

## ORGANIZATIONAL RESPONSE TO DISASTER: A TYPOLOGY OF ADAPTATION AND CHANGE\*

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### INTRODUCTION

Effective and efficient response to natural and technological disaster is a recurrent problem for governments and relief organizations world-wide. Whether responding to an earthquake in Bolivia, Turkey, or California, a drought in Central Africa, or a fatal train derailment in Sydney, organizations are faced with the task of moving necessary personnel and equipment to the disaster site and coordinating required activities.

The way in which organizations, and communities in general, respond to disaster has been the subject of extensive research over the last three decades (see Barton, 1970, for an excellent review of much of this research).

Particularly emphasized in the disaster literature are the: social psychological consequences of being involved in disaster, variables affecting individual's activities during the event,

formation of "disaster subcultures", organizational activities, and collective behavior. Of particular interest here is a typology of organizational response to disaster developed by Brouillette and Quarantelli (1971). This paper will involve an attempted synthesis of the Brouillette and Quarantelli model with recent findings concerning the developmental nature of disaster, the concept "disaster subculture", as well as an empirical test in American society of the revised model.

### BROUILLETTE AND QUARANTELLI'S MODEL

Brouillette and Quarantelli argue that traditional Weberian definitions of bureaucracy as set forth in the sociological literature (Weber, 1947) are of questionable utility in studying organizational change; the model tends to be static and unitary. Changes, especially in the short run, if considered at all, are treated as "the consequences of the informal patterns of beliefs and interactions that exist even within highly formalized bureaucracies" (Brouillette and Quarantelli, 1971: 40). Brouillette and Quarantelli suggest that short-run organizational change, which they call "adaptation to an im-

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mediate stress situation,” can be expressed in terms of the formal organization. To do so, they employ Eisenstadt’s (1959: 302–320) concept of de-bureaucratization. De-bureaucratization occurs when new organizational structures and functions emerge. In the collective stress situation, such as a disaster, there is a shift from the normal state to a de-bureaucratized operation. (Various segments of the organization can, however, be differentially affected.)

In the Brouillette and Quarantelli typology, bureaucratic operations are classified along two dimensions: structure and task (or function). They consider that both structure and function can be subject to de-bureaucratization; so, both dimensions can be dichotomized into bureaucratized and de-bureaucratized segments. These segments are referred to, respectively, as “regular” or “ongoing” and “new”. Cross-tabulating the dichotomized structure and function dimensions, a fourfold typology of response to immediate stress results, is shown in Fig. 1.

		TASKS	
		Regular	New
STRUCTURE	Ongoing	Type I	Type III
	New	Type II	Type IV

Fig. 1. Brouillette and Quarantelli’s typology of patterns of bureaucratic adaptation.

A Type I adaptation to the stressful event means that both ongoing structures and regular tasks are continued. A Type II response requires the organization to modify its structure in order to continue regular functions. Conversely, a Type III response involves perpetuation of ongoing structure, but a modification in task. While, in a Type IV adaptation, both patterns of structure and function are created. The type of response to immediate stress made by the bureaucracy is dependent upon both internal and external factors (Brouillette and Quarantelli, 1971: 43–45). Internal factors include personnel’s perceptions of demands,

particular bureaucratic structure, the organization’s emergency capability and perceived effectiveness and efficiency. External factors encompass: situational conditions, ecological dimensions, interorganizational relationships, community context, and societal context. Accordingly, the actual response by an organization to an immediate stress event is dependent upon internal and external variables.

While Brouillette and Quarantelli’s typology of formal organizational response to immediate stress seems to be a useful classificatory schema, recent findings, especially in the field of disaster research, make it possible to expand and elaborate their model. Two concepts in particular seem to be of value: the idea of stress, in this instance a disaster, as a “process,” and the notion of a “disaster subculture”.

## DEVELOPMENT OF DISASTERS

The term, “disaster,” as used in the sociological literature refers to a type of collective stress situation (Barton, 1970: 38–47) brought about by a catastrophic change (Carr, 1932) in the physical or social environments, that causes a basic disruption of the social context within which individuals and groups function (Killian, 1956). What constitutes a “catastrophic change” is a matter of social definition; the necessary degree of severity varies with situational context (both social structural and ecological), and across cultures and sub-cultures.

Because disaster is a type of collective stress, Barton (1970) argues that it can be classified along four broad dimensions: scope of impact, speed of onset, duration of impact, and social preparedness. He also distinguishes five phases, or time periods through which disasters proceed:

1. the predisaster period;
2. the period of detection and communication of warning of specific threat;
3. the period of immediate, relatively unorganized response;
4. the period of organized social response;
5. the post disaster equilibrium.

(See also Turner, 1976, for a somewhat different developmental schema.) Combining the four dimensions of collective stress and the five processual phases of disaster, it is possible to specify “disaster problems” for social units of varying levels of aggregation. Here, Barton’s typology of problems for formal organizations is most relevant.

In the predisaster phase, formal organizations engage in disaster preparation. During the period of threat, action response begins; the organization mobilizes resources and/or transmits warnings to others. In immediate response (phase three), formal organizations face the problems of mobilizing members, coordinating their activities, and organizing and engaging in interactions (*rélations*) with the public and other organizations. During the period of organized response, coordinating and relational activities are continued. In the final phase, difficulties include coping with the disaster’s effects on internal structure, public relations, and interorganizational relations.

The degree to which any organization engages in these activities depends on other variables including members’ role definitions, knowledge of necessary relationships and actions, normative action orientedness, role conflicts, resource availability, leadership, recruitment and confidence, organizational goals, and prior planning and centralized authority. These, and other important variables affecting organizational response are discussed at great length by Barton. What is most interesting in terms of this current paper is that, where specific disaster agents are recurring, there is a tendency for organizational members, and representatives of other aspects of the community to form what has been termed a “disaster subculture”.

