SECTION IV: THE ROLES OF GOALS IN HUMAN PERFORMANCE SYSTEMS

A Goal-Directed Model for the Design of Human Performance Systems

Richard W. Malott
Maria Emma Garcia

SUMMARY. A behavior systems analysis perspective is employed to guide development of a goal-directed model for the design of human performance systems presented in this article. The goal-directed model is discussed in terms of the following: (1) its basic concepts (i.e., system, behavioral system, and behavioral systems analysis), (2) the importance and implications of identifying the ultimate goals, (3) a description of a goal-directed model for the design of systems, and (4) a specification of the criteria for defining objectives that will lead to achievement of the ultimate goals. Finally, it is suggested that use of a goal-directed model would help organizations move toward accomplishing their ultimate goals.

Richard W. Malott and Maria Emma Garcia are affiliated with the Department of Psychology, Western Michigan University. The authors thank Dale Brethower, as well as the students in their graduate seminars, for their helpful feedback on earlier drafts of this paper.

THE PROBLEM

In the United States, we spend fortunes on health care ($415,639,000,000 in 1982) (Department of Commerce: Bureau of Census, 1985, pgs. 104-5); yet the life expectancy of a 40-year-old male is 2 years less here than that in Bolivia, one of the poorest countries in South America; our chances of dying of heart disease in 1974 were nearly the same as in 1910; only one out of seven countries studied had a rate of heart disease higher than ours (Leonard, Hoefer & Pritikin, 1974, pgs. 5-16); and in 1982, several countries had a lower rate of infant mortality than we had (Department of Commerce: Bureau of Census, 1985, p. 862).

In 1970 we spent $4,000,000,000 at the dentist's; yet 98% of us would have dental disease, most of us would lose many of our teeth and 25,000,000 of us would needlessly lose all of our teeth before we die, prematurely (McGuire, 1964).

In 1977, we spent 100 billion dollars on public education; yet 20% of our adults were functionally illiterate, and an additional 39% could not determine the unit price of various sized boxes of breakfast cereals (Gilbert, 1978, p. 232).

We use more of the world's resources than any other country; yet we had to close down the Henry Hudson Parkway, the magnificent highway along the west side of Manhattan, because it had collapsed and we could not afford to keep it up. Our auto industry was in a shambles because we could not build the cars Americans wanted, with the quality they wanted, and at a price they wanted, while other countries could. We have to ship our iron to other countries, for processing into steel, and then import it back, because we have let our processing plants slip into antiquity.

Though some of these data are old, the picture has not improved greatly since they were collected. They illustrate the notion that most organizations fail (Sarason, 1972). And if they do not fail to survive, at least they fail to achieve their ultimate goals; and even if they do achieve some of those goals, they still fail to achieve their ultimate goals, to the extend intended. Most organizations are underachievers; most have great room for improvement, whether they are organizations in education, the hu-

man services, government, or business (for other examples, see Harris, 1981).

A Behavioral-Systems Solution

We advocate a three-step process to reducing organizational failure and increasing organizational success:

1. Design an idealized organization containing all the components, properly connected, so as to achieve the ultimate goals.
2. Evaluate the existing organization against the idealized organization, in order to identify the problem areas.
3. Modify the existing organization along the lines of the idealized one.

In this paper, we will deal only with the first step—the design of organizations or, more generally, behavioral systems.

WHAT IS SYSTEM?

Here are examples of systems: An automobile is a set of components designed to get you from here to there—a transportation system. We often speak of transportation systems, however, as including, not only the automobile, but also the train, plane, boat, horse, foot, etc., along with the streets, roads, railroad tracks, waterways, and airways. A computer is a set of components designed to keep you up all night trying to achieve the objective of getting those components to work together properly—a frustration system.

A *system* is an organized, integrated, unified set of components, accomplishing a particular set of ultimate goals or objectives; so a random set of objects or people is not a system. An example of a non-system would be a group of shoppers in a discount store, the day before Christmas. They all have individual goals, but no collective goal. On the other hand, the store is very much a system, often a very effective one.

A system may be created, as a result of a design, a plan, for example a human organization such as the United Nations. Or a system may result from evolution based on natural selection, for example biological systems such as our respiratory system. The

crucial feature of a system is that it have a goal, in the case of designed systems, or a function, in the case of evolutionary systems.

However, to say that a human-designed system is goal-directed is not to make a teleological error. We are not making the error of saying the cause occurs after the effect. Instead we are saying you can specify a goal and then design a system with the hope of achieving that goal in the future. This past specification of the goal is controlling your current design of the system; but in spite of your best design, you still may fail to achieve that goal in the future.

We have been discussing systems of action, either planned or evolved systems; however, there are also systems of classification, such as the periodic table of chemistry or the operant-respondent dichotomy of behavior analysis. In this paper, we will deal only with those systems of action that have resulted from design or at least might be better off if they had resulted from design.

WHAT IS A BEHAVIORAL SYSTEM?

A *behavioral system* is one in which the principle components are organisms, usually human beings, working together to accomplish some set of ultimate goals or objectives. Organizations are behavioral systems—for example, a factory, a hospital, a school, a city government. But there are some behavioral systems that, by convention, we do not usually call organizations—for example, on a large scale, an entire country, on an intermediate scale, a department or division of an organization, on a smaller scale, a family, and on a tiny scale, we may consider individual people as behavioral systems, though not as organizations. In this later case, the system's components might consist of various tasks the individual does.

THE REALISM OF ULTIMATE GOALS

The preceding analysis may be a little naive or idealistic because many, if not most, behavioral systems or organizations are neither systematic nor particularly organized. Rather, they consist of somewhat accidental, historic collections of individuals

who, not only may not be working toward a common ultimate goal but, in fact, may be working at cross purposes with each other. For example, one cynical observer defined the university as a collection of professors tied together by a central heating plant.

So is it realistic to define systems in terms of their ultimate goals? Maybe not. Maybe it is idealistic. But you need this idealism, if you want to increase the extent to which organizations move in the direction of their nominal goals. Otherwise, organizations simply flounder around aimlessly serving the personal interests of those in power, from the president to the janitor. We advocate cynical idealism, rather than naive idealism. The assumption of *cynical idealism* is that nothing will end up the way it should; but if you work harder than you should have to, trying to get your system to accomplish its goals, then your system will not be as much of a disaster as it otherwise would have been.

THE IMPORTANCE OF NEAR-ULTIMATE GOALS

When we define a system, we think we should do so in terms not only of its intermediate objectives but also in terms of its ultimate objectives. For example, in defining an educational system, we keep in mind that it is a failure if it does not accomplish its ultimate goal of producing students who actually put their newly-acquired repertoires to the service of humanity. Accomplishing the intermediate objective of altering the student's repertoires is not enough, difficult though it is. We should not define systems just in terms of their intermediate objectives.

For another example, consider the buggy whip manufacturer in the early part of this century. Suppose it defined its objective as the manufacture of buggy whips. Well it would probably go out of business as Henry Ford took over. But suppose it defined itself as a system with the objective of helping humanity through the use of transportation systems; and it just happened to be doing so at the time of manufacturing buggy whips. Then as the needs changed, its intermediate-range objectives could change while maintaining its ultimate objectives. And such a company would more likely stay in business; perhaps it would now be manufacturing locking caps for gasoline tanks on cars.

