunity; some don't. The latter keep on repeating the same mistakes their life over. For them, there is no chance of change as much as they say they want it. The same is true for organizations.

When people are good at something and you ask them how they do it they often cannot answer. That's because they are *unconsciously* competent and cannot dissect what makes them good. The people who achieve real mastery at something know what it is that makes them so good. *Think sportsmen*. They learn from their own failures as well as their successes. They are consciously competent.

If managers became consciously competent then they too could learn from doing things right as well as doing things wrong. This would be a real competitive edge.

The amount of irrationality that executives attribute to others is directly proportional to their own

Executives almost always consider themselves to be rational. But they tend to consider all those - subordinates, competitors, suppliers, customers - who disagree with them on any issue to be irrational. This *is* irrational.

For example, executives of a foundation that supported family planning efforts in developing countries considered the large number of children produced per family in these countries to be irrational. The fact is that few of these countries provided any form of social security; therefore one could only survive the unemployment that inevitably came with age if one had enough children to provide financial support. To try to convince those with no access to social security and insufficient income to provide it for themselves, to have fewer children is to ask them to commit a delayed suicide. Now who is irrational?

In an organization, problems created by the behavior of others cannot be solved by assuming them to be irrational. They can only be solved by assuming the others are rational, finding the point of view that makes them so, and addressing that rationally. The first detergent on the market failed despite its superior cleaning power. Attributing this to the irrationality of the housewife led nowhere. But assuming she was rational and trying to find its basis revealed that she estimated the cleaning power of a product by the amount of suds it produced. The original detergent produced none. *Tide* then came onto the market producing suds and success.

The problem isn't that irrational managers accuse others of being irrational, it's that they don't have the skills needed to listen to, and understand, other peoples' point of view. Had the soap powder executives found what the housewives really wanted they wouldn't have provided something that didn't hit the spot. It's a basic but common mistake. Managers either assume that others think the same way as they do or they're not really interested in finding out.

In sales or marketing it's really important to listen and to understand your customers' needs. If you don't, you're unlikely to get the business. I've been shocked that many sales people can't do this. They listen for just long enough to get what they think is a buying signal and start talking about their products. Real listening and the desire to understand are critically important for businesses. Lots don't realise it - few do it well.

Listening is different to hearing. Good communicators assume they *don't* necessarily know what people mean. For example, if a customer says he wants an easy-to-use mobile phone we have to find out what he means by easy-to-use; his definition may be very different from ours. If we *do* find out then we've listened and are much less likely to judge him to be irrational. We can also make the kind of phone he wants.

The best managers are genuinely interested in finding out what other people think and have superb listening skills.

There is no point in asking consumers - who do not know what they want - to say what they want

Many new product and service introductions have been disastrous despite the extensive surveys conducted to show that there is consumer interest in, and intention to buy, such a product or service. These surveys have incorrectly assumed that most consumers know what they want.

Consumers can discover what they want in products and services by designing them. It is in design that people find what they want. Furthermore, consumer involvement in product/service design almost always gets creative results.

Two examples. A group of men designing their ideal men's store discovered that they did not want the lowest price for clothing of a specified quality but the highest quality for a specified price. (They decided how much they were going to spend before going shopping.) Second, they wanted clothing arranged by size rather than type so they could go to one part of a store where all types of clothing in their size were gathered. (Because they disliked shopping, they waited until they wanted to buy several things before they went shopping.) Third, they wanted saleswomen, not salesmen, because they said 'You can't trust a man's opinion of how you look'. Finally, they wanted sales personnel to be available only when asked for.

Then, a group of airline passengers playing with a mock-up of an airplane's interior found out how to arrange the seats so each one was on an aisle, and do so without decreasing the number of seats or increasing the number of aisles.

It's astonishing that focus groups are still the method most organizations (including political parties, of course) use to determine what consumers want.

