interpersonal structure. Similarly, assignment of priorities to demands determines the speed upon which they will be acted. The four basic elements, i.e., normative and interpersonal structures and internal and external resources, can again be used to explain this process. Determination of the legitimacy of demands and assignment of priorities to demands is crucial in understanding organizational behavior as frequently there is dissensus among organizational incumbents concerning the legitimacy and/or priorities of demands. This brings us to the next basic concept, that of organizational strain.

Organizational strain is defined as inconsistencies or discrepancies between structural elements of an organization. Strain at the lowest structural level has been labeled role conflict, i.e., when various role requirements are of such a nature that individuals are faced with conflicting specifications.[42] Evidence that role conflict exists in most organizations was best supported by the impressive study of Kahn, Wolfe, Quinn and Snoek.[43] Strain at the dyadic level may involve role conflict in which specifications are inconsistent or excessive, or role ambiguity in which they are poorly defined.

At another level, inconsistencies may exist between official and unofficial structures. Similarly, normative dissensus may be focalized between two structural units of an organization (e.g., departments). Among the several dimensions between which dissensus may exist are the legitimacy and priority of demands. For example, following an earthquake, first-aid units attached to a Fire Department may want to render all the help they can in searching for victims, even to the point of utilizing additional men from

other units, e.g., those with a pumper. However, if there is danger of numerous fires developing (which frequently occur following earthquakes due to movement of underground gas pipes), fire officials may choose to place highest priority on maintaining a "state of readiness" for fire suppression.

While such structural inconsistencies are probably found in varying degrees in all organizations and simply exist as part of the ongoing structure, they may result in serious organizational problems in times of disaster. Knowledge of such organizational strain is essential in predicting organizational reaction to stress situations since we would hypothesize that it is precisely at these points that one might anticipate "breakdown" or emergent problems.

It is assumed that organizational capability and demand represent a dynamic equilibrium, where under normal conditions a relatively stable relationship exists with capability exceeding demands. Organizational stress is not viewed as a set of external conditions, but rather is a term used to refer to the state of an organization when certain conditions are present. Thus, organizational stress is defined as the organizational state or condition when organizational demands exceed organizational capability.[44] Organizational stress is not a discrete variable, but rather, constitutes a continuum. The degree of stress is determined by the disparity between two variables: (1) level of organizational demands and (2) level of capability. Upon analysis, the complexity of this relationship becomes apparent. To simplify as much as possible let us examine the characteristics of a maximum stress situation such as might be initially produced by a natural disaster. Note that it is not the disaster per se that is the source of the stress, but rather the change in demands and capability.

A. change in demands made on the organization
   1. quantity
      a) sharp increase
      b) increase in unanticipated
   2. priority
      a) consequences of organizational action threaten central values of organization or society, i.e., organizational actions are viewed with increased seriousness
      b) immediate organizational action is required
   3. qualitative changes
      a) demands previously met, but not currently being met are made on the organization
      b) new demands not previously made on the organization are made and temporarily accepted by the organization

B. change in capability of the organization
   1. intra-organizational
      a) absence of personnel, especially key personnel[45]
      b) absence of important equipment, material, or buildings
      c) absence of crucial information or records
   2. extra-organizational
      a) absence of personnel, especially key personnel
      b) absence of important equipment, material, or buildings
      c) absence of crucial information or records

Some of these factors may be illustrated in the following way by examples drawn from the field work of the Disaster Research Center.

A. Change in the demands made on the organization

1a. A very sharp increase in demands made on the organization.

Following the Coliseum explosion in Indianapolis, one hospital had 120 injured persons enter its emergency room within a one hour period.

1b. The increase in demands is unanticipated.

In the Anchorage, Alaska earthquake, there was neither warning nor a previous event of a similar nature. The unexpectedness of demands is perhaps best illustrated by the fact that no organization, with the exception of the public utilities, had any plans for dealing with peace-time disasters.

2a. An increase in demands which includes those which must be given high priority

Due to the high value placed on life within American culture, the police at the Indianapolis Coliseum explosion initially focused much of their effort on transporting the injured to hospitals instead of controlling traffic and securing the area.

2b. An increase in demands which included those requiring immediate organizational action

In Crescent City, California, the fire department, while assisting the police in security and rescue activities, was suddenly faced, right after the fourth seismic sea-wave hit, with a number of small fires over a 29 block area as well as a major fire at an oil and gasoline facility.

3b. An increase in demands which includes those of a type not usually made on the organization but which are temporarily accepted as legitimate

In floods, in Montana, a city engineering department was called upon to direct rescue and evacuation operations and to help in traffic control and security in addition to its normal engineering functions.

