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Task and Sentient Systems and Their Boundary Controls*

Foreword (by E.J.M.)

What follows is a lightly edited version of the concluding chapters of a book by the late Kenneth Rice and myself, first published in 1967: *Systems of Organization: The Control of Task and Sentient Systems*, pp. 251–69. It extended Rice's previous applications of open system theory to the study of organizations (Rice 1958, 1963).

In this book we defined a *task system* as comprising the "system of activities . . . required to complete the process of transforming an intake into an output . . . plus the human and physical resources required to perform the activities." A *sentient system* or group is one that "demands and receives loyalty from its members." "An effective sentient system relates members of an enterprise to each other and to the enterprise in ways that are relevant to the skills and experience required for task performance"; it also provides its members with some defense against anxiety.

In the body of the book we drew on material from our own action research and consultancy in a range of enterprises in order to explore several themes: transactions across enterprise boundaries (sales, dry-cleaning); disentanglement of coincident task boundaries (family businesses); temporary and transitional task systems (design and construction of a new steel-works, research institutions, airlines); and the elimination of organizational boundaries within enterprises (a computer-controlled production system in a steel-works).

Most concepts and theories of organization had been based on production activities. In the open system framework these are "conversion systems," lying between the "import" and "export" activities of the enterprise. The Tavistock Institute's early applications of the concept of the *socio-technical system* had been in similar settings and there was a strong interest in seeking joint optimization of the social and technical. Rice's experiments in textile

weaving fell into that category. But many of our examples concerned activity systems, such as sales, which cross the boundaries of the enterprise, and also temporary and transitional systems, such as construction or research, where teams are brought together for a specific task: when that is completed they are disbanded and redeployed in new configurations. These suggested that the primary work-group concept of coincident task- and sentient-group organization is not essential to provide the means through which the individual is affiliated to the enterprise. Obversely, if the individual is exposed to frequent changes in work-group membership, in role, or in organization, then he needs some relatively more secure and enduring affiliation to relate him to the task of the enterprise. He must therefore occupy at least two work-oriented roles—one in a task system and the other in a sentient system. In a research enterprise, for example, sentient needs may be provided by a relatively permanent scientific or professional base, from which the individual is assigned to transient project teams.

Conceptually and practically, therefore, it is necessary to create three forms of organization: to control task performance; to ensure people's commitment to enterprise objectives; and to regulate relations between task and sentient systems. These requirements are inherent in temporary and transitional systems of activity; and the corresponding project-type organization provides the most appropriate basis for a general theory of organization.

That is one major theme running through the book. The second is that such a model requires the precise definition and control of the boundaries of activity systems and of groups. These two themes are taken up again, with other examples, in the concluding chapters.

Task and Sentient Systems

Tasks Precluding Coincidence of Task and Sentient Boundaries

If a task system, and hence a task group, straddles an enterprise boundary, it cannot be contained within the organizational boundaries of the enterprise; discrepancy between task and sentient systems is therefore inevitable. More importantly, if managing systems and their accompanying control and service functions are modelled on factory production systems, they tend to give hierarchies that are too simple and too inflexible to fit the complexities of such task performance. The representatives of a sales force and establishments in the dry-cleaning industry illustrated this part of our thesis.

The organization of professional service could also be considered within the same conceptual framework. The characteristic feature of a professional relationship is that it is made between a client (or patient) who wants help and a

professional person who gives it, or tries to do so. The activity system through which the help is given has a boundary that encompasses professional and client. On the one side, the client has to rely on the skill, experience and integrity of the professional to do what is necessary; on the other, the professional has to forswear exploitation of the dependent relationship involved. Implicit in the professional-client relationship is the possibility of failure, with corresponding anxieties, conscious or unconscious, that the client's problems may be intractable or the professional's skills inadequate. The more there is at stake, the more intense the confused and ambivalent feelings associated with the dependence are likely to be.