Similarly, Sidley (1986) pointed out that the railroads made

the mistake of defining their near-ultimate objective as getting people to ride their trains, failing to realize that their ultimate objective was to get people from one city to another, that getting them on the train was just an intermediate objective. The consequence of this failure is that many railroad systems did not survive (another ultimate objective). Sidley also made the same point with regard to the movie studios that defined their near-ultimate objective as getting people to watch movies, rather than as providing entertainment to people, with the result that it took the studios many lean years to get into the television industry.

The "brain drain" also illustrates the problem of losing sight of ultimate goals. Many underdeveloped countries, especially the oil countries, designed educational systems to get advanced training for their professionals, training selected on the basis of earlier needs assessments for their countries. For instance, during a 10-year period, one county paid for the overseas education of 40 thousand of its students, in order to get this advanced university training. Unfortunately, on returning home, the students found that the program administrators had lost sight of the original goal—to fill the needs of their country; instead, the administrators now viewed their goal as simply to provide the opportunity for education, with the result that many of these students failed to find jobs in their native country and returned to the host countries for employment—the brain drain.

THE DANGERS OF ENLIGHTENED SELF-INTEREST

A system may have profit optimization as its main objective, but it might also have humanitarian sub-objectives contributing toward profit optimization. For example, a health work force might lead to greater productivity. So the employer might spend a fair amount of money on a diet and exercise program for the employees. The sub-objective is to improve the employees' health—a humanitarian sub-objective. But the underlying assumption is that this sub-objective would result in fewer days of absence due to illness which might contribute to the employer's profit maximization. Thus the humanitarian sub-objective contributes to the self-interest of the employer. And the employer is enlightened to understand these ultimate benefits in terms of dollars. In other words, the system may be looking after its own

self-interest in an enlightened, though somewhat roundabout way. But one should not be mislead by enlightened self-interest to assume that the humanitarian objectives will not get left behind, in the crunch, when profit optimization is threatened.

THE LIMITS OF A SYSTEM

Now, just what should we include in your system, and what should you exclude? Defining the limits of a system can be tricky. For example, suppose problems at home are hurting a worker's performance on the job. Do you include the home, the spouse, and the children as part of the system defined by the job? You might; corporate America is reported to be nearly as concerned about the spouses of the executives to be hired as about the executives themselves; can the spouse mix a good cocktail and yet avoid consuming too many in the process.

Alternatively, you might say the home is a separate system. Then you must deal with the interactions of other systems with the system of concern. You must deal with the influence of outside systems, both supporting systems and competing systems.

Incompatibility of Goals

Here is a variation on that same problem of competing systems or subsystems: The objective of a behavioral systems analysis is to design or redesign a system so it will more effectively accomplish its goals. But in making a system more goal-directed, resources are diverted from other people's systems that have other goals. For example, a system might require some of its employees to work harder; but those employees might be, in turn, members of family systems that have other goals; or an individual employee as a small system, might have other goals, like playing golf. As another example of this incompatibility, maximizing the longevity of the population is incompatible with maximizing the profit of the tobacco industry. These illustrate the problem of *incompatibility of goals*.

In 1967 a pharmaceutical company applied for approval to sell an injectable drug as a contraceptive. In 1973 the Federal Drug Administration recommended approval. But in 1975 new data suggested the drug might cause cervical cancer. So in 1978, the

Federal Drug Administration rejected the application for approval. However, that did not stop the company from having an overseas branch manufacture and sell the drug in 80 other countries.

This illustrates two relevant issues, not only the possible failure to keep in view the ultimate goal of aiding the well-being of humanity, but also the conflict of objectives between different organizations as they lined up to do battle on this issue from the perspective of their own more limited goals, the pharmaceutical company with its goal of profit along with other groups with goals of population control vs. groups with goals of maximizing health and rights to life.

Another example of incompatibility of objectives is the struggle, for the past two decades, between employees with seniority and black employees in the Kalamazoo public school systems. During a budget crunch, the Kalamazoo public schools had to reduce their staff. Who would be dismissed? A problem of incompatibility of objectives among different systems evolved in the Public Schools. Three groups argued for the retention of senior faculty, claiming the objective of high-quality education. Another group argued for the retention of the black faculty, claiming the objective of improving the well-being of the black community, along with a sub-objectives of increasing the number of black teachers who served as role models for black students, because only 6.5% of the teaching staff in the Kalamazoo public schools were black, in 1979, many without seniority.

CONSIDERING ALL INFLUENCES

It may not be too critical whether you expand the definition of your system to encompass all influences, with the possible exception of the phases of the moon, or whether you just keep an eye out for external influences. What is critical is that you not forget to consider all possible influences that may affect your organization's achieving its ultimate goals. A failure to consider these influences is a weakness of many designers and managers of organizations but a major strength of behavioral systems analysis.

This consideration is critical because the history of reform in

both education and the human services is littered with the corpses of noble but naive organizations killed by sabotage from within or starved to death by lack of support from without, even though those organizations were doing an exemplary job of serving their constituents at the time of their demise. Every professional behavior modifier who has been in the field for more than five months has at least two personal tales of the failure of "successful" systems. For example, in a massive nationwide comparison demonstration, Project Follow-Through showed the overwhelming superiority of applied behavior analysis and direct instruction to all other current approaches to public education; yet it has had minimal impact on public education on a national level, because the less effective approaches have much stronger political support (Lindsley, 1985). The problem of ignoring "outside" influences is so wide-spread and fatal that Brethower (1982) builds his model, the total performance system, around the concept of receiving-system feedback, a concept that encompasses these outside influences.

Though it may not be critical how you do it, we personally are so nervous about leaving out a fatal factor that we recommend trying to bring all "outside" influences into the system, so they will not be overlooked. In other words, we recommend considering the worker's family part of the system. Of course this sometimes means your system will be overwhelmingly large; so be it.

WHAT IS BEHAVIORAL SYSTEMS ANALYSIS?

Behavioral systems analysis is, of course, the analysis of behavioral systems, the design, evaluation, and modification of systems to help them accomplish their objectives, an attempt to find the ultimate objectives of the unorganized "organization" and then to help it get organized, to function as a smooth system with all components working toward the same set of ultimate objectives. And if we cannot get all of the components functioning as part of an integrated system working toward its ultimate objectives, then we will settle for 90% and attempt to minimize the disruption caused by the discrepant 10%.

Behavioral systems analysis consists of behavior analysis, as well as systems analysis. And *behavior analysis* consists of the

science and technology of studying and managing behavior, usually human behavior. Behavior analysis tends to concentrate on three major conditions that influence or control behavior: (a) the motivation of the individual, (b) the cues of the immediate environment, and (c) the results of the behavior.