B. Change in the capability of the organization

1a. An absence or loss of personnel,especially key personnel

In the Niigata earthquake in Japan, some organizations had as many as half of their personnel absent for extended periods of time because their families had been affected by the earthquake itself or by resulting fires and floods.

1b. An absence, loss or breakdown of equipment, materials or buildings

Following Hurricane Betsy in New Orleans, both the police and fire departments lost vehicles when they were swamped by the rapidly rising water.

1c. An absence or loss of information or records

Vital records which could have been of invaluable aid in identifying the thousands of dead were buried under tons of debris at the Vaiont Dam disaster in Italy.

Some Basic Problems

It is clear then, that a condition of stress in an organization may be produced by a change in capability, by a change in demands or some combination of both. The general hypothesis which emerges is that there will be a change in the organizational performance structure when the legitimate demands placed on the organization are greater than its capability. At this point a basic methodological problem must be treated. If one is interested in understanding and predicting the various consequences of organizational stress he must be able to determine if it is present and the degree to which it is present. This requires a valid measure of demand level and level of organizational capability. Further, the two measures must be in some type of commensurate units or at least translatable into some common unit of comparison so that it can be determined whether or not at a given point in time the total demand on the organization is in fact greater than its capability, i.e., whether or not a condition of stress actually exists. As will be pointed out

later, this measurement problem apparently can be handled satisfactorily for certain organizations but for many it still appears to be problematic--or at least not readily feasible.

Let us be more specific about these measurement problems. Even the problem of measuring demand level is not an uncomplicated one. Look at the hospital as an example. We may wish to count the number of patients entering the hospital as a crude indicator of demand level. But note that of those entering via the emergency room some are "treated and released," some are "held for observation" ranging from a few hours to several days, some are "critical" cases requiring immediate and intensive care, some require many hours of surgery while others only minor medical treatment. Clearly, each patient is not the same "demand unit" as every other patient. The same may be said for patients entering via the regular admitting office.

Quite apart from the time involved for diagnosis and treatment the various patients may represent a different kind of demand. Given the norms of the hospital, ten cases of food poisioning represent a different demand than ten patients with multiple fractures and massive hemorrhaging. This suggests the necessity for classifying the various types of demand and their concomitant capability requirements. A 30 quart supply of whole blood may be more than an adequate resource for accident victims but it is largely irrelevant for patients with food poisioning.

It is also clear from our research thus far that at a given point in time the demand level may vary considerably from one segment of the organization to the next. For an electric company following a tornado the demand level for the Maintenance and Repair department may be very high while there

may be no increase at all in the demand for meter reading and billing.

To summarize, then, it should be remembered that measurement of demand level in an organization must take the following, at least, into account.

1. "Demand units" may vary as to the total amount of effort required.

2. The total amount of time necessary for an acceptable response may also vary.

3. Speed or urgency will be critical in some cases but not in others.

4. Demand units will vary as to the kind of response required.

5. At any given point in time the demand level may vary among segments of the organization.

Now we need to note some of the problems involved in measuring organizational capability. In every organization there is undoubtedly some "interchangeability of parts" but in most modern organizations this possibility is relatively limited. Clearly, female clerks in an electric company contribute very little to the organization's capability to repair downed electric lines. A laboratory technician can't be substituted for a surgeon. For most organizations then, the total number of personnel is not a useful indicator of capability level. This would suggest that a useful measure of capability needs to include an assessment of the various capabilities of the various segments of the organization. In short, it requires a profile of capabilities which is relevant for the kinds of demands which do or could develop.

Capability does not refer to what has been accomplished but to what could be accomplished. Even though department "X" has never processed more than "N" units in any previous 24 hour period, it may actually have a capability of N plus 10. Our observations indicate that when a disaster strikes a community the "productivity" of many organizations increases remarkably which suggests that pre-disaster estimates of capability would have been too low in many cases. Well-planned "field exercises" and laboratory simulations may provide reasonable estimates in some cases but the general problem is a difficult one.

The time factor is another crucial element in estimating capability. If given an indefinite amount of time even a small, "ill-equipped" organization can accomplish wonders. In most organizations, therefore, there are norms which specify what is an acceptable as contrasted to an "intolerable" time lag in the accomplishment of various tasks. The police may be able to disperse a crowd of 1,000 in three hours but not in ten minutes. Shall we say that the demand was greater than their capability from the very instant that the crowd formed or only after some reasonable length of time, (e.g., 45 minutes,) has elapsed. Clearly some time parameter must be incorporated in measures of capability.

