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# INTERNATIONAL DISASTER ASSISTANCE IN THE MEXICO CITY EARTHQUAKE

LOUISE K. COMFORT

*La ciudad sabe a tragedia,*
*pero también a fraternidad.*
*—un lector*

Immediately following the first news announcements of the September 19, 1985, earthquake in Mexico City, disaster assistance from international sources began arriving. Food, medical supplies, heavy equipment, clothing, and other goods arrived by the ton at Mexico City International Airport,[1] much of it unrequested, most of it untargeted, with no designated recipient organization or group. Simultaneously, international rescue workers at the sites of collapsed buildings in Mexico City were hampered by inadequate knowledge of the locale, lack of appropriate equipment, and lack of coordination among the multiple rescue teams and organizations.[2] Equipment, supplies, rescue workers, and money arrived from fifty-two nations and four international organizations to assist the disaster relief effort in Mexico City.[3] The government of Mexico established an expert commission made up of distinguished officials and highly respected citizens to implement valid procedures for cataloguing and tracking the disposition of incoming supplies.[4] The decision-making tasks involved in coordinating the international

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assistance efforts and matching them to actual local needs were enormously complex.

## THE DECISION-MAKING PROCESS IN INTERNATIONAL DISASTER ASSISTANCE

The massive earthquake prompted an extraordinary outpouring of humanitarian international assistance to the Mexican people in their tragedy. But questions remain. What kinds of assistance, and how much, were actually needed by the Mexicans? What were the most appropriate means of getting aid to the Mexican victims of the disaster? In what ways can international organizations, operating in concert, take constructive action to assist another nation struck by tragedy?

Clearly, the international community acted promptly, warmly, and generously in response to perceived needs created by the disaster in Mexico.[5] The Mexican government, in turn, acted responsibly in setting up disaster operations procedures to manage the rescue and relief efforts,[6] and the Mexican people acknowledged gratefully the care and concern showed them by the international community.[7] Yet, despite the good will, effort, and energy expended by international and Mexican participants, the international rescue and relief operations had a relatively minor effect in lessening the toll of dead and injured, restoring functional services to the city, or easing the burden of those people rendered homeless by the earthquake.[8] The comparatively weak ratio of results achieved to assistance extended compels a reconsideration of the international disaster assistance process.

In Mexico City, the enormity of the need was obvious to all who watched the evening news. The availability of resources—time, skill, and materials—was equally clear, documented by passenger lists and shipping labels on incoming planes and by thousands of volunteers who helped to clear debris, direct traffic, and distribute food and water to those made suddenly homeless. The problem, however, was the complex one of making timely and appropriate decisions simultaneously under conditions of great uncertainty and incomplete information. The inability of rational modes of problem solving to cope with great complexity, noted by other researchers,[9] was painfully apparent in light of the enormity of demands engendered by the earthquake disaster. The sobering question raised by the events in Mexico City is whether members of the international

community will use this opportunity to reflect upon means by which they might improve their shared decision-making process to achieve a stronger ratio of results produced for efforts extended in international disaster assistance.

## THE LOGIC OF ACTION IN UNCERTAIN ENVIRONMENTS

Searching for an explanation of the decision-making process in international disaster assistance, one quickly dismisses the thesis of events proceeding according to a rational plan. The degree of error, confusion, uncertainty, or omission that characterized the daily operations of the international relief agencies during the first weeks following the earthquakes defied the dedicated efforts of the most professional personnel in international organizations to order their actions in optimal ways. Yet, decisions were made, actions were taken, and as the hours and days of disaster assistance activities proceeded, an increasing degree of order and rationality evolved from the interaction of participating organizations.[10]

The international search dog teams, for example, were plagued by the initial frustration of not knowing which buildings had been searched or what buildings offered the most likely chance of finding victims alive; the wasted time involved in waiting for needed equipment to move debris once survivors had been located; and the unwitting clash of technologies when the noise of traffic and rescue vehicles disrupted the silence required for seismic detection of survivors. These unanticipated problems compelled the various teams to reexamine their procedures of operation.[11]

Clearly, the members of the various international teams arrived in Mexico City with no predesigned plan for their rescue activities. They engaged separately in rescue operations, according to their respective forms of training and experience. Encountering difficulties and frustration in the lack of coordination among their particular efforts, members of the teams devised their own procedures for coordinating their interdependent activities in a more effective manner.[12]

These conditions suggest a different mode of rationality in operation than the standard administrative model of rational planning, in which one first devises a plan for action in regard to a specific problem, then systematically carries out the plan to achieve the desired result.[13] Instead, organizations acted simultaneously in response to a particular problem. Then, observing the results against

the shared goal of rescuing survivors, they redesigned their respective actions to approximate that goal more closely.[14] The evolving degree of cooperation among the individual organizations resulted in more effective performance for the set of international organizations engaged in search and rescue activities. It is a logic of action, reflection upon the consequences of that action, and choice based upon fit performance. The decision-making process, employing rationality, is similar to the biological model of evolutionary choice, which assumes adaptation in response to the demands of the environment, with adaptive choices made upon the basis of fitness in that environment.[15] Characteristics of this model have been recognized in the decision-making processes of business organizations also operating in environments of great uncertainty and complexity.[16]

## THE EVOLUTIONARY MODEL OF ADAPTATION

What is the model of evolutionary adaptation in complex environmental conditions and in what ways, if any, does this model offer insight into the decision-making process in international disaster assistance? The concept of adaptation is used by biologists to explain the processes whereby "an initially unorganized system acquires increasing self-control in complex environments."[17] Examining the process of adaptation in both natural and artificial systems, Holland states that "adaptation, whatever its context, involves a progressive modification of some structure or structures. These structures constitute the grist of the adaptive process, being largely determined by the field of study."[18] The structures undergoing modification display the visible evidence of adaptation, but successive structural modifications are likely to reveal a basic set of operators that act upon the structures. It is the repeated action of these operators upon the identified structures that produces the observed adaptation.[19]

The model of adaptation is simple. There are three major components in the process that can be identified for any field. First, there is the environment of the system that is undergoing adaptation. The environment provides the context in which adaptation occurs and offers multiple stimuli and obstacles to the process. Second, the "adaptive plan" is the set of beliefs or conditions influencing structural choices in the environment at successive stages of development in order to improve performance. The adaptive plan

includes the central values and intelligent sensing mechanisms that drive the selection process. Third, the measure of performance or "fitness" of the structure in that environment serves as the criterion for choice in retaining or modifying the structures.

