over which the individual presumably has some control and, therefore, "merits." In other words, the individual's *private* capacities are involved. But do not the individual's capacities depend to more than a trivial degree upon the genetic material with which he enters the social contest, and over which he has no more control than his race or his sex? And, therefore, is not the allocation of status according to ability actually just as much an "ascribed" criterion as the more traditional assignment of positions based on "social" heredity?

If one of the major social issues facing contemporary societies, as we have suggested, involves a basic confrontation between the principles of social heredity and the meritocracy, then which mode of selection is more equitable? Which is more "just" if volition is involved in neither the mental capacities that an individual inherits nor the social advantages conferred upon him by his parents?

Although one mode is perhaps no more equitable than the other, *one* does appear to be more rational. Here, we would agree with Linton's position, and others, that social heredity, while not "dysfunctional" in simpler societies, no longer meets the demands of a complex technology. To the extent that the survival of our present technology (and social order) depends upon the effective utilization of human resources, then the identification, sorting, and development of talent will continue to be persuasive arguments.

A FRAMEWORK FOR THE COMPARATIVE ANALYSIS OF ORGANIZATIONS *

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Complex organizations are conceptualized in terms of their technologies, or the work done on raw materials. Two aspects of technology vary independently: the number of exceptions that must be handled, and the degree to which search is an analyzable or unanalyzable procedure. If there is a large number of exceptions and search is not logical and analytic, the technology is described as nonroutine. Few exceptions and analyzable search procedures describe a routine technology. Two other types result from other combinations—craft and engineering technologies. Task structures vary with the technology utilized, and are analyzed in terms of control and coordination and three levels of management. Social structure in turn is related to technology and task structure. Finally, the variations in three types of goals are weakly related to the preceding variables in this conceptualization. The perspective provides a basis for comparing organizations which avoids many problems found in other schemes utilizing structure, function or goals as the basis for comparison. Furthermore, it allows one to selectively utilize competing organizational theories once it is understood that their relevance is restricted to organizations with specific kinds of technologies. The scheme makes apparent some errors in present efforts to compare organizations.

THIS paper presents a perspective on organizations that hopefully will provide a basis for comparative organizational analysis, and also allow one to utilize selectively the existing theories of organizational behavior. There are four characteristics of this perspective.

First, technology, or the work done in organizations, is considered the defining

* Revision of a paper read at the 1966 Annual Meeting of the American Sociological Association. This paper was prepared during the course of research on industrial corporations supported by Grant No. GS-742, National Science Foundation. Numerous colleagues criticized an earlier version unstintingly, but I would like to single out Ernest Vargas, Geoffrey Guest and Anthony Kovner, who transcended their graduate student roles at the University of Pittsburgh during the formulation of these ideas in sticky field situations.

characteristic of organizations. That is, organizations are seen primarily as systems for getting work done, for applying techniques to the problem of altering raw materials—whether the materials be people, symbols or things. This is in contrast to other perspectives which see organizations as, for example, cooperative systems, institutions, or decision-making systems.

Second, this perspective treats technology as an independent variable, and structure—the arrangements among people for getting work done—as a dependent variable. Goals are conceived of as being in part a dependent variable. What is held to be an independent and dependent variable when one abstracts general variables from a highly interdependent and complex social system is less of an assertion about reality than a strategy of analysis. Thus, no claim is made that for all purposes technology need be an independent variable.

Third, this perspective attempts to conceptualize the organization as a whole, rather than to deal only with specific processes or subparts. Thus, while the importance of technology has often been demonstrated within work groups or for particular organizational processes, here it will be used as a basis for dealing with the organization as an organization.

Finally, and in the long run perhaps most importantly, the perspective holds that technology is a better basis for comparing organizations than the several schemes which now exist.[1]

None of these points in itself is new, and the last section of this article discusses the uses to which the concept of technology has been put by others. However, the attempt to deal with all four points simultaneously, or, to put it differently, to pay systematic attention to the role of technology in analyzing and comparing organizations as a whole, is believed to be distinctive.

[1] E.g., social function (schools, business firms, hospitals, etc.), as used by Talcott Parsons in *Structure and Process in Modern Society,* Glencoe, Ill.: The Free Press, 1960, pp. 44–47; who benefits, proposed by Peter M. Blau and William R. Scott in *Formal Organizations,* San Francisco: Chandler, 1962, pp. 42–45; or compliance structure, as used by Amitai Etzioni, *A Comparative Analysis of Complex Organizations,* New York: The Free Press, 1961.

TECHNOLOGY AND RAW MATERIALS

By technology is meant the actions that an individual performs upon an object, with or without the aid of tools or mechanical devices, in order to make some change in that object. The object, or "raw material," may be a living being, human or otherwise, a symbol or an inanimate object. People are raw materials in people-changing or people-processing organizations; symbols are materials in banks, advertising agencies and some research organizations; the interactions of people are raw materials to be manipulated by administrators in organizations; boards of directors, committees and councils are usually involved with the changing or processing of symbols and human interactions, and so on.

In the course of changing this material in an organizational setting, the individual must interact with others. The form that this interaction takes we will call the structure of the organization. It involves the arrangements or relationships that permit the coordination and control of work. Some work is actually concerned with changing or maintaining the structure of an organization. Most administrators have this as a key role, and there is a variety of technologies for it. The distinction between technology and structure has its gray areas, but basically it is the difference between an individual acting directly upon a material that is to be changed and an individual interacting with other individuals in the course of trying to change that material. In some cases the material to be changed and the "other individuals" he interacts with are the same objects, but the relationships are different in each case.

There are a number of aspects of technology which are no doubt important to consider in some contexts, such as the environment of the work (noise, dirt, etc.) or the possibilities of seductive or exploitative relationships with clients, patients or customers. For our purposes, however, we are concerned with two aspects of technology that seem to be directly relevant to organizational structure. The first is the number of exceptional cases encountered in the work,[2] that is, the degree to which stimuli

[2] Cf. James March and Herbert Simon, *Organi-*

are perceived as familiar or unfamiliar. This varies on a scale from low to high.

The second is the nature of the search process that is undertaken by the individual when exceptions occur. We distinguish two types of search process. The first type involves a search which can be conducted on a logical, analytical basis. Search processes are always exceptional actions undertaken by the individual. They are nonroutine. No programs exist for them. If a program exists, only a very trivial search is involved in switching from one program to another program when the stimuli change.[3] But though nonroutine, one type of search may be logical, systematic and analytical. This is exemplified by the mechanical engineering unit of a firm building large machinery, or by programmers writing individual programs for slow readers in a special school. The second type of search process occurs when the problem is so vague and poorly conceptualized as to make it virtually unanalyzable. In this case, no "formal" search is undertaken, but instead one draws upon the residue of unanalyzed experience or intuition, or relies upon chance and guesswork. Examples would be work with exotic metals or nuclear fuels, psychiatric casework, and some kinds of advertising. We can conceive of a scale from analyzable to unanalyzable problems.

