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The Organizational and Interorganizational Development of Disasters

Barry A. Turner

Public inquiries into behavior connected with three major disasters are examined and classified to study the conditions under which large-scale intelligence failures develop. Common causal features are rigidities in institutional beliefs, distracting decoy phenomena, neglect of outside complaints, multiple information-handling difficulties, exacerbation of the hazards by strangers, failure to comply with regulations, and a tendency to minimize emergent danger. Such features form part of the incubation stage in a sequence of disaster development, accumulating unnoticed until a precipitating event leads to the onset of the disaster and a degree of cultural collapse. Recommendations following public inquiries are seen as part of a process of cultural readjustment after a disaster, allowing the ill-structured problem which led to the failure to be absorbed into the culture in a well-structured form. The sequence model of intelligence failure presented and the discussion of cases are intended to offer a paradigm for discussion of less tragic, but equally important organizational and interorganizational failures of foresight.

Administrative organizations may be thought of as cultural mechanisms developed to set collective goals and make arrangements to deploy available resources to attain those goals. Given this concern with future objectives, analysts have paid considerable attention to the manner in which organizational structures are patterned to cope with unknown events—or uncertainty—in the future facing the organization and its environment (Crozier, 1964; Thompson, 1967; Lawrence and Lorsch, 1967).

Uncertainty creates problems for action. Actors' organizations resolve these problems by following rules of thumb, using rituals, relying on habitual patterns, or, more self-consciously, by setting goals and making plans to reach them. These devices provide the determinateness and certainty needed to embark upon organizational action in the present. But since organizations are indeterminate open systems, particularly in their orientation to future events (Thompson, 1967: 10), members of organizations can never be sure that their present actions will be adequate for the attainment of their desired goals.

Prediction is made more difficult by the complex and extensive nature of the tasks that must be carried out to fulfill organizational goals of any significance. Many tasks, particularly the more important ones, are loosely formulated, directed to ill-defined or possibly conflicting ends, and lacking unequivocal criteria for deciding when the goals have been attained. This situation is resolved sometimes by creating small areas of certainty which can be handled. At other times the problem is redrawn in a more precise form which ignores features that are difficult to specify or are nonquantifiable. Action is made possible in organizations by the collective adoption of simplifying assumptions about the environment, producing what Simon (1957) called a framework of "bounded rationality."

When a task which was formerly small enough to be handled amenably grows to an unmanageable size, resources may be

increased to handle the larger problem, or parts of it may be passed on to other organizations, so that the task becomes an interorganizational one (Hirsch, 1975). Alternatively, the task to be handled may shrink to fit the resources available or the amount of information that can be handled adequately in processing it (Meier, 1965). Each of these strategies, and many others, resolve for members of an organization the problem of what to do next by simplifying the manner in which the current situation is interpreted. They offer a way of deciding what to ignore in a more complex formulation to produce a statement of the problem in which uncertainty has been reduced. The success of such strategies, however, turns on the issue of whether the simplified diagnosis of the present and likely future situation is accurate enough to enable the organizational goals to be achieved without encountering unexpected difficulties that lead on to catastrophe.

The central difficulty, therefore, lies in discovering which aspects of the current set of problems facing an organization are prudent to ignore and which should be attended to, and how an acceptable level of safety can be established as a criterion in carrying out this exercise. Wilensky (1967) has suggested that to deal with such situations, one must discover how to recognize high-quality intelligence about the problem in hand, using the term *intelligence* in its military sense. Wilensky's criteria for high-quality intelligence are that it should be "clear, timely, reliable, valid, adequate and wide-ranging" so that it is understandable by the users, is available when needed, is perceived similarly by different users, "captures reality," gives a full account of the context, and poses the major policy alternatives.

This is excellent as a normative statement of what is desirable, but it does little in practical situations to offer tests of clarity, timeliness, or adequacy of intelligence. One means which Wilensky did put forward for tackling these latter issues, however, is by the examination of failures of intelligence, these being more important than failures of control. Taking up this suggestion, this article considers the manner in which such an approach could be used to begin to identify, as Wilensky (1967: 121) puts it, "the conditions that foster the failure of foresight." British public inquiries into major public disasters offer sets of information about some aspects of the intelligence failures that led up to them. A number of such inquiries have been scrutinized to find patterns of similarities that make such happenings more understandable and, it is hoped, more avoidable (Turner, 1976). The public inquiries referred to, and others currently being examined, all involve loss of life and damage to property on a large scale. This gives to the reports a tragic clarity arising from a concern to prevent a repetition of such major and unforeseen accidents. The main purpose of the present research, however, is not to produce a general theory of such disasters, although one may emerge incidentally, but to use them as a paradigm for the understanding of organizational failures of foresight, which are also in their way disastrous, although they may lack the public impact produced by a major loss of life.

FORESIGHT AND ITS FAILURE

In accounting for failures of foresight, undesirable events

known about in advance but which were unavoidable with the resources available can be disregarded. In addition, little time need be spent on catastrophes that were completely unpredictable. Neither of these categories present problems of explanation. In the former case, because of lack of resources, no action was possible. In the latter, no action could have been taken because of a total lack of information or intelligence. In practice, however, such extremes are rare, and in most cases of undesirable or catastrophic events, some forewarning is available potentially, and some avoiding action is possible notionally.