We know the problems:

- § Participants want to impress the people running the group, or to be liked by them
- § People's private intentions (never mind their publicly stated ones) seldom match the reality of their behaviour
- § Sometimes we lie to ourselves
- § We don't know ourselves as well as we think we do

The best organizations are starting to use customers in more and more creative ways – including asking them to design their products. Software companies have been using their best customers to beta-test products for years. Some organizations employ customers on part-time or short-term contracts. The best organizations go further and employ their most vociferous critics. Maybe this is the direction that political parties will go. Already in the UK, the leader of the Conservative Party has hired environmentalist Zac Goldsmith (and a natural enemy of the Tories) to lead his environmental policy group. This *ought to* work better than the Labour Party's endless focus groups.

Overheads, slides and power point projectors are *not* visual aids to managers. They transform managers into auditory aids to the visuals

Black, white and green boards and easels-and-pads are visual aids, but slide, overhead and power point projectors are not. They eliminate the need for the speaker to think while talking. The speaker is frequently viewed as an obstruction to reading what is projected.

In general, the more artistic projections are, the less significant is their content. Copies of slides or overheads distributed beforehand eliminate the need for members of the audience to pay attention to the speaker and remove any guilt they might feel by not doing so. This is not altered by the fact that the handouts are seldom used after the presentation. Their principal function is to provide evidence of attendance. They also provide those in the audience with something to occupy their minds while the speaker drones on.

In addition, a speaker who reads what is on the screen insults a literate audience unless he or she had the foresight to make the projections illegible or incomprehensible.

Agreed. PowerPoint is an overused tool. Instead of using it to enhance their presentations many managers use it as a crutch, a way to make sure they remember what they're going to say and a focal point that takes their audience's attention away from them.

If a presenter is skilled and persuasive it doesn't matter what type of visual aid he uses, he will influence the audience. If he isn't then he'll bore the audience no matter what he does.

Good presenters tell a story, using the Emotional Intelligence skills of empathy and affect to establish a rapport and build a connection with their audience. Before PowerPoint was invented people tried harder to develop these skills. Technology disables people and communication just as often as it enables them. Technology like PowerPoint helps managers forget that they are talking to human beings who actually need to be engaged and who listen more when they can respond emotionally to a presenter.

This is a reminder that the best organizations almost always put emphasis on interpersonal skills.

The Authors

Russell L. Ackoff is the Anheuser-Busch Emeritus Professor of Management Science at The Wharton School, University of Pennsylvania. He has written numerous books on Systems Management, the most recent of which are *Beating the System*, co-authored with Sheldon Rovin, *Re-Designing the Corporation*, *Ackoff's Best* and *Idealized Design*, co-authored with Jason Magidson and Herbert J. Addison. A founding member of the Institute of Management Sciences, his work in consulting and education has involved more than 350 corporations and 75 government agencies in the United States and beyond. Management grandee, he was ranked 26 in the most recent list of the world's most influential business thinkers.

Herbert J. Addison has worked for some 40 years in academic, educational and business book publishing, including for many years at Oxford University Press. He is the author of the business section in the 'New York Times Guide to Essential Knowledge' and is a close friend of Russ Ackoff.

Sally Bibb is Director of Group Sales Development for the Economist Group. She is based in London with responsibility for Europe, Asia and North America. She has specialised in organization and executive development for 15 years and has a Masters in Organizational Change. Co-author of the award-winning book *Trust Matters - for Organisational and Personal Success*, she is series editor for *The Truth about Business* and author of *The Stone Age Company*, the first title in the series.

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A major mistake that managers make

Russell L. Ackoff

All through school we are taught that making a mistake is a *bad thing*. We are downgraded for them. When we graduate and enter the real world and the organizations that occupy it, the aversion to mistakes continues. As a result one tries either to avoid them or, if one is made, to conceal it or transfer blame to another.

We pay a high price for this because one can only learn from mistakes; by identifying and correcting them.