These components interact with one another in an adaptation process that can be characterized by a set of fundamental questions appropriate to any system. These questions, posed by Holland, are as follows:

1. To what parts of the environment is the system adapting?
2. How does the environment act upon the adapting system?
3. What structures are undergoing adaptation?
4. What are the mechanisms of adaptation?
5. What part of the history of its interaction with the environment does the organism retain?
6. What limits are there to the adaptive process?
7. How are different adaptive processes to be compared?[10]

Each of the questions identifies a basic characteristic of the adaptation process. These characteristics, defined as elements for a particular adaptive process, can be represented by symbols which may be used to model the process mathematically. Since the purpose of this essay is not to develop a mathematical model but to identify, if possible, an explanatory model for the international disaster assistance process in Mexico City, these characteristics will be defined in common language terms. Corresponding to the seven questions listed, the terms are defined as follows:

1. Environment (E): the specific parts of the larger environment or universe to which the system under study is adapting.
2. Inputs (I): the range of signals transmitted from the environment to the system undergoing adaptation.
3. Structures (S): the set of attainable forms within which the adapting plan acts in the environment.
4. Operators (O): the set of means or processes for modifying structures employed by an adaptive plan.
5. Memory (M): the specific aspects of the history of its interaction with the environment that the adapting system retains.
6. Limits (L): the existing constraints to the adaptive process.

7. Criterion (C): the measure by which different adaptive processes may be compared to determine fitness within the set.[21]

The adaptive process may thus be represented by the schema shown in Figure 1. The general environment generates stimuli that activate an adapting system. This system is illustrated by the presence of an adaptive plan that receives inputs from the general environment. The adaptive plan then selects operators that, in turn, act upon structures located in a particular environment. This action produces a performance in the particular environment that is observed and evaluated according to the criterion of fitness. Feedback from the performance is returned to the adaptive plan which retains in its memory a selective record of the event. Informed by the previous experience, the adaptive plan initiates a new cycle of adaptation, seeking to improve its performance within the limits of the operating environment. The process is dynamic.

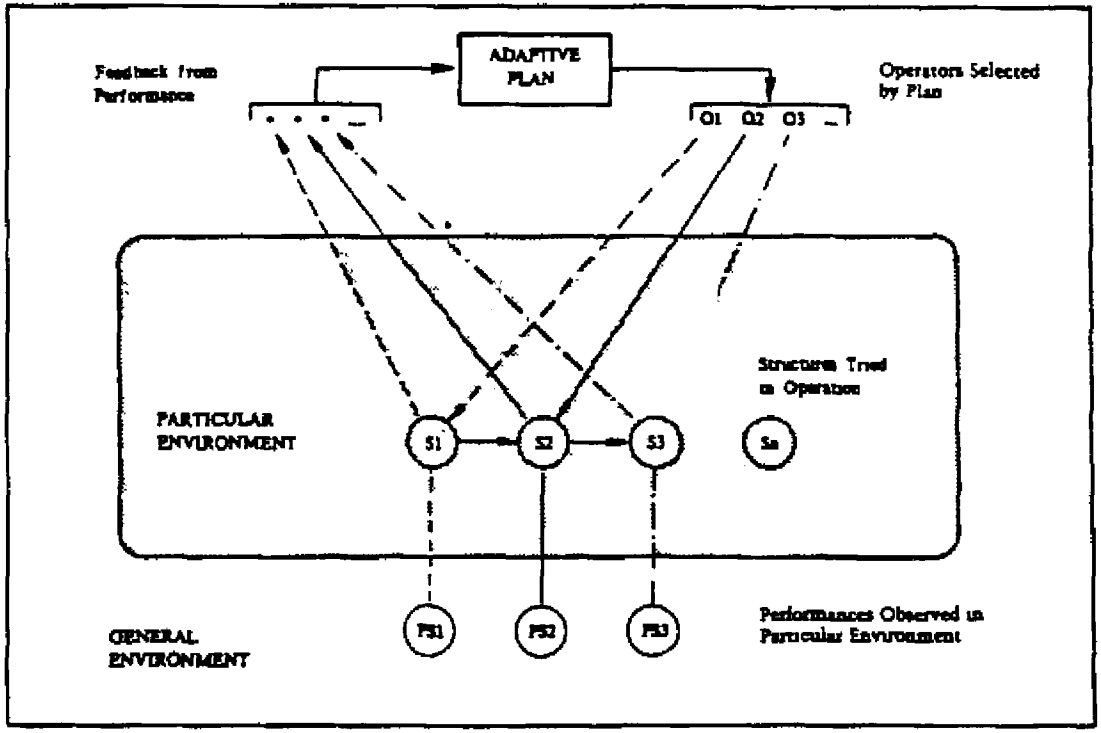
While the schema depicts the form and flow of the adaptive process, it is equally important to note the major obstacles to adaptation. These obstacles, according to Holland, are also generic, and inhibit adaptation in any environment. They are: 1) size; 2) complexity; 3) interdependence among parameters; 4) variance in performance measures over time and space; and 5) the great flux of information from the environment that needs to be screened and ordered in terms of relevance.[22]

The adaptation process depicted by this model is a very simple dynamic of selection for action, trial, observation of performance, and new selection on the basis of a fitness criterion. It assumes intelligent actors that utilize information from observed performance as their basis of choice in successive actions. It acknowledges simultaneous actions by multiple operators, yet sorts the effects of those actions into categories for second-stage development on the basis of performance. To what extent is this model applicable to the international disaster assistance process? If appropriate, the model may be used to explain the events in Mexico City following the September 19, 1985, earthquake.