This situation may be clarified by making use of a definition produced by an early researcher into disaster phenomena. Carr (1932) suggested that "a catastrophic change is a change in the functional adequacy of certain cultural artefacts" (Killian, 1956: 1–2). A failure of foresight may therefore be regarded as the collapse of precautions that had hitherto been regarded culturally as adequate. Small-scale everyday accidents do not provoke a cultural reevaluation of precautions. There may be a failure of foresight at an individual level when a man drops a plate or falls off a ladder while painting his house, but such events provoke no surprise in the community, and call for no widespread cultural readjustment. By the same token, there is little need for a reevaluation of culturally accepted precautionary devices when accidents, even on a large scale, occur in situations recognized as hazardous. When a trawler is lost in Arctic fishing grounds, or when a wall collapses onto a firefighting team, there is much less comment than when an accident kills passengers on a suburban commuter train.

The concern here, therefore, is to make an examination of some large-scale disasters that are potentially foreseeable and potentially avoidable, and that, at the same time, are sufficiently unexpected and sufficiently disruptive to provoke a cultural reassessment of the artefacts and precautions available to prevent such occurrences. The intention of this examination is to look for a set of organizational patterns that precede such disasters. Having identified such a pattern, one can go on to ask whether it can also be found in the preconditions for other major organizational failures which do not lead necessarily to loss of life, but which, nevertheless, provoke the disruption of cultural assumptions about the efficacy of current precautions, such as the collapse of a major public company.

An extensive literature of disaster studies has grown up since World War II (Fritz, 1961; Wallace, 1956; Rayner, 1957; Barton, 1969; Nosow and Form, 1958), building on the work of such earlier writers as Queen and Mann (1925) and Carr (1932). A number of these studies have set out a variety of developmental models for disasters (Carr, 1932; Powell, Rayner, and Finesinger, 1953; Wallace, 1956; Barton, 1969), but because this literature is oriented to the sequence that begins with a warning of danger and moves through the onset of danger to the problems of alarm, panic, and rescue, none of the sequence patterns presented are of much help in dealing with the organizational events that permit potentially avoidable incidents to occur. Disaster planning literature aimed at management similarly begins with the assumption

that a catastrophe will occur, and directs attention to the forming of emergency committees and the organization of rescue and relief plans (Healy, 1969). Accident investigators (Goeller, 1969; Hale and Hale, 1970; Wigglesworth, 1972; Lawrence, 1974) have identified a preaccident period, but have regarded it as an individual rather than an organizational phenomenon.

Table 1

The Sequence of Events Associated with a Failure of Foresight

Stage I	Notionally normal starting point: (a) Initial culturally accepted beliefs about the world and its hazards (b) Associated precautionary norms set out in laws, codes of practice, mores, and folkways.
Stage II	Incubation period: the accumulation of an unnoticed set of events which are at odds with the accepted beliefs about hazards and the norms for their avoidance.
Stage III	Precipitating event: forces itself to the attention and transforms general perceptions of Stage II.
Stage IV	Onset: the immediate consequences of the collapse of cultural precautions become apparent.
Stage V	Rescue and salvage — first stage adjustment: the immediate postcollapse situation is recognized in ad hoc adjustments which permit the work of rescue and salvage to be started.
Stage VI	Full cultural readjustment: an inquiry or assessment is carried out, and beliefs and precautionary norms are adjusted to fit the newly gained understanding of the world.

To make it easier to organize the current data, therefore, a new developmental sequence is set out, taking account of the period when the events leading up to the disaster develop. Since it is assumed that a disaster in the sociological sense involves a basic disruption of the social context and a radical departure from the pattern of normal expectations for a significant portion of the community, the model in Table 1 begins at a notional starting point where matters can be assumed to be reasonably normal—Stage I. The set of culturally held beliefs—Stage Ia— about the world and its hazards are at this point sufficiently accurate to enable individuals and groups to survive successfully in the world. This level of coping with the world is achieved by adhering to a set of normative prescriptions—Stage Ib—that are consonant with accepted beliefs. Such prescriptions about the precautions necessary to avoid recognized hazards are embodied in laws, codes of practice, mores, and folkways. When unfortunate consequences follow on a violation of these sets of norms, there is no need for any cultural readjustment, for such an occurrence serves to strengthen the force of the existing prescriptions.

A disaster or a cultural collapse takes place because of some inaccuracy or inadequacy in the accepted norms and beliefs, but if the disruption is to be of any consequence, the discrepancy between the way the world is thought to operate and the way it really does rarely develops instantaneously. Instead, there is an accumulation of a number of events that are at odds with the picture of the world and its hazards represented by existing norms and beliefs. Commonly, in this incubation period—Stage I, a chain of discrepant events develop and accumulate unnoticed. For this to happen, all of

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these events must fall into one of two categories: either the events are not known to anyone or they are known but not fully understood by all concerned, so that their full range of properties is not appreciated in the same way that they will be after the disaster (Lawrence, 1974). In this incubation stage the failure of foresight develops. It is in the conditions for the development of this stage that the answers to Wilensky's problems about the adequacy of organizational intelligence can be found.