#### DISASTER SUBCULTURE

A disaster subculture includes “those adjustments, actual and potential, social, psychological, and physical, which are used by residents of such areas to cope with disasters which

have struck or which tradition indicates may strike in the future” (Moore, 1964: 195). In other words, where a disaster subculture is in existence, norms, values, beliefs, orientations, and resources are geared to react to specific disaster agents. However, since the disaster subculture operates on expectations of future events based on tradition or community experience, cultural, psychological, and physical preparations are only devised to deal with certain magnitudes of the disaster agent. When an incident occurs as a consequence of an agent that is not expected, or when an expected agent is encountered in an unanticipated magnitude, the subculture’s preparations can be inadequate to handle the situation. Under these conditions, the subculture’s norms and activities may break down and some form of “emergent behavior” may evolve. Emergent behaviors are those forms of action, and the norms, values, and beliefs governing those actions, that rise out of the disaster situation.

If the disaster agent is still seen as a recurring threat, it is possible, then, that emergent behavior will become routinized as part of a modified disaster subculture. In some instances, however, the subculture will incorporate only some of the emergent behavior, or not change its preparations at all. For example, Boston, Massachusetts sits on a major earthquake fault and, in colonial times, there was at least one substantial quake. But, in that locality earthquakes are not seen as a threat so building codes and disaster plans are not geared to respond to earthquakes. It seems the extent to which the specific disaster subculture will evolve to incorporate emergent behavior is dependent upon characteristics of the individual subculture and situation.

Another property of disaster subcultures is that during what Barton calls the pre-disaster and long-run post-disaster equilibrium phases, much of the expected disaster behavior is *latent* (Wenger and Weller, 1973). In so far as disaster-oriented behavior differs from usual activity, that behaviour will not be engaged in under

“normal” circumstances. The behavior only becomes manifest during the detection and communication, relatively unorganized response, and organized social response phases. During normal periods, subculture members may engage in preparation for the next incidence, but they also are expected to continue their everyday activities.

Where a disaster subculture exists within a formal organizational framework, expected disaster subcultural behavior is conventionally kept as part of “the files” (Weber, 1970: 197) in the form of a “disaster plan”. The disaster plan, if fully developed, details personnel, resources, locations, and communications to be used in the event of a disaster caused by an expected disaster agent within specified parameters. Thus, in a disaster, the organization can respond in a systematic, pre-specified manner by making manifest (or invoking) the normally latent activities of the disaster subculture (as specified in the disaster plan).

In terms of Eisenstadt’s conception of response by de-bureaucratization, invoking the disaster plan, or its equivalent, would not constitute an actual emergence of new structure/function patterns. Instead, it would be a temporary or intermittent metamorphosis of the organization. Insofar as structures and functions were pre-specified, and if transformation were in accordance with those specifications, the organization would be *re*-bureaucratized, not *de*-bureaucratized. Response would be bureaucratic, within regulated confines of authority, and according to explicit written rules and regulations.

**MODIFICATION OF BROUILLETTE AND QUARANTELLI’S MODEL**

Using the concept “disaster subculture” and treating disaster as a process with distinct phases, it is possible to theoretically modify and elaborate Brouillette and Quarantelli’s model of organizational response to stress. First, Brouillette and Quarantelli’s model does not

clearly define the role of the disaster subculture in organizational response. The independent variable, the disaster, is treated as an exogenous variable that modifies the environment within which the organization functions. In effect, the disaster is considered to be a variable that affects the condition of the environment; organizational response to the modified environment can only be made, according to this model, by continuing normal operations, or in some manner having “new” patterns of structure and/or function evolve.

Typification of structures and functions as either “ongoing” or “new” (see Fig. 1) obscures the workings of any existing disaster subculture within organizations. Since during “normal” periods most disaster-related activities are latent, they cannot appropriately be classified as “ongoing”; nor, can they be categorized as “new” since they existed prior to the onset of the disaster episode. Instead, a more illuminating pattern might be to distinguish three types of structure and function: manifest, latent, and emergent. It would then be possible to section organizational operations into nine conceptually distinct categories. Activities and patterns can now be classified as: ongoing (manifest), expected under specified conditions (latent), or unexpected or new (emergent).

		FUNCTIONS		
		Manifest	Latent	Emergent
STRUCTURE	Manifest	Type 1	Type 11	Type 111
	Latent	Type 1V	Type V	Type V1
	Emergent	Type V11	Type V111	Type 1X

Fig. 2. Patterns of bureaucratic operation.

Second, if the specific agent induced disaster episode is treated as a process rather than a condition, it is possible to distinguish time sequencing of response and to specify differences between *short run (particularistic) response* to

an event and *long run (universalistic) change* in the organization. Brouillette and Quarantelli's model is not sufficiently precise to warrant this distinction. Yet, in terms of organizational change, these two levels of reaction are vastly different.

If a disaster agent, or magnitude of the occurrence, is defined by the disaster subculture as unique, it is likely that any structure/function patterns emerging from the episode will be particularistic. That is, they are only necessary to combat the unique, non-recurring situation. It is unlikely that such responses will be systematically integrated into the disaster subculture's normative and knowledge systems. There is no real long-term organizational change. Conversely, if the subculture defines a disaster episode as being within usual parameters, emergent structures and functions are likely to be universalistic. That is, they would be seen as applying to the usual parameters of a possibly recurring disaster agent. Thus, long run, actual organizational change would occur.

In Fig. 3 is the revised typology of organizational response to disaster where the disaster is considered as a process. As developed here, the disaster episode is divided into Barton's five phases. However, further research may suggest other, more refined divisions.