## THE INTERNATIONAL ASSISTANCE PROCESS IN THE 1985 EARTHQUAKE

The context and sequence of events following the massive 1985 earthquake in Mexico City offer an apt environment in which

FIGURE 1
A MODEL OF ADAPTATION




Adapted from John Holland, *Adaptation in Natural and Artificial Systems*, p. 22.

observe the continuing search for order and an evolving pattern o improved performance among multiple organizations. The domai of possible adaptive processes is vast. This analysis will select tw particular environments out of the very large set of possible environ ments to observe the interaction among the component element of the model in order to determine whether adaptive processes wer operating to improve performance. These environments, containin some common and some unique elements, illustrate central prob lems in the international disaster assistance process.

First, the environment of search and rescue operations, carrie out by international rescue teams, will be reviewed to determin whether an operating logic of action emerged from the condition of complexity and uncertainty surrounding this process. This phas of international disaster assistance is selected for analysis for severa reasons. The president of Mexico, Miguel de la Madrid Hurtado declared the first priority for the Mexican government and its peopl to be search and rescue of survivors trapped in the damaged build ings.[23] Further, international teams generated a high level of visibil ity and attention in the media with their applications of nev technologies never before used in disaster operations.[24] Activities o the international search and rescue teams were documented care fully by multiple agencies, allowing consideration of the sam events from multiple perspectives and various sources of evidence Finally, several significant research studies have reported an "emer gent" cooperation among multiple organizations engaged in disaste response, especially in search and rescue operations.[25] This analysi builds upon findings reported in previous research in its theoretica conception of patterns of organization emerging from the comple environment of disaster.

Second, the perceived effect of international disaster assistanc efforts, including the search and rescue operations, will be reporte from a survey of residents of the damaged neighborhoods in Mexic City.[26] The actual delivery of assistance to the damaged neighbo hoods, reported through the perceptions of residents, offers a valu able check on the portrayal of the process through media report official documents, or interviews with participants or governmenta decision-makers. These two particular environments of the interna tional disaster assistance process both complement and contradic each other. To the extent that contradictions are reduced and com plementarity increased over successive stages of interaction be tween the two subsets, the evolution of "fitness" or improved per

formance in the larger environment of international disaster assistance is indicated.

## ADAPTATION IN PERFORMANCE OF SEARCH AND RESCUE TEAMS

By use of the model of adaptation outlined earlier, it is possible to identify the different components of an adaptive process from the context of post-disaster search and rescue operations in Mexico City. For the purposes of this study, the environment under analysis includes the domain of international actors only, although the international teams interacted regularly with the Mexican government. The impact of the international teams upon the operations of the Mexican government in search and rescue activities likely generated a separate adaptive process, but consideration of that process is beyond the scope of this study. The specific environment of the international search and rescue teams generated multiple stimuli and powerful obstacles to effective performance. These will be described in the identification of terms for the adaptation model in this context.

The second major component of the model is the "adaptive plan"—the set of inputs from the environment interacting with possible forms for action that determine the actual choices made in international search and rescue operations. The adaptive plan in this environment includes the shared values of humanitarian concern for victims of the disaster and commitment to responsible action demonstrated by all nations that extended disaster assistance to Mexico. It is expressed, for example, in the logo of the U.S. Search and Rescue (SAR) Dog Team, "That Others May Live."[17] Again, the specific elements of the adaptive plan will be described in the identification of terms for the model.

Finally, the criterion of fit performance in this environment was the rescue of human life, drawing upon professional standards of organizational effectiveness and efficiency that were acknowledged by the international rescue teams, separately and collectively.[18]

Given the initial assessment that the basic components of an adaptive process did exist in the Mexican disaster, the further elements of the model can be specified and defined with reference to the seven fundamental terms that characterize the adaptation process.

*Environment.* The system under study is the decision-making process in international disaster assistance. The system itself is nascent, and although decisions are clearly made regarding the allocation and implementation of international disaster assistance, the process by which these decisions are made and the criteria for choice appear to be evolving with experience in disaster operations. The larger environment for this system is disaster management in catastrophic natural or technological events. More specifically, the tentative system of decision making that emerged among international organizations extending disaster assistance following the earthquake was adapting to the wider disaster environment in Mexico City. The time period under study is the twelve-day period from September 19 through October 1, 1985, during which the international search and rescue activities occurred. Particular characteristics of this environment include the urban setting of 18 million people, the entrapment of large numbers of people in collapsed multistory buildings, and the technical difficulties of rescue operations that required moving or cutting through vast amounts of concrete and steel debris.[29]

*Inputs.* Multiple stimuli from this environment acted upon the decision-making process. Three types of stimuli, however, were powerful and consistent influences upon the system, engaging its attention and prompting its response. First, the media, and particularly the international press, acted very quickly to transmit news of the earthquake to national capitals of the world.[30] Second, news of the catastrophic earthquake prompted an immediate and generous humanitarian response from nations around the world. At final count, fifty-two nations and four international organizations sent personnel, equipment, materials, and money to assist Mexico in the rescue and recovery operations. The arrival of these personnel and goods in Mexico both increased the possibilities and altered the requirements for productive action in the disaster environment. Third, direct observations of participants in search and rescue activities contributed a continuing flow of information and assessment of requirements for effective action. Equally, reports and response of informed observers regarding the unfolding search and rescue operations added an important perspective to the decision-making process.[31] All three inputs contribute to the transmission of data to multiple recipients simultaneously and the transformation of those data into information marshaled for decision support.

*Structures.* Again, multiple structures emerged in the activities of the search and rescue operations process. The clearest and most visible structures were, first, the search and rescue teams sent by nine nations—France, West Germany, Israel, Italy, Spain, Switzerland, the United Kingdom, the United States, and Venezuela.[32] Not all teams were in communication with one another; not all teams had the same technologies or strategies in search and rescue operations. Yet, all teams did share the same commitment to locate and rescue victims trapped in the debris. Second, the national embassies located in Mexico City served as points of communication between the respective search teams and their national capitals and as possible points of coordination among the teams working in the field.[33] Third, the international organizations—the United Nations Disaster Relief Office, the International Red Cross, the Pan American Health Organization, and the Catholic Relief Services, to name a few of the most visible or most active—offered possibilities for collaboration among national efforts in disaster operations.[34] Each set of structures engaged in disaster operations and thus had the opportunity either to facilitate or obstruct the overall process.