For example, a note on your calendar shows that you have four days to prepare your annual budget request and you have not started. Looking at that calendar functions as a motivating operation (Michael, 1984), making failure to work on the budget an aversive condition. The actions of starting to desperately prepare your budget request is reinforced by a reduction in that aversive condition ("fear" or "anxiety" reduction). A report from the grapevine says the chief executive officer just got back from a seminar on organizational behavior management. This report functions as a cue, a stimulus in the presence of which requesting an allotment for an organizational-behavior-management consultant may produce a favorable outcome.

(We must admit that, in actual practice, most behavior analysts do not show much concern for the motivating condition, perhaps because they are usually dealing with such generalized reinforcers that lack of concern for the relevant motivating conditions produces no obvious problems. Furthermore they often mistake motivating operations, such as the note on the calendar, for cues or discriminative stimuli. And they often mistake delayed outcomes, such as a favorable reaction to a budget request, for reinforcement of that request [Malott, 1984b, 1986].)

In general, behavior analysis attempts to answer the questions, "What is it that people do? Why do they do it? And how can we help them do what they should do; so they can do it better?" Behavior systems analysis adds a prior question: "Just what is it they should do anyhow?"

So behavioral systems analysis is an effort to first use a systems analysis approach to analyze the ultimate objectives of an organization; then to determine the manner in which the various components of the organization contribute or fail to contribute to the accomplishments of that organization—its ultimate objectives; and finally behavioral systems analysis involves the use of behavior analysis in the design of improved organizational environments to help the individuals and groups in the organization

perform in such a manner that their components of the organization will contribute more effectively to the ultimate objectives of that organization (cf. Malott, 1974).

BEHAVIORAL SYSTEMS DESIGN ON THE FLY

Few designers of behavioral programs have the opportunity of designing a system a priori. Most often behavior systems analysts are employed to debug an ongoing but floundering system. They must, therefore, simultaneously engage in planning and executing.

Most of what we are discussing is called organizational planning. Thus it would be naive to think you can delay program implementation until every detail has been planned. Either old age, death, or boredom will occur first. And there is probably no stronger catalyst for effective planning than starting the program and then trying to continue it while planning one step ahead of the organization's planning needs. One must get the system running, and write off the failures along the way as instructive pilot studies. Such an approach will increase overall systems productivity, but it will also increase the number of rough edges on the systems. The more successful the advanced planning, of course, the fewer the problems in the future.

WHAT IS GOAL-DIRECTED DESIGN?

On the one hand, goal-directed design is hard to do. It is counterintuitive. It does not make sense. It is, however, the only sensible way to design an organization or system. On the other hand, it is simple:

1. You determine the ultimate goals of the organization. For example, the ultimate goals of a transportation system might be to help people and things get from here to there in a timely and cost-effective manner. The ultimate goals of a health system might be to help people maintain optimal health in a humane and cost-effective manner.
2. Then you determine the *intermediate goals*. For example, making sure the trains run on time or making sure everyone

who needs flu shots gets them. Again, other requirements such as timeliness and cost-effectiveness must be met.

3. And finally, you determine the *initial or logistic goals*. For example, making sure the tracks are in good repair or making sure the flu vaccine has been ordered.

So the essence of goal-directed design is to start with the ultimate goals or objectives, ask what are the initial or logistic prerequisites for achieving the ultimate goals, and gradually working your way back, finding the prerequisites for each subsequent set of objectives, until you finally reach your initial objectives, what you need to do tomorrow to start the system running. Your goal-directed analysis will generate a sequence of objectives, perhaps dozens, each lower one leading to the next higher one, each initial objective leading to a slightly more distant objective, up through the intermediate objectives, until you finally arrive at your ultimate goals. In this way you make it more likely that your analysis includes every component needed for the accomplishment of your ultimate objective with no useless components. The approach presented here owes much to the work of Gilbert (1978) and Brethower (1982) and is similar to the top-down approach described by Semprevivo (1982).

However, most planners and managers start in the vicinity of the initial objectives, accomplishing many things that eventually prove irrelevant to their ultimate objectives—the real purpose of the system in the first place. Of course, people are sometimes so confused about the process that they never realize they were off track from the very beginning. For example, you do not buy 500 bedpans as your first step in starting a railroad. A hospital, maybe; but not a railroad. Now that seems obvious; no one would make that mistake. The reason is that most of us do have some general sense of our intermediate objectives, if not our ultimate objectives. But that general sense is usually not good enough to keep us out of trouble.

Consider a less obvious example. What is the first thing everyone does when starting a new system or reviving an old one? Buy a bunch of computers, of course. And, often, if not usually, computers are not the solution—fun, yes; the solution, no (Malott, 1984a). We encountered one small educational organization that

went bankrupt, partially because it invested most of its resources in computers and other attractive nuisances. In other cases, computers have functioned as kept ladies, sitting prettily on the shelves, collecting dust.

Now consider an example of analyzing systems in terms of more ultimate goals: "Objective—to maximize the number of people who receive information about our organization or product or service." That may be fine, but you cannot stop there. You must follow with something like this: "Objectives—to maximize the number of people who read the information, understand it, agree with its point of view, and act on it or follow its suggestions." And in fact these latter objectives may be incompatible with the first objective. In other words, the bottom line is action. Perhaps you should concentrate on getting the information to only 100 people but doing such a good job that 50 of them will act appropriately. However, if you just go for contacting the most people, the contact may be so superficial that only 20 will respond, even though you will have contacted thousands. So always make sure that your lower-level objectives are leading you most effectively to where you want to go. Do not get locked into the wrong tactics by lack of vision or imagination regarding the lower-level objectives.

Our universities are full of examples where we would be more likely to achieve our more ultimate objectives, if we could keep them clearly in view, rather than being content with the accomplishment of intermediate objectives: A brilliant, well-delivered lecture does not necessarily lead to learning (repertoire altering) on the part of the students. Learning what was lectured on, does not necessarily lead to a functional or useful repertoire for the students. Acquiring a useful repertoire does not necessarily lead to using that repertoire on graduation. And graduation does not necessarily lead to relevant employment. For about 40% of the graduate students in the United States, the completion of much or most of their course work will only lead to an ABD degree (all but dissertation) (Berelson, 1960). For affirmative action, the successful recruitment of a large number of minority students does not generally lead to the graduation of a significantly increased number—the more ultimate goal.

The moral: Before you select the solution, define the prob-

lems. Before you buy the hardware, find out what you will do with it. And before you find out what you will do with it, find out why you want to do whatever it was you wanted to do in the first place. In other words, define your ultimate objectives, then your intermediate objectives, and only then worry about the nuts and bolts, the initial objectives, whether to invest heavily in computers, lectures, increased admission efforts, et cetera.

Do not be too concerned about whether borderline objectives should really be classified as an initial objective or an intermediate objective. For example, is diagnosing a disease an initial or intermediate objective in the physicians's effort to cure a patient? Do not worry about it. Just make sure your objectives are arranged in a logical sequence so that an objective at any given level has listed below it all of the prerequisite, more basic objectives needed for its accomplishment. Regardless of the classification of the diagnostic objective, the medical system should make sure that diagnosis is included in the right place in the chain of objectives leading to a healthy patient. In other words, be sure you have included every crucial objective and avoid wasting resources on irrelevant, dead-end objectives.