#### INTERPRETATION OF THE ORGANIZATIONAL RESPONSE TYPOLOGY

Empirical analysis of organizational response to a disaster episode involves classification of structure/function patterns and tracing changes in those patterns in the various phases. Through enumeration and tracing of patterns it is possible to both define disaster-related organizational activities and to distinguish sources of organizational change. For example, an organization may engage in certain functions at  $T_1$  that becomes suspended at  $T_2$ . If the organizational structure is not modified, but the unit's functions are transformed according to a pre-determined plan, what had been a Type I pattern

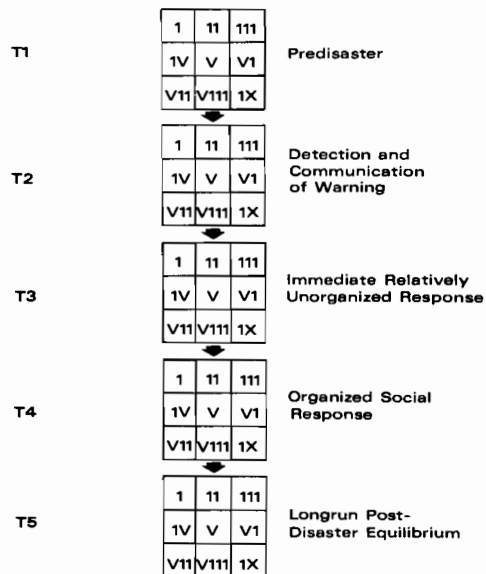


Fig. 3. Organizational response to a disaster episode.

at  $T_1$  becomes a Type II pattern at  $T_2$ , i.e., the function becomes latent. Conversely, the functions that were latent at  $T_1$  are, at  $T_2$ , now manifest. Thus, in this example, organizational response to the disaster episode through  $T_2$  would involve suspension of usual functions (making them latent) and the taking up of planned activities (making them manifest). For the sake of clarity, if the organization continued its  $T_2$  patterns through  $T_3$  and  $T_4$ , then its response to this disaster episode would consist entirely of modifying its functions in a pre-determined manner. These changes could be expected in  $T_2$  and they could continue through the remainder of the episode. If  $T_1$  patterns re-emerged at  $T_5$ , then no organizational change occurred in response to the disaster.

Universalistic adaptations associated with the disaster episode can be distinguished by comparing structure/function patterns through the various phases. Any emergent action or structure at  $T_2$ ,  $T_3$ , or  $T_4$  that is incorporated at  $T_5$  in either the manifest or latent organizational patterns are classified as universalistic adaptations. Patterns that emerge at  $T_2$ ,  $T_3$ , or  $T_4$  that are not included in manifest or latent patterns at  $T_5$  are particularistic responses.

## AN EMPIRICAL EXAMPLE

### Site Selection and Methods

In June, 1972, much of the East Coast of the United States was raked by Hurricane Agnes. What resulted was widespread record flooding and destruction. In some cities, up to one third of the population and most businesses were displaced. Some areas affected by Agnes had also been lashed three years earlier (August, 1969) by Hurricane Camille. In our research effort we decided that a city that had suffered such major flooding as a result of these two hurricanes would be a reasonable site to test this model. The effects of both hurricanes were similar in terms of floods produced, and they occurred in a short enough interval that the impact of the first should not have been entirely forgotten by the second episode. Following Brouillette and Quarantelli's lead, we also focused on a public works department.

The site studied is a middle-size city (roughly a quarter of a million inhabitants) in the central section of the East Coast of the United States. Preliminary contact suggested that the city had well-developed disaster plans and that the public works department could be intensively studied.

Teams of researchers were sent to the disaster site on three separate occasions. Starting with the first day of flooding, researchers were present in the Emergency Operating Center (E.O.C.). While there, they were able to systematically observe communications and structures within the E.O.C. and communications between the E.O.C. and field workers. Approximately one year after the disaster episode a second team was sent into the field. In their two data collection periods, forty-eight in-depth interviews were obtained from "key personnel" both inside and outside the public works department and with a cross-section of departmental employees. All interviews were conducted in private, but with the full cooperation of city and departmental of-

ficials. The data presented below were obtained from analysis of transcriptions and original recordings of events and interviews, and from such secondary sources as the charts of organization, operating manuals, various disaster plans, and newspaper accounts of the incident.

### Development of the Disaster

Barton's taxonomy of disaster phases proved somewhat unclear when we applied it to our actual case of organizational response to stress. First, because disasters are processes, it is difficult to clearly distinguish the onset and termination of each phase; thus, the divisions become heuristic devices designating the most general activities characterizing the time period. Further, in at least one instance ( $T_2/T_3$ ), activities supposedly typifying two separate phases overlapped almost in their entirety. In another case ( $T_4$ ), Barton's division was not found to be sufficiently detailed to permit adequate classification of activities. It was necessary to portion this category into two parts:  $T_{4a}$ , organized response to the immediate threat and  $T_{4b}$ , organized short-run post-impact response.

#### $T_1$ , The Pre-impact Period

In the event that a community suffers recurring disaster episodes as a consequence of a single agent, it is difficult to distinguish Post-disaster from Pre-disaster Equilibria. In this case, major disaster episodes caused by a common agent – hurricane induced flooding – occurred three years apart. Since it was necessary, however, to delineate a pre-disaster period, a time frame of one year prior to impact was chosen.

Following the 1969 floods caused by Hurricane Camille, the city had greatly modified its disaster plans. A committee consisting of department heads, including the department of public works, thoroughly reviewed flood response activity, human and material resources, and organizational structures. Their work resulted in a disaster plan that specified future response

in great depth not just for floods but also for snow storms and technological disasters. For the most part, the committee's efforts resulted in a renovation of the organizational structure and a more in-depth specification of available material, personnel, and delineation of policies. Once the new disaster plan was published, and the information disseminated throughout the city's bureaucratic system, a post-disaster equilibrium was reached. The only other "major" changes were in the turnover of two key personnel: the city manager and director of the Public Works Department.