*Operators.* The means of adaptation in the international disaster assistance system are primarily those involving communication—patterns, styles, technologies, and language. Since the process of adaptation in this environment depends upon the capacity of the human participants to learn from their own, and others', experience, the form, content, and mode of communication among them becomes the primary set of operators upon the structures. Specifically, this set of operators includes the informal patterns of communication that developed between search team members and between the different participating teams. It also includes the more formal patterns of communication that took place between their respective governments through the medium of embassy contacts. Further, it includes the limited but potentially important contacts between the national embassies and the international disaster relief organizations. Finally, it includes the very limited, but potentially even more powerful contact between the set of structures—field search teams, national embassies, and international organizations—and the citizens of Mexico who benefited from their efforts.

*Memory.* The interaction among operators and structures in the given disaster environment is extremely complex. Not all of those interactions are retained in the collective history of the process.

Memory constitutes the vital record of those events and experiences "selected" as critical to performance. These events and experiences then serve as the lessons learned from the interaction. Several types of experience were vividly embedded in the collective memory of the human participants in search and rescue operations. First was the great sense of frustration at not being able to accomplish their intended goals because of lack of coordination, organization, or facilitation among the separate actors in the process. This sense of frustration was heightened by the recognition that intent, materials, or personnel were not lacking; rather, communication, planning, and administrative skills appropriate to the magnitude of the task were.[35]

Second, equally powerful in shaping the collective memory of this process was the shared experience of experimentation with new methods of developing coordination, inventing communications procedures between participants, and pooling information regarding common tasks. Finally, the ensuing satisfaction of improving performance through cooperation provided an important link between past and future performance. It left with each participant the glimpse of effectiveness in collective performance and the generative commitment to increase this effectiveness in further interactions.[36] Memory serves as the stored body of knowledge derived from experience that has been judged worthy of retention in guiding the decision process.

*Limits.* Limits to action abound in disaster operations, and a primary one is the sheer complexity of a disaster the magnitude of the Mexican earthquake. The vastness of the search and rescue task, involving some 954 collapsed buildings with estimated tens of thousands of people trapped in them,[37] presented the search and rescue teams with an extraordinarily difficult problem. Compounding the complexity was the urgency of time. The chances of rescuing survivors alive from the debris declined with each hour, each day of delay. The technologies employed in the search and rescue operations introduced new possibilities for action but added new requirements for field support, information, and coordination. Unplanned, these requirements at times had the perverse effect of delaying rather than facilitating the operations.[38]

A third, and powerful, limit on the decision-making process was the availability of accurate, timely, and relevant information. This condition was exacerbated by the severe damage to Telefono de México (TELMEX), the Mexican telecommunications facilities

which virtually closed down all international telephone communications in the first ten days after the disaster.[39] Without ready and easy access to authorities in Mexico, it was extremely difficult for decision makers engaged in the international disaster assistance process to confirm reports of damage, correct errors in perception, and make appropriate allocations of personnel, equipment, and materials to facilitate operations.

Fourth, the diversity of languages, technologies, and premises for operation among the different units and levels of decision makers significantly limited the capacity of the participants to attain a common understanding of their shared responsibilities. The unfortunate disagreement between the French and U.S. search teams over the most appropriate procedure to use in locating survivors in unsafe buildings illustrates the obstacles encountered in the decision-making process.[40]

Finally, the limiting conditions of complexity, time, information, and communications interacted with one another to compound the problem. The dynamics of the process itself, uncharted and little understood by the participants, served to limit their capacity for effective performance.

*Criterion for Fit Performance.* The final element in the model of adaptation in international search and rescue operations is at once the simplest and the most important. It is the criterion for choice regarding which actions are repeated and which actions are discarded in the continuing search for fit performance. It represents the logic of action under uncertain conditions and, very simply, can be defined as "what works" in widely varying circumstances, judged by highly diverse actors.[41] Agreement on what works is based largely upon the contribution of a given action to achieving the common goal. In search and rescue operations, this measure of performance is the location and rescue of live victims. In the larger case of the Mexican disaster, this goal was also very clear to all involved—it meant actions to save lives, assist the homeless, and restore basic services. These goals were recognized in the priorities for action set by President Miguel de la Madrid of Mexico and acknowledged by all participating international teams.[42]

Further specifying the criterion for fit performance was the shared recognition of professional standards by the participating teams. Although the members differed in language, culture, and technology, they respected the training, discipline, and accomplished performance of their international colleagues. A common

sense of professional standards informed their separate judgments of fit performance.

## MODEL OF ADAPTATION IN INTERNATIONAL DISASTER ASSISTANCE

The seven elements identified—environment, inputs, structures, operators, memory, limits, and criterion for fitness—present the components of a possible model of adaptation in the decision-making process in international search and rescue operations in the Mexican earthquake disaster. To Holland, a problem in adaptation is recognizable when the limits, environment, and criterion of fit performance can be specified within a given context. An adaptive system is identifiable when the structures, operators, inputs, and adaptive plan can be specified within that context.[43] This inquiry will review a selected sequence of events in search and rescue operations in the Mexican disaster to determine whether adaptation, or an evolutionary improvement in performance, did in fact occur.

## EVOLUTION OF IMPROVED PERFORMANCE IN SEARCH AND RESCUE OPERATIONS

Applying this model of adaptation to international search and rescue operations, it is possible to distinguish four phases in the decision-making process that illustrate beginning steps in the evolution of improved performance. These phases indicate both increasing control over the environment by individual search teams and increasing recognition of shared objectives and merit of collaborative efforts among the teams. The process is complex and will be described here only in sufficient detail to indicate the operation of the model.

*Initial Decision to Send Teams to Mexico City.* The wider environment in which decisions were taken by national governments to send search and rescue teams to Mexico City was characterized by very little information and great uncertainty. The process also differed from nation to nation. In the interest of brevity, the U.S. case will be used to illustrate the dynamics of the process. While the details differed, similar conditions existed for all countries that sent search and rescue teams.