The sentient groups to which professional men and women commit themselves and from which they draw their support are the professional associations and their related learned societies. Membership is a qualification to practice. And the sanction to practice those professions that are concerned with the lives, liberties and property of their clients has, in our society, the force of law. Society, in effect, not only defines the boundaries of the task system and of the sentient system, and separates them, but also, through the sentient system, controls professional conduct in the task system.

Attempts that have been made to devise organizations based on person-centered task systems have also ignored the more general case of the task system that is temporary and transitional. We used building, research and air transport as our examples. The theater provides another. In the theater the task group is the cast and other staff assembled for a play. While the play is running, task group and sentient group are, or should be, coincident; but actors have "the profession" as their superordinate sentient group, to which they can commit themselves whether acting or "resting." Without the profession and the regard in which it is held, both by its members and by the public, it is doubtful if the theater could survive.

NATURAL COINCIDENCE

In the family business, by definition, task and sentient boundaries must coincide. But such a form of organization requires for its effectiveness conditions of stable equilibrium. In conditions of social, economic and technical change, commitment to the one group, the family, can not only distort judgments about task decisions, but can also lead to disruption of sentient-group relationships. In addition, as the group increases in size, it is less able to provide either satisfactory relationships or adequate self-regulation.

The great religious institutions are also examples of enterprises with coincidence of task and sentient boundaries. A church is characterized by its members' collective belief in a deity or system of deities on whom they can depend,

and also in some kind of life after death as well. The sentient system of a church, to which its members commit themselves, is therefore unbounded, in that it has no ending. In the spiritual sense there is no export system. Yet many of the tasks undertaken by the church are performed in activity systems that must have a finite life, if only because in human terms death is an end. As religious beliefs change, and scientific knowledge questions more and more of the assumptions on which they are based, a church finds it increasingly difficult to reconcile its bounded practical responsibilities for the living and the unbounded sentient system on which its membership depends.

CONTRIVED COINCIDENCE

One of the earliest attempts deliberately to invent a form of work organization in which task- and sentient-group boundaries coincided was in the textile industry (Rice, 1958). The invention, which accompanied the introduction of automatic looms, was stimulated by the need to counter the human deprivation caused by job breakdown and the concomitant loss of a traditional craft skill. The outcome was the formation of internally led, quasi-autonomous, primary work groups. The results showed greatly increased production, higher quality, reduced costs, and, so far as could be judged from their behavior, much greater satisfaction for the workers.

From this and subsequent experiments and observations we were able to postulate the particular conditions under which such autonomous work groups were likely to be effective:

- The task must be such that those engaged in its parts can experience, as a group, the completion of a whole task.
- There must be a well-defined boundary with a measurable intake/output ratio that can serve as a criterion of performance.
- The group has to be of such a size that it can not only regulate its own activities, but also provide satisfactory personal relationships.
- Neither the range of skills required nor differences of status should be so large as to prevent internal mobility.
- The task/sentient group should not be unique. Disaffected members need the possibility of moving to another similar group. Otherwise the investment in the one group is likely to be so great as to distort values and judgements, and the possibility of expulsion so threatening as to be destructive.

This last condition in particular certainly does not hold in the family business. The commitment of their members that such groups require for their effective-

ness is itself a barrier to accommodating change. Even so, there is undoubtedly scope, in industries with relatively stable technologies, for improvements in productivity by creating socio-technical systems in which task and sentient boundaries coincide.

COINCIDENT BOUNDARIES AND CHANGE

The pace of change is, however, becoming faster: for enterprises in industries facing frequent product obsolescence or technological innovation, organization must become a readily dispensable tool.

The case from the steel industry showed that introduction of computers for scheduling and for production and process control had already disrupted not only accepted task-system boundaries but also the associated sentient groups; and, in consequence, had called into question the validity of the location of traditional organizational boundaries and of the associated management roles. Comprehensive data-storage with instantaneous access, the computer programming of routine decision making and the building of simulation models to allow the results of alternative strategies to be compared before they are implemented, can lead only to a greater centralization of power and control. The inherent evolutionary capacity of modern computer technology—the capacity of the computer to learn from experience—will rapidly make redundant much of the specialized experience, particularly in middle management and administration, on which so much decision-making has had to rely in the past. With this redundancy many established career patterns and their associated promotion paths will disappear. New kinds of organization will provide new roles requiring new skills, and attempts to preserve traditional organizations and traditional roles must inevitably lead to inefficiency and social dislocation.