It should also be noted that capability is not a static variable. The personnel capability of an organization may triple when all of the off-duty members finally report for work. Furthermore, an organization will have some external resources which, when mobilized, may increase its capability sharply. Later, withdrawal of some of these resources can reduce the over-all capability. Injuries, illness, and equipment breakdown may also produce a

reduction in capability level. Just as the demands on an organization may fluctuate over a period of time so too may the capability level. Any very useful research on organizational stress will need to include data on variation over time for both of these basic variables.

The discussion of these measurement problems is by no means complete but from what has been presented it is probably safe to say that the direct measurement of organizational stress as conceptualized here will probably not be feasible for most research efforts in the near future. What then are the available alternatives?

Suppose that we view stress in the way that a physician thinks of illness. Illness refers to the state or condition of an organism and is said to exist when certain indicators or symptoms are present. Thus, when changes in normal functioning of the organism occur, as indicated by the presence of a fever, for example, illness is said to be present. The word "ill" is used as a descriptive adjective, i.e., it describes the general state of the organism. The existence of this condition may be known only by certain observable indicators and no direct measure of the condition may be available. It is possible then that we may be able to ascertain the existence of the stress condition by noting certain standardized symptoms as indicators. Further, we may discover that the symptoms of "mild stress" differ significantly from those of "acute stress." In short, we may be able to get satisfactory but indirect measures of organizational stress. Such an approach has many precedents in sociological and psychological research.

How might social scientists proceed in an effort to locate valid indicators of organizational stress? What kinds of indicators should be

seriously examined? We might start by looking for any significant changes in the performance structure of an organization which follow a large-scale alteration of the environment such as occurs in a natural disaster. But we have learned that some of these observable changes are planned and programmed in advance. This is obvious when a hospital rehearses its "disaster plan." Such contingency plans will often produce an "over supply" of personnel and significant modifications in procedures, interaction and activity patterns. These changes can and do occur in the absence of any significant change in demand level as when a hospital is warned that mass casualties will soon arrive and they never materialize. Such planned changes may occur in the absence of stress.

But suppose we look at "unplanned" changes--those which occur with little or no consultation and overt decision-making involved. On the face of it one could anticipate that when demand exceeds capability the most obvious change would be either disorganization and irrelevant activity or a changed mode of organization which appears to be both relevant and somewhat effective. We have seen very little evidence of the former but a good deal of the latter. In short, it is our impression that when an organization or part thereof appears to be clearly "overloaded" (in a state of stress), a variety of unplanned changes in the performance structure occur most of which appear to be adaptive rather than maladaptive in relation to the immediate demand level. Among the unplanned changes which occur there ought to be certain kinds which reoccur in many organizations which appear to be under stress and over a period of time it ought to be possible to isolate some of the more valid ones to use as standard indicators of organizational stress.

The search for these stress indicators could proceed on two fronts. First, there should be field studies of organizations in disaster or other unusual settings where there appears to be a disparity in the demand-capability ratio. At a minimum, it should be possible to locate organizations or parts of organizations where the evidence clearly suggests that they are under stress even though exact measures of demand and capability are not readily available. For example, in the blizzard of 1967, the Chicago Transit Authority lost almost all of its bus transportation capability at a time when there was a sharp increase in demand.[46] In cases like this a careful examination of the unplanned changes in the organizational performance structure, when compared to the normal patterns and contingency plans, should yield a variety of stress indicators. In other disasters--e.g., where one hospital was clearly overloaded while others in the same community were not, the latter could be used for control purposes to be certain that some apparent indicators were not just artifacts of the alerting and warning processes. During a wide-spread electric power blackout it is likely that many organizations would be under stress primarily through a drastic reduction in capability. It was a qualitative change in demands that probably put the Dallas Police force under stress following the assassination of President Kennedy.

A second approach to the search for stress indicators can be conducted through laboratory simulation where small organizations or segments of larger organizations can be brought to the laboratory and realistic simulations of both "normal" and stress periods can be conducted.[47] The problems of observing and recording unplanned changes are considerably less than in field studies but it must be recognized that it simply is not feasible to

bring some organizations or segments of organizations into a laboratory, e.g., the emergency room of a hospital, if the intent is to analyze such units under realistic conditions. But having stated this reservation we want to make it clear that realistic laboratory simulation in the social sciences has scarcely gotten underway.[48] Practitioners of the "hard sciences" with all of their mathematical models and exotic instrumentation have nevertheless spent billions of dollars conducting research through the use of simulators of one kind or another. It would appear that social scientists have been both timid and lacking in imagination when it comes to attempting realistic simulation of social systems. If the study of system stress is a justifiable objective then serious attention ought to be given to realistic simulation as one method to be used.