The particular environment in which the United States made the decision to send search and rescue teams to Mexico City was one of classic disorder in the midst of enormous complexity. The first news reports of the disaster had greatly exaggerated the damage

estimating that 37 percent of the city had been destroyed with possibly 100,000 dead.[44] Further confirmation or correction of these reports was not possible because international telephone communications had been destroyed. In Mexico City, the U.S. ambassador contacted officials of the Mexican government to offer assistance. The Mexican officials replied that they were in the process of determining what kind of assistance was needed. In Nashville, Tennessee, trained search and rescue personnel attending the annual conference of the National Association of Search and Rescue (NASAR) learned of the Mexican disaster through televised news reports and immediately contacted U.S. officials in the State Department, volunteering their assistance in disaster operations.[45] Hours passed with no further information from Mexico City or Washington. News reports stated that President Miguel de la Madrid of Mexico had announced that Mexico would be able to manage the disaster with its own resources.[46]

Aware that every hour of delay reduced the likelihood of finding live victims in the debris, trained NASAR personnel in Nashville worried about the status of search and rescue operations in Mexico City and waited for a response to their offer of assistance. Finally, the telephone call came from Washington, late on Friday, September 20, 1985, confirming a request from Mexican officials for experts in mine safety, demolition, and search and rescue operations. The United States would send a team of eleven persons with specialized equipment and search dogs to Mexico City. Members of the team were asked to be ready to leave early the following morning. The team of seismic detection experts, snake video camera experts, mine safety experts, and trained search dogs with their handlers arrived in Mexico City at 3:00 p.m. local time, Saturday, September 21, 1985, nearly 56 hours after the earthquake had occurred.[47] Additional personnel arrived later, bringing the total number of U.S. personnel involved in search and rescue operations to twenty-seven, organized in six teams.

In this environment of unplanned, unfolding events, a problem for adaptation is clearly recognizable. The limits for action in disaster search and rescue are time, information, and the enormous difficulty of the task. The environment of nearly one thousand collapsed buildings with estimated tens of thousands of persons trapped inside compelled a reconsideration of routine operations. The criterion for fit performance was the rescue of survivors.

From this context and the reported sequence of events, an adaptive system is also identifiable. The structures through which adap-

tation to demands from the environment was occurring were the international search and rescue teams. The operators modifying these structures were the means of communication among the different participants: among members of the separate international teams; between the separate teams and their respective governments; between the national embassies and the Mexican government officials. The inputs to the adaptive system were, most importantly, the international press and the various media correspondents who reported the events and consequences of the disaster to their respective national capitals. The adaptive plan is demonstrated through the concurrent decisions by nine nations, influenced by information from the disaster environment and awareness of actual skills, technologies, and personnel available in their respective nations, to mobilize and send search and rescue teams to Mexico City.

The linkage is tenuous, the messages communicated incomplete and at times contradictory. Errors were made, but they were corrected and constructive actions were taken on the basis of additional information. For example, the initial judgment of the Mexican government not to request assistance was changed on the basis of further evidence, and the next set of actions involved in sending the U.S team followed accordingly. The most powerful recollection of this history of interactions stored in the collective memory of search and rescue personnel was the number of hours (56) subtracted from the optimal period (72 hours) for life-saving search and rescue operations immediately following the disaster—a delay caused by lack of clarity and order in the decision-making process.

*Allocation of Tasks in Search and Rescue Operations.* Once in Mexico City, the U.S. search team reported to the U.S. embassy for guidance in field operations. The team was to work under the supervision of the embassy in the section of the city where disaster operations were being directed by the Mexican Navy (Department of Marine). The actual extent of administrative support and guidance available to the search team, however, was extremely limited The U.S. embassy did provide translators to the search teams, and the translators, rather than any coordinating administrative personnel, directed the search teams to the locations where victims were presumed alive.[48]

The initial experience of the U.S. team in field operations was extremely frustrating. Needed supplies and trained personnel to support the field teams were not available. For example, the dog

teams had no means of communicating between field sites and the embassy's disaster operating center, greatly hampering their work when additional equipment or medical assistance was needed. The lack of hand-held radios, essential to disaster operations, delayed by minutes and hours the coordination of equipment and personnel necessary to rescue operations. The television camera team had a radio supplied by the embassy, but lack of trained communications personnel at the embassy made it difficult to send or receive information. Under conditions where time meant life, the lack of adequate communications facilities between participating groups and organizations proved seriously limiting. The problem was partially solved, days into the rescue operations, when an embassy employee discovered a long-forgotten box of hand-held radios in the embassy basement and wondered if they might be useful in the disaster operations.[49]

Differing technologies and techniques of rescue operations conflicted in field operations. The sensitive seismic detection equipment employed by the group of experts from the U.S. Office of Mine Health and Safety required silence for effective operation. Yet, stopping the jackhammers and cutting saws of the other rescue teams to allow the seismic team to work would delay the possible rescue of other victims. Recognizing the dilemma, members of the teams using the different types of equipment conferred and agreed to schedule their work so that the seismic team would work at night when it was quiet to identify possible leads for live victims. These leads would then be followed up by the teams that could cut through the debris to reach survivors during daylight hours.[50] These incidents and others compelled the members of the U.S. team to reexamine their operating conditions and procedures.

Several steps were taken to improve performance in the field. One of the members of the U.S. team, experienced in emergency management operations, established a separate office in the U.S. embassy to provide administrative support specifically to the U.S. dog teams but also provided information and coordination to other U.S. experts in the field.[51] During the day, the administrative coordinator would meet with Mexican government officials, secure maps of the damaged areas with building sites marked that were known to have people trapped inside, check the status of these buildings for current information regarding signs of life, identify the types of structural damage to the building and the supposed location of the survivors to assess the likely types of equipment necessary

for rescue operations, and assign the teams accordingly f maximum utilization of time and skills.[52]

A problem for adaptation was clearly apparent in the operati of the U.S. search teams in Mexico. The limits to their actions we the very real constraints of time, lack of coordination, lack of co munication facilities, and lack of systematic information. The en ronment was chaotic in terms of administrative operations, diffic and risky in terms of the work setting among collapsed buildings an unfamiliar city. The criterion for performance was obvious to participants; what mattered was the successful discovery and resc of human life from the debris. Aware of the obstacles that hinder their efforts at search and rescue, members of the U.S. team examined their activities within this environment in order to i prove their performance, given the relentless limits of time a complexity.