Beyond this stage, a further pattern of development, one that begins with the incidence of a precipitating event—Stage III—can be discerned. Such an event arouses attention because of its immediate characteristics. For instance, the train crashes, the building catches fire, or share prices begin to drop. More significantly, the precipitating incident also makes it inevitable that the general perception of all of the events in the incubation period will be transformed, by offering criteria that identify the incubating network of events so that the process of transforming the ill-structured problem into a well-structured problem may begin. The precipitating event is followed immediately by the onset—Stage IV—of the direct and unanticipated consequences of the failure, an onset which occurs with varying rate and intensity, and over an area of varying scope (Carr, 1932). Closely related is the following stage of rescue and salvage—Stage V, in which rapid and ad hoc redefinitions of the situation are made by participants to permit a recognition of the most important features of the failure and enable work of rescue and salvage to be carried out. When the immediate effects have subsided, it becomes possible to carry out a more leisurely and less superficial assessment of the incident, and to move toward something like a full cultural adjustment—Stage VI—of beliefs, norms, and precautions, making them compatible with the newly gained understanding of the world.

Reference will be made to this model in the discussion of the data examined, paying particular attention to the incubation period, for there is a special concern to identify the conditions that make it possible for unnoticed, misperceived, and misunderstood events to accumulate in a manner that leads eventually to cultural disruption.

VARIABLE DISJUNCTION OF INFORMATION

In an earlier examination of the behavior of managers and others concerned with the scheduling of work through batch-production factories, it was noted (Turner, 1970; Kynaston Reeves and Turner, 1972) that the problem of obtaining an optimal schedule was an ill-structured problem, and that it was a problem with a potentially infinite set of solutions. Groups and individuals tackled this problem, therefore, by the semitacit adoption of a series of rules of thumb which had been found in the past to circumnavigate the central scheduling problem, without the need to specify it precisely.

The various groups in this highly complex situation were trying to manipulate a state of affairs for which they were unable to agree upon a single authoritative description. Because each person had access to a slightly different set of information, each tended to construct slightly differing

theories about what was happening, and about what needed to be done. Given sufficient time, money, and energy, it would have been possible to reconcile all the conflicting aspects of these sets to produce one agreed upon set, but in such situations, complexity and uncertainty are high, while time, money, and energy are scarce.

This condition was seen to be an example of a more general state that arises when the amount of information that can be generated or attended to with available resources is considerably less than the amount of information needed to describe fully or take account of the complexity of the situation. Relevant information, or perhaps what Wilensky called high-quality intelligence, under such circumstances, therefore, becomes a scarce resource in itself. The cost of obtaining one piece of information has to be balanced against the cost of obtaining an alternative bit. This state of the variable disjunction of information cannot be dismissed as a lack of communication. Rather, it is a situation in which high complexity and continuous change make it necessary to be extremely selective in the use of communications.

Tonge (1961), in tackling a related issue, drew a distinction between well-structured problems and ill-structured problems that is useful for this discussion. Well-structured problems, Tonge suggested, are numerically described, with specified goals and available routines for their solution. Ill-structured problems, such as batch-production scheduling, often use symbolic or verbal variables, have vague, nonquantifiable goals, and lack available routines for solving them, so that rules of thumb or ad hoc heuristic procedures are commonly used to devise solutions for them.

DATA

Since it was likely that the pattern of behavior and the information condition observed in dealing with the batch-production scheduling problem were instances of a more general and significant phenomenon, the examination of disaster reports was consciously selective, in that those disasters likely to display a variable disjunction of information were of particular interest. A number of reports in which it was relatively easy in the official inquiry to attribute the failure to a lack of appreciation of some previously unknown factor or to some clearly recognized lapse from good practice were rejected as being of little interest at the present stage (Micheal Colliery, 1968; Sea Gem,1967).

The discussion is not intended to apply to all disasters, therefore, but is explicitly an examination of three selected examples of intelligence failure in complex circumstances that promised some similarities with the condition of variable disjunction of information already described.

The three reports of incidents analyzed are the *Report by the Tribunal of Inquiry* (1966 –1967) set up to investigate the Aberfan disaster in Wales, the *Report of the Public Inquiry into the Accident at Hixon Level Crossing on January 6th, 1968* (1968), and the *Report of the Summerland Fire Commission* (1974).

In the first incident (Aberfan, 1966–1967), a portion of a colliery tip on a mountainside at Aberfan slid down into the

village in 1966, engulfing the school, killing 144 people, including 116 children, 109 of whom were in the school. In the second incident (Hixon, 1968), a large road transporter, 148 feet long, carrying a very heavy transformer was hit by an express train while it was negotiating a new type of automatically controlled half-barrier rail crossing, killing three railwaymen and eight passengers on the train. The transporter moved at two miles per hour and, therefore, could not clear the crossing in the 24-second warning period. In the third case (Summerland, 1974), a holiday leisure complex at Douglas, Isle of Man, with approximately 3,000 people inside, caught fire, on August 2, 1973. The building, an open structure clad partly in sheet steel and partly in acrylic sheeting, burned rapidly and 50 men, women, and children in the building died.

Detailed notes were taken of the contents of the three reports, and in a second stage, the notes were carefully sifted and analyzed, by labeling and categorizing the phenomena encountered in as accurate a manner as possible. Patterns of relationships between the observed categories were then sought. This procedure is very close to that recommended by Glaser and Strauss (1967), and is intended to develop a basis for handling discussions, not only of the present incidents, but also of future incidents of this kind.