... in business, if mistakes are made and laws are not broken, you rarely see any formal investigation. Even when the companies themselves look into what happened, they don't do it in a structured and rigorous way. They don't learn anything from the process. (Mittelstaedt, Jr., 2005)

One does not learn from doing something right; one already knows how to do it. By doing something right one gets confirmation of what one already knows but no new knowledge. The fact that schools are more interested in teaching than in learning is apparent from their failure to determine if students learn from their mistakes. Once they are graded based on the number of mistakes they make, the teacher presses on, does not check to determine whether the student has learned from the mistakes made.

Schools, including business schools, do not even reveal the fact that there are two kinds of mistakes.

Errors of commission: doing something that should not have been done.

Errors of omission: not doing something that should have been done.

Errors of omission, lost opportunities, are generally more critical than errors of commission. Organizations fail or decline more frequently because of what they did *not* do than because of what they did. For example, IBM ran into serious trouble several decades ago because it did not pursue development of the small computer. Eventually it woke up but never really caught up. Kodak was slow to get into digital photography and is paying a very high price for it today. Additional examples are cited by Mittelstaedt (2005): Coca Cola's "New Coke," Firestone's tire debacle, Intel's mishandling of its Pentium chip recall, American Express's failed blue card Optima launch and Webvan's ill-fated online grocery shopping experiment.

The type of accounting that all organizations use accounts for only the lesser important errors, those of commission. If something wrong is done, it eventually shows up in the books. For example, when Kodak bought Sterling Drugs and eventually had to sell it, the loss involved was conspicuous in its books. But errors of omission never appear "in the books." The fact that Kodak failed to acquire Xerox when it could have, never appears in its books.

The combined effect of these predispositions of schools and the organizations of which we are part is very costly. Most people are part of an organization that looks down on and censure mistakes. But the only kind of mistake their organizations take into account are errors of commission. Then, to avoid censure one must try to minimize such errors. This is accomplished when managers do as little as possible. This is seldom a decision made consciously; rather it is a culturally imposed disposition of which most are unconscious. It is the disposition to avoid making a mistake or to accepting responsibility for one that is made that makes

organizations averse to change to The cost of not changing is seldom taken into account.

Many years ago, when I was working on a project in one of the ten largest corporations in the United States, a senior vice president asked if I would be willing to give a course to 200 of the company's top executives on the frontiers of management thinking. I was more than willing to do so. He then explained that he wanted ten two-day courses of approximately twenty each. The first four would cover lower level vice presidents. The next three would cover intermediate level vice presidents. The next two would cover senior vice presidents and the final one would cover the executive office.

I used the last half of the second day of the course for questions and discussion of the material I had presented. At the end of the first course, one member said, "This stuff is great. I would love to use it but I can't without the approval of my boss. Are you going to get a chance to present the same material to him?" I explained that I would somewhere in the three second-level courses yet to come. He said he would approach his boss for approval as soon as he came out of the class.

Essentially the same issue was raised in each of the four lower level classes. It was also raised in each of the three second level courses. These vice presidents also believed they needed the approval of their bosses, senior vice presidents, before initiating significant changes. As a result, I was not surprised when the senior vice presidents expressed their dependency on approval from the executive office before they could initiate the kind of changes I advocated.

I could hardly wait to see what kind of reaction I would get in the final course given to members of the executive office. The CEO opened the discussion. He said, "This stuff is great. I want very much for it to be used in this company but I can't impose it

on my subordinates. They must accept it voluntarily. Are you going to get a chance to present it to them so I can get their approval and support?”

This was a paralyzed company. No one in senior management was willing to do something that might turn out to be wrong. Every one of them wanted someone else to assume responsibility for whatever they tried. As a result, significant changes were seldom made.

Such risk aversion clearly limits learning and development of organizations especially in a changing environment. Such aversion is a cultural rather than an individual characteristic. It is not the result of individually made conscious decisions; it is a consequence of the way the culture works. Most of the managers who are affected by it are unaware of such a cultural influence.