An adaptive system is also identifiable in this sequence events The structures engaged in operations were the subgrou with differing skills and using different technologies of the U team—the dog teams, the seismic team, the video camera team, a the mine safety experts. The operators that modified the perf mance of these structures were the informal patterns of commu cation that developed among the members of the U.S. team as th met in the evenings in their hotel to share information about t day's activities and to receive information regarding the next da assignments. The inputs to the adapting system were the dir observations of the individual team members and the reports fro relevant organizations or Mexican citizens which were collect and summarized for members of the team through the evolvi operations center (Dog Base) established after arrival. The adapti plan is revealed through the interaction of these inputs from t environment through the communications processes with the a ing structures, the search and rescue teams. Again, the criterion f fit performance drives the growing awareness of the need to chan the operating procedures and organizational structure of search a rescue operations. The adaptive plan represents the learning cap ity of the individual participants engaged in search and rescue op ations, as they assimilated information from their environment a used that information to guide their own choices for action, giv the resources, constraints, and operating forms available.

A vital element stored in the collective memory of the U search team regarding these interactions is the significant improv

ment they were able to achieve in their performance in the field with systematic collection of information regarding the operations sites, readily available and accessible communications between field and administrative operations, and appropriate allocation of tasks and technologies among the different members and groups of the team. Equally apparent, however, is the fact that the obstacles to effective performance encountered by the U.S. team were also hindering the operations of other national teams engaged in the same process.

*Coordination Among the Teams.* Given the lack of coordination, information, and communication among the search teams, it is not surprising that conflicts would emerge over the technologies and approaches to be used in locating and rescuing the victims. Participation in rescue activities resulted in differing judgments about appropriate technical and administrative requirements. Two incidents illustrate this problem.

At Juarez Hospital, dangerously unsafe structurally but with known victims trapped in the debris, the French and U.S. rescue teams working in different areas of the same site disagreed sharply over the most appropriate means of reaching the victims. The U.S. team, mindful that each hour of delay reduced the chances of getting the victims out alive, advocated the use of heavy equipment to clear access to them more quickly. The French team, mindful of the risk that the unsafe building might collapse completely and crush the victims in the process, favored a slower, tunneling approach which, although it might delay the rescue, would be less likely to precipitate further structural collapse. Unable to resolve the dispute, the French team left the site and left Mexico City the next day.[53]

A similar dilemma emerged in the use of British military helicopters in the rescue operations. The collapse of multi-storied buildings required the removal of heavy concrete and steel sections of debris to reach the victims underneath. One means of accomplishing this task was to use helicopters that had the capacity to lift heavy objects. The British had military helicopters with this capacity stationed in Belize, only a few hours away. A request went out from the Mexican government to the British embassy for the use of those helicopters, and the British operations officer in the embassy arranged to have them sent with experienced technical crews to Mexico City to assist in the rescue operations. Disagreement over appropriate rescue techniques emerged among the various teams, and the use of British helicopters was criticized because

the powerful machines would be too noisy and would disturb other rescue efforts. The request came to cancel the dispatch of the helicopters to Mexico City. The British embassy complied. Hours later, the request came again for the use of the helicopters. The British embassy renewed the arrangements to send the helicopters. They arrived the next day, and were sent to a site outside the city. The crews were advised to await further instruction for their use. Three days later, the helicopters and their crews returned to Belize, never having participated in the rescue operations.[54]

Awareness of the cost of lack of coordination and communication among the different international teams was expressed by representatives of several of the teams. The head of the German rescue delegation noted both the lack of communication between central operations and field operations and the organizational problems in performance due to a lack of adequate preparation.[55] The leader of the French rescue delegation acknowledged the same general lack of organization and plan for action.[56] Members of the U.S. delegation confirmed this observation. While these spokesmen recognized the tremendous effort, generous good will, and professional skills that individual teams had displayed in the rescue effort, they also acknowledged the frustrating delays and the heartbreaking loss of vital rescue time.[57]

The problem in adaptation in this sequence of interactions is defined by the limit common to all international teams—time. Working under the extreme urgency of diminishing hours available for life-saving rescue of victims, the teams experienced the damaging consequences of conflicting technologies and inadequate administrative coordination. The working environment of the international teams was further constrained by the detrimental effects of national concerns for reputation. Pride and commitment to specific technologies by separate national teams tended to obstruct the genuine exploration of cooperative solutions to the extremely difficult problems of search and rescue midst the urban mountains of collapsed concrete and steel. The criterion of fit performance, nonetheless, remained the successful rescue of live victims. The low ratio of victims found to effort expended compelled all participating teams to reflect soberly upon their collective performance.

An emerging adaptive system is identifiable in the context of these interactions. The structures are the nine international search and rescue teams, operating independently and in conjunction with assigned departments of the Mexican government. The operators

influencing these structures are the means of communication—informal among colleagues between the national embassies in Mexico City, more formal at scheduled meetings with representatives of the national embassies and international organizations (UNDRO, PAHO), and, most important, interpersonal communication among members of different international teams sharing common tasks. The inputs to this system are the reports in the media, particularly the international press, which allowed members of the different national teams to learn how others perceived their actions in contrast to their own intent.

Tentative, incomplete, a beginning adaptive plan is recognizable in the spontaneous actions among several of the international teams. For example, representatives of the U.S., German, and Swiss dog teams began meeting each evening to share information from the day's activities, to learn of new sites for the possible location of survivors, and to coordinate jointly their activities for the following day. In another instance, representatives from a Japanese team of structural engineers, visiting the sites of the collapsed buildings and investigating the effects of the magnitude and intensity of the earthquake upon different structural forms, filmed a videotape to record their assessments and shared this tape with members of the U.S. team.[58] Cooperative inquiry of this kind contributes to the cumulation of international data regarding the effects of massive earthquakes in urban settings. Actions such as these, evolving out of the common recognition of the need for better coordination among search and rescue teams and better information about the structural design of buildings being searched, demonstrate the shared commitment of the participating teams to the collective goal of rescue of the victims.