OBSERVED PATTERNS

Major Causal Features

The common feature which forms the initial starting point for dicussion in the Aberfan, Hixon, and Summerland disasters is that in each case the accident occurred when a large complex problem, the limits of which were difficult to specify, was being dealt with by a number of groups and individuals usually operating in separate organizations and separate departments within organizations. Thus, at Aberfan, the ill-structured problem was the running of the pit and its ancillary activities to the satisfaction of H.M. Inspectors of Mines, of the various departments of the National Coal Board, the pit employees, and local residents and their elected representatives. At Hixon, the problem was the introduction and operation of a new type of level crossing to the satisfaction of the various departments within British Rail, the Ministry of Transport, the police, and the wide range of road users, including children, farmers, and those likely to use the crossing with animals, agricultural machinery, or other abnormal loads. Finally, at Summerland, the problem tackled was one of building a new, profitable, and safe form of leisure center, using some new materials. For each case, the dominant factors upon which the inquiry concentrated are summarized below, together with a brief indication of the organizational units and subunits involved in each incident.

Aberfan. The Tribunal of Inquiry considered the part played by a number of bodies and organizational units in its lengthy assessment of the events leading up to the tip slide. In addition to evidence taken from technical advisory bodies, the tribunal heard evidence relating to the organization of the colliery where the tip was located and to the role of the area and divisional bodies responsible for this colliery. Evidence

concerning involvement of the National Coal Board headquarters, the activities of a body set up to review organization within the Board, and the part played by the National Union of Mineworkers was reviewed. The tribunal was particularly interested in information about the policies pursued in selecting sites for tips and about the manner in which information about earlier nonfatal tip slides had been disseminated within this very large organization. On this last point, the tribunal discovered that knowledge about the procedures necessary to stabilize tips potentially had been available for many years. An engineer in a local company, which was subsequently incorporated into the National Coal Board, produced a memorandum in 1939 anticipating the causes of the disaster. But subsequent circulation of this document in the National Coal Board was restricted to a small number of the professional engineering groups. This meant that the nature of the problem was not generally appreciated, in spite of the occurrence of other tip slides in postwar years. The London headquarters of the National Coal Board remained unaware that tips constituted a potential source of serious danger until after the Aberfan incident.

Organizations outside the National Coal Board were involved when local residents protested, through the local borough council, about the possible danger from the tips at Aberfan. The local planning committee and borough engineers office were concerned in negotiations with the Board, assisted to some extent by the local Member of Parliament. The tribunal considered at length the unsatisfactory manner in which these representations were handled locally by the Board and its failure to reach a satisfactory conclusion.

Finally the tribunal took much evidence from management and workers at the colliery about the perfunctory manner in which the decision to build a tip over a small stream had been made and about the response of management and workers to the various warning signs that were apparent as this tip grew in size and the slip became imminent.

Although the situation was complex and there were many contributing factors, the Tribunal of Inquiry found that the dominant pattern of thought that contributed to the disaster was one present in the National Coal Board and, more generally, in the coal industry. It can be characterized as a pervasive institutional set of attitudes, beliefs, and perceptions that led to a collective neglect by almost everyone concerned of the problems of tip safety.

This neglect had a number of components. There were historic and institutional precedents in the neglect of tips by the 1938 Commission on Safety in Mines and by H. M. Inspectors of Mines and Quarries. These were reinforced by sets of industrial beliefs in the coal industry that gave little consideration to tips. As a consequence, the perception of potential dangers associated with tips was dimmed, even when slips occurred elsewhere. Few staff were appointed to deal with the problem of tip safety. Organizational practices were concerned more with the problems of mines than with those of tips. Such literature as existed on tip safety was neglected or not given wide circulation. Naturally, this powerful bias in the coal industry affected patterns of decision making so that

when, for example, decisions about the siting of new tips were being made, little trouble was taken over the problem.

Hixon. The investigation into this incident drew on evidence from a substantial number of organizations. In British Rail, for example, evidence was taken from the train crew, from those departments responsible for planning and implementing the introduction of new forms of automatic crossing, from those responsible for disseminating publicity to potential users of the crossings, and from those who installed, inspected, and modified the Hixon crossing. Evidence was taken in the Ministry of Transport from the railway inspectorate responsible for approving the new crossings and the procedures associated with them. Those responsible in the police force for circulating information about the new crossings and for briefing police patrols escorting abnormal loads were questioned, as well as policemen who were escorting the load which was in the collision.

The communication links between the Ministry of Transport and the police through the government department responsible for police affairs also came under scrutiny, as did communications between the police and a unit in British Rail responsible for bridge safety. This unit checked routes for abnormal loads that might constitute a danger to weak bridges, but it was not required explicitly to consider such hazards as automatic level crossings. Evidence was also heard from members of two commercial organizations: the company which owned the transformer that was in transit and which had a factory adjacent to the automatic level crossing and the haulage company which owned the transporter. In the latter company, patterns of responsibility and awareness of statutory obligations for the transport of abnormal loads were examined. The inquiry also considered communications between top management, middle management, and the transporter crew, and communications between top management and British Rail over a previous incident concerning a lorry stalled on an automatic level crossing.

Within this complex set of organizational responsibilities and communications, the central and most distinctive contributing feature leading up to the disaster was a failure on the part of a large number of individuals in British Rail departments, in the management of the road hauliers concerned, and in the Ministry of Transport. They failed to bring together creatively the information they all had, or had access to, in a way which would have made clear the danger of the new crossings to a long slow-moving vehicle that was in the middle of an automatic half-barrier crossing when it began to close. Other precautions had been taken, but not this one, and this was the factor which led to the accident. This failure, a failure in creative problem solving, was compounded by a passive administrative stance adopted by other parties involved. Notable among these were the police, who had received the information necessary to avert the disaster, but who failed for a number of reasons to consider it actively. A further contributing factor was the behavior of the drivers and crew of the transporter who could have acted to avert the disaster, had they been alerted to the need for this and to the procedures called for. They became involved in this tragedy as members

of the public who were expected to take a responsibility for their own behavior in relation to the hazard of the crossings.