In this paper, we talk about initial objectives leading to intermediate objectives and intermediate objectives leading to ultimate objectives. Others refer to objectives leading to goals and goals leading to missions, with objectives being very specific and concrete and relatively easily measured, goals being somewhat more distant and less easily specified, and the mission being the ultimate goal and something that is hopelessly vague (for example the well-being of humanity). Gilbert (1978, p. 118) reverses this sequence somewhat putting goals at a greater distance than mission.

NUMBERING SYSTEM FOR OUTLINING

It greatly facilitates goal-directed systems design to display the hierarchical relation between objectives in an outline format, but the construction of an outline with the needed details requires a more detailed numbering system that the usual combination of English letters and Arabic and Roman numerals. Thus we present

such a numbering system before dealing with other substantive issues.

The outline in Figure 1 has two high-level objectives, numbered 1. and 2.. And each of those two objectives has three subobjectives at the next lower level. The numbers 1.1, 1.2, and 1.3 mean that the attainment of the resources, rules, and contingencies are all prerequisites to the ultimate objective 1. In other words, immediately subordinate objectives are indented one level. (It is important to note that objectives 1.1, 1.2, and 1.3 are all at the same level as prerequisites to objective 1. This means that they can occur independently, in any order. For example, 1.3, the contingency objective, could be achieved before 1.1, the resources objective; only further indentation indicates the prerequisite nature of an objective. Also note that 1.1 and 2.1 indicate different objectives, because they serve different superordinant objectives, even though both objectives deal with resources.)

The outline in Figure 2 expands Objective No. 1 of Figure 1, with one lower level of objectives added. For example, 1.2.2 means that research and development is a prerequisite to 1.2, rules, which in turn is a prerequisite to ultimate objective 1.

As also shown in Figure 2, we sometimes use points of ellipsis (three dots, ". . .") to indicate the omission of objectives parallel to others that are presented. And we often use capitalized headings, like "RESOURCES," for our objectives, with either an explicit or implied detailed explication of that objective. See Figure 3 for part of this sequence of objectives presented in tree form.

1. ULTIMATE OBJECTIVE NO. 1
   The attainment of the well-being of humanity.
   1.1. RESOURCES
   1.2. RULES
   1.3. CONTINGENCIES
2. ULTIMATE OBJECTIVE NO.2
   The attainment of the professional objectives of the system's staff.
   2.1. RESOURCES
   2.2. RULES
   2.3. CONTINGENCIES

Figure 1. An outline of a general overview of objectives.

AN EXAMPLE OF A GOAL-DIRECTED SYSTEMS ANALYSIS

Perhaps we can best raise the various considerations of goal-directed systems design, in the context a detailed example (see Figure 4). We start with the well-being of humanity, the ultimate objective, the one we believe all systems should be working toward. Note that because of space limitations, we only provide a key word or two, when displaying the objectives in tree form. You would also need to include a list of objectives in outline form to provide the needed details.

Also note that we placed a colon after each of the objectives in the first three levels of objective. The colon signifies that the preceding objectives, i.e., lower-level objectives (objectives to the right) are not prerequisite objectives but rather they are defining objectives. For example, attaining physical and psychological well-being are not prerequisites to attaining the well-being of humanity, rather they are an exhaustive definition of the well-being of humanity. (Some might also include spiritual well-being.)

Figure 5 shows some of the sub-objectives for the dental objective. When you have more than one resource, each must be treated separately. We indicate this by putting each resource in a separate set of parentheses and then following it with the triad of resources, rules, and contingencies, repeating the name of the

1. ULTIMATE OBJECTIVE NO. 1
   The attainment of the well-being of humanity.
   - 1.1. RESOURCES
     - 1.1.1. DISTRIBUTION
     - 1.1.2. PRODUCTION
     - 1.1.3. RESEARCH AND DEVELOPMENT
   - 1.2. RULES
     - 1.2.1. DISTRIBUTION
     - 1.2.2. PRODUCTION
     - 1.2.3. RESEARCH AND DEVELOPMENT
   - 1.3. CONTINGENCIES
     - 1.3.1. ...

2. ULTIMATE OBJECTIVE NO. 2
   The attainment of the professional objectives of the system's staff.

Figure 2. A more detailed outline of objectives.

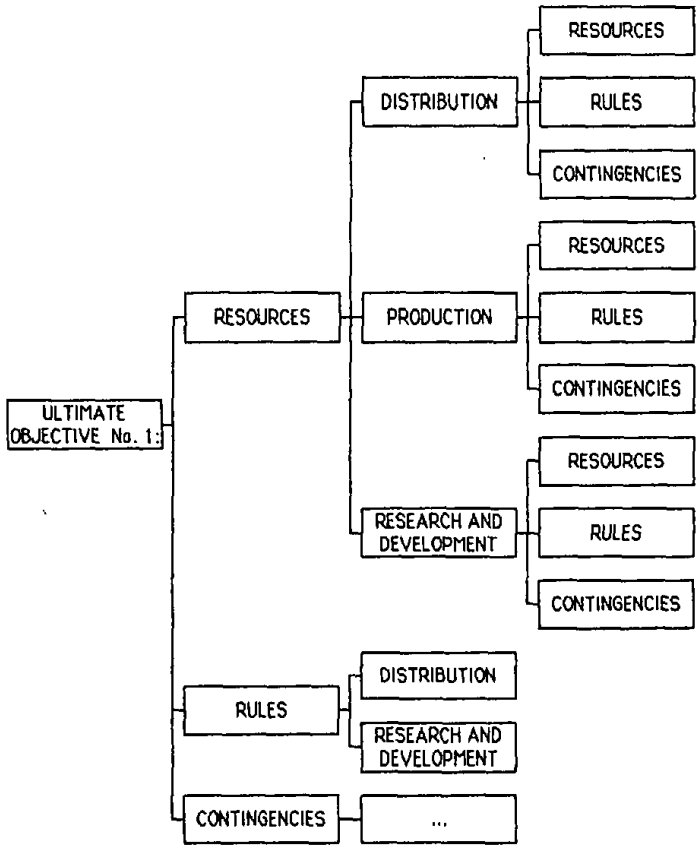

Figure 3. A tree-diagram of objectives.

specific resource under the heading of resource. For example "(floss)" is preceded by "RESOURCES floss," "RULES if you got 'em, floss 'em," and "CONTINGENCIES parental contingencies, guilt, and behavior modification contingencies." We would treat "(brushes)" etc. similarly. (Note: We use uppercase for the generic headings of objectives, like "RESOURCES," and upper and lower case for specific instances, like "floss." We also use the abbreviation R&D in place of RESEARCH AND DEVELOPMENT.)

As prerequisites to attaining "RESOURCES floss," we indicate that the floss will be distributed by pharmacies, it will be produced on the floss farms of Montana, and research and development on new varieties of hybrid floss will be conducted by the Montana State Agricultural College.

It seems to work best to eliminate production from the triad of objectives preceding rules, because the distinction between production of rules and research and development of rules is too subtle. Thus we have the Montana State Dental College doing research to determine the proper rules for using floss and then distributing the results by way of professional and popular publications.