If we dichotomize these two continua into the presence or absence of exceptional cases and into the presence or absence of analyzable problems, we have a four-fold table as in Figure 1. The upper right-hand quadrant, cell 2, where there are many exceptional cases and a few analytic techniques for analyzing them, is one extreme to which we will refer as nonroutine. In the lower left-hand quadrant, cell 4, we have the routine extreme, where there are few exceptions and there are analytic techniques for handling those that occur. A one-dimensional scheme would follow the dotted line from routine to nonroutine. But note that the other two quadrants may represent viable cases in themselves and they have been labeled with some industrial examples. Few cases would probably fall in the upper left-hand corner of cell 1, or lower right-hand corner of cell 3, but otherwise many organizations are expected to appear in these two cells.

Techniques are performed upon raw materials. The state of the art of analyzing the characteristics of the raw materials is likely to determine what kind of technology

zations, New York: Wiley, 1958, pp. 141–142, where a related distinction is made on the basis of search behavior. In our view the occurrence of an exceptional case is prior to search behavior, and various types of search behavior can be distinguished.

[3] *Ibid.,* p. 142.

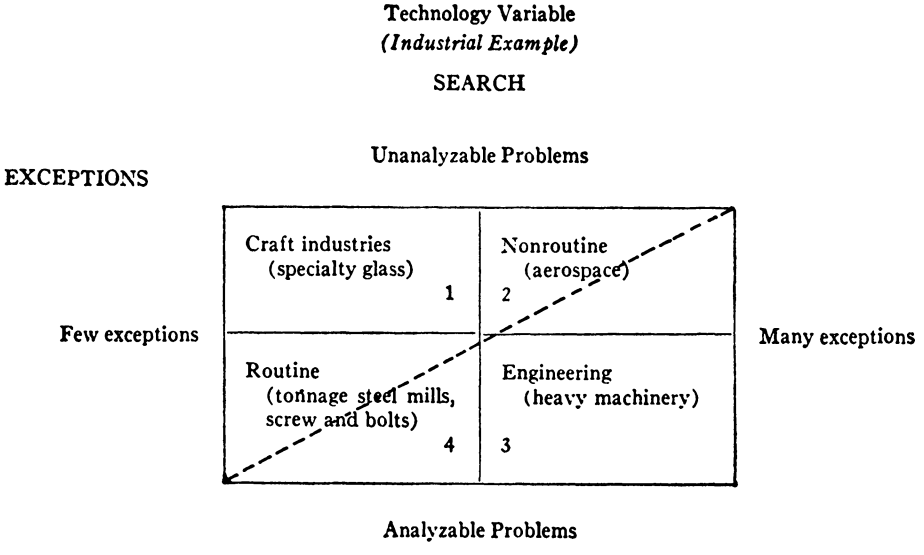

FIGURE 1.

will be used. (Tools are also necessary, of course, but by and large, the construction of tools is a simpler problem than the analysis of the nature of the material and generally follows the analysis.) To understand the nature of the material means to be able to control it better and achieve more predictability and efficiency in transformation. We are not referring here to the "essence" of the material, only to the way the organization itself perceives it.

The other relevant characteristic of the raw material, besides the understandability of its nature, is its stability and variability; that is, whether the material can be treated in a standardized fashion or whether continual adjustment to it is necessary. Organizations uniformly seek to standardize their raw material in order to minimize exceptional situations. This is the point of de-individualizing processes found in military academies, monasteries and prisons, or the superiority of the synthetic shoe material Corfam over leather.

These two characteristics interact, of course. On the one hand, increased knowledge of the nature of the material may lead to the perception of more varieties of possible outcomes or products, which in turn increases the need for more intimate knowledge of the nature of the material. Or the organization, with increased knowledge of one type of material, may begin to work with a variety of related materials about which more needs to be known, as when a social service agency or employment agency relaxes its admission criteria as it gains confidence, but in the process sets off more search behavior, or when a manufacturing organization starts producing new but related products. On the other hand, if increased knowledge of the material is gained but no expansion of the variety of output occurs, this permits easier analysis of the sources of problems that may arise in the transformation process. It may also allow one to prevent the rise of such problems by the design of the production process.

A recent analysis of a public defender system by Sudnow highlights the twin characteristics of the material variable.[4] On the one hand, offenders are distributed into uniform categories by means of the conception of the "normal crime," and on the other hand, control over the individual offender is insured because the public defender well understands the offender's "nature"—that is, his low status, limited understanding and intellectual resources, and his impecunious condition. The technology, then, can be routine because there are few exceptions (and these are handled by a different set of personnel) and no search behavior on the public defender's part is required. The lawyer in private practice, of course, is a contrasting case.[5]

It will readily be seen that these two characteristics of the raw material are paralleled in the four-fold table of technology (Figure 2). If the technology of an organization is going to move from cell 2 to any of the other cells, it can only do so either by reducing the variability of the material and thus the number of exceptional cases that occur, or by increasing the knowledge of the material and thus allowing more analytic techniques to be used, or both. One may move from cell 2 to cell 1 with increasing production runs, clients served, accounts handled, research projects underway, agency programs administered and so forth, since this allows more experience to be gained and thus reduces the number of stimuli seen as exceptions. If technical knowledge increases, increasing the reliability of search procedures, one may move from cell 2 to cell 3. If both things happen—and this is the aim of most organizations—one may move from cell 2 to cell 4.[6]

TASK AND SOCIAL STRUCTURE

For our purpose, the task structure of an organization is conceived of as consisting of

[4] David Sudnow, "Normal Crimes: Sociological Features of the Penal Code in a Public Defender Office," *Social Problems,* 12 (Winter, 1965), pp. 255–276.

[5] For a more extensive treatment of raw material somewhat along these lines, see David Street, Robert Vinter and Charles Perrow, *Organization for Treatment, A Comparative Study of Institutions for Delinquents,* New York: The Free Press, 1966, Chap. 1.

[6] Some organizations, such as mental hospitals, perceive that their technology is inadequate to their goals, and try to move from cell 4 to cell 2 in the search for a new technology.