Summerland. The organizational background to the Summerland fire is possibly the most complex and the most diffuse of that of any of the three cases discussed. The leisure center was developed by Douglas Corporation, the local authority of the largest town on the island, with financial assistance from the government of the Isle of Man. The shell of the completed building, owned by the corporation, was leased to a leisure company which had authority to design and build the more decorative part of the interior. There was an important gap in the continuity of the project between the design and construction of the shell under one design team, and the design and furnishing of the building by the lessees, employing a second design team. In addition to its role as developer, the local authority was involved through its planning, engineering, and fire safety committees in scrutinizing successive bylaw, planning, and safety submissions for the building as design and construction progressed.

The design of the shell of the building was placed in the hands of a local architectural practice, which, in turn, obtained agreement for a larger company on the UK mainland to be retained as associate architects. In the second phase, the design and fitting out of the interior, the UK architects were employed as principals by the lessees of the building, the leisure company. Because two of the most important construction materials used were novel, the manufacturers and distributors of these materials were included in the Summerland Fire Commission's inquiries. Additional factors the commission considered to be relevant to its investigation were the extent to which informal contacts between those in the island community were developed at the expense of more formal procedures, and the extent to which the need to have the second phase of the building completed in time for the tourist season led to the cutting of corners through pressure of work.

A final area of investigation concerned staff organization in the completed leisure center, in particular the severely limited nature of the arrangements made for the training of staff in fire procedures.

The commission concluded that the underlying factors were "many human errors and failures, and it was the accumulation of these, too much reliance on an 'old boy' network and some very ill-defined and poor communications which led to the disaster" (Summerland, 1974). These general factors were operating in a situation in which a small architectural firm was undertaking its first large commission, designing a new kind of building, which posed new fire risks, and which was built with new types of construction materials. In addition, the conditions under which it was anticipated that the building would operate were changed significantly during the design process.

The precise patterns of events, and even their dominant components, are different in each case; presumably, this is why parallels have not been drawn more frequently in the past. But looking beyond these immediate differences, a number of similarities can be discerned.

Similarities

The common features of such disasters have been described in detail elsewhere (Turner, 1976), but they may be summarized under the following headings.

Rigidities in perception and belief in organizational settings. The accurate perception of the possibility of disaster was inhibited by cultural and institutional factors. The Aberfan case in particular offers a powerful and tragic instance of the manner in which a failure of perception may be created, structured, and reinforced by a set of institutional, cultural, or subcultural beliefs and their associated practices.

All organizations develop within them elements of continuous culture which are related to their tasks and their environment (Turner, 1971). Part of the effectiveness of organizations stems from their development of such cultures, but this very property also brings with it the danger of a collective blindness to important issues. This is the danger that some vital factors may have been left outside the framework of bounded rationality. When a pervasive and long-established set of beliefs exists within an organization, these beliefs influence the attitudes and perceptions of men and women in the organization. They affect decision-making procedures and mold organizational arrangements and provisions so that there is a possibility of a vicious, self-reinforcing circle growing up, when it is generally believed that an area is not important or problematic (Crozier, 1964; Gouldner, 1954).

The decoy problem. A recurrent feature of the reports analyzed is that in many instances, when some hazard or problem was perceived, action taken to deal with that problem distracted attention from the problems which eventually caused trouble. In other words, a contributory factor to the disasters was the attention paid to some well-defined problem or source of danger which was dealt with, but which distracted attention from another dangerous but ill-structured problem in the background. For example, at Hixon, a number of parties concerned were aware that the process of taking an abnormal load across a level crossing was potentially hazardous. Representatives of both the haulage company and the company owning the transformer assessed the crossing considering the hazard of arcing onto the overhead electric wires; the police escort and the transporter crew stopped to discuss this problem, as well as the problem of negotiating an uneven section of the crossing. But none of these parties considered the particular danger to which a long, slow load might be exposed.

Organizational exclusivity: disregard of nonmembers. In two of the cases, individuals outside the principal organizations concerned had foreseen the danger that led to the disaster, and had complained, only to meet with a high-handed or dismissive response. They were fobbed off with ambiguous or misleading statements, or subjected to public relations exercises, because it was automatically assumed that the organizations knew better than outsiders about the hazards of the situations with which they were dealing. Thus, the local council at Aberfan failed to gain any satisfactory response from the National Coal Board to the expression of its anxiety, and a query from the road hauliers to British Rail

about the problems of the new crossings was dismissed by British Rail in a letter "remarkable for its arrogance and high-handedness," in the words of the official report.

Information difficulties. Information difficulties are likely to be associated with ill-structured problems, since it is not easy for any of the individuals or parties involved to fully grasp and handle these vague and complex problems. In situations of disjunct information, the simple remedy of better communication will not work unless resources are increased so that the problem is no longer ill-structured, or unless the problem defined is reduced to a size which can be adequately handled by the existing information net (Meier, 1965).

Communication and information handling difficulties are widespread in all organizations, and it would be wrong to suggest that all such cases lead on to disaster. Moreover, the cases examined here are of little value in assessing such a suggestion, since they were originally selected as likely to display a condition of disjunct information.