Behavior analysts do the research and development on the contingencies needed to cause people to follow the rules for the proper use of the resource floss ("R&D behavioral research"). In the case of much applied behavior analytic research, the dis-

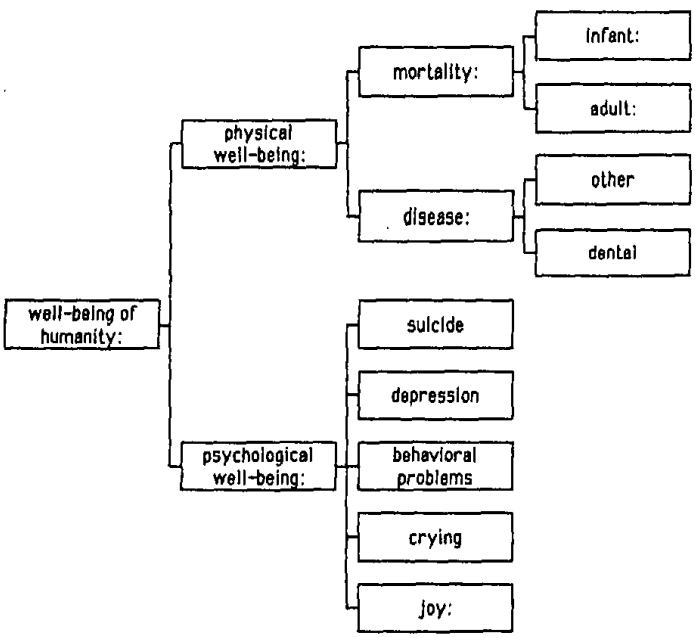

Figure 4. An application of a tree-diagram (part 1).

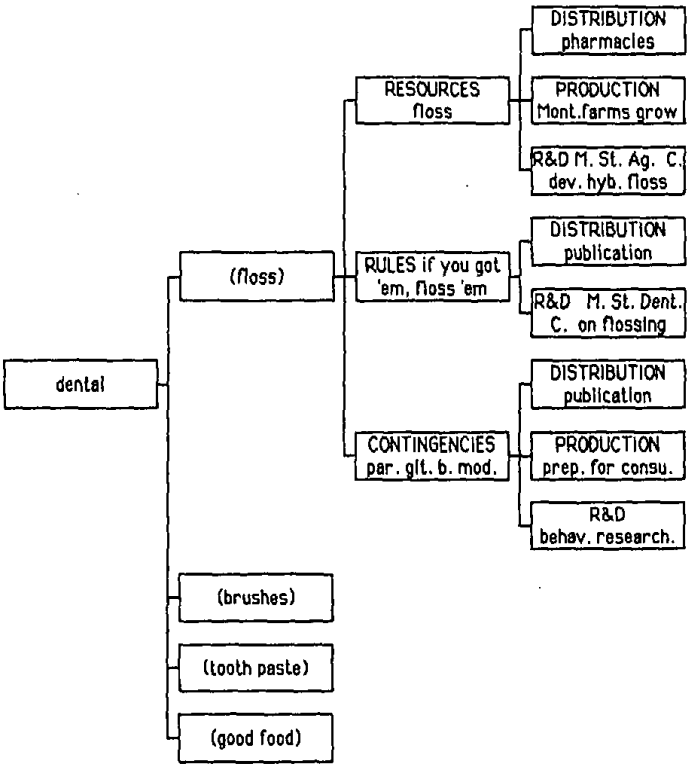

Figure 5. An application of a tree-diagram (part 2).

tinction between production and research and development will also often be questionable, unless hardware is involved. Again, the results would be distributed by way of publication.

In Figure 6, we expand on the objective "R&D behavioral research." Again we need several resources, each connected with a bridging objective in parentheses, such as "(researchers)" and "(research managers)."

It is difficult to keep track of who is doing what to whom when there are different levels of staff and clients or recipients in one of these hierarchies of objectives. Remember that the rules for a given resource describe how to use that resource. In the case of

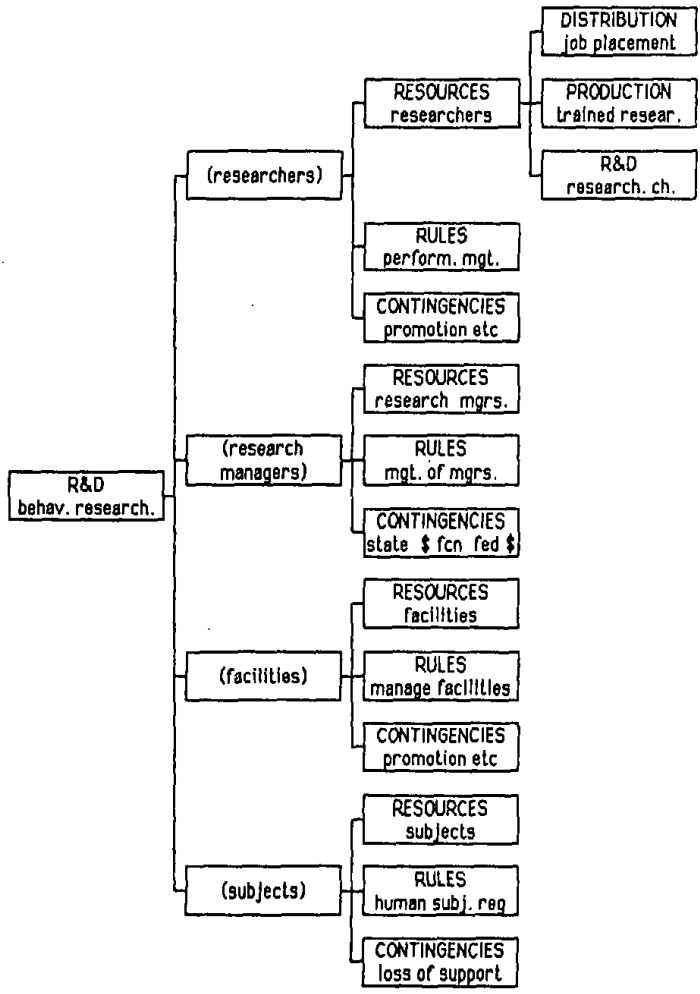

Figure 6. An application of a tree-diagram (part 3).

the resource floss (Figure 5), the rule is an admonition to daily flossing. Similarly, for "(researchers)," the rules are for how someone else will use these resources; so "RULES performance management" is for the research managers and describes procedures for the management of the researchers' performance. At

this level, the rules are not for the researchers; the rules do not describe procedures that researchers should use for doing good research.

Similarly, "CONTINGENCIES promotion etc." apply to the research managers' use of the rules for the management of the performance of the researchers. "CONTINGENCIES" at this level does apply to the researchers.

The same analysis applies when we look at the research managers themselves as a resource "(research managers)." Here the rules and contingencies apply to the manager of those managers, perhaps a college dean or university president. Here "CONTINGENCIES of state budget allocation is a function of federally-funded research" applies more directly to the dean or president, not the department chair who might be responsible for managing the research of his or her faculty.