The new city manager was professional and highly trained. Informants from various agencies in the community (police, works, public affairs, etc.) told us that, prior to the disaster event, he had been accepted as a legitimate, effective leader. Unlike his predecessor, who was seen as autocratic, the new manager utilized an "open" participatory administrative policy. Department heads and line personnel were expected to make input in decisions that fell within their scope of expertise. This openness coupled with his perceived ability seemed to support his reputation as an effective and efficient administrative head.

Like the new city manager, the Director of Public Works enjoyed a reputation as an effective and efficient leader and his relationships with the city manager, other major department heads, and his own personnel were amiable. Unlike the city manager, the director of the works department had been promoted from within and his qualifications resulted primarily from experience in the local setting.

During the  $T_1$  period, no major shifts in the structure/function set of the works department were instituted; the organization was in a relatively "steady state" (Rappaport, 1974; 28-32). This stability of the structure/function set is reflected in the taxonomy presented in Fig. 4 in which there are no emergent patterns (since emergence denotes at least short term organizational change).

In the pre-impact period, the Department of Public Works' formal structure was that described by Max Weber as typical of bureaucracies (Cell 1). Overseeing the entire operation was the Departmental Director; below him were three Bureau Chiefs heading the bureaus of Operations, Engineering, and Management. Within each bureau, tasks and authority were hierarchically arranged; the array of tasks and authority are reflected in the organizational chart and various written documents.

The largest subdivision within the department is the Bureau of Operations with its roughly 700 personnel and extensive inventory of supplies and equipment. Under normal circumstances this organization was responsible for street sanitation, street, sewer, bridge, and vehicle maintenance, and the harbour. Each of these separate tasks were assigned to semi-autonomous divisions under the bureau chief. This bureau was generally concerned with actual implementation of services, so personnel included a substantial proportion of semi-skilled and unskilled laborers, vehicle operators, and their immediate supervisors (foremen). Equipment in the inventory of this bureau included garbage trucks, dump trucks, street sweepers, road graders, bulldozers and other construction and maintenance related material.

The Bureau of Engineering contained approximately 150, mainly white collar engineering and drawing personnel apportioned into two divisions: Survey and Design. Responsibilities of this bureau included design of capital projects, providing expert advice on construction, and conducting engineering surveys. This bureau possessed little heavy equipment; its material was design and survey oriented.

The third bureau within the Department, the Bureau of Management, was relatively small, having a staff of under fifty, and its functions pertained exclusively to budgeting and costing of capital projects. Its personnel were, in the main, accountants, bookkeepers, and supporting clerical workers.

**FUNCTIONS**

		<b>Manifest</b>	<b>Latent</b>	<b>Emergent</b>
<b>STRUCTURE</b>	<b>Manifest</b>	<u>Dept. of Public Works</u> <u>1 Bureau of Operations</u> a street sanitation b street maintenance c sewer maintenance d bridge maintenance e vehicle maintenance f harbour  <u>2 Bureau of Engineering</u> a Design and construction of capital projects b survey  <u>3 Bureau of Management</u> Capital projects budget planning ----- <u>All Bureaus, Emergency Planning and Instruction</u>	<u>1 Bureau of Engineering</u> a bridge surveys b collapsed building surveys c roadway repair d floodwater warning survey e advise on packing dike  <u>2 Bureau of Management</u> a disbursement of meal money b disbursement of emergency funds	•
	<b>Latent</b>	•	<u>Re-bureaucratized Structure</u> a loss of autonomy b re-organization of personnel c intake of personnel a recreations and utilities b volunteers/prisoners d modified communications channels ----- <u>Functions</u> a Dike closure b sand bagging c cleanup d suspension of: a refuse pickup b sanitation c normal maintenance e Communication of emergency information	•
	<b>Emergent</b>	•	•	•

•This particular disaster plan did not include major latent structure/manifest function components  
 \*In the immediate pre-impact period, no major emergent structures and functions were found

Fig. 4. Pattern of major structures and functions at T<sub>1</sub>.

According to the city's flood disaster plan, the Department of Public Works was to be intimately involved in disaster oriented activity. In the event of a flood warning, the City Manager, or his designated representative, would determine if the threat were sufficiently severe to warrant invoking the disaster plan.

This decision was based on the Weather Bureau's predictions of the flood's crest. If a crest were predicted that would damage business and residential property, the plan would be put into action. Once the plan was declared in force, all relevant personnel (as specifically delineated in the plan) were contacted by telephone. These

personnel were then responsible for contacting others, and so forth, in an expanding, formally designated communications network. One of the “key personnel” contacted in the first wave of calls was the Director of Public Works, or in his absence, the Chief of the Bureau of Operations.

With invocation of the disaster plan, normal city bureaucratic structure was suspended and the City Manager effectively took direct control of relevant departments, including the Department of Public Works. Organizationally, the city was “re-bureaucratized”. Departmental directors officially became advisory to the City Manager and all major decisions made by them were to be, at least *post hoc*, ratified by the manager.

Within the works department the structure of the Bureau of Operations was to undergo significant modifications. The Bureau Chief was designated to take command of field operations. Work crews were re-assigned, supervisory personnel shifted, and new personnel were taken in from other departments. The structure of the other two bureaus, Engineering and Management, were not directly affected by re-bureaucratization; their lines of authority and communication were to remain basically as in the pre-disaster phase.