Nonetheless, the varying types of communication difficulty examined in the three cases are of some interest. In each case, unresolved ambiguities about warning signs, orders and procedures, and responsibilities and controls were noted. For example, at Aberfan, there were a number of disagreements about the state of the tip and about the nature of earlier slips. At Hixon, a requirement by the inspectorate that a warning notice be moved to a position "facing traffic" on the road was intended to ensure that the notice was at a right angle to the flow of road traffic and visible to approaching traffic. In fact, the notice was moved so that it was parallel to the road and facing stationary traffic at the crossing. At Summerland, considerable ambiguity surrounded the issue of the reaction of the plastic panels when exposed to fire and the conditions under which waivers for their use were issued by the local authority. In both the Hixon and Aberfan cases, some top management groups adopted an idealistic and unrealistic view of the problem area. It is relatively easy for chief executives to assume that their departments have effective safety precautions and that all eventualities have been dealt with when they are remote from those departments. These assumptions are unlikely to be tested by reality except in the case of disaster.

In each case, too, wrong or misleading information was sent from one party to another, sometimes because of interpersonal difficulties between two particular individuals and information was unintentionally distorted. In the Summerland case, an overreliance was placed upon informal networks developed for other purposes. Even when information was available, it was not always made use of, either because the recipients did not perceive or attend to it, or because they failed to see its significance for the actions they were taking. Information about the operation of the new automatic rail crossings was available in every police station, but was buried in a long technical memorandum, which the inquiry characterized as "mere flotsam in the station," and which few policemen could be expected to read in detail. At Summerland, some breaches of good practice in, for example, the construction of a void of combustible materials, arose not

because information was not available, but because work was being pushed ahead in a state of intense activity.

Involvement of strangers. In both the Hixon and Summerland cases, and particularly in the latter, a contributing factor to the disaster was the presence of numbers of untrained or uninformed people in potentially hazardous situations. When access to a potentially hazardous process or site can be restricted to trained or skilled personnel, the range of incidents likely to activate the hazard is considerably reduced. But when those not directly under the control of or socialized by the organizations concerned can put themselves in a position where they can activate the hazards if they behave improperly from the organization's point of view, the risks are vastly increased. This group, which will often be made up of members of the public, can be referred to as "strangers." The basic problem about strangers is that they are difficult to brief. As a group, they are also difficult to define, so that information about the desired procedures must be disseminated to a wide and amorphous group of potential users, many of whom will never actually need it. Because of the difficulty of defining such a group, administrators may also run into error in communicating with them because they adopt oversimplified stereotypes when considering their likely behavior or characteristics. Thus, even when reflecting after the accident on the process of planning the new automatic crossings, a member of the railway inspectorate thought it unreasonable that the inspectorate should have to consider the whole range of road traffic which might potentially use a crossing, rather than the general run of such traffic, an attitude which was not accepted in the final report. Similarly, at Summerland, stereotyped assumptions about the likely behavior of the general public in the event of a fire ignored those parents who were separated from their children who were in the children's cinema on another floor. These parents fought to reach them against the flow of the crowd, increasing congestion on a crowded and dangerous staircase.

The problems created in situations where safe operation relies to some extent upon the safe behavior of strangers are intensified by the fact that the strangers are always located at the moment of danger at a site where they have a number of opportunities to manipulate the situation in ways not foreseen by those designing the abstract safety system. They may thus create complications by manipulating some of the manifold properties which any specific and concrete site possesses.

Failure to comply with existing regulations. Few relevant regulations had been framed in the Aberfan case regarding tip safety, but at Hixon, and particularly at Summerland, regulations that already existed were not satisfactorily complied with. Those concerned either did not realize that the regulations applied to the case in hand or they approached these regulations with a feeling of "what can we get away with?" At other points, the regulations were not adequately implemented, mainly because they had become out-of-date and difficult to apply to changed technical, social, or cultural conditions. The manner in which theater regulations devised to apply to traditional theaters are to be interpreted when applied to a multiactivity leisure center such as Summerland,

with cinemas, bars, and entertainment at several levels within a large enveloping structure, offers a case in point.

Minimizing emergent danger. Another problem which recurs at many points in the three reports is that of a failure to see or to appreciate fully the magnitude of some emergent danger. When possible hazards were recognized, they were commonly underestimated; even when the danger was more clearly visible, many individuals and groups undervalued it. Thus, the warning signs of an impending tip slide at Aberfan were not recognized by some individuals, and those who did see some danger completely failed to anticipate accurately the scale of the possible movement of the coal waste. At Summerland, the danger posed by a small rubbish fire against the side of the building was not appreciated for some time; even when it was, the elaborate fire alarm system built into the complex was not used, and the delay in contacting the fire service was such that one of the first notifications they received was from a ship at sea which could see the blaze on shore. Ambiguity and disagreement among several parties about the status and significance of the evidence pointing to possible danger also served to lead to an undervaluing of such evidence, particularly when the more complacent group was also the more powerful one.