In industry the invention of a new product can give its inventors several years' start over potential competitors. If the market for the product is lucrative, imitations enter the field. As soon as that happens the inventive phase is over. Thereafter, modification and new applications of the product can give a competitive advantage, but the start gained by such innovations rapidly shortens as know-how in manufacturing and application becomes more generally available. If by this time the market for the product has become a mass market, then mass production—which by reason of its heavy investment in specific manufacturing processes is the enemy of invention and innovation—takes over and inhibits further change until the product itself becomes obsolete.

Institutions tend to follow the same pattern. A new institution in a new field starts up with high hopes and little acceptance. If it survives the early indifference to its outputs (or even attempts to crush it), its ideas and methods gradually become acceptable and it becomes respectable. A new institution can

command great investment from its members. Their task and sentient groups coincide. They are prepared to work long hours often for little money because of their belief in their cause. In time, other sentient groups exert their pull— family, other jobs, established professions—and members leave; the remainder may struggle on, but, unless new ideas emerge, the institution can easily be submerged and become indistinguishable from its contemporaries.

DIFFERENT KINDS OF SENTIENCE

This brings us to the point that while sentient groups have to have meaning, or else commitment will be inadequate, the sentience may arise in different ways and have different meanings at different times. Sentience is likely to be strongest where task and sentient boundaries coincide and, more particularly, where members share both a common belief in the objective of the group and complementary beliefs about their respective contributions to it. As our work with family businesses demonstrated, beliefs that the contributions of the various members are not merely complementary but indispensable introduce such ambivalent stress into situations that task performance suffers and the sentience itself is correspondingly vulnerable. At the other end of the spectrum, a group in which every member has a similar role, so that all are interchangeable and each individual is all too dispensable, cannot acquire sentience unless it finds supplementary activities through which members can make individual and complementary contributions. Many groups of semiskilled and unskilled workers fall into this category. The professional body is in yet another category since, although it is largely undifferentiated in terms of the qualifications and the rights and obligations of its members, it is at the same time the powerful sanctioning body that confers on them the right and security to engage in professional relations with their clients. To be effective as sentient groups, the kinds of scientific base that we adumbrated earlier need to have something of this professional quality.

The nature of the sentient requirements is also determined by the nature of the task of the enterprise. An enterprise that carries out a socially reputable task usually has little difficulty in obtaining the commitment of its members; one that is socially questionable will have much more difficulty; and one that is socially objectionable can get commitment only from rebels and deviants. Indeed, antisocial enterprises require elaborate codes of behavior to ensure adherence and, furthermore, have to impose severe penalties for their breach.

In fact, most institutions have had to devise special mechanisms to reinforce commitment. Pension and housing schemes, staff parties, salesmen's rallies, exhibitions, house magazines, are among the more frequently used. But it is

notable that welfare activities, sports clubs and profit-sharing schemes have had a very limited success in industry. Even types of co-ownership, in which employees have had equity voting rights, have proved less attractive than their inventors hoped. The sentient group of ownership has been insufficiently professional, usually because the majority of co-owners have not had the experience and skill required to make strategic decisions about relations with the environment.

One widespread mechanism through which highly structured organizations reinforce both their internal differentiation and the commitment of their members is ritual role-reversal. This may be observed, for example, in an Indian temple festival when, on one day in the year, a member of an untouchable caste may be accorded the honor and respect normally reserved for a Brahman. In our own society there is the comparable army tradition that officers serve Christmas dinner to the men. Similarly, during a sale in a large department store, the ordinary selling staff may elect managers from among themselves, and the normal managers become staff. But successful mechanisms like these are not easy to invent.