Raw Material Variables
(People-Changing Examples)
PERCEIVED NATURE OF RAW MATERIAL

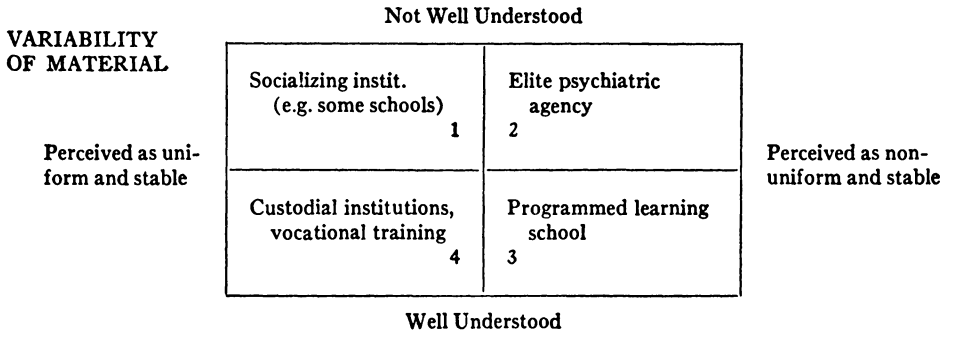

FIGURE 2.

two dimensions, control and coordination. Control itself can be broken up into two components. They are the degree of discretion an individual or group possesses in carrying out its tasks, and the power of an individual or group to mobilize scarce resources and to control definitions of various situations, such as the definition of the nature of the raw material. Discretion here does not mean freedom from supervision or freedom simply to vary task sequences or pace of work. Both of these are compatible with routine activities, and some nonroutine tasks must be closely supervised or have precise sequences of tasks, once a program is selected, because of their critical nature. Nor does the length of time between performance reviews[7] necessarily indicate discretion. Rather, discretion involves judgments about whether close supervision is required on one task or another, about changing programs, and about the interdependence of one's task with other tasks.[8] Discretion and power may often be correlated,[9] but there is an important distinction. Power affects outcomes directly because it involves choices regarding basic goals and strategies. Discretion relates to choices among means and judgments of the critical and interdependent nature of tasks. The consequences of decisions in the case of discretion have no direct influence on goals and strategies; these decisions are formed within the framework of accepted goals and strategies.

Coordination, on the other hand, can be achieved through planning or feedback, to use the terms proposed by March and

[7] Eliot Jaques, *The Measurement of Responsibility*, Cambridge: Harvard University Press, 1959.

[8] This raises serious operationalization problems. In my own work, first-line supervisors were said to have considerable independence in some routine production situations, and to have little in some nonroutine situations, according to a questionnaire, though it was observed that the former had little discretion and the latter a good deal. Kovner found the same kind of responses with a similar question regarding control of job and pace of work among nurses in routine and nonroutine nursing units. See Anthony Kovner, "The Nursing Unit: A Technological Perspective," unpublished Ph.D. dissertation, University of Pittsburgh, 1966. See also the discrepancy between scores on a similar matter resulting from different interpretations of discretion in two studies: Rose L. Coser, "Authority and Decision-Making in a Hospital," *American Sociological Review*, 23 (February, 1958), pp. 56–64, and James L. Hawkins, and Eugene Selmanoff, "Authority Structure, Ambiguity of the Medical Task, Absence of Doctor from the Ward, and the Behavior of Nurses," Indiana University, mimeo.

[9] See, for example, a developmental scheme which holds that critical tasks requiring considerable discretion are the basis for group domination in hospitals and other organizations, in Charles Perrow, "Analysis of Goals in Complex Organizations," *American Sociological Review*, 26 (April, 1961), pp. 335–341. See also the compelling illustration presented in the discussion of maintenance personnel in a thoroughly routinized cigarette factory by Michel Crozier, *The Bureaucratic Phenomenon*, Chicago: University of Chicago Press, 1964, Chap. 4.

Simon.[10] Coordination by planning refers to the programmed interaction of tasks, which interaction is clearly defined by rules or by the very tools and machinery or the logic of the transformation process. Coordination by feedback, on the other hand, refers to negotiated alterations in the nature or sequence of tasks performed by two different units.

It is now necessary to distinguish three functional or task areas within management in organizations. Area One, the design and planning function, entails such major decisions as what goods or services are to be produced, who the customers will be, the technology employed, and the source of legitimacy and capital. Area Two, the technical control and support of production and marketing, includes such functions (to use industrial terms) as accounting, product and process research, quality control, scheduling, engineering, plant management, purchasing, customer service, advertising, market research, and general sales management. (Not all are important, or even existent, of course, in all industrial organizations.) This is distinguished as a function, though not necessarily in terms of actual persons or positions, from Area Three, the supervision of production and marketing. This area involves the direct supervision of those dealing with the basic raw materials and those doing direct selling.[11] In the subsequent discussion we shall ignore marketing, and, for a time, Area One.

Figure 3 shows crudely the kinds of values that might be expected to appear in the task structure, considering only Areas Two and Three—technical control and support of production, and the supervision of production. Some global organizational characterizations of structure are given at the bottom of each cell. Those familiar with Burns and Stalker's work will recognize cell 2 as closest to the organic structure and cell 4 as closest to the mechanistic structure.[12]

In cell 2, we have nonuniform raw materials in both areas which are not well understood, and thus present many occasions for exceptional handling. However, the search required cannot be logically conducted, but must involve a high degree of experimentation and "feel." In such a technological situation, the discretion of both those who supervise the transformation of the basic raw material, and those who provide technical help for this process, must be high. The supervisors will request help from

[10] *Op. cit.*, p. 160.

[11] The distinction between Areas Two and Three is based upon a more limited distinction used by Joan Woodward in her brilliant study, *Industrial Organization*, London: Oxford University Press, 1965.

[12] Tom Burns and G. M. Stalker, *The Management of Innovation*, London: Tavistock Publications, 1961.