Whether in the laboratory or the field what kinds of stress indicators might we hope to isolate? In any research effort what is observed and recorded flows from the theoretical framework being utilized. At least that is the ideal we teach and attempt to practice. Since a number of theoretical perspectives dealing with system stress will undoubtedly emerge it is almost certain that the stress indicators "found" to be the most significant will vary among researchers with different theoretical orientations, at least for a time.

Since we have begun work in this area and have attempted to outline a theoretical framework for the study of system stress we will conclude by listing some of the ideas about stress indicators which appear to us to be potentially fruitful.

1. Drastic curtailment or complete cessation of certain on-going activities of the organization.

The specific kind of activity may vary depending on the type of organization being observed. It could be record-keeping in some cases and sales or recruitment activity in another.

2. Change in the hierarchial level where "important" organizational decisions are made.

Evidence to date suggests that for some organizations critical decisions are made with greater frequency at lower levels of the organization during the stress period. It is possible that in other organizations the reverse trend may be in evidence.

3. Reduction in number of persons conferred with before certain types of decisions are reached.

This may apply to only certain types of decisions. "Routine" decisions may well be an exception.

4. Change in the pattern and utilization of standard channels of communication.

Since the actual communication channels normally used seldom are a carbon copy of the officially prescribed channels it will be necessary to use as a base line the network as it operates on a day-to-day basis prior to the stress period. It is anticipated that the changes would assume at least two forms: a) Reduction in the frequency and thoroughness of reporting upward in the organization, and b) short-circuiting in both upward and downward communication.

5. Modes of communication shift to maximize speed even at the expense of established standards of thoroughness and accuracy.

Here we would anticipate a proportional increase in telephone and face-to-face communication as compared to written communication.

6. An increase in short-circuiting the lines of authority.

The sending of orders or requests is, of course, a special form of communication and some short-circuiting of official lines probably occurs almost daily. We would anticipate a significant increase in this phenomenon during the stress period.

We would hold, of course, that the search for valid, standard stress indicators should not be viewed as an end in itself. It may well be true that some of the indicators will have relatively little theoretical import when viewed individually. The social scientist's ultimate interest here is in the processes and structural changes which make up the entire gestalt of

organizational adaptation and response to overload. Nevertheless, the search for stress indicators appears to be a necessary step to both theoretical and methodological advances in the study of social systems under stress.

FOOTNOTES

1. A rather sizeable volume of literature exists on personal or psychological stress. Among the better reviews are: Harold Basowitz, et al., Anxiety and Stress (New York: McGraw-Hill Book Company, Inc., 1955); W. D. Chiles, Psychological Stress as a Theoretical Concept (Dayton, Ohio: Wright-Patterson AFB, Wright Air Development Center, ARDC, USAF, July, 1957); William Harris, Robert Machie, and Clark L. Wilson, Performance Under Stress: A Review and Critique of Recent Studies (Los Angeles: Human Factors Research, Inc., 1956); I. L. Janis, Psychological Stress (New York: John Wiley, 1958); Hans Selye, The Stresses of Life (New York: McGraw-Hill, 1956); and Richard S. Lazarus, Psychological Stress and the Coping Process (New York: McGraw-Hill, 1966).

2. Anthony F. C. Wallace, Human Behavior in Extreme Situations: A Survey of the Literature and Suggestions for Further Research (Washington, D.C.: National Academy of Sciences--National Research Council, 1956), p.1.

3. Bruno Bettelheim, "Individual and Mass Behavior in Extreme Situations,"Journal of Abnormal and Social Psychology, XXXVIII (October, 1943), 417-452.

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5. E. Paul Torrance, "Behaviorism Emergencies and Extreme Situations." (unpublished final report), (Lackland Air Force Base, Texas: Air Force Personnel and Training Research Center, 1957), pp. 7-8.

6. E. Paul Torrance, Constructive Behavior: Stress, Personality and Mental Health, (Belmont, Calif.: Wadsworth Publishing Co., Inc., 1965) p. 140.

7. W. I. Thomas, Source Book for Social Origins (Boston: The Gorham Press, 1909), pp. 16-22.

8. For example, see Elizabeth W. Nall, "The Influence of Crisis in the Modification of Social Organization" (unpublished Master's thesis, Dept. of Sociology, Michigan State University, 1956), pp. 10-11. (A crisis is ". . . a destruction of the social system resulting from any cause.")