*Formation of Professional Standards for Search and Rescue Operations.* Engagement in the international search and rescue process precipitated differing responses from individual teams, but the experience engendered thoughtful reflection on the requirements for improved performance in international disaster assistance and generated fresh commitment to design a set of professional standards in search and rescue operations. The handlers of search dogs with the U.S. team, for example, have developed, at the request of the then U.S. Ambassador to Mexico, John Gavin, an organizational format and set of operational procedures to mobilize an official U.S. Dog Team for search and rescue operations in any disaster, national or international.[59] Other conferences, national and international,

have focused on the experience of search and rescue operations in the Mexico City disaster and have generated a continuing inquiry into the design of an effective process for international disaster assistance, drawing constructively upon the lessons learned in the Mexican experience.[40] These efforts are tentative, nascent steps, they are still in process and have yet to be tested in actual performance. Yet these efforts do indicate the powerful capacity of individual participants to select from their own performance in actual situations those qualities that demonstrate "fitness" to the complex environment of disaster operations and to discard those that prove ineffective or irrelevant.

## THE PERCEPTION OF INTERNATIONAL DISASTER ASSISTANCE BY THE AFFECTED POPULATION

An important test of the model of adaptation in the international disaster assistance process in the Mexican disaster is the perception of that process by the intended beneficiaries, the residents of the damaged areas in Mexico City. A survey of 728 residents of these areas reveals some interesting findings in reference to their actual experience with international disaster assistance.[41] The findings provide a useful check against the reported operation of the process as perceived by the press and by members of the international teams and the governments they served. Especially interesting is a series of questions that appear to show a direct relationship between involvement in international disaster assistance and information available. These findings are reported in Tables 1–5.

As cited in Table 1, the large majority, 563 out of 728 respondents (77.3 percent) in the survey, perceived international aid to be very beneficial or beneficial to Mexico in coping with the problems generated by the earthquakes. Yet, when asked whether there was information in their district about how to get access to this international aid, the proportion responding positively dropped to 258, or 35.4 percent, of the respondents in the survey. When asked whether the information given in their district about how to ask for, and receive, aid was sufficient, the proportion responding positively dropped still further to 167 respondents, or 22.9 percent of the total number interviewed. The number of respondents who reported actually receiving aid—either themselves, their families, or their immediate neighbors—dropped again to 76 residents, or 10.4 percent

of the total sample. Those who reported actual contact with an international organization engaged in disaster assistance—either themselves, their families, or their neighbors—fell to the very small proportion of 47 respondents, or 6.5 percent of the total number of cases in the sample.

TABLE 1
Perceived Benefit of International Aid

"Mexico has received in these last two months [November 1985] much gratuitous international aid to alleviate the problems generated by the earthquakes. How beneficial, in your opinion, has this international assistance been?"

| | *N* | % |
|---|---|---|
| Very beneficial | 341 | 46.8 |
| Beneficial | 222 | 30.5 |
| So-So | 62 | 8.5 |
| Not so beneficial | 47 | 6.5 |
| No benefit | 42 | 5.8 |
| Don't know | 14 | 1.9 |
| | 728 | 100.0 |

Valid N = 714

TABLE 2
Perceived Availability of Information Regarding International Aid in District

"Was there information in your district about how to get access to this [international] aid, if necessary?"

| | *N* | % |
|---|---|---|
| Yes | 258 | 35.4 |
| No | 433 | 59.5 |
| Don't know | 34 | 4.7 |
| Not applicable | 3 | .4 |
| | 728 | 100.0 |

Valid N = 691

These findings indicate that, although the large majority of residents of the damaged neighborhoods in Mexico City were aware of the international assistance being given to Mexico and perceived it positively, very few residents actually received such assistance and even fewer had contact with international organizations engaged in the delivery of such assistance. Given the complexity of the environment, the ratio of assistance received to assistance extended is not surprising. What appears to be critical, however, is the level of information available to citizens to facilitate their own capacity to request and receive international disaster assistance.

TABLE 3
Perceived Sufficiency of Information Regarding International Aid in District

"In your opinion, was the information given in your district about how to ask for and receive aid sufficient?"

| | *N* | % |
|---|---|---|
| Sufficient | 167 | 22.9 |
| Insufficient | 253 | 34.8 |
| Don't know | 49 | 6.7 |
| Inapplicable | 259 | 35.6 |
| | 728 | 100.0 |

Valid N = 420

TABLE 4
Reception of International Aid

"In fact, did you or your family or any of your neighbors receive any aid of this type?"

| | *N* | % |
|---|---|---|
| Yes | 76 | 10.4 |
| No | 641 | 88.1 |
| No response | 11 | 1.5 |
| | 728 | 100.0 |

Valid N = 717

TABLE 5
Direct Contact with International Organizations Distributing Aid

| "Did you or your family or any of your neighbors have direct contact with an international or foreign organization that was distributing aid?" | *N* | % |
|---|---|---|
| Yes | 47 | 6.5 |
| No | 667 | 91.6 |
| Don't know | 14 | 1.9 |
| | 728 | 100.0 |
| **If yes, "What Type of Aid?"** | | |
| Shelter | 1 | .1 |
| Foodstuffs | 8 | 1.1 |
| Water | 2 | .3 |
| Rescue efforts | 12 | 1.6 |
| Building analysis | 8 | 1.1 |
| Medicines | 6 | .8 |
| Blankets, clothing | 3 | .4 |
| Messages, communication | 3 | .4 |
| Total types of aid | 43 | 5.8 |
| Other or No response | 685 | 94.2 |
| Total cases | 728 | 100.0 |
| **"What organization?"** | | |
| U.N. | 2 | .3 |
| Red Cross | 13 | 1.8 |
| Foreign rescue teams | 12 | 1.6 |
| Private clergy, Salvation Army | 2 | .3 |
| Catholic organization | 3 | .4 |
| Other | 6 | 5.2 |
| Don't know | 690 | 94.8 |
| | 728 | 100.0 |

Further analysis indicates that even those who did receive ai or had contact with international organizations did not always re port that information about international aid was either availabl in their district or sufficient to gain access. Table 6 shows that o the 252 respondents who reported that information regarding inte national aid was available in their districts, more than one-thir 36.9 percent, found that information to be insufficient in order t request or receive aid. Table 7 shows that of the 75 respondents wh reported actually receiving international aid, 28, or 37.3 percen stated there was no information about aid in their district. Mo telling, nearly two-thirds of the respondents, 65.8 percent, reporte they did not receive international aid and that information abo international aid was not available in their districts. In Table 8, 2 of the 54 respondents, 42.6 percent, who reported receiving intern tional aid perceived information about aid to be insufficient. It also interesting that 22 of the 76 respondents (28.9 percent) wh reported receiving aid did not respond to the question on sufficienc of information.