Task Structure

Task-Related Interactions

	Discretion	Power	Coord. w/in gp.	Interdependence of groups	Discretion	Power	Coord. w/in gp.	Interdependence of groups
Technical Superv.	Low High	Low High	Plan Feed	Low	High High	High High	Feed Feed	High
	Decentralized			1	2	Flexible, Polycentralized		
Technical Superv.	Low Low	High Low	Plan Plan	4 Low	3 High Low	High Low	Feed Plan	Low
	Formal, Centralized				Flexible, Centralized			

FIGURE 3.

technical personnel rather than receive orders from them, or there may not even be a clear line of distinction between the two in terms of persons. That is, the clinical psychologist or the quality control engineer will find himself "on the line" so to speak, dealing directly with patients or exotic metals and working side by side with the supervisors who are nominally of lower status. The power of both groups will be high, and not at the expense of each other. The coordination will be through feedback—that is, considerable mutual adjustment must be made. The interdependence of the two groups will be high. The development of product groups and product managers in industry provides an example, as does the somewhat premature attempt of one correctional institution to utilize a cottage system bringing both clinical and line personnel together with joint responsibility for running autonomous cottages.[13]

In the case of cell 4, uniform stable materials whose relevant nature is perceived as well understood can be handled with few exceptions occurring, and those that do occur can be taken care of with analytical search processes. In such a situation the discretion of both groups is likely to be low. This is a well-programmed production process and there is no need to allow much discretion. Indeed, there is danger in doing so. However, the power of the technical group over the supervisory group is high, for they direct the activities of the supervisors of production on the basis of routine reports generated by the supervisors. Those in Area Three are likely to see those in Area Two as hindrances to their work rather than aides. Coordination can be through planning in both groups, and the interdependence of the two groups is low; it is a directive rather than an interdependent relationship.

Cell 3 represents a variation from either of these extremes, for here, in contrast to cell 2, the existence of many exceptions which require search procedures increases both the power and the discretion of the technical group, which handles these exceptions, at the expense of the supervisory group. The supervisors of production respond to the results of these search processes rather than undertake search themselves. In the case of cell 1, the situation is reversed. Because search cannot be logical and analytical, when the infrequent exceptions occur they are handled by those in closest contact with the production process such as teachers and skilled craftsmen, and there is minimal development of administrative services. Of course, in schools that attempt to do little socialization but simply offer instruction and provide custody, technical (administrative) services grow and we move to cell 2.

Having thus related technology to task structure, let us turn to another aspect of structure—the non-task-related but organizationally relevant interactions of people. We call this the social structure.

Figure 4 follows our previous four-fold classification and indicates the variety of

[13] Street, *et al., op. cit.*, Chaps. 5, 6. The organization is called Milton.

(Social Structure)

The bases of non-task-related interaction

Social identity (communal) 1	Goal identification (mission, "character" of organization, distinctive competence, etc.) 2
4 Instrumental identity (job security, pay, protection from arbitrary power)	3 Work or task identification (technical satisfactions)

FIGURE 4.

bases for non-task-related interactions. All are present in all organizations, but the saliency varies. In cell 2, these interactions are likely to revolve more around the mission, long-range goals, and direction of development of the organizations than around the other three bases. This is because of the task structure characteristic of a flexible, polycentric organization, or at least is related to it. The category "social identity" in cell 1 is meant to convey that the non-task-related interactions of personnel that are organizationally relevant revolve around communal or personal satisfactions born of long tenure and close working relationships. This is true especially at the supervisory level, which is a large management group in this type of structure. However, it is very possible, as Blauner and others have shown, for communal relations to develop in cell 4 types of organizations if the organization is located in a rural area where kinship and rural ties are strong.[14] The basis of interaction in cell 3 is instrumental identity and in cell 4, work or task identification. These would also be predicted upon the basis of the technology.

So far we have ignored Area One—design and planning. This area receives more inputs from the environment than the other areas, and thus its tasks and technologies are derived from both internal and external stimuli. If the product environment of the organization—a term meant to cover competitors, customers, suppliers, unions and regulatory agencies—were the same in all four cells of Figure 3, we would expect the design and planning areas in cell 4 to have routine tasks and techniques, and nonroutine ones in cell 2. This is because the occasions for design and long-range planning would be few in the one and many in the other. For example, at least until very recently, the decisions that executives in the primary metals industries, railroads and surface mining had to make were probably rather routine, while those of executives in new industries such as electronics and aerospace were probably nonroutine.[15] One would expect that cell 1 would also be routine, and cell 3 somewhat nonroutine. But the product environment can alter all this. Organizations in cell 4 can be in a rapidly changing market situation even though the technical control and the supervision of production are fairly routine. Consumer goods industries probably deal with many decisions where the search behavior confronts unanalyzable problems such as the hemline of women's clothes, fads in the toy industry, or the length of time that tail fins or the boxy look in autos will last. Generally speaking, however, though the intrinsic characteristics of the product remain the same, rapid changes in the extrinsic characteristics will introduce nonroutine tasks in the design and planning area, even though it hardly alters the routine character of the technical control and the supervision of production.[16]

These are industrial examples, but it also seems likely that the tasks of Area One in custodial mental hospitals are quite different from those in treatment-oriented hospitals. Relations with the regulatory agencies, supplying agencies, the consumers such as courts and families, and the other agencies that compete for funds or clients, will be rather routine in the first, while they will be quite nonroutine and sensitive in the second. This would not be true, of course, if the latter have the means of isolating themselves from their environment.[17] Similarly, the market situation of vocational training institutions may change rather quickly as industrial technologies change,

[14] Robert Blauner, *Alienation and Freedom: The Factory Worker and His Industry,* Chicago: University of Chicago Press, 1964, Chap. 4. Blauner's theory, incidentally, is entirely consistent with the perspective proposed here, even though we do not concern ourselves explicitly in this article with the morale of hourly employees.

[15] On the former see Alfred D. Chandler, Jr., *Strategy and Structure,* Cambridge, Mass.: MIT Press, 1962, pp. 329–330, and Chap. 7 in general. The discussion of social structure and time periods by Stinchcombe can be interpreted in this manner also. Those exceptions that occur in his data appear to be examples of nonroutine technologies established in periods of predominantly routine technologies, or *vice versa.* See Arthur Stinchcombe, "Social Structure and Organizations" in James March (ed.) *Handbook of Organizations,* Chicago: Rand McNally, 1965, pp. 142–169, esp. p. 158.

[16] On the distinction between intrinsic and extrinsic prestige, see Charles Perrow, "Organizational Prestige, Some Functions and Dysfunctions," *American Journal of Sociology,* 66 (January, 1961), pp. 335–341.

[17] Cf. Street, *et al., op. cit.,* Chap. 4.

requiring changes in the design and planning of the institution, while the market of a public school that attempts to socialize youths will not change as often.

GOALS

Finally, let us turn to the last major variable, goals. Three categories of goals can be distinguished for present purposes.[18] These are system goals, which relate to the characteristics of the system as a whole, independent of its products; product characteristic goals, which relate to the characteristics of the products the organization decides to emphasize; and derived goals, which refer to the uses to which power generated by organizational activities can be put, independent of system or product goals.