Organization must become tolerant of errors provided that learning is derived from them. This was once very effectively articulated by August Busch, III, CEO of Anheuser-Busch, when he told his reports, “If you didn’t make a serious mistake last year you probably didn’t do your job and try something new. There is nothing wrong in trying and failing, but you had better learn from it. If you make the same mistake twice, you may not be here the next year.”

How can an organization’s culture be changed so that it is concerned about errors of omission as errors of commission? How can it assure learning from both types of error? This requires systematic and conscious support of an organization’s learning. Such support involves the following steps.

1. Preparing a record of every decision of any significance, ones that involve doing something or (of particular importance) ones that involve not doing something. This record should include the following information:

- The justification for the decision including its expected effects and the time by which they are expected.

Decisions are made for only two possible reasons: to make something happen that would not otherwise happen, or to prevent something from happening that would otherwise happen. For each decision the type of expected effect should be made explicit and it should be formulated in a form that is subject to verification.

For example, if a decision is made to increase advertising expenditures, what increase in sales is expected and by when? Or if a decision is not to make a possible acquisition because of the poor performance expected of it in the future, how and when can this expectation be verified?

- The assumptions on which the expectations are based.

For example, that competitors will not increase their advertising expenditures. Or, in the case of an acquisition not made, that its acquirer will not be able to increase its returns so as to make the acquisition worthwhile.

- The information, knowledge, and understanding that went into the decision.
- Who made the decision, how it was made, and when.

The decision record should be signed off by the senior manager involved in making it. However, it can be prepared by anyone designated by that manager.

2. The decision should be monitored to determine whether the expectations are being met and the assumptions on which they are based remain valid.

3. When a deviation is found in either the assumptions or expectations, it should be diagnosed, the cause determined and corrective action prescribed and taken.
4. The corrective action is itself the result of a decision. A record of this decision should be made and treated as the original decision. In this way the process can not only yield learning but also learning how to learn.
5. A record of the entire process (all four steps) should be made and stored for easy access by those who may later be confronted by the need to make a similar type of decision.

The number of people required to carry out these steps obviously varies as a function of the size of the organization involved, and the number of decision made. This process can and should be conducted at every level of an organization at which critical decisions are made. The process can, of course, be facilitated by use of computers.

These steps, with appropriate modifications, have been taken at General Motors' Corporate Strategy and Knowledge Development Department and Du Pont's Research and Development Department, among others. When applied, something additional has been learned: mistakes are avoided by formulating a decision record. When the expectations and assumptions on which a decision is to be based are made explicit, it often becomes apparent that the decision that might otherwise be made should be avoided.

Consider a case of learning from a decision not to do something. When a possible acquisition was revealed to a large corporation it conducted a considerable amount of research to determine what was the current value of the candidate. It then determined that this value was not high enough to justify the asking price for the

acquisition. Someone else subsequently acquired the company for considerably more than the first company was willing to pay for it. The acquiring party made changes in the acquired company that increased its value significantly. After these changes were made the acquired company yielded a return greater than was being earned by the company which had turned down the acquisition. The lesson it learned from all this was: in determining the value of a potential acquisition, a plan is required for what would be done after the acquisition to increase the value of the acquired company. This estimated enhanced value should be the basis for what the acquirer is willing to pay, not its current value.

The reluctance of an organization to make changes that involve a risk results in a future that happens to that organization, over which it has little control. The willingness to make changes that involve a risk enables an organization to have a major role in creating its future.

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WHY FEW ORGANIZATIONS ADOPT SYSTEMS THINKING

Russell L. Ackoff

I frequently talk to groups of managers on the nature of systems thinking and its radical implications to management. In doing so I use several case studies involving prominent American corporations. At the end of the presentation I am almost always asked, "If this way of thinking is as good as you say it is, why don't more organizations use it?"