Some enterprises may seek to mobilize more commitment than is necessary for effective task performance. We have known companies in which the cost of a high turnover of staff has been more than outweighed by the flexibility and new ideas that it infuses into the system. Management's desire to reduce turnover and increase loyalty may sometimes be motivated more by a desire to be loved than by the need to be efficient.

What is important is the relative balance of sentience of groups committed to the status quo and groups committed to change. Efforts by other workers to replicate elsewhere the experimental changes in weaving cited above often foundered through a failure to create initially a strong sentient group committed to experimentation. It was only such a group that could provide the necessary protective boundary within which innovation could be encouraged to take place. However, once the new autonomous groups had established themselves, they acquired their own valency and froze into a new status quo, and the group committed to experimentation disappeared.

To maintain adaptiveness, the greatest sentience must remain vested in a group committed to change. A contribution to the literature on institution-building by Perlmutter (1965) carried the subtitle "The Building of Indispensable Institutions." A major lesson from our own work is that the indispensability of the whole institution may depend on building dispensability into the parts. But the sentience of the overall institutional boundary within which this can happen is not easy to sustain. It is here that personal leadership often has a part to play. During a period of critical changes in particular, a charismatic leader who embodies a belief in the future of the enterprise can be a focus of its

sentience and enable members to withdraw sentience from the parts that need to be dispensed with.

Boundary Controls

THE PROTECTIVE FUNCTION OF CONTROL

The need for boundary controls to protect the conversion process from interference from the environment and to adjust both intake and output to environmental demands was demonstrated in our studies of research organizations and of air transport.

In its purest form, boundary control permits only those transactions between the system and its environment that are essential to performance of the primary task. It admits the necessary intakes, releases the outputs, and maintains and replenishes the resources of the task system.

Strict controls are necessary to protect experimental situations, especially those that involve social change. Without protection—diminishing as the experimental changes become more acceptable—interference can lead to "too early crystallization in social and economic dimensions because of anxiety about the disturbance of traditional patterns" (Rice, 1958).

In the same way, conferences and courses that provide opportunities for experiential learning about the human problems of leadership have to impose strict boundary controls both between the conference and its environment and within the conference between its various events, in order to protect both members and staff during a process that can be stressful (Rice, 1965). The boundaries of the conference itself are protected by the exclusion of all visitors and by the refusal to make reports on participants or to publish anything that could be attributed to any individual. Within the conference program the specific task of each event is defined as precisely as possible; staff roles and role-sets are also defined and staff members adhere to them. Time, too, is used as a boundary: events start and stop at the times published. Overspill, at least as far as the staff are concerned, is avoided as much as possible. These controls are reinforced by clear definition of territorial boundaries.

The throughput of a conference or course, like that of any educational institution, is, however, human. No conference management could guarantee to control member behavior. This is not attempted except by example. All rules are made for, and enforced on, staff. In effect, boundary controls are strict, but they are imposed only where they can be effective.

In other settings, one observes all too often controls being imposed not to protect the task system from interference but to protect management against

anxiety. Parameters are controlled not because they are relevant but because they are measurable. Their function is to create an illusion of certainty as a means of coping with intolerable uncertainty.

INHERENT AND IMPOSED CONTROLS

The easiest kind of control to maintain is that over a physical throughput when the transformation in the conversion process never leaves the throughput in an unstable condition. Machine shops in engineering provide an obvious example. The process can be stopped at any time to check the accuracy of the work done and to make any necessary adjustments. Materials or part-processed products do not deteriorate or change in form while the inspection is carried out. More difficult and more dangerous are controls over chemical processes or those that involve unstable materials such as molten metal or atomic reactions. In these processes boundary controls can be imposed only at infrequent intervals and monitoring is the only form of regulation possible at other times. More difficult still are controls over a human throughput: the throughput has a will of its own which is often at variance with the controlling agency. Adequate control is possible only when the dependence involved in the process is fully accepted both by the members of the enterprise and by the individuals who comprise the throughput. Otherwise it is necessary to provide members with the support that enables them to tolerate the uncertainties involved.