We would expect completely routinized organizations to stress those "system" goals of organizational stability, low risk, and perhaps high profits or economical operations rather than growth. (See Figure 5.) In terms of "product characteristic" goals, they would be more likely to emphasize quantity than quality, stable lines over unstable or diversified lines, superficial transformations (e.g., instilling discipline in deviant clients) over basic transformation (such as character restructuring), and so forth. Their "derived" goals are likely to emphasize conservative attitudes towards the government, conservative political philosophies, conservative forms of corporate giving. Also, they are perhaps more likely to have individuals who exploit, for their own benefit, relations with suppliers, and who have collusive arrangements with competitors and devious and excessive forms of management compensation. Obviously, these comments upon possible goals are open to serious question. For one thing, we lack such data on goals for a large number of organizations. Furthermore, personalities and the environment may shape goals more than the other variables of technology and structure. Finally, the link between structure and goals is an intuitive one, based upon unproven assumptions regarding attitudes generated by task relations. But the comments are meant to suggest how goals may be shaped or constrained, though hardly specified, through the influence of technology and structure.

SOME CAUTIONS

This truncated perspective ignores the role of the cultural and social environment in making available definitions of raw material, providing technologies, and restricting the range of feasible structures and goals.[19] It also ignores, for the most part, the role of the product environment—customers,

[18] For a full discussion of these and three others see Charles Perrow, "Organizational Goals," *International Encyclopedia of the Social Sciences*, (rev. ed.), forthcoming. (Draft copies, mimeo. 18 pp., can be obtained from the author.)

[19] The role of the cultural and social environment is developed in somewhat more detail in a review of studies of general and mental hospitals in Charles Perrow, "Hospitals: Technology, Structure and Goals," in James March, *op. cit.*, Chap. 22.

Goals

System	Product	Derived	System	Product	Derived
Stability Few risks Moderate to low profit emphasis	Quality No innovations	Conserv. 1	High growth High risks Low emphasis on profit 2	High quality Innovative	Liberal
Stability Few risks High profit emphasis	Quantity No innovations	4 Conserv.	3 Moderate growth Some risks Moderate profit emphasis	Reliability Moderate innovations	Liberal

FIGURE 5.

competitors, suppliers, unions and regulatory agencies—and the material and human resources. These will have their independent effect upon the major variables.

In addition, it is not proposed here that there are four types of organizations. The two-dimensional scheme is conceived of as consisting of two continua. Nor are the dimensions and the specifications of the variables necessarily the best. It is argued, however, that the main variables—raw materials, technology, task and social structure, goals, and some differentiation of task areas within organizations, are critical ones. As to the assignment of independent and dependent variables, occasions can be readily cited where changes in goals, for example those brought about by changes in the market place or the personalities of top executives, have brought about changes in the technology utilized. The argument is somewhat more subtle than one of temporal priorities. Rather, it says that structure and goals must adjust to technology or the organization will be subject to strong strains. For a radical change in goals to be a successful one, it may require a change in technology, and thus in structure, or else there will be a large price paid for the lack of fit between these variables.[20] Furthermore, as one proceeds, analytically, from technology through the two kinds of structure to goals, increasingly the prior variable only sets limits upon the range of possible variations in the next variable. Thus, technology may predict task structure quite well in a large number of organizations,[21] but these two predict social structure less well, and these three only set broad limits upon the range of possible goals.

COMPARATIVE ANALYSES

If all this is at all persuasive, it means that we have a powerful tool for comparing organizations. The first implication of this for comparative studies is that we cannot expect a particular relationship found in one organization to be found in another unless we know these organizations are in fact similar with respect to their technology. Thus, the fact that the cosmopolitan-local relationship that worked so well in Antioch College was not found in the outpatient department of a hospital should not surprise us; the work performed by the professionals in each case was markedly different.[22] That morale was associated with bureaucracy in fairly routine public schools, but not in research organizations, is understandable.[23] Less obvious, however, is the point that types of organization—in terms of their function in society—will vary as much within each type as between types. Thus, some schools, hospitals, banks and steel companies may have more in common, because of their routine character, than routine and nonroutine schools, routine and nonroutine hospitals, and so forth. To assume that you are holding constant the major variable by comparing several schools or several steel mills is unwarranted until one looks at the technologies employed by

[20] This is argued in detail in Perrow, *ibid.*, pp. 926–946. Kovner finds those nursing units with the greatest divergence between technology and structure to have the lowest scores on a dimension of goal realization. *Op. cit.*, pp. 96–97.

[21] Unfortunately, verification of the predicted relationships would require a large sample of organizations since there are bound to be many examples of incompatibility between the variables. However, even in a small sample, those whose structure was appropriate to their technology should have fewer "strains" than those whose structure was inappropriate. Joan Woodward, using a similar approach with 100 industrial firms found strong relationships between production systems and certain aspects of structure, though the rudimentary information and analysis on the 100 firms leaves one in doubt as to how strong. See Joan Woodward, *op. cit.*

[22] Cf. Alvin Gouldner, "Cosmopolitans and Locals: Toward an Analysis of Latent Social Roles," *Administrative Science Quarterly*, 2 (December, 1957, March, 1958), pp. 281–306, 444–480, and Warren G. Bennis, N. Berkowitz, M. Affinito, and M. Malone, "Reference Groups and Loyalties in the Out-Patient Department," *Administrative Science Quarterly*, 2 (March, 1958), pp. 481–500.

[23] Gerald H. Moeller and W. W. Charters, "Relation of Bureaucratization to Sense of Power Among Teachers," *Administrative Science Quarterly*, 10 (December, 1966), pp. 444–465. In addition, for this reason one becomes wary of propositional inventories that fail to make sufficient distinctions among organizations, but attempt to support the propositions by illustrations that are likely to restrict the scope of the proposition to the particular type of organization used in the illustration. For the most recent example, see William A. Rushing, "Organizational Rules and Surveillance: Propositions in Comparative Organizational Analysis," *Administrative Science Quarterly*, 10 (December, 1966), pp. 423–443.

various schools or steel mills. In fact, the variations within one type of organization may be such that some schools are like prisons, some prisons like churches, some churches like factories, some factories like universities, and so on.[24] Once this is recognized, of course, analysis of the differences between churches or whatever can be a powerful tool, as witness the familiar contrast of custodial and treatment-oriented people-changing institutions.