According to the flood disaster plan, the Department’s functions were also to undergo modification. The Bureau of Operations was to suspend normal activity and, instead, concentrate on dike closure, sand bagging and post-impact cleanup. The other two bureaus, unlike Operations, were to continue their usual functions at a reduced level and to reassign some personnel to emergency activity. In addition to its normal survey and design activity, the Bureau of Engineering was to conduct bridge surveys, collapsed building surveys, a flood water warning survey, and offer professional advice on field activities including dike closure and roadway repair. In addition to its usual functions, the Bureau of Management was to oversee disbursement of meal money and any

required emergency funds. These activities were expected to be conducted within a time frame consistent with the progression of the particular disaster episode and in keeping with decisions made by the City Manager and his advisors.

During readjustment following the Camille flood and in the pre-impact period, city and departmental leaders had stressed transmission of necessary information in the disaster plan to personnel at all organizational levels from the city manager to the unskilled laborers. While at each descending level the scope of information transmitted was reduced, expected activities were well specified. The great majority of organizational members were made aware of their duties, any change in supervision, and communication channels to be used in the event of a flood.

During the pre-disaster period, structures and functions related to disaster response existed only on paper and in the minds of various personnel; they were only put in force when the correct sequencing of stimuli necessitated their activation. In this sense, during  $T_1$  these structures and functions were *latent or dormant*. In terms of the typology, the re-bureaucratized structure (especially that which “normally” would have constituted the Bureau of Operations) and that structure’s functions were both latent at  $T_1$ ; this is a Type V pattern. Since the expanded functions of the other two Bureaus were not associated with planned modification in structure (re-bureaucratization) – (that is, tasks required of an ongoing unit were expected to modify) – that portion of the plan is a Type II pattern. (In this instance, no major Type IV patterns were defined for the organization. Normal tasks, if not addressed by the usual structure, were expected to be at least temporarily suspended).

#### **$T_2$ and $T_3$ : Communication of Warning and Relatively Unorganized Response**

Where a community has a sophisticated

disaster subculture, where the disaster agent is recurring, and where warning provides a sufficient opportunity for some pre-impact preparations, the periods of communication of warning and immediate unorganized response can coincide. Such is the current case. As soon as an outside agency (the weather bureau) notified appropriate civic officials that a flood was imminent, communication of warning and systematization of response began. A time lapse of over twelve hours between original communication of the warning and actual onset of the event allowed, in this instance,  $T_2$  and  $T_3$  periods to almost totally overlap (see Fig. 5). (In an event characterized by little or no warning,  $T_2$  and  $T_3$  would, most likely, be more separated.)

The flood warning was transmitted to the city manager early on Wednesday evening ( $T_2$  commenced), by 8 pm the Manager was engaged in a meeting with the Director of Public Works and the Public Information and Research Officer. At roughly 11 pm the decision was reached to invoke the disaster plan and, according to the plan, "twenty key personnel" were contacted to operationalize the communication network and begin organizing response. By 12.01 am on Thursday, approximately one hour after the plan was activated, all twenty key personnel were assembled in the E.O.C. for their first meeting. Within two-and-a-half hours (by 2.30 in the morning) concerted, organized response to the expected flood had been launched, and within seven hours the operation was in full swing.

As for the works department, the  $T_2$  and  $T_3$  period is most characterized by filtering of communication of warning down the hierarchy and assembly of personnel at staging centers. High ranking personnel were notified of the imminent danger and they, in turn, notified others in lower positions. The Director assumed his post as advisor to the City Manager for diking and sandbagging, and the Chief of the Bureau of Operations began arranging field activities

(Cell I). As more personnel arrived at the staging areas, they were assigned to fill sandbags. Also in accordance with the plan, personnel from the Bureau of Engineering made their way up-river and instituted their series of reports on the water level. Other personnel from the division were engaged in discussions concerning possible alternative strategies for packing the dike. During this same period, especially toward morning, the Bureau of Management began its preparations for fund disbursement. (Other aspects of the disaster plan, by design, were still latent.)

The vast majority of activity in  $T_2/T_3$  should be classified as "organization and communication". Events, while appearing on the surface to be unsystematic, were actually proceeding according to plan. Overall, everything went in keeping with expectations. Nearly all required personnel were contacted (only a few unskilled laborers were missed), tasks were assigned, and staging began. Any disorganization encountered was only a temporary consequence of the necessary time lag between communication of warning to an individual and their arrival at an appropriate staging area. While delays were minimal, they were also unavoidable, thus compelling some disorder. By roughly 7 am, the  $T_2/T_3$  period was fading into  $T_{4a}$ ; organized response to the immediate threat, for the most part, had replaced warning and disorganization.

The only major deviation from the disaster plan encountered in  $T_2/T_3$  was the use of National Guard troops to aid in sandbagging. This modification in the structure of cooperative arrangements between the City and National Guard (Cell VII) emerged from two sources. First, the Weather Service predicted a flood crest of 28 feet, a near record. Second, to deal with this massive (but within recognized parameters) threat, the City Manager decided on an "all out" effort. Thus, standing arrangements between the City and National Guard were modified.

**FUNCTIONS**

		<b>Manifest</b>	<b>Latent</b>	<b>Emergent</b>
<b>STRUCTURE</b>	<b>Manifest</b>	(Communications of Warning of impending flood). ----- <u>1. Rebureaucratized Structure</u> a. City manager directly in charge b. Director advisory capacity c. E O C operative Functions: Communication a. mobilization of personnel b. decisions concerning appropriate action c. sand bagging <u>2. Bureau of Engineering</u> a. floodwater warning survey b. advise on packing dike (c. design and construction of capital projects) <u>3. Bureau of Management</u> (a. capital projects budget planning) b. set-up for disbursement of food money and emergency funds.	(Rebureaucratized Structures) <u>Functions</u> dike closure ----- <u>2. Bureau of Engineering</u> a. survey (general) b. bridge survey c. collapsed build. survey d. roadway repair	
	<b>Latent</b>		<u>Dept. of Public Works</u> <u>Bureau of Operations</u> a. street sanitation b. street maintenance c. sewer maintenance d. bridge maintenance e. vehicle maintenance f. harbour ----- (Rebureaucratized Structures Functions) ----- clean up ----- <u>All Bureau's: Emergency Planning and Instruction</u>	
	<b>Emergent</b>	Intake of National Guard Personnel		

\*Major structure/function patterns not noted in this phase.