9. Thomas, op. cit., p. 18.

10. Murray A. Straus, "Communication, Creativity and Social Class Differences in Family Response to an Experimentally Simulated Crisis" (Minneapolis: University of Minnesota, 1964), p. 2. (Unpublished research report on Project 2027.)

11. Ibid., pp. 3-4.

12. Kent Miller and Ira Iscoe, "The Concept of Crisis: Current Status and Mental Health Implications," Human Organization, XXII (Fall, 1963), pp. 195-201.

13. Ibid., p. 196.

14. James A. Robinson, "The Concept of Crisis in Decision-Making," Series Studies in Social and Economic Sciences, Symposia Studies No.11. (Washington D.C.: The National Institute of Social and Behavioral Sciences, June, 1962), p. 8.

15. Charles F. Hermann, "Some Consequences of Crisis Which Limit the Viability of Organizations," Administrative Science Quarterly, VIII (June, 1963),p.64. A similar discussion was presented by Charles F. Hermann, et al., "Memorandum No. 1 for Project Michelson: Some Relations of Crisis to Selected Decision Process and Outcome Variables" (Evanston, Illinois: Northwestern University, 1964; unpublished research report for the "Studies in Crisis Decision-Making Project,") pp. 3-6.

16. Hermann, "Some Consequences of Crisis Which Limit the Viability of Organizations," op. cit., p. 65.

17. W. H. Form and Sigmund Nosow, Community in Disaster (New York: Harper and Brothers, 1958).

18. Ibid., p. 12.

19. Over 300 reports on natural disasters have been located and analyzed by the Disaster Research Center staff. Among the more theoretically oriented works are: George W. Baker and Dwight W. Chapman, Man and Society in Disaster (New York: McGraw-Hill Book Company, Inc., 1955); Allen H. Barton, Social Organization Under Stress: A Sociological Review of Disaster Studies (Washington, D.C.: National Academy of Sciences--National Research Council, 1963); F. L. Bates, et al., The Social and Psychological Consequences of a Natural Disaster: A Longitudinal Study of Hurricane Audrey (Washington, D.C.: National Academy of Sciences--National Research Council, 1963); Roy A. Clifford, The Rio Grande Flood: A Comparative Study of Border Communities in Disaster (Washington, D.C.: National Academy of Sciences--National Research Council, 1956); Billy G. Crane, "Intergovernmental Relations in Disaster Relief in Texas" (Ph.D. dissertation, Department of Sociology, University of Texas, 1960); Fred Roberts Crawford, "Patterns of Family Readjustment to Tornadic Disasters: A Sociological Case Study" (Ph.D. dissertation, Department of Sociology, University of Texas, 1957); Charles Willard Fogleman, "Family and Community in Disaster: A Socio-Psychological Study of the Effects of a Major Disaster Upon Individuals and Groups Within the Impact Area" (Ph.D. dissertation, Department of Sociology, Louisiana State University, 1958); W. H. Form and Sigmund Nosow, op. cit.; Charles E. Fritz and J. H. Mathewson, Convergence Behavior in Disasters (Washington, D.C.: National Academy of Sciences--National Research Council, 1957); Harry E. Moore,

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20. Barton, op. cit.

21. Ibid., p. 3.

22. Bates, et al., op. cit., pp. 77-79.

23. Ibid., pp. 53-60.

24. The term is from Gouldner in which he makes a distinction between the "natural system" and "rational" models for the analysis of complex organizations. See Alvin W. Gouldner, "Organizational Analysis," Sociology Today, ed. Robert K. Merton, et al. (New York: Basic Books, Inc., 1959), pp. 400-428.

25. Robert K. Merton, Social Theory and Social Structure (rev. and enlarged ed.; Glencoe, Illinois: The Free Press, 1957), p. 122.

26. Talcott Parsons, et al., Theories of Society (Glencoe, Illinois: The Free Press, 1962), p. 71.

27. Ibid., p. 75.

28. William J. Goode, "A Theory of Role Strain," American Sociological Review, XXV (August, 1960), pp. 483-496.

29. Robert H. Guest, Organizational Change: The Effect of Successful Leadership (Homewood, Illinois: The Dorsey Press, Inc., 1962), p. 144.

30. Ibid.

31. Ralph M. Stogdill, Individual Behavior and Group Achievement (New York: Oxford University Press, 1959), p. 198.

32. Alvin L. Bertrand, "The Stress-Strain Element of Social Systems: A Micro Theory of Conflict and Change," Social Forces, XLII (October, 1963) p. 4.

33. Ibid.