Another implication is that there is little point in testing the effect of a parameter variable, such as size, age, auspices, geographical dispersion, or even national culture, unless we control for technology. For example, in the case of size, to compare the structure of a small R and D lab where the tasks of all three areas are likely to be quite nonroutine with the structure of a large bank where they are likely to be quite routine is fruitless. The nature of their tasks is so different that the structures must vary independently of their different sizes.[25] A meaningful study of the effect of size on structure can be made only if we control for technology, and compare, say, large and small banks all of which have similar servives, or large and small R and D labs. Similarly, though the brilliant work of Crozier on French culture is very suggestive, many of his conclusions may stem from the fact that only very routine organizations were studied, and even those lacked many critical elements of the bureaucratic model.[26] Equally routine organizations in a protected product environment in the U.S. might have displayed the same characteristics.

Finally, to call for decentralization, representative bureaucracy, collegial authority, or employee-centered, innovative or organic organizations—to mention only a few of the highly normative prescriptions that are being offered by social scientists today—is to call for a type of structure that can be realized only with a certain type of technology, unless we are willing to pay a high cost in terms of output. Given a routine technology, the much maligned Weberian bureaucracy probably constitutes the socially optimum form of organizational structure.

If all this is plausible, then existing varieties of organizational theory must be selectively applied. It is increasingly recognized that there is no "one best" theory (any more than there is "one best" organizational structure, form of leadership, or whatever) unless it be so general as to be of little utility in understanding the variety of organizations. The perspective proposed here may allow us to utilize existing theories selectively.

For example, a characteristic of thoroughly routinized organizations is the programmatic character of decisions, and perhaps the infrequency with which important decisions have to be made. A decision-making framework that attempts to simulate executive behavior would be fruitful in such cases, for decisions are programmed and routinized. There are fairly clear guidelines for decisions, and clear routing maps, flow charts, and so forth. (See the examples in the second half of the Cyert and March volume, *The Behavioral Theory of the Firm.*[27]) However, a decision-making perspective which emphasizes uncertainty, such as Herbert Simon's, or that illustrated in the first part of the Cyert and March volume, would not be fruitful here.[28] It would be fruitful where nonroutine tasks are involved.

The study of organizations with a moderate or high component of nonroutine activities, especially at the design and planning level, would benefit from the institutional analysis proposed by Selznick, whereas more routine organizations would not. Selznick, himself, would see them as technical tools. The Communist Party is engaged in nonroutine activities and Selznick chose to analyze the nonroutine rather than the routine as-

[24] Many of the frameworks for comparative analysis, such as those cited in footnote 1, break down because of their broad categories. The failure of some of these schemes to meaningfully order the data from a large sample of a great variety of organizations is discussed in J. Eugene Haas, Richard H. Hall and Norman J. Johnson, "Toward an Empirically Derived Taxonomy of Organizations," in Raymond V. Bowers (ed.), *Studies on Behavior in Organizations,* Atlanta: University of Georgia Press, 1966, pp. 157–180.

[25] This may be a basic error in the ambitious survey conducted by Haas and his associates, *ibid.*

[26] Crozier, *op. cit.*

[27] Richard M. Cyert and James G. March, *The Behavioral Theory of the Firm,* Englewood Cliffs, New Jersey: Prentice-Hall, 1963, Chaps. 7–11.

[28] *Ibid.,* Chaps. 1–4, 6.

pects of the multi-organization, the Tennessee Valley Authority.[29] Except for its Bell Laboratories, the American Telephone and Telegraph Corporation is probably a rather routine organization in a stable product environment and Barnard's equilibrium analysis works well.[30] Equilibrium analysis also works well for the routine operatives at the production level in economic organizations that constitute most of the subjects for the discussion by March and Simon of the contribution-inducement model.[31] Where nonroutine activities are involved, however, the measurement of both inducements and contributions tends to be difficult, and little is gained by this model except the unenlightening assertion that if the person stays in the organization and produces, there must be some kind of an inducement at least to match his contribution.[32]

There are, of course, many aspects of the general perspectives or theories of organizations that apply to all organizations, and many more will be forthcoming. What is asserted here is that we know enough about organizations in general, at this point, to suggest that more of our effort should be directed toward "middle range" theories which attempt to increase their predictive power by specifying the types of organizations to which they apply. To do this we need far better classification systems than we now have. A better classification system will be based upon a basic aspect of all organizations. In this paper we have suggested that a better system would be one which conceptualizes organizations in terms of the work that they do rather than their structure or their goals.

OTHER STUDIES UTILIZING TECHNOLOGY

If there is anything novel in the present essay it is the setting forth of an integrated and somewhat comprehensive viewpoint on technology and complex organizations. Numerous studies have dealt with specific aspects of this viewpoint and some are discussed here.

There have been a few general theoretical statements regarding technology and structure. The one closest to the perspective presented here is a seminal essay by Litwak [33] which distinguishes uniform and nonuniform tasks. His framework received some empirical support in an interesting essay by Hall.[34] One of the first attempts to specify some structural and goal concomitants of technology in general terms was by Thompson and Bates.[35] March and Simon,[36] and Simon

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[29] Philip Selznick, *The Organizational Weapon,* New York: McGraw-Hill, 1952, and *TVA and The Grass Roots,* Berkeley: University of California Press, 1949. See also *Leadership in Administration,* Evanston, Ill.: Row, Peterson, 1957, Chap. 1.

[30] Chester Barnard, *The Functions of the Executive,* Cambridge: Harvard University Press, 1938.

[31] March and Simon, *op. cit.,* Chap. 4.

[32] Woodward's remarkable book offers several implicit examples of selective utility. It seems clear, for example, that firms in her middle category (large batch, assembly and mass production) exhibit the characteristics of political science models such as Melville Dalton (*Men Who Manage,* New York: Wiley, 1959) and the first part of Cyert and March (*op. cit.*). But this view would not illuminate the other two categories in her scheme; application must be selective.

[33] Eugene Litwak, "Models of Organization Which Permit Conflict," *American Journal of Sociology,* 67 (September, 1961), pp. 177–184.