It is easy to reply by saying that organizations naturally resist change. This of course is a tautology. I once asked a vice president of marketing why consumers used his product. He answered, "Because they like it." I then asked him how he knew this. He answered, "Because they use it." Our answer to the question about failure of organizations to adopt systems thinking is seldom any better than this.

There be many reasons why any particular organization fails to adopt systems thinking but I believe there are two that are the most important, one general and one specific. By a general reason I mean one that is responsible for organizations failing to adopt any transforming idea, let alone systems thinking. By a specific reason I mean one responsible for the failure to adopt systems thinking in particular. First, consider the general explanation.

All through school, from kindergarten all the way through university, mistakes are treated as bad things. We are downgraded for them. Furthermore, no effort is made to determine whether we have learned anything from them. The grade given, not learning from our mistakes, is a *fait accompli*

When, on the completion of our schooling, we enter an employing organization, which also makes it clear that mistakes are a bad thing and that they will be held against us. Managers laugh when I tell them of an organization I once heard of that offers an annual prize for the best mistake made last year. That mistake is defined as the one from which they have learned most. When August Busch, III, was CEO of the Anheuser-Busch Companies he once told his assembled vice presidents, "If you didn't make a serious mistake last year you probably didn't do your job because you didn't try anything new. There is nothing wrong in making a mistake, but if you ever make the same mistake twice you probably won't be here the next year." He had it right: mistakes will be forgiven if we learn from them.

We cannot learn from doing anything right. We already know how to do it. Of course we may get confirmation of what we already know and this has some value, but it is not learning. We can learn from mistakes if we identify and correct them. Therefore, organizations and individuals that never admit to a mistake never learn anything. Organizations and individuals that always transfer responsibility for their mistakes to others also avoid learning. One need look no further for an example than to the executive office of my government.

THE GENERAL REASON

To understand why organizations do not use mistakes as opportunities for learning, other than a disposition inherited from educational institutions, we must recognize that there are two types of mistake: errors of commission and errors of omission. An error of commission occurs when an organization or individual does something that should not have been done. For example, when Kodak acquired Sterling Drugs it made a very costly mistake. It had to be sold subsequently. Its sale involved a considerable write-off.

Robert F. Bruner, in his book, *Deals from Hell* (Wiley, 2005, New York) cites a number of acquisitions that went sour in a big way. The Sony-Columbia merger in 1989 resulted in a \$2.7 billion write-off. The acquisition of National Cash Register by AT&T, cost AT&T \$4.1 billion. His champion of errors of commission is the merger of AOL and Time Warner. It resulted in a \$200 billion loss in stock-market value and a \$54 billion write-down in the worth of the combination's assets.

Bruner points out that in most such cases the executives responsible such losses made significant gains in their own compensation. They were able to disclaim responsibility for their mistakes.

An error of omission occurs when an individual or organization fails to do something it should have done. For example, when Kodak failed to acquire Xerox when it could have, or when Xerox failed to develop the small computer produced by its employees. Of the two types of error, errors of omission are usually the more important. The deterioration and failure of organizations are almost always due to something they did *not* do.

Not too long ago IBM got into serious trouble because it ignored the reduction of the size of computers. Fortunately, it eventually corrected this error but it came close to going out of business. Kodak is currently in a precarious position because it did not press the development of digital photography. General Motors and Ford are in trouble because they have not innovated in ways that Toyota and Honda have.

Now for a key fact: accounting systems in the western world only take account of errors of commission, the less important of the two types of error. They take no account of errors of omission. Therefore, in an organization that frowns on mistakes and in which only errors of commission are identified, a manager only has to be concerned about doing something that should not have been done. Because errors

of omission are not recorded they often go unacknowledged. If acknowledged, accountability for them is seldom made explicit. In such a situation a manager who wants invoke as little disapproval as possible must try either to minimize errors of commission or transfer to others responsibility for those he or she makes.

The best way to do this is to do nothing, or as little as one can get away with. This is a major reason that organizations do not make radical changes.