TABLE 6
The Relationship Between Availability and Sufficiency of Information Regarding International Aid

| *Availability of information in district* | *Sufficiency of information* | | *Total* | |
|---|---|---|---|---|
| | *Sufficient* | *Insufficient* | *N* | *%* |
| Yes | 159 | 93 | 252 | |
| | 63.1[a] | 36.9 | | 60.7 |
| | 95.8[b] | 37.3 | | |
| | 34.3[c] | 22.4 | | |
| No | 7 | 156 | 163 | |
| | 4.3 | 45.7 | | |
| | 4.2 | 62.7 | | |
| | 1.7 | 37.8 | | 39.3 |
| Total cases | 166 | 249 | 415 | |
| | 40.0 | 60.0 | | 100.0 |

Chi Square = 142.592 Sig = .000 DF = 1

[a] row percent [b] column percent [c] percent of total cases

TABLE 7
The Relationship Between Availability of Information and Reception of International Aid

| *Availability of information in district* | | | | |
|---|---|---|---|---|
| *Reception of international aid* | *Yes* | *No* | *Total* *N* | *%* |
| Yes | 47 | 28 | 75 | |
| | 62.7[a] | 37.3 | | |
| | 18.5[b] | 6 6 | | |
| | 6.9[c] | 4.1 | | 11 0 |
| No | 207 | 399 | 606 | |
| | 34.2 | 65.8 | | |
| | 81.5 | 93.4 | | |
| | 30.4 | 58.6 | | 89.0 |
| Total cases | 254 | 427 | 681 | |
| | 37.3 | 62.7 | | 100.0 |

Chi Square = 23.193 Sig. = .000 DF = 1

[a] row percent [b] column percent [c] percent of total cases

TABLE 8
The Relationship Between Reception of International Aid and Sufficiency of Information

| *Reception of international aid* | | | | |
|---|---|---|---|---|
| *Sufficiency of information* | *Yes* | *No* | *Total* *N* | *%* |
| Sufficient | 31 | 134 | 165 | |
| | 18.8[a] | 81.2 | | |
| | 57.4[b] | 37.3 | | |
| | 7.5[c] | 32.4 | | 40.0 |
| Insufficient | 23 | 225 | 248 | |
| | 9.3 | 90.7 | | |
| | 42.6 | 62.7 | | 60.0 |
| | 5.6 | 54.5 | | |
| Total cases | 54 | 359 | 413 | |
| | 13.1 | 86.9 | | 100.0 |

From these findings it is clear that there are major discrepancies between the intent and effort expended and the actual receipt of international assistance by residents of the damaged neighborhoods. While there is evidence of adaptation occurring among the participating international organizations for the mobilization and dispatch of assistance to the disaster environment, that process is not yet complementary to the requirements for requesting and receiving aid by the neighborhood residents.

In contrast to the theory of organizational anarchy in complex environments, where organizations are perceived as making decisions only by chance,[52] data from the international disaster assistance process in the Mexican case show an evolving capacity by the international system to modify its form of operations in a disaster environment based upon a clear criterion of fit performance—specifically, the rescue of human life. An adaptive plan, rather than chance, appears to be influencing decisions made by participants in the search and rescue process. Extending this adaptive plan to the larger environment of the intended recipients of international disaster assistance is a still more complex and difficult task. The most promising means appears to be through increasing the level of information available to the intended recipients, so that they may also add their energy and capacity to the evolving adaptive system.

## NOTES

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2. *Excelsior*, Mexico City, 25 September 1985; 26 September 1985; 27 September 1985, p. 1A; 29 September 1985, p. 1A; *The News*, Mexico City, 26 September 1985, pp. 3–4; 27 September 1985, p. 5. Interview: Linda Wallace, U.S. Dog Team, 22 November 1985; William Pierce, Administrative Coordinator, U.S. Dog Team, 9 April 1986.
3. Final Disaster Summary Report, "Mexico—1985 Earthquakes," U.S. Embassy, Mexico City, Office of Foreign Disaster Assistance, Washington, D.C., January 1986, pp. 47–55.

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5. *Excelsior*, Mexico City, 21 September 1985, p. 4A; 23 September 1985, p. 5A; 27 September 1985, p. 19A; *La Jornada*, Mexico City, 21 September 1985, p. 11; 22 September 1985.
6. *La Jornada*, 20 September 1985, p. 23; *Excelsior*, 23 September 1985, p. 23A; *Excelsior*, 3 October 1985, p. 1A; 5 October 1985, p. 5.
7. *Excelsior*, 28 September 1985. This positive perception of international disaster assistance was also documented in study findings from the survey of residents of the damaged neighborhoods conducted jointly by researchers from the University of Pittsburgh and Instituto Autónomo de México, Mexico City, November 1985. I wish to thank my colleagues in Mexico, Federico Estevez and Dora Schael Lehman, for their professional skill and support in the conduct of this study.
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21. This set of terms is adapted from Holland's set of fundamental que tions regarding adaptation, cited earlier.
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43. Holland, *Adaptation*, p. 28.
44. Wallace interview, 22 November 1985.
45. Ibid.
46. CBS News, 20 September 1985; *Excelsior*, 20 September 1985.
47. Final Disaster Summary Report, U.S. Office of Foreign Disaster Assistance, p. 24.
48. Wallace interview, 22 November 1985.
49. Ibid.
50. Jeffery H. Kravitz, member Seismic Detection Group, U.S. Search and Rescue Team, interview, 22 January 1986.
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