[34] Richard H. Hall, "Intraorganizational Structural Variation: Application of The Bureaucratic Model," *Administrative Science Quarterly,* 7 (December, 1962), pp. 295–308. However, the normative anti-bureaucratic tone of many of Hall's questionnaire items precludes an adequate test. An affirmative response to an item such as "I have to ask my boss before I do almost anything" probably indicates a very poor boss, rather than a situation where a bureaucratic structure is viable. A factor analysis of Hall's items was utilized to construct several discrete dimensions of some aspects of bureaucracy in connection with research reported by Aiken and Hage. It appears that the groupings are not on the basis of content, but on the evaluative wording of the items. Those stated negatively, as in the above example, group together, and those implying "good" leadership techniques (rather than bureaucratic or nonbureaucratic techniques) group together. It is doubtful that anything but good or bad leadership in a gross sense is being tested here. A valid item for degree of bureaucratization would permit respondents to approve of the necessity for close supervision, for example, as well as to indicate it is not appropriate. See Michael Aiken and Jerald Hage, "Organizational Alienation: A Comparative Analysis," *American Sociological Review,* 31 (August, 1966), pp. 497–507.

[35] James D. Thompson and Frederick L. Bates, "Technology, Organization, and Administration," *Administrative Science Quarterly,* 2 (March, 1957), pp. 325–343.

[36] James March and Herbert Simon, *Organizations,* New York: Wiley, 1958.

alone,[37] proposed and discussed a distinction between programmed and nonprogrammed decisions in general terms. Bennis[38] verges upon a technological conceptualization in parts of his excellent review of leadership theory and administrative behavior.

There have been numerous studies of the role of technology in work groups and small groups. One of the most widely cited is that of the long-wall coaling method by Trist and Bamforth.[39] In our terms this represents a premature attempt at rationalizing nonroutine activities. An assembly-line work layout was imposed on a craft and job-shop operation which was essentially nonroutine, and the results were predictably unfortunate, as were similar attempts to impose a bureaucratic structure on the nonroutine underground mining operations described by Gouldner.[40] Those interested in human relations in organizations have increasingly toyed with technology as an independent variable, but with mixed feelings and reluctance, since it appears to jeopardize some implicit values of this school of thought. See, for example, the curious chapter in Likert[41] where many of the central hypotheses of previous and subsequent chapters are undermined by observing that the consequences of leadership style varied with the routine and nonroutine nature of the work. More sophisticated statements of the impact of technology upon work groups can be found in Dubin[42] and in the comparative study of Turner and Lawrence.[43] The most sophisticated statement of the impact upon workers is presented by Blauner,[44] who uses a comparative framework to great effect; he also summarizes the vast literature on this topic which need not be cited here. Studies of experimental groups have provided evidence of the effect of technology upon small group structure. See the work of Bavelas,[45] Guetzkow and Simon,[46] and Leavitt.[47]

The impact of routine technologies upon both managerial and nonmanagerial personnel is apparent, though not explicit, in Argyris' study of a bank,[48] in Sudnow's study of a court system,[49] and in two studies of French organizations by Crozier.[50]

Technology plays an explicit and important role in a number of studies of single types of organizations, such as Janowitz's outstanding study of the military,[51] and Rose Coser's contrast of two units in a long-term hospital.[52] It is implicit in her contrast of a medical and a surgical ward.[53] It is also implicit in Rosengren's analysis of milieu therapy.[54] It plays the key role in the au-

[37] Herbert Simon, *The New Science of Management Decisions,* New York: Harper, 1960.

[38] Warren G. Bennis, "Leadership Theory and Administrative Behavior: The Problem of Authority," *Administrative Science Quarterly,* 4 (April, 1959), pp. 259–301.

[39] Eric L. Trist and E. K. Bamforth, "Some Social and Psychological Consequences of the Long-Wall Method of Coal-Getting," *Human Relations,* 4 (1951), pp. 3–38.

[40] Alvin W. Gouldner, *Patterns of Industrial Bureaucracy,* Glencoe, Ill.: The Free Press, 1954.

[41] Rensis Likert, *New Patterns of Management,* New York: McGraw-Hill, 1961, Chap. 7.

[42] Robert Dubin, "Supervision and Productivity: Empirical Findings and Theoretical Considerations," in Robert Dubin, George C. Homans, Floyd C. Mann and Delbert C. Miller, *Leadership and Productivity,* San Francisco: Chandler, 1965, pp. 1–50.

[43] Arthur N. Turner and Paul R. Lawrence, *Industrial Jobs and the Worker,* Cambridge: Harvard University Press, 1965.

[44] Robert Blauner, *Alienation and Freedom: The Factory Worker and His Industry,* Chicago: University of Chicago Press, 1964.

[45] Alex Bavelas, "Communication Patterns in Task-Oriented Groups," *Journal of the Statistical Society of America,* 22 (1950), pp. 725–730.

[46] Harold Guetzkow and Herbert Simon, "The Impact of Certain Communication Nets Upon Organization and Performance in Task-Oriented Groups," in Albert H. Rubenstein and Chadwick J. Haverstroh, eds. *Some Theories of Organization,* Homewood, Ill.: The Dorsey Press, 1960, pp. 259–277.

[47] Harold J. Leavitt, "Some Effects of Certain Communication Patterns on Group Performance," *Readings in Social Psychology,* Eleanor Maccoby, *et al.,* eds., New York: Holt, Rinehart & Winston Inc., 1958, pp. 546–563.

[48] Chris Argyris, *Organization of a Bank,* New Haven, Conn.: Yale University Press, 1954.

[49] David Sudnow, "Normal Crimes: Sociological Features of the Penal Code in a Public Defender Office," *Social Problems,* 12 (Winter, 1965), pp. 255–276.

[50] Michel Crozier, *The Bureaucratic Phenomenon,* Chicago: University of Chicago Press, 1964.

[51] Morris Janowitz, *The Professional Soldier,* Glencoe, Ill.: The Free Press, 1960.

[52] Rose L. Coser, "Alienation and the Social Structure: A Case Analysis of a Hospital," in Eliot Freidson (ed.), *The Hospital in Modern Society,* New York: The Free Press, 1963, pp. 231–265.

[53] Rose L. Coser, "Authority and Decision-Making in a Hospital," *American Sociological Review,* 23, (February, 1958), pp. 56–64.