Fig. 5. Patterns and major structures and functions at T<sub>2</sub> and T<sub>3</sub>.

**T<sub>4a</sub>: Organized Response to Immediate Threat**

Within seven hours of the first meeting of "key personnel" in the E.O.C., the Department of Works had fully organized its response to the immediate threat. Required personnel had been contacted, equipment was readied, and all major functions required by the disaster plan

were underway. However, because of certain ecological features of the area affected and the unprecedented magnitude of actual flooding, much of what occurred in T<sub>4a</sub> was not included in the disaster plan (see Fig. 6).

In terms of personnel required and effort expended, the major responsibility of the Department's re-bureaucratized structure at T<sub>4a</sub> was to

		FUNCTIONS		
		Manifest	Latent	Emergent
STRUCTURE	Manifest	<p>1. <u>Rebureaucratized Structure</u> (same as T<sub>2</sub> &amp; T<sub>3</sub>)</p> <p>Functions:</p> <p>a. dike closure</p> <p>b. sand bagging</p> <p>-----</p> <p>2. <u>Bureau of Engineering</u></p> <p>a. floodwater warning survey</p> <p>b. advice on packing dike</p> <p>c. bridge survey</p> <p>d. collapsed building survey</p> <p>e. roadway repairs</p> <p>f. design construction of capital projects</p> <p>3. <u>Bureau of Management</u></p> <p>a. capital projects budget planning</p> <p>b. disbursement of food money</p>		<p>Obtaining dump trucks to cover flumes</p> <p>Evacuate dike and pumping station</p>
	Latent		<p><u>Dept. of Public Works</u> <u>Bureau of Operations</u> (same as T<sub>2</sub> &amp; T<sub>3</sub>)</p> <p>-----</p> <p>(Rebureaucratized Structure's functions)</p> <p>a. cleanup</p> <p>-----</p> <p>All Bureaus: Emergency Planning and Training</p>	
	Emergent	<p>Use of Police Communications Network</p>		<p>Advise nearby city</p>

• Major structure / function patterns not noted during this phase

Fig. 6. Patterns of major structures and functions at T<sub>4a</sub>: organized response to immediate threat.

close and sandbag the dike protecting low-lying businesses, warehouses, and residences on the north side of the river and to sandbag a low-lying flood water pumping station. Underlying the dike in two places, and running behind much of its length, was a twenty-foot-wide stone and mortar, concrete covered channel or

flume used to supply water to the city docks — (at one time the channel was an open canal). The design of the flume was such that in the event of what was defined locally as very severe flooding (26 feet or so), hydrostatic pressure built up in the flume causing its top to lift off which allowed water to spill out behind the

dike. Thus, in “unusual” circumstances, it was necessary to weight the top of the flume to prevent water streaming out and undermining flood control efforts.

In the first twelve hours of  $T_{4a}$  the Weather Service was predicting near record floods of 28 feet. In the city’s entire history, which stretches back to Colonial times, this level had only been exceeded once – in the 1969 Camille floods. However, by mid-evening it became clear that the crest prediction was much too low. The actual crest was over 36.5 feet; seven and a half feet higher than the previous record. These two factors, relative location of facilities and sheer extent of the flooding, worked together to substantially undermine the department’s diking and control efforts.

In terms of the typology, during  $T_{4a}$ , most efforts of the Department’s re-bureaucratized structure were addressed to closing and sandbagging the dike, and sandbagging the pumping station (Cell I). By 5 o’clock in the afternoon, this work was basically completed. Later in the evening, as it became apparent that the flume was going to need reinforcing, the Chief of the Bureau of Operations, who was now in charge in the field, requested permission from the E.O.C. to contact volunteer dump truck drivers who would use their fully loaded trucks to weight down the flume. Using both Departmental equipment and additional trucks provided by volunteers from local construction firms, forty fully loaded dump trucks were run onto the flume at roughly 8 p.m. Reinforcing the flume in this way was not part of the disaster plan, so it was an emergent task. However, since this contingency was handled through normal channels, which were designed for intake of volunteers, there was no change in structure. Reinforcing the flume in this manner is a Type III response.

During this portion of the disaster response, the only part of the formal structure that failed to function as specified in the disaster plan was the communication channel between the E.O.C. and the Chief of the Bureau of Operations.

Because of a mechanical failure, the two-way radio used to link them broke down. Since no backup communications system was provided, the Chief relayed communiqués through a nearby policeman’s patrol car radio. This modification in the lines of communication in an effort to continue normal functions would be classed as a Type VII response.

By 8.30 in the evening the Weather Service had revised its crest predictions to between 30 and 31 feet – one to two feet higher than the sandbagged dike. The decision was made in the E.O.C. to evacuate personnel at the dike, to have them stand by, but to leave the dump trucks on the flume. (This would allow time to shut off gas supplies in low-lying areas and close down a water treatment plant). By 10 pm it was apparent to the Chief of the Bureau of Operations that pressure in the flume was building rapidly and it would soon be uncontrollable, consequently he decided to remove the dump trucks. This decision was ratified by the E.O.C., and the trucks were removed. Again, since normal structures were used to handle evacuation of personnel and equipment (an emergent task) this would be a Type III response.