A number of years ago when I was working on a project for a major automotive manufacturing company, the Executive Vice President asked me if I would give a two-day course on systems thinking to the company's top 200 managers and executives. I was delighted. He said he wanted to restrict classes to 20 so that there would be plenty of discussion. He had the following plan: four sessions of junior vice presidents, three of intermediate level vice presidents, two of senior vice presidents, and finally one of the executive office. The sessions were to be conduct from the lower level up.

At the end of the first session to junior vice presidents one said, "This stuff is great. I would love to use it but you are talking to the wrong people. I can't introduce it without the approval of my boss. Are you going to get a chance to present it to him?" I told I would in one of the later courses. He assured me he would hit his boss for approval as he came out of his session. In each of the first four sessions of junior vice presidents the same issue was raised.

In the first group on the second tier, with intermediate level vice presidents, the same issue was raised. I was told they also wanted to introduce systems thinking but could not do so without their bosses' approval. Again I told them their bosses would eventually be exposed to the same ideas. In each of the three sessions at this level the same issue was raised.

In the two sessions involving senior vice presidents the same issue was raised. They asked if I would have a chance to present the material to the CEO and his executive committee. I said I would. I could hardly wait to hear what the CEO would say.

At the end of the session which he attended he said, "This stuff is great. I would love to use it. But I can't do it with the approval and support of my subordinates. Are you going to get a chance to present it to them?" This was a typical organization, one in which the principal operating principle was "Cover your ass." Application of this principle produced a management that tried to minimize its responsibility and accountability. The result was a paralyzed organization, one that almost never initiated change of any kind let alone innovation. It made changes only when a competitor made it necessary for it to do so.

This deficiency in organizations can be eliminated by taking the following steps.

1. Record every decision of importance, whether to do something or not. The *Decision Record* should include (a) the expected effects of the decision and by when they are expected, (b) the assumptions on which the expectations are based, (c) the inputs to the decision (information, knowledge and understanding), and (d) how the decision was made and by whom.
2. Monitor the decisions to detect any deviation of fact from expectations and assumptions. When a deviation is found, determine its cause and take corrective action.
3. The choice of a corrective action is itself a decision and should be treated in the same way as the original decision, a Decision Record should be prepared for it. In this way one can learn how to correct mistakes; that is, *learn*

how to learn more rapidly and effectively. Learning how to learn is probably the most important thing an organization or individual can learn.

4. The decision by an organization not to adopt systems thinking should be treated in this way. Making explicit the assumptions on which such a decision is based and monitoring them can lead to a reversal of the decision in time.

THE SPECIFIC REASON

Very few managers have any knowledge or understanding of systems thinking, and for good reason. Very little of our literature and lectures are addressed to potential users. I very seldom come across an organizational decision maker who has had any previous exposure to systems thinking.

We are an introverted profession. We do most of our writing and speaking to each other. This is apparent on examination of the content of any of our journals or conferences. To be sure, some communication among ourselves is necessary, but it is not sufficient.

Until we communicate to our potential users in a language they can understand, they and we will not understand what we are talking about. If Einstein could do it with relativity theory, we should be able to do it with systems thinking (Einstein and Infeld, 1951). It is easy to hide the ambiguity and vagueness in our own thinking behind jargon, but almost impossible to do so when speaking or writing in ordinary language.

We have developed a vocabulary that equips our students with the ability to speak with authority about subjects they do not understand. Little wonder they do not become effective spokespersons to potential users.

This society should publish a journal addressed to potential users. It should have managers on its editorial board. It should invite dialog with potential users either electronically or in print. In addition, it should occasionally hold conferences that provide a bridge between system thinkers and their potential users. These conferences should reveal what are we doing and can do that they should know about?

Furthermore, the articles published in our usual journals should be required to answer the “so what” question at the end of each submission. The answer to this question should be an explicit statement of how the author intends to affect the behavior or thinking of the reader. No article should be published without such an appendage.

Let’s start to think outside the box into which we have painted ourselves!

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