If we go down one level beneath "RESOURCES researchers," we note that "R&D researcher characteristics" signifies that the relevant research and development at this level is not about how to accomplish "PRODUCTION trained researchers," rather it is about what should be the characteristics of the product, trained researchers. This is analogous to R&D on the characteristics of a good or marketable automobile as an activity parallel to the production of automobiles. In our analyses, research and development on effective techniques of production occurs at a lower, prerequisite, level. Of course, under some ideal circumstances, research and development work on product characteristics is a prerequisite to production, but again, it should also be ongoing with production and distribution, to facilitate continuous modification and upgrading.

In Figure 7, we look at some of the objectives prerequisite to "PRODUCTION of trained researchers." Again, several resources are needed. We will look in more detail at "(raw graduate students)." Notice that it is at this lower level that we state the objective that we are to attain "RULES how to train researchers." These are the rules to be followed for achieving the higher-level objective "PRODUCTION of trained researchers," rules to be followed by university faculty. And "CONTINGENCIES publication and behavior modification contingencies" apply to this faculty for following that rule, not to "RESOURCES raw

graduate students." Nothing new is involved in the remaining objectives in Figure 7 or those subordinate ones that are not shown.

Note the exhaustive and recursive nature of the two triads throughout Figures 5, 6, and 7. Each objective is taken from one of the two triads, resources, rules, and contingencies, or distribution, production, and research and development. And each objective has as its immediately prerequisite objectives the members of the other triad. For example, resources always has the prerequisites of distribution, production, and research and development; and distribution always has the immediate prerequisites of resources, rules, and contingencies. These two alternating triads seem to be necessary and sufficient for exhaustively describing any hierarchy of objectives. Our hierarchy of objectives is

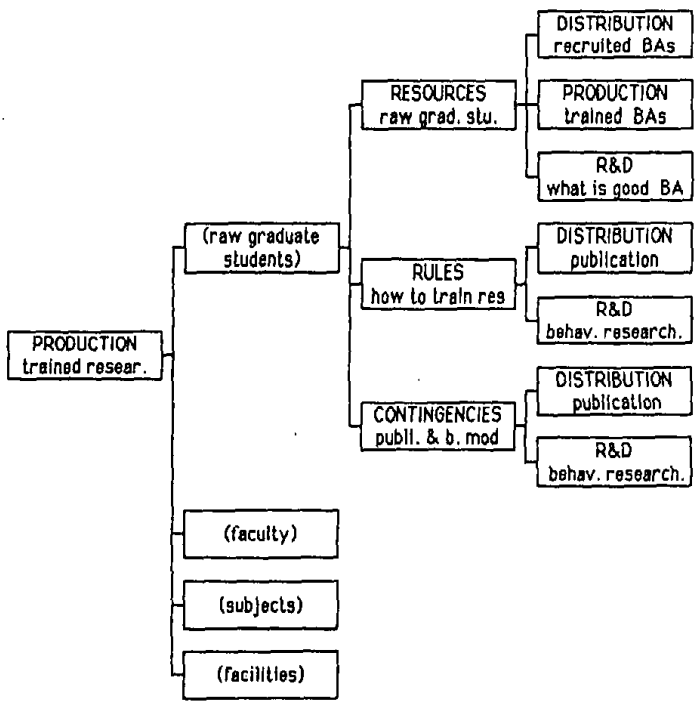

Figure 7. An application of a tree-diagram (part 4).

somewhat analogous to Gilbert's (1978) performance matrix (Chap. 4) and our triad of resources, rules, and contingencies is somewhat analogous to his behavior engineering model (Chap. 3).

(When developing an outline of the sequence of objectives, we recommend using an outline processor such as Thoughtline by Spite Software, 4875 SW 19th Drive, Portland, OR 97201, for both CPM and MS/DOS microcomputers. For developing outlines that can be converted into tree diagrams, we recommend MORE by Living Videotext, 2432 Charleston Road, Mountain View, CA 94043, for the Macintosh.)

PERSONAL SATISFACTION AS AN ULTIMATE OBJECTIVE

In Figure 1, objective 2, attaining the professional goals of the system's staff, may seem a little off the mark. It certainly tends to be ignored. Personal satisfaction as an ultimate objective refers to things like job satisfaction for personnel within the system. The senior author was first introduced to this perspective, while teaching at Denison University. During a faculty debate concerning how to run the university so as to best serve the students, a poet stood up and said, "What about me? What about the faculty and staff? We are part of this whole system. We need to be served too." These remarks could have been dismissed as the mushy-headed thinking of your typical poet. But upon reflection, his argument seemed reasonable and valid. Because we propose to be concerned about the quality of life – the well-being of humanity, and because the people who are the system are also part of humanity, we must be concerned about their well-being as well as those they serve, e.g., students, consumers, patients, and so on. Personnel within the system should have all the material, spiritual, and psychological benefits we propose to provide the recipients of our goods and services.

Adopting this ultimate objective results in a set of practical problems. How can we specify the objective in terms of accomplishments? How can we measure it? Some possibilities are absenteeism, tardiness, turnover, and perhaps questionnaire responses.

MULTIPLE ULTIMATE OBJECTIVES

This second ultimate objective also raises another problem: Gilbert (1978, p. 153) recommends that a system should only have one ultimate objective, in order to reduce the amount of internal conflict within the system. While that would be nice, it is rarely possible. Universities offer good examples of systems that have conflicting objectives, at least, nearly ultimate objectives – teaching, research, and community service. And it is a very nebulous causal path from those objectives to the single ultimate objective (saving the world or maximizing the well-being of humanity); so it is difficult to select the best priorities of emphasis among teaching, research, and community service. The result is that we all tend to argue for what ever is most expedient or immediately rewarding.

THE BIG PICTURE

We think the three sub-objectives, 1.1, 1.2, and 1.3 of Figure 1, may encompass all of the objectives leading to the well-being of humanity. For its well-being, humanity needs sufficient resources, accurate rules for the use of those resources, and an effective set of contingencies and incentives to insure that those rules are followed. Resources come from agriculture, mining, and manufacturing. Rules are roughly synonymous with education, both formal and informal. And the contingency system to support following those rules is probably provided by religion, human services, and education.

Within each of these three branches we have distribution, production, and research and development. In Figure 2, we have presented all three objectives, as concurrent objectives, at the same level. Our rationale is that the activities to achieve them occur at the same time, at least in established organizations. However, in an idealized case for a new product, research and development must occur before production, which in turn most occur before distribution. In that case, research and development should be indented beneath production, which in turn should be indented beneath distribution.

In addition to the usual sales systems, we might want to view social security as being part of the distribution sub-objective under resources. In other words, the purpose of social security is to redistribute resources. But we might also view the military as being involved in the redistribution of resources or the preservation of resources.

Behavioral systems analysis is useful for the proper functioning of all three components, distribution, production, and research and development in all three of the areas, resources, rules and contingency management.

Thus, we have two triads: (1) Triad 1: resources, rules, and contingencies; (2) Triad 2: distribution, production, and research and development (R&D).