With the failure of the flume and subsequent collapse of portions of the dike, the re-bureaucratized portions of the Works Department ended their organized efforts to combat the disaster agent. All that remained was to wait until the water receded to begin cleanup (Cell V). Thus, at 11 p.m. personnel were dismissed and the Director left the E.O.C. Because of a request for help from a nearby city downstream, the Chief of Bureau of Operations was reassigned as their liaison officer (Cell IX).

During this  $T_{4a}$  period, the two other bureaus in the Department were functioning as expected (Cell I). Personnel from the Bureau of Engineering were involved in flood water warning, bridge survey, and packing the dike. As the dike collapsed, they began checking nearby buildings for damage, and, as roads became inundated, they attempted to find ways to repair them. At the beginning of normal working

hours other personnel not directly assigned to disaster-oriented tasks continued their design projects. As for the Bureau of Management, a few of their employees were called in to provide meal money, but in the main, they continued normal operations.

**T<sub>4b</sub>: Period of Organized Short-run Post-Impact Response**

By 5 pm on Friday, the flood water had begun to recede and the city's efforts turned from responding to an immediate threat to cleanup and repair. Since flooding had been so severe, this was not an easy task. City wide, high water had necessitated evacuation of low-lying areas and it had inundated large sections of town, making many public utilities temporarily inoperable. Until the flood water receded and utilities were again made operable, the disaster plan remained in force. Within a few days, however, basic utilities (especially water, gas, and electric service) were again functioning and the city returned to its normal structure.

During the T<sub>4b</sub> period (see Fig. 7) the re-bureaucratized structure of the Department of Public Works was responsible for opening the dike to allow flood water to recede more quickly, repairing the dike, flushing the streets, and clearing debris. All of these functions were continued even after normal bureaucratic operations resumed. In terms of the typology, since the extent of flooding encountered in the Agnes episode was not anticipated, plans for opening the dike to release floodwater were non-existent, but crews had been kept on stand-by to be used as needed. Thus, a manifest structure was used to handle an emergent function (Cell VII). The other cleanup functions were considered routine and so were covered in the disaster plan (Cell I).

Once power and water services had been re-established, the need for immediate word-of-mouth communication diminished. This factor led to closing down the E.O.C. and normalization of the city's formal organization. The move-

ment from re-bureaucratized to normal bureaucratized structure is indicated in Fig. 7 by an arrow (Cell I and Cell V). Once normal structure resumed, it was also possible to return some personnel to their usual functions. This *gradual* return to normalcy is what most typified organizational behavior in the T<sub>4b</sub> period.

As for the Bureau of Engineering, in the first days of T<sub>4b</sub>, personnel were heavily engaged in surveying damaged buildings and providing technical assistance on roadway and bridge repair (Cell I). Their other emergency functions had again become latent (Cell II). During the course of the flood, however, E.O.C. personnel had determined that existing contour maps of the city were not sufficiently detailed to allow accurate prediction of areas that would be inundated by flooding of any given magnitude. Thus, the survey section of the Bureau of Engineering was assigned the function of drawing detailed contour maps (Cell III). The remainder of the Bureau continued its usual operations (Cell I).

During T<sub>4b</sub>, much of the effort of the Bureau of Management was directed toward determining the cost to the city of emergency and cleanup activities. As with the other bureaus, the man-hours expended in this emergency related pursuit declined during the T<sub>4b</sub> period, and greater emphasis was placed on resumption of usual activities (Cell I).

**T<sub>5</sub>: Period of Post-Disaster Equilibrium**

As with the other disaster phases it was difficult to specify exactly the timing of the onset of T<sub>5</sub>. Various elements within the Department returned to a "normal" or "steady state" at diverse times. Overall, however, within one year after the onset of the disaster episode the Department, as a whole, had regained normalcy. What is perhaps most interesting about the T<sub>5</sub> period, in this case, is that there were no significant shifts in structure/function patterns when comparing T<sub>1</sub> and T<sub>5</sub>. The event, because of its unprecedented magnitude was defined by the

		FUNCTIONS		
		Manifest	Latent	Emergent
STRUCTURE	Manifest	<u>Rebureaucratized Structure</u> (f) cleanup Bureau of Operations (Same as T <sub>1</sub> ) a. cleanup b. normal functions (Same as T <sub>1</sub> ) <hr/> 2. <u>Bureau of Engineer:</u> a. bridge survey b. collapsed build. survey c. roadway repair d. design and construction of capital projects <hr/> 3. <u>Bureau of Management</u> a. disbursement of emergency funds b. capital projects budget planning <hr/> All Bureaus: Emergency Planning and training	a. floodwater warning survey b. advise on packing the dike  a. disbursement of meal money	re-draw city contour maps
	Latent		<u>Dept. of Public Works</u> <u>Bureau of Operations</u> (Same as T <sub>2</sub> /T <sub>3</sub> & T <sub>4a</sub> )  Rebureaucratized Structure a. dike closure b. sandbagging	
	Emergent	<u>Rebureaucratized Structure</u> Opening the dike for floodwater		

\* Major Structure / Function patterns not noted in this phase

Fig. 7. T<sub>4b</sub>: Period of short-run post impact response.

city as a fluke beyond the scope of “normal” disasters; thus, no long term organizational change occurred. All responses to the disaster episode were short-run adaptations to a temporarily modified environment: no structure/function patterns initiated at T<sub>2</sub>/T<sub>3</sub>, T<sub>4a</sub>, or T<sub>4b</sub> were ongoing at T<sub>5</sub> (see Fig. 8).