[54] William R. Rosengren, "Communication, Or-

thor's analysis of the literature on general and mental hospitals,[55] and in his longitudinal study of a maximum security institution for juveniles.[56] It plays an ambiguous role in the Street, *et al.*, study of six correctional institutions where its impact is obscured by a competing emphasis upon executive goals and behavior, and an inappropriate reliance upon a simple custodial-treatment continuum which leads to many ambiguities about the middle organizations where components of treatment vary independently.[57]

Explicit contrasts of organizations have utilized technological variables. The most ambitious, of course, is Udy's analysis of simple organizations in nonindustrial societies where the emphasis upon technology is explicit.[58] Unfortunately, it is difficult to import his techniques of operationalization and his theory into the world of complex organizations in industrialized societies. As is noted in the preceding essay, technology is a relevant variable, and is sometimes made explicit, in Stinchcombe's discussion of structure and time periods.[59] It also plays a role, though not the key one, in his discussion of craft and bureaucratic organization.[60] The key role is reserved for market factors, and this is true of two other comparative studies —the study of two business concerns by Dill[61] and an ambitious study of two industrial firms by Lorsch.[62] In both these cases it would appear that technology is an important variable but is absorbed in the broader variable, environment. A study of several British firms by Burns and Stalker[63] uses technology as an important variable, though in a quite nonrigorous fashion; their one explicit comparison of a routine and a nonroutine firm is excellent.[64]

The most ambitious and stimulating comparative study using technology as an independent variable is Joan Woodward's survey of 100 industrial organizations.[65] Her independent variable is not, strictly speaking, technology, but is a mixture of type of production, size of production run, layout of work and type of customer order. These distinctions overlap and it is difficult to decide how a particular kind of organization might be classified in her scheme, or how she made her final classification. An examination of the actual types of organizations (bakery, electronic firm, etc.) utilized in her study, kindly provided by Miss Woodward, suggests that most of those in the general category "small batch and unit" are probably involved in nonroutine production; those in the "large batch and unit" are probably involved in routine production; those in the "large batch and mass production" category have a mixture of routine and nonroutine technologies, but are predominantly routine. If so, her findings would be consistent with our perspective. However, her analysis of continuous process firms unfortunately cannot easily be incorporated in the scheme advanced here. Efforts to do so after her book appeared floundered because of lack of crucial data.

Considering the strong empirical tradition of sociology, it is surprising that so few studies actually give details regarding the kind of work performed in organizations that permit technological generalizations. Two of the best are Gouldner's contrast of mining

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ganization and Conduct," *Administrative Science Quarterly,* 9 (June, 1964), pp. 70–90.

[55] Charles Perrow, "Hospitals: Technology Structure and Goals," in James March, ed., *Handbook of Organizations,* Chicago: Rand McNally, 1965, Chap. 22.

[56] Charles Perrow, "Reality Adjustment: A Young Organization Settles for Humane Care," *Social Problems,* 14 (Summer, 1966), pp. 69–79.

[57] David Street, Robert Vinter and Charles Perrow, *Organization for Treatment: A Comparative Study of Institutions for Delinquents,* New York: The Free Press, 1966.

[58] Stanley Udy, *Organization of Work,* New Haven: Human Relations Area Files Press, 1959.

[59] Arthur L. Stinchcombe, "Social Structure and Organization," in James March (ed.), *Handbook of Organizations,* Chicago: Rand McNally, 1965, Chap. 4.

[60] Arthur L. Stinchcombe, "Bureaucratic and Craft Administration of Production: A Comparative Study," *Administrative Science Quarterly,* 4 (September, 1959) pp. 168–187.

[61] William Dill, "Environment as an Influence on Managerial Autonomy," *Administrative Science Quarterly,* 2 (March, 1958), pp. 409–443.

[62] Jay W. Lorsch, *Product Innovation and Organization,* New York: Macmillan, 1965.

[63] Tom Burns and G. M. Stalker, *The Management of Innovation,* London: Tavistock Publications, 1961.

[64] *Ibid.,* Chap. 5.

[65] Joan Woodward, *Industrial Organization: Theory and Practice,* London: Oxford University Press, 1965.

and manufacturing within a gypsum plant,[66] and Blau's implicit contrast of a routine employment agency and a nonroutine regulatory agency.[67] The works of Argyris,[68] Crozier,[69] Sudnow,[70] and Trist and Bamford [71] also are exceptions.

Finally, we should mention the problem of operationalizing the various concepts of technology—programmed and nonprogrammed decisions, uniform and nonuniform events, routine and nonroutine techniques, simple and complex technologies, and so forth. This has rarely been systematically handled. Udy's procedures do not seem to be applicable to complex organizations.[72] Neither Lorsch [73] nor Hall [74] indicate in detail how they make their distinctions. March and Simon provide some general guidelines,[75] but Litwak [76] provides none. It is impossible to determine how Woodward [77] or Burns and Stalker [78] arrived at their classifications of companies. Street, *et al.*,[79] provide indications of operationalization, but these are not particularly applicable to other types of organizations nor are the authors particularly sensitive to the problem. Only Turner and Lawrence [80] have approached the problem systematically and fully described in an appendix the measurement of their variables. The level of conceptualization is not general enough to apply to other types of organizations than industrial firms, and the material is limited to blue-collar workers, but it is at least encouraging that in our own study of industrial firms we arrived independently at some roughly similar measures.

Udy, in a discussion of this paper, aptly noted the difficulty of reconciling the respondent's perception of the nature of his work with the observer's perception, which is based upon a comparative view. Few organizations will characterize themselves as routine, and most employees emphasize the variability of their jobs and the discretion required. Nevertheless, contrasts between extreme examples of a single type of organization appear to present no problem. It seems clear that the technology of custodial and therapeutic mental hospitals, or of firms producing ingot molds and those producing titanium-based metals, differ greatly. On the other hand, to say precisely wherein these differences occur, and how one might compare the two routine examples, is far more difficult. Such operationalization, however, depends first upon adequate conceptualization. That proposed in this essay—the two continua of exceptions and search procedures —hopefully can be operationalized for a variety of settings. (An attempt is made, with fair success, by Kovner in his study of nursing units.[81]) But much more research and theory will be required to determine if these concepts are relevant and adequate. Meanwhile, we are aware of a number of other studies of technology and organization currently under way or even in press; other concepts will no doubt be formulated and perhaps will be given systematic operational definition.

[66] Gouldner, *op. cit.*
[67] Blau, Peter, *Dynamics of Bureaucracy*, Chicago: University of Chicago Press, 1955.
[68] Argyris, *op. cit.*
[69] Crozier, *op. cit.*
[70] Sudnow, *op. cit.*
[71] Trist and Bamford, *op. cit.*
[72] Udy, *op. cit.*
[73] Lorsch, *op. cit.*
[74] Hall, *op. cit.*
[75] March and Simon, *op. cit.*, pp. 142–143.
[76] Litwak, *op. cit.*
[77] Woodward, *op. cit.*
[78] Burns, *op. cit.*
[79] Street, *et al.*, *op. cit.*
[80] Turner, *op. cit.*

[81] Anthony Kovner, "The Nursing Unit: A Technological Perspective," unpublished Ph.D. dissertation, University of Pittsburgh, 1966.