When the full scale of developing danger became impossible to ignore, the apparently straightforward act of strengthening precautions was not always the response; instead, some individuals began to take action to shift the blame, while others sought to take control of the situation by wholly inappropriate and quasi-magical means. Surprisingly, this behavior extended to a tendency for individuals who were exposed to danger themselves to fail to call for help. Such behavior has been noted in more extensive studies, particularly of behavior

Table 2

Common Features Observed in the Development of 3 Major Disasters and Their Relation to Various Stages of Development

Stage of Development	Feature	Comments
Stage I. Initial beliefs and norms	Failure to comply with existing regulations	Violation of existing precautions
Stage II. Incubation period	Rigidities of belief and perception	A. Events unnoticed or misunderstood because of erroneous assumptions
	Decoy phenomena	
	Disregard of complaints from outsiders	
	Information difficulties and noise	B. Events unnoticed or misunderstood because of difficulties of handling information in complex situations
	The involvement of strangers	
	Failure to comply with discredited or out-of-date regulations	C. Effective violation of precautions passing unnoticed because of cultural lag in formal precautions
	Minimizing of emergent danger	D. Events unnoticed or misunderstood because of a reluctance to fear the worst outcome
Stage III. Precipitating event		
Stage IV. Onset		
Stage V. Rescue and salvage		
Stage VI. Full cultural readjustment	Definition of new well-structured problems and appropriate precautions in inquiries following the disaster	The establishment of a new level of precautions and expectations

Table 3

Some Examples of the Features Listed in Table 2

Feature	Example
IIA Rigidities of belief and perception	Major institutional neglect of tips as a potential source of danger (Aberfan)
Decoy phenomena	Local residents mistakenly thought that the danger from tips at Aberfan was associated with the tipping of very fine waste, and they withdrew some of their complaints when it was agreed that this would not be tipped
	Concern of police and transporter crew at Hixon with the danger of arcing onto overhead wires, and not with collision
Disregard of complaints from outsiders	Complaints from Aberfan residents not adequately dealt with by National Coal Board
	High-handed response from British Rail to haulage company over stalled lorry on crossing prior to Hixon accident
IIB Information difficulties and noise	Poor communication between individuals because of poor personal relations (Aberfan)
	Ambiguous orders: does facing traffic mean facing approaching traffic, or stationary traffic at the crossing (Hixon)
	Information buried in a mass of irrelevant material (Hixon)
	Information neglected because of pressure of work (Summerland)
	Police expected government documents to be interpreted for them, but this was not done with the automatic crossings instructions
Involvement of strangers	People using a rail crossing at Hixon were strangers to the rail system
	Public using the leisure center at Summerland were strangers to the organizations operating the center
IIC Failure to comply with discredited or out-of-date regulations	Uncertainty about how traditional theater regulations should apply to a new concept leisure center such as Summerland
IID Minimizing of emergent danger	Early movements of the tip at Aberfan were not conceived of as leading to major hazard
	Minor fire at Summerland was dealt with by staff, and there was delay in summoning the fire brigade

in fires (Barlay, 1972) and in mining accidents (Lawrence, 1974). This behavior occurs partly because of a fear of sounding an unnecessary alarm, and partly because of psychological pressures to deny danger and to assert one's continued invulnerability (Wolfenstein, 1957).

All of these features of the three reports (summarized in Tables 2 and 3) relate to events leading up to the incidents. Another concern, reflected in the recommendations of the reports, deals with processes of cultural readjustment rather than with the incubation of the disaster.

Nature of recommendations after the disaster: the definition of well-structured problems. An important function of tribunals of inquiry is to make recommendations to prevent a recurrence of the particular kind of disaster being investi-

gated. All three of the reports examined contain such rec-
ommendations. Though the recommendations are diverse,
they have in common the following feature: each dealt with
the problem that caused the disaster as it was later revealed
and not as it presented itself to those involved beforehand.
The recommendations, therefore, treat the well-structured
problem defined and revealed by the disaster, rather than
with preexisting, ill-structured problems.

DISCUSSION

An analysis of the features of the organizational and adminis-
trative arrangements associated with the three disasters can
serve to define the processes by which organizational failures
develop. The relation of the common features of the analysis
to the model outlined earlier is set out schematically in Table
2. In Stage I, prior to the incubation period, two of the in-
quiries revealed varying degrees of failure to comply with
existing regulations. Where the regulations were still current
and applicable, such behavior represented a violation of exist-
ing precautionary norms, and any accident which might have
resulted from such behavior would not have made cultural
readjustment necessary. There is no problem in accounting
for a catastrophe that occurs because a train driver is drunk, a
pleasure boat is overloaded, or a company executive fails to
observe codes of practice.

Most of the features extracted from the inquiry reports fall, of
course, within the second stage of the incubation period,
which is precisely the period when failures of foresight are
developing. These may be clustered into four groupings
within this period.

**Events unnoticed or misunderstood because of erroneous
assumptions.** Discrepant events begin to accumulate in this
period without eliciting comment, either because they are not
noticed or because their significance is misunderstood. In
each of the cases examined, some events contributing to the
disaster were unappreciated because no one expected or
was alert for such phenomena, or because they were
explained away as alternative, decoy phenomena, so that
their full nature was missed. By its very nature, such a condi-
tion is a difficult one to observe without the benefit of
hindsight, but clues may be sought by an examination of the
manner in which those who dissent from accepted organiza-
tional views are treated. If the existing orthodoxy automati-
cally dismisses complaints from outsiders as attempts to
claim power by nonexpert cranks, the existence of an undue
degree of organizational bias and rigidity is suspected. By the
same token, when members of the organization adopt over-
rigid stereotypes of the problems and the people being dealt
with, dangerous misperceptions are again likely to develop.