### DISCUSSION

In testing the revised model of organizational response to stress, at least in American society, several problems became evident including difficulties encountered in classifying events, specifying phase parameters, and adequately

**FUNCTIONS**

	<b>Manifest</b>	<b>Latent</b>	<b>Emergent</b>
<b>Manifest</b>	<u>Dept. of Public Works</u> <u>1 Bureau of Operations</u> a street sanitation b street maintenance c sewer maintenance d bridge maintenance e vehicle maintenance f harbour <u>2 Bureau of Engineering</u> a. Design and construction of capital projects b. survey <u>3. Bureau of Management</u> Capital projects budget planning ----- <u>All Bureaus</u> Emergency Planning and Instruction	<u>1 Bureau of Engineering</u> a bridge surveys b collapsed building surveys c roadway repair d floodwater warning survey e advise on packing dike  <u>2 Bureau of Management</u> a disbursement of meal money b disbursement of emergency funds	•
<b>Latent</b>	+	<u>Re-bureaucratized Structure</u> a loss of autonomy b re-organization of personnel c intake of personnel a recreations and utilities b volunteers/prisoners d modified communications channels ----- <u>Functions</u> a Dike closure b sand bagging c cleanup d suspension of: a refuse pickup b sanitation c normal maintenance e Communication of emergency information	•
<b>Emergent</b>	•	•	•

+This particular disaster plan did not include major latent structure/manifest function components  
 •In the immediate pre-impact period, no major emergent structures and functions were found

Fig. 8. Pattern of major structures and functions at T<sub>5</sub>.

delineating the number of phases. These difficulties will be discussed below. Overall, however, it was possible to define the role of a disaster subculture in a formal organizational context, to classify organizational response in accordance with a processual typology, and to

distinguish particularistic adaptations from universalistic organizational change.

In the episode described above, long-run universalistic change in the organization's structure/function set as a result of the disaster was minimal. Largely, this failure to change,

even in the face of the obvious inadequacy of the response, is a consequence of what Brouillette and Quarantelli refer to as “personnel’s perceptions of demands” and what Barton terms “definition of the situation”. Department of Works’ personnel and city administrators in general defined the event as wholly beyond the scope of “usual” floods; the chances of another episode of this magnitude occurring again were defined as minuscule. Given their definition of the situation they were able to perceive their plans as adequate and their response as effective and efficient.

It is not suggested that no long-run changes resulted from the episode — some did. But, in the main, change occurred at the individual psychological level or within the informal organizational structure. (For instance, the Chief of the Bureau of Operations reported that he and the police agreed that, in the future, a police patrol car would be assigned as a back-up communications channel. This modification in procedure was in the form of an informal agreement, not incorporated in the formal structure.) The typology of adaptation, as derived in this paper is defined in terms of the formal organization, so modifications in informal structure are not included. It would be possible, however, to extend the analysis to the informal level and create a typology of informal organizational adaptation. Here, however, these informal social and psychological shifts are treated variously as causes of organizational change or intervening and situational variables.

Also in the empirical example presented above, certain cells in the typology were unused, specifically, Cell IV, Cell VI, and Cell VIII. Lack of the types of responses denoted by these cells is an idiosyncrasy of this particular stress response. These cells could be utilized in other stress situations. For example, during the civil disorders and student riots of the 1960’s and early 1970’s, the National Guard maintained reserve (latent) forces for patrolling and crowd control (a manifest function) in the event that already mobilized forces were in-

adequate (Cell IV). It is also possible for functions to emerge (such as the unanticipated clean-up following a very severe riot) that would be assigned to what were then latent structures (i.e., reserve forces) (Cell VI); or, for anticipated functions (such as disaster relief) to be dealt with by, say, combining previously autonomous agencies (Cell VIII).

As for empirical difficulties encountered in applying the model, the greatest problem involved actual classification of events. At times, it was difficult to distinguish emergent from latent patterns because the organization functioned so smoothly. In these instances the decision was made entirely in the context of the written disaster plan. In stress situations where actions are not so clearly specified, categorization may be even more problematic.

Another set of difficulties were related to Barton’s typology of disaster phases. Theoretically, a neat division of an episode into distinct categories may make sense, but empirically, no such clear separations existed. At times, phases overlapped and at other times, Barton’s divisions were too broad. Therefore, certain modifications seem in order.

First, since a disaster is a process, its phases can be expected to blend into each other. The entire process might be viewed as a series of partly overlapping normal curves where the distance between consecutive midpoints is significantly different. In the area of overlap, it is not possible to distinguish one curve from the other, but at the mode and in the regions near the mode, distinctions can be drawn. The width of the region within which differences can be observed depends upon the degree to which the curves overlap. In terms of disaster phases, it can be expected that the degree of overlap will vary with individual disasters and depends on such factors as pre-planning, orientation of personnel toward action, time lapse between notification and onset, and the like. Further research is required into the exact nature of relationships among the many variables.

Second, some questions evolved out of this

research as to the number of phases and their designation. Here, five phases were defined, but they differed somewhat from Barton's. This difference is most likely explained by the fact that Barton derived his typology by extrapolating from many disaster studies. Thus, his generalized phasing should not be expected to fit the individual case exactly. Nevertheless, the data suggest that his typology may be over generalized. Further empirical tests of his division into phases are indicated.

Finally, in the course of this research it became clear that, in certain disaster situations a sixth phase in the typology may be required: Long-Run Post-Episodal Response. When a disaster episode is particularly severe, such as in the 1972 Wilkes-Barre Pennsylvania floods, organized post-impact response in the form of cleanup and repatriation of displaced residents may continue for years. Evidence of long-run difficulties, such as psychological depression and resistance among residents to breaking up the Federal mobile home parks is just now being understood. So, it may be advisable, when there has been large scale severe loss, to extend the typology.

In summary, this research supports the efficacy of a processual typology of bureaucratic response to stressful events. It is also possible to distinguish particularistic and universalistic re-

sponses. However, caution must be exercised in establishing the sequence and phasing of events in the individual empirical application.

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