Sometimes it helps to use these two triads in a recursive manner. For example, Figure 2 suggests that Triad 2 (distribution etc.) supports each component of Triad 1 (resources etc.). Consider the case of rules for the proper use of resources. We must do research to discover or develop those rules. Then we must produce or package them in such a manner that they will be useful (for example make them more concrete). And we must distribute them to potential users, for example through journal articles. Then we can begin the recursive process of specifying a new set of the Triad 1 objectives for each of the Triad 2 objectives, and so on, as shown in Figure 3.

Again, each of the objectives of the new Triad 1 are in turn supported by a set of objectives from a new Triad 2 (distribution, etc.). You can continue this recursive process until you have reached as low-level a set of objectives as suits your purposes, until you have discovered the source of system dysfunction, or until you have reached a level of objective that will be achieved with no explicit concern from the system.

The use of this sequence of recursive, alternately-repeating, triads helps insure that you have listed all the relevant objectives. It is fairly comprehensive, in that all of your objectives will probably be one of the six types of objectives described by the two triads. But you may not be able to apply all three objectives from a particular triad to a particular higher level objective in every case. For example, the distinction between production of rules

and research and development on rules mentioned above may have been somewhat forced.

CRITERIA FOR GOOD OBJECTIVES

Good objectives should satisfy the following criteria:

1. They should be in a logical sequence.
2. They should generally be stated as accomplishments rather than as activities.
3. They should be specified in terms of a set of measurable dimensions of quantity, quality, and cost.

Logical Sequencing

The objectives should form a logical sequence; they should form a causal chain in which each objective or set of objectives leads to the next higher objective. For example, consider the following logical sequence of objectives:

1 Profit optimized.
  1.1 Market share optimized.
    1.1.1 Goods produced.

And as mentioned earlier, one objective that leads to another objective should be indented beneath that objective it leads to, for example:

1 Have trained employees.
  1.1 Have trainees recruited.

It is often difficult to fill in the logical steps between the initial objectives (e.g., buy the paper clips) and the ultimate objectives (e.g., save the world). So here are some questions you might ask of your initial and intermediate objectives, to help you fill in that gap. "Why do you want to achieve the initial objectives of your system?" "In what way will they contribute to the ultimate objectives?" An initial objective might be "an increase in the skill level of minority clerical workers." And you might then ask, "How does that help humanity?" Answer: "It promotes social justice." Question: "How does it promote social justice?" etc.

Question: "And how does promoting social justice help humanity?" Answering these and other difficult questions should help fill in the causal sequence of objectives between your initial and ultimate objectives. We would, of course, need to specify objectives like social justice in terms of the other criteria for good objectives. These criteria are discussed below.

How do you know when you have reached the ultimate objective? When you cannot answer the "So what?" question. And that objective is probably something like the survival of our species. All other objectives should have an answer to the question, "So what? Why do you want to accomplish that?" That question is answered by pointing to the next higher objective. For example, "Why do you want to increase the skill level of minority clerical workers?" "So they will get more and better jobs." "And why do you want that?" "So they can more effectively help with the work of society and receive greater benefits from society." "And why do you want them to help with the work?" "So the work of society will be better done." "Why?" "So that the well-being of society (humanity) will be achieved." "Why?" "Sorry, no answer. That is just what I want; suffering humanity makes me uncomfortable." (This is similar to Skinner's notion of designing cultures for their survival [Skinner, 1953, chap. 18]).

To fill in the larger system into which your own system or subsystem fits, you might also ask what other objectives and systems are parallel to yours. For example, "What other systems are working toward achieving social justice?" And, "How do they relate to our system?" For example, in our university, we have the Martin Luther King Jr. Program, the Rosa Parks/Martin Luther King Jr. Program, the Mentor-Mentee Program, the Academic Skills Center, the Action Group for the Retention of Black Students in the College of Arts and Sciences, the University Retention Committee, special minority recruitment efforts, and others. They all work toward the common objective of increasing the number of academically successful black students in our university. So you may want to consider all such parallel systems,

including them, along with your own, when listing the intermediate objectives that lead to your more ultimate objectives. Another way to do this might be to place your own system within The Big Picture of recursive triads.

Accomplishment vs. Activities

Most professional systems analysts argue that you should specify the objectives as accomplishments and not as activities. An accomplishment is something you can observe in the absence of the producer, the actor, the activity. Avoid the activity trap (Odiorne, 1974). Avoid the trap of actively running around in circles that do not lead to your ultimate objectives. We can be very active and accomplish nothing. For example most people, including behaviorists, define teaching in terms of lecturing. But lecturing is an activity. The typical behavioral systems analyst defines teaching in terms of the initial accomplishment—the student's learning. And that is a much more effective way of looking at education. But the most sophisticated behavioral systems analysts (e.g., Gilbert, 1978) would evaluate (if not define) teaching in terms of its contribution to ultimate objectives; students can spend a large amount of time learning much that they will never use, that will be of no value to anything, and we believe that is often the case. So we think it is usually better to specify objectives in terms of accomplishments rather than activities; but if you do not have your eye on the ultimate goal, you still may accomplish nothing ultimate value.

Here are some examples of the distinction between accomplishments and activities: "Interview supervisors" is an activity. But "interviews obtained" is an accomplishment. "Optimize profit" and "produce product" are activities, but "profit optimized" and "product produced" are accomplishments. Generally, to specify accomplishments rather than activities, you should avoid verbs, but verbs like "obtain" and "achieve" will usually work. However, we are not convinced of the universal importance of a distinction between an activity and an accomplishment that depends on these linguistic subtleties.

Accomplishments rather than activities are usually equated with permanent results, permanent products—for example, an

article written or a bridge built. But some objectives do not leave permanent proof of accomplishment. For example, although the comedian's telling jokes is an activity, the audience's laughing is an accomplishment of the jokes; but the laughter is transient, not a permanent proof of accomplishment.

We might say we could get permanent proof of accomplishment, if we were to make a video tape of the laughing audience. But that is not satisfactory, because we could also take a video tape of the comedian telling jokes, as permanent proof; but the joke telling is still an activity for the comedian. Of course, the laughing audience is an activity for the audience; but the laughter of the audience is an accomplishment from the point of view of the comedian.

Means vs. Ends

Perhaps we should cautiously accept activities, as well as accomplishments, when listing our objectives. The real issue is that we should avoid falling into the ends-means trap, rather than avoiding falling into the activity trap. If we are satisfied with accomplishing lower-level objectives and not concerned with their contribution to higher-level objectives, we have fallen into the ends-means trap. For example, having a health program in operation (or worse yet, operating a health program) is just as well specified an objective as having a church built, though the concreteness of the built church might make it seem more like an accomplishment and less like an activity. But, both are incomplete analyses, unless they are followed by a higher level objective that does specify an accomplishment in terms of number of healthy people or number of souls saved. The fundamental principle is to avoid being satisfied with stating an objective that is just a means to an end; you must ultimately specify and achieve that end.

Here is another example: "Attending a three day seminar" is an activity and more importantly it is a means to an end. In spite of linguistic differences, it is functionally the same as the accomplishment "having 20 people attend the seminar." But they are both just means to an end, at least an intermediate end, such as the following objective, stated as an accomplishment: "Eighteen

students pass the test at the end of the seminar with a score greater than 92%."