**Events unnoticed or misunderstood because of difficulties
in handling information in complex situations.** Each of the
disaster inquiries revealed a complex and varied pattern of
misunderstandings, ambiguities, and failures of communica-
tion, some of which contributed to the disaster, and others of
which were revealed incidentally and were found to have no
bearing on the accident. Perfect communication will never be
possible in any but the simplest of systems. And many of the

misunderstandings and failures to communicate revealed by public inquiries could be readily duplicated in organizational situations where no disastrous outcome occurs. It is reasonable to expect, however, some kind of relationship between increasing difficulty in information handling and increasing likelihood of failures of communication accumulating in such a way as to lead to the incubation of a disaster.

Tasks that must be handled by large organizations will generate a large number of messages within the organization. Thus, they are more likely to offer an opportunity for failures of communication to develop than are tasks which can be handled in a smaller organization. Similarly, where a task is handled by a number of agencies, there is more likelihood of communication failures occurring than when a task can be contained within a single agency. The likelihood of such failures will be increased further by the fact that each organizational unit or subunit will have developed its own distinctive subculture and its own framework of bounded rationality. This may give rise to erroneous assumptions about the portion of the problem that is being handled by other units. Again, the more prolonged, complex, vague, hasty and large-scale the task, the more likelihood of information handling difficulties arising. Prolonged tasks are likely to be associated with changes in goals, responsibilities, and administrative roles that create difficulties. Large and complex tasks generate more information; vague tasks generate more ambiguities and more noise (Wohlstetter, 1962). Rushed tasks lead to the overlooking of information because of pressure of work. Two factors which were identified as particularly contributing to the complexity and unpredictability of organizational tasks are the design of large complex sites, and the management of groups of strangers who have access to such sites.

Since a state of variable disjunction of information is by definition one in which the resources available to handle information are inadequate, such a condition would be expected to increase the propensity for information difficulties to accumulate in a hazardous manner.

Effective violations of precautions passing unnoticed because of cultural lag in existing precautions. A simple failure to observe existing regulations is one problem, but a more complex situation arises when existing precautionary regulations are discredited, because they are out-of-date or inapplicable to the case in hand, but not yet changed. In such cases, as when existing theater regulations were deemed to be inapplicable to the Summerland leisure center, there may be difficulty in finding an appropriate standard by which to judge the ad hoc solutions arrived at, without the benefit of guidance from well-considered formal precautions.

Events unnoticed or misunderstood because of a reluctance to fear the worst outcome. This tendency was a particularly noticeable one in the evidence submitted to the inquiries studied, and it has been noted also by other observers. Clearly, when existing danger signs are not perceived, given low priority, treated as ambiguous or as sources of disagreement, and considered insignificant because of psychological dispositions or for other reasons, another avenue is provided for the accumulation of events which may combine to lead to disaster.

Stages III to V in Table 2 cover the area of most preexisting disaster studies. No attempt was made in the present study to categorize events falling in these three stages. In Stage VI, however, a role was played by each of the committees or tribunals of inquiry in establishing a new level of precautions and new expectations about their efficacy. In each case, the report weighed and evaluated the behavior revealed by its inquiries, marking it down as responsible or irresponsible, or good or bad practice, even when the behavior may have had no direct bearing upon the particular incident investigated. Each report then concluded by making recommendations which sought to amend existing beliefs and assumptions, and to establish new norms of behavior, to prevent a recurrence of similar incidents.

CONCLUSION

The present article initiates debate and research into the important question of the conditions under which organizational groupings can make gross errors of perception, judgment, and calculation that lead to unfortunate or disastrous consequences. The above catalog of conditions represents only a first contribution to this debate. Work is currently being pursued to extend the range of disaster reports studied, and to include a consideration of other forms of organizational failures. The overall findings reported here could be restated as the proposition that disaster-provoking events tend to accumulate because they have been overlooked or misinterpreted as a result of false assumptions, poor communications, cultural lag, and misplaced optimism.

At this level of generality, such a proposition may not be particularly unexpected, but it should be considered in the light of two points. First, disasters, other than those arising from natural forces, are not created overnight. It is rare that an individual, by virtue of a single error, can create a disastrous outcome in an area formerly believed to be relatively secure. To achieve such a transformation, he or she needs the unwitting assistance offered by access to the resources and resource flows (Benson, 1975) of large organizations, and time. The three accidents discussed here had been incubating for a number of years. In the case of Aberfan, the accumulation of the basic misconceptions which contributed in a major way to the tragedy began a century or so ago. By contrast with an analysis of 405 accidents in gold mines (Lawrence, 1974), which showed a mean of 1.96 human errors per accident, an approximate count of similar types of error shows that the disasters at Aberfan, Hixon, and Summerland were associated with 36, 61, and 50 errors per disaster, respectively. Small-scale failures can be produced very rapidly, but large-scale failures can only be produced if time and resources are devoted to them.

Second, the listing of general categories fails to convey fully the complexity of the series of events from which the general categories have been drawn. It is not merely that there are 50 or more subtle variations in modes of miscommunication. More than that, the categories of events listed in Tables 2 and 3 represent cultural, institutional, informational, psychological, and task-related phenomena in organizational and interorganizational settings. Each of the disasters arose not because of a

single factor, but because of the accumulation of complex branching chains made up of mixes of each kind of these phenomena. A major research task is the production of taxonomies of such interactions if the preconditions of disaster and of other failures of foresight are to be more fully understood.

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