The nature of the controlling agency can radically affect attitudes towards, and acceptance of, the kinds of control imposed. Where, as in religious institutions, the authority for sanctions is derived from a deity, those who believe cannot question the rightness or the wrongness of decisions based on belief. To be engaged in God's work precludes most human interference. There are other spheres, again, in which control is easier to maintain because it is derived from natural sources rather than from human agency. The managers of enterprises concerned with the sea, with agriculture, mining and the care of the sick have for a long time exploited their own dependence on "acts of God," and hence their inability to take responsibility for what happens, as a means of controlling those employed by them.

In many chemical processes, once chemicals are mixed the process starts and is self-activating: the process itself takes control and so imposed organizational controls can be kept to a minimum. Generally speaking, the greater the number of controls that are implicit in the task or its technology, and the more effective they are, the fewer the managerial controls it is necessary to impose. When neither task nor technology provides effective built-in controls, management must devise regulatory mechanisms to ensure that it can manage. Conversely, the greater the number of automatic processes, the fewer the man-

agerial controls that should be required. It is, of course, true that automation often involves more inflexible activity systems; and, since they must by kept going, additional controls may be needed over intake and output. The total system has to live up to its automated parts. In other words, if appropriate boundary conditions are to be maintained, managerial control at the boundaries may have to be increased. The introduction of automation allows for more integration between the parts of the process and avoids some intermediate stocks and hence the tying up of working capital. But the elimination of intermediate stocks also demands greater sensitivity to market demand, with correspondingly more frequent adjustments throughout the process.

CONTRACTING OUT

The confusion between task and sentient systems and the problem of differentiating their boundaries and of controlling their interrelations are in some measure simplified by greater differentiation between the subsystems of complex enterprises. One large oil refinery, for example, directly employs only the few chemists and engineers that are required for its operating activities and for its technical and financial control functions. All other work—maintenance, transport, and even site security—is contracted out to other enterprises specializing in such services. This is by no means unique. An airline, particularly at stations away from its base, will commonly contract out passenger-handling, catering, and even load-control calculations and some aircraft maintenance activities. And, of course, the majority of industrial companies import parts of their products from manufacturers who have specialized in the required technology. The trend appears to be increasing: firms of professional architects, civil engineers and accountants have existed for a very long time, and agencies that provide temporary secretaries have also been available for many years. It is now possible to make continuing contracts for domestic as well as office cleaning, for canteen catering, long-term car hire, management recruitment, draughtsmanship, babysitting and a host of other services that were formerly the normal activities of the enterprise concerned.

Contracting out intakes and services can relieve management of many of the headaches of control of the relationships between different task and sentient groups within the enterprise. In particular, it simplifies the problem of controlling internal sentient boundaries. Against this, however, management faces greater difficulties when what is contracted out is the essential maintenance activity required to keep the process going, or a vital ingredient of the import-conversion-export process by which the enterprise performs its primary task. Management may well find that it has lost control of its own enterprise by

giving too many hostages to other managements. In the building industry, the major problem is to get sufficient commitment to a project group to maintain any kind of control over the activities of its various parts. With strikes and other stoppages one group can hold the total enterprise at ransom, as has been demonstrated only too often in the automobile industry.

Specialization of technology and product in subenterprises or separate enterprises can no doubt increase the efficiency of the parts, but until new forms of organization are invented—with activity system, task group and sentient group adequately differentiated and their interrelations controlled—it is not certain that greater efficiency of the parts will add up to greater efficiency of the whole.

PERMEABLE BOUNDARIES

Strict boundary controls are especially difficult to maintain in those systems that by their nature have to be more open. Hospitals, for example, cannot easily control emergency admissions. In general, those institutions and professions that offer help of any kind, physical or spiritual, frequently find that either their intake or their output is intractable to control. Those who come for help tend to be accepted—however hopeless their case—and once admitted are frequently difficult to export. In a study of disasters Raker, Wallace and Rayner (1956) reported: "The general pattern has been that the nearest hospitals are overwhelmed and the hospitals more remote from the disaster zone receive fewer casualties than their reasonable share." The authors show the value of triage as a control mechanism for the most effective allocation of limited medical resources. More discrimination in admission leads to greater chances of recovery for the majority; but imposition of the controls to achieve this discrimination demands an exercise of judgment and a decision-making process that run counter to all the training of most of those who manage the institution, particularly if it has a moral or religious basis. In consequence from the point of view of society as a whole, far too many resources are often spent on the virtually hopeless, while those who could recover with the minimum of help go helpless.