Specification of the Standards

You should specify the standards for each accomplishment, for example, write at least five pages per day, with no more than five grammar errors, and spend no more than six hours doing so. Sometimes it will help to look at the exemplary performers in an area to determine what are reasonable standards to set, as Gilbert (1978, p. 30-42) recommends.

Objectives should be measurable along the following dimensions (Gilbert, 1978, p. 45):

1. Quantity
   (a) Rate
   (b) Timeliness
   (c) Volume
2. Quality
   (a) Accuracy
   (b) Class
3. Cost
   (a) Labor
   (b) Material
   (c) Capital equipment
   (d) Management

Here is an objective, that illustrates some of the sub-dimensions: A 30-page (volume) article to Federal Express by 7:00 pm, 2-13-87 (timeliness), with no more than one grammatical error per 10 pages and no more than one conceptual error per 20 pages (accuracy) and containing at least two concepts, issues, or approaches per 10 pages that will be novel to most of the readers, that does not require more than 50 hours of author revision from the original rough draft or more than three hours of work from the journal editor (labor). We might add that the article be accepted without major revisions, a combination of accuracy and class. (Note: The standard of timeliness usually deals with deadlines.)

There are two major types of quality dimensions—accuracy

and class. Class is the hardest to define. It is usually the most subjective, but often most important, nonetheless. Examples of class dimensions would be appropriateness, and the extent that the product is aesthetically rewarding (like a piece of music or a painting). Though class is probably the most difficult dimension to measure objectively, we can in fact take objective measures of people's subjective opinions, for instance a board of experts or a board of lay people, a reviewing panel. Class is important because it may be the crucial dimension in distinguishing between an outstanding or brilliant professional career and one which is mediocre. (Gilbert also lists novelty as a subdimension. We have not found it too relevant to the daily concerns of most systems analysts. It would, however, be relevant to systems of artistic production.)

Usually, if not always, you should specify standards for at least one subdimension for each of the three major dimensions. In other words, you should specify a standard for quantity, quality, and cost, and perhaps more than one dimension for some of them, for example, timeliness as well as rate. And, of course, in specifying these standards, you will automatically need to specify the units of measurement, for example, parts per hours, errors per page, dollars or hours of work per project.

You will express rate in terms of some quantity of units produced per unit of time, for example "Graduate five MA students per year," or "Sell 10 cars per day." You will usually state the standards of cost using the expression "less than" or "equal to or less than"—for example, "less than $3 per part."

Controllability?

Gilbert (1978, p. 153) states that objectives should specify accomplishments that are completely controllable by the person responsible for achieving those accomplishments. And when this is possible, it is, no doubt a good idea. Unfortunately we must often be held responsible for accomplishing objectives over which we have only partial control, for example, the success of a business.

Still we can raise the question of whether we should make special incentives contingent on the accomplishment of objec-

tives over which our staff has only partial control. For example, should we give a bonus, or merit pay, or part of the regular salary to sales people based on their sales, even though outside influences may also be important? Or should we provide special incentives for teachers based on the success of their students or therapists based on the success of their clients? The problem is that, if they are not held at least partially responsible for the achievement of such objectives, then they might not go the extra mile such achievement may require, whereas otherwise, they might put out the required extra effort. One solution is to make only bonus pay contingent on accomplishment.

Another compatible solution is to specify those steps in the process of selling, teaching, and therapy that would constitute going that extra mile and then making pay partially contingent on properly completing the process, even though it might not always result in achievement of the end objective (B. Yancey, Personal Communication, 1987).

Figure 8 shows a form to be used as a job aid in specifying a single objective, and Figure 9 shows an example of the application of this form.

CONCLUSIONS

In this paper, we have argued that most organizations or human performance systems fail to fully achieve their ultimate goals, while suggesting that they can be moved in the right direction with the aid of behavioral systems analysis. Success depends on emphasizing goal-directed systems design, where designers insuring that all of the organization's efforts and initial and intermediate objectives lead clearly to its ultimate objectives.

As difficult as this design phase is, it is but the first of several along the path to organizational effectiveness. Not discussed in this paper is the next phase that involves continuous evaluation of the extent to which a system is achieving its sub-objectives and the use of behavior analysis to guide modification of organizational practices that move it closer to jointly achieving sub-objectives and ultimate objectives.

Many of the other articles in this volume address the questions concerning whether goals, once specified, are being achieved in-

Objective-specification form

SUMMARY STATEMENT OF OBJECTIVE:

WHO IS RESPONSIBLE FOR ITS ACCOMPLISHMENT?

WHAT ARE THE STANDARDS?

- QUANTITY
  - RATE:
  - TIMELINESS:
  - VOLUME:
- QUALITY
  - ACCURACY:
  - CLASS:
- COST
  - LABOR:
  - MATERIALS:
  - CAPITAL EQUIPMENT:
  - MANAGEMENT:

IS THIS OBJECTIVE LOGICALLY PLACED?

IS IT STATED AS AN ACCOMPLISHMENT?

Figure 8. A form for the specification of objectives.

tentionally, rather than accidentally. The idea of causal mapping described by Mainstone and Levi (this volume) (in their Figure 7) is related to the concepts developed in this article. We have, however, attacked the issues concerning higher-level objectives which connect the system of other systems and society, the hierarchy of objectives, the connections among them, and their measurement. Thus, we have discussed the steps a systems designer should take to select the system outputs to be controlled with techniques such as SPC; we have done this instead of discussing a specific application of SPC. Use of our goal-directed model in

Objective-specification form

SUMMARY STATEMENT OF OBJECTIVE:
Instructional materials prepared to teach goal-directed systems analysis.
WHO IS RESPONSIBLE FOR ITS ACCOMPLISHMENT?
Malott.
WHAT ARE THE STANDARDS?

QUANTITY

RATE:
Three pages per week: one page of commentary, one page of exercises, and one page of examples of similar exercises.
TIMELINESS:
Every Wednesday at 2:00 PM.
VOLUME:
Not applicable.
QUALITY
ACCURACY:
Low rate of spelling errors to standards of Micro-Spell. Material consistent with the current procedure of goal-directed systems analysis, for example, numbering system.
CLASS:
Students will evaluate the material as enjoyable, useful, easy, and a reasonable amount of work. Students will be able to correctly apply exercises to novel problems in class.
COST

LABOR
Malott will spend no more than five hours per week preparing these materials.
MATERIALS:
These instructional materials will make use of no more than the normal amount of paper. But they may involve considerable time on the computer by the students, for example, 3-4 hours per week.
CAPITAL EQUIPMENT:
Make use of no more than the micro-computer facilities normally available.
MANAGEMENT:
No appreciable management costs, other than some performance contracting and a few dollar penalties from Malott.
IS THIS OBJECTIVE LOGICALLY PLACED?
We cannot tell, out of context.
IS IT STATED AS AN ACCOMPLISHMENT?
Yes.

Figure 9. An application of the form for the specification of objectives.

no way precludes the use of SPC. However, it does suggest what issues must be resolved before SPC should be used.

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