The introduction of medical services into developing and overcrowded countries can have tragic consequences when food, housing and other services necessary to sustain the resulting increased population are not provided as well. To advocate only "balanced" progress is, however, easy when one is not face-to-face with the suffering that absence of medical care can entail—particularly if medical services are available and others are not. Members of the medical profession cannot just deny the Hippocratic code that has been at

least implicit throughout their training. Nevertheless, their failure to control their boundary can result eventually in greater suffering for the very people they save.

DESTRUCTION AND RECONSTITUTION OF BOUNDARIES

Disasters also provide extreme examples of the obliteration of normal boundaries. Floods, hurricanes, earthquakes or nuclear bombs literally annihilate familiar landmarks by which human life is guided. It has been suggested that behavior in disaster can be analyzed in three overlapping phases: impact, recoil and post-traumatic stress (Tyhurst, 1951). The first can last from seconds up to one-and-a-half hours; the second from hours to weeks; and the third for the rest of life. In the period of impact, up to a quarter of those affected remain cool and collected, appreciate what has happened and plan recovery; up to three-quarters are stunned, bewildered, lost and numb; the remainder become hysterical and show other pathological symptoms. In the period of recoil the majority move about aimlessly, seeking shelter without plan or real purpose; they are in a dependent, childlike state in which anyone who takes charge and proposes action is followed. In other words, anyone who can replace the destroyed boundaries can assume control of the new boundaries. If, however, in anticipation of disaster, a new set of landmarks and guideposts is got ready—rescue stations, precise directions about evacuation and so on— and the boundary control functions are manned in advance, casualty rates can be lowered dramatically.

Disasters are fortunately rare, but they serve to emphasize the importance of defined boundaries and of boundary control functions. Any transaction across enterprise boundaries, an essential process for any living system, involves the drawing, temporarily at least, of new boundaries. And the drawing of new boundaries contains the possibility that these will prove stronger than the old. Such a transaction therefore has in it the elements of incipient disaster, in which not only are essential tasks undone, but sentient systems are destroyed as well.

We can learn something more from the examination of disaster. So far as is known, the actual occurrence of mass panic is rare; but the myth of panic in disaster is strong. The myth, and belief in it, is a mechanism by which stress is discharged and control restored. The destruction of boundaries is so stressful that someone has to go to pieces, or has to be believed to do so—someone or some group has to carry the role of panic leader. In more normal situations, religious sects, immigrants, racial groups, delinquents or other socially condemned minorities can threaten, or be perceived to threaten, the integrity of group boundaries. The preservation and protection of adequate sentient boundaries often depend, therefore, on finding or inventing other groups on whom

can be projected the feelings and behavior that, if retained within the sentient group, would destroy its sentience.

It is indeed very often the charismatic leader who identifies such out-groups and so mobilizes the commitment of his or her followers. While this is no doubt functional during a period of crisis and individual disorientation, in the longer term it carries dangers of its own. Commitment to the boundary represented by a charismatic leader implies a corresponding withdrawal of commitment to the most important human boundary of all—the individual's own boundary between outside and inside. In Bion's terminology (See Sutherland, 1, 2, "Bion Revisited"), charismatic leadership promotes "basic assumption" behavior, and at the level of the "assumption group" the individual in effect surrenders ego function to the group.

Long-term solutions to the problem of maintaining adaptiveness to change cannot therefore depend on manipulative techniques. On the contrary, they must depend on helping the individual to develop greater maturity in controlling the boundary between his or her own inner world and the realities of